SOUTHERN AFRICAN MARINE LINEFISH SPECIES PROFILES

B.Q. Mann (Editor)
- drawings by N. Kistnasamy and D. Hattingh -

OCEANOGRAPHIC RESEARCH INSTITUTE

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FRONT COVER: A shoal of slinger (*Chrysoblephus puniceus*) over a coral reef in the St Lucia Marine Reserve near Sodwana Bay (Camilla Floros)

BACK COVER: Brindle bass (*Epinephelus lanceolatus*) (Darrell Hattingh)

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SOUTH AFRICAN ASSOCIATION FOR MARINE BIOLOGICAL RESEARCH

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ABSTRACT

This publication is a compilation of species profiles for 139 important marine linefish species from 38 families caught in southern African waters, including both teleosts and elasmobranchs. It provides a comprehensive update of a previous edition published in 2000. Where available, referenced information for each species is presented on distribution, movement, habitat, feeding, reproduction, biometrics, fishery, biological reference points, stock status, vulnerability, current regulations, management considerations and research requirements. Each profile is intended to be an up-to-date summary of what is currently known about the species in order to help users, managers and scientists to determine effective management plans, to ensure the future conservation and sustainable use of each species. The profiles are also intended to highlight the research needed to support the effective management of southern Africa's marine linefish resources.

ACKNOWLEDGEMENTS

Previous editions of the "Visboekie" have proved to be extremely useful and it is my hope that this new edition will prove to be equally useful in guiding linefish research and management in southern Africa. The enthusiasm and hard work of all the marine scientists who contributed towards the compilation and review of the species profiles contained in this book are gratefully acknowledged. In particular, I would like to single out some of my colleagues at ORI; namely Jade Maggs, Stuart Dunlop and Sean Fennessy who went beyond the call of duty in this regard. Also a big thank you to Bernadine Everett for her assistance with formatting, checking and printing the final draft. Prideel Majiedt and Kerry Sink from the South African National Biodiversity Institute, Sven Kerwath and Chris Wilke from the Fisheries Branch of the Department of Agriculture, Forestry and Fisheries and Colin Attwood from the University of Cape Town are thanked for their assistance throughout the extended duration of this project. Financial support from the South African Association for Marine Biological Research and the South African National Biodiversity Institute is gratefully acknowledged. Finally, I would like to thank my wife Judy Mann for her support and encouragement during the many long hours it took to edit this book.

CONTENTS

FOREWORD

In an age of instant gratification, instant responses, virtual media and vicarious experiences, it is a rare privilege to be writing a foreword for a good old-fashioned paper book. This book is filled with up-to-date, relevant and interesting information on the linefish of southern Africa and as such it will become, like its predecessors, the ‘go to’ publication for everyone interested in the conservation of our precious linefish resources. What makes this publication special is the collaborative nature of its development – linefish researchers from around South Africa have freely contributed their knowledge to the individual species profiles. We all share a passion for our fish and by sharing their expertise these researchers will be enabling everyone interested in southern African marine linefish to contribute towards their conservation and wise management. Without good scientific information, it is impossible to effectively manage natural resources. This book places into the hands of fishermen, managers, scientists and anyone else interested in fish, the information that they need to make wise decisions about linefish management. Although this hard copy format will become a treasured resource on the desk of anyone interested in fisheries management, it will also be produced as an electronic, searchable database and perhaps even an app, both of which will make the data even more accessible. South Africa has a good track record of linefish conservation, our research is good, our network of marine protected areas should remain sacrosanct and our management efforts should always be guided by good science and be fairly implemented.

I would like to thank all of the members of the Marine Linefish Research Group (MLRG) who willingly gave of their time to write “their” species profiles, the South African National Biodiversity Institute (SANBI) for funding the development of the project and the South African Association for Marine Biological Research (SAAMBR) for funding most of the time spent on compiling the book. In particular I would like to thank Bruce Mann, a senior scientist at the Oceanographic Research Institute (ORI), for his commitment to the future of South Africa’s linefish. Ultimately this book is a labour of love for fish and a plea to all those concerned to use the information wisely and to make the best possible decisions to ensure the future of South Africa’s linefish resources.

Judy Mann
Chief Executive Officer, SAAMBR

The South African National Biodiversity Institute (SANBI) provided some of the core funding for the work presented in this publication through its Threatened Species Programme. SANBI’s Marine Programme catalysed this updated publication in partnership with the Oceanographic Research Institute (ORI), the Fisheries Branch of the Department of Agriculture, Forestry and Fisheries (DAFF) and the Marine Linefish Research Group (MLRG). SANBI has a mandate to monitor and report on the status of biodiversity as specified in the Biodiversity Act (Act 10 of 2004). This project was led by ORI and benefits from the scientific expertise of 50 researchers from the MLRG and further afield. This important publication updates the South African Linefish Status Reports, published by ORI in 2000. It represents a valuable and contemporary synthesis of scientific knowledge about species caught by one of South Africa’s most diverse, important and oldest fisheries. These profiles will now be used to support national conservation assessments for linefish and the red-listing of marine species in South Africa. As such, this publication is highly valuable for the assessment, monitoring and conservation of marine biodiversity in South Africa.

Kerry Sink
Marine Programme Manager, SANBI and Domatilla Raimondo, Threatened Species Programme Manager, SANBI

INTRODUCTION

The concept of periodically collating and publishing scientific information on key marine linefish species has proven to be most successful in the past. Three past editions of the "Visboekie" (Wallace and van der Elst 1983, van der Elst and Adkin 1991, Mann 2000) have made a significant contribution to fisheries management and linefish research in South Africa and further afield. While the two earlier editions focused mainly on biological information of key linefish species, the later edition contained an increasing amount of quantitative information on stock status. The current publication has continued this trend and, where available, has provided up-to-date information on the biology, ecology, status and vulnerability of important linefish species found around the southern African coastline.

The Marine Living Resources Act (Act 18 of 1998) calls for the establishment of operational management plans for important harvestable species in South Africa. While this has been attained for some important commercial species such as hake and pilchard, this process has, in the case of harvested marine linefish species, been more limited, largely due to the multi-species, multi-user nature of the linefishery. To address this need Griffiths et al. (1999) developed the Linefish Management Protocol (LMP) for the South African Linefishery. The LMP was designed to execute management plans for each important linefish species through a predetermined cycle of monitoring, assessment and revision of management regulations. Status reports were thus prepared for each key linefish species (Mann 2000) and species-specific management plans were developed based on these reports according to the LMP (Griffiths 1999). While some of the methods recommended by Griffiths et al. (1999) may now be slightly outdated, the principle of compiling updated status reports (called species profiles in this edition) remains the same and these should contribute to updating current species-specific management plans.

Following the declaration of an emergency in the South African linefishery in December 2000 and the recognition of the urgent need to rebuild many overexploited linefish stocks, implementation of the species-specific management plans eventually took place during the mid-2000s. In April 2005 a comprehensive suite of linefish regulations were promulgated and during 2003 and 2006 medium- and long-term commercial linefishing rights were allocated respectively. The allocation of these long-term rights included a substantial effort reduction and the implementation of a regionalized management system. Furthermore, attempts have been made over the past decade to recognize and manage the subsistence component of the linefishery that had previously been marginalized and overlooked (Branch 2002). It has now been 13 years since the original status reports were compiled (Mann 2000) and nearly a decade since the implementation of resultant management interventions. It is, therefore, crucial that the species profiles for key linefish species are updated to determine whether management interventions have contributed to the recovery of the linefishery.

In addition to their use for applied management of individual linefish species, the species profiles play an important role in increasing public awareness. In particular, both the process of evaluating vulnerability of fish species for the IUCN Red List and the process of increasing consumer awareness through the Southern African Sustainable Seafood Initiative (SASSI) have and will continue to make extensive use of these species profiles as a basis for species' evaluations.

MARINE LINEFISHING IN SOUTHERN AFRICA

Linefishing is defined as that activity where fish are harvested using a hook and line but excludes the use of set pelagic or demersal longlines, which are managed as separate fisheries. Although the method used is different, spearfishing is incorporated into the definition of "linefishing" for management purposes. Linefishing includes commercial, subsistence and recreational sectors, the latter often being referred to as angling.

The commercial linefishery comprises a large number of vessels and provides a livelihood for many thousands of people spread along the entire South African coast. With the long-term rights allocation process in 2006 the commercial linefishery was divided into three separate sectors consisting of the traditional linefishery (452 vessels and 3450 crew), the hake-handline sector (130 vessels and 785 crew) and the tuna-pole sector (200 vessels and 3600 crew). The combined role of these fishery sectors in providing fresh fish to the nation is considerable. Vessels used in the commercial linefishery range from 6-8m ski-boats capable of being launched through the surf to >20m harbour-based, freezer vessels that carry over 20 crew and can remain at sea for over two weeks.

Subsistence linefishers generally consist of poor people living within walking distance of the coast. They mainly fish from the shore using low technology gear such as handlines or simple rod and reel and the fish caught are generally used for their own and their family's consumption, while a surplus may be sold locally. While the actual number of subsistence fishers is not known, there are an estimated 28 000 households in South Africa which partly rely on fishing and intertidal invertebrate collecting for food security (Clark et al. 2002). There is an increasing frequency of true subsistence fishing from the west coast to the east with a peak in the former Transkei region of the Eastern Cape (Clark et al. 2002, Mann et al. 2003). A large number of people living along the Cape West Coast make use of small vessels (known locally as "bakkies"), which are either rowed or use small outboard motors to catch linefish species such as hottentot, snoek and yellowtail at sea. These fishers, along with gill-, seine-net and trap fishers, are perhaps better categorised as artisanal or small-scale commercial fishers. A policy dealing with both the subsistence and small-scale commercial sectors has recently been published (DAFF 2012).

The open access recreational fishery is large and growing, with an estimated 500 000 participants in 1996 (McGrath et al. 1997), while Leibold and van Zyl (2008) estimated as many as 900 000 participants in 2007. The marine recreational fishery in South Africa is therefore by far the largest sector in terms of the number of participants. While less than six percent of marine anglers are affiliated to angling clubs and organizations, this fishery is divided into four distinct facets: shore angling, deep sea angling, estuarine angling and spearfishing (van der Elst 1989). The importance of this fishery in meeting the recreational needs of the nation is considerable. Moreover, the infrastructure associated with tourism, boats, tackle and bait industries make this a particularly valuable fishery, possibly in excess of R9 billion per annum total economic impact (Leibold and van Zyl 2008).

STATUS OF THE LINEFISHERY

The South African Linefishery has undergone significant changes over the years. From modest beginnings in the middle of the 1800s, this fishery has grown to include a large number of recreational, subsistence and commercial fishers. The effect of this escalating effort and the improvement in fishing technology has manifested itself in several ways, most notably on the status of the linefish resource itself. Significantly, it has resulted in a severe change in the species composition of landings, primarily due to the serial overfishing of large, endemic reef fishes (van der Elst and de Freitas 1988). Several of these species are slow growing sparids with complicated life histories, including sex change, and which have been severely overexploited.

As a result of growing concern for the linefish resources, biological studies on a few important sparid species (e.g. seventy-four, hottentot and carpenter) were initiated in the 1960s (Ahrens 1964, Nepgen 1977). However, a number of decades passed before the fishery received the necessary research attention that was concomitant with its status. With the exception of species such as elf/shad in KwaZulu-Natal, and snoek and kob in the Western Cape, no other species-specific restrictions were promulgated until a comprehensive management framework was introduced for the linefishery in early 1985 (van der Elst and Garratt 1984, Penney et al. 1989). Included in this framework was the introduction of a two-tiered permit system for commercial fishers, freezing of commercial effort at the 1985 level, the introduction of revised minimum size limits equal to sizes at maturity, the division of species into categories based on perceived vulnerability to exploitation, with associated daily bag limits for recreational and in some cases commercial fishers, and the introduction of national closed seasons for certain species (Griffiths et al. 1999). One of the main objectives of this initiative was to steer fishing effort away from “vulnerable” resident reef fish species to more “resilient” migratory shoaling species. Although species categories and size limits were revised in 1992, in essence the management framework remained unchanged until the late 1990s. Owing to a lack of biological and fisheries data, the level of protection afforded to each species depended largely on subjective perceptions of their vulnerability to exploitation, rather than on quantitative evaluations of stock status.

Research surveys conducted in the mid-1990s revealed that the regulations had failed to provide a reasonable measure of resource protection, mainly because of poor enforcement and the fact that the regulations themselves were not limiting (Attwood and Bennett 1995a, Brouwer et al. 1997, Mann et al. 1997b, Penney et al. 1997, Sauer et al. 1997). Catch rates for many species continued to decline and the first per-recruit stock assessments revealed that many of the so-called “resilient” species (e.g. dusky kob and geelbek) were in fact also severely overexploited (Griffiths 1997b, c, 2000, Hutton et al. 2001). Given the increasing demands for access to the fishery and the perilous status of many of the important linefish stocks, a substantial revision of the management procedure was required. This led to the development of the Linefish Management Protocol (LMP) tailored to the requirements of the South African linefishery (Griffiths et al. 1999).

Based partly on implementation of the LMP and other management interventions, the linefishery has been subjected to a number of radical changes during the past decade. Amongst others this has included: the introduction of a national licensing system for recreational fishers in 1998; the declaration of an emergency in the linefishery in December 2000; the implementation of a ban on beach driving in January 2002; the recognition and registration of subsistence linefishers in 2003; a nominal 70% cut in commercial linefishing effort with the implementation of medium- and long-term fishing rights in 2003 and 2006 respectively and regionalisation of the commercial linefishery; promulgation of a suite of species-specific linefish regulations in April 2005; and proclamation of another six marine protected areas (MPAs) bringing the total MPA network to 23 in South Africa (with approximately 9% of the coastline length now falling into no-take MPAs). Assessment of the impact of these management interventions is a necessary and ongoing process (e.g. Dunlop and Mann 2012, 2013) and recent innovative stock assessment techniques suggest a positive response to management in some commercial linefish species in South Africa (Winker et al. 2012, 2013).

Despite the positive signals there is certainly no room for complacency. Overall it appears that at least 11 of the 139 linefish species reviewed in this book are considered to be overexploited and the stocks of a further 19 species appear to have collapsed (Figure 1a). There thus remains an urgent need for stock rebuilding, with the associated catch and effort monitoring and stock assessment of key linefish species. The stock status of only 56 (40%) of our most important linefish species is known and some of these assessments are now outdated. The subjective rankings by authors suggest that at least 30 of the species considered should receive high research priority and a further 60 should receive medium priority (Figure 1b).

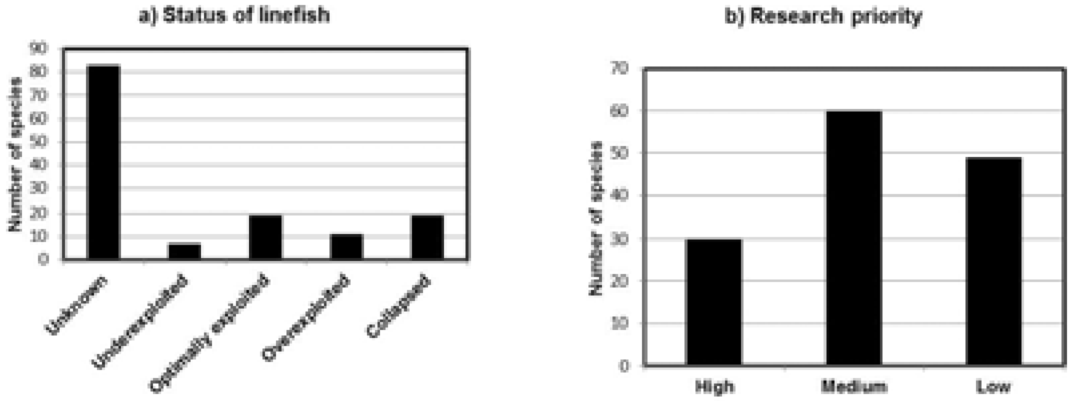


Figure 1a & b. Population status and research priority of 139 linefish species evaluated in this book.

HOW TO USE THIS BOOK

It is intended that this book should serve both as a reference and a working document. The individual species profiles provide information in specific categories on each species as well as a comprehensive bibliography. Where information is lacking the word "Unknown" has been used to highlight gaps in current knowledge. As linefish research is an ongoing process, the current species profiles will need to be updated as more and improved information becomes available. In this regard, readers of this document are requested to bring any mistakes or updates to the attention of the editor (bruce@ori.org.za) so that future species profiles may be correctly updated. The responsibility for the scientific correctness of the individual species profiles lies primarily with the compiling author and appointed referee for that profile.

The arrangement of this book is by family name in alphabetical order. It was decided to include both cartilaginous species (sharks, rays and chimaeras) and bony fish together rather than separate them as was done in the previous edition. Where possible, individual species profiles are confined to two pages but this was not possible in the case of important species where much information was available. Considerable use has been made of abbreviations and symbols to shorten the document. While most are self-explanatory, some may require reference to Appendix II.

<u>How to cite this document</u>: The species profiles should be referenced by including the names of both the compiler and the referee as given in the example below:
West W, Marsac F. 2013. Albacore (*Thunnus alalunga*). In: Mann BQ. (Ed). Southern African Marine Linefish Species Profiles. Special Publication, Oceanographic Research Institute, Durban 9: 179-180.

SPECIES CONSIDERED

Approximately 250 species have been reported caught by linefishers around southern Africa, although only a dozen of these together account for more than 90% of the catch. Linefishers further eastward catch a greater diversity of fishes, mostly species from the rich Indo-Pacific ichthyofauna. A total of 139 species are dealt with in this book. Criteria for inclusion were the species' importance in landings, target value for certain fishery sectors, depleted species and those considered to have future potential in the linefishery. While the list of species was based primarily on the previous editions of this book (van der Elst and Adkin 1991, Mann 2000), additional species were added based on a comprehensive prioritization exercise conducted by Lamberth and Joubert (1999) and Griffiths and Lamberth (2002)**.**

CRITERIA EVALUATED

In order to provide a synoptic yet comprehensive overview of the natural history, fishery, population dynamics and status of each species, a number of criteria were identified. These were carefully evaluated in light of research progress, and wherever possible, details are provided with the relevant references. If unavailable from southern Africa, species information from the Western Indian Ocean or elsewhere is provided. Criteria evaluated for each species are as follows:

SCIENTIFIC NAME: Genus and species according to Smith and Heemstra (1991) and hence the Smith's number is given in brackets. Name changes were checked in Heemstra and Heemstra (2004) and FishBase (Froese and Pauly 2012).
COMMON NAMES: The vernacular names given are those most commonly used in South Africa.
COMPILER: Name of compiler (organization and email address are given in Appendix I).
REVIEWER: Name of referee (organization and email address are given in Appendix I).
DATE OF REPORT COMPLETION: Month and year when the species profile was completed.

GLOBAL DISTRIBUTION: The global distribution of the species is briefly described.
SOUTHERN AFRICAN DISTRIBUTION: The distribution of the species or stock within southern African waters is given (Figure 2) and use is made of the following general area abbreviations:
MOZ - Mozambique (Ponta do Ouro northwards)
KZN - KwaZulu-Natal (Ponta do Ouro to Umtamvuna River)
EC - Eastern Cape (Umtamvuna River to Bloukrans River)
WC - Western Cape (Bloukrans River to Olifants River)
NC - Northern Cape (Olifants River to Orange River)
NAM - Namibia (Orange River to Kunene River)

Figure 2. Map of southern Africa showing areas, places and rivers mentioned in the document.

MOVEMENT: If known, the species is categorised as resident, nomadic or migratory and a brief description of movement behaviour is given, normally based on the results of tag and recapture studies.

HABITAT: A brief description of the habitat and depth preferences of adults and juveniles, and the occurrence of eggs and larvae, if known.

FEEDING: A brief description of the diet and feeding preferences of adults and juveniles, if known.

REPRODUCTION:
Reproductive style: When known, this is specified for the species (e.g. gonochorist, protogynous hermaphrodite, viviparous etc.).
Breeding/spawning season: Months when breeding or spawning occurs.
Breeding/spawning locality: Area where breeding or spawning occurs.
Age at 50% maturity: Calculated or observed age (or range of ages) at maturity is given. When available it is

stated whether this was calculated for males, females and/or combined sexes and where and when the study was conducted.
Length at 50% maturity: Calculated or observed length (or range of lengths) at maturity is given. When available it is stated whether this was calculated for males, females and/or combined sexes and where and when the study was conducted.

BIOMETRICS:
Maximum recorded age: Maximum age of the species recorded in any particular study.
Maximum recorded weight: Heaviest specimen recorded in a particular study or the maximum weight recorded locally or internationally (e.g. IGFA or local fishing association websites). When available, details of the sex, locality and year caught are provided.
Maximum recorded length: Largest specimen recorded. When available, details of the sex, locality and year caught are provided.
Length-length relationship: When available, various useful length relationships are given using the correct notation (e.g. fork length/total length relationships).
Length-weight relationship: The most appropriate length/weight relationship equations are given using the correct notation. When available, information is provided on sex, area and year of study. In well-studied species for which a number of different length/weight relationships are available, the geometric mean given in Froese and Pauly (2012) is used.
Growth parameters: When available the von Bertalanffy growth parameters (L_∞; K; t_0) are provided with the area and year of the study. If growth of the species has not been studied in southern Africa but has been determined elsewhere, the most relevant growth parameters determined for that species are given (see Appendix II for symbols used).

FISHERY: An indication is given of which sectors of the linefishery (and other fisheries) target the species and where along the southern African coastline it is most commonly caught.

BIOLOGICAL REFERENCE POINTS:
Fishing mortality rate (F): Instantaneous fishing mortality rate.
Natural mortality rate (M): Instantaneous natural mortality rate.
Total mortality rate (Z): Instantaneous total mortality rate (where Z = F + M).
F_{MSY} yr^{-1}: The F value at which maximum sustainable yield is theoretically achieved.
F_{SB40} yr^{-1}: The F value at which spawning biomass is reduced to 40% of its theoretical pristine level (target reference point).
F_{SB25} yr^{-1}: The F value at which spawning biomass is reduced to 25% of its theoretical pristine level (threshold reference point).
$F_{0.1}$ yr^{-1}: A more conservative level of F than F_{MSY}, and at which maximum yield is approximated but more protection is provided for the spawning biomass.
$SBPR_{current}$: The percentage to which spawning biomass per recruit has been reduced at current F.
References & Comments: Comments are provided on when and where the study was done and relevant references are provided.

STOCK STATUS:
Stock assessment method: The type of method used in the most recent stock assessment e.g. per-recruit analysis, virtual population analysis, surplus production modelling, etc.
Year completed: The year when the most recent stock assessment was conducted.
Locality: The area where the most recent stock assessment was conducted.
Status: When a stock assessment has been conducted, status is reported as one of the following categories: underexploited; optimally exploited; overexploited or collapsed (see Griffiths et al. 1999 for definition). When a specific stock assessment has not been conducted and stock status is not known, stock status indicators are provided in terms of available trends (see below).
Trend in CPUE: A brief description of any known trends in catch per unit effort for the species with reference to where this information is published or, if unpublished, from which data source this trend was determined.
Trend in catch composition: A brief description of any known trends in percentage catch composition for the species with reference to where this information is published or, if unpublished, from which data source this trend was determined.
Trend in mean size: A brief description of any known trends in mean size.
Trend in sex ratio: A brief description of any known changes in sex ratio (especially relevant to sex changing species).

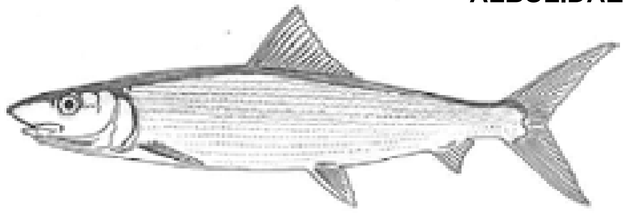
VULNERABILITY RATING:
MLRA: Current (2013) listing of the species in terms of regulations promulgated under the MLRA (Act 18 of 1998).
IUCN Red List: For species that have been evaluated, global threat status and the year that the assessment was published on the IUCN Red List website (IUCN 2012) are given.

CURRENT REGULATIONS: The most recent regulations (as of 2013) published in the Government Gazette in terms of the MLRA (Act 18 of 1998) were used for this purpose.
Daily bag limit: The current daily bag limit as it applies to recreational, subsistence and commercial fishers.
Minimum size limit: The current minimum size limit for the species.
Closed Season: The specific dates of any closed season for the species.
Other regulations: Any other regulations that have particular relevance to the species in question.
MPA effectiveness: Any marine protected areas that have either been shown or are believed to be effective in protecting the species.

MANAGEMENT CONSIDERATIONS: Any comments specific to the future management of the species.

RESEARCH REQUIREMENTS: The outstanding research needs for each species are identified.
Research priority: A simple subjective ranking (i.e. high, medium or low) is given by the responsible authors in terms of the perceived importance of conducting future research on each species. This should be cross-referenced with the research priority formally assessed by Lamberth and Joubert (1999).

REFERENCES: References are quoted in the text and presented in alphabetical order at the end of the book. While references cited in this book mainly comprise material published in southern Africa, foreign references applicable to the species outside southern African waters are also used when local information is lacking. Extensive use was made of “grey” literature such as unpublished reports. Certain websites such as FishBase (Froese and Pauly 2012), IUCN Red List (IUCN 2012) and Marine fish eggs and larvae (Connell 2012) proved to be most useful and have been used extensively in the compilation of this book.



SCIENTIFIC NAME: *Albula oligolepis* (Smith No. 38.1)
COMMON NAMES: Bonefish, Smallscale bonefish
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Much confusion surrounds the taxonomy of the *Albula* species found in SA waters. Previously referred to as *A. vulpes* (Smith and Heemstra 1991), then described as *A. glossodonta* (Heemstra and Heemstra 2004), now believed to be *A. oligolepis* (Hidaka et al. 2008), which has an Indo-West Pacific distribution including SA, MOZ, Mauritius, Seychelles, Somalia, Yemen, Oman, India, western Thailand and north eastern Australia (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
A. vulpes previously thought to be widespread throughout tropical seas (Smith 2003) but may actually be comprised of as many as eight or nine genetically distinct species, with some overlap in ranges (Colborn et al. 2001, Wallace and Tringali 2010). *A. vulpes* now reported to be restricted to tropical and subtropical northwest Atlantic (Adams et al. 2012b). Previous records of *A. vulpes* in SA waters most likely refer to the newly described *A. oligolepis* (Hidaka et al. 2008). Extends south to East London (van der Elst 1993)

MOVEMENT: Unknown
Only 1 recapture from the 319 bonefish tagged in the ORI Tagging Project, likely to be high levels of predation on tagged and released individuals (Danylchuck et al. 2007, Mann 2012)

HABITAT
Adults: An inshore, shallow-water species associated with sandy and muddy bottoms (van der Elst 1993), also in mangrove swamps (Smith 2003)
Juveniles: Little known, similar to adults
Eggs and larvae: Larvae pass through an eel-like leptocephalus phase before maturing into the adult form at about 6cm TL (Jones et al. 1978, van der Elst 1993)

FEEDING
Adults: Crabs, cracker shrimps, worms and molluscs (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown, but probably gonochoristic similar to *A. vulpes* (Jones et al. 1978)
Breeding/spawning season: All year round (van der Elst 1993, Smith 2003)
Breeding/spawning locality: Spawning thought to occur in slightly deeper water further offshore in tropical and subtropical regions (van der Elst 1993, Smith 2003)
Age at 50% maturity: 1-2 years (van der Elst 1993)
Length at 50% maturity: 25-30cm TL (van der Elst 1993)

BIOMETRICS
Maximum recorded age: Unknown in SA waters, *A. vulpes* aged to a maximum of 19 years in the Florida Keys (Crabtree et al. 1996)
Maximum recorded weight: 8.61kg, SA angling record (van der Elst 1993)
Maximum recorded length: 100cm FL, some of the largest specimens on record were caught in KZN waters (van der Elst 1993, Smith 2003)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: $Wt(g) = 0.0233 \times FL(cm)^{2.89}$; SA (Torres 1991a)
Growth parameters: Not aged

FISHERY
Popular among light tackle shore anglers along the Zululand coast due to its fighting ability but is not considered good eating due to numerous tiny bones (van der Elst 1993). Around Indian Ocean islands often targeted on fly tackle. Occasionally netted in the beach seine fishery off Durban (Beckley and Fennessy 1996). Recent evidence of more bonefish being caught in southern KZN suggesting a range extension possibly associated with increasing sea temperature (B. Mann, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown

F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

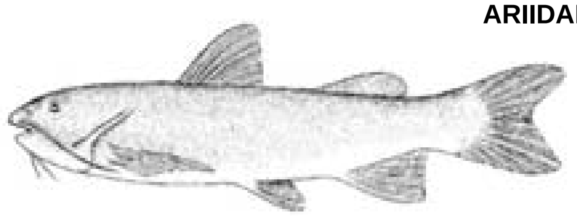
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2012 (Adams et al. 2012a)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably benefits from receiving full protection in the no-take zones of the St Lucia and Maputaland MPAs on the KZN north coast (Mann 2012)

MANAGEMENT CONSIDERATIONS
The suitability of spatial protection, using MPAs, is dependent on knowledge of movement behaviour, which is currently lacking for this species in SA waters. As a precautionary approach, consideration should be given to managing this fish as a recreational species and introducing a daily bag limit of 5 pppd and a minimum legal size limit of 40cm TL

RESEARCH REQUIREMENTS
Taxonomy and genetics, reproductive biology, movement, early life-history, age and growth
Research priority: Low



SCIENTIFIC NAME: *Galeichthys ater* (Smith No. 59.2)
COMMON NAMES: Black seacatfish, Black seabarbel
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Endemic to the entire south coast of SA between Margate in KZN and Swakopmund in NAM (Tilney 1990, Smith and Heemstra 1991). Previously confused with *Galeichthys trowi*, a newly described species occurring off KZN and Transkei (Kulongowski 2010)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Exclusively marine, primarily in the region between East London and Table Bay (Kulongowski 2010)

MOVEMENT: Unknown
Juveniles migrate from the intertidal to shallow subtidal reefs before recruitment into the fishery. No evidence of a breeding migration evident (Tilney 1990). Recapture data on the ORI Tagging Project is primarily for *Galeichthys trowi*, which has been shown to be a highly resident species (B. Mann, ORI, pers. obs)

HABITAT
Adults: Shallow offshore reefs to about 60m (Tilney 1990)
Juveniles: Strictly marine, found in intertidal pools and on shallow subtidal reefs (Tilney 1990)
Eggs and larvae: Paternal mouth brooder (Tilney 1990)

FEEDING
Adults: Benthic invertebrates, primarily annelid worms (Tilney 1990, van der Elst and Adkin 1991)
Juveniles: Benthic crustaceans, particularly amphipods and isopods (Prochazka 1998)

REPRODUCTION
Reproductive style: Gonochorist, paternal mouth-brooders (Tilney 1990)
Breeding/spawning season: Spawning between Aug-Oct, peaking in Aug in the EC (Tilney 1990)
Breeding/spawning locality: Shallow reefs off the EC (Tilney 1990)
Age at 50% maturity: Males: 9 years; Females: 7 years; EC (Tilney 1990)
Length at 50% maturity: Males: 225mm FL; Females: 245mm FL; Combined sexes: 235mm FL; EC (Tilney 1990)

BIOMETRICS
Maximum recorded age: >15 years, Female, EC, 1990 (Tilney 1990)
Maximum recorded weight: 1.3kg, derived from length-weight relationship (Tilney 1990)
Maximum recorded length: 45cm TL (Smith and Heemstra 1991)
Length-length relationship: TL(cm) = 1.075FL(cm); TL(cm) = 1.157SL(cm), based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000138 \times FL(mm)^{3.04}$; EC (Tilney 1990)
Growth parameters: Combined sexes: L_∞ = 279mm FL; K = 0.274; t_0 = -1.406; EC (Tilney 1990)

FISHERY
Largely a bycatch in the commercial and recreational skiboat linefishery. Comprises approximately 30% (±10t per annum) of Port Alfred linefish catches – increases in importance when other linefish species are less abundant (Hecht and Tilney 1989, Tilney 1990, Donovan 2010). Also occasionally taken by shore anglers and in beach seine-nets where it is generally regarded as an undesirable bycatch species (Tilney 1990)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Males: $0.123yr^{-1}$; Females: $0.124yr^{-1}$
Natural mortality rate (M): Males: $0.211yr^{-1}$; Females: $0.133yr^{-1}$ (determined using Pauly's method)
Total mortality rate (Z): Males: $0.334yr^{-1}$; Females: $0.257yr^{-1}$
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: Males: 0.24; Females: 0.14
F_{SB25} yr^{-1}: Males: >0.25; Females: 0.25
$F_{0.1}$ yr^{-1}: Males: 0.28; Females: 0.23
$SBPR_{current}$: Males: 57%; Females: 53%
Year completed: 1990
Locality: EC
References & Comments: Tilney (1990)

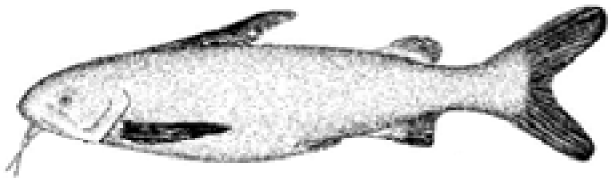
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1990
Locality: EC
Status: >50% - underexploited (Tilney 1990)
Trend in CPUE: Unknown
Trend in catch composition: Contribution to catch composition has fluctuated in the Port Alfred skiboat fishery. In terms of the non-sparid group including *G. feliceps* and *G. ater*, catch composition from three time periods (commercial and recreational catches combined) showed an initial steep decline followed by a slight recovery: 1985-87 (31.3%); 1996-98 (1.2%); 2006-08 (6.1%) (Hecht and Tilney 1989, Donovan 2010)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio was 1:1 in the EC (Tilney 1990), no data on trends

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Recorded in a number of MPAs in the EC and WC and likely to receive protection in no-take areas within these MPAs that include suitable reef habitat for this species

MANAGEMENT CONSIDERATIONS
Black seacatfish are vulnerable to overfishing due to their relatively low fecundity and are becoming an increasingly important component of commercial catches as other target linefish species decline. Careful monitoring of catch and effort is therefore required, especially because this species is normally taken by the crew and is often not recorded

RESEARCH REQUIREMENTS
Re-evaluate biological and population parameters and re-assess stock status
Research priority: Medium



SCIENTIFIC NAME: *Galeichthys feliceps* (Smith No. 59.3)
COMMON NAMES: White seacatfish, White seabarbel
COMPILER: BQ Mann
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Endemic from Walvis Bay in NAM round to Mbashe River in EC (Heemstra and Heemstra 2004, Kulongowski 2010)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Most abundant along the southern SA coast from Cape Town to Port Alfred (Kulongowski 2010)

MOVEMENT: Unknown
Adult males migrate into estuaries during their mouth-brooding phase, between Sep-Mar and remain there for 3-4 months (Tilney 1990, Heemstra and Heemstra 2004). Of the 31 recaptures (8.73%) recorded on the ORI Tagging Project, the mean distance moved was 2km and the maximum 21km. However, these data may be unreliable as volunteer taggers may confuse different seacatfish species (B. Mann, ORI, pers. obs.)

HABITAT
Adults: Found in the inshore marine and estuarine environment – prefer muddy and sandy substrata and reef fringes down to 100m (Heemstra and Heemstra 2004)
Juveniles: Juveniles found in shallower water than adults, abundant in turbid estuaries, less abundant in clear estuaries, unable to survive salinities of less than 8ppt (Bennett 1985, Tilney and Mann 2000)
Eggs and larvae: Mouth-brooding adult males found in estuaries between Sep-Mar. Eggs are large (15-16mm in diameter) with an average brood size of 49 eggs, which hatch after 75-80 days (Tilney 1990, Heemstra and Heemstra 2004)

FEEDING
Adults: Diet includes benthic crustaceans (mainly crabs), polychaetes, molluscs (including cephalopods) and fish (Marais 1984, Bennett 1989, Heemstra and Heemstra 2004)
Juveniles: Benthic crustaceans including amphipods and decapods, and insects (chironomid larvae) (Bennett 1989)

REPRODUCTION
Reproductive style: Gonochorist, paternal mouth-brooders (Tilney 1990)
Breeding/spawning season: Peak GSI in Sep, spawning between Sep-Dec in the EC (Tilney 1990)
Breeding/spawning locality: Known to breed in large estuaries and on shallow reefs in the EC (Tilney 1990)
Age at 50% maturity: Males: 10 years; Females: 9 years; EC (Tilney 1990)
Length at 50% maturity: Males: 315mm FL; Females: 295mm FL; EC (Tilney 1990)

BIOMETRICS
Maximum recorded age: >18 years; Female; EC (Tilney 1990)
Maximum recorded weight: 3.8kg; SA angling record (van der Elst 1993)
Maximum recorded length: 55cm TL (Smith and Heemstra 1991)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.00000955 x FL(mm)$^{3.08}$; EC (Tilney 1990)
Growth parameters: Males: L_∞ = 390mm FL; K = 0.147; t_0 = -1.406; Females: L_∞ = 408mm FL; K = 0.119; t_0 = -1.834; EC (Tilney 1990)

FISHERY
Largely caught as a bycatch of the commercial skiboat fishery in the EC. A limited amount of targeting occurs by skiboats in the EC when catches of preferred species are poor (Hecht and Tilney 1989, Tilney 1990, Donovan 2010). Also targeted by some skiboats off Swakopmund in NAM. Largely an undesirable bycatch species in the recreational skiboat fishery and the shore fishery (Tilney and Mann 2000). Also caught as a bycatch in the inshore trawl fishery and in the beach seine and gill-net fisheries in the WC (Lamberth et al. 1997)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.25yr^{-1}
Natural mortality rate (M): 0.12yr^{-1}
Total mortality rate (Z): 0.37yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.17
F_{SB25} yr^{-1}: 0.34

$F_{0.1}$ yr^{-1}: 0.21
$SBPR_{current}$: 29%
Year completed: 1990
Locality: EC
References & Comments: Combined sexes (Tilney 1990)

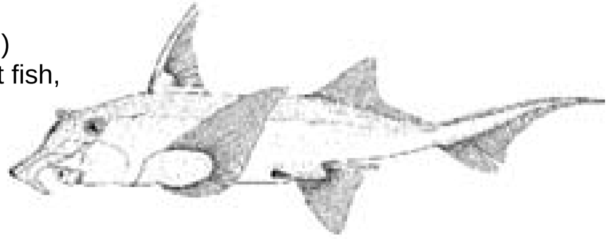
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1990
Locality: EC
Status: 25-40% - overexploited (Tilney 1990)
Trend in CPUE: Unknown
Trend in catch composition: Contribution to catch composition has fluctuated in the Port Alfred skiboat fishery. In terms of the non-sparid group including *G. feliceps* and *G. ater*, catch composition from three time periods (commercial and recreational catches combined) showed an initial steep decline followed by a slight recovery: 1985-87 (31.3%); 1996-98 (1.2%); 2006-08 (6.1%) (Hecht and Tilney 1989, Donovan 2010)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio 1:1.03 (whole population, EC) (Tilney 1990) but no information on trends

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Recorded in a number of MPAs in the EC and WC and likely to receive protection in no-take areas within these MPAs that include suitable habitat for this species

MANAGEMENT CONSIDERATIONS
White seacatfish are vulnerable to overfishing due to their estuarine dependency and relatively low fecundity and are becoming an increasingly important component of commercial catches as other target linefish species decline. Careful monitoring of catch and effort is therefore required, especially because this species is normally taken by the crew and is often not recorded. Better protection of estuarine habitats in the EC and WC is required

RESEARCH REQUIREMENTS
Re-evaluate biological and population parameters and re-assess stock status
Research priority: Medium



SCIENTIFIC NAME: *Callorhinchus capensis* (Smith No. 34.1)
COMMON NAMES: St Joseph, Elephant fish, Cape elephant fish, Silver trumpeter
COMPILER: C da Silva
REVIEWER: SJ Lamberth
DATE OF REPORT COMPLETION: December 2012

GLOBAL DISTRIBUTION: Endemic, NAM to KZN (Compagno et al. 1986, 1989, Krefft 1990)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Primarily found along the Namibian, western and southern coast of SA, rare off KZN (Compagno et al. 1989, 1991, Freer 1992)

MOVEMENT: Nomadic
Mature fish have an annual onshore/offshore migration for reproductive purposes (Freer and Griffiths 1993a)

HABITAT
Adults: A demersal marine species primarily living over soft substrata, depth range 10-374m (Compagno et al. 1986, 1989, Freer and Griffiths 1993a)
Juveniles: Juveniles found predominantly inshore <50m (Freer and Griffiths 1993a)
Eggs and larvae: Eggs deposited in the shallow nearshore and dissipative surf zones (Freer and Griffiths 1993a)

FEEDING
Adults: Benthic invertebrates including bivalves, gastropods, polychaetes, crustaceans and fish (Ribbink 1971, Freer and Griffiths 1993a). Also known to feed on black mussels (Abi 2011)
Juveniles: Similar to adults

REPRODUCTION
Reproductive style: Oviparous, up to a maximum of 22 eggs, incubation time 9-12 months. Sperm storage inside the oviducal gland is likely and represents an advantage for deep-water species that exhibit sexual segregation. Semen plug probably provides a competitive advantage
Breeding/spawning season: In summer, mature *C. capensis* usually migrate inshore to mate and lay eggs in shallow, sheltered bays (Freer and Griffiths 1993a)
Breeding/spawning locality: Confirmed courtship, mating and breeding ground in St Helena Bay on the west coast (Freer and Griffiths 1993a)
Age at 50% maturity: Males: 3.3 years; Females: 4.2 years; St Helena Bay; 1993 (Freer and Griffiths 1993a)
Length at 50% maturity: Males: 434mm FL; Females: 496mm FL; St Helena Bay; 2011 (Abi 2011)

BIOMETRICS
Maximum recorded age: 10 years; WC; 1993 (Freer and Griffiths 1993b)
Maximum recorded weight: 5.25kg; 2001; IGFA angling records (in Froese and Pauly 2012)
Maximum recorded length: 122cm FL (Compagno 1986)
Length-length relationship: Unknown
Length-weight relationship: $Wt(g) = 0.008 \times TL(cm)^3$, based on one fish of 87cm TL (Froese and Pauly 2012)
Growth parameters: Males: L_∞ = 648mm FL; K = 0.171; t_0 = -0.721; Females: L_∞ = 1089mm FL; K = 0.0515; t_0 = -0.606; WC (Freer and Griffiths 1993b)

FISHERY
Caught by directed gillnet and beach seine fisheries off the West Coast and in False Bay (Freer and Griffiths 1993a, Lamberth et al. 1997) but <10mt recorded in 2010. Large numbers caught as a bycatch in the inshore trawl fishery (over 800mt caught in 2010). Occasionally caught inshore by recreational boat and shore anglers and subsistence shore fishers during and following upwelling events

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Decline in catches may be due to the "silver trumpeter" market collapsing, however substantial catches are now made by the inshore trawl fishery that used to be made by the beach seine and gill net fishery. Stock status further complicated by lack of life-history data, understanding of movement patterns, residency, sexual segregation and their status as a low value, bycatch species
Trend in catch composition: Difficult to quantify as St Joseph are caught by a number of different fisheries as bycatch and they tend to school by sex and size
Trend in mean size: Unknown
Trend in sex ratio: Unknown

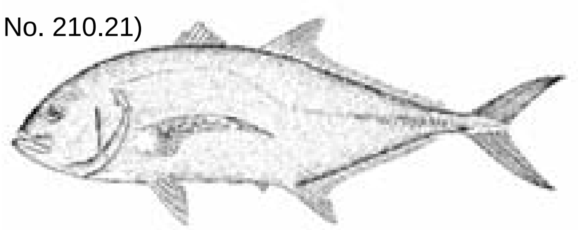
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern, 2006 (Pheeha and Dagit 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: It is likely that MPAs in the SW Cape and along the West Coast play a role in providing protection for this species

MANAGEMENT CONSIDERATIONS
It is recommended that St Helena Bay should be closed to inshore trawl activity during the summer months to protect aggregations of large females during their breeding period

RESEARCH REQUIREMENTS
Update ageing, conduct stock assessment, conduct an update on the St Joseph fishery, identify opportunities for market development and value adding, conduct tests for trace metals especially methyl mercury, investigate parasites, vectors and transferability to humans, better understand physiology
Research priority: Medium

SCIENTIFIC NAME: *Caranx heberi (previously C. sem)* (Smith No. 210.21)
COMMON NAMES: Blacktip kingfish, Yellowtail kingfish, Blacktip trevally
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: Broadly distributed in coastal waters throughout most of the Indo-West Pacific, from the Persian Gulf down to SA, Australia and Fiji islands, but no verified records from the Red Sea (Smith-Vaniz 1984, Smith-Vaniz 2003, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
East coast of SA to Algoa Bay but rare south of KZN (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Most abundant in SA waters during summer (van der Elst 1993). Seems to have a limited home range of about 3km compared to other carangid species (Heemstra and Heemstra 2004). Of the 26 recaptures (4.01%) recorded in the ORI Tagging Project, 21 were caught at the same location where the fish had been originally tagged, with the remaining five fish moving a mean distance of 19km (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Over rocky reefs and pinnacles in 5-20m, normally in clean coastal waters where it often aggregates in shoals, seldom in turbid or estuarine waters (Smith-Vaniz 1984, van der Elst 1993, Smith-Vaniz 2003, Heemstra and Heemstra 2004)
Juveniles: Common in coastal bays and large, unspoilt estuaries (Blaber and Cyrus 1983, van der Elst 1993)
Eggs and larvae: Pelagic eggs recorded inshore off Park Rynie during summer on the KZN south coast (Connell 2012)

FEEDING
Adults: Mostly small fish but also squid, shrimps, mantis shrimps, swimming crabs and occasionally small crayfish (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown but likely to be a gonochoristic, broadcast spawner (B. Mann, ORI, pers. obs.)
Breeding/spawning season: Spawning occurs during summer in tropical areas (Heemstra and Heemstra 2004). Eggs recorded off Park Rynie on the KZN south coast mainly during Dec-Jan (Connell 2012)
Breeding/spawning locality: Inshore in tropical regions (van der Elst 1993) with spawning probably occurring close to the surf-zone (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: 50cm FL, KZN (van der Elst and Adkin 1991)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 12.5kg, SA angling record (van der Elst 1993)
Maximum recorded length: 100cm TL (van der Elst 1993)
Length-length relationship: TL(mm) = 1.138FL(mm) + 9.8; SA (van der Elst and Adkin 1991)
TL(cm) = 1.267SL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.0386x\ FL(cm)^{2.856}$; SA (van der Elst and Adkin 1991)
Growth parameters: Unknown

FISHERY
Caught by shore anglers, skiboat anglers and spearfishers (van der Elst 1993), especially in northern KZN (Dunlop 2011). Of little commercial importance in SA

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown

$SBPR_{current}$: Unknown
References & Comments: Not assessed

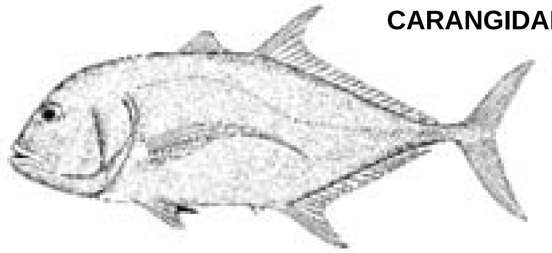
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Comprised 0.24% and 0.08% of shore anglers and recreational ski-boat anglers catches respectively in KZN during 2008-10, but little information on trends (Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Protected from capture in some no-take MPAs along the SA east coast such as in the sanctuary areas of the St Lucia and Maputaland MPAs (Mann 2012) and also likely to receive some protection in the Aliwal Shoal and Pondoland MPAs

MANAGEMENT CONSIDERATIONS
An important gamefish species, especially for light-tackle anglers. More information is needed on the biology, population dynamics and status of this species in SA waters and consideration could be given to the introduction of a minimum size limit as a precautionary measure

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, movement, stock assessment, early life history, fishery trends
Research priority: Low



SCIENTIFIC NAME: *Caranx ignobilis* (Smith No. 210.17)
COMMON NAMES: Giant kingfish, Giant trevally
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Widespread in Indo-West and Central Pacific, Red Sea down to SA, extending eastwards to Hawaii and Marquesas islands (Smith-Vaniz 1984, Smith-Vaniz 2003, Heemstra and Heemstra 2004, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Algoa Bay northwards (Smith-Vaniz 2003, Heemstra and Heemstra 2004) but less common in EC waters south of the former Transkei (B. Mann, ORI, pers. obs.)

MOVEMENT: Unknown
Adults appear to be fairly wide ranging (Wetherbee et al. 2004, Meyer et al. 2007). Of the 102 recaptures recorded on the ORI Tagging Project, the mean distance moved is 14km and it has been suggested the adults may occupy large home ranges for extended periods (B. Mann, ORI, pers. obs). However, adults are also more abundant off KZN during the summer months suggesting a southward migration (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Common in tropical and subtropical marine habitats such as shallow coastal areas, islands, atolls and isolated shoals, often associated with reefs (Sudekum et al. 1991, van der Elst 1993, Whitfield 1998, Smith-Vaniz 2003). Mainly in shallow water but have been recorded to depths of 188m (Froese and Pauly 2012) Sometimes semi-resident in large estuarine systems such as Kosi Bay (Mann et al. 2000). Often associated with the KZN sardine run (R. van der Elst, ORI, pers. obs.)
Juveniles: Recruitment of juveniles into KZN estuaries occurs during summer, larger juveniles and sub-adults may remain in the estuarine environment prior to maturation (Blaber and Cyrus 1983, Blaber 1986, Smith 1992, Whitfield 1998, Smith-Vaniz 2003). Juveniles also fairly common in the surf-zone along the MOZ and northern KZN coast (B. Mann, ORI, pers. obs.)
Eggs and larvae: Little known about early life history, no giant kingfish eggs recorded by Connell (2012) along the KZN south coast and no juveniles smaller than 40mm SL recorded in KZN estuaries (Blaber and Cyrus 1983)

FEEDING
Adults: Fish constitutes 70% of diet, balance consists of squid, mantis shrimps and other crustaceans (Smith-Vaniz 1984, van der Elst 1993)
Juveniles: Similar to adults (Smith 1992)

REPRODUCTION
Reproductive style: Gonochoristic, broadcast spawner (Sudekum et al. 1991)
Breeding/spawning season: Summer in KZN waters (van der Elst 1993, Whitfield 1998)
Breeding/spawning locality: Widespread in tropical areas (van der Elst 1993), recorded from Zanzibar, Hawaii and the Philippines where it appears likely that males and females aggregate in sex-specific shoals (Williams 1965, Sudekum et al. 1991). Meyer et al. (2007) reported seasonal spawning aggregations in Hawaii. Spawning usually takes place on the seaward side of inshore reefs and over offshore banks (Myers 1999). Big shoals of large individuals in daisy-chain formation have been reported from southern MOZ and from the Mtentu Estuary (EC), but it is not certain whether this is spawning related
Age at 50% maturity: 3-3.5 years (Sudekum et al. 1991, van der Elst 1993)
Length at 50% maturity: 60-65cm FL, KZN (van der Elst and Adkin 1991, van der Elst 1993)

BIOMETRICS
Maximum recorded age: >10 years; Hawaii (Sudekum et al. 1991)
Maximum recorded weight: 68kg; Hawaii (Sudekum et al. 1991), 80kg (Bagnis et al. 1984)
Maximum recorded length: 165cm FL (Sudekum et al. 1991, Smith-Vaniz 2003)
Length-length relationship: TL(mm) = 1.056FL(mm) + 58.7; KZN (van der Elst and Adkin 1991)
SL(mm) = 0.924FL(mm) + 6; Hawaii (Sudekum et al. 1991)
Length-weight relationship: Wt(kg) = 0.0000207 x FL(cm)$^{2.987}$; KZN (van der Elst and Adkin 1991);
Wt(g) = 0.0234 x FL(cm)$^{2.96}$; Geometric mean from nine studies (Froese and Pauly 2012)
Growth parameters: L_∞ = 1838mm SL; K = 0.111; t_0 = 0.097; Hawaii (Sudekum et al. 1991)

FISHERY
Important recreational gamefish, caught by shore anglers, ski-boat anglers and spearfishers, highly sought after as a trophy fish (van der Elst 1993) but nowadays large specimens are often released. Of little commercial value locally but is harvested in the artisanal trap fishery within Kosi Bay (Kyle 1986)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

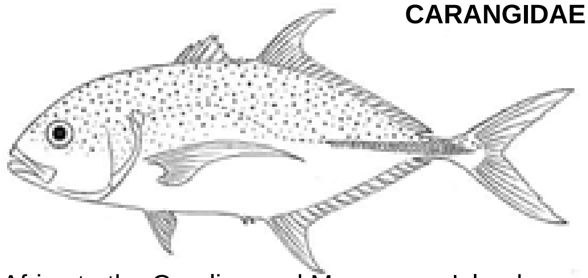
STOCK STATUS
Status: Not assessed
Trend in CPUE: Very low numbers sampled in angling surveys along the KZN coast thus preventing analysis of catch trends. Lloyd et al. (2012) reported an increase in average CPUE between 1989-97 and 2002-07 from the records of a single competitive spearfisher operating along the KZN coast
Trend in catch composition: Giant kingfish only comprised 0.03% of the shore angling catch and 0.02% of the recreational ski-boat catch by number in a study conducted along the KZN coast between 2008-10 (Dunlop 2011). Lloyd et al. (2012) reported an increase in contribution to catch composition between 1989-97 (0.4%) and 2002-07 (1.4%) from the records of a single competitive spearfisher operating along the KZN coast
Trend in mean size: Unknown
Trend in sex ratio: Males are more numerous in SA waters (van der Elst 1993) but the trend in sex ratio is not known

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Protected from capture in some no-take MPAs along the SA east coast such as within the sanctuary areas of the St Lucia, Maputaland, Aliwal Shoal and Pondoland MPAs. A particularly sensitive area is the Mtentu Estuary, which falls within the Pondoland MPA no-take zone, where shoals of large adults aggregate during early summer (Oct-Dec). However, the tendency towards ranging behaviour may place protected populations at risk, especially in the case of small MPAs. Juveniles may receive some protection within no-take areas in Lake St Lucia and Kosi Bay

MANAGEMENT CONSIDERATIONS
Giant kingfish is a top predator in inshore marine habitats and its aggressive behaviour makes it vulnerable to localised overfishing. Greater protection of juveniles (perhaps through the introduction of a minimum size limit and increased protection of estuarine nursery habitats) may be necessary to ensure the future sustainable use of this important species in SA waters. In recreational fisheries, catch and release of this species should continue to be encouraged

RESEARCH REQUIREMENTS
Age and growth, stock assessment, movement, early life history
Research priority: Medium



SCIENTIFIC NAME: *Caranx papuensis* (Smith No. 210.20)
COMMON NAMES: Brassy kingfish, Greenspot kingfish, Brassy trevally
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Indo-Pacific: eastern and southern Africa to the Caroline and Marquesan Islands, north to the Ryukyu Islands and south to Australia (Paxton et al. 1989, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
A tropical to sub-tropical species recorded as far south as Port Alfred in the EC (Heemstra and Heemstra 2004) but rare south of KZN (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Although more common in catches during the summer months (van der Elst 1993), 63 recaptures (6.27%) recorded in the ORI Tagging Project have a mean distance moved of 1km and a maximum distance of 13km, suggesting high levels of residency (ORI Tagging Project, unpubl. data)

HABITAT
Adults: An inshore species inhabiting coral and rocky reefs, both in sheltered lagoons and seaward facing reefs (Kuiter and Tonozuka 2001). Also found in the surf-zone along northern KZN beaches (van der Elst 1993) and enters clear water estuaries such as Kosi Bay (B. Mann, ORI, pers. obs.). Intolerant of turbid water and low salinity environments (van der Elst 1993)
Juveniles: Utilizes clear estuaries and sheltered bays and lagoons as nursery areas (Blaber and Cyrus 1983, van der Elst 1993, Whitfield 1998)
Eggs and larvae: Unknown

FEEDING
Adults: Diet includes mainly small bony fish, crabs and shrimps (Kulbicki et al. 2005)
Juveniles: Filter feeds on mysids and juvenile penaeids (Blaber and Cyrus 1983)

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: 42cm FL; Papua New Guinea; based on a review of literature and an underwater videography technique (Longenecker et al. 2012)

BIOMETRICS
Maximum recorded age: 5 years, Papua New Guinea, Based on an otolith reading of one 39cm SL specimen (Fry et al. 2006)
Maximum recorded weight: 7.9kg, Bazaruto, MOZ, 2008 (IGFA 2012)
Maximum recorded length: 88cm TL (Lieske and Myers 1994)
Length-length relationship: TL(cm) = 1.13FL(cm); Based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.0249 x $FL(cm)^{2.91}$; New Caledonia (n=169, 6.5-65cm FL) (Letourneur et al. 1998)
Growth parameters: Unknown

FISHERY
Mainly taken by shore anglers fishing along northern KZN and MOZ beaches, occasionally speared by divers (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

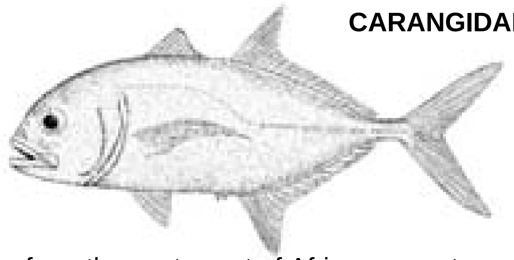
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Comprises a very small percentage of anglers' catches in KZN with little information on trends (B. Mann, ORI, pers. obs.)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Due to the residency shown by this species it is likely to receive some protection in the no-take sanctuary areas of the St Lucia and Maputaland MPAs

MANAGEMENT CONSIDERATIONS
More information is required on the biology of this species. However, given that it is a tropical species and is protected within the St Lucia and Maputaland MPAs, no further management intervention is required other than on-going monitoring of catch and effort

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, movement, early life history
Research priority: Low



SCIENTIFIC NAME: *Caranx sexfasciatus* (Smith No. 210.22)
COMMON NAMES: Bigeye kingfish, Bigeye trevally
COMPILER: BQ Mann
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Widespread in tropical Indo-West Pacific, from the east coast of Africa across to Australia and Japan, including Hawaii; also occurs in Eastern Pacific Ocean and from Ecuador to Mexico, including the Galapagos islands (Smith-Vaniz 1984, Smith-Vaniz 2003)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Mostly in MOZ and KZN waters, juveniles found as far south as Knysna (Heemstra and Heemstra 2004), the most abundant *Caranx* species in SA waters (Smith-Vaniz 2003)

MOVEMENT: Unknown
Adult fish appear to be summer migrants to northern KZN waters (Kyle 1986). Data recorded on the ORI Tagging Project shows that of the 29 recaptured bigeye kingfish (5.6%), 23 were recaptured in the same location as where they had been tagged, while the remaining six recaptures had moved, on average, 62km (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Associated with coral reefs and found in coastal and oceanic waters to depths of 146m (Dominici-Arosemena et al. 2010). Prefers clear, warmer waters; sensitive to changes in salinity and water turbidity (van der Elst 1993, Whitfield 1998). Most active nocturnally (Heemstra and Heemstra 2004)
Juveniles: Commonly found in estuaries from KZN to the southern parts of the EC, predominantly associated with clear water although smaller juveniles may be found in more turbid water (Blaber and Cyrus 1983, Blaber and Cyrus 1987, van der Elst 1993, Whitfield 1998, Smith-Vaniz 2003). Newly recruited juveniles enter estuaries in KZN at 30-60 mm SL (Whitfield 1998)
Eggs and larvae: Unknown, not recorded by Connell (2012) on the KZN south coast

FEEDING
Adults: Predominantly small fish, but also prawns, mantis shrimps, swimming crabs and other midwater organisms (van der Elst 1993).
Juveniles: Diet of newly recruited juveniles (30 mm SL) in KZN estuaries is dominated by calanoid copepods (Whitfield 1998), larger juveniles in estuaries feed on small fish and penaied prawns (Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Gonochorist (R. van der Elst, ORI, pers. comm.). Spawns in pairs at dusk with the male being darker in colour than the female (Heemstra and Heemstra 2004)
Breeding/spawning season: Spring and summer in KZN waters (Kyle 1986, van der Elst 1993, Whitfield 1998)
Breeding/spawning locality: Inshore marine environment probably along much of the MOZ and Maputaland coast (B. Mann, ORI, pers. obs.)
Age at 50% maturity: Unknown
Length at 50% maturity: 50cm FL; KZN (van der Elst 1993)

BIOMETRICS
Maximum recorded age: 11 years, Papua New Guinea (Fry et al. 2006)
Maximum recorded weight: 18kg (Frimodt 1995). IGFA all-tackle record is 14.3kg (Heemstra and Heemstra 2004)
Maximum recorded length: 120cm TL (Frimodt 1995)
Length-length relationship: TL(mm) = 1.14FL(mm) + 6.5; KZN (van der Elst and Adkin 1991)
SL(cm) = 0.874TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.0265 x $SL(cm)^{3.005}$; Juveniles in SA estuaries (2.8-31.0mm SL, n=183) (Harrison 2001). The equation given by van der Elst and Adkin (1991) is doubtful
Growth parameters: L_∞ = 80cm FL; K = 0.24; Papua New Guinea; parameters estimated by the Petersen method (Munro and Williams 1985). Growth of juveniles in SA estuaries is about 12cm per year for the first two years of life (Blaber and Cyrus 1983)

FISHERY
Popular recreational gamefish especially in northern KZN and MOZ, caught by shore anglers and recreational skiboat fishers and occasionally speared by divers. Popular with saltwater flyfishing enthusiasts in Kosi Bay and along the Maputaland coast (Kyle 1986, van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.65 yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: M estimated using Pauly's equation (Munro and Williams 1985)

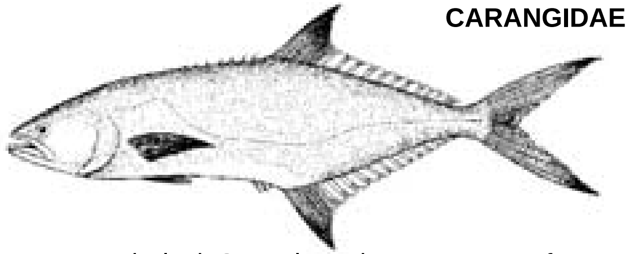
STOCK STATUS
Status: Unknown
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Least Concern; 2010 (Dominici-Arosemena et al. 2010)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Protected from capture in some no-take MPAs along the SA east coast such as in the sanctuary areas of the St Lucia, Maputaland, Aliwal Shoal and Pondoland MPAs. Juveniles may receive protection within certain estuaries zoned for no-take

MANAGEMENT CONSIDERATIONS
An important gamefish species, especially for saltwater flyfishing and light-tackle angling enthusiasts. More information is needed on the biology and status of this species in SA waters and consideration could be given to the introduction of a minimum size limit as a precautionary measure

RESEARCH REQUIREMENTS
Age and growth, reproductive biology, early life history, movement, stock assessment, fishery trends
Research priority: Low



SCIENTIFIC NAME: *Lichia amia* (Smith No. 210.33)
COMMON NAMES: Garrick, Leervis
COMPILER: BQ Mann
REVIEWER: WM Potts
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Confined to parts of the Mediterranean and Black Sea, along the west coast of Africa including Mauritania to northern NAM and the south-eastern seaboard of SA. Scarce between Cunene Mouth and Table Bay (Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
SA distribution from Orange River to Cape Vidal, possibly extending to Maputo (van der Elst et al. 1993, Lamberth 2003). NAM/Angolan stock separate to the SA stock (Potts et al. 2008)

MOVEMENT: Migratory
Adults migrate annually to KZN during winter to spawn. During summer adults return to Cape waters (van der Elst et al. 1993, Smith 2008)

HABITAT
Adults: Nearshore surface waters from the surf zone to a depth of 50m. Seldom found more than 500m from shore (van der Elst 1993, van der Elst et al. 1993)
Juveniles: Common in EC and WC estuaries and coastal shallows. Estuaries provide important nursery areas (Whitfield and Kok 1992, van der Elst et al. 1993, Whitfield 1998)
Eggs and larvae: Distributed southwards inshore of the Agulhas Current from spawning grounds in central KZN (Beckley 1993, Connell 2012)

FEEDING
Adults: Primarily piscivorous (Coetzee 1982, Smale and Kok 1983, Whitfield 1998)
Juveniles: Pisciviorous but smaller juveniles also feed on crustaceans (Coetzee 1982, Smale and Kok 1983, Whitfield 1998)

REPRODUCTION
Reproductive style: Gonochorist (van der Elst et al. 1993)
Breeding/spawning season: Sep-Nov in KZN (van der Elst et al. 1993)
Breeding/spawning locality: KZN waters (van der Elst et al. 1993). Spawning likely to occur in central KZN i.e. within the Natal Bight north of Durban (Connell 2012)
Age at 50% maturity: Combined sexes: 4 years; KZN; 1990 (approximate age based on length at 50% maturity) (van der Elst et al. 1993, Smith 2008)
Length at 50% maturity: Males: 75cm FL; Females: 85cm FL; Combined sexes: 80cm FL; KZN, 1990 (van der Elst et al. 1993)

BIOMETRICS
Maximum recorded age: 10 years; KZN; 1990 (Smith 2008)
Maximum recorded weight: 32.2kg, SA angling record (van der Elst 1993)
Maximum recorded length: 180cm TL (Smith and Heemstra 1991)
Length-length relationship: Combined sexes: TL(mm) = 1.204FL(mm) - 6.762; KZN (Smith 2008)
Combined sexes: TL(mm) = 0.915FL(mm)$^{1.046}$; EC (van der Elst and Adkin 1991)
Length-weight relationship: Combined sexes: Wt(g) = 0.00001124 x FL(mm)$^{3.015}$; SA (Smith 2008)
Combined sexes: Wt(g) = 0.00007286 x FL(mm)$^{2.725}$; KZN (van der Elst and Adkin 1991)
Combined sexes: Wt(g) = 0.0000132 x FL(mm)$^{3.015}$; EC estuaries (Marais and Baird 1980)
Growth parameters: Combined sexes: L_∞ = 1206mm FL; K = 0.2; t_0 = -1.1; KZN (Smith 2008)

FISHERY
Highly sought after as a recreational trophy fish by shore anglers, skiboat anglers and spearfishers, especially during the winter/spring season in KZN. Also targeted in estuaries in the EC. Makes up a relatively small percentage of the overall catch of these sectors (van der Elst et al. 1993, Smith 2008)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.42yr^{-1}
Natural mortality rate (M): 0.33yr^{-1}
Total mortality rate (Z): 0.75yr^{-1}
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: 0.18

F_{SB25} yr^{-1}: 0.28
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: 14%
Year completed: 2008
Locality: KZN
References & Comments: Smith (2008). An earlier assessment undertaken by van der Elst et al. (1993) found that the garrick stock was underexploited

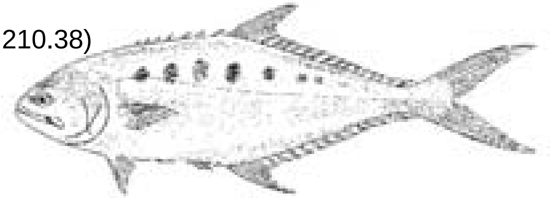
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2008
Locality: KZN
Status: <25% - collapsed (Smith 2008)
Trend in CPUE: Smith (2008) reported a substantial decline in CPUE in the shore fishery (52%), skiboat fishery (90%) and spearfishery (93%) in KZN between 1985-2006. However, van der Elst et al. (1993) found that CPUE in KZN varied from year to year with no clear trend between 1957-1991
Trend in catch composition: Decline in percentage contribution to the shore fishery (28%), skiboat fishery (77%) and spearfishery (84%) in KZN between 1985-2006. Despite the decline in catches, improved technology has increased efficiency when targeting this species (Smith 2008)
Trend in mean size: Indication of cyclical trends in mean size which are probably recruitment driven (van der Elst et al. 1993)
Trend in sex ratio: M:F sex ratio 1:1 (van der Elst et al. 1993) but no data on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: prohibited
Minimum size limit: 70cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Effectiveness of MPAs is probably limited due to migratory behaviour of adults, however, estuarine protected areas could provide important protection for juveniles (Smith 2008)

MANAGEMENT CONSIDERATIONS
Garrick is a prime recreational angling species and trophy fish that should be managed to attain a large size and not a large tonnage of landings (van der Elst et al. 1993). Based on the most recent stock assessment (Smith 2008), the adult stock of garrick has collapsed and is urgently in need of stock rebuilding. An increase in the minimum size limit to 90cm TL and/or the introduction of a two-month closed season (1 Oct - 30 Nov) has been proposed (Smith 2008). Furthermore, estuarine protected areas in the EC and WC should be established to provide protection for juveniles (Smith 2008)

RESEARCH REQUIREMENTS
Once appropriate management actions have been implemented to enable stock rebuilding to take place, careful monitoring is required to evaluate management effectiveness. Further egg and larval studies should be conducted to identify spawning grounds. Juvenile and adult estuarine use should be quantified and estuaries of high conservation importance for this species should be identified and protected
Research priority: Medium



SCIENTIFIC NAME: *Scomberoides commersonnianus* (Smith No. 210.38)
COMMON NAMES: Largemouth queenfish, Talang queenfish
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Widely distributed throughout the Indian and western Pacific Ocean (Smith and Heemstra 1991, van der Elst 1993, Griffiths et al. 2005, Griffiths et al. 2006)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Widespread, but nowhere abundant, from Algoa Bay northwards (Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Only 15 recaptures (4.41%) out of 340 tagged with a mean distance travelled of 1km (ORI Tagging Project, unpubl. data). This suggests they may display a degree of resident behaviour, possibly related to food availability; however movement behaviour needs further investigation

HABITAT
Adults: Pelagic, tropical coastal regions, periodically enters estuaries, generally intolerant of low salinities but will enter turbid water, swims in small groups and often frequents reefs and offshore islands (Fischer and Bianchi 1984, Blaber et al. 1989, Smith and Heemstra 1991, van der Elst 1993, Griffiths et al. 2005). Sometimes associated with whale sharks (R. van der Elst, ORI, pers. obs.)
Juveniles: Classified as a species which is only partially dependent on estuaries, however, juveniles are abundant in estuaries in north-east Australia (Blaber et al. 1995, Griffiths et al. 2005). Small juveniles not recorded in SA estuaries but sub-adults are fairly common in St Lucia, Durban Bay and Richards Bay (Wallace et al. 1984, Mann et al. 2002, Pradervand et al. 2002, Beckley et al. 2008)
Eggs and larvae: Unknown

FEEDING
Adults: Diet includes small pelagic and bottom-dwelling fish, as well as mantis shrimps, swimming crabs and squid (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Juveniles have a specialised dentition which enables them to feed on scales of other fish. Larger juveniles also eat mysids, juvenile penaeid prawns and small fish (Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Gonochorist (Griffiths et al. 2005)
Breeding/spawning season: Locally unknown, but has a protracted spawning season between Sep-Mar (summer) in northern Australia (Griffiths et al. 2005)
Breeding/spawning locality: Unknown. Most abundant in KZN during summer (van der Elst 1993)
Age at 50% maturity: Females: 4-5 years; Northern Australia (Griffiths et al. 2006)
Length at 50% maturity: Females: 635mm FL; Northern Australia (Griffiths et al. 2006)

BIOMETRICS
Maximum recorded age: 15-16 years; Northern Australia; based on maximum recorded length of 120cm TL (Griffiths et al. 2005)
Maximum recorded weight: 16kg (Fischer and Bianchi 1984)
Maximum recorded length: 120cm TL (Fischer and Bianchi 1984)
Length-length relationship: Combined sexes: TL(mm) = 1.1077FL(mm) + 15.731; Northern Australia (Griffiths et al. 2006)
Length-weight relationship: Combined sexes: Wt(kg) = 0.00004 x $FL(mm)^{2.7915}$; Northern Australia (Griffiths et al. 2006)
Growth parameters: Combined sexes: L_∞ = 1404mm FL; K = 0.1; t_0 = 1.21; Northern Australia (Griffiths et al. 2006)

FISHERY
Occasionally caught by shore anglers (van der Elst 1993, Pradervand et al. 2007, Beckley et al. 2008, Mann 2012), recreational skiboat anglers and estuarine boat anglers, particularly in St Lucia and Durban Bay (van der Elst 1993, Guastella 1994, Mann et al. 1997a, Mann et al. 2002, Pradervand et al. 2002). Also occasionally taken by spearfishermen (Mann et al. 1997b). Seldom caught in the commercial linefishery

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: No stock assessments done in SA. A stock assessment was conducted in 2006 in northern Australia and the stock was found to be growth and recruitment overfished (Griffiths et al. 2006)

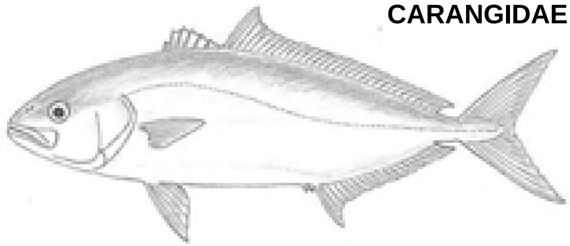
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercials: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: No-take MPAs in southern MOZ, KZN and northern parts of the EC could provide some protection for this species. Similarly, since this species appears to be estuarine associated to a certain degree, no-take areas within large estuaries in this area should also contribute towards its protection, particularly for juveniles and sub-adults

MANAGEMENT CONSIDERATIONS
As this species appears to be estuarine associated to a certain degree, greater protection of the estuarine environment along southern MOZ, KZN and TKI coasts may offer more protection. Consideration should be given to decommercialising this species as it is primarily targeted by recreational anglers and makes little contribution to commercial fisheries in SA

RESEARCH REQUIREMENTS
More research on the general biology of this species is needed including distribution and abundance, age and growth, reproductive biology and movement patterns
Research priority: Low



SCIENTIFIC NAME: *Seriola dumerili* (Smith No. 210.43)
COMMON NAMES: Greater amberjack, Greater yellowtail
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Circumglobal in subtropical and tropical seas (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Along East African coast as far south as Algoa Bay (Smith-Vaniz 2003)

MOVEMENT: Migratory
Oceanodromous (McClellan and Cummings 1997, Riede 2004). No recaptures of the 46 tagged in SA waters to date (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Deep reefs and deep offshore canyons or drop-offs, mainly from 18-72m but recorded as deep as 360m (Smith-Vaniz 1984)
Juveniles: Small individuals, less than 3 kg, may be taken in shallow water less than 10m (Smith-Vaniz 1984). Smaller juveniles associate with floating plants or debris in oceanic and offshore neritic waters (Smith-Vaniz 1984)
Eggs and larvae: Eggs and larvae pelagic and recorded in offshore samples (>50m depth) off the KZN south coast but difficult to distinguish from *S. rivoliana* (Connell 2012)

FEEDING
Adults: Primarily feed on small fishes and invertebrates (Smith-Vaniz 1986)
Juveniles: Unknown

REPRODUCTION
Reproductive style: External fertilisation, gonochoristic (Marino et al. 1995)
Breeding/spawning season: Summer months in SA waters (Connell 2012), summer spawning also recorded in the Mediterranean (Marino et al. 1995)
Breeding/spawning locality: Eggs generally recorded offshore in depths >50m off the KZN south coast (Connell 2012). Spawns in coastal areas in the Mediterranean (Marino et al. 1995)
Age at 50% maturity: Combined sexes: 4 years; Italy; 1990-92 (Marino et al. 1995)
Length at 50% maturity: Females: 109cm SL; Males: 113cm SL; Italy; 1990-92 (Marino et al. 1995)

BIOMETRICS
Maximum recorded age: Female: 15 years; Gulf of Mexico; 1990-92 (Thompson et al. 1999)
Maximum recorded weight: 80.6kg (Smith-Vaniz 1984)
Maximum recorded length: 188cm TL (Smith-Vaniz 1984)
Length-length relationship: FL(cm) = 0.88TL(cm) -1.773; Gulf of Mexico (Manooch and Potts 1997)
Length-weight relationship: Males: Wt(g) = 0.0175x FL(cm)$^{2.96}$; Gulf of Mexico (Thompson et al. 1999)
Females: Wt(g) = 0.0325 x FL(cm)$^{2.87}$; Gulf of Mexico (Thompson et al. 1999)
Growth parameters: Combined sexes: L_∞ = 138.9cm FL; K = 0.25; t_0 = -0.79; Gulf of Mexico (Thompson et al. 1999). L_∞ in this study may have been influenced by cooler climate, all fish over 9 years old were female
Combined sexes: L_∞ = 174.6cm TL; K = 0.19; t_0 = -0.314; SE Adriatic Sea (Kozul et al. 2001)

FISHERY
Targeted primarily by recreational ski-boat fishermen using vertical jigging tackle on deep reefs. Occasionally caught by commercial ski-boat fishers. Although its preference for deeper water makes is difficult to target by spearfishers, small individuals may occasionally be taken by this sector

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.3yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters, M estimated in the SE Adriatic Sea (Kozul et al. 2001)

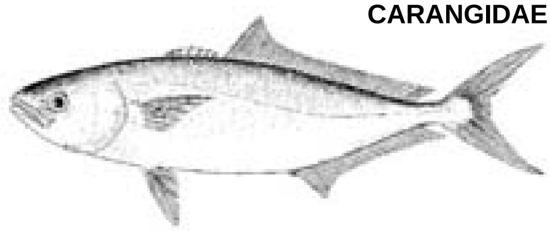
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown locally, but male dominated 1:0.94 in the SE Adriatic Sea (Kozul et al. 2001)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Ban on vertical jigging in the St Lucia and Maputaland MPAs
MPA effectiveness: Probably benefits from some protection in a number of no-take MPAs along the east of coast of SA. Although capture of *S. dumerili* in the St Lucia and Maputaland MPAs is permitted, a recent ban placed on "vertical jigging" within these two MPAs is likely to reduce fishing mortality on this species in the area

MANAGEMENT CONSIDERATIONS
Because of its preference for deep water and the difficulty associated with fishing in the powerful Agulhas Current off the eastern seaboard of SA, this species has probably not experienced heavy fishing mortality. However, with the recent introduction of thin, strong braided fishing lines and "vertical jigging" gear, enabling anglers to effectively fish in deeper water, it is likely that this species will be more heavily exploited in future

RESEARCH REQUIREMENTS
Information is required on fishery trends in SA waters, as well as biological data on age and growth and reproductive biology
Research priority: Low



SCIENTIFIC NAME: *Seriola lalandi* (Smith No. 210.44)
COMMON NAMES: Giant yellowtail, Cape yellowtail, Geelstert
COMPILER: SE Kerwath
REVIEWER: CG Wilke
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Circumglobal, confined to warm temperate shelf waters and seamounts and oceanic islands (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
SA population occurs from the NAM to northern KZN but is mostly concentrated in shelf waters of the WC

MOVEMENT: Nomadic
The fish aggregate and move between offshore reefs such as Alphard, 72-, 45- and 12-Mile banks in the Agulhas region and Bellows Rock, the Anvil, Rocky Bank around the Cape but can also be found along the West Coast between Dassen Island and Hondeklip Bay, as well as offshore areas such as Tripp and Vema Seamounts (Penney 1990). Adults move up the east coast to KZN during winter following the sardines (Heemstra and Heemstra 2004)

HABITAT
Adults: Epipelagic, with larger fish occurring to depths of 40m
Juveniles: Epipelagic, shoals associated with flotsam
Eggs and larvae: Pelagic (Brownell 1979)

FEEDING
Adults: Prey on pelagic baitfish species such as *Sardinops*, *Trachurus*, *Engraulis* and *Scomber* as well as squid and crustaceans
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochorist
Breeding/spawning season: Nov-Feb
Breeding/spawning locality: Southern KZN to Cape Point
Age at 50% maturity: Combined sexes: 2-3 years; WC (AJ Penney, DAFF, unpubl. data)
Males: 0+ years; Females: 4 years; NSW Australia (Gillanders et al. 1999b)
Length at 50% maturity: Combined sexes: 615mm FL; WC (AJ Penney, DAFF, unpubl. data)
Males: 470mm FL; Females: 834mm FL; NSW Australia (Gillanders et al. 1999b)

BIOMETRICS
Maximum recorded age: 21 years; NSW Australia (Steward et al. 2004). Gillanders et al. (1999a) recorded a maximum age of only 11 years
Maximum recorded weight: 58.5kg; SA angling record (Heemstra and Heemstra 2004)
Maximum recorded length: 143cm TL (DAFF, unpubl. data)
Length-length relationship: TL(cm) = 1.116FL(cm) (JE Randall, 1997, unpubl. data)
SL(cm) = 0.969FL(cm) (JE Randall, 1997, unpubl. data)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0331 \times FL(cm)^{2.7566}$; WC; n=5948 (AJ Penney, DAFF, unpubl. data). Combined sexes: $Wt(g) = 0.0639 \times FL(cm)^{2.61}$; WC (DAFF, unpubl. data)
Growth parameters: Combined sexes: L_∞ = 125.2cm FL; K = 0.189; t_0 = -0.74; NSW Australia (Gillanders 1999a)

FISHERY
Amongst the top four species landed by the traditional commercial linefishery in terms of total reported catch, often only surpassed by snoek (NMLS, unpubl. data). Also targeted by artisanal beach seine fishers (Lamberth et al. 1997), recreational skiboat fishers (Sauer et al. 1997), shore anglers (Bennett 1990) and spearfishers (Mann et al. 1997b). Purse-seining for yellowtail has been prohibited since 1982 (Penney 1990)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): $0.2yr^{-1}$
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown

$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: No previous per-recruit assessments for yellowtail have been published and the unpublished data cannot be verified

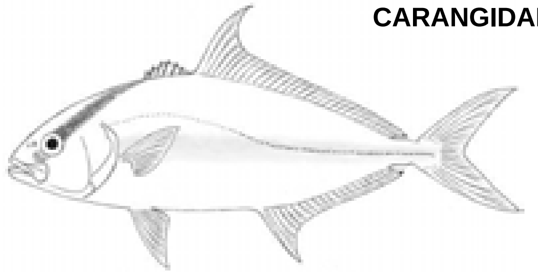
STOCK STATUS
Stock assessment method: Surplus production model
Year completed: 2011
Locality: SA
Status: 40-50% - optimally exploited. According to a recent surplus production model, even the most conservative estimate suggests that the biomass in 2010 was at 44% of carrying capacity (Winker et al. 2012)
Trend in CPUE: Catches fluctuate annually being driven by recruitment success. Standardised CPUE increased abruptly after the state of emergency was declared in the linefishery in 2000, but the increase was not sustained (Winker et al. 2012)
Trend in catch composition: Over the past 27 years yellowtail has consistently comprised one of the top four species in the traditional commercial linefishery in terms of total reported catch. The reported annual catch from the commercial linefishery has declined from an average of 700t from 1985-95 to an average of 400t per annum from 1996-2011
Trend in mean size: No significant trend in the length frequency data from commercial catches over the past 10 years (DAFF, unpubl. data)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Apart from the commercial linefishery and the beach seine fishery, where there is no limit on yellowtail catch, there is a temporary concession for catching 50 yellowtail per person per day in the Tuna Pole sector for two boats that fish north of Cape Columbine
MPA effectiveness: MPAs are unlikely to be important for this highly mobile species

MANAGEMENT CONSIDERATIONS
Currently the stock appears to be healthy. Improved monitoring and recording of catch and effort taken by all sectors of the recreational fishery is required

RESEARCH REQUIREMENTS
Age and growth and life history parameters need to be determined for the SA stock of this species
Research priority: Low



SCIENTIFIC NAME: *Seriola rivoliana* (Smith No. 210.45)
COMMON NAMES: Longfin amberjack, Longfin yellowtail, Tropical yellowtail, Almacojack
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Circumtropical (Smith-Vaniz 2003), including Red Sea and Persian Gulf (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Occurs from Knysna in the WC (Smith-Vaniz 2003) northward along the east coast of Africa (Heemstra and Heemstra 2004). Recent reports of this species extending as far south as Arniston in the WC (J. Smal, pers. comm.)

MOVEMENT: Unknown
Only 47 tagged to date in SA waters with no recaptures (ORI Tagging Project, unpubl. data)

HABITAT
Adults: In oceanic waters and over coral and rocky reefs (van der Elst 1993). Outer-reef slopes and offshore banks 30-160 m (Heemstra and Heemstra 2004, Froese and Pauly 2012)
Juveniles: Juveniles <20cm occur below floating objects at sea (van der Elst 1993, Heemstra and Heemstra 2004)
Eggs and larvae: Eggs pelagic (van der Elst 1993)

FEEDING
Adults: Small fish (van der Elst 1993) and invertebrates (Froese and Pauly 2012)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic (Smith-Vaniz 1986)
Breeding/spawning season: Spring (van der Elst 1993)
Breeding/spawning locality: Tropical areas (van der Elst 1993)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 59.9kg; World angling record (IGFA 2001)
Maximum recorded length: 160cm FL; World angling record (IGFA 2001)
Length-length relationship: TL(cm) = 1.107FL(cm); based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.0359x\ FL(cm)^{2.801}$; Brazil (Length range: 47.5 - 93 cm FL, n=87) (Frota et al. 2004)
Growth parameters: Unknown

FISHERY
Caught mainly by recreational ski-boat anglers using baits or artificial lures, especially vertical jigs; also targeted by spearfishers (van der Elst 1993). Occasionally caught by commercial boat-based linefishers. Increasingly being used for mariculture internationally due to their fast growth rate in captivity (B. Mann, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

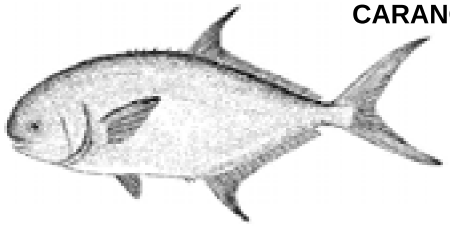
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercials: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably benefits from some protection in a number of no-take MPAs along the east of coast of SA. Although capture of *S. rivoliana* in the controlled areas of the St Lucia and Maputaland MPAs is permitted, a recent ban placed on vertical jigging within these two MPAs is likely to reduce fishing mortality on this species in the MPA

MANAGEMENT CONSIDERATIONS
On-going monitoring of the linefishery is required as this species is likely to be increasingly targeted in future due to the development of thin, braided lines and fast sinking lures (vertical jigs). A potentially an important mariculture species

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, movement, fishery trends, mariculture potential
Research priority: Low

CARANGIDAE



SCIENTIFIC NAME: *Trachinotus africanus* (Smith No. 210.47)
COMMON NAMES: Southern pompano, African pompano
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Indian Ocean: Gulf of Aden and Oman, MOZ and SA across to western Indonesia (Heemstra and Heemstra 2004, Froese and Pauly 2012). Smith-Vaniz (1984) suggested that distributional gap along most of African east coast may reflect a collecting artefact but Smith-Vaniz (2003) indicated that the gap may be real and merely reflect limited availability of preferred habitat
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Occurs locally between Knysna (WC) and Delagoa Bay in southern MOZ (Smith-Vaniz 2003) but seldom caught south of KZN (B. Mann, ORI, pers. obs.)

MOVEMENT: Unknown
Of the 23 recaptures recorded on the ORI Tagging Project, the mean distance travelled is 57km, indicating that adults may be fairly wide ranging (ORI Tagging Project, unpubl. data). A southward migration into KZN waters occurs during the summer months (van der Elst 1993)

HABITAT
Adults: Found in the surf-zone along sandy beaches but usually in close association with nearshore reefs or rocky outcrops (van der Elst 1993, Smith-Vaniz 2003)
Juveniles: Young make use of sheltered bays as nursery areas, particularly along Durban's beachfront and may sometimes enter estuaries (Wallace 1975, Berry et al. 1982, van der Elst 1993)
Eggs and larvae: Unknown

FEEDING
Adults: Primarily rock mussels, also sand mussels, sand dollars, crabs and mole crabs (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown but assumed to be gonochoristic
Breeding/spawning season: Spring in KZN (van der Elst 1993)
Breeding/spawning locality: Spawning thought to occur in northern KZN and southern MOZ (Mann and van der Elst 2000)
Age at 50% maturity: 2-3 years; KZN (van der Elst 1993)
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown, but some specimens known to live for over 10 years in Durban Sea World Aquarium (B. Mann, ORI, pers. obs.)
Maximum recorded weight: >25kg; Durban Sea World Aquarium; Captive specimens (van der Elst 1993)
Maximum recorded length: 92cm TL (Smith-Vaniz 1984)
Length-length relationship: TL(cm) = 1.156FL(cm); Based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Caught primarily by shore anglers and spearfishers along the KZN and MOZ coast (Mann et al. 1997a, Dunlop 2011), juveniles sometimes taken as a bycatch in the beach seine fishery in Durban (Beckley and Fennessy 1996)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

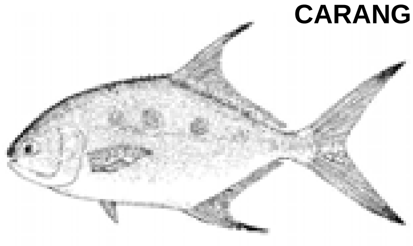
STOCK STATUS
Status: Not assessed
Trend in CPUE: CPUE remained similar in the KZN shore fishery between 1994-96 (0.007 $fish^{-1}.angler\ day^{-1}$) and 2009-10 (0.006 $fish^{-1}.angler\ day^{-1}$) (Mann et al. 1997a, Dunlop 2011)
Trend in catch composition: The catch composition (by number) remained unchanged at 0.6% between 1994-96 and 2009-10 in the KZN shore fishery(Mann et al. 1997a, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercials: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Protected from fishing in some no-take MPAs along the SA east coast such as within the St Lucia and Maputaland sanctuary areas (Mann 2012). However, because of its wide ranging behaviour, protected populations may be susceptible to fishing outside boundaries of smaller protected areas

MANAGEMENT CONSIDERATIONS
Little is known about the biology and ecology of this species and further investigation is warranted. Van der Elst and Adkin (1991) expressed some concern about the vulnerability of juveniles in nursery areas along Durban's beachfront, where they are sometimes caught in great numbers by a seine netting operation

RESEARCH REQUIREMENTS
Morphometrics, reproductive biology, age and growth, stock assessment, residency and migration, early life history
Research priority: Low



SCIENTIFIC NAME: *Trachinotus botla* (Smith No. 210.50)
COMMON NAMES: Largespot pompano, Wave garrick, Wave trevally, Swallowtail dart
COMPILER: D Parker
REVIEWER: AJ Booth
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Widespread Indo-Pacific species from Algoa Bay northwards to Kenya, also Madagascar, Sri Lanka, eastern and western Australia (Fischer and Bianchi 1984, Smith and Heemstra 1991, McPhee 1995)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Mainly found along the KZN north coast and northwards into MOZ, seldom seen south of Port St Johns along the former Transkei coast (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Based on 46 recaptures (1.88%), this species appears to be a surf-zone resident with 78% of recaptures taken within 1km of the release site (Parker et al. 2013). However, some fish have undertaken movements in excess of 100km (Parker et al. 2013, ORI Tagging Project, unpubl. data)

HABITAT
Adults: Inhabits shallow coastal waters, often preferring the rough surf zone along sandy beaches and rocky ledges (van der Elst 1993, Parker 2012)
Juveniles: Found in the shallowest part of the surf zone where they are at times stranded by receding waves, intolerant of fresh or turbid waters (van der Elst 1993)
Eggs and larvae: Unknown, probably pelagic

FEEDING
Adults: Brachyurans, bivalves and teleosts (Parker 2012)
Juveniles: Small teleosts, copepods and juvenile mole crabs (Parker 2012)

REPRODUCTION
Reproductive style: Gonochorist (Parker 2012)
Breeding/spawning season: Protracted spawning season throughout the summer period Nov-Feb (Parker 2012)
Breeding/spawning locality: Little known, reproductively active fish have been recorded in northern KZN (Parker 2012)
Age at 50% maturity: Males and females: 2.3 years; Sodwana Bay; KZN; 2011 (Parker 2012)
Length at 50% maturity: Males: 253mm FL; Females: 242mm FL; Sodwana Bay; KZN; 2011 (Parker 2012)

BIOMETRICS
Maximum recorded age: 6 years; Sodwana Bay; KZN; 2011 (Parker 2012)
Maximum recorded weight: 2.5kg; SA angling record (van der Elst 1993). Maximum weight recorded by Parker (2012) at Sodwana Bay during 2011 was a female of 1806g
Maximum recorded length: 60cm TL (van der Elst 1993). Maximum length recorded by Parker (2012) at Sodwana Bay during 2011 was a female of 495mm FL
Length-length relationship: Combined sexes: TL(mm) = 1.36FL(mm) - 33.52; Sodwana Bay; KZN (Parker 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.00002 x $FL(mm)^{2.96}$; Sodwana Bay; KZN (Parker 2012)
Growth parameters: A Schnute's four parameter growth model was used to describe the growth of *T. botla* (Parker 2012). Male: a = 1.56 $year^{-1}$; b = -6.47; L_1 = 128.33 mm FL; L_2 = 420.85 mm FL; τ_1 = 0.167; τ_2 = 6.75
Female: a = 1.73 $year^{-1}$; b = -7.37; L_1 = 129.45 mm FL; L_2 = 472.38 mm FL; τ1 = 0.167; τ_2 = 6.75

FISHERY
Important in the recreational shore fishery in northern KZN and MOZ and often targeted by light-tackle anglers (Parker 2012). Comprised 2.8% (by number) of shore anglers catches in KZN between 2009-10 (Dunlop 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.27yr^{-1}
Natural mortality rate (M): 1.04yr^{-1}
Total mortality rate (Z): 1.31yr^{-1}
F_{MSY} yr^{-1}: Unestimatable - YPR curve asymptotic

F_{SB40} yr^{-1}: 1.32
F_{SB25} yr^{-1}: 3.22
$F_{0.1}$ yr^{-1}: 1.29
$SBPR_{current}$: 75%
Year completed: 2012
Locality: KZN
References & Comments: Parker et al. (2013)

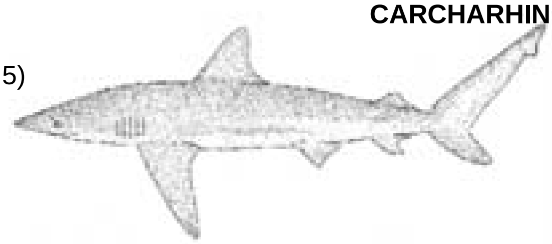
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2012
Locality: KZN
Status: >50% - underexploited (Parker et al. 2013)
Trend in CPUE: NMLS data between 1987 and 2010 indicates that the KZN shore fishery has remained relatively stable since 2000 (i.e. an average catch rate of 0.06 fish $angler^{-1}.day^{-1}$). Catches normally peak seasonally between Dec-Mar. Catch records displayed a latitudinal trend with areas north of St Lucia having a much higher mean annual CPUE than more southerly areas (Parker 2012)
Trend in catch composition: Slight increase in composition of KZN shore anglers from 1.4% during 1994-96 (Mann et al. 1997) to 2.8% in 2009-10 (Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Catch rates and mean size of fish in unfished areas of the St Lucia Marine Reserve is greater than in adjacent exploited areas showing that this species has benefitted from spatial protection (Mann 2012)

MANAGEMENT CONSIDERATIONS
Current management regulations in place for this species appear to be sufficient to ensure sustainable use. If there is an increase in exploitation of *T. botla* in future (i.e. increasing fishing mortality) whereby stock status declines, a minimum size limit of 30cm TL should be implemented

RESEARCH REQUIREMENTS
Determine spawning locality, quantify subsistence linefishers' dependence on this species and quantify long-term effects of the tongue-replacing isopod *Cymothoa borbonica* on the *T. botla* population
Research priority: Low



SCIENTIFIC NAME: *Carcharhinus brachyurus* (Smith No. 9.5)
COMMON NAMES: Copper shark, Bronze whaler
COMPILER: SP Wintner
REVIEWER: SFJ Dudley
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Widespread cosmopolitan species found in south-western Atlantic from southern Brazil to northern Argentina (Lucifora et al. 2005), eastern Atlantic including the north-western and south-western coast of Africa (Walter and Ebert 1991) and in the Mediterranean (Compagno 1984). Indian Ocean off south-eastern SA (Cliff and Dudley 1992) and off Western Australia (Last and Stevens 2009). Also found in the Pacific Ocean off areas such as southern Australia, New Zealand, Japan, southern California, Baja California and off Peru (Garrick 1982)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Walter and Ebert (1991) suggested two discrete populations: one from the south WC eastwards and the other from just south of Walvis Bay northwards. Recent genetic work (Benavides et al. 2011), however, shows no differences in population genetic structure between NAM and SA samples, but differences when compared with Australia/New Zealand and Peru populations

MOVEMENT: Migratory
Penetrates KZN waters in winter during the annual "sardine run" (Bass et al. 1973, Cliff and Dudley 1992). Of the 8605 copper sharks tagged in SA and NAM waters only 267 (3.1%) have been recaptured (ORI Tagging Project, unpubl. data). Mean and maximum distance travelled was 161 and 1790km respectively, suggesting that this species is probably migratory but exact movement patterns are as yet unclear

HABITAT
Adults: Neritic, occurs over the continental shelf from the surf-zone to at least 100m depth either close to the surface or near the bottom (Compagno et al. 1989). It occurs both inshore and offshore and is found in most temperate, warm-temperate, subtropical and tropical waters (Garrick 1982, Compagno 1984, Smale 1991, Compagno and Niem 1998, Last and Stevens 2009)
Juveniles: Coastal waters in the EC and WC (Smale 1991)

FEEDING
Adults: Teleosts in 92% of 413 stomachs examined by KZNSB (Cliff and Dudley 1992). Those were mainly from adults caught during the sardine run
Juveniles: Small shoaling fish especially from the families Clupeidae and Carangidae and inshore chokka squid *Loligo* (Smale 1991)

REPRODUCTION
Reproductive style: Placental viviparity (Bass et al. 1973, Smale 1991)
Breeding/spawning season: Mating after Jun/Jul (Cliff and Dudley 1992), parturition from Jun-Feb in SA waters (Smale 1991, Cliff and Dudley 1992)
Breeding/spawning locality: Parturition probably occurs south of KZN in the cooler waters of the EC and WC (Smale 1991, Cliff and Dudley 1992)
Age at 50% maturity: Males: 20.3 years; Females 22.6 years; KZN, 2006. Based on Dudley and Simpfendorfer's (2006) median length at 50% maturity and Walter and Ebert's (1991) growth curve
Length at 50% maturity: Males: 181cm PCL; Females: 191cm PCL; KZN, 2006 (Dudley and Simpfendorfer 2006)

BIOMETRICS
Maximum recorded age: 30 years (Walter and Ebert 1991)
Maximum recorded weight: 203kg; Female; KZN; 1978 (Cliff and Dudley 1992)
Maximum recorded length: 312cm TL; Female; KZN; 1978 (Cliff and Dudley 1992)
Length-length relationship: Combined sexes: TL(cm) = 1.27PCL(cm) + 1.502; KNZ (n=1519, range 16-237cm PCL) (Cliff and Dudley 1992)
Combined sexes: FL(cm) = 1.046PCL(cm) + 6.89; KZN (n=135, range 140-225cm PCL (Cliff and Dudley 1992)
Length-weight relationship: Males: Wt(kg) = 0.00000749 x PCL(cm)$^{3.11}$; KZN (Cliff and Dudley 1992)
Females: Wt(kg) = 0.00000671 x PCL(cm)$^{3.14}$; KZN (Cliff and Dudley 1992)
Growth parameters: Combined sexes: L_∞ = 384.8cm TL; K = 0.0385; t_0 = -3.477; SA and NAM; n=61 (Walter and Ebert 1991)
Combined sexes: L_∞ = 453.1cm TL; K = 0.0272; t_0 = -3.477; SA and NAM; Based on back calculations from 61 vertebrae (Walter and Ebert 1991)

FISHERY
Targeted by competitive shore anglers but mostly released alive (Pradervand and Govender 2003, Pradervand 2004, Pradervand et al. 2007). Juveniles sometimes caught and kept by commercial ski-boat fishermen depending on market availability. Adult copper sharks are captured in the protective shark nets in KZN (Cliff and Dudley 1992). Occasionally caught by pelagic tuna and swordfish directed longlines (Petersen et al. 2009). Also taken in the demersal shark longlining fishery, midwater trawls, inshore and offshore demersal trawls and pilchard purse seines as a bycatch, but there is some uncertainty regarding identification (C. da Silva, DAFF, pers. comm.). Is one of several species taken by beach seine nets in the WC (Lamberth 2006)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

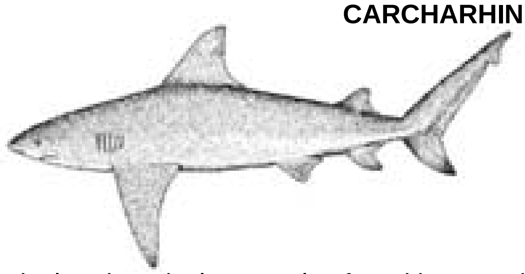
STOCK STATUS
Status: Not assessed
Trend in CPUE: Stable in KZNSB net catches between 1978-2003 (Dudley and Simpfendorfer 2006). No change since then (S. Dudley, KZNSB, pers. obs.)
Trend in catch composition: Unknown
Trend in mean size: Stable in KZNSB net catches between 1978-2003 (Dudley and Simpfendorfer 2006). No change since then (S. Dudley, KZNSB, pers. obs.)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2003 (Duffy and Gordon 2003)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers
MPA effectiveness: MPAs probably only of value in areas where parturition takes place for protection of juveniles but little information

MANAGEMENT CONSIDERATIONS
Evidence suggests that this shark matures late and has a limited reproductive output once mature. It is thus highly vulnerable to fishing pressure, whether targeted or caught as a bycatch, particularly if both adults and juveniles are exploited. Of particular concern is the recent genetic finding that this species seems to be isolated from both Australasia and the western Atlantic regions with no female dispersal between these regions (Benavides et al. 2011). Although no work has been done on male dispersal, the SA copper shark population may rely primarily on local reproduction and recruitment for replenishment and should therefore be carefully monitored and managed as an "isolated" population. Species identification is a problem in the collection of catch data and this needs to be addressed

RESEARCH REQUIREMENTS
Validation of age estimates, determination of movement patterns, collection of accurate catch and effort data in all coastal provinces to estimate trends in abundance
Research priority: Medium



SCIENTIFIC NAME: *Carcharhinus leucas* (Smith No. 9.9)
COMMON NAMES: Zambezi shark (South Africa), Bull shark (global), Zambesihaai
COMPILER: ME McCord
REVIEWER: G Cliff
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Worldwide warm-temperate, subtropical and tropical seas. Also found in estuarine, riverine and lake systems (Compagno et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Recently described as occurring in the Breede River in the WC (McCord and Lamberth 2009), which represents a 366km southward range extension

MOVEMENT: Migratory
Recent satellite telemetry has indicated that individuals can move large distances (e.g. from the WC to MOZ). However, it is suspected that *C. leucas* is a seasonal resident in some areas (e.g. on certain reef systems), but the degree and extent of residency and migration are uncertain (McCord et al. in prep.)

HABITAT
Adults: Coastal waters including inshore and offshore reefs, the surf zone, estuaries, rivers (Heemstra and Heemstra 2004)
Juveniles: New-borns appear to be confined to their nursery areas in coastal lagoons, turbid estuaries and rivers (Bass et al 1973; Heemstra and Heemstra 2004)

FEEDING
Adults: Indiscriminate, especially in larger individuals; there is a shift towards elasmobranchs with increasing size. Sea turtles, marine and terrestrial mammals, birds, crustaceans and cephalopods are occasionally taken (Bass et al 1973, Cliff and Dudley 1991)
Juveniles: Very strong predominance of teleosts in smaller sharks taken in rivers and lakes (Bass et al 1973). Teleosts also dominate in diet of smaller sharks caught in the sea. Sea turtles, mammals and invertebrates are occasionally taken (Cliff and Dudley 1991)

REPRODUCTION
Reproductive style: Viviparous, with yolk-sac placenta (Compagno et al. 2005)
Breeding/spawning season: A prolonged mating and pupping season is possible (Cliff and Dudley 1991) as embryos of similar size were found on the KZN coast in both summer and winter. In Florida the gestation period is 10-11 months (Clark and von Schmidt 1965). Most evidence indicates a pupping season between Nov-Feb (Bass et al 1973, Cliff and Dudley 1991)
Breeding/spawning locality: Mating and early pregnancy takes place to the north of KZN (Bass et al 1973). The St Lucia Estuary is the only known nursery area on the KZN coast. Other large estuarine systems on the SA east coast, including Richards Bay (van der Elst 1993) and the Umzimvubu River and adjacent rivers (KZNSB, unpubl. data) may also act as nursery areas
Age at 50% maturity: Males: 20 years; Females: 21 years; KZN (Wintner et al. 2002)
Length at 50% maturity: Males: 188cm PCL; Females: 192cm PCL; KZN (Dudley and Simpfendorfer 2006)

BIOMETRICS
Maximum recorded age: >50 years; KZN (Wintner et al. 2002)
Maximum recorded weight: 317kg; Kenya; IGFA all-tackle record (Heemstra and Heemstra 2004). Estimates for a 4.0m TL (3.2m PCL) female captured in Breede River are in excess of 600kg (McCord and Lambeth 2009) but this is well outside the length:weight curve provided by Cliff and Dudley (1991). This is considered an overestimate (S. Wintner, KZNSB, unpubl. data)
Maximum recorded length: 400cm TL; WC; Newly described maximum length for the species (McCord and Lamberth 2009)
Length-length relationship: Combined sexes: TL(cm) = 1.234PCL(cm) + 11.31; KZN (Cliff and Dudley 1991)
Length-weight relationship: Males: $Wt(kg) = 0.0000263 \times PCL(cm)^{2.93}$; KZN (n=266) (Cliff and Dudley 1991)
Females: $Wt(kg) = 0.000021 \times PCL(cm)^{2.98}$; KZN (n=306) (Cliff and Dudley 1991)
Growth parameters: Combined sexes: L_∞ = 230cm PCL; K = 0.071; t_0 = -5.12; KZN; (n=123) (Wintner et al. 2002)

FISHERY
Important in the competitive shore fishery, primarily in KZN but extending into the EC; but most specimens are released. Also caught year-round in the bather protection nets of the KZNSB but mainly in summer (Cliff and Dudley 1991). Some recreational ski-boat anglers target this species around Protea Banks in southern KZN

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

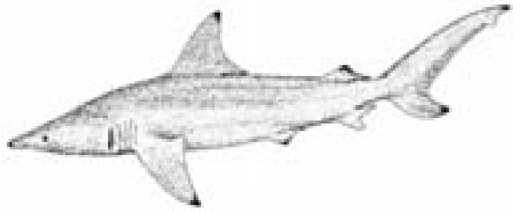
STOCK STATUS
Status: No stock assessment exists for *C. leucas* in SA. Declining catch rates in the KZN bather protection nets could simply be a case of localised stock depletion (Dudley and Cliff 2010)
Trend in CPUE: Decline in catch rates recorded in the KZNSB bather protection nets (Dudley and Simpfendorfer 2006, Dudley and Cliff 2010)
Trend in catch composition: No apparent trend, *C. leucas* comprise a mean of ~4% of the shark catch taken in the KZN nets (KZNSB, unpubl. data)
Trend in mean size: No change in mean or median size of catches in the KZN beach protection nets (Dudley and Simpfendorfer 2006)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2009 (Simpfendorfer and Burgess 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: No person may catch, be in possession of, or transport a Zambezi shark in the Aliwal Shoal MPA. Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers
MPA effectiveness: It is likely that the St Lucia and Maputaland MPAs in northern KZN and the Pondoland MPA in the EC provide protection for this species

MANAGEMENT CONSIDERATIONS
Like many elasmobranch species, *C. leucas* is vulnerable to overexploitation due to its life-history characteristics. The decline in catch rates in the KZN bather protection nets and the extended closure of the mouth of Lake St Lucia, a major nursery ground, indicate the need for possible management intervention. In the absence of a stock assessment and the difficulty in undertaking such, options include: no harvesting by commercial and recreational fishers, especially of breeding stock (>180cm PCL) and of any individuals in MPAs (especially Maputaland and St Lucia MPAs)

RESEARCH REQUIREMENTS
Need to improve understanding of movement patterns, including site fidelity and reproductive philopatry. Ascertain which river systems other than Lake St Lucia are important nursery grounds and quantify the extent of dependency of neonates and juveniles on estuarine and river systems. Simple stock assessment parameters must be determined to assess population trends and fishery-specific susceptibility
Research priority: Medium



SCIENTIFIC NAME: *Carcharhinus limbatus* (Smith No. 9.10)
COMMON NAMES: Blacktip shark
COMPILER: SFJ Dudley
REVIEWER: SP Wintner
DATE OF REPORT COMPLETION: February 2012

GLOBAL DISTRIBUTION: Circumglobal in tropical and subtropical continental waters (Compagno 1984)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Cape Point northwards to the Red Sea, including around Madagascar (Compagno 1984, Compagno et al. 1989)

MOVEMENT: Migratory
Present in KZN shark net catches year-round but less abundant from Jul-Oct. Absence of certain life history stages from catches suggests breeding migration and the seasonal differences in sex ratio suggests different migratory behaviour between sexes (Dudley and Cliff 1993). Mean distance travelled by 35 tagged animals was 78km (Dunlop et al. 2011) but presumably biased upwards by one movement of 1 288km from Bazaruto, MOZ, to Zinkwazi, KZN (Mann et al. 2006b). Some evidence of site fidelity, with three animals tagged and released by KZNSB staff recaptured at or less than 2km from the tagging locality after 2.8, 2.9 and 4.8 years, respectively (KZNSB unpubl. data). Evidence for philopatry for nursery areas among female blacktip sharks on the US Atlantic coast is presented by Keeney et al. (2003) and references therein

HABITAT
Adults: Pelagic but not truly oceanic (Compagno 1984). On KZN coast, penetrates the surf zone and occasionally St Lucia Estuary; offshore, seldom caught in water >30m (Bass et al. 1973)
Juveniles: Young animals may use coastal waters of MOZ (Bass et al. 1973). Elsewhere, known to use coastal waters, including estuarine salt marshes and tidal creeks, as a nursery (Branstetter and McEachran 1986, Castro 1993)

FEEDING
Adults: In KZN teleosts found in 83% of non-empty stomachs sampled, but with geographical and seasonal differences in diet (Dudley and Cliff 1993). Important prey species include *Trachurus delagoa* and *Sardinops sagax* (Dudley and Cliff 1993, 2010)
Juveniles: Unknown locally

REPRODUCTION
Reproductive style: Placental viviparity (Branstetter 1981)
Breeding/spawning season: Animals in mating condition found predominantly between Nov-Dec. Gestation period about 12 months (Dudley and Cliff 1993)
Breeding/spawning locality: Of the adults caught in KZN, few are in mating condition, suggesting mating generally occurs elsewhere (Dudley and Cliff 1993). Similarly, pregnant females appear to move elsewhere to pup, possibly the coastal waters of MOZ (Bass et al.1973)
Age at 50% maturity: Males: 5.7 years; Females: 6.1 years; KZN; derived from growth curve (Wintner and Cliff (1996) using length at 50% maturity (Dudley and Simpfendorfer 2006)
Length at 50% maturity: Males: 147.7cm PCL; Females: 151.7cm PCL; KZN (Dudley and Simpfendorfer 2006)

BIOMETRICS
Maximum recorded age: 11 years; Female; KZN; maximum age observed by Wintner and Cliff (1996)
Maximum recorded weight: 130kg; Female; Anstey's Beach; KZN; 2003 (KZNSB unpubl. data)
Maximum recorded length: 195.1cm PCL; Female; Umtentweni; KZN; 1995 (KZNSB unpubl. data)
Length-length relationship: Combined sexes: TL(cm) = 1.334PCL(cm) + 4.27; KZN (Dudley and Cliff 1993); (Note TL with the upper caudal fin in its natural position i.e. not placed parallel to body axis)
Combined sexes: FL(cm) = 1.074PCL(cm) + 2.4; KZN (Dudley and Cliff 1993)
Length-weight relationship: Males: Wt(kg) = $0.0000118 \times PCL(cm)^{3.05}$; KZN (Dudley and Cliff 1993)
Females: Wt(kg) = $0.0000108 \times PCL(cm)^{3.08}$; KZN (Dudley and Cliff 1993)
Growth parameters: Combined sexes: L_∞ = 193.6cm PCL; K = 0.21; t_0 = -1.2; KZN (Wintner and Cliff 1996)

FISHERY
No known commercial fishery but unconfirmed reports of some targeting on the KZN coast. Caught by recreational shore and boat anglers. Ranked third (in terms of numbers) in the *Carcharhinus* catch of competition anglers in KZN and northern EC (Pradervand 2004, Pradervand et al. 2007). A mean annual catch of 97 sharks was taken in the protective gill-nets (shark nets) off KZN beaches between 1978 and 2010 (KZNSB unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Dudley and Simpfendorfer (2006) calculated an intrinsic rate of population increase for this species of 0.141 and an estimate from the Pacific was 0.054 (Smith et al. 1998)

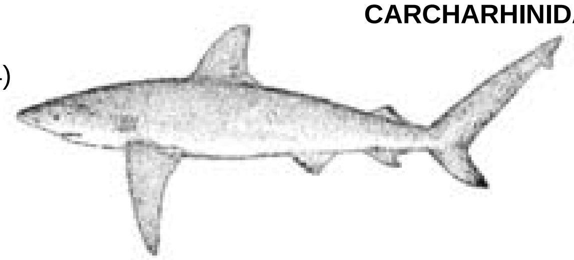
STOCK STATUS
Status: Not assessed
Trend in CPUE: Shark nets have been fishing off KZN beaches since 1952 but the time series of blacktip shark catches begins only in 1978. This is because of initial confusion of this shark with other netted species, such as the spinner shark *Carcharhinus brevipinna* and, to a lesser extent, the copper shark *C. brachyurus*. There was a significant decline in catch rate over the 26-year period 1978-2003 (Dudley and Simpfendorfer 2006) but there was a slight recovery thereafter such that the trend over the entire 33-year period 1978-2010 was not significant (Dudley et al. 2011)
Trend in catch composition: No significant trend; constitutes a mean annual 10.2% of the total catch of 14 species of large sharks caught in the KZN shark nets 1978-2010 (KZNSB unpubl. data). (Note that these data exclude catches taken on drumlines, which have different species selectivity)
Trend in mean size: No trend in annual mean or median PCL of either sex in KZN shark net catches 1978-2010 (KZNSB unpubl. data)
Trend in sex ratio: No trend in annual sex ratio in KZN shark nets 1978-2010 (KZNSB unpubl. data)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2009 (Burgess and Branstetter 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers
MPA effectiveness: Hypothetically, if the blacktip shark does demonstrate site specificity, even if seasonal, individuals that regularly spend time in MPAs could be protected from exploitation. This may be particularly important if targeted fishing for the species were to develop in the future

MANAGEMENT CONSIDERATIONS
Although there appears to be little or no commercial exploitation in SA waters at present, the species is probably exploited by artisanal fisheries in MOZ. It is targeted, together with other large coastal sharks, in other parts of the world, e.g. the US east coast, where management measures had to be introduced in the 1990s to rebuild depleted stocks (Branstetter 1999, Musick 1999, NMFS 1999, 2000). Given the potential for commercial shark fishing to increase on the KZN coast, managers should consider adopting the precautionary principle at an early stage of the development of any new fishery (see Castro et al. 1999). With regard to the KZN shark nets, the KZNSB has reduced fishing effort in order to reduce captures of all exploited species

RESEARCH REQUIREMENTS
Location and protection of nursery grounds for this species, although these are probably outside SA's borders, would potentially be useful for regional management purposes. The KZNSB will continue to monitor trends in catch and size, as the only indices of stock status currently available. This species appears to be responsible for extensive depredation on hooked linefish in the commercial and recreational skiboat linefishery in KZN (B. Mann, ORI, pers. comm.). This not only represents a negative economic impact on that fishery but may also lead to fishers attempting to remove blacktips and other sharks from a given area in an attempt to reduce the loss of hooked fish
Research priority: Medium



SCIENTIFIC NAME: *Carcharhinus obscurus* (Smith No. 9.14)
COMMON NAMES: Dusky shark, Ridgeback grey shark, Donkerhaai
COMPILER: SFJ Dudley
REVIEWER: M Dicken
DATE OF REPORT COMPLETION: July 2012

GLOBAL DISTRIBUTION: Tropical and warm temperate waters (Compagno et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Eastern seaboard of SA (Compagno et al. 1989) with possible occurrence in NC and NAM (Compagno et al. 2005)

MOVEMENT: Migratory
There have been several studies of movements of primarily young dusky sharks on the SA east coast (Davies and Joubert 1967, Bass et al. 1973, Hussey et al. 2009, Dicken 2011). Small sharks undertake a southerly migration from the core nursery area in central-southern KZN to the EC and SC but do not appear to remain in Cape waters in winter (Hussey et al. 2009). It is possible that not all young sharks undertake the migration. Large sharks move inshore seasonally from the outer shelf (Bass et al. 1973)

HABITAT
Adults: Pelagic in warm waters of the outer continental shelf in 200-400m water depth, with adult females coming inshore to pup (Bass et al. 1973)
Juveniles: In the surf zone off sandy beaches along the KZN coast and in shallow bays in the SEC (Bass et al. 1973, Smale 1991). The deep water Port of Ngqura appears to be an important summer nursery habitat for juvenile sharks in the EC (Dicken 2011)

FEEDING
Adults: In large dusky sharks (≥210cm PCL), excluding pregnant females, sampled from the KZN shark nets, the frequency of occurrence of teleosts was highest at 72.1% and the percentage by mass of elasmobranchs was highest at 52.2% (Dudley et al. 2005). Sardine *Sardinops sagax* were particularly commonly encountered at 48.2%. In pregnant females, elasmobranchs dominated in terms of both frequency of occurrence (46.4%) and mass (77.7%)
Juveniles: In small dusky sharks (<100cm PCL) sampled from the KZN shark nets, teleosts dominated in terms of both frequency of occurrence (65.1%) and percentage by mass (57.4%) (Dudley et al. 2005). Commonly encountered prey families were the Haemulidae and Sparidae (both demersal) and the Scombridae (pelagic)

REPRODUCTION
Reproductive style: Placental viviparity (Bass et al. 1973, Wourms 1981)
Breeding/spawning season: Prolonged breeding season; pregnant females with near-term embryos caught in KZN shark nets between Feb-Dec, but 82% caught from Mar-Jul (Dudley et al. 2005). Median litter size 10 embryos, maximum 16, sex ratio equal. Size at birth usually 61-70cm PCL but may exceed 70cm (Dudley et al. 2005)
Breeding/spawning locality: Mating and most of the gestation period occurs away from KZN nearshore waters (Bass et al. 1973, Dudley et al. 2005). Pupping occurs in nearshore waters between Richards Bay and the KZN/EC border but the northern part of that region, adjacent to the Thukela Bank, may be preferred (Dudley et al. 2005)
Age at 50% maturity: Males: 16.7-19.7 years based on length at 50% maturity from Dudley and Simpfendorfer (2006), and growth curves from Natanson and Kohler (1996) and Hussey et al. (2009)
Females: 17.5-20.6 years based on length at 50% maturity from Dudley and Simpfendorfer (2006), and growth curves from Natanson and Kohler (1996) and Hussey et al. (2009)
Length at 50% maturity: Males: 211cm PCL; Females: 215cm PCL; KZN (Dudley and Simpfendorfer 2006)

BIOMETRICS
Maximum recorded age: >70 years; calculated age at the then maximum recorded size of 300cm PCL (Natanson and Kohler 1996). Hussey et al. (2009) back-calculated maximum longevity at 64.2 years
Maximum recorded weight: 450kg; Female; KZN; 1995. This specimen, caught in the KZN shark nets at Zinkwazi in July 1995, may be the largest on record globally (Dudley et al. 2005)
Maximum recorded length: 284cm PCL; 377cm TL; Female; KZN; 1995. This specimen, caught in the KZN shark nets at Zinkwazi in July 1995, may be the largest on record globally (Dudley et al. 2005)
Length-length relationship: Combined sexes: TL(cm) = 1.312PCL(cm) + 4.552; KZN; TL with the upper caudal fin in its natural position (Dudley et al. 2005)
Combined sexes: FL(cm) = 1.074PCL(cm) + 2.053; KZN (Dudley et al. 2005)

Length-weight relationship: Combined sexes: Wt(kg) = 0.0000119 x $PCL(cm)^{3.04}$; KZN (Dudley et al. 2005)
Growth parameters: Combined sexes: L_∞ = 334cm FL; K = 0.047; t_0 = -5.18; KZN (Natanson and Kohler 1996)
Combined sexes: L_∞ = 310cm FL; K = 0.054; t_0 = -5.4; KZN (Hussey et al. 2009)

FISHERY
Neonates and juveniles are exploited in KZN and EC waters by recreational and commercial linefisheries, and juvenile, adolescent and adult dusky sharks are captured in the protective shark nets in KZN (Dudley 2004, Dudley et al. 2005, Govender and Birnie 1997, Pradervand 2004, Pradervand et al. 2007). Dusky sharks are also taken as bycatch in the offshore pelagic longline fishery (Petersen et al. 2009)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.27yr^{-1}
Natural mortality rate (M): 0.015yr^{-1}
Total mortality rate (Z): 0.285yr^{-1}
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
Year completed: 1997
Locality: KZN
References & Comments: Govender and Birnie (1997) used mark-recapture data for juveniles caught from 1986-93 and estimated an instantaneous fishing mortality rate of 0.27yr^{-1}. They expressed concern that this greatly exceeded a calculated natural mortality rate of 0.015yr^{-1} and may result in overfishing. Since 1995 however, catch-and-release has been promoted in shore angling competitions (Pradervand et al. 2007)

STOCK STATUS
Status: Not assessed. Dudley and Simpfendorfer (2006) calculated an intrinsic rate of population increase for this species of 0.041, and an estimate from the Pacific was 0.020 (Smith et al. 1998). Both these values reflect very low productivity
Trend in CPUE: No trend in KZN shark net catches over the 26-year period 1978-2003 (Dudley and Simpfendorfer 2006) but a significant decline over the longer period 1978-2010 (Dudley et al. 2011). In the competition shore fishery 1977-2000, dusky and copper sharks (combined) showed a non-significant decline in the former Transkei (EC) but this may primarily reflect a change in targeting (Pradervand 2004). A similar result was reported for dusky sharks in the KZN shore fishery (Pradervand et al. 2007)
Trend in catch composition: No significant trend in the KZN shark net catches 1978-2010; constituted a mean annual 19.6% of the total catch of 14 species of large sharks (KZNSB unpubl. data). (Note that these data exclude catches taken on drumlines, which have different species selectivity). In the competition shore fishery 1977-2000, the contribution of dusky and copper sharks (combined) (4.5% by number, former Transkei) and dusky sharks (25.9%, KZN), showed non-significant declines that may primarily reflect a change in targeting (Pradervand 2004, Pradervand et al. 2007)
Trend in mean size: No trend in annual mean or median PCL of either sex in KZN shark net catches 1978-2010 (KZNSB unpubl. data). In the competition shore fishery 1977-2000, no trend in mean annual individual mass of dusky and copper sharks (combined; former Transkei) or dusky sharks (KZN) (Pradervand 2004, Pradervand et al. 2007)
Trend in sex ratio: No trend in annual sex ratio in KZN shark nets 1978-2010 (KZNSB unpubl. data)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2009 (Musick et al. 2009). Amongst the slowest-growing and latest-maturing of known sharks, bearing small litters after a long gestation period. Red List assessment based on very high intrinsic vulnerability of this species to depletion, significant estimated declines in several areas of its range and inferred declines in highly fished areas from which data are not available (Musick et al. 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers
MPA effectiveness: MPAs are probably of limited effect for a species that is highly migratory and that is not known to be philopatric. MPAs that are within the core nursery area of KZN will provide protection for some neonates

MANAGEMENT CONSIDERATIONS

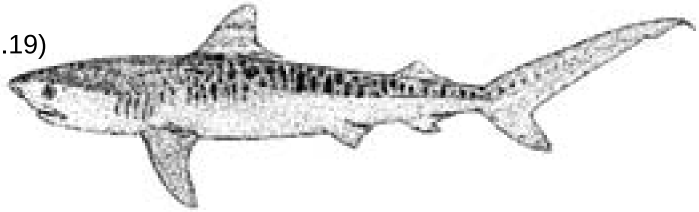
The life history characteristics of dusky sharks are not conducive to high levels of exploitation but a small commercial fishery targeting neonates and young juveniles may be sustainable. Consideration should be given to improving the monitoring of commercial catches and limiting catches if necessary. The release of sharks caught in the recreational fishery, already widely practised, should be encouraged. Total effort in the KZN beach protection program has been reduced (Cliff and Dudley 2011) but the recently-introduced drumlines take a higher catch of small dusky sharks than do shark nets (Dudley 2011). Bycatch by pelagic longline vessels should be monitored

RESEARCH REQUIREMENTS

Investigate whether exploitation needs to be capped (and, if so, at what level), or whether other management measures are required (e.g. the setting of an upper size limit). Consider the experience in Western Australia where commercial catches of neonates and juveniles declined (McAuley et al. 2007). Movements, and possible exploitation, of adults and sub-adults in the south-west Indian Ocean are not well understood. A satellite-tracking project focussing on the larger size classes may help to improve knowledge of such movements

Research priority: High

CARCHARHINIDAE



SCIENTIFIC NAME: *Galeocerdo cuvier* (Smith No. 9.19)
COMMON NAMES: Tiger shark
COMPILER: G Cliff
REVIEWER: SP Wintner
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Worldwide in warm-temperate, subtropical and tropical seas. Also found in estuaries, harbours and lagoons. Not regarded as an oceanic species but does occur far offshore (Compagno 1984, Simpfendorfer 2009)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Cape St Francis is listed as the southernmost limit of its distribution in SA waters (Compagno et al. 1989)

MOVEMENT: Nomadic
To date 454 tiger sharks have been tagged in SA waters with 23 recaptures (5.07%). Most recaptures have been taken in relatively close proximity to where they were originally tagged, while others have undertaken long distance movements (ORI Tagging Project, unpubl. data). For example, two sharks tagged in KZN inshore waters were recaptured; one in SW Madagascar and another in the MOZ Channel (Wintner 2004). In other regions individuals maintain large home ranges but return to specific areas on a regular basis (Holland et al. 1999, Heithaus 2001); there is thus also some evidence for this behaviour in KZN (Wintner 2004)

HABITAT
Adults: Coastal and far offshore in warm temperate and tropical waters (Compagno et al. 1989). It is assumed that the largest individuals are found in lower latitudes, making such excursions during the warmer summer months
Juveniles: Coastal waters in tropical regions. There are no known nursery areas for tiger sharks on the SA coast

FEEDING
Adults: Tiger sharks have one of the most diverse diets of any known shark species, which includes marine mammals, sea birds, elasmobranchs, teleosts and cephalopods. It is also a well-known scavenger (Compagno 1984, Heithaus 2001, Simpfendorfer et al. 2001)
Juveniles: There are ontogenic changes in diet (Simpfendorfer 1992, Lowe et al. 1996, Aitken 2003), with juveniles restricted to smaller prey such as cephalopods and smaller teleosts (Simpfendorfer et al. 2001)

REPRODUCTION
Reproductive style: The only carcharhinid with aplacental viviparous development (Compagno 1984). Bears 10-82 pups (Compagno et al. 1989)
Breeding/spawning season: Mating occurs mainly in spring with gestation lasting 13-16 months and pupping occurring during the following summer (Simpfendorfer 2009)
Breeding/spawning locality: Mostly in tropical areas, little evidence of breeding in SA waters. Only 2% of females and 9% of males caught in the KZN bather protection program were mature (Dudley and Simpfendorfer 2006). A single pregnant female was caught in central KZN in February 1980 (KZNSB unpubl. data)
Age at 50% maturity: Females: 11 years; Males: 8 years; KZN (Wintner and Dudley 2000)
Length at 50% maturity: Females: 273cm PCL; Males: 247cm PCL; KZN (Dudley and Simpfendorfer 2006)

BIOMETRICS
Maximum recorded age: 50 years; Gulf of Mexico (Branstetter et al. 1987). The maximum ages of tiger sharks aged in KZN were 13 years for females and 11 years for males with few large individuals available for study (Wintner and Dudley 2000)
Maximum recorded weight: 807.4kg; IGFA World angling record (van der Elst 1993). The maximum weights of tiger sharks caught in the KZN bather protection program was a female of 483kg caught off Richards Bay in 1985 and a male of 490kg caught off Salt Rock in 1987 (KZNSB unpubl. data)
Maximum recorded length: 750cm TL, Male; Thailand (Vidthayanon 2005). The maximum lengths of tiger sharks caught in the KZN bather protection program was a female of 320cm PCL caught off Richards Bay in 1985 and a male of 310cm PCL caught off Salt Rock in 1987 (KZNSB unpubl. data)
Length-length relationship: Combined sexes: PCL(cm) = 0.783TL(cm) - 12.05; KZN (Aitken 2003)
Combined sexes: PCL(cm) = 0.925FL(cm) - 14.37; KZN (Aitken 2003)
Length-weight relationship: Females: $Wt(kg) = 0.000007 \times PCL(cm)^{3.12}$; KZN (Aitken 2003)
Males: $Wt(kg) = 0.000006 \times PCL(cm)^{3.14}$; KZN (Aitken 2003)
Growth parameters: Combined sexes: L_{∞} = 301cm PCL, K = 0.202, t_0 = -1.11; KZN (Wintner and Dudley 2000). This study lacked small (<100 cm) and large animals; the largest male and female in this study was 301cm and 300cm PCL, respectively

FISHERY
Rare bycatch in KZN shore and recreational boat fisheries (Pradervand 1999). On occasion has been targeted by the commercial skiboat fishery on the central KZN coast. Approximately 60 (mainly immature) individuals are caught each year in the KZN bather protection program; survival rate is high with about 25 sharks released alive (Cliff and Dudley 2010)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Dudley and Simpfendorfer (2006) calculated an intrinsic rate of population increase of 0.227 for this species, with a fishing mortality rate at which population growth is zero of $0.27yr^{-1}$

STOCK STATUS
Status: Not assessed
Trend in CPUE: The KZN bather protection program commenced in 1952 but accurate catch data are only available since 1978. There was a significant increasing trend in catch rate from 1978-2003 (Dudley and Simpfendorfer 2006). This also applies for the period 1978-2010 (S. Dudley, KZNSB, unpubl. data)
Trend in catch composition: The contribution of tiger sharks to the total catch of 14 species of large sharks caught in the KZN shark nets, 1978-2011, showed a significant increase with time ($p<0.001$), from a fitted value of 1.9% in 1978 to a fitted value of 9.6% in 2011. The mean annual contribution was 5.8% (S. Dudley, KZNSB, unpubl. data)
Trend in mean size: There was no trend in mean or median size of females caught in the KZN bather protection program, but an increase in mean and median size of males for the period 1978-2010 (S. Dudley, KZNSB, unpubl. data)
Trend in sex ratio: The M:F sex ratio of the KZN shark net catch was dominated by females (1:2.2). There was no trend in the annual sex ratio of tiger sharks caught in the KZN shark nets for the period 1978-2011 (S. Dudley, KZNSB, unpubl. data)

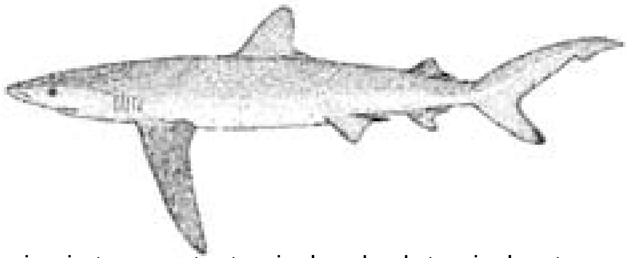
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2009 (Simpfendorfer 2009). This assessment was based on the information published in the 2005 shark status survey (Fowler et al. 2005)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: No person may catch, be in possession of, or transport a tiger shark in the Aliwal Shoal MPA. Elsewhere sharks must be landed whole, although they may be headed or gutted. No sale of catch by recreational anglers
MPA effectiveness: Small congregations of tiger sharks are the focus of baited dives in the Aliwal Shoal MPA (Dicken and Hosking 2009). Tiger sharks are also relatively common in the St Lucia and Maputaland MPAs (G. Cliff, KZNSB, pers. obs.)

MANAGEMENT CONSIDERATIONS
Much controversy surrounds the shark diving industry that has developed within the Aliwal Shoal MPA and careful management is required to ensure that tiger sharks do not become conditioned by reward feeding

RESEARCH REQUIREMENTS
Monitor residency and movement patterns of animals in the Aliwal Shoal MPA. Ascertain why this population is almost exclusively female
Research priority: Medium

CARCHARHINIDAE



SCIENTIFIC NAME: *Prionace glauca* (Smith No. 9.32)
COMMON NAMES: Blue shark
COMPILER: K Jolly
REVIEWER: C da Silva
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Oceanic and circumglobal occurring in temperate, tropical and sub-tropical waters (Bigelow and Schroeder 1948, Compagno 1984)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Stock structure in SA waters unknown - possible inter-mixing between South Atlantic and Indian Ocean blue sharks (da Silva et al. 2010). Tagging studies in the North Atlantic suggest a single stock of blue sharks in that area (Kohler and Turner 2008)

MOVEMENT: Migratory
Seasonal migrations that are influenced by factors such as water temperature, prey abundance and reproductive status (Carey and Scharold 1990, Kohler et al. 2002)

HABITAT
Adults: Oceanic and epipelagic, ranges in depths from the surface to a depth of 600m (Nakano and Stevens 2008)
Juveniles: Possible nursery areas off the sub-tropical convergence zone in the Southwest Atlantic (Montealegre-Quijano and Vooren 2010) and off the Cape (da Silva et al. 2010)

FEEDING
Adults: Diet consists mainly of cephalopods (Kubodera et al. 2007) and small pelagic fish (Hendersen et al. 2001) but appear to have opportunistic feeding behaviour
Juveniles: Unknown, assumed to be similar to adults

REPRODUCTION
Reproductive style: Placental viviparity (Pratt 1979)
Breeding/spawning season: Mating occurs in the summer months in the North and South Atlantic (Pratt 1979, Amorim 1992, Hazin and Lessa 2005)
Breeding/spawning locality: Parturition areas suspected off South-eastern Atlantic (Hazin et al. 2000), and off SA (da Silva et al. 2010) associated with ocean fronts with large horizontal temperature gradients and high productivity, such as sub-tropical and polar convergences
Age at 50% maturity: Females: 5.5-6 years; Males: 4.9-7 years; N. Atlantic, Mediterranean and SA (Pratt 1979, Megalofonou et al. 2009, Jolly 2011)
Length at 50% maturity: Females: 194.4-214.7cm TL; 190cm FL; Males: 201.4-202.9cm TL; 183cm FL; N. Atlantic, Mediterranean and SA (Pratt 1979, Megalofonou et al. 2009, Jolly 2011)

BIOMETRICS
Maximum recorded age: 16 years, males and females; N and S Atlantic (Skomal and Natanson 2003, Jolly 2011)
Maximum recorded weight: 198kg; 1983 (IGFA World angling record)
Maximum recorded length: 383cm TL (Compagno 1984)
Length-length relationship: Combined sexes: FL(cm) = 0.8313TL(cm) + 1.39; NW Atlantic (Kohler et al. 1995)
Combined sexes: PCL(cm) = 0.762TL(cm) – 2.505; N Pacific (Nakano et al. 1985)
Males: FL(cm) = 0.78TL(cm) + 11.27; N Atlantic (Hazin et al. 1991)
Females: FL(cm) = 0.73TL(cm) + 23.52; N Atlantic (Hazin et al. 1991)
Length-weight relationship: Male: $Wt(kg) = 0.000003293 \times PCL(cm)^{3.225}$; N Pacific (Nakano 1994)
Female: $Wt(kg) = 0.000005388 \times PCL(cm)^{3.102}$; N Pacific (Nakano 1994)
Male: $Wt(kg) = 0.000000392 \times TL(cm)^{3.41}$; Atlantic (Stevens 1975)
Female: $Wt(kg) = 0.00000131 \times TL(cm)^{3.2}$; Atlantic (Stevens 1975)
Growth parameters: Combined sexes: L_∞ = 3116mm TL; K = 0.12; t_0 = -1.66; SA (Jolly 2011)
Males: L_∞ = 2946mm TL; K = 0.14; t_0 = -1.3; SA (Jolly 2011)
Females: L_∞ = 3347mm TL; K = 0.11; t_0 = -2.19; SA (Jolly 2011)
See other growth parameters for blue sharks from N Atlantic (Skomal and Natanson 2003), NE Brazil (Lessa et al. 2004), NE Atlantic (Hendersen et al. 2001) and the Pacific (Nakano 1994, Manning and Francis 2005)

FISHERY
Taken as bycatch in the pelagic shark longline fisheries, tuna/swordfish longline fisheries (Petersen et al. 2009) and occasionally caught in the recreational boat fishery

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.15-0.2yr^{-1}
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
Year completed: 2008
Locality: N and S Atlantic
References & Comments: Report of the 2008 shark stock assessment meeting (ICCAT 2009)

STOCK STATUS
Stock assessment method: Other
Year completed: 2008
Locality: North Atlantic
Status: >50% - underexploited (ICCAT 2009)
Trend in CPUE: Inconsistent trends in blue shark CPUE across the globe. Standardized CPUE for SA suggests that blue shark abundance has remained relatively stable from 1998-2008 (Jolly 2011). 60-80% decline in blue shark CPUE in the NW Atlantic (Baum et al. 2003, Simpendorfer et al. 2002, Hueter and Simpendorfer 2008). No significant trend in blue shark CPUE in the Pacific Ocean (Matsunaga and Nakano 1999). No significant trend in blue shark CPUE data from 1971-93 for the Atlantic or Indian Oceans (Nakano 1996). North and South Atlantic blue shark population appears stable based on standardised CPUE from 1990-2007 using Spanish longline fleet data (Mejuto et al. 2009)
Trend in catch composition: 80% decline in male blue shark CPUE between 1977-94 in NW Atlantic but no significant decline in female CPUE (Simpendorfer et al. 2002)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2009 (Stevens 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers. Management of the blue shark falls under a number of RFMOs
MPA effectiveness: MPAs are not considered effective for this highly mobile species

MANAGEMENT CONSIDERATIONS
Blue sharks require an internationally co-ordinated management strategy as they are a wide ranging species whose migration patterns involve the crossing of international boundaries. Cortes (2008) suggests that management plans should focus on the protection of juveniles

RESEARCH REQUIREMENTS
Identification of pupping grounds and juvenile nursery areas. Stock identity and status. Validation of age and growth estimates
Research priority: Medium

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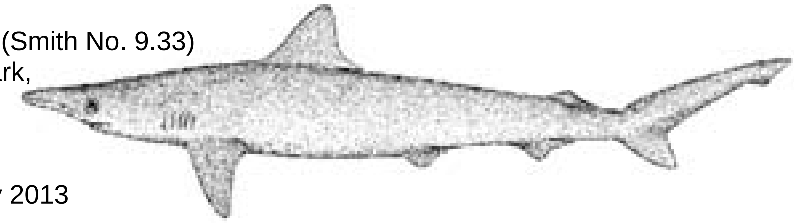


SCIENTIFIC NAME: *Rhizoprionodon acutus* (Smith No. 9.33)
COMMON NAMES: Milk shark, Grey dogshark, White-eyed shark, Longman's shark
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Tropical and subtropical continental shelf waters of the eastern Atlantic, Indian and western Pacific Oceans (Compagno 1984)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common off northern and central KZN during summer (van der Elst 1993, Pradervand et al. 2007). Some individuals recorded in the EC (Pradervand and Govender 2003, Pradervand 2004)

MOVEMENT: Nomadic
896 animals tagged in SA waters and 26 recaptures (2.9% recaptured), with the greatest distance travelled of 363km, the mean distance moved of 87.5km and the maximum rate of travel 28km.day^{-1} (ORI Tagging Project, unpubl. data). However, these data should be used with circumspection, given the similarity to other carcharhinid sharks commonly caught by shore anglers, specifically neonate spinner sharks *Carcharhinus brevipinna*

HABITAT
Adults: From close inshore to depths of 200m (Compagno 1984). Especially abundant in summer off the sandy beaches of northern and central KZN, usually occurring in midwater or near the bottom (van der Elst 1993). Sometimes found in estuaries but not in fresh water (Mann et al. 2002, Beckley et al. 2008). Probably uses the surf-zone for protection from larger shark species (van der Elst 1993)
Juveniles: Shallow bays in surf-zone off sandy beaches in northern KZN (Bass et al. 1975, van der Elst 1993). Off NE Australia recorded using shallow, muddy embayments as nursery grounds (Simpfendorfer and Milward 1993)

FEEDING
Adults: Small teleosts, cephalopods, gastropods and crustaceans (Bass et al. 1975, Heemstra and Heemstra 2004)
Juveniles: Similar to adults. It is likely that there are diet shifts with increasing size which is related to intra-species competition as recorded with other similar Carcharhinid spp. (White et al. 2004)

REPRODUCTION
Reproductive style: Mating with distinct pairing and embrace, viviparous with a yolk-sac placenta, 2-8 pups per litter (mean = 4.7) after about one year gestation. Pups 25-39 cm at birth (Bass et al. 1975, Compagno 1984, Heemstra and Heemstra 2004)
Breeding/spawning season: Pupping recorded from Nov-Jan (summer) in KZN waters (Bass et al. 1975, van der Elst 1993). Breeding recorded during spring in Oman (Henderson et al. 2006) and from May-Jun (summer) off Senegal (Capape et al. 2006)
Breeding/spawning locality: Thought to use shallow embayments, such as around Richards Bay and elsewhere on the KZN north coast for pupping (Bass et al. 1975). Off NE Australia recorded using a shallow embayment with a muddy substratum as a nursery ground (Simpfendorfer and Milward 1993). Pregnant females off Senegal were relatively abundant inshore when waters warmed up (Capape et al. 2006)
Age at 50% maturity: Males: 1.8 years; Females: 2.3 years; KZN and southern MOZ; 1975; derived from growth curve of van der Elst (1993) based on length at maturity from Bass et al. (1975) but ageing needs verification
Length at 50% maturity: Males: 68-72cm TL; Females: 70-80cm; KZN and southern MOZ; 1975 (Bass et al. 1975, van der Elst 1993). Populations from different areas (e.g. Senegal and Oman) show slight differences with regard to size at maturity (Capape et al. 2006, Henderson et al. 2006)

BIOMETRICS
Maximum recorded age: 8 years (Compagno 1984) but age and growth needs verification
Maximum recorded weight: 6.8kg; SA angling record (van der Elst 1993)
Maximum recorded length: Males: 89cm TL; Females: 102cm TL; KZN (Bass et al. 1975). Elsewhere known to reach 175cm TL (Rainboth 1996)
Length-length relationship: TL(cm) = 1.269PCL(cm); based on picture of one specimen (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.00477 x TL(cm)$^{2.981}$; KZN (R. van der Elst, ORI, unpubl. data)
Combined sexes: Wt(g) = 0.0079 x TL(cm)$^{2.987}$; India (Krishnamoorth and Jagadis 1986)

Growth parameters: Combined sexes: L_∞ = 110cm TL; K = 0.35; t_0 = -1; KZN (R. van der Elst, ORI, unpubl. data, but needs verification). Combined sexes: L_∞ = 105cm TL; K = 0.6; India (Kasim 1991)

FISHERY
Seldom targeted by recreational shore anglers and mostly caught as a bycatch (Mann et al. 1997, Dunlop 2011), except during shore angling competitions (Pradervand 2004, Pradervand et al. 2007). Few are consumed and most are discarded. Comprises a small percentage (3.7%) of the bycatch taken by inshore prawn trawls on the Thukela Banks during summer (Fennessy 1994). Occasionally caught as a bycatch by recreational and commercial boat fishers, usually discarded but sometimes kept for bait (Dunlop 2011). Forms a small percentage of the catch taken by subsistence shore fishers in northern KZN (S. Dunlop, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: In the KZN competitive shore fishery CPUE for milk sharks increased from 1973-76, and this increase was attributed to a reduction in predation caused by the KZN shark nets (van der Elst 1979), a conclusion subsequently re-examined and partially rebutted by Dudley and Cliff (1993a, b). Subsequently, CPUE trends showed a significant decline by number from 1977-2000 (Pradervand et al. 2007). Whether this was related to actual changes in species abundance or a change in directed angling effort is unclear. Subsequent to this, all fish caught in shore angling competitions are measured and released and the implementation of the beach vehicle ban in 2002 has probably benefitted the population as shore anglers are no longer able to access large areas along the KZN north coast where this species was previously targeted (Mann et al. 2008)
Trend in catch composition: Composition of the shark component, which in latter years comprised primarily dusky and milk sharks, increased from 1956-76 in KZN's competitive shore fishery, while that of teleosts decreased (van der Elst 1979). Between 1977-2000 milk sharks comprised 18% of the catch by number and 7.8% of the catch by weight in the KZN competitive shore fishery (Pradervand et al. 2007). During this period milk sharks showed a significant decline in percentage composition by number (Pradervand et al. 2007). Subsequent to this it is likely that fishing mortality on this species has been reduced (see above)
Trend in mean size: Milk sharks caught from 1977-2000 in the KZN competitive shore fishery showed a slight but significant increase in mean size (Pradervand et al. 2007). However, between 1984-2011 no obvious changes were recorded in mean size of milk sharks tagged in the ORI Tagging Project (S. Dunlop, ORI Tagging Project, unpubl. data)
Trend in sex ratio: Unknown in SA. Elsewhere M:F sex ratios range between 1:1.26 in N Australia (Stevens and McLoughlin 1991), 1:2.3 in Oman (Henderson et al. 2006) and 1:1.34 in E India (Krishnamoorthi and Jagadis 1986)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2003 (Simpfendorfer 2003)

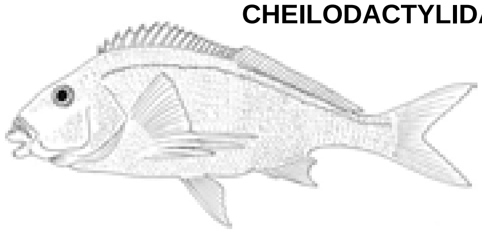
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch by recreational anglers
MPA effectiveness: Uncommon in the St Lucia and Maputaland MPAs (B. Mann, ORI, pers. obs.). This species is most abundant in the region of the Natal Bight (Durban to the Umfolozi River) where there is currently little MPA protection

MANAGEMENT CONSIDERATIONS

Although this species is not exploited commercially in SA at present, it is targeted or caught as bycatch and utilized in other parts of the world, e.g. the Indian east coast (Krishnamoorthi and Jagadis 1986), Senegal (Capape et al. 2006) and N. Australia (Last and Stevens 1994). Given the potential for commercial shark fishing to increase on the KZN coast, managers should consider adopting the precautionary principle at an early stage of the development of any such fishery

RESEARCH REQUIREMENTS

Due to its commercial potential and since no local research has been conducted on this species since 1975, information is required on reproductive biology, age and growth, CPUE and catch composition, stock assessment, stock distribution, movements patterns, early life history and juvenile nursery areas
Research priority: Medium



SCIENTIFIC NAME: *Chirodactylus grandis* (Smith No. 215.4)
COMMON NAMES: Bank steenbras
COMPILER: AD Wood
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic, NAM to southern KZN (Smith and Bauchot 1984)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
From Walvis Bay possibly to Port St Johns; mostly in deeper water off EC and WC (Heemstra and Heemstra 2004). KZN records probably confused with *C. jessicalenorum* (Smith and Heemstra 1991)

MOVEMENT: Unknown

HABITAT
Adults: 20 to 150m depth, normally over reef or mud banks (Smith and Bauchot 1984, Smith and Heemstra 1991)
Juveniles: Unknown, but probably similar to adults
Eggs and larvae: Unknown, but most likely pelagic

FEEDING
Adults: Small bottom dwelling invertebrates, squid and small fish (Smith and Bauchot 1984, Meyer and Smale 1991)
Juveniles: Assumed to be similar to adults (Smith and Bauchot 1984)

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 10kg; 1967; SA spearfishing record
Maximum recorded length: 180cm TL (Smith and Bauchot 1984)
Length-length relationship: Unknown
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Caught as a bycatch of the inshore trawl fishery and boat-based linefisheries, although seldom takes bait. Much sought after target species by spearfishermen (Smith and Bauchot 1984, Smith and Heemstra 1991, AD Wood, GEC, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

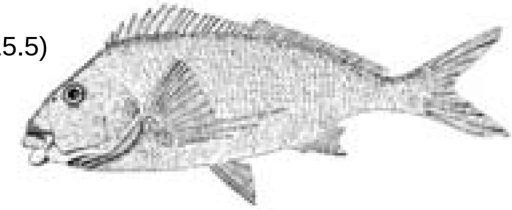
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Not recorded in many MPAs. However, most likely to receive some protection in MPAs in EC and WC that include reef areas in depths >20m

MANAGEMENT CONSIDERATIONS
Life history data and a stock assessment are needed before management interventions can be considered. However, a minimum size limit of 40cm TL could be considered as a precautionary measure

RESEARCH REQUIREMENTS
Age and growth, reproductive biology, distribution, movement and stock assessment
Research priority: Low



SCIENTIFIC NAME: *Chirodactylus jessicalenorum* (Smith No. 215.5)
COMMON NAMES: Natal fingerfin, Natal banky
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Endemic to SA (Smith and Bauchot 1984, Heemstra and Heemstra 2004) but also recently found along the southeast coast of Madagascar (B. Mann, ORI, pers. obs.)

SOUTHERN AFRICAN DISTRIBUTION: EC, KZN
Occurs from Algoa Bay, EC, north to Sodwana Bay, KZN (van der Elst 1993, Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Known to congregate at certain times of the year into loosely packed shoals, presumably as a prelude to spawning (van der Elst 1993)

HABITAT
Adults: Shallow coastal waters from 3-38 m (Heemstra and Heemstra 2004), preferring rocky reefs (van der Elst 1993). Recently (22 July 2009) recorded down to 60m off Durban (http://www.spearfishing.co.za/news/60m-dive.html)
Juveniles: Small juveniles often shelter under floating objects (van der Elst 1993, Smith 2003)
Eggs and larvae: Pelagic eggs recorded by Connell (2012) in 20-30m off Park Rynie on the KZN south coast

FEEDING
Adults: Diurnal, feeding on small, benthic invertebrates, but also squid and small fish (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown, but presumably small juveniles feed on zooplankton

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Little known, eggs most common during winter (Connell 2012)
Breeding/spawning locality: Eggs have been collected along the 20-30m depth contour off Park Rynie on the KZN south coast each year between 1987-2011 (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 10.2kg, SA spearfishing record (van der Elst 1993)
Maximum recorded length: 75cm TL (van der Elst 1993)
Length-length relationship: SL(cm) = 0.794TL(cm); TL(cm) = 1.119FL(cm); equations derived from measurement of photographs (Froese and Pauly 2012)
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Taken mainly by spearfishers (van der Elst 1993), but still only accounted for 3-5% of the catch composition recorded in KZN by Mann et al. (1997a). Lloyd et al. (2012) reported a much greater contribution to catch composition, based on the records of a single skilled spearfisher diving in KZN waters

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

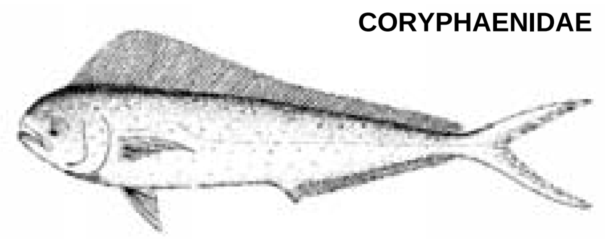
STOCK STATUS
Status: Not assessed
Trend in CPUE: Lloyd et al. (2012) reported a decrease in average CPUE between 1989-97 and 2002-07 from the records of a single skilled spearfisher diving in KZN waters
Trend in catch composition: Contribution reported to be relatively stable between 1984-95 (BQ Mann, ORI, unpubl. data). Lloyd et al. (2012) reported a decrease in contribution to overall catch between 1989-97 and 2002-07 from the records of a single skilled spearfisher diving in KZN waters
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2010 (Collen et al. 2010)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None, previously a minimum weight limit of 2kg for shore spearfishers in KZN (prior to 1998)
Closed Season: None
Other regulations: None
MPA effectiveness: Likely to receive protection in the Hluleka MPA and no-take zones of the St Lucia, Maputaland, Aliwal Shoal and Pondoland MPAs

MANAGEMENT CONSIDERATIONS
Although little is known about the biology and stock status of this species, it is advised that a bag limit of 5pppd and a minimum size limit of 40cm TL be introduced across all sectors as a precautionary measure

RESEARCH REQUIREMENTS
Age and growth, morphometrics, reproductive biology, stock assessment, movement, early life history
Research priority: Low



SCIENTIFIC NAME: *Coryphaena hippurus* (Smith No. 211.2)
COMMON NAMES: Dorado, Dolphinfish, Mahimahi
COMPILER: SD Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Worldwide in tropical and temperate waters (Collette et al. 2011). Occurs in the Atlantic, Indian and Pacific Oceans and in the Mediterranean, most common in water temperatures between 21–30°C (Collette et al. 2011) and generally between 30° N and S latitudes (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Distributed throughout SA waters to 35° south with occasional large adults being caught off the Cape south coast (Smith and Heemstra 1991, van der Elst 1993). Not in the Benguela system off the west coast and NAM but are found in warmer oceanic waters further offshore

MOVEMENT: Nomadic
Largely nomadic although some pre-spawning migration has been proposed in the western and tropical areas of the Atlantic Ocean (Oxenford and Hunte 1986a, b, Massuti and Morales-Nin 1995, Collette et al. 2011)

HABITAT
Adults: Epipelagic, wide-ranging in oceanic and shelf waters, sometimes aggregate under floating objects, often seen in pairs. May form small aggregations (Oxenford and Hunte 1987, van der Elst 1993, Massuti and Morales-Nin 1995, 1997, Collette et al. 2011). Normally close to the surface but can be found to depths of 85m (Collette et al. 2011)
Juveniles: Pelagic, often associated with flotsam, can sometimes drift into large embayments where their cryptic colouring provides good camouflage (Smith and Heemstra 1991, van der Elst 1993, Ditty et al. 1994)
Eggs and larvae: Although egg and larval development and distribution are poorly understood, larvae are widely distributed in neritic and oceanic waters primarily near the surface (Collette et al. 2011). Larvae are usually found at temperatures greater than 24°C and offshore beyond the 50m depth isobath (Shcherbachev 1973, Rose and Hassler 1974, Ditty et al. 1994. Collette et al. 2011). Off the KZN south coast eggs and larvae were collected only during the summer months and mainly in offshore samples (Connell 2012)

FEEDING
Adults: Small fish, especially pelagic drifters such as juvenile trigger fish, crustaceans, nautilus, squid and a wide variety of planktonic organisms (Bannister 1976, van der Elst 1993, Oxenford and Hunte 1999, Tripp-Valdez et al. 2010, Collette et al. 2011). Also known to feed on flying fish, mackerel and small carangids (Heemstra and Heemstra 2004)
Juveniles: Planktonic organisms such as fish and crustacean larvae (van der Elst 1993)

REPRODUCTION
Reproductive style: Gonochoristic, multiple spawners, show sexual dimorphism with males growing larger and having a steeper forehead (Oxenford and Hunte 1986a)
Breeding/spawning season: Mainly during summer, although spawning has been recorded throughout the year (Shcherbachev 1973, Oxenford and Hunte 1986a, b, van der Elst 1993, Ditty et al. 1994, Massuti and Morales-Nin 1997, Benjamin and Kurup 2012, McBride et al. 2012)
Breeding/spawning locality: Tropical oceanic waters, often closer to shore (Shcherbachev 1973, Ditty et al. 1994, Massuti and Morales-Nin 1995, 1997, Benjamin and Kurup 2012, McBride et al. 2012)
Age at 50% maturity: Combined sexes: 3-5 months; off Florida and Barbados but varies considerably according to region (Oxenford and Hunte 1986a, Collette et al. 2011, McBride et al. 2012)
Length at 50% maturity: Size at maturity varies considerably between individual fish and regions but is normally around 65-70cm FL for females and 75-80cm FL for males (Oxenford and Hunte 1986a, b, Massuti and Morales-Nin 1997, Heemstra and Heemstra 2004, McBride et al. 2012)

BIOMETRICS
Maximum recorded age: Longevity can reach over 4 years but is usually less than 2 years (Collette et al. 2011; IGFA 2011)
Maximum recorded weight: 39.46kg; Papagallo Gulf, Costa Rica; 1976 (Collette et al. 2011, IGFA 2011). Note that Heemstra and Heemstra (2004) report a maximum weight of 46kg
Maximum recorded length: 200cm FL; Papagallo Gulf, Costa Rica; 1976; but more commonly found to 100cm FL (Collette et al. 2011, IGFA 2011)
Length-length relationship: Males: FL(cm) = 0.823TL(cm); Females: FL(cm) = 0.839TL(cm); Columbia and Panama (Lasso and Zapata 1999)
Length-weight relationship: Combined sexes: $Wt(kg) = 0.0000447 \times FL(cm)^{2.602}$; KZN (van der Elst and Adkin

1991). Males: Wt(kg) = 0.0000000124 x $SL(cm)^{2.94}$; Females: Wt(kg) = 0.0000000222 x $SL(cm)^{2.84}$; Central Atlantic (Oxenford and Hunte 1986a, b)
Growth parameters: L_∞ = 169.6cm SL; K = 0.72; t_0 = 0.068; Hawaii - captive fish (Benetti et al. 1995)
Combined sexes: L_∞ = 194.25cm TL; K = 0.4; SW India (Benjamin and Kurup 2012)

FISHERY
Highly prized commercial and recreational species throughout its circumglobal range (Collette et al. 2011). Seldom specifically targeted by commercial skiboat fishers in SA comprising only 0.84% of the catch by weight in KZN (Dunlop and Mann 2013). But forms a major component of the recreational skiboat sector in KZN, both by number (2.6%) and weight (9.8%) (Dunlop and Mann 2013). Also comprises 1.02% of the catch by weight in the charter boat sector in KZN (Dunlop and Mann 2013). Often targeted around natural and artificial FADs. Occasionally caught in the recreational boat sector in the EC (Brouwer and Buxton 2002). Caught as a bycatch in the pelagic longline fisheries in the SW Indian Ocean (Adrill et al. 2011). Forms a small percentage of the catch in the SA spearfishery (Mann et al. 1997b). Although there was an increasing interest shown in the aquaculture potential of this species in the 80s and 90s (Hassler and Hogarth 1977, Kraul 1989, 1991), it is not farmed in SA waters

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed in SA. Off the south-west coast of India, stock was found to be underexploited (Benjamin and Kurup 2012)
Trend in CPUE: Unknown in SA waters. Globally there is no indication that this species is undergoing significant population declines (Collette et al. 2011), partly because it is very fast-growing, early maturing and short-lived
Trend in catch composition: Little information in SA waters. In KZN catch composition by weight by recreational skiboat anglers increased from 0.9% in 1997 (Mann et al. 1997a) to 9.8% in 2009 (Dunlop and Mann 2013), however, this is likely explained by sampling biases and natural fluctuations in the population from year to year
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2011 (Collette et al. 2011)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Due to its highly nomadic behaviour, little protection is offered in MPAs

MANAGEMENT CONSIDERATIONS
Due to low fishing pressure in SA, stocks are thought to be healthy and underexploited. Bycatch of pelagic longline vessels fishing in SA waters needs to be carefully monitored

RESEARCH REQUIREMENTS
Information on seasonal movement patterns and catches by foreign fishing vessels in SA waters is needed. Clarification is required whether bullet dorado *C. equiselis* is found in SA waters (Heemstra and Heemstra 2004)
Research priority: Low

SCIENTIFIC NAME: *Dasyatis chrysonota* (Smith No. 30.3)
COMMON NAMES: Blue stingray, Blou pylstert
COMPILER: A Götz
REVIEWER: PD Cowley
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: From central Angola south-east to Cape Agulhas and north-east to St Lucia (northern KZN), and possibly occurring off MOZ and beyond (Cowley and Compagno 1993, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Single stock is assumed to occur from Angola to northern KZN (P. Cowley, SAIAB, pers. obs.)

MOVEMENT: Unknown
Found inshore in summer dispersing further offshore during cooler winter months. Offshore migration is related to reproductive seasonality (Buxton et al. 1984, Cowley 1988, 1990). Limited tagging information on long shore coastal movements because of a low recapture rate i.e. only 6 recaptures (0.24%) of the 2502 tagged (ORI Tagging Project unpubl. data)

HABITAT
Adults: In spring and summer they are found in shallow water in the vicinity of sandy beaches, estuary mouths, coastal lagoons and sand and mud flats but in winter they move offshore and are found at depths down to 110m (Cowley 1990, 1997, Cowley and Compagno 1993)
Juveniles: Females give birth to pups inshore, the juveniles then move offshore for their first one to two years (Cowley 1990)

FEEDING
Adults: Diet varies with size and habitat. Within the surf-zone main prey items include *Callianassa* spp., *Donax* spp. and polychaetes. Beyond backline the main prey are *Balanoglossus capensis* and *Callianassa* spp. (Ebert and Cowley 2003)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Viviparous, nine months gestation, 1-7 pups, average 2.8 (Cowley 1990, Ebert and Cowley 2009)
Breeding/spawning season: Pupping occurs during early summer (Oct–Nov) (Cowley 1990). GSI indicates that males are most active during spring, females during summer and autumn (Ebert and Cowley 2009)
Breeding/spawning locality: Pupping occurs in sheltered inshore marine environments such as calm bays and estuary mouths along the EC and WC coasts (Cowley 1990)
Age at 50% maturity: Males: 5 years; Females: 7 years; SE Cape (Cowley 1990)
Length at 50% maturity: Males: 395mm DW; Females: 505mm DW; SE Cape; 1990 (Ebert and Cowley 2009)

BIOMETRICS
Maximum recorded age: Males: 9 years; Females: 14 years; SE Cape; 1990 (Cowley 1997)
Maximum recorded weight: 24.5kg; SA angling record (van der Elst 1993, Heemstra and Heemstra 2004)
Maximum recorded length: 750mm DW (Compagno et al. 1989a, van der Elst 1993)
Length-length relationship: Combined sexes: TL(mm) = 1.4DW(mm); SA (van der Elst 1993)
Length-weight relationship: Males: $Wt(g) = 0.00001 \times DW(mm)^{3.186}$; SE Cape (Cowley 1990)
Females: $Wt(g) = 0.000009 \times DW(mm)^{3.2512}$; SE Cape (Cowley 1990)
Growth parameters: Females: L_∞ = 913.4mm DW; K = 0.07; t_0 = -4.48; SE Cape (Cowley 1990, 1997)
Males: L_∞ = 531.8mm DW; K = 0.17; t_0 = -3.65; SE Cape (Cowley 1990, 1997)

FISHERY
Popular target species for recreational shore anglers, especially during shore angling competitions (Cowley 1990, 1997, Pradervand and Govender 2003). Occasionally taken by both recreational and commercial skiboat fishers but are normally discarded. Juveniles are caught offshore as a bycatch by inshore trawlers in the SE and SW Cape. Adults sometimes caught as a bycatch in beach seines in False Bay (P. Cowley, SAIAB, pers. obs.) and off Durban beach (B. Mann, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown

F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

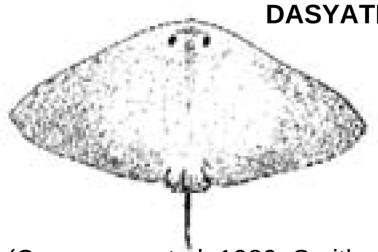
STOCK STATUS
Status: Not assessed
Trend in CPUE: *D. chrysonota* exhibited a decreasing CPUE trend from 1988-1998 both in terms of numbers and mass in shore angling competitions held in the Border area (Fish River to Kei Mouth) (Pradervand and Govender 2003)
Trend in catch composition: Declined in percentage composition in shore angling competitions by number and mass in the Border area (Fish River to Kei Mouth) between 1982-98 (Pradervand and Govender 2003)
Trend in mean size: *D. chrysonota* showed a significant increase in mean mass between 1982-98 in the competitive shore fishery in the Border area (Fish River to Kei Mouth) (Pradervand and Govender 2003)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2009 (Smale 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: Unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: This species is protected in a number of no-take MPAs along the eastern seaboard of SA

MANAGEMENT CONSIDERATIONS
The commercial value of stingrays has increased in recent years with export to the East. The current status is not known but stingrays are potentially vulnerable to post capture (and release) mortality (Cowley 1988, 1990). Discarded bycatch from inshore trawlers is unlikely to survive (Smale 2009). While this species receives some protection in several inshore bays closed to trawling and in MPAs, catches should be carefully monitored. The late age at maturity and low fecundity make them vulnerable to over-exploitation and a precautionary management strategy is advised (Ebert and Cowley 2009)

RESEARCH REQUIREMENTS
Analysis of long-term catch trends, catch composition, stock distribution, residency and migration, potential long-shore migration, stock assessment and juvenile nursery areas
Research priority: Medium



SCIENTIFIC NAME: *Gymnura natalensis* (Smith No. 30.7)
COMMON NAMES: Diamond ray, Butterfly ray, Backwater butterfly ray
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Endemic, from southern NAM to southern MOZ (Compagno et al. 1989, Smith and Heemstra 1991, van der Elst 1993, Lamberth et al. 1994). Possibly also in Kenya and Tanzania (Wintner 2006)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Found around the entire SA coast (Wallace 1967, Smith and Heemstra 1991, van der Elst 1993)

MOVEMENT: Nomadic
Only 17 recaptures from 2 799 animals tagged (0.61%) with a mean distance travelled of 244km (ORI Tagging Project, unpubl. data). This suggests they are not resident but no clear migratory patterns were evident

HABITAT
Adults: Shallow, sandy beaches, estuaries and offshore banks to a depth of 75m (Wallace 1967, Fennessy 1994)
Juveniles: Mainly found in sheltered sandy bays along the coast and in estuaries (van der Elst and Adkin 1991) but also on offshore banks (Fennessy 1994)

FEEDING
Adults: Mainly teleosts, but crustaceans (benthic copepods, crabs, shrimps, prawns), molluscs (bivalves, cephalopods, gastropods) and polychaetes supplement the diet (van der Elst 1993, Smale et al. 2001)
Juveniles: Unknown but probably similar to adults

REPRODUCTION
Reproductive style: Ovoviparous, 12 month gestation period with 2-9 pups per litter. Pups born at ~35cm DW (Wallace 1967, Compagno et al. 1989, van der Elst 1993, Wintner 2006)
Breeding/spawning season: Little known, gravid females were recorded in Durban Bay from Jan-Aug (Wallace 1967, van der Elst 1993)
Breeding/spawning locality: Unknown but probably throughout its distribution off shallow sandy beaches and bays. A large number of individuals are caught every year between Richards Bay and the Thukela River in KZN during summer following strong north-easterly winds (Pradervand et al. 2007) and it is thought that this may be a breeding aggregation
Age at 50% maturity: Males: ~2 years; Females: ~6years; based on the growth curve from van der Elst (1993) and length at maturity from Wallace (1967)
Length at 50% maturity: Males: 100cm DW; Females: 150cm DW; KZN (Wallace 1967, van der Elst 1993). Note that the smallest mature male dissected at the KZNSB was 964mm DW and the smallest female was 1 669mm DW (KZNSB unpubl. data)

BIOMETRICS
Maximum recorded age: ~24 years (van der Elst 1993)
Maximum recorded weight: 120kg (Smith and Heemstra 1991). Note that the SA angling record is 104.7kg (SASAA unpubl. data)
Maximum recorded length: 2500mm DW (Smith and Heemstra 1991). Note that the SA angling record is 2240mm DW (SASAA unpubl. data)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(kg) = 0.0000075 x DW(cm)$^{3.04}$; SA (n=338, ORI Tagging Project unpubl. data). Combined sexes: Wt(g) = 0.00768DW(cm)$^{3.02}$; SA (Torres 1991a)
Growth parameters: L_∞ = 250cm DW; K = 0.1508; t_0 = -1 (van der Elst and Adkin 1991)

FISHERY
Commonly caught as a bycatch by recreational shore anglers (Brouwer et al. 1997) and are specifically targeted during shore angling competitions (Pradervand and Govender 2003, Pradervand 2004, Pradervand et al. 2007), but most are released. Many are also landed in estuaries (van der Elst 1993, Whitfield 2005). Comprises a large percentage (12.9%) of the bycatch taken in prawn trawls off the Thukela Banks during summer, with an associated 46.4% release mortality (Fennessy 1994). Occasionally caught by competitive light tackle boat anglers but seldom kept (S. Dunlop, ORI, pers. obs.). Often caught in the shark nets off certain KZN beaches but most released alive (12.6% of total batoid catch between 1981-2000) (Young 2001). Adults and juveniles are caught as a bycatch in the beach seine fishery off Durban (Beckley and Fennessy 1996) and in the WC (Lamberth et al. 1994, Lamberth 2006)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

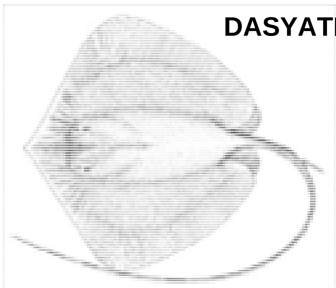
STOCK STATUS
Status: Not assessed
Trend in CPUE: *G. natalensis* showed a significant increase in CPUE by number and weight in the KZN competitive shore angling fishery between 1977-2000 probably as a result of more effective targeting (Pradervand et al. 2007). No significant trends were observed in the KZNSB net catches where mortality is minor (Wintner 2006). The SA population is likely to have benefitted from the beach vehicle ban which was implemented in 2002 as large portions of the beaches where *G. natalensis* was commonly targeted by competitive shore anglers are now relatively inaccessible (Mann et al. 2008)
Trend in catch composition: *G. natalensis* showed a significant increase in catch composition in the KZN competitive shore fishery between 1977-2000 probably as a result of increased targeting (Pradervand et al. 2007)
Trend in mean size: *G. natalensis* showed a slight but significant increase in mean weight in the KZN competitive shore fishery between 1977-2000 (Pradervand et al. 2007)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2006 (Wintner 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Since it has a broad distribution, protection of this species is probably offered in many MPAs along the eastern seaboard of SA with suitable habitat. However, there is little evidence of this in the literature

MANAGEMENT CONSIDERATIONS
Generally these rays are released alive when taken by anglers and when caught in the KZNSB nets, a practise which should continue to be encouraged. However, release mortality is not known and could be substantial due to angling practices such as gaffing and poor handling. Although fishing effort has decreased in the Thukela Bank prawn trawl fishery and a closed season has been implemented, careful monitoring of this important breeding/nursery area is needed and consideration should be given to the establishment of a MPA in this unique ecosystem

RESEARCH REQUIREMENTS
More information is needed on the reproductive biology, age and growth, catch composition, stock distribution, movement patterns, early life history and juvenile nursery areas of this species. The possible occurrence of this species off Kenya and Tanzania requires further investigation
Research priority: Low



SCIENTIFIC NAME: *Himantura gerrardi* (Smith No. 30.9)
COMMON NAMES: Sharpnose stingray, Brown stringray, Skerpneus-pylstert, Whitespotted whipray
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Widespread in Indo-West Pacific, but overall distribution is poorly defined (Manjaji et al. 2009)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common off northern and central KZN during summer (Wallace 1967, van der Elst 1993, Pradervand et al. 2007). Some individuals recorded in the former Transkei (Pradervand 2004) and as far south as East London (Smith and Heemstra 1991)

MOVEMENT: Unknown
Only 3 recaptures from 1 395 animals tagged (0.21% recaptured). Of the 3 returns, 2 were recaptured at the same locality. The one recapture that did move away from original tag locality was recaught 24km away (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Sandy surf-zone, muddy estuaries and offshore banks to depths of 40m (Wallace 1967, van der Elst 1993, Fennessy 1994)
Juveniles: Similar to adults to depths of 33m (van der Elst and Adkin 1991, Fennessy 1994)

FEEDING
Adults: Primarily benthic crustaceans (Compagno et al. 1989)
Juveniles: Unknown, probably similar to adults

REPRODUCTION
Reproductive style: Viviparous with histotrophy, produces 1-4 pups after approximately one-year gestation, size at birth is 18-21cm DW (Manjaji 2004)
Breeding/spawning season: Summer (Compagno et al. 1989, van der Elst 1993)
Breeding/spawning locality: Thought to pup in shallow waters off sandy beaches and bays in KZN and MOZ (van der Elst 1993) and on the Thukela Banks (Fennessy 1994)
Age at 50% maturity: Little known, according to van der Elst (1993), sexual maturity is attained at approximately 5-7 years old but ageing needs to be verified
Length at 50% maturity: Little known, according to van der Elst (1993), sexual maturity is attained at 60-70cm DW (combined sexes). In Indonesia males were recorded reaching maturity at 48cm DW, while females matured at 54 cm DW (Manjaji 2004, White and Dharmadi 2007)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 34kg; KZN; SA angling record (van der Elst 1993)
Maximum recorded length: 123cm DW; SA angling record (SASAA 2012)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(kg) = 0.0000898 x $DW(cm)^{2.751}$; KZN (n=232) (ORI Tagging Project unpubl. data)
Growth parameters: Unknown

FISHERY
Caught as a bycatch by recreational shore anglers (Mann et al. 1997, Dunlop 2011), targeted for weight during shore angling competitions (Pradervand 2004, Pradervand et al. 2007), but most are released. Also landed by shore anglers fishing in estuaries (Mann et al. 2002, Pradervand et al. 2003, Beckley et al. 2008). Comprises a small percentage (8.2%) of the bycatch taken by prawn trawls on the Thukela Banks during summer (Fennessy 1994). Occasionally caught as a bycatch by inshore and estuarine recreational boat anglers (James et al. 2001, Mann et al. 2002, Pradervand et al. 2003, Everett and Fennessy 2007); often targeted by competitive light tackle boat anglers but seldom kept (S. Dunlop, ORI, pers. obs.). Sometimes caught in shark nets off certain KZN beaches (Dudley and Cliff 1993). Adults and juveniles are caught as a bycatch in beach seine-net fishery off Durban (Beckley and Fennessy 1996)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

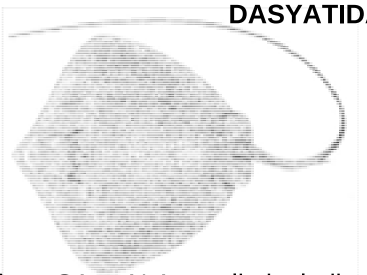
STOCK STATUS
Status: Not assessed
Trend in CPUE: *H. gerrardi* showed a significant increase in CPUE by number and weight in the KZN competitive shore-based fishery from 1977-2000 (Pradervand et al. 2007). Whether this was related to an increase in species abundance or a change in targeting is unclear. This species has probably benefitted from the beach vehicle ban which was implemented in 2002 as large portions of the beaches where *H. gerrardi* was commonly targeted by competitive shore anglers are now relatively inaccessible (Mann et al. 2008). Furthermore, due to the implementation of an extended closed trawl season between August and February each year and reduced inshore prawn catches (Olbers and Fennessy 2007), the impact of the prawn trawl fishery on *H. gerrardi* has probably decreased
Trend in catch composition: From 1977-2000 *H. gerrardi* comprised 2% of the catch by number and 4.2% of the catch by weight in the KZN competitive shore fishery (Pradervand et al. 2007). Catch composition showed a slight increase over this period but this was not significant (Pradervand et al. 2007)
Trend in mean size: *H. gerrardi* showed a slight but significant increase in mean annual weight from 1977-2000 in the KZN competitive shore fishery (Pradervand et al. 2007). Between 2000-2011 no increase in the mean size of fish tagged per year was recorded in the ORI Tagging Project (S. Dunlop, ORI, unpubl. data)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2009 (Manjaji et al. 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: May receive some protection in no-take areas within the St Lucia and Maputaland MPAs and the adjacent Ponto do Ouro Partial Marine Reserve (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Although the population of this species appears to be stable in SA waters, globally it is targeted or caught as a bycatch in many fisheries and has been overexploited in some heavily fished areas (Manjaji et al. 2009). The species has a number of vulnerable life history characteristics (e.g. low fecundity, late maturity, inshore distribution, etc.) and careful consideration should be given to the management of this species, including possible decommercialization

RESEARCH REQUIREMENTS
Little research has been conducted on this species in SA waters and more information is required on its reproductive biology, age and growth, catch trends, taxonomy and stock distribution, movement patterns, early life history and juvenile nursery areas
Research priority: Medium



SCIENTIFIC NAME: *Himantura uarnak* (Smith No. 30.10)
COMMON NAMES: Honeycomb stingray, Marbled stingray, Leopard stingray, Reticulate whipray, Heuningkoek pylstert
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Wide-spread distribution in the Indo-West Pacific, from SA to N Australia including the Red Sea and Persian Gulf (Wallace 1967, Compagno et al. 1989), recently found in the Mediterranean (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Locally abundant off northern and central KZN during summer (Wallace 1967, van der Elst 1993, Pradervand et al. 2007). Some individuals recorded in the former Transkei (Pradervand 2004) and occasionally as far south as East London (Smith and Heemstra 1991)

MOVEMENT: Resident
Only 8 recaptures from 579 animals tagged (1.4%). Of the 8 returns all but two were recaptured at the same locality. The two recaptures that did move away from original tag locality were recaught within 10 km (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Benthic on inshore and offshore sandy bottoms to depths of 40-50m, also frequently enter estuaries (Wallace 1967, Compagno et al. 1989, Fennessy 1994, Heemstra and Heemstra 2004)
Juveniles: Mainly found in estuaries and sheltered sandy bays along the coast (Mann et al. 2002, Beckley and Fennessy 1996) but juveniles also found on offshore banks to depths of 33m (Fennessy 1994)

FEEDING
Adults: Bivalves, cephalopods, crustaceans, polychaetes and small fish (Compagno et al. 1989, van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown, probably similar to adults

REPRODUCTION
Reproductive style: Ovoviviparous, 12 month gestation with 3-5 pups per litter. Pups born at 28-30cm DW (Compagno et al. 1989, Heemstra and Heemstra 2004)
Breeding/spawning season: Summer (Compagno et al. 1989, van der Elst 1993)
Breeding/spawning locality: Little known, thought to breed in shallow waters off sandy beaches in northern KZN and MOZ. New born pups sometimes caught in estuaries and sheltered sandy bays along the KZN north coast (S. Chater, uShaka Sea World, pers. com.)
Age at 50% maturity: Little known, van der Elst (1993) and Heemstra and Heemstra (2004) report that maturity is attained at 4-5 years but ageing needs to be verified
Length at 50% maturity: Little known, van der Elst (1993) reported that sexual maturity is attained at approximately 100cm DW. In contrast, mature males were recorded from 85cm DW off Mumbai, India (Raja and Zacharia 2009) and Froese and Pauly (2012) report maturity at 82-84cm DW

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 117.9kg; KZN; SA angling record (van der Elst 1993)
Maximum recorded length: 200cm DW (van der Elst 1993)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: $Wt(kg) = 0.0001057 \times DW(cm)^{2.713}$; KZN (n=115) (ORI Tagging Project unpubl. data)
Growth parameters: Unknown

FISHERY
Commonly caught as a bycatch by recreational shore anglers (Mann et al. 1997, Dunlop 2011) and are often targeted during shore angling competitions (Pradervand 2004, Pradervand et al. 2007), but most are released. Many are also landed from the shore in estuaries (Mann et al. 2002, Beckley et al. 2008). Occasionally caught as a bycatch by inshore and estuarine recreational boat anglers (Mann et al. 1997, Mann et al. 2002, Everett and Fennessy 2007); often targeted by competitive light tackle boat anglers (S. Dunlop, ORI, pers. obs.) but seldom kept. Comprises a small percentage (2.2%) of the bycatch taken by inshore prawn trawls on the Thukela Banks during summer (Fennessy 1994). Often caught in the bather protective gill-nets (shark nets) off certain KZN beaches (Dudley and Cliff 1993) but most released alive. Adults and juveniles are caught as a bycatch in beach seine fishery off Durban (Beckley and Fennessy 1996)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

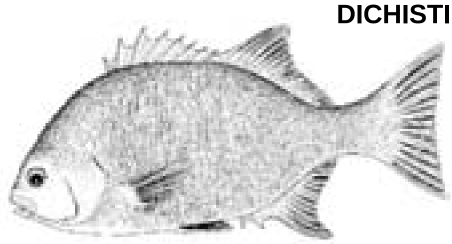
STOCK STATUS
Status: Not assessed
Trend in CPUE: Little known. SA population of *H. uarnak* is likely to have benefitted from the beach vehicle ban which was implemented in 2002 as large portions of the beaches where *H. uarnak* was commonly targeted by competitive shore anglers are now relatively inaccessible (Mann et al. 2008). Furthermore, due to an extended closed trawl season implemented between August and February each year and reduced inshore prawn catches (Olbers and Fennessy 2007), the impact of the KZN prawn trawl fishery on *H. uarnak* is likely to have decreased. However, the closing of the mouth of the St Lucia Estuary in June 2002 has probably negatively affected the population as this was an important nursery area for the species (Mann et al. 2002, Mann and Pradervand 2007)
Trend in catch composition: Little known. Between 1977-2000 *H. uarnak* comprised 0.4% of the catch by number and 2.1% of the catch by weight in the KZN competitive shore fishery (Pradervand et al. 2007)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2009 (Manjaji and White 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: May receive some protection in no-take areas within the St Lucia and Maputaland MPAs and the adjacent Ponto do Ouro Partial Marine Reserve, especially since it seems to be quite resident.

MANAGEMENT CONSIDERATIONS
Due to its vulnerable life-history characteristics (large size at maturity, large maximum size, low fecundity, preference for shallow water, dependence on estuarine nursery areas, etc.), *H. uarnak* requires careful management and consideration should be given to decommercialising this species. Furthermore, global trends indicate that stocks are declining due to over-exploitation, specifically because it is a retained bycatch in many fisheries (Manjaji and White 2009)

RESEARCH REQUIREMENTS
More information is required on *H. uarnak* to improve effective management including reproductive biology, age and growth, trends in CPUE and catch composition, stock distribution, movement patterns, early life history and juvenile nursery areas.
Research priority: Medium



SCIENTIFIC NAME: *Dichistius capensis* (Smith No. 187.01)
COMMON NAMES: Galjoen, Damba
COMPILER: CG Attwood
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2012

GLOBAL DISTRIBUTION: Endemic to southern Africa occurring from southern Angola to Durban (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
More abundant in cooler waters <21°C, rare on the KZN south coast (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Most fish are resident (90%). A small percentage are nomadic. Nomads can move throughout the range. It is uncertain whether individuals adopt one or the other pattern (i.e. residency or nomadism), or if all fish can adopt both patterns, but in unequal proportions (Attwood and Bennett 1994). The latter explanation is supported by a model (Attwood and Cowley 2005)

HABITAT
Adults: Broken surf (white water) in areas of mixed rock and sand are favoured. Also found in the surf-zone along sandy beaches and in kelp beds (Attwood and Farquhar 1999). Sometimes found on offshore pinnacles in large shoals
Juveniles: Immediate sublittoral surf-zone
Eggs and larvae: Unknown, eggs have never been located

FEEDING
Adults: Epilithic feeders. Principally molluscivores with brown mussels *Perna perna* dominating the diet (Bennett and Griffiths 1986)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic, indeterminate batch spawner (Bennett and Griffiths 1986)
Breeding/spawning season: Sep-Feb (Bennett and Griffiths 1986)
Breeding/spawning locality: Probably throughout the range. Eggs deformed below 16°C (van der Lingen 1994)
Age at 50% maturity: Males: 4.9 years; Females: 5.2 years; WC; 1985 (Bennett and Griffiths 1986)
Length at 50% maturity: Males: 31cm TL; Females: 34cm TL; WC; 1985 (Bennett and Griffiths 1986)

BIOMETRICS
Maximum recorded age: Males: 12 years; WC; 1985 (Bennett and Griffiths (1986); Females: 21 years; EC; 2008, (DAFF unpubl. data). Bennett and Griffiths (1986) aged 500 females and the oldest was 13 years. A sectioned otolith of a 65cm TL fish from PE was aged by M Kirstan (ex-DAFF) at 21 years. A tagged fish was recaptured after 14 years at De Hoop MPA. Assuming age at tagging of 4 years, it was at least 18 years of age at recapture (Attwood and Swart 2000)
Maximum recorded weight: Males: 1665g; WC; 1985 (Bennett and Griffiths 1986). Females: 6.5kg; WC; 1930 (SA angling record, taken at Hermanus, cast in SA Museum)
Maximum recorded length: Males: 47cm TL; WC; 1985 (Bennett and Griffiths 1986). Females: 74cm TL; WC; 1930 (cast in SA Museum)
Length-length relationship: Combined sexes: TL(mm) = 0.91FL(mm) + 2.71; WC (Bennett and Griffiths 1986)
Length-weight relationship: Combined sexes: Wt(g) = 0.00000903 x TL(mm)$^{3.12}$; WC (Bennett and Griffiths 1986)
Growth parameters: Males: L_∞ = 472mm TL; K = 0.252; t_0 = 0.694; WC (Bennett and Griffiths 1986)
Females: L_∞ = 677mm TL; K = 0.142; t_0 = 0.282; WC (Bennett and Griffiths 1986)

FISHERY
Among the most common targets of recreational shore anglers in the WC (Brouwer et al. 1997). Also frequently targeted by spearfishermen (Mann et al. 1997b). Taken illegally in gill-nets on the west coast (Lamberth et al. 1997)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Highly variable depending on location. Attwood (2003) predicted F values between 0.8 and 1.75yr^{-1}. Bennett (1988) estimated F at 0.53yr^{-1} for males and 1.08yr^{-1} for females in the WC
Natural mortality rate (M): 0.43yr^{-1} (Attwood 2003). Bennett (1988) estimated M at 0.38yr^{-1} for males and

$0.32y^{-1}$ for females in the WC
Total mortality rate (Z): Highly variable depending on location. Attwood (2003) estimated Z at $2.01yr^{-1}$ at an unprotected site on the Cape Peninsula
F_{MSY} yr^{-1}: 0.5 (Attwood 2003)
F_{SB40} yr^{-1}: 0.8 (males); 0.25 (females) (Bennett 1988)
F_{SB25} yr^{-1}: >1 (males); 0.4 (females) (Bennett 1988)
$F_{0.1}$ yr^{-1}: 0.31 (males); 0.54 (females) (Attwood 2003)
$SBPR_{current}$: Bennett (1988) estimated SBPR at 45% for males and 20% for females. However, work by Attwood (2003) suggests considerably higher reductions in SBPR in certain localities and it is likely that the stock is only being sustained because of unfished natural refuges and MPAs
Year completed: Various assessments conducted
Locality: WC
References & Comments: Bennett (1988), Attwood and Bennett (1990), Attwood and Bennett (1995a), Attwood (2003)

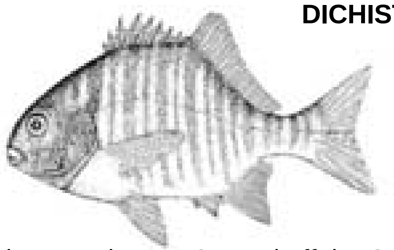
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: Various assessments conducted
Locality: WC
Status: <25% - collapsed (Bennett 1988, Attwood and Bennett 1990, Attwood and Bennett 1995a, Attwood 2003)
Trend in CPUE: Cyclical changes observed at De Hoop MPA (C. Attwood, UCT, unpubl. data), and in angling club records over a period of approximately 20 years (Bennett et al. 1994)
Trend in catch composition: No clear trends
Trend in mean size: Cyclical changes observed at De Hoop MPA (C. Attwood, UCT, unpubl. data)
Trend in sex ratio: No data

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2 pppd; Commercial: prohibited
Minimum size limit: 35cm TL
Closed Season: 15 Oct to 28(9) Feb
Other regulations: No sale
MPA effectiveness: Galjoen CPUE recovered dramatically in De Hoop MPA shortly after its closure. There is a marked difference in CPUE and size structure between exploited and unexploited areas. A small fraction of adults leave MPAs, as deduced from tagging, which suggests that MPAs sustain adjacent fisheries by way of adult spill over and perhaps also egg and larval export (Bennett and Attwood 1991, Bennett and Attwood 1993a, 1993b, Attwood and Bennett 1994, Attwood and Bennett 1995b, Attwood and Cowley 2005, Solano-Fernandez et al. 2012)

MANAGEMENT CONSIDERATIONS
CPUE needs to be monitored reliably at several focal points

RESEARCH REQUIREMENTS
Age and growth should be re-evaluated, following discovery of some very old specimens based on sectioned otoliths
Research priority: Medium



SCIENTIFIC NAME: *Dichistius multifasciatus* (Smith No. 187.2)
COMMON NAMES: Banded galjoen
COMPILER: BQ Mann
REVIEWER: SD Dunlop
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: South-east African endemic from WC through to southern MOZ and off the SE coast of Madagascar (Joubert and Hanekom 1980, Fischer and Bianchi 1984, Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Southern MOZ to Stilbaai in the WC, common along the KZN and Transkei coast (Smith and Heemstra 1991)

MOVEMENT: Resident
To date a total of 6 (2.4%) of the 246 banded galjoen tagged have been recaptured. Although these data suggest that banded galjoen may be quite nomadic with a mean distance travelled of 94km (ORI Tagging Project, unpubl. data), van der Elst (1993) regards this as a semi-resident species and it is likely that its movement behaviour is more similar to galjoen (*Dichistius capensis*) with a high percentage of resident individuals (B. Mann, ORI, pers. obs.)

HABITAT
Adults: Inshore reef fish found in the turbulent surf-zone along rocky shores (Joubert and Hanekom 1980, Joubert 1981a, van der Elst 1993)
Juveniles: Found over shallow reefs, in tidal rock pools and sub-tidal gullies (Berry et al. 1982, van der Elst 1993)
Eggs and larvae: Pelagic eggs and larvae described by Connell (2012), more commonly sampled in the inshore marine environment off the KZN coast during winter and spring

FEEDING
Adults: Benthic carnivore feeding on a variety of invertebrates including bryozoans, ascidians, polychaetes, small crustaceans and molluscs (Joubert and Hanekom 1980, van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Extended spawning season from Mar-Oct, peaking during winter and spring in KZN (Jul-Oct) (Joubert 1981a, Connell 2012)
Breeding/spawning locality: Spawning recorded off the KZN coast (Joubert 1981a, van der Elst 1993), with eggs and larvae mainly in inshore waters (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Males: 190mm FL; Females: 215mm FL; KZN; 1975-77, Note that this is the size at first maturity reported by Joubert (1981a)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 1.7kg; SA angling record (van der Elst 1993)
Maximum recorded length: 320mm FL (Smith and Heemstra 1991)
Length-length relationship: Combined sexes: FL(mm) = 0.885TL(mm) + 3.741; KZN (Joubert 1981a)
Length-weight relationship: Combined sexes: Wt(g) = 0.000012 x FL(mm)$^{3.152}$; KZN (Joubert 1981a)
Growth parameters: Unknown

FISHERY
Of moderate importance to recreational and subsistence shore fishers along the KZN and TKI coast (Joubert 1981a, Brouwer et al. 1997, Mann et al. 2003, Dunlop 2011). Larger specimens are occasionally speared (B. Mann, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown

SBPR$_{current}$: Unknown
References & Comments: Not assessed

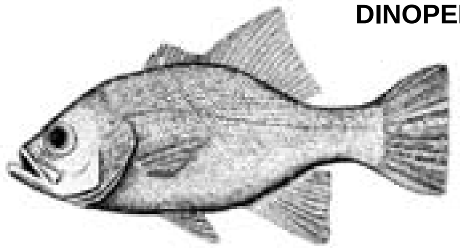
STOCK STATUS
Status: Not assessed
Trend in CPUE: CPUE declined from 0.03 fish.angler^{-1}day^{-1} between 1975-77 (Joubert 1981b) to 0.01 fish angler^{-1}day^{-1} between 1994-96 (Mann et al. 1997) and remained at 0.01 fish angler^{-1}day^{-1} between 2009-10 in KZN (Dunlop 2011). However, this may be as a result of subtle differences in survey design and amount of rocky shore habitat sampled in the above studies rather than a decrease in abundance (S. Dunlop, ORI, pers. obs.)
Trend in catch composition: Decrease in catch composition from 2.94% between 1975-77 (Joubert 1981b) to 0.95% between 1994-96 (Mann et al. 1997) and then increased to 1.15% between 2009-10 in KZN (Dunlop 2011). Subtle differences in survey design by these studies may have resulted in the observed changes in percentage composition (S. Dunlop, ORI, pers. obs.)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio was 1:1.3 in KZN from 1975-77 (Joubert 1981a), trend unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: No-take MPAs along the KZN and Transkei coasts with suitable rocky surf-zone habitat are likely to provide protection for this species

MANAGEMENT CONSIDERATIONS
Although only a moderately important shore angling species caught along the KZN and Transkei coast, banded galjoen are commonly caught by subsistence fishers. Possible declines in both CPUE and catch composition since the 1970s suggest that further investigation of the status of this species is warranted

RESEARCH REQUIREMENTS
Age and growth, stock assessment, movement patterns, stock distribution, early life history and recruitment studies
Research priority: Medium



SCIENTIFIC NAME: *Dinoperca petersi* (Smith No. 180.1)
COMMON NAMES: Cave bass, Lampfish, Lantern fish
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Western Indian Ocean including Pakistan, southern Oman, Kenya, MOZ and eastern seaboard of SA (Smith and Heemstra 1991, Randall 1995)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Extending south to Mossel Bay (Smith and Heemstra 1991, Heemstra and Heemstra 2004)

MOVEMENT: Resident
Tagging in the St Lucia and Pondoland MPAs has shown this species to be highly resident. However, a small proportion of the population (<5%) appears to be more nomadic with movements of up to 90km (Mann 2012)

HABITAT
Adults: Inhabits high profile reefs to depths of 75m (Heemstra and Heemstra 2004), found in caves and under ledges during the day, active nocturnally, often solitary (van der Elst 1988)
Juveniles: Found in intertidal rock pools and subtidal gullies (van der Elst and Adkin 1991)
Eggs and larvae: Eggs found in shelf waters 0.5 - 5km offshore (Connell 2012)

FEEDING
Adults: Crustaceans (shrimps, mantis shrimps, crabs) and small fish (van der Elst 1988, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Reportedly in winter in KZN (van der Elst 1988) although Connell (2012) reported highest frequency of eggs in southern KZN during Dec-Apr
Breeding/spawning locality: Known to spawn off KZN, suggested to be in shelf waters 20-30m depth (van der Elst 1988, Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown, estimated to be ~30cm TL (van der Elst 1988)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 5.8kg; SA spearfishing record (van der Elst 1988)
Maximum recorded length: 75cm TL (van der Elst 1988)
Length-length relationship: SL(cm) = 0.743TL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0249 x $TL(cm)^{2.96}$; KZN (Torres 1991a)
Growth parameters: Unknown

FISHERY
A minor component of catches in all fishery sectors in which it occurs, contributing between 0.07 (shore fishing) to 1.5% (recreational boat fishing) of catches by number (Mann 1997a, Dunlop 2011), except for subsistence fishing for which the contribution is not known. Frequently taken by spearfishers in KZN (Mann et al. 1997a)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

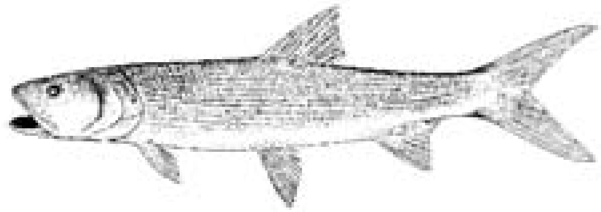
STOCK STATUS
Status: Not assessed
Trend in CPUE: KZN, boat-based, kept fish only, per boat outing; Recreational 1994-96: 0.08 by no. and 0.08 by wt, increasing to 0.14 and 0.21 in 2008-09; Commercial 1994-96: 0.86 by no. and 0.73 by wt, increasing to 1.0 and 1.72 in 2008-09 (Mann et al. 1997a, Dunlop 2011). Significant increase recorded in the previously exploited area of the St Lucia MPA between 2002-2011 (B. Mann, ORI, unpubl. data)
Trend in catch composition: KZN, boat-based, kept fish only; Recreational 1994-96: 1.2% by no. and 0.6% by wt, increasing to 1.6% and 1.4% in 2008-09; Commercial 1994-96: 0.8% by no. and 0.8% by wt, decreasing to 0.3% and 0.7% in 2008-09 (Mann et al. 1997a, Dunlop 2011)
Trend in mean size: Mean size has remained stable (~350mm FL) in the St Lucia MPA between 2002-2011 (B. Mann, ORI, unpubl. data)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Population south of KZN is unlikely to spawn and there may be a northward movement of individuals to join the reproductively active part of the population. Several MPAs in KZN and the northern parts of the EC (Chater et al. 1995, Mann et al. 2006, Mann 2012) will assist in maintaining resident populations within no-take areas (this includes the Ponta do Ouro Partial MPA in southern MOZ)

MANAGEMENT CONSIDERATIONS
This species is potentially vulnerable to overexploitation and consideration should be given to implementing a minimum size limit of 30cm TL as a precautionary measure. It is also likely that this species would benefit from an improved network of MPAs in the Natal Bioregion. Regular linefish surveys and on-going catch and effort monitoring is required to provide basic catch information

RESEARCH REQUIREMENTS
More information on life history of this species, particularly age, growth, reproductive biology and movement is required. CPUE should continue to be monitored, preferably with better spatial information on catch locality
Research priority: Medium



SCIENTIFIC NAME: *Elops machnata* (Smith No. 36.2)
COMMON NAMES: Springer, Ladyfish, Tenpounder
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Distributed in the Indo-West Pacific from the Red Sea to East Africa, SA, Seychelles, Madagascar and western Mascarenes (extinct in Réunion) east to Philippines; possibly Hawaiian Islands (Whitehead 1984, van der Elst 1993, Whitfield 1998, Smith 2003, Eschmeyer and Fong 2008)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Extends from the Breede River north-eastwards, common off EC and KZN (van der Elst 1993, Whitfield 1998, Smith 2003)

MOVEMENT: Unknown
Juveniles appear to be resident in estuaries whereas adults are probably migratory (ORI Tagging Project, unpubl. data). More abundant off the EC during spring and summer but large shoals of breeding adults found off MOZ during winter, possibly suggesting a northward spawning migration during late summer to autumn (Plumstead et al. 1989, van der Elst 1993)

HABITAT
Adults: Adults found in shallow coastal waters and commonly enter estuaries, particularly larger subtropical estuaries which are permanently open. May be found in turbid water and has a wide salinity tolerance (Wallace 1975a, Marais and Baird 1980a,b, Marais 1984, Cyrus and Blaber 1987, van der Elst 1993, Whitfield 1998)
Juveniles: Common in warm, turbid estuaries on which they are dependent as nursery areas (Wallace 1975a, Wallace and van der Elst 1975, Wallace et al. 1984, Cyrus and Blaber 1987, Paterson and Whitfield 1996)
Eggs and larvae: Spawning takes place at sea with larvae entering KZN and EC estuaries between 20-40mm SL during spring and summer; larvae resemble transparent eel leptocephali but have a forked tail (Wallace 1975b, Wallace and van der Elst 1975, Melville-Smith and Baird 1980, Beckley 1984, van der Elst 1993, Whitfield 1998, Smith 2003)

FEEDING
Adults: Feeds mainly during the early evening (van der Elst 1993) and primarily on small fish and crustaceans (Whitfield and Blaber 1978, Marais 1984, Hecht and van der Lingen 1992)
Juveniles: Juveniles larger than 28cm SL feed on small fish and crustaceans (Whitfield and Blaber 1978, Marais 1984, Hecht and van der Lingen 1992), diet of smaller juveniles unknown (Whitfield 1998)

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Large shoals of breeding adults recorded off MOZ in winter (van der Elst 1993, Smith 2003). Transparent leptocephali larvae between 20-40mm SL enter KZN and EC estuaries in spring and summer (Melville-Smith and Baird 1980, Harris and Cyrus 1995)
Breeding/spawning locality: Very few reproductively active fish found in KZN (Wallace 1975b). Large shoals of breeding adults recorded off MOZ (van der Elst 1993, Smith 2003)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 11.8kg; SA angling record (van der Elst 1993)
Maximum recorded length: 118cm FL; IGFA 2001 database (Froese and Pauly 2012)
Length-length relationship: TL(cm) = 1.13FL(cm) + 2.869; EC estuaries (Marais and Baird 1980a)
TL(cm) = 1.197SL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.00383 x $SL(cm)^{3.224}$; SA estuaries; 1993-99 (Harrison 2001)
Wt(g) = 0.0072 x $FL(cm)^{3.0527}$; EC estuaries 1993-99 (Harrison 2001)
Growth parameters: Unknown

FISHERY
Important component of estuarine sport anglers' catches in KZN and EC (Mann et al. 2002). Particularly popular with saltwater fly anglers. Also taken by shore anglers, recreational skiboat anglers and spearfishermen in small numbers. Of little commercial importance but caught by subsistence and artisanal fishers in St Lucia and Kosi Bay using fish traps and illegal gill-nets (Kyle 1986, van der Elst 1989, van der Elst 1993, Mann 1995)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Increase in research gill-net CPUE between late 1970s and 1992-93 in both the Sundays and Swartkops estuaries, EC (Marais and Baird 1980b, Marais 1981, Baird et al. 1996). Upward trend in recreational linefishing CPUE in the St Lucia lake system between 1986-1999 (Mann et al. 2002). Little subsequent analysed data available but the St Lucia population is likely to have declined due to the drought and the closed mouth (Mann and Pradervand 2007)
Trend in catch composition: Increase in percentage contribution to anglers' catches from 1.9% in 1972-78 to 2.2% in 1988-93 in Swartkops estuary EC (Marais and Baird 1980a, Baird et al. 1996). Little subsequent analysed data available
Trend in mean size: Unknown
Trend in sex ratio: Unknown

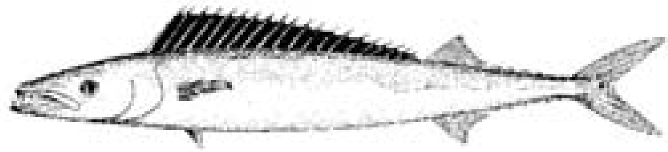
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Least Concern; 2012 (Adams et al. 2012c)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Exploitation of *E. machnata* is prohibited in the Dwesa-Cwebe and Hluleka MPAs and within the no-take zones of the Pondoland, St Lucia and Maputaland MPAs. Also receives protection in the Lake St Lucia Wilderness area

MANAGEMENT CONSIDERATIONS
E. machnata would benefit from more estuarine protected areas to reduce fishing mortality and to limit degradation of important nursery areas. Currently considered to be under moderate exploitation pressure

RESEARCH REQUIREMENTS
Age and growth, reproductive maturity, stock assessment, early life-history, movement patterns
Research priority: Low

SCIENTIFIC NAME: *Thyrsites atun* (Smith No. 247.8)
COMMON NAMES: Snoek, Cape snoek, Barracouta
COMPILER: SE Kerwath
REVIEWER: CG Wilke
DATE OF REPORT COMPLETION: June 2012



GLOBAL DISTRIBUTION: Temperate waters of the southern hemisphere (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Angola to Algoa Bay (Heemstra and Heemstra 2004)

MOVEMENT: Nomadic
Adults move offshore (between 150-450m isobaths) in winter/spring to spawn. Long shore movement is generally random (Nepgen 1979, Griffiths 2002)

HABITAT
Adults: Mesopelagic along the shelf and near islands and seamounts (Heemstra and Heemstra 2004). Found to depths of 550m (Kailola et al. 1993), near bottom during the day and often migrates to the surface at night
Juveniles: Epipelagic. Shelf waters shallower than 150m off Cape Columbine and east of Danger Point (Griffiths 2002)
Eggs and larvae: Epipelagic, high concentrations of eggs found along the shelf break (150–400m) off the western Agulhas Bank and along the west coast

FEEDING
Adults: Snoek prey on a wide variety of demersal and pelagic organisms, including teleosts, crustaceans and cephalopods. The prey composition is dependent on fish size and area (Griffiths 2002)
Juveniles: Smaller juveniles feed on fish larvae, while larger juveniles feed on teleosts such as sardines and anchovies as well as euphausids (Griffiths 2002)

REPRODUCTION
Reproductive style: Gonochorist
Breeding/spawning season: Jun-Nov (Griffiths 2002)
Breeding/spawning locality: Spawning occurs along the shelf break (150–400m) off the western Agulhas Bank and along the west coast (Griffiths 2002)
Age at 50% maturity: Combined sexes: 3 years; SA (Griffiths 2002)
Length at 50% maturity: Combined sexes: 73cm TL; SA (Griffiths 2002)

BIOMETRICS
Maximum recorded age: 10 years; SA; 2002 (M. Griffiths, DAFF, unpubl. data)
Maximum recorded weight: 9kg; SA (Nepgen 1979)
Maximum recorded length: 1250mm TL; SA; 2002 (M. Griffiths, DAFF, unpubl. data)
Length-length relationship: Combined sexes: FL(mm) = 0.8994TL(mm) + 4.05; SA (M. Griffiths, DAFF, unpubl. data)
Length-weight relationship: Wt(g) = 0.000006 x $TL(mm)^{3.07}$; SA (M. Griffiths, DAFF, unpubl. data)
Growth parameters: L_∞ = 115.3cm TL; K = 0.2943; t_0 = -1.056; NAM (Vendiktova 1988). Only published information available for the SA stock

FISHERY
Snoek is the main target of the commercial linefishery along the west coast and off the SW Cape where it comprises over 40% of the landed catch. It is also an important component of the demersal trawl bycatch and catches are comparable to those made by the lineboat fleet. The tuna pole sector retains full access to snoek on condition that tuna are unavailable. The handline hake sector also retains full access to snoek as part of their permit conditions. Snoek is also taken as an incidental bycatch in the pelagic purse-seine fishery and is targeted over weekends by recreational boat anglers (Griffiths 2002)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): $0.3yr^{-1}$
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown

$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: No per-recruit assessment has been undertaken for the SA stock but the species is reported to be optimally exploited (DAFF, unpubl. data)

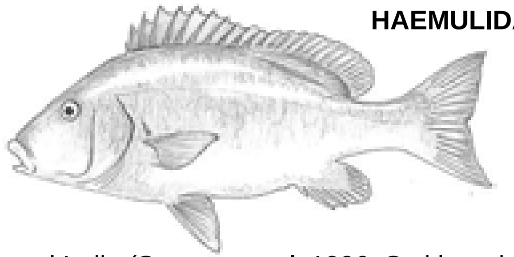
STOCK STATUS
Stock assessment method: Other
Year completed: 2012
Locality: SA
Status: 40-50% - optimally exploited (DAFF, unpubl. data)
Trend in CPUE: No discernible trend in nominal CPUE in the linefishery over the past 10 years (DAFF, unpubl. data)
Trend in catch composition: Snoek represents the bulk of the lineboat catches and is the most important target for the fleet in the WC. Reported catch since the allocation of long-term rights in 2006 has averaged around 6 000mt per annum. Although snoek availability is erratic, there is no apparent change in the contribution of snoek to the catches over the past 25 years
Trend in mean size: No apparent trend in the size frequency of commercial lineboat catches (DAFF, unpubl. data)
Trend in sex ratio: Sex ratios in catches are dependent on fishing area and reproductive season (Griffiths 2002), but there is no apparent trend that indicates a change in the sex ratio over time (DAFF, unpubl. data)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: 60 cm TL
Closed Season: None
Other regulations: The bycatch limit clause in the demersal trawl permit conditions constricts the snoek bycatch. Snoek bycatch may not exceed 20% of any landed weight and if the snoek catch exceeds 25% of the total weight within one haul, the vessel must move to a depth of at least 50m different from that fishing station
MPA effectiveness: MPAs are unlikely to be important for this nomadic species

MANAGEMENT CONSIDERATIONS
User conflict between the trawl and linefishery needs to be resolved. Large fluctuations in market price are unfavourable for the fishers. This situation is compounded by the import of snoek from elsewhere

RESEARCH REQUIREMENTS
CPUE standardisation and stock assessment. Determine growth parameters from samples that represent the entire distribution. Assess the effect of market price on fisher behaviour. Better understand environmental effects on fish distribution
Research priority: Medium



SCIENTIFIC NAME: *Plectorhinchus chubbi* (Smith No. 179.2)
COMMON NAMES: Dusky rubberlip
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: East Africa, from Somalia down to SA, and India (Sommer et al. 1996, Smith and Mackay 2003). Also reported from Indonesia and NW Australia (Gloerfelt-Tarp and Kailola 1984)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA, reported occurring as far south as Port Alfred (Froese and Pauly 2012)

MOVEMENT: Unknown
Most likely resident based on limited tag recapture data (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Rocky and coral reefs down to 80m (van der Elst 1993, Smith and Mackay 2003)
Juveniles: Intertidal weedy areas (Smith and Mackay 2003), sometimes associated with patches of drifting and decaying seaweed (van der Elst 1993)
Eggs and larvae: Pelagic eggs recorded off Park Rynie on the KZN south coast. Also recorded spawning in the main tank of the old Durban Aquarium (Connell 2012)

FEEDING
Adults: Omnivorous: small crabs, shrimps, polychaete worms and small fish (van der Elst 1993)
Juveniles: Known to feed on small shrimps (*Macropotasma* sp.) associated with rotting seaweed (van der Elst 1993)

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Summer (Connell 2012)
Breeding/spawning locality: Recorded off Park Rynie on the KZN south coast (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 9.7kg; 2001; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 75cm TL (Smith and Mackay 2003)
Length-length relationship: SL(cm) = 0.827TL(cm); derived from photographs (Froese and Pauly 2012)
Length-weight relationship: Wt(kg) = 0.00002 x FL(cm)$^{2.9478}$; SASAA length-weight table (SASAA 2012)
Growth parameters: Unknown

FISHERY
Flesh makes good eating and is therefore popular amongst anglers and spearfishers. However, it is often reluctant to take baits and is mostly taken by spearfishers (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

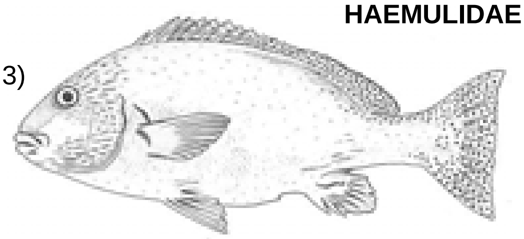
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: This species is protected within the St Lucia, Maputaland, Aliwal Shoal and Pondoland MPAs (J. Maggs, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Little known about this species but as a precautionary measure, it is advised that a minimum size limit of 40cm TL be introduced across all sectors

RESEARCH REQUIREMENTS
Age and growth, reproductive biology, movement, morphometrics, early life history
Research priority: Low



SCIENTIFIC NAME: *Plectorhinchus flavomaculatus* (Smith No. 179.3)
COMMON NAMES: Lemonfish
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Indo-West Pacific: Red Sea south to SA, east to Papua New Guinea, north to southern Japan, and south to Western Australia and New South Wales (Lieske and Myers 1994)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA, occurs as far south as Port St Johns (van der Elst 1993)

MOVEMENT: Resident
In Kenya, Kaunda-Arara et al. (2004) reported mostly resident behaviour with some incidence of longer range dispersal. In SA, limited tagging data supports the predominance of residency (ORI Tagging Project unpubl. data)

HABITAT
Adults: Coral and rocky reefs from the surf-zone down to 80m (van der Elst 1993)
Juveniles: Tidal rock pools and subtidal gullies, often in seaweed (van der Elst 1993, Smith and Mackay 2003). Juveniles known to enter tropical estuaries and harbours (Kuiter and Tonozuka 2001)
Eggs and larvae: Small juveniles (< 20mm TL) have been netted from the surface over the continental shelf off Durban indicating a pelagic egg/larval phase (S. Chater. Sea World, Durban, pers. comm.)

FEEDING
Adults: Small crabs, marine worms, shrimps and sometimes small fish (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Largely unknown, but spawning aggregations reported from Kenya (Robinson et al. 2008)
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: Little known, Lau and Li (2000) estimated first maturity at 34cm TL in the Asia-Pacific region

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 4.4kg; SA; 1960; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 60cm TL (Smith and Mackay 2003)
Length-length relationship: Unknown
Length-weight relationship: Wt(kg) = 0.00002 x $FL(cm)^{2.9515}$; SASAA length-weight table (SASAA 2012)
Growth parameters: Unknown

FISHERY
Flesh makes good eating and therefore popular amongst anglers and spearfishers. However, is often reluctant to take baits and is mostly taken by spearfishers (van der Elst 1993). Of limited commercial importance in KZN

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Voluntarily submitted competition data from the KZN recreational shore-fishery indicates an increasing trend in CPUE (NMLS unpubl. data)

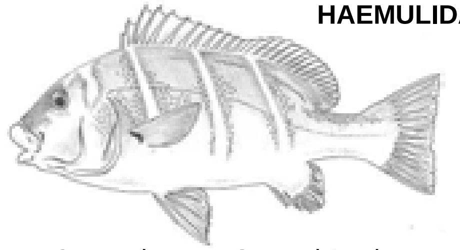
Trend in catch composition: Voluntarily submitted competition data from the KZN recreational shore-fishery indicates a slight increase in the contribution to total reported catch (NMLS unpubl. data)
Trend in mean size: Voluntarily submitted competition data from the KZN recreational shore-fishery indicates a slight increase in the annual mean weight (NMLS unpubl. data)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Resident behaviour recorded in the surf-zone within the St Lucia MPA in northern KZN (B. Mann, ORI, unpubl. data) suggests that this and other no-take MPAs in the region can provide spatial protection for this species

MANAGEMENT CONSIDERATIONS
Little known about this species but as a precautionary measure, it is advised that a minimum size limit of 40cm TL be introduced across all sectors

RESEARCH REQUIREMENTS
Age and growth, mortality rates, stock assessment, reproduction, early life history
Research priority: Low



SCIENTIFIC NAME: *Plectorhinchus playfairi* (Smith No. 179.7)
COMMON NAMES: Whitebarred rubberlip
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Western Indian Ocean: Red Sea and southern Oman down to SA and Madagascar (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA found along the KZN and EC coast as far south as Port St Johns (Smith and Mackay 2003)

MOVEMENT: Unknown
Most likely a resident species, but little tagging data to support this

HABITAT
Adults: Rocky and coral reefs from intertidal zone down to 80m (van der Elst 1993)
Juveniles: Shallow (< 20m) coral and rocky reefs (B. Mann, ORI, pers. obs.)
Eggs and larvae: Most likely pelagic, similar to other Plectorhinchinae (Leis and Rennis 2000)

FEEDING
Adults: Small invertebrate animals such as shrimps, marine worms, small crabs and occasionally juvenile fish (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 6.8kg; 1984; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 90cm TL (Smith and Mackay 2003)
Length-length relationship: SL(cm) = 0.84TL(cm); derived from photo (Froese and Pauly 2012)
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Taken mostly along the Maputaland coast in northern KZN, but seldom takes a baited hook. In shallow water (<20m) most are too small to be of interest to spearfishers (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

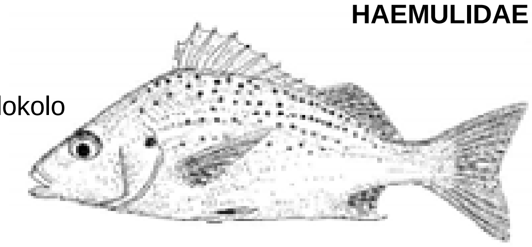
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Although nowhere abundant in SA, this species is most prevalent in northern KZN, where it occurs in the St Lucia and Maputaland MPAs. Within these two reserves, this species may not be caught from a boat but may be targeted by shore anglers in controlled zones. Likely to also occur in the Aliwal Shoal and Pondoland MPAs but, if so, probably in relatively low numbers

MANAGEMENT CONSIDERATIONS
Little known about this species but current levels of protection in MPAs appear to be adequate for the conservation of this species in SA waters

RESEARCH REQUIREMENTS
Little known about the biology and morphometrics of this species
Research priority: Low



SCIENTIFIC NAME: *Pomadasys commersonnii* (Smith No. 179.10)
COMMON NAMES: Spotted grunter, Spotty, Tiger, Knorhaan, Inkolokolo
COMPILER: PD Cowley
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: July 2012

GLOBAL DISTRIBUTION: Tropical and warm temperate western Indian Ocean from India to False Bay in WC (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Entire eastern seaboard of SA (Heemstra and Heemstra 2004). No population differentiation was observed between genetic samples from the EC to KZN, indicating that the different regions along the SA coast are highly connected (Klopper 2005)

MOVEMENT: Resident
Despite making seaward migrations to spawn, spotted grunters are largely resident to one estuary. ORI tagging data revealed that 95% of recaptures were made within 3.5km of the release site and only 2% moved more than 100km (Cowley et al. 2012). Acoustic telemetry studies have confirmed extreme residency by juveniles in both permanently open and intermittently open estuaries (Childs et al. 2008, O'Connell 2008). Extreme weather events (with sharp barometric pressure drops) can displace resident individuals from their home estuaries (Cowley et al. 2012)

HABITAT
Adults: Estuaries and coastal waters over soft sediments (Wallace 1975a, Whitfield 1998). Adults also venture into the river/estuary interface (freshwater), presumably to get rid of parasites (Childs et al. 2008)
Juveniles: Estuaries, harbours, coastal embayments and shallow coastal waters (Wallace 1975a,b, Whitfield 1998)
Eggs and larvae: Shallow coastal waters near estuary mouths and in harbours of KZN (Harris and Cyrus 1995, 1996, 1997, 1999, Connell 2012). Eggs were recorded in Lake St Lucia (during a closed state) in Aug-Sep 1994 (Connell 1996). Third most common egg recorded from Durban harbour mouth, with spawning in this region from June to January (Connell 2012)

FEEDING
Adults: Diet of estuarine fish consists of crustaceans and molluscs (e.g. sand prawn *Callianassa kraussi*, mud prawn *Upogebia* spp, pencil bait *Solen* spp) and the relative importance of the dominant prey varies between estuaries (Marais 1984, Hecht and van der Lingen 1992, Webb 2002)
Juveniles: In the Great Fish Estuary juveniles (< 300mm TL) mostly consumed the benthic amphipod *Grandidierella lignorum* (63%) but also sand prawn (31%) (Webb 2002). In Durban harbour, diet included bivalve siphon tips, benthic crustaceans and polychaetes (Graham 1994)

REPRODUCTION
Reproductive style: Gonochorist (Wallace 1975b)
Breeding/spawning season: Aug-Dec in KZN (Wallace 1975b). Spawning not recorded in EC (Webb 2002). Ripe fish recently reported from the WC during summer (SJ Lamberth & JD Filmalter pers. comm.)
Breeding/spawning locality: In KZN coastal waters adjacent to estuary mouths and in harbours (Wallace 1975b, Connell 2012). Not yet confirmed from EC and WC waters (Webb 2002). However, ripe running individuals have recently been recorded from the Breede Estuary in WC (SJ Lamberth and JD Filmalter pers. comm.)
Age at 50% maturity: Males: 2.5 years; Females: 3 years; KZN; derived from Wallace and Schleyer (1979). Webb (2002) reported males maturing at 3 years in the EC, while Fennessy (2000) calculated 3.2 years for combined sexes, converted from Lm of 34cm TL (Wallace 1975b) using logistic growth of Fennessy (2000)
Length at 50% maturity: Males: 330mm TL; Females: 390mm TL; Combined sexes: 340mm TL; KZN (Wallace 1975b). Webb (2002) calculated Lm at 305mm TL for male fish in the EC

BIOMETRICS
Maximum recorded age: Various estimates ranging from 14 years in the EC (Webb 2002), 15 years in the EC (Webb 2002) and between 15-19 years in KZN (Wallace and Schleyer 1979, Webb 2002)
Maximum recorded weight: 9.5kg; Durban KZN; 1949; SA angling record (SASAA 2012)
8.6kg; Umzumbe KZN; 1997; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 910mm FL (8.5kg); St Lucia beach; 1999 (ORI unpubl. data). The largest fish recorded by Wallace and Schleyer (1979) was 867mm TL
Length-length relationship: Combined sexes: SL(mm) = 0.7803TL(mm) - 7.4938; KZN (Wallace 1975a)
Combined sexes: FL(mm) = 0.9252TL(mm) – 2.1901; KZN (Wallace 1975a)

Combined sexes: TL(mm) = 1.074FL(mm) + 2.926; EC and WC; n=593 (Webb 2002)
Length-weight relationship: Combined sexes: Wt(g) = 0.00003 x $FL(mm)^{2.885}$; WC and EC; n=522, no significant difference between males and females (Webb 2002)
Combined sexes: Wt(g) = 0.00002 x $TL(mm)^{2.891}$; WC and EC; n=692, no significant difference between males and females (Webb 2002)
Combined sexes: Wt(g) = 0.000014 x $TL(mm)^{2.956}$; KZN (van der Elst and Adkin 1991)
Growth parameters: Combined sexes: L_∞ = 895mm TL; K = 0.066; t_0 = 0.348; KZN (Wallace and Schleyer 1979). Combined sexes: L_∞ = 753mm TL; K = 0.154; t_0 = -1.615; WC (Webb 2002)
Combined sexes: L_∞ = 839mm TL; K = 0.17; t_0 = -0.349; KZN (Webb 2002)
Combined sexes: L_∞ = 721mm TL; K = 0.468; t_0 = 3.41; Logistic growth model; KZN (Fennessy 2000a)

FISHERY
Very important recreational angling species in estuaries throughout its distribution from the Breede Estuary to Kosi Bay (Baird et al. 1996, James et al. 2001, Mann et al. 2002, Pradervand et al. 2003, Cowley et al. 2004, King 2005, Potts et al. 2005). Also an important species in estuarine-based subsistence fisheries (Potts et al. 2005, Napier et al. 2009) and illegal gill net and trap fisheries (Kyle 1986, 1999, Mann 1995, Mwanyama et al. 1999). Less important in the coastal shore fishery (Bennett et al. 1994, Brouwer et al. 1997, Pradervand and Govender 2003, Pradervand 2004, King 2005, Pradervand et al. 2007) and skiboat fishery (Brouwer and Buxton 2002, Dunlop and Mann 2013). Occasionally taken in the recreational spearfishery (Mann et al. 1997b, Lloyd et al. 2012) and as a bycatch of inshore trawlers on the Thukela Banks (Fennessy 2000)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.28yr^{-1}$
Natural mortality rate (M): $0.28yr^{-1}$
Total mortality rate (Z): $0.56yr^{-1}$
F_{MSY} yr^{-1}: 0.42
F_{SB40} yr^{-1}: 0.22
F_{SB25} yr^{-1}: 0.43
$F_{0.1}$ yr^{-1}: 0.24
$SBPR_{current}$: 35%
Year completed: 2000
Locality: KZN
References & Comments: Calculations based on a maximum age of 16 years (Fennessy 2000a)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2000
Locality: KZN
Status: 25-40% - overexploited (Fennessy 2000a)
Trend in CPUE: No clear historical trend in angler CPUE at St Lucia between 1956-76 (van der Elst 1977) or Kosi Bay (James et al. 2001). Decline from 0.11 $fish.angler^{-1}$ to 0.01 $fish.angler^{-1}$ from 1997-2005 in shore angler's catches in the vicinity of Lake St Lucia - due to prolonged closure of the St Lucia mouth (Mann and Pradervand 2007). Gillnet catches in the Swartkops and Sundays estuaries revealed a decrease in abundance between 1980-92 (Baird et al. 1996). Interannual differences within single estuaries can be highly variable due to recruitment strength
Trend in catch composition: Percentage catch composition in estuarine linefisheries from the WC to KZN are as follows: Berg (0%), Knysna (subsistence only) (5%), Keurbooms (25%), Kromme (31%), Gamtoos (34%), Swartkops (36%), Sundays (24-43%), Bushmans (30%), Kariega (43%), Kowie (17-32%), Great Fish (54-63%), Durban harbour (15-34%), Umgeni (10%), Richards Bay harbour (19%), St Lucia (25%), Kosi Bay (54%) (Hutchings et al. 2008, Napier et al. 2009, King 2005, Pradervand and Baird 2002, Cowley et al. 2004, Cowley et al. 2009, Pradervand et al. 2003, Beckley et al. 2003, Mann et al. 2002, James et al. 2001). Interannual differences within single estuaries can be highly variable due to recruitment strength
Trend in mean size: No clear trends evident from any long-term dataset (e.g. van der Elst 1977). Evaluation of a changing trend in mean size is probably not possible for estuarine fishes due to the dominance of juveniles in these nursery habitats
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Stilbaai, Dwesa-Cwebe and Pondoland MPAs include no-take EPAs that benefit this species. The no-take wilderness areas in the Richards Bay, St Lucia and Kosi Bay estuarine systems are also likely to provide some protection for juveniles (Mann et al. 1998)

MANAGEMENT CONSIDERATIONS
Consider reducing the daily bag limit to 2pppd. Identify and proclaim suitable no-take EPAs. Restore the long-term ecological functioning of Lake St Lucia. Enforce no sale of this recreational species. Stamp out illegal gill netting in estuaries by implementing appropriate penalties

RESEARCH REQUIREMENTS
Conduct stock assessments at a regional level. Investigate reproductive biology and possibility of spawning migrations in the WC and EC
Research priority: Medium

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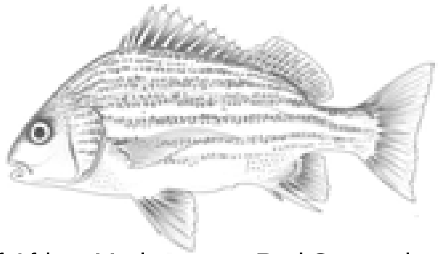

SCIENTIFIC NAME: *Pomadasys furcatus* (Smith No. 179.11)
COMMON NAMES: Grey grunter, Banded grunter
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Indo-West Pacific including east coast of Africa, Madagascar, Red Sea and Indonesia (Gloerfelt-Tarp and Kailola 1984, Smith and McKay 1991)
SOUTHERN AFRICAN DISTRIBUTION: KZN, MOZ
MOZ south to KZN, mainly along the Maputaland coast and rare south of Durban (Smith and McKay 1991, van der Elst 1993)

MOVEMENT: Resident
A tag-recapture study conducted in the St Lucia Marine Reserve has shown that this species is highly resident with a mean distance moved of only 138m from 55 recaptures (Mann 2012)

HABITAT
Adults: Inhabits shallow inshore reefs and sandy areas close to reefs, mainly in the surf zone (van der Elst 1993, B. Mann, ORI, pers. obs.)
Juveniles: Little known, similar to adults (B. Mann, ORI, pers. obs.)
Eggs and larvae: Unknown, probably pelagic

FEEDING
Adults: Small crabs, shrimps, mole crabs and polychaete worms (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown, probably gonochoristic
Breeding/spawning season: Little known, ripe fish encountered in spring in northern KZN (van der Elst 1993)
Breeding/spawning locality: Little known, probably limited to inshore waters of the Maputaland coast northwards into MOZ waters (B. Mann, ORI, pers. obs.)
Age at 50% maturity: Unknown
Length at 50% maturity: Little known, van der Elst (1993) recorded sexual maturity being attained at about 20cm TL

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 1kg; SA angling record (van der Elst 1993)
Maximum recorded length: 50cm TL; KZN (van der Elst 1993) but few exceed 40cm TL (B. Mann, ORI, pers. obs.)
Length-length relationship: SL(cm) = 0.814TL(cm); derived from photographs (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.03 x FL(cm)$^{2.84}$; KZN (Torres 1991a)
Growth parameters: Unknown

FISHERY
A small fish species commonly caught by subsistence and recreational shore fishers along the KZN north coast (van der Elst 1993, Dunlop and Mann 2012)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown in the KZN shore fishery overall. In the St Lucia Marine Reserve CPUE of shore anglers catches monitored in a research fishing project increased significantly in the previously exploited area between Cape Vidal and Leven Point since the implementation of the beach vehicle ban in Jan 2002 (Mann 2012)
Trend in catch composition: Grey grunter comprised only 0.14% of fish kept by shore anglers sampled along the KZN coast (Dunlop and Mann 2012), although this survey did not cover the Maputaland area north of Cape Vidal thoroughly. In the St Lucia Marine Reserve north of Cape Vidal grey grunter comprised 21% by number of shore anglers' catches in a research fishing project from 2001-2011. Catch composition showed a slight increase in the previously exploited area between Cape Vidal and Leven Point over this 10-year period following the implementation of the beach vehicle ban in Jan 2002 (Mann 2012)
Trend in mean size: Showed a significant increase in mean size (250 to 270mm FL) in the previously exploited area between Cape Vidal and Leven Point from 2002-04 (after which it stabilized at ~270mm FL) as a result of the implementation of the beach vehicle ban in Jan 2002 (Mann 2012)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: This resident species is abundant in the St Lucia and Maputaland MPAs and receives protection within the no-take sanctuary areas within these reserves (Mann 2012). Likely to also receive some protection within no-take areas of the Ponto do Ouro Partial Marine Reserve in southern MOZ (M. Goncalves, PPF, pers. comm.)

MANAGEMENT CONSIDERATIONS
Grey grunter is important to subsistence shore fishers in northern KZN and southern MOZ. Although seemingly still abundant, more information is needed on its biology and stock status to ensure its sustainable utilization in the future

RESEARCH REQUIREMENTS
Distribution and abundance, reproductive biology, age and growth, stock assessment, catch and effort data
Research priority: Low

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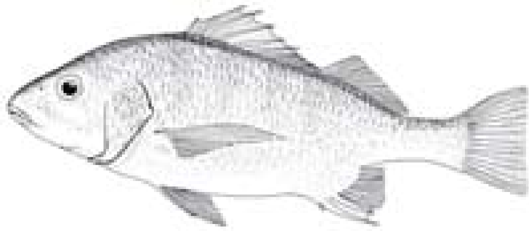

SCIENTIFIC NAME: *Pomadasys kaakan* (Smith No. 179.13)
COMMON NAMES: Javelin grunter, Mof grunter, Spies knorder
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Tropical and subtropical Indo-West Pacific, from Red Sea south to the EC (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
South to at least the Mbashe Estuary in the former Transkei (Whitfield 1998)

MOVEMENT: Unknown
Juveniles occur in estuaries and move into the marine environment to spawn on maturing

HABITAT
Adults: Soft substrata in estuaries and shallow coastal waters to 75m depth (van der Elst 1988); often associated with wrecks (van der Elst and Adkin 1991)
Juveniles: Utilise estuaries as nursery areas (Whitfield 1998)
Eggs and larvae: In shelf waters - no haemulid larvae seen in off shelf samples (Beckley 1993)

FEEDING
Adults: Crabs and polychaetes (van der Elst 1988)
Juveniles: Copepods (van der Elst 1988)

REPRODUCTION
Reproductive style: Unknown; likely gonochorist
Breeding/spawning season: During winter in KZN (van der Elst 1988)
Breeding/spawning locality: Reportedly near river mouths (van der Elst 1988); Wallace (1975b) reported ripe and spent fish from the Thukela Banks
Age at 50% maturity: Unknown
Length at 50% maturity: 35cm TL; Asia-Pacific region (Froese and Pauly 2012)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 5.7kg; SA angling record (van der Elst 1988)
Maximum recorded length: 80cm TL (Fischer et al. 1990)
Length-length relationship: SL(cm) = 0.841TL(cm) - 0.274 (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0000657 x $TL(mm)^{2.713}$; KZN (van der Elst and Adkin 1991)
Growth parameters: L_∞ = 62.5cm; K = 0.25; Pakistan, Iqbal (1988) cited in Froese and Pauly (2012)

FISHERY
Seldom seen in KZN (Mann et al. 1997a, Dunlop and Mann 2012) and Transkei (Pradervand 2004) shore angling catches. Also not very common in KZN estuarine angling catches (Mann et al. 2002, James et al. 2001, Beckley et al. 2008), except quite commonly caught by boat anglers in Richards Bay harbour (Everett and Fennessy 2007). Quite common in historical and more recent (illegal) gill net catches from Mhlatuze Estuary (ORI, unpubl. data) but rare in St Lucia (Mwanyama et al. 1999). Not commonly caught from KZN offshore skiboats (Mann et al. 1997a, Dunlop and Mann 2013) and not reported in spearfishing catches (Mann et al. 1997b). Large fish fairly commonly caught and retained by shallow water prawn trawlers on the Thukela Bank (Fennessy and Groeneveld 1997) although effort in this fishery is currently extremely low

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: KZN commercial skiboats: 1994-96; 0.1% by no. and 0.1% by weight (Mann et al. 1997a); 2008-09; not recorded (Dunlop 2011). KZN recreational skiboats: 1994-96; 0.6% by no. and 0.5% by weight (Mann et al. 1997a); 2008-09; 0.25% by no. and 0.3% by weight (Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: As adults of this species are primarily found on muddy substrata, it is likely that only the Pondoland and the Dwesa-Cwebe MPAs provide the correct habitat type. However, available records suggest that they are not abundant in these areas (Mann et al. 2006). EPAs such as the Mhlatuze Estuary and Lake St Lucia wilderness area will provide some protection for juveniles

MANAGEMENT CONSIDERATIONS
The status of this species in not known and would be difficult to assess using standard methods as it is not readily targeted. It could well be considerably compromised given the degraded and pressured state of many of the main estuaries it utilizes. There is very limited estuarine protection for this species; the Mhlatuze Estuary appears to have been historically important for juveniles and requires better management, particularly compliance (illegal netting in Mhlatuze Estuary is frequent). Ecological functioning of the St Lucia system needs to be restored as this is also an important habitat for juveniles. Additional offshore MPA protection is also required - the northern part of the KZN Bight, including the Thukela Bank, is suitable habitat and appears to be a site for spawning aggregations - part of this area should be protected within an MPA. The St Lucia trawling grounds (off St Lucia mouth) should be closed to trawling as this is probably also an important offshore habitat

RESEARCH REQUIREMENTS
Monitoring of the St Lucia system using seines and gill-nets for recruitment of this species; monitoring of recreational estuarine boat catches in Richards Bay harbour; research to support the identification and declaration of an offshore MPA in the northern part of the KZN Bight
Research priority: Medium

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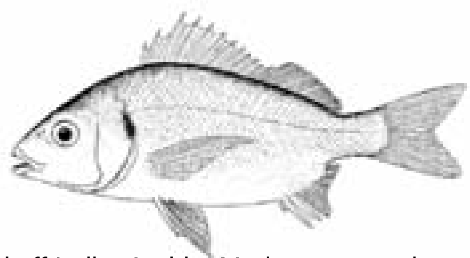


SCIENTIFIC NAME: *Pomadasys olivaceus* (Smith No. 179.17)
COMMON NAMES: Piggy, Pinky, Varkie, Olive grunter
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Widespread in the Indian Ocean; found off India, Arabia, Madagascar and extending along the entire east African coast to False Bay (Fischer and Bianchi 1984, Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Entire eastern seaboard of SA reaching False Bay in the WC (Joubert and Hanekom 1980, Buxton et al. 1984)

MOVEMENT: Resident
No long shore migration known, there is a trend in size with depth with adult fish found in deeper water in the EC (Buxton et al. 1984). Similarly in KZN adult fish migrate offshore into slightly deeper water to spawn (Joubert 1981a)

HABITAT
Adults: Offshore reefs or soft substrate banks from 10-90m, often aggregating around pinnacles and shipwrecks (Joubert and Hanekom 1980, Joubert 1981a, Buxton et al. 1984, van der Elst 1993, Fennessy et al. 1994, Heemstra and Heemstra 2004)
Juveniles: Inshore surf-zone reefs down to 10m, sandy beach surf zone and the lower reaches of estuaries (Joubert and Hanekom 1980, Joubert 1981a, Berry et al. 1982, Beckley 1983, 1984a,b, Lasiak 1986, Whitfield and Kok 1992)
Eggs and larvae: Eggs common in inshore samples off the KZN south coast (Connell 2012). Larvae are shelf-associated between Thukela and Algoa Bay (Beckley 1993). Also recorded off Tsitsikamma (Tilney and Buxton 1994, Wood 1999). Larvae probably develop offshore and only migrate to inshore nursery areas as post-larvae once they are capable of swimming (Beckley 1986)

FEEDING
Adults: Primarily crustaceans (including stomatopods, mysids and amphipods) and polychaete worms (Joubert and Hankom 1980, Buxton et al. 1984)
Juveniles: Small crustaceans and polychaetes (Joubert and Hanekom 1980, Lasiak 1986)

REPRODUCTION
Reproductive style: Unknown, probably gonochoristic
Breeding/spawning season: Prolonged spawning period, occurring throughout the year in KZN and EC (Joubert 1981a, Buxton et al. 1984) with a slight peak in winter (Connell 2012)
Breeding/spawning locality: In water 10-30m depth probably along most of the east coast of SA (van der Elst 1993, Connell 2012), although not common north of Cape Vidal (B. Mann, ORI, pers. obs.)
Age at 50% maturity: Combined sexes: 3 years; KZN (Wellington 2002) (estimated from the growth curve based on Lm of 130mm FL)
Length at 50% maturity: Combined sexes: 130mm FL; KZN; 1977-79 (Joubert 1981a)

BIOMETRICS
Maximum recorded age: 10 years; KZN (Wellington 2002)
Maximum recorded weight: 0.4kg (Heemstra and Heemstra 2004)
Maximum recorded length: 31cm TL (Heemstra and Heemstra 2004); max length recorded by Joubert (1981a) in KZN was 230mm TL
Length-length relationship: Combined sexes: FL(mm) = 0.902TL(mm) + 1.584; KZN; Juveniles (Joubert 1981a). Combined sexes: FL(mm) = 0.927TL(mm) – 2.726; KZN; Adults (Joubert 1981a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.000014 \times FL(mm)^{3.07}$; KZN; Juveniles (Joubert 1981a). Combined sexes: $Wt(g) = 0.000088 \times FL(mm)^{2.726}$; KZN; Adults (Joubert 1981a)
Growth parameters: Combined sexes: L_∞ = 210mm FL; K = 0.226; t_0 = -1.478; KZN (Wellington 2002)

FISHERY
Important shore angling species in KZN and the EC, often caught by subsistence fishers or used as bait by recreational anglers (Joubert 1981b, Brouwer et al. 1997, Brouwer and Buxton 2002, Mann et al. 2003, Dunlop and Mann 2012). Caught as a bycatch in the prawn trawl fishery on the shallow Thukela Banks (Fennessy et al. 1994), inshore trawls in the southern Cape (Buxton et al. 1984) and in the beach seine net fishery in Durban Bay (Beckley and Fennessy 1996). Occasionally caught for bait by recreational ski-boat anglers

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.15yr^{-1}$
Natural mortality rate (M): $0.29yr^{-1}$
Total mortality rate (Z): $0.44yr^{-1}$
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.175
F_{SB25} yr^{-1}: 0.25
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 44%
Year completed: 2002
Locality: KZN
References & Comments: Wellington (2002), (used a conservative estimate of M)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2002
Locality: KZN
Status: 40-50% - optimally exploited (Wellington 2002)
Trend in CPUE: Decrease between 1975-77 (0.21 $fish.angler^{-1}.day^{-1}$) and 1994-96 (0.035 $fish.angler^{-1}.day^{-1}$) by number in KZN (Joubert 1981b, Mann et al. 1997a) but then increased slightly between 2009-10 to 0.06 $fish.angler^{-1}.day^{-1}$ (Dunlop and Mann 2012). While the above studies may have been affected by sampling biases, a similar decreasing trend was observed in NMLS shore patrol data from the KZN coast between 1985-2006 (Pradervand 2007). Connell (2012) also noted a decline in the number of eggs collected along the KZN south coast after 2000 but ascribed this to lower than average rainfall
Trend in catch composition: Decrease between 1975-77 (19.65%) and 1994-96 (2.98%) in KZN (Joubert 1981b, Mann et al. 1997a) but then increased to 6.47% between 2009-10 (Dunlop and Mann 2012). Subtle differences in survey design by these studies may have resulted in the observed changes in percentage composition (B. Mann, ORI, pers. obs.). Percentage composition in NMLS shore patrol data from KZN between 1985-2001 was variable with no significant trends (Wellington 2002)
Trend in mean size: Modal size in the shore fishery has remained similar at around 100-125mm TL between 1975-77, 1994-96 and 2009-10 in KZN (Joubert 1981a, Mann et al. 1997a, Dunlop and Mann 2012)
Trend in sex ratio: M:F sex ratios recorded along the KZN coast by Joubert (1981a) were: Juveniles = 1:1.1; Adults = 1:2.7. No data available on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

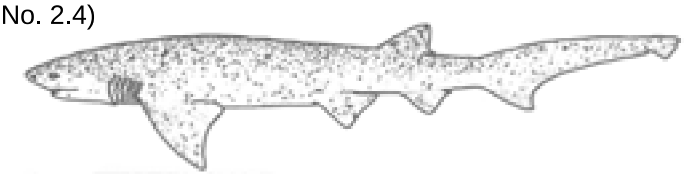
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: 7.5cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: An abundant species found in most MPAs in KZN, EC and WC. Particularly abundant in the Pondoland MPA (Mann et al. 2006) but not common in the St Lucia and Maputaland MPAs in northern KZN (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Prior to 2005 listed as a bait species with no daily bag limit, bag limit of 10pppd introduced in April 2005 as a precautionary measure. Piggys are an extremely abundant species throughout their distribution and form an important prey species for larger fish. Declining catch rates reported in KZN are likely to be associated with environmental factors such as reduced rainfall (Connell 2012). The recent increase in catch rates along the KZN coast reported by Dunlop and Mann (2012), despite the implementation of a daily bag limit, suggest an increase in population size. Reduced prawn trawling on the shallow Thukela Banks since the early 2000s is also likely to have reduced overall fishing pressure on this species in KZN (Olbers and Fennessy 2007)

RESEARCH REQUIREMENTS
On-going monitoring of catch and effort, inshore/offshore movement, early life history
Research priority: Low

HEXANCHIDAE

SCIENTIFIC NAME: *Notorynchus cepedianus* (Smith No. 2.4)
COMMON NAMES: Cowshark, Broadnosed sevengill shark, Spotted sevengill shark, Slapstert haai
COMPILER: T Zweig
REVIEWER: ME McCord
DATE OF REPORT COMPLETION: October 2012



GLOBAL DISTRIBUTION: Worldwide in cool temperate seas (Compagno et al. 1989, 2005)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
In southern African waters known from NAM to East London (Ebert 1996)

MOVEMENT: Nomadic
Based on 156 recaptures (5.5%) recorded in the ORI Tagging Project, Mann and Bullen (2009) showed that cowsharks appear to have a random movement pattern with no clear patterns. Recaptured animals on the NAM coast showed a lower mean distance travelled (24km) compared to those on the Cape west coast (50km) and those on the S Cape coast (144km). However, the relatively high percentage of cowsharks recaptured at the same locality to where they were tagged (38%) suggests that some individuals may be fairly resident or that they regularly return to the same areas. Barnett et al. (2011) has shown high levels of site fidelity

HABITAT
Adults: Continental shelf to 50m (Compagno et al. 2005), however large individuals have been found at depths of up to 570m (Ebert 2001)
Juveniles: Unknown in SA. Inshore bays are recorded as being important for juveniles in California (Ebert 1996). Anecdotal evidence from recreational shore anglers indicates that Betty's Bay in the WC may be an important aggregation site for juvenile cowsharks (M. McCord, SA Shark Conservancy, pers. obs.)

FEEDING
Adults: >180cm TL: Chondrichthyans, marine mammals, teleosts and miscellaneous (crustaceans, bivalves and algae) (Ebert 2002)
Juveniles: <120cm TL: Teleosts, chondrichthyans and miscellaneous (crustaceans, bivalves and algae) (Ebert 2002)

REPRODUCTION
Reproductive style: Ovoviviparous/aplacental viviparous. Up to 82 pups (40-42cm) observed in single female (Ebert 1989), reproductive cycle 24 months (Ebert 1986)
Breeding/spawning season: Unknown in SA. Gonad characteristics, egg size, embryo development and scarring in adults suggest spring/summer breeding season in California (Ebert 1986)
Breeding/spawning locality: Unknown in SA although coastal bays are known to be important pupping areas elsewhere (Ebert 2001)
Age at 50% maturity: Males: 4-5 years; Females: 11 years (Heemstra and Heemstra 2004). Ebert (1996) noted that it is difficult to ascertain age due to lack of calcification of vertebrae
Length at 50% maturity: Males: 150-180cm TL (Heemstra and Heemstra 2004). Ebert (1996) noted that viable sperm is found at 150cm although true calcification of claspers only occurs at 165cm. Females: ~200cm TL (Heemstra and Heemstra 2004)

BIOMETRICS
Maximum recorded age: 49 years (Camhi et al. 1998). Compagno (2005) reported an estimated maximum age of 30 years
Maximum recorded weight: >182kg; Female; California (Ebert 1989). SA angling record is 108.9kg (SASAA 2012)
Maximum recorded length: 300cm TL (Compagno et al. 1989, Heemstra and Heemstra 2004)
Length-length relationship: Unknown
Length-weight relationship: Wt(kg) = 0.0000033 x PCL(cm)$^{3.28}$; SA; n=177 (ORI Tagging Project, unpubl. data)
Growth parameters: Unknown

FISHERY
Often caught in organised recreational shore angling catch and release competitions in the WC to accrue points for personal and club records. May be of some importance in the commercial linefishery when teleost catches are low. Although price per kg is low and the demersal shark longline industry has agreed not to retain cow sharks, catches may be retained when catches of more valuable species are low

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2005 (Compagno 2005)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch of any species by recreational anglers. Demersal shark longline is managed under a Total Allowable Effort of 6 vessels (DAFF, 2010, permit conditions)
MPA effectiveness: Research indicates high levels of site fidelity (Barnett et al. 2011). Well sited MPAs are therefore likely to be important for the conservation of this species

MANAGEMENT CONSIDERATIONS
Slow growth, late maturity and their inshore distribution render this species potentially vulnerable to overexploitation and precautionary a management approach is advised. Paucity of data relating to life-history, habitat use, site fidelity and stock status require investigation in order to apply species-specific management strategies

RESEARCH REQUIREMENTS
Stock identity, age and growth, movement and site fidelity (adults and juveniles) and analysis of available catch trends. A joint study to examine philopatry, genetic structure, broad- and fine-scale movement and quantify fisheries impacts will be undertaken beginning November 2012 (M. McCord, SA Shark Conservancy, pers. comm.)
Research priority: High

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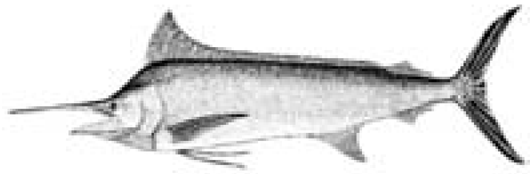

SCIENTIFIC NAME: *Istiompax indica* (Smith No. 252.2)
COMMON NAMES: Black marlin
COMPILER: RP van der Elst
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Previously this species was included in the genus *Makaira* (Collette et al. 2011b). Distributed throughout tropical and sub-tropical waters of the Indo-Pacific in temperatures ranging from 15-30°C. Rarely reported from the Atlantic. During summer reaches temperate waters. Coastal and oceanic (Nakamura 1975, 1985, Fischer and Bianchi 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004, IOTC 2011)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Thought to be one stock of black marlin found throughout the Indian Ocean which extends down the eastern seaboard of SA with occasional strays entering the Atlantic Ocean by way of the Cape (Nakamura 1985, van der Elst 1990, Smith and Heemstra 1991)

MOVEMENT: Migratory
Highly mobile species which appears to move into higher latitudes during summer and returns to warmer, tropical waters during winter but movement patterns appear not to be entirely predictable. In the tropical WIO, black marlin is more abundant during the north-east monsoon period (Merrett 1971, Nakamura 1975, Pepperell 1990, Speare 1994). Black marlin is the most common marlin species in SA waters and is most abundant off the KZN coast during the summer months and may range as far south as Cape Point (Shannon et al. 1989, van der Elst 1990)

HABITAT
Adults: Oceanic, highly migratory and epipelagic, usually above the thermocline. Often found close to land masses, islands and coral reefs at depths ranging from 0-200m (Fischer and Bianchi 1984, Nakamura 1985). Most common off KZN during summer especially around deep, submarine canyons that reach close to the shore (van der Elst 1990)
Juveniles: Widely distributed by surface currents, found predominantly in nearshore coastal waters. No juvenile black marlin have yet been positively identified in SA waters (van der Elst 1990, van der Elst 1993)
Eggs and larvae: Pelagic, found in surface waters of warm, tropical oceans (27-28^{0}C), often found closely associated with the seaward side of reef edges (Nakumara 1985, Leis et al. 1987)

FEEDING
Adults: A powerful predator of pelagic shoaling fishes, including tuna and squid. Takes food at the surface but also at depths and occasionally near reefs (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Heterosexual, females grow larger than males. Prefer temperatures 27-28°C for spawning. Highly fecund with a mature female producing in the order of 40 million eggs (Nakamura 1985)
Breeding/spawning season: Unknown from WIO. Spawning occurs from Oct-Dec in the north-western Coral Sea, May-Jun in South China Sea and from Aug-Oct around Taiwan (Nakamura 1985, Leis et al. 1987, Speare and Williams 1992)
Breeding/spawning locality: Areas identified from the north-western Coral Sea, south China Sea and around Taiwan (Nakamura 1985, Leis et al. 1987, Speare and Williams 1992). No reproductively active black marlin recorded in SA waters (van der Elst 1990) and no spawning areas as yet identified in the Indian Ocean (Cyr et al. 1990)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown, weight at maturity is >200kg in females and around 50-80 kg in males (Pepperell 1990, van der Elst 1993, Speare 1994)

BIOMETRICS
Maximum recorded age: Males: 13 years; Females: 20 years; Indian Ocean (Cyr et al. 1990)
Maximum recorded weight: 707.6kg; World angling record; Peru; 1953 (IGFA 2012). SA angling record is 354.2kg; KZN; 1987 (SADSAA 2012)
Maximum recorded length: 448cm TL; Indian Ocean (Nakamura 1985)
Length-length relationship: TL(cm) = 1.127FL(cm); based on a photograph (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.00000094 x LJFL(mm)$^{3.272}$; KZN (van der Elst and Adkin 1991)
Growth parameters: Combined sexes: L_∞ = 282cm FL (eye-fork length); K = 0.474; Pacific (Koto and Kodama 1962 as quoted by Weatherhall and Yang 1980)

FISHERY
Taken by pelagic longlines (44%) and drift gill-nets (49%) throughout the Indian Ocean region, especially by China, Taiwan, Japan, Korea, Sri-Lanka and Indonesia: total catch reached 4 569mt per annum but is much less than other billfish species (IOTC 2011b). Important recreational target species, caught by skiboat anglers primarily off east coast of Africa including KZN but most are released. Little commercial harvesting of black marlin occurs from mainland Africa although foreign fleets do take this species as bycatch under license in the MOZ Channel and elsewhere in the SWIO (Shannon et al. 1989, van der Elst 1990, IOTC 2011b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology

STOCK STATUS
Status: Unknown. Original estimates of MSY for the Indian Ocean of 1400-1550mt by Silas (1989) may be too conservative as landings have exceeded 2 000mt for past 20 years and now peak at ~4 000mt (IOTC 2011b)
Trend in CPUE: Little known in the SWIO. In the Indian Ocean as a whole, CPUE exhibited dramatic declines since the beginning of the fishery in the 1950s with catches in the initial fishing grounds decreasing substantially. Nominal CPUE in north-western Australia has declined from 2.0 to about 0.25 (approximately 87%) since 1977, while nominal CPUE in the Seychelles area has been very low and has declined from 0.3 to 0.2 (30% decline) since the 1970s (Collette et al. 2011b)
Trend in catch composition: Progressive increase in landings in the SWIO from 1980s to present, mainly in longline and drift gillnet fisheries (IOTC 2011b). Total Indian Ocean catch of 4 000mt may be an underestimate as species are mixed and reported generically as billfish (IOTC 2006, 2011b)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio of 1:6.7 in KZN (van der Elst 1990) but no data on trends. Males dominate smaller size classes (20-200kg), while females dominate the larger size classes (Nakamura 1985)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Data Deficient; 2011 (Collette et al. 2011b)

CURRENT REGULATIONS
Daily bag limit: Recreational: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: Listed as a no-sale recreational species. However, allowed as a bycatch on pelagic longline vessels operating in SA waters. This anomaly in the legislation needs to be resolved
MPA effectiveness: Highly migratory nature not conducive to protection in MPAs

MANAGEMENT CONSIDERATIONS
SA must enforce the 12nm limit for pelagic longlining (20nm in KZN) and prevent targeting of marlin by longline vessels by limiting bycatch to less than 15%. Improved collaboration with the IOTC is needed. An effective observer programme is needed to monitor catch in pelagic longline fisheries operating in the SA EEZ. Limit access to marlin until better data is available. Pelagic longlines should be required to reduce shallow hook sets (near buoys) as this can reduce the marlin bycatch by >50% (Kitchell et al. 2004). Catch and release should continue to be encouraged in the recreational linefishery and greater use of circle hooks should be promoted to enhance post release survival

RESEARCH REQUIREMENTS
No quantitative stock assessment is currently available for marlins and sailfish in the Indian Ocean, due to a lack of fishery data for several gears. This, together with a lack of biological data, are cause for concern (IOTC 2006). Key topics are basic biology, age and growth, stock distribution, movement patterns in the SWIO, identification of spawning areas, reproductive strategies and sex ratios. Greater attention should also be paid to sport and small-scale fishers' catches
Research priority: Medium

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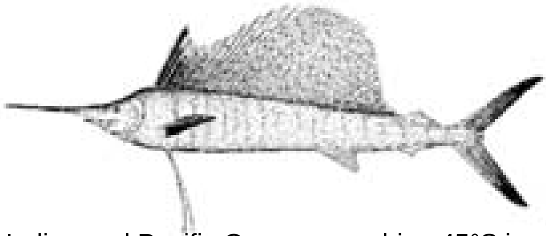

SCIENTIFIC NAME: *Istiophorus platypterus* (Smith No. 252.1)
COMMON NAMES: Sailfish, Indo-Pacific sailfish
COMPILER: RP van der Elst
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Tropical and temperate waters of the Indian and Pacific Oceans, reaching 45°S in the WIO (Nakamura 1985). It has been suggested that the related Atlantic sailfish (*I. albicans*) should be treated as a conspecific (Collette et al. 2011)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Recorded as far south as False Bay in the WC (Heemstra and Heemstra 2004), although seldom caught south of KZN

MOVEMENT: Migratory
Variable migratory behaviour; known to undertake long-range movements but also locally restricted based on ORI tagging data (recapture range from 0 to 1 060km with a mean of 63km). Sailfish appear to penetrate into the higher latitudes during the summer months returning to more tropical waters during the winter. Migration probably associated with warm currents (Beardsley et al. 1975, Nakamura 1985). Off the SA east coast sailfish are seldom caught south of KZN, and it is believed that these fish migrate down from northern MOZ in summer from Nov-Feb (van der Elst 1990)

HABITAT
Adults: Epipelagic, found primarily near the surface although has been recorded to depths of 160m but normally remains above the thermocline. Densest concentrations of sailfish are found near large land masses or offshore islands (Maksimov 1971, Beardsley et al 1975, Nakamura 1985, van der Elst 1988, Heemstra and Heemstra 2004)
Juveniles: Epipelagic, often close to the surface at night, appear to be closely associated with warm currents (Beardsley et al. 1975)
Eggs and larvae: Larvae remain in the upper 6m of the water column and are often found in close proximity to reefs (Beardsley et al. 1975, Leis et al. 1987). Post-larval sailfish have been recorded off KZN from Jan-Apr (van der Elst 1988)

FEEDING
Adults: Prey includes a diversity of small fishes, often those associated with flotsam and FADs. Also squids and stomatopods seasonally. May feed in groups by "balling" prey such as anchovies and sardines into tight shoals (van der Elst 1988, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Heterosexual, females usually grow larger than males (Beardsley et al. 1975). Spawning occurs with males and females forming pairs, or two or three males with one female (Nakamura 1985)
Breeding/spawning season: Spawning may occur throughout the year with a peak in summer (Maksimov 1971, Nakamura 1985, van der Elst 1990)
Breeding/spawning locality: Spawns in tropical epipelagic shelf waters (Maksimov 1971, Beardsley et al 1975, Nakamura 1985, Leis et al.1987). Little reproductive activity observed in KZN waters (van der Elst 1990)
Age at 50% maturity: Combined sexes: ~3 years; KZN; 1970s; data collected during opportunistic sampling with modest sample size (van der Elst 1988)
Length at 50% maturity: Combined sexes: ~150cm LJFL; KZN; 1970s; data collected during opportunistic sampling with modest sample size (van der Elst 1988)

BIOMETRICS
Maximum recorded age: 12 years; Female; Taiwan; 1998-99 (Chiang et al. 2004). Prince et al. (1986) recorded Atlantic sailfish reaching a maximum age of 13 years in the Gulf of Mexico
Maximum recorded weight: 100.2kg; Ecuador; 1947; World angling record (IGFA 2012). SA angling record is 64.9kg; KZN; 1974 (SADSAA 2012)
Maximum recorded length: 348cm LJFL; World angling record (IGFA 2012)
Length-length relationship: Males: EFL(cm) = 0.893LJFL(cm) - 5.196; Taiwan (Chiang et al. 2004)
Females: EFL(cm) = 0.876LJFL(cm) - 2.209; Taiwan (Chiang et al. 2004)
Length-weight relationship: Combined sexes: Wt(g) = 0.1078 x LJFL(mm)$^{1.662}$; KZN (van der Elst and Adkin 1991). Males: Wt(g) = 0.0042 x LJFL(cm)$^{2.985}$; Taiwan (Chiang et al. 2004)
Females: Wt(g) = 0.0046 x LJFL(cm)$^{2.97}$; Taiwan (Chiang et al. 2004)
Growth parameters: Males: L_∞ = 253cm LJFL; K = 0.12; t_0 = -3.92; Taiwan (Chiang et al. 2004)
Females: L_∞ = 261cm LJFL; K = 0.11; t_0 = -4.21; Taiwan (Chiang et al. 2004)

FISHERY
Only targeted as gamefish in sport fisheries but valued bycatch in artisanal and commercial fisheries throughout their distribution. Caught using a number of methods including trolling (lures and/or baits), longlining, gill-nets, harpooning etc. (Beardsley et al 1975). Off SA, sailfish are primarily targeted by recreational ski-boat anglers in northern KZN (van der Elst 1988, Hill and Bursik 1997)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown in SA waters; ranges from $0.54yr^{-1}$ to $1.73yr^{-1}$ elsewhere (Squire and Suzuki 1980)
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed – note that assessment is urgently needed for the Indian Ocean sailfish population
Trend in CPUE: SA data too scant to detect trends. Indian Ocean catch data for sailfish is often aggregated with other billfish species (Collette et al. 2011)
Trend in catch composition: SA data too scant to detect trends
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio = 1:4.3 in KZN sport catches (van der Elst 1990). No data available on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Least Concern; 2011 (Collette et al. 2011)

CURRENT REGULATIONS
Daily bag limit: Recreational: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: Listed as a no-sale recreational species. However, allowed as a bycatch on pelagic longline vessels operating in SA waters. This anomaly in the legislation needs to be resolved
MPA effectiveness: Highly migratory nature is not conducive to protection in MPAs

MANAGEMENT CONSIDERATIONS
Encourage catch-and-release by sport fisheries and use of circle hooks to reduce post-release mortality. In SA enforce 12nm limit for pelagic longlining (20nm in KZN) and prevent targeting of sailfish by longline vessels by limiting bycatch to less than 15%. Greater collaboration is needed in the management of sailfish in the Indian Ocean and as such, initiatives proposed by the IOTC working group on billfish (WGB) need to be supported (IOTC 2006, 2011b). This includes recording of sailfish catches separate to other billfish species

RESEARCH REQUIREMENTS
Despite its relative importance in the Indian Ocean, this species remains in need of study as many of its key biological reference points remain unknown. This includes information on stock distribution, migration patterns, age and growth, reproductive biology, stock assessment and trends in catch and effort
Research priority: Medium

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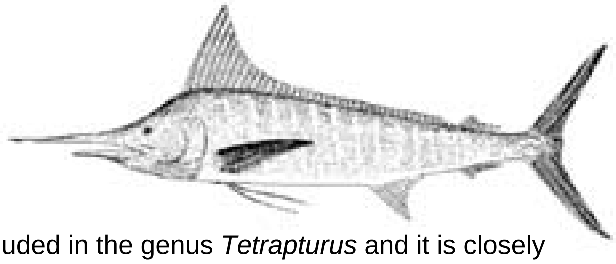

SCIENTIFIC NAME: *Kajikia audax* (Smith No. 252.6)
COMMON NAMES: Striped marlin
COMPILER: RP van der Elst
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Previously, this species was included in the genus *Tetrapturus* and it is closely related to the Atlantic white marlin *Kajikia albida* (Collette et al. 2006). Striped marlin is widely distributed in tropical and temperate waters of the Indo-Pacific and strays are occasionally found in the south-eastern Atlantic (Collette et al. 2011d). Most wide-ranging of the Indo-Pacific marlins found between 45°N and 35-40°S latitude (Nakamura 1985, Squire 1987)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
In the WIO densely distributed in the Arabian Sea, around Sri Lanka and in the MOZ Channel, extending southwards to the WC during summer (Pillai and Ueyanagi 1977, Smith and Heemstra 1991)

MOVEMENT: Migratory
Undertakes extensive migrations with a tendency to move towards the equator during winter months. Migratory rates and patterns are, however, highly variable and preliminary genetic study suggests spatial partitioning of genetic variation and possible spawning site fidelity (Squire 1987, Squire and Suzuki 1990, Brill et al. 1993, Graves and McDowell 1995)

HABITAT
Adults: Pelagic and oceanodromous species usually found above the thermocline although it has been found to depths of 289m. It generally inhabits cooler water than either black or blue marlin (Nakamura 1985). Abundance increases further offshore; usually seen close to shore only where deep drop-offs occur (Kailola et al. 1993). It is mostly solitary, but forms small schools by size during the spawning season (Collette et al. 2011d)
Juveniles: Epipelagic, distributions appear to coincide with larval distributions in equatorial waters of both the Indian and Pacific Oceans (Ueyanagi and Wares 1975, Nakamura 1985). In the Pacific juveniles migrate eastward to feeding areas on the west coast of America (Squire and Suzuki 1990)
Eggs and larvae: Recorded between 10° and 20°S in the WIO during early to mid-summer and between 6°N and 6°S in the eastern Indian Ocean. Lower temperature limit of larvae is approximately 24°C (Ueyanagi and Wares 1975, Nakamura 1985, Kailola et al. 1993). Larvae in the NW and SW Pacific occur between the equator and 30°N and 30°S respectively and are transported westwards by the Equatorial Current (Squire and Suzuki 1990)

FEEDING
Adults: Diurnal feeder of small shoaling fishes, crustaceans and squids (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Heterosexual with no sexual dimorphism, but females tend to grow larger than males (Ueyanagi and Wares 1975)
Breeding/spawning season: Early to mid-summer in the Indian Ocean (Ueyanagi and Wares 1975, Nakamura 1985, Kailola et al. 1993)
Breeding/spawning locality: Spawning occurs between 10° and 20°S in the WIO and between 6°N and 6°S in the eastern Indian Ocean (Ueyanagi and Wares 1975, Nakamura 1985, Kailola et al. 1993). In the Pacific, major spawning areas are located in the NW and SW Pacific (Squire and Suzuki 1990)
Age at 50% maturity: Combined sexes: 2-3 years (Skillman and Young 1976, Anonymous 2009)
Length at 50% maturity: Combined sexes: 140-170cm EFL (Bartoo and Ueyanagi 1980, Nakamura 1985, Anonymous 2009)

BIOMETRICS
Maximum recorded age: 9 years (Anonymous 2009). Limited data available due to difficulties associated with ageing this species (Davie and Hall 1990)
Maximum recorded weight: 224.1kg; New Zealand; 1986; World angling record (IGFA 2012). SA angling record: 116.35kg; WC; 1999 (SADSAA 2012). Allen and Steene (1988) reported maximum weight for striped marlin as 440kg
Maximum recorded length: 320-350cm TL (Nakamura 1985, van der Elst 1993). Allen and Steene (1988) reported maximum length of 420cm TL for striped marlin
Length-length relationship: TL(cm) = 1.083LJFL(cm); based on a picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.013 x LJFL(cm)$^{2.81}$; KZN (Torres 1991a)
Combined sexes: Wt(g) = 0.00457 x EFL(cm)$^{2.982}$; Eastern Pacific; n=535 (Ueyanagi and Wares 1975)
Growth parameters: Males: L_∞ = 277cm TL; K = 0.315; t_0 = -0.521; Pacific (Skillman and Young 1976)
Females: L_∞ = 252cm TL; K = 0.696; t_0 = 0.136; Pacific (Skillman and Young 1976)

FISHERY
Caught mainly with pelagic longlines (98%) with smaller numbers taken by drift gill-nets and trolling lines (IOTC 2011b). Not considered a target species but comprises an important bycatch for industrial fisheries in the Indian Ocean. Modest but unknown quantities taken by sport fishing but most are released. Only of moderate importance in sport catches off SA, with most fish caught between Nov-Dec (van der Elst 1990). Second most important billfish species (after sailfish) caught by the sports fishery in Kenyan waters (Silas 1989)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Unknown. Although CPUE data are available, a stock assessment has not been conducted for this species in the Indian Ocean (IOTC 2011b)
Trend in CPUE: Historically, most commercial landings were reported from the central Indian Ocean but the distribution has changed since the 1980s with most of the catch now taken in the western areas of the Indian Ocean (IOTC 2006, 2011b). Catch trends for striped marlin are highly variable; possibly reflecting poor reporting to species level. Recent annual Indian Ocean landings have fluctuated between 2 000 and 8 000mt. Significant and concerning declines in recent catch rates have been reported (e.g. 95% decline in CPUE of Japanese longliners operating off Seychelles) but the reasons are not clearly understood (IOTC 2011b). The stock is not considered to be well managed and more information is needed to understand population declines for striped marlin in the Indian Ocean (Collette et al. 2011d)
Trend in catch composition: Poor reporting to species level but declining longline catches in the WIO (Collette et al. 2011d)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio normally 1:1 but males tend to predominate in individual spawning groups (van der Elst 1993). Off KZN, mature females tend to dominate catches 1:3.3 (van der Elst 1990)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Near Threatened; 2011 (Collette et al. 2011d)

CURRENT REGULATIONS
Daily bag limit: Recreational: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: Listed as a no-sale recreational species. However, allowed as a bycatch on pelagic longline vessels operating in SA waters. This anomaly in the legislation needs to be resolved
MPA effectiveness: Highly migratory nature is not conducive to protection in MPAs

MANAGEMENT CONSIDERATIONS
SA must enforce 12nm limit for pelagic longlining (20nm in KZN) and prevent targeting of marlin by longline vessels by limiting bycatch to less than 15%. Improved collaboration with the IOTC is needed. An effective observer programme is needed to monitor catch in pelagic longline fisheries operating in the SA EEZ. Limit access to marlin until better data are available. Pelagic longlines should be required to reduce shallow hook sets (near buoys) as this can reduce marlin bycatch by >50% (Kitchell et al. 2006). Catch and release should continue to be encouraged in the recreational linefishery and greater use of circle hooks should be promoted to enhance post release survival

RESEARCH REQUIREMENTS
IOTC recommends that urgent priority is given to striped marlin CPUE analysis at the regional level. Also size data analyses, age and growth, stock assessment, stock distribution, genetics, migration patterns and reproductive biology information are required. Better submission of catch statistics to species level: perhaps by on-board observers. Improve estimates of sport catches
Research priority: Medium

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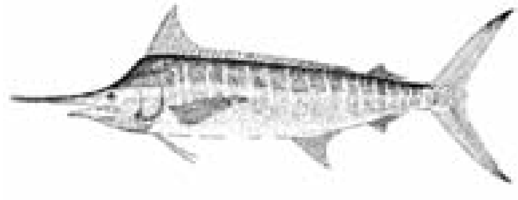

SCIENTIFIC NAME: *Makaira nigricans* (Smith No. 252.3)
COMMON NAMES: Blue marlin
COMPILER: RP van der Elst
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Blue marlin of the Indo-Pacific and the Atlantic are conspecifics now both known under the name of *Makaira nigricans*. The Indo-Pacific blue marlin was previously known as *M. mazara* (Collette et al. 2011c, IOTC 2011b). It is a pan-tropical species occurring in the Atlantic, Pacific and Indian Oceans mainly between 35° N and 35° S latitude (Fischer and Bianchi 1984, Nakamura 1985)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Known throughout the Indian Ocean north of 30°S latitude, but sometimes reaching as far south as Cape Town (Heemstra and Heemstra 2004)

MOVEMENT: Migratory
Extensive and seasonal migrations with fish migrating into higher latitudes during the summer months and returning to equatorial waters during the winter. Some evidence of migratory activity being greater in males (Rivas 1975, Nakamura 1985, Cyr et al. 1990, van der Elst 1993)

HABITAT
Adults: Epipelagic, oceanic species occurring in clear, warm surface waters >24°C above the thermocline, not usually found close to land masses or islands unless there is a steep drop-off of the shelf (Rivas 1975, Nakamura 1985)
Juveniles: Pelagic and oceanic, often found in association with warm currents (Rivas 1975). No larvae or juveniles have been positively identified off SA (van der Elst 1990)
Eggs and larvae: Tropical waters, occur primarily in the surface stratum (0-6m) and may be found concentrated on the seaward edge of reefs (Rivas 1975, Leis et al. 1987)

FEEDING
Adults: Top predator feeding on a diversity of epipelagic fishes, especially smaller tunas and squids (Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Heterosexual, dimorphic species with females growing considerably larger than males (Rivas 1975, Namakura 1985, Cyr et al. 1990, Hopper 1990)
Breeding/spawning season: Summer-autumn in southern latitudes < 30°S in the Indian Ocean (Leis et al. 1987, Hopper 1990, van der Elst 1993) but may spawn year-round in equatorial waters < 10°S (Kailola et al. 1993)
Breeding/spawning locality: Distinct breeding populations and spawning occurs between 30°N and 30°S. Specific spawning grounds have yet to be identified in the Indian Ocean (van der Elst 1993)
Age at 50% maturity: Combined sexes: 1-2 years (Prince 1991; Heemstra and Heemstra 2004)
Length at 50% maturity: Males: ~140cm EFL; Females: ~200cm EFL (Heemstra and Heemstra 2004). Weights at first maturity are: Males: 31–47kg; Females: 60–80kg; Pacific (Hopper 1990)

BIOMETRICS
Maximum recorded age: Males: 18 years; Females: 27 years; Pacific (Hill et al. 1989). Cyr et al. (1990) recorded the maximum age of blue marlin in the Indian Ocean as 21 years
Maximum recorded weight: 636kg; Brazil (Atlantic); 1992; World angling record (IGFA 2012). SA angling record: 521.4kg; Sodwana, KZN; 2007 (SADSAA 2012). Heemstra and Heemstra (2004) report that males reach a maximum of 150kg, while females may reach over 906kg
Maximum recorded length: 450cm TL; 350cm EFL (Heemstra and Heemstra 2004)
Length-length relationship: Unknown
Length-weight relationship: Males: $Wt(g) = 0.0035 \times LJFL(cm)^{3.158}$; Gulf of Mexico, n=1969 (Prince 1991)
Females: $Wt(g) = 0.002 \times LJFL(cm)^{3.273}$; Gulf of Mexico; n=3260 (Prince 1991)
Growth parameters: Combined sexes: L_∞ = 210cm LJFL; K = 1.53; t_0 = -0.15; Gulf of Mexico (Prince 1991)
Males: L_∞ = 371cm FL; K = 0.29; North Central Pacific (Skillman and Young 1976)
Females: L_∞ = 659cm FL; K = 0.12; North Central Pacific (Skillman and Young 1976)

FISHERY
Important bycatch (non-target) component of commercial fisheries in the Indian Ocean being taken mainly by pelagic longlines (60%) and drift gill-nets (30%) with remaining catches recorded by line (trolling) (IOTC 2011b).

More recently, larger catches have been reported from the western and central tropical Indian Ocean and, to a lesser extent, the MOZ Channel and SA. The catches of blue marlin are typically higher than those of black marlin and striped marlin combined. The mean annual catch of blue marlin in the Indian Ocean over past decade was about 9 600mt (IOTC 2011b). Blue marlin are occasionally captured by recreational sport fishermen off the KZN coast usually during summer (Nov-Mar) with most being hooked further offshore than other billfish species (van der Elst 1990)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per recruit methodology

STOCK STATUS
Status: Unknown. In 1989 the MSY was conservatively estimated at between 3 400–3 600mt $annum^{-1}$ in the Indian Ocean (Silas 1989) but landings are currently nearly three times this. IOTC (2011b) concludes that the MSY for blue marlin for the whole Indian Ocean remains unknown
Trend in CPUE: CPUE of Japanese longliners in NW Australian waters has declined by 70.6% over an 18-year period (1989-2007), while it has declined by 56.9% in the Seychelles over the same period (Collette et al. 2011c). The decline in the Indian Ocean is thus in the order of 63–69%. It is important to note that these data are limited and catch data from other longline fisheries are not available. The stock is not considered to be well managed and more information is needed to understand population declines for blue marlin in the Indian Ocean (Collette et al. 2011c)
Trend in catch composition: Fluctuations in the percentage composition are evident in the pelagic longline fishery in the Indian Ocean although the overall trend appears to be positive. No quantitative stock assessment is currently available for blue marlin in the Indian Ocean and there is a lack of reliable fishery data for several gears (IOTC 2011b)
Trend in mean size: Unknown
Trend in sex ratio: Sex ratio depends on season and area. During the summer reproductive season in Hawaiian waters males outnumber females by as much as 6:1, during the rest of the year the sex ratio is close to 1:1 or larger females outnumber males (Hopper 1990). Catches off KZN consist predominantly of larger females (van der Elst 1990)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Vulnerable; 2011 (Collette et al. 2011c)

CURRENT REGULATIONS
Daily bag limit: Recreational: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: Listed as a no-sale recreational species. However, allowed as a bycatch on pelagic longline vessels operating in SA waters. This anomaly in the legislation needs to be resolved
MPA effectiveness: Highly migratory nature is not conducive to protection in MPAs

MANAGEMENT CONSIDERATIONS
In SA enforce 12nm limit for pelagic longlining (20nm in KZN) and prevent targeting of marlin by longline vessels by limiting bycatch to less than 15%. Improved collaboration with IOTC is needed. An effective observer programme is needed to monitor catch in pelagic longline fisheries operating in the SA EEZ. Limit access to marlin until better data are available. Pelagic longlines should be required to reduce shallow hook sets (near buoys) as this can reduce marlin bycatch by >50% (Kitchell et al. 2006). Catch and release should continue to be encouraged in the recreational linefishery and greater use of circle hooks should be promoted to enhance post release survival

RESEARCH REQUIREMENTS
Age and growth, stock distribution, migration patterns, reproductive biology. Annual WIO catches of blue marlin urgently need to be reviewed. Improvement is required in data collection and reporting to enable a stock assessment to be undertaken
Research priority: Medium

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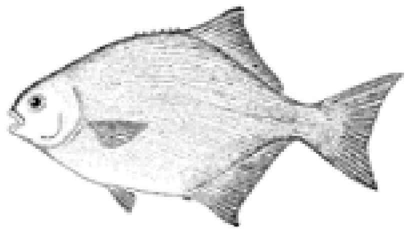


SCIENTIFIC NAME: *Neoscorpis lithophilus* (Smith No. 190.1)
COMMON NAMES: Stonebream, Stinker, Stinkvis
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Endemic, subtropical species found between southern MOZ and False Bay (Fischer and Bianchi 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004), recently also found along the southeast coast of Madagascar (B. Mann, ORI, pers. obs.)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Along east coast from southern MOZ (Inhaca Island) to Cape Agulhas (Joubert and Hanekom 1980, van der Elst 1993, Mann et al. 2002)

MOVEMENT: Unknown
To date only 5 (0.77%) of the 648 stonebream tagged have been recaptured. Although these data suggest that stonebream may be quite nomadic with a mean distance travelled of 30km (ORI Tagging Project, unpubl. data), it is believed that its movement behaviour is more likely to be fairly resident, typical of other inshore reef fish species (B. Mann, ORI, pers. obs.)

HABITAT
Adults: Inshore reef fish found in shallow, rocky areas with turbulent surf (Joubert and Hanekom 1980, Smith and Heemstra 1991, van der Elst 1993)
Juveniles: Shallow subtidal gullies and rock pools (Joubert 1981a, Berry et al. 1982, van der Elst 1993)
Eggs and larvae: Pelagic eggs and larvae described by Connell (2012), mainly found in inshore waters along the KZN south coast during late summer

FEEDING
Adults: Diet includes mainly red and green algae but also feeds on copepods and other small invertebrates associated with algae (Joubert and Hanekom 1980, van der Elst 1993)
Juveniles: Similar to adults, no apparent change in diet with increase in size (Joubert and Hankom 1980)

REPRODUCTION
Reproductive style: Gonochoristic (Mann et al. 2002b)
Breeding/spawning season: Extended spawning season Jun-Jan (Joubert 1981a)
Breeding/spawning locality: Shallow coastal waters off southern MOZ and along the northern KZN coast (Joubert 1981a, van der Elst 1993, Mann et al. 2002b), possibly some spawning further south (S. Dunlop, ORI, pers. obs.)
Age at 50% maturity: Combined sexes: 3-4 years; KZN; 1994-99 (Mann et al. 2002b)
Length at 50% maturity: Males: 262mm FL; Females: 292mm FL; KZN; 1975-77; Size at first maturity (Joubert 1981a)

BIOMETRICS
Maximum recorded age: 10 years; KZN; 1994-99 (Mann et al. 2002b). Maximum age is likely to exceed this based on record size
Maximum recorded weight: 2.6kg; SA spearfishing record; 1978 (SAUFF 2012)
Maximum recorded length: 50cm FL (van der Elst 1993, Heemstra and Heemstra 2004)
Length-length relationship: Combined sexes: FL(mm) = 0.89TL(mm) - 0.914; KZN (Joubert 1981a)
Length-weight relationship: Combined sexes: Wt(g) = 0.000014 x $FL(mm)^{3.08}$; KZN (Joubert 1981a)
Growth parameters: Combined sexes: L_∞ = 413.4mm FL; K = 0.222; t_0 = -0.981; KZN (Mann et al. 2002b)

FISHERY
One of the top six most important species caught in the shore fishery along the KZN and TKI coasts (Joubert 1981b, Mann et al. 1997a, Mann et al. 2003, Dunlop and Mann 2012), becomes progressively less abundant further south (Brouwer et al. 1997). Larger specimens occasionally taken by spearfishermen (Mann et al. 1997b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.15yr^{-1}$
Natural mortality rate (M): $0.29yr^{-1}$
Total mortality rate (Z): $0.44yr^{-1}$
F_{MSY} yr^{-1}: 0.35
F_{SB40} yr^{-1}: 0.18

F_{SB25} yr^{-1}: 0.28
$F_{0.1}$ yr^{-1}: 0.21
$SBPR_{current}$: 46%
Year completed: 2002
Locality: KZN
References & Comments: Mann et al. (2002b)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2002
Locality: KZN
Status: 40-50% - optimally exploited (Mann et al. 2002b)
Trend in CPUE: Decreased between 1975-77 (0.09 fish.angler^{-1}.day^{-1}), 1994-96 (0.05 fish.angler^{-1}.day^{-1}) and 2009-10 (0.03 fish.angler^{-1}.day^{-1}) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). This may be as a result of subtle differences in survey design and amount of rocky shore habitat sampled in the above studies rather than a decrease in abundance (Mann et al. 2002). However, long-term NMLS monitoring of shore anglers catches in KZN between 1985-2006 also revealed a decrease in stonebream CPUE over this period from 0.02 to 0.01 fish.angler^{-1} inspected (Pradervand 2007)
Trend in catch composition: Decreased between 1975-77 (7.94%), 1994-96 (4.18%) and 2009-10 (2.99%) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Subtle differences in survey design by these studies may have resulted in the observed changes in percentage composition (B. Mann, ORI, pers. obs.). Percentage composition has remained relatively stable in NMLS shore patrol data from KZN between 1985-2011 (J. Maggs, ORI, unpubl. data)
Trend in mean size: Mean size remained similar between 1975-77 and 1994-96 in KZN at around 280mm FL (Joubert 1981a, Mann et al. 1997a, Dunlop 2011). Between 1994-96 and 2009-10 it decreased from ~280mm FL to 255mm FL but this is based on a relatively small sample size (Mann et al. 1997a, S. Dunlop, ORI, unpubl. data)
Trend in sex ratio: M:F sex ratio remained similar between 1975-77 (1:1.2) and 1994-99 (1:1.14) (Joubert 1981a, B. Mann, ORI, unpubl. data)

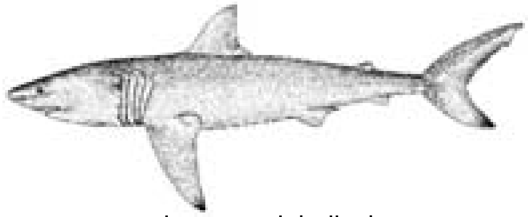
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: No-take MPAs containing suitable rocky surf-zone habitat in southern MOZ, KZN and the northern parts of the EC are likely to provide protection for this species (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Stonebream is an important shore angling species along the southern MOZ, KZN and TKI coasts and is commonly caught by subsistence fishers. With growing demand being made by the subsistence sector, and the apparent decline in CPUE along the KZN coast, careful monitoring of the status of this species is needed to ensure sustainable utilization. Consideration should be given to the implementation of a minimum size limit of 30cm TL as this would ensure maintaining SBPR at >25% of pristine even with a doubling of current F (Mann et al. 2002)

RESEARCH REQUIREMENTS
Monitor trends in CPUE, catch composition and mean size, investigate movement patterns
Research priority: Low

LAMNIDAE



SCIENTIFIC NAME: *Carcharodon carcharias* (Smith No. 14.1)
COMMON NAMES: Great white shark, White shark, Witdoodshaai
COMPILER: G Cliff
REVIEWER: SP Wintner
DATE OF REPORT COMPLETION: February 2012

GLOBAL DISTRIBUTION: Widely distributed in warm and cold temperate coastal waters globally, but occasionally found in the tropics and in open oceans (Compagno 2001)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Although this species occurs along the entire SA coast, its regional distribution is centred in the SW Cape (Bass et al. 1975). It occurs on the continental shelf and often ventures into shallow water, but is capable of oceanic movement (Bonfil et al. 2005, Cliff et al. 2000, Compagno 2001, Zuffa et al. 2002, Dudley 2012)

MOVEMENT: Nomadic
SA white sharks have shown a number of different movement types. These include rapid trans-oceanic return migrations (Western Australia), frequent long-distance coastal return migrations, smaller-scale patrolling and site fidelity (Bonfil et al. 2005). Recapture of sharks tagged in KZN and the SW Cape showed evidence of site fidelity or repeated use of migratory routes (Cliff et al. 1996b)

HABITAT
Adults: Pelagic, wide-ranging in coastal and shelf waters but occasionally oceanic. Intolerant of low salinity environments (Compagno 2001)
Juveniles: Similar to adults (Compagno 2001)

FEEDING
Adults: A highly varied diet with marine mammals (cetaceans and seals), bony and cartilaginous fish and cephalopods being the most important (Bass et al. 1975, Cliff et al. 1989 and Cliff et al. 1996a). Opportunistic scavenging off whale carcasses is common
Juveniles: Similar to adults (Bass et al. 1975, Cliff et al. 1989 and Cliff et al. 1996b). Opportunistic scavenging of whale carcasses has been observed (Dicken 2008)

REPRODUCTION
Reproductive style: Aplacental viviparous development. Embryos are oophagous, deriving their nourishment from the ingestion of packets of unfertilised eggs (Gilmore 1993, Francis 1996)
Breeding/spawning season: Nothing is known, given the very small number of mature animals examined in SA, of which only one female was "apparently" mature (Bass et al 1975, Dudley 2012)
Breeding/spawning locality: The capture of a 140cm TL (20 kg) individual (Smith 1951) and sighting of small individuals (approx. 150cm TL) in Algoa Bay (Dicken 2008) suggests that the EC, and specifically Algoa Bay, may represent a nursery ground for this species. Small individuals (153-157cm TL) have also been caught in the KZN shark nets (Dudley 2012)
Age at 50% maturity: Males: 8-9 years; Females: ~16 years; KZN; 1999 (Dudley 2012), extrapolating from the growth curve of Wintner and Cliff (1999) which did not include mature females/large animals
Length at 50% maturity: Males: 309cm PCL; KZN (Dudley and Simpfendorfer 2006), based on sharks caught in the KZN shark nets only; no mature females in this catch. Females: 396cm PCL; KZN and worldwide (Dudley 2012), converted using Mollet and Cailliet (1996) equation

BIOMETRICS
Maximum recorded age: >50 years; KZN; 1999 (S. Wintner, KZN Sharks Board, unpubl. data)
Maximum recorded weight: 1241kg; Female; Gansbaai, WC; 1987. Caught in a pilchard purse-seine net (KZN Sharks Board and LJV Compagno unpubl. data). World angling record: 1208.4; Australia; 1959 (IGFA 2012)
Maximum recorded length: 540cm TL; Female; Gansbaai, WC; 1987. Caught in a pilchard purse-seine net, this sharks was reported to be 6m long but was more conservatively estimated to be 5.4m TL based on tooth and fin measurements (LJV Compagno, unpubl. data)
Length-length relationship: Combined sexes: TL(cm) = 1.245PCL(cm) + 7.975; KZN; Range 131-373cm PCL; TL with the upper caudal fin placed parallel to body axis (Cliff et al. 1996a)
Combined sexes: FL(cm) = 1.1PCL(cm) + 3.554; KZN; Range 131-373cm PCL (Cliff et al. 1996a)
Length-weight relationship: Combined sexes: $Wt(kg) = 0.0000214 \times PCL(cm)^{2.944}$; KZN; Range 131-373cm PCL (Cliff et al. 1996a). $Wt(kg) = 46.0(girth^2 PCL)^{0.927}$ (Mollet and Cailliet 1996: dimensions in metres), based on a worldwide study of 140 animals; includes animals of up to 4.4m PCL, but apparently no SA specimens. These authors found that including girth (measured behind the pectoral fins and in front of the first dorsal) provides a more accurate weight estimate than using length alone
Growth parameters: Combined sexes: L_∞ = 544cm PCL; K = 0.065; t_0 = -4.4; KZN; Based on 114 animals 128-373cm PCL, of which three (all males) were mature (Wintner and Cliff 1999)

FISHERY

Prior to full protection of this species in 1991 (Compagno 1991), trophy hunting for extremely large individuals in the SW Cape was a major source of mortality. Currently approximately 33 individuals, almost all of which are immature, are caught annually in the KZN shark nets. Increased targeting of juveniles by shore anglers in the SW Cape has been reported recently; the animals are generally returned alive, but mortalities through capture stress are unknown

BIOLOGICAL REFERENCE POINTS

Fishing mortality rate (F): $0.055 yr^{-1}$
Natural mortality rate (M): see below
Total mortality rate (Z): $0.53 yr^{-1}$
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
Year completed: 1996
Locality: SA
References & Comments: Cliff et al. (1996b) where $Z - F = 0.48 yr^{-1} = M + U$, where M is the instantaneous rate of mortality and U is the sum of the instantaneous rate of emigration and long-term tag shedding

STOCK STATUS

Status: Unknown
Trend in CPUE: Shark nets have been fishing off KZN since 1952 but accurate catch data are only available since 1978. There was no significant trend in catch rate from 1978-2003 (Dudley and Simpfendorfer 2006). This also applies for the period 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data), suggesting that the population is stable
Trend in catch composition: The contribution by white sharks to the total catch of 14 species of large sharks caught in the KZN shark nets from 1978-2010, showed a significant increase with time (p=0.01), from a fitted value of 2.6% in 1978 to a fitted value of 4.5% in 2010. The mean contribution was 3.5% (S. Dudley, KZN Sharks Board, unpubl. data)
Trend in mean size: There was no trend in mean or median size of males or females caught in the shark nets from 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data)
Trend in sex ratio: There was no trend in the annual sex ratio in the KZN shark nets from 1978-2010 (S. Dudley, KZN Sharks Board unpubl. data)

VULNERABILITY RATING

MLRA: Prohibited species
IUCN Red List: Vulnerable; 2009 (Fergusson et al. 2009)

CURRENT REGULATIONS

Daily bag limit: Zero
Minimum size limit: Not applicable
Closed Season: Not applicable
Other regulations: Prohibited species
MPA effectiveness: Given the nomadic nature, MPAs will provide limited protection. As Algoa Bay appears to be a possible nursery ground, any MPAs in this region may benefit newborns

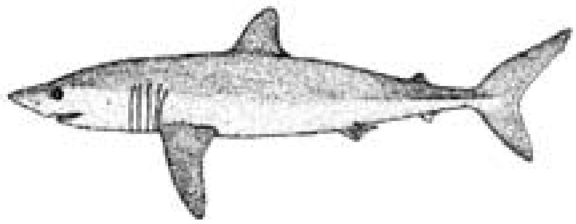
MANAGEMENT CONSIDERATIONS

Prevent the deliberate targeting of juveniles by shore anglers in the SW Cape. Continue monitoring existing cage dive operators

RESEARCH REQUIREMENTS

Learn more about the mating and pupping/gestation grounds; reassess age and growth estimates incorporating more large individuals
Research priority: Medium

LAMNIDAE



SCIENTIFIC NAME: *Isurus oxyrinchus* (Smith No. 14.2)
COMMON NAMES: Shortfin mako, Mako shark
COMPILER: A Foulis
REVIEWER: JC Groeneveld
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: Circumglobal distribution in temperate and tropical seas (Heemstra and Heemstra 2004, CMS 2007, Cavanagh et al. 2008)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Found around the entire SA coast. Genetic differentiation in mitochondrial DNA across global populations has resulted in partially segregated population structure (Heist et al. 1996, Mucientes et al. 2009)

MOVEMENT: Migratory
North Atlantic tagging studies have revealed seasonal migrations and trans-Atlantic movements exceeding 3 920km (Heemstra and Heemstra 2004)

HABITAT
Adults: Coastal, epipelagic, found in depths of 1-500m (Campana et al. 2005, Cavanagh et al. 2008, Cortes 2008)
Juveniles: Pelagic, higher catch rates observed along the 200m isobath on the Agulhas Bank (Petersen et al. 2009, Foulis 2013)

FEEDING
Adults: Opportunistic: pelagic cephalopods, pelagic teleosts (including billfish), crustaceans, small cetaceans, small elasmobranchs, sometimes cannibalistic (Stillwell and Kohler 1982, Maia et al. 2006). Sharks caught nearshore in KZN preyed mainly on elasmobranchs, including milk sharks *Rhizoprionodon acutus*, dusky sharks *Carcharhinus obscurus* and spotted eagle rays *Aetobatus narinari* (Foulis 2013). Sharks caught far offshore in KZN preyed mainly on teleosts. Most common in stomach samples were maasbanker *Trachurus trachurus* and sardine *Sardinops sagax* (Foulis 2013)
Juveniles: Similar to adults

REPRODUCTION
Reproductive style: Ovoviviparous, oophagous (Mollet et al. 1999, Campana et al. 2005)
Breeding/spawning season: Parturition occurs in late winter to early spring in both hemispheres (Mollet et al. 1999, Campana et al. 2005)
Breeding/spawning locality: Little known, there is speculation that these sharks move inshore to breed (Campana et al. 2005, Stevens et al. 2005)
Age at 50% maturity: Males: 7-9 years; Females: 14-21 years; Atlantic, Pacific and Indian Oceans; 1999-2012 (Campana et al. 2005, Bishop et al. 2006, Natanson et al. 2006, Cerna and Licandeo 2009, Foulis 2013)
Length at 50% maturity: Males: 185-199cm FL (165cm PCL); Females: 253-275cm FL (220cm PCL); North Atlantic and SWIO (Cliff et al. 1990, Natanson et al. 2006, Foulis 2013)

BIOMETRICS
Maximum recorded age: Males: 21-34 years; Females: 28-38 years; studies from various regions throughout distribution (Campana et al. 2005, Bishop et al. 2006, Natanson et al. 2006, Cerna and Licandeo 2009, Foulis 2013)
Maximum recorded weight: 553.8kg; Atlantic, USA, World angling record (IGFA 2012)
Maximum recorded length: 411cm FL; Canada (Campana et al. 2005)
Length-length relationship: Combined sexes: FL(cm) = 0.9286TL(cm) - 1.7101; NW Atlantic (Kohler et al. 1994)
Length-weight relationship: Combined sexes: Wt(kg) = 0.00000524 x $FL(cm)^{3.1407}$; NW Atlantic, (Kohler et al. 1994); Males: Wt(kg) = 0.00000308 x $FL(cm)^{3.2096}$; Females: Wt(kg) = 0.00000304 x $FL(cm)^{3.2512}$; SWIO (Foulis 2013)
Growth parameters: Males: L_∞ = 295cm FL, K = 0.152; Females: L_∞ = 315cm FL, K = 0.127; SWIO (Foulis 2013). Males: L_∞ = 302cm FL, K = 0.052; t_0 = -9; Females: L_∞ = 820cm FL, K = 0.013; t_0 = -11.3; New Zealand (Bishop et al. 2006)

FISHERY
Targeted in the large pelagic longline fishery and by recreational game fishermen. This species is taken in relatively high numbers as bycatch in both the pelagic tuna- and swordfish-directed longline fisheries (Campana et al. 2005, Cavanagh et al. 2008, Cortes 2008, Petersen et al. 2009). Caught in the protective shark nets set approximately 500m offshore of swimming beaches along the KZN coast (Cliff et al. 1990)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology

STOCK STATUS
Stock assessment method: Other
Year completed: 2005
Locality: SA
Status: 25-40% - overexploited. Based on extrapolations from catch rates (Petersen et al. 2009)
Trend in CPUE: Between 2001-2005 Petersen et al. (2009) showed a decrease in standardized CPUE of mako sharks based on logbook and observer data in SA waters. Subsequently a standardized CPUE index based on logbooks showed a slight increase in shark abundance between 1998-2010, although a CPUE index based on observer data showed a decline between 2002-2010 (Foulis 2013)
Trend in catch composition: Mako sharks are the most commonly retained bycatch species, but the second most captured shark species, in the pelagic longline fisheries in SA forming 17.2% of the bycatch (Petersen et al. 2009). It also forms the bulk of the catch taken by the shark-directed pelagic longline fishery (>90%)
Trend in mean size: Petersen et al. (2009) showed a significant decrease in average total length with a drop from 220cm in 2002 to 140cm in 2007. However, no trend in standardized mean size based on observer data was observed between 2002-2009 (Foulis 2013)
Trend in sex ratio: M:F sex ratio of 2.3:1 was found in KZN shark nets between 1978-2010. Ratio was 1.1:1 based on samples from pelagic longliners operating in SA waters (Foulis 2013)

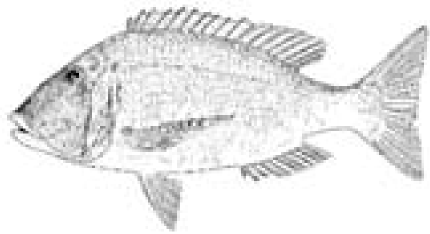
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2009 (Cailliet et al. 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: As a bycatch, the shark catch cannot be more than 10% (by dressed weight) of the total catch of the target species. Fins may be landed detached from the body but the ratio of fin to carcass cannot be higher than 8% of the total weight of shark trunks. Permit holders are requested to encourage crew to release live sharks (Tuna Longline permit conditions 1 February 2010 – 31 January 2011)
MPA effectiveness: Highly migratory species and unlikely to benefit from the current MPA network around SA

MANAGEMENT CONSIDERATIONS
1) Sharks to be landed with fins naturally attached (cut and folded also permitted); 2) Spatial management framework suggested for longline fishing sectors - to include shark bycatch information; 3) Regular deployment of fisheries observers to collect accurate fisheries and biological data; 4) Incorporation of observer data into assessments to develop fisheries management strategies; 5) realistic upper catch limit to be set for different longline sectors; 6) Area closures to be considered, on account of high catches of juveniles on some areas of the Agulhas Bank; 7) Closed fishing season for shark longline fishery to reduce fishing effort; 8) Phasing out of shark-directed pelagic longline fishery to be continued; 8) Minimum size limit to be considered - based on size at maturity, it should be in the region of 200cm FL; 9) Under-reporting of shark bycatches by tuna and swordfish longline fleets to be estimated (Foulis 2013)

RESEARCH REQUIREMENTS
Stock assessments required. Genetic structure of stocks need to be determined - are there separate Atlantic and Indian Ocean populations? Identify management units. Identify demographic trends over space and time to define adult/juvenile habitats; breeding areas; migration routes
Research priority: High

LETHRINIDAE



SCIENTIFIC NAME: *Lethrinus crocineus* (Smith No. 185.5)
COMMON NAMES: Yellowfin emperor, Yellowtail emperor, Scavenger
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Western Indian Ocean, Kenya south to EC, also WIO islands and Sri Lanka (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Heemstra and Heemstra (2004) report southernmost limit as St Lucia, but recently reported from the Pondoland MPA in the EC (Maggs et al. 2013)

MOVEMENT: Resident
Very limited tagging data suggests residency (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Generally occurring over deeper reefs and adjacent sandy areas down to 150m (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
Juveniles: Unknown
Eggs and larvae: Unknown

FEEDING
Adults: Little known, likely to include squid, pteropods, mantis shrimps and juvenile fish (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Unknown in SA; Apr-May in Seychelles (Robinson et al. 2004); ripe fish seen in Oct and Jan in Kenya (Nzioka 1979)
Breeding/spawning locality: Unknown in SA; recorded on Seychelles Bank (Robinson et al. 2004) and in Kenyan waters (Nzioka 1979)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 8.8kg; KZN; 1985; SA spearfishing record (SAUFF 2012). Heemstra and Heemstra (2004) recorded a maximum weight of 3.25kg
Maximum recorded length: 600mm TL (Smith and Heemstra 1991, van der Elst 1993)
Length-length relationship: TL(cm) = 1.074FL(cm); TL(cm) = 1.176SL(cm) (Froese and Pauly 2012)
Length-weight relationship: Unknown
Growth parameters: Not aged

FISHERY
Has appeared in reasonable numbers (~1% by no.) in KZN commercial skiboat catches at times, much less common in recreational skiboat catches; small (< 1%) contribution to semi-industrial linefish catches in southern MOZ. Seldom taken by spearfishermen due to its preference for deeper water

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS

Status: Not assessed
Trend in CPUE: KZN recreational skiboat catch rates: 0 fish.outing^{-1} in 1994-95 (Mann et al. 1997), 0.001 fish.outing^{-1} in 2008-09 (Dunlop 2011); commercial catch rates declined from 1 fish or 0.4 kg.outing^{-1} in 1994-95 (Mann et al.1997) to 0 in 2008-09 (Dunlop 2011)
Trend in catch composition: Percentage composition in KZN commercial skiboats 1994-95: 1% by no. and 0.5% by wt (Mann et al. 1997) but not reported in 2008-09 surveys (Dunlop 2011); not reported in recreational skiboat catches in 1994-95 (Mann et al. 1997) and very small contribution in 2008-09 - 0.02% by no. and 0.01% by wt (Dunlop 2011). Not observed in Transkei skiboat surveys in 1997-99 (Fennessy et al. 2003), and not common in Pondoland MPA at depths <30m (Maggs et al. 2013)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING

MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS

Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: No-take zones within the Pondoland, Aliwal Shoal and St Lucia/Maputaland MPAs provide protection for this species in SA - particularly the Maputaland MPA where this species occurs in high abundance at some localities (B. Mann, ORI, unpubl. data). The adjacent Ponta do Ouro Partial Marine Reserve in MOZ will also provide some protection

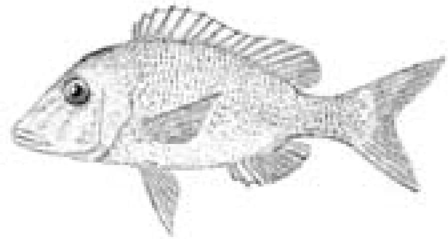
MANAGEMENT CONSIDERATIONS

Northern KZN is generally the southernmost limit of the range of this essentially tropical species, and a considerable part of its SA distribution is protected by well-managed MPAs; there is also some protection in southern MOZ. The possible decline in contribution to commercial catches from 1994-95 to 2008-09 may be anomalous (sampling artefact) as this species is probably not very common. Current management in SA is thus probably adequate. Some indications that the range is extending southward, with periodic catches being recorded in the Pondoland MPA (B. Mann, ORI, unpubl. data)

RESEARCH REQUIREMENTS

Linefish Observer Programme to undertake regular monitoring of skiboat catches in KZN. There should be collaborative negotiation towards the declaration of an MPA north of Maputo in MOZ as some protection in the central region of southern MOZ is required
Research priority: Low

LETHRINIDAE



SCIENTIFIC NAME: *Lethrinus nebulosus* (Smith No. 185.13)
COMMON NAMES: Blue emperor, Spangled emperor, Mata-hari, Scavenger
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Indo-West Pacific region from SA to Japan including Australian waters (Aldonov and Druzhinin 1978, Young and Martin 1982, Fischer and Bianchi 1984, Smith and Heemstra 1991, Ebisawa 1990, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: KZN, MOZ
Southern limit in SA only confirmed to Sodwana Bay but may extend to Richards Bay; specimens south of this (reported to Algoa Bay in Heemstra and Heemstra 2004) are likely to be another *Lethrinus* species, yet to be described (Gavin Gouws, SAIAB, unpubl. data)

MOVEMENT: Unknown
Not known in SA waters; adults possibly migrate to shallow reef areas for spawning (Ibrahim et al. 1988a) and likely move to deeper waters with age. Limited tag and recapture results for the undescribed *Lethrinus* sp. suggest a high degree of residency (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Adults occur alone or in small shoals on coral and rocky reefs from 10m down to 50-80m, often found on sand between reefs and over the reef itself (Aldonov and Druzhinin 1978, Smith and Heemstra 1991, van der Elst 1993), fish moving into deeper water as they age (McBWilliams et al. 1992)
Juveniles: Juveniles form large schools in shallow, sheltered sandy areas, including seagrass and mangrove areas (Gel and Whittington 2002)
Eggs and larvae: Pelagic eggs and larvae (Brothers et al. 1983, Kailola et al. 1993)

FEEDING
Adults: Echinoderms, molluscs, crustaceans, polychaete worms and small fishes (Heemstra and Heemstra 2004, Froese and Pauly 2012)
Juveniles: Similar to adults

REPRODUCTION
Reproductive style: Not assessed in SA waters; some studies have suggested juvenile protogyny, which is effectively functional gonochorism (e.g. Carpenter and Allen 1989, Marriott et al. 2010), while others have considered the species to be a protogynous hermaphrodite (Young and Martin 1982, Allsop and West 2003)
Breeding/spawning season: Not assessed in SA waters; several studies on FishBase indicate year-round spawning (no peaks), some report spring and summer peaks in both northern and southern hemispheres (Baddar 1987, Ebisawa 1990)
Breeding/spawning locality: Shallow reef areas in tropical waters (Ibrahim et al. 1988a)
Age at 50% maturity: Males: ranging from 3-8 years; Females: 4-9 years; based on several studies reported in FishBase (Froese and Pauly 2012); not studied in SA waters
Length at 50% maturity: Ranging from 28-46cm; based on several studies reported in FishBase (Froese and Pauly 2012); not studied in SA waters cm

BIOMETRICS
Maximum recorded age: Ranging from 19-27 years; based on several studies reported in FishBase (Froese and Pauly 2012)
Maximum recorded weight: 9.45kg; Japan; 2002; World angling record (IGFA 2012)
Maximum recorded length: Ranging from 62-87cm TL; based on several studies reported in FishBase (Froese and Pauly 2012)
Length-length relationship: FL(cm) = 0.89TL(cm) + 0.312 (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0187 \times FL(cm)^{2.996}$; New Caledonia (Kulbicki et al. 2005. Not assessed in SA so this is the most reliable estimate based on sample size given by FishBase (Froese and Pauly 2012)
Growth parameters: Females: L_∞ = 61.7cm FL; K = 0.21; New Caledonia. FishBase gives parameters from >20 studies; the parameters provided here are the median results; t_0 not provided (Froese and Pauly 2012)

FISHERY
Given the recent realization that *L. nebulosus* sensu stricto is likely to be restricted to northern KZN, it is probable that the species only makes a very small contribution to recreational and commercial skiboat catches in KZN. Previous reports of the species in SA (e.g. Mann et al. 1997 and Dunlop 2011), are therefore primarily referring to the as-yet undescribed *Lethrinus* sp. Neither species appears to feature in recreational shorefishing or spearfishing catches (Mann et al. 1997, Dunlop 2011) but *L. nebulosus* is caught by shore anglers from Kosi Bay northwards into MOZ waters (B. Mann, ORI, pers. obs.) and are taken by spearfishers in these waters (van der Elst 1993). *L. nebulosus* probably makes a reasonable contribution to semi-industrial lineboat catches, recreational skiboat catches and artisanal catches in southern MOZ (IIP unpubl. data), but it is not known what proportion of these reported catches include the undescribed Lethrinus sp.

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters but has been assessed elsewhere (e.g. Ibrahim et al. 1988b)

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown (SA data for *L. nebulosus* includes 2 species)
Trend in catch composition: Unknown (SA data for *L. nebulosus* includes 2 species). However, the undescribed *Lethrinus* sp. appears to comprise an increased proportion of commercial skiboat catches in KZN waters and between 2008-09 it was the third most important species recorded comprising 4.9% of the total catch by number (Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

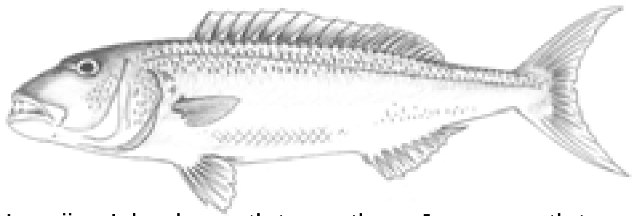
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia/Maputaland MPAs are likely to provide the only protection for this species in SA. The adjacent Ponta do Ouro Partial Marine Reserve in MOZ will also provide some protection. The undescribed *Lethrinus* sp. receives some protection in the Pondoland MPA but appears to be more abundant in exploited areas than in no-take areas probably in response to removal of predatory fish by fishing (Maggs et al. 2013).

MANAGEMENT CONSIDERATIONS
Northern KZN is the southernmost limit of the range of this essentially tropical species, and most of its SA distribution is protected by a well-managed MPA; there is also some protection in southern MOZ. However, the as yet undescribed *Lethrinus* sp. forms an important component of the commercial skiboat catches in KZN and semi-industrial lineboat catches in southern MOZ and requires careful monitoring and increased research effort

RESEARCH REQUIREMENTS
Research priority for *L. nebulosus* in SA is low but there should be collaborative negotiation towards the declaration of an MPA north of Maputo, as some protection in the central region of southern MOZ is required. Once the new *Lethrinus* sp. has been described, research should be conducted to determine its distribution and stock status both in KZN and southern MOZ waters. Due to the increasing importance of this as yet undescribed species to catches in the area, it should receive high research priority
Research priority: Low for *L. nebulosus*; High for undescribed *Lethrinus* sp.

LUTJANIDAE



SCIENTIFIC NAME: *Aprion virescens* (Smith No. 181.3)
COMMON NAMES: Green jobfish, Kaakap
COMPILER: C Floros
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: February 2012

GLOBAL DISTRIBUTION: Indo-Pacific: East Africa to the Hawaiian Islands, north to southern Japan, south to Australia (Allen 1985)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common north of St Lucia (Floros 2010), observed as far south as Pondoland in the Eastern Cape (Mann et al. 2006)

MOVEMENT: Unknown
Unknown in SA waters. Seasonally resident within large core areas in Hawaii (Meyer et al. 2007)

HABITAT
Adults: Inhabits inshore reef areas, from the surface down to 100m depth (Allen 1985, van der Elst 1993)
Juveniles: Juveniles have been recorded far from land, borne along by ocean currents (van der Elst 1993)
Eggs and larvae: Eggs and larvae pelagic (Leis and Lee 1994, Leis and Rennis 2000)

FEEDING
Adults: Diurnal predator (Dale et al. 2010) feeding mainly on fish, but also on crustaceans and cephalopods (Allen 1985). Consumption of planktonic and mid-water prey suggests pelagic foraging (Allen 1985, Dale et al. 2010)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Reproductive mode is gonochoristic and fertilization is external via egg scattering in open water or near the substratum (Allen 1985)
Breeding/spawning season: Spawning has been recorded from Jan-May (van der Elst 1993) and in Nov (Allen 1985)
Breeding/spawning locality: East Africa (Allen 1985, van der Elst 1993)
Age at 50% maturity: 3-4 years; SA (van der Elst 1993); 4-5 years; Hawaii; 1984-86; disparities in size at sexual maturity between areas may reflect differences in resource utilization and growth rate (Everson et al. 1989)
Length at 50% maturity: 700-750mm TL; SA (van der Elst 1993). Talbot (1960) found that maturity was reached at 410 and 465mm SL in males and females respectively in Kenyan waters

BIOMETRICS
Maximum recorded age: 16 years; Great Barrier Reef; 1995-2005 (Heupel et al. 2009)
Maximum recorded weight: 20.2kg; Japan; 2003; World angling record (IGFA 2012). SA spearfishing record is 16.8kg; KZN; 2005 (SAUFF 2012)
Maximum recorded length: 112cm TL; Female; Seychelles (de Moussac 1988)
Length-length relationship: SL(cm) = 0.81TL(cm); FL(cm) = 0.819TL(cm) (Froese and Pauly 2012)
Length-weight relationship: Wt(kg) = 0.0000294 x $FL(cm)^{2.76}$; KZN (Torres 1991a)
Growth parameters: L_∞ = 683mm FL; K = 0.35; t_0 = -1.53; Great Barrier Reef (Heupel et al. 2009). Based on a sample where the largest individual of 778mm FL, was much smaller than the maximum recorded size

FISHERY
Commonly targeted species by recreational skiboat anglers and spearfishermen, particularly in northern KZN and MOZ (van der Elst 1993, C. Floros, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown but it is apparent that abundance has declined in exploited areas of the St Lucia and Maputaland MPAs (Floros 2010)
Trend in catch composition: Increase in percentage contribution to recreational catch composition since 2002 (NMLS, unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

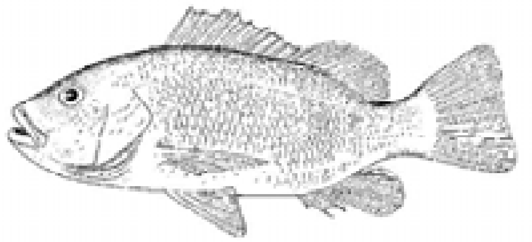
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: No-take sanctuary zones in the St Lucia and Maputaland MPAs have been shown to provide important refuge for numbers of large individuals (Floros 2010)

MANAGEMENT CONSIDERATIONS
Considered to be a “semi-pelagic gamefish species” and thus legally targeted by recreational skiboat anglers and spearfishers in controlled areas of the St Lucia and Maputaland MPAs. However, low numbers, primarily of small individuals occurring in these areas (Floros 2010) in contrast to nearby no-take areas suggests that this species is vulnerable to exploitation due to residency. This species should receive greater protection in these MPAs. Bag and minimum size limits should also be considered for open areas and consideration should be given to decommercializing this species in SA waters to ensure sustainable use

RESEARCH REQUIREMENTS
Need to determine age and growth, movement patterns, early life history, juvenile nursery areas, spawning locality and stock assessment
Research priority: Medium

LUTJANIDAE



SCIENTIFIC NAME: *Lutjanus argentimaculatus* (Smith No. 181.5)
COMMON NAMES: River snapper, Rock salmon, River roman, Mangrove snapper, Red snapper, Mangrove jack
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: December 2011

GLOBAL DISTRIBUTION: Widespread in tropical Indo-West Pacific from Red Sea and Persian Gulf down to SA, and extending eastwards to Samoa and the Line Islands in the Pacific (Allen 1985, Allen and Talbot 1985, Anderson and Allen 1986, van der Elst 1993, Lieske and Myers 1994). Has dispersed into eastern Mediterranean (off Lebanon) but not well established there (Allen 1985)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Occurs in estuaries as far south as Port Elizabeth (Whitfield 1998), uncommon offshore in KZN and EC waters (Chater et al 1993, Floros 2010, Maggs 2011) and little information on relative abundance in MOZ (Maggs et al 2010)

MOVEMENT: Resident
Highly resident with infrequent long-range movements and ontogenetic habitat shift with juveniles moving from inshore estuarine habitats to offshore reefs with the onset of maturity (Russell and McDougall 2005, ORI Tagging Project, unpubl. data)

HABITAT
Adults: Predominantly marine, usually found on coral or rocky reefs down to 80-120m (Allen and Talbot 1985, van der Elst 1993, Whitfield 1998)
Juveniles: About 30-50 days after hatching, juveniles of 18-50mm TL migrate into littoral nursery areas such as brackish mangrove estuaries and the lower part of freshwater streams; within estuaries juveniles prefer rocky areas or the prop roots of mangroves where they can tolerate very low salinity levels (Allen 1985, Allen and Talbot 1985, Doi and Singhagraiwan 1993, van der Elst 1993, Whitfield 1998)
Eggs and larvae: Spawning occurs at sea and eggs and larvae are widely dispersed by currents (Leis 1987, van der Elst 1993, Whitfield 1998). *L. argentimaculatus* has been successfully spawned and raised in captivity and larval development has been well researched (Doi and Singhagraiwan 1993)

FEEDING
Adults: Carnivorous ambush predator taking mostly mugilids and other baitfish species from under rocky ledges and prop roots of mangrove trees in estuaries. A variety of small reef fish, crabs and crayfish are taken in the offshore environment (van der Elst 1993, Kulbicki et al. 2005)
Juveniles: Unknown, most likely small fish and estuarine invertebrates

REPRODUCTION
Reproductive style: Gonochoristic (Thompson and Munro 1983, Grimes 1987)
Breeding/spawning season: Spawning during austral spring and summer (van der Elst 1993, Whitfield 1998, Russell and McDougall 2008) but has been recorded throughout the year in low latitudes (Johannes 1981, Allen 1985). Spawning activity most pronounced during the full and third quarter moon phases (Russell and McDougall 2008)
Breeding/spawning locality: Although not recorded, spawning is thought to occur on offshore reefs in northern KZN and MOZ (van der Elst 1993, Whitfield 1998). In Palau, spawning aggregations recorded in coral reef lagoons and outer reef slopes (Johannes 1978)
Age at 50% maturity: Unknown
Length at 50% maturity: Males: 471mm FL; Females: 531mm FL; Queensland, Australia, 1999-2002 (Russell and McDougall 2008)

BIOMETRICS
Maximum recorded age: 31 years; Papua New Guinea; 1999-2002 (Fry et al. 2006) but has been aged to up to 39 years (Froese and Pauly 2012)
Maximum recorded weight: 16.6kg; SA spearfishing record (SAUFF 2012); 14.1kg; SA shore angling record (SASAA 2012)
Maximum recorded length: 1000-1200mm TL (Allen 1985, van der Elst 1993)
Length-length relationship: Combined sexes: FL(mm) = 0.959TL(mm) + 2.019; Queensland, Australia; n=1514; range 20-735mm TL (Russell and McDougall 2008)
Length-weight relationship: Combined sexes: $Wt(g) = 0.028 \times FL(cm)^{2.844}$; New Caledonia; n=308 (Kulbricki et al. 2005b)
Growth parameters: Combined sexes: L_∞ = 105cm TL; K = 0.187; Malaysia (Ambak et al. 1985)

FISHERY
Popular species with estuarine sport anglers in KZN and the EC, also infrequently taken by recreational and commercial skiboat fishers and spearfishers mainly in northern KZN and MOZ. Also caught by subsistence and artisanal fishers in Kosi Bay using gill-nets and fish traps (Kyle 1986, Kyle 1999, van der Elst 1993). Elsewhere in the world this species is captured with handlines, nets and traps and is an important species for coastal mariculture (Doi and Singhagraiwan 1993, Emata et al. 1999)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Decline in CPUE between 1981-84 in the Kosi Bay trap fishery (Kyle 1986). Decline from 0.008 to 0.004 fish.angler^{-1}.hr^{-1} between 1986-99 in the Kosi Bay recreational linefishery (James et al. 2001)
Trend in catch composition: Decrease in percentage composition between 1981-84 in Kosi Bay trap fishery (Kyle 1986). Percentage composition fluctuated between 2-6.3% between 1986-99 in the Kosi Bay recreational linefishery (James et al. 2001)
Trend in mean size: Mean mass fluctuated between 2.2-3.3kg between 1986-99 in the Kosi Bay recreational linefishery (James et al. 2001)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Owing to their residency (Russell and McDougall 2005), adults of this species most likely benefit from protection in the St Lucia and Maputaland Marine Reserves and to a lesser extent in the Aliwal Shoal and Pondoland MPAs. Juveniles also most likely receive protection in estuarine systems closed to fishing such as the St Lucia Wilderness Area, Lake Amanzimnyama in Kosi Bay and the Mtentu and Msikaba estuaries in the Pondoland MPA (B. Mann, ORI, pers. comm.)

MANAGEMENT CONSIDERATIONS
Although at the southernmost extent of its distribution, estuarine degradation in KZN has probably had a serious effect on populations of this estuarine-dependent species. Protection of suitable estuarine habitat along the KZN and EC coasts should be seen as a high priority

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, stock assessment, stock distribution, movement, early life history, mariculture potential
Research priority: Medium

LUTJANIDAE

SCIENTIFIC NAME: *Lutjanus rivulatus* (Smith No. 181.16)
COMMON NAMES: Speckled snapper, Blubberlip snapper
COMPILER: BQ Mann
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Indo-Pacific: East Africa to Tahiti, north to southern Japan, south to Australia (Allen 1985, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common along the southern MOZ and Maputaland coast (B. Mann, ORI, pers obs.), rare south of Durban (Heemstra and Heemstra 2004)

MOVEMENT: Resident
A highly resident species with a small home range size of a few 100m^2 (Mann 2012). Of the 1 490 tagged in the ORI Tagging Project, a remarkable 564 (37.85%) have been recaptured with a mean distance travelled of 1km. However, some individuals (approximately 5% of the population) undertake larger movements, some in excess of 100km (Mann 2012)

HABITAT
Adults: Found on coral and rocky reefs from the surf-zone out to depths of 100m, often associated with caves and ledges (van der Elst 1993, Sommer et al. 1996, Heemstra and Heemstra 2004)
Juveniles: Surf-zone reefs and subtidal gullies (B. Mann, ORI, pers. obs.), also over shallow, algae dominated reef flats (Kuiter and Tonozuka 2001)
Eggs and larvae: Little known, pelagic eggs not recorded on the KZN south coast (Connell 2012)

FEEDING
Adults: Reef fishes, cuttlefish, crabs, crayfish, octopus, polychaete worms and other benthic invertebrates (Allen 1985, van der Elst 1993)
Juveniles: Similar to adults but smaller prey (B. Mann, ORI, pers. obs.)

REPRODUCTION
Reproductive style: Dioecious, batch spawner (Allen 1985)
Breeding/spawning season: Spawns during summer (van der Elst 1993, Heemstra and Heemstra 2004)
Breeding/spawning locality: Mainly in tropical regions (van der Elst 1993)
Age at 50% maturity: Unknown
Length at 50% maturity: 45-50cm TL (Allen 1985, van der Elst 1993, Heemstra and Heemstra 2004). Lau and Li (2000) recorded maturity at 37cm FL in the Asia-Pacific region

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 12.3kg; KZN; 2004; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 80cm TL (Randall 1995, Heemstra and Heemstra 2004)
Length-length relationship: TL(cm) = 1.029FL(cm); Based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000781 x FL(mm)$^{2.806}$; St Lucia Marine Reserve, KZN; n=77 (B. Mann, ORI, unpubl. data). Combined sexes: Wt(g) = 0.00843 x FL(cm)$^{3.26}$; New Caledonia; n=12 (Kulbricki et al. 2005b)
Growth parameters: Combined sexes: L_∞ = 64.5cm FL; K = 0.33; Papua New Guinea; determined using ELEFAN 1 (Munro and Williams 1985). Mann (2012) determined the mean growth rate of 328 recaptured speckled snapper (280-580mm FL) to be relatively slow at 39mm per year

FISHERY
Mainly caught by shore fishers along the KZN north coast and occasionally speared by divers (van der Elst 1993). A valuable food fish caught by artisanal fishers in MOZ and elsewhere in tropical East Africa (B. Mann, ORI, pers. obs.). Farmed in Taiwan and sold live on the Hong Kong fish market (Lee and Sadovy 1998)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.55 yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown

F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: M estimated from Pauly's equation (Munro and Williams 1985)

STOCK STATUS
Status: Not assessed
Trend in CPUE: CPUE in the fished area of the St Lucia Marine Reserve (south of the no-take sanctuary area between Cape Vidal and Leven Point) has shown a significant increase (0.05 to 0.15 fish.angler^{-1}.hr^{-1}) from 2001-12, which is likely associated with the implementation of the beach driving ban in Jan 2002 (Mann 2012). Little is known about speckled snapper outside the marine reserve but populations are thought to have been fished down to very low levels due to their high residency and vulnerability to capture (B. Mann, ORI, pers. obs.)
Trend in catch composition: Contribution to catch composition has increased from 10% to 15% by number from 2001-12 in the fished area of the St Lucia Marine Reserve (south of the no-take sanctuary area between Cape Vidal and Leven Point) since the implementation of the beach driving ban in Jan 2002 (Mann 2012). Outside MPAs, speckled snapper contributes a very small percentage of shore anglers' catches (Dunlop and Mann 2012)
Trend in mean size: A significant increase in mean size of speckled snapper (from 275 to 335mm FL) was recorded in the fished area of the St Lucia Marine Reserve (south of the no-take sanctuary area between Cape Vidal and Leven Point) since the implementation of the beach driving ban in Jan 2002 (Mann 2012). No data on trends outside MPAs.
Trend in sex ratio: Unknown

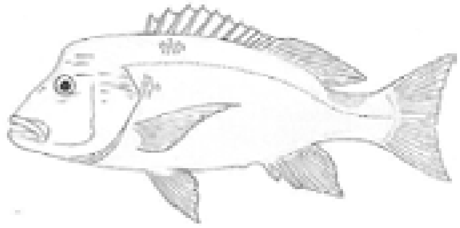
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: This resident species receives protection within the no-take sanctuary areas of the St Lucia and Maputaland MPAs (Mann 2012). As no bottom fishing is allowed from a vessel anywhere within these MPAs, adults on deeper offshore reefs also receive protection throughout the St Lucia and Maputaland MPAs. Likely to also receive protection in the no-take area of the Ponto do Ouro Partial Marine Reserve in MOZ (Miguel Gonclaves, PPF, pers. comm.)

MANAGEMENT CONSIDERATIONS
Although well protected in the St Lucia and Maputaland MPAs, it is likely that speckled snapper have been heavily depleted in exploited areas along the KZN north coast due to their high level of residency and vulnerability to capture. As a consequence, the introduction of a strict daily bag limit of 1pppd and a minimum size limit of 40cm TL should be considered as a precautionary measure

RESEARCH REQUIREMENTS
Age and growth, reproductive biology, stock assessment, early life history
Research priority: Medium

LUTJANIDAE



SCIENTIFIC NAME: *Lutjanus sanguineus* (Smith No. 181.18)
COMMON NAMES: Blood snapper, Humphead snapper
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Western Indian Ocean. From the Red Sea east to the Arabian Sea and south to SA. Records from the eastern Indian Ocean and the Western Central Pacific are most likely to be misidentifications of *L. malabaricus* (Allen 1985)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA, occurs as far south as Algoa Bay (Anderson and Allen 2003), but seldom observed south of KZN (B. Mann, ORI, pers. obs.)

MOVEMENT: Unknown
Likely to be fairly resident similar to other lutjanids

HABITAT
Adults: Coral and rocky reefs to at least 100m (Allen 1985). In SA, the species has a preference for slightly silty, turbid regions in the vicinity of offshore banks (van der Elst 1993)
Juveniles: Unknown
Eggs and larvae: Most likely pelagic (Leis 1987)

FEEDING
Adults: Primarily a nocturnal feeder, preying mainly on reef-dwelling fish and on invertebrates such as prawns, crabs, mantis shrimp, squid and zooplankton (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic (Allen 1985, Grimes 1987)
Breeding/spawning season: Allen (1985) reported spawning off East Africa during the austral spring and summer, with peak activity in Oct, while van der Elst (1993) reported spawning off tropical East Africa during Jun-Jul (austral winter)
Breeding/spawning locality: Tropical regions of East Africa (Allen 1985). No reproductively active fish or small juveniles have been observed in SA waters (van der Elst 1993)
Age at 50% maturity: 6 years; East Africa (van der Elst 1993). Lee and Al-Baz (1989) estimated maturity at 2.5-3 years in the Arabian Gulf
Length at 50% maturity: 50-55cm TL; East Africa (van der Elst 1993). Lee and Al-Baz (1989) estimated length at maturity to be 47.3cm TL in the Arabian Gulf

BIOMETRICS
Maximum recorded age: 13 years; Gulf of Aden and Red Sea; 1982-83; estimated maximum age (Kedidi and Bouhlel 1985, Sanders and Morgan 1989)
Maximum recorded weight: 22-23kg (Lieske and Myers 1994, Anderson and Allen 2003). SA spearfishing record only 9.5kg (SAUFF 2012)
Maximum recorded length: 85-100cm TL (Allen 1985, Lieske and Myers 1994)
Length-length relationship: TL(cm) = 1.036FL(cm); TL(cm) = 1.177SL(cm); Based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0184 x FL(cm)$^{2.92}$; SA (Torres 1991a)
Growth parameters: L_∞ = 89cm; K = 0.236; t_0 = 0.281; Gulf of Aden and Red Sea; 1982-83 (Kedidi and Bouhlel 1985)

FISHERY
Bulk of catch taken by commercial ski-boat fishers in northern KZN and MOZ. Also occasionally taken by recreational ski-boat anglers in KZN (van der Elst 1993). Rarely taken by spearfishers in SA waters (van der Elst 1993), primarily due to the preference of this species for deeper water. Also taken by handlines, vertical longlines, traps and occasionally by trawl along the East African coast (Allen 1985)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.34yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown

F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: M estimated by Sanders and Morgan (1989)

STOCK STATUS
Status: Not assessed
Trend in CPUE: Inspections of recreational ski-boats on the KZN coast show slightly elevated CPUE between 1992-96, otherwise CPUE generally very low (NMLS unpubl. data)
Trend in catch composition: Inspections of recreational ski-boats on the KZN coast show slightly elevated catch contribution between 1992-96, otherwise contribution generally very low (NMLS unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: As documented in other lutjanids, blood snapper is likely to be a fairly resident species, and are therefore likely to benefit from protection in the St Lucia and Maputaland MPAs in northern KZN. Although blood snapper are found as far south as Algoa Bay in the vicinity of other MPAs, they are most prevalent off northern KZN

MANAGEMENT CONSIDERATIONS
As blood snapper reaches its southern distribution limit and is unlikely to spawn in SA waters, management should be focused in more tropical areas of East Africa (e.g. MOZ, Tanzania and Kenya) where this species is more abundant and important to local fisheries

RESEARCH REQUIREMENTS
Age and growth, stock assessment, early life history, movement behaviour, spawning areas
Research priority: Low

LUTJANIDAE

SCIENTIFIC NAME: *Lutjanus sebae* (Smith No. 181.19)
COMMON NAMES: Emperor snapper, Emperor red snapper
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Indo-West Pacific, southern Red Sea and East Africa across to New Caledonia, north to southern Japan and south to Australia (Heemstra and Heemstra 2004, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: KZN, MOZ
In SA waters known to occur as far south as Durban (van der Elst 1993, Heemstra and Heemstra 2004)

MOVEMENT: Resident
Sumpton et al. (2008)

HABITAT
Adults: Coral and rocky reefs down to at least 100m depth (Allen 1985, Anderson and Allen 2003), with some reported down to 180m off the Great Barrier Reef (McPherson and Squire 1992)
Juveniles: Frequently commensal with sea urchins, sometimes found in estuarine mangrove areas (Allen 1985, van der Elst 1993, Heemstra and Heemstra 2004)
Eggs and larvae: Pelagic (Leis and Rennis 2000)

FEEDING
Adults: Feeds by day and night primarily on crustaceans such as crabs, shrimps and crayfish, fish and squid are also occasionally eaten (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Broadcast spawner, gonochoristic (Allen 1985, Grimes 1987, Froese and Pauly 2012)
Breeding/spawning season: Protracted summer spawning from Oct-Mar (van der Elst 1993, Froese and Pauly 2012)
Breeding/spawning locality: Recorded from Great Barrier Reef, Australia and New Caledonia (Froese and Pauly 2012), likely to occur in more tropical areas throughout its distribution (van der Elst 1993)
Age at 50% maturity: van der Elst (1993) reported age at maturity as 4 years in East Africa. However, Newman and Dunk (2002) and Grandcourt et al. (2008) report age at maturity to be 8 and 9 years in NW Australia and the Seychelles respectively
Length at 50% maturity: 61-63cm FL; Seychelles; 1977-2006 (Mees 1992, Grandcourt et al. 2008)

BIOMETRICS
Maximum recorded age: Males: 30 years; Females: 34 years; NW Australia; 1997-99 (Newman and Dunk 2002)
Maximum recorded weight: 27kg (Anderson and Allen 2003); 32.7kg; Great Barrier Reef (McPherson and Squire 1992)
Maximum recorded length: 100cm TL (Allen 1985); 81cm FL; Male; Great Barrier Reef (McPherson and Squire 1992)
Length-length relationship: Combined sexes: TL(mm) = 1.0654FL(mm) + 3.5947;
FL(mm) = 1.1521SL(mm) + 11.823; NW Australia (Newman and Dunk 2002)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00002051 \times FL(mm)^{3.0147}$; NW Australia (Newman and Dunk 2002). Combined sexes: $Wt(g) = 0.019 \times FL(cm)^{3.01}$; Seychelles (Grandcourt et al. 2008)
Growth parameters: Combined sexes: L_∞ = 524.77mm FL; K = 0.233, t_0 = 0.0563; NW Australia (Newman and Dunk 2002). Combined sexes: L_∞ = 78.7cm FL; K = 0.14, t_0 = -1.9; Seychelles (Grandcourt et al. 2008)

FISHERY
Rare along the SA coast and only occurs on the extreme KZN north coast and in MOZ waters. As a consequence it is seldom taken by recreational and commercial ski-boat fishers but occasional fish are caught south of the St Lucia Marine Reserve (J. Maggs, ORI, pers. obs.). Seldom taken by spearfishers in KZN because of its preference for deeper water. Elsewhere caught on line, in traps and trawled on flat reefs (Heemstra and Heemstra 2004)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.09yr^{-1}$
Natural mortality rate (M): $0.12yr^{-1}$
Total mortality rate (Z): $0.21yr^{-1}$

F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters. The mortality estimates given are based on a study conducted by Grandcourt et al. (2008) in the Seychelles

STOCK STATUS
Status: Not assessed in SA waters
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

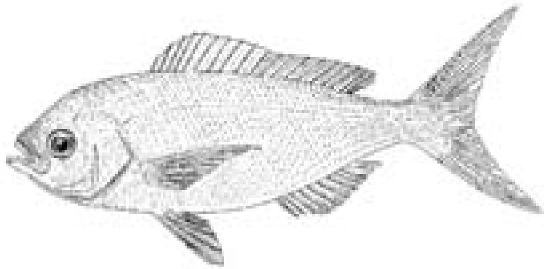
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Emperor snapper are a resident reef species (Sumpton et al. 2008), and is therefore likely to benefit from protection in the St Lucia and Maputaland marine reserves in northern KZN where they are most prevalent within SA waters (J. Maggs, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Within SA waters, emperor snapper are at the southern limit of their distribution and are already strictly protected with the St Lucia and Maputaland MPAs. However, this is likely to be a shared stock with MOZ where it is currently being heavily exploited, especially in northern MOZ (S. Fennessy, ORI, pers. comm.). Better protection of this species is thus required in MOZ waters, including the establishment and enforcement of an MPA north of Maputo

RESEARCH REQUIREMENTS
MOZ authorities need to consider focused research on this species to ensure its sustainable utilization. This should include improvement of catch statistics as currently this species is not differentiated from other snapper species (Fennessy et al. 2012). An age and growth study and stock assessment may also be warranted
Research priority: Low

LUTJANIDAE



SCIENTIFIC NAME: *Paracaesio xanthura* (Smith No. 181.21)
COMMON NAMES: Protea bream, Yellowtail fusilier, Yellowtail blue snapper
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Indo-Pacific: East Africa across to Indonesia, north to southern Japan, south to south-eastern Australia (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: KZN, MOZ
In SA, range extends to southern KZN (King and Fraser 2002), where it is caught seasonally in fair numbers, particularly off the Shelly Beach area (NMLS unpubl. data)

MOVEMENT: Resident
Limited data, but diving observations indicate that large reef-associated shoals are present year round in the Park Rynie area on the KZN south coast (A. Connell, 2012, pers. comm.). Strong seasonality in reported catches almost certainly reflects a switch in feeding behaviour, rather than a migration away from the area

HABITAT
Adults: Forms large shoals over offshore rocky and coral reefs in depths of 20-200m (Fischer and Bianchi 1984, Allen 1985)
Juveniles: Unknown
Eggs and larvae: Pelagic (Connell 2012)

FEEDING
Adults: Predominantly zooplankton (Allen 1985)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Austral summer (Connell 2012)
Breeding/spawning locality: Eggs recorded on the 20-30m depth contour off Park Rynie on the KZN south coast (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 2.85kg; KZN; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 45-50cm TL (Anderson and Allen 1991, NMLS unpubl. data)
Length-length relationship: FL(cm) = 0.863TL(cm); SL(cm) = 0.927FL(cm) (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0227 x SL(cm)^3, Papua New Guinea; based on a sample of 2 fish (Froese and Pauly 2012)
Growth parameters: Unknown

FISHERY
Primarily caught by commercial and recreational boat-based linefishers on offshore reefs along the KZN south coast. Greatest commercial and recreational landings of this species recorded at the Shelly Beach and Port Shepstone launch-sites on the KZN south coast during winter and early spring. Occasionally taken by spearfishers (NMLS unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Recreational skiboat sector: upward trend in mean annual numerical CPUE; Commercial skiboat sector: downward trend in weight-based CPUE (NMLS unpubl. data)
Trend in catch composition: Recreational skiboat sector: increasing contribution to reported catch in numbers but has never contributed more than 0.6%; Commercial skiboat sector: decreasing contribution to total catch in terms of weight (NMLS unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

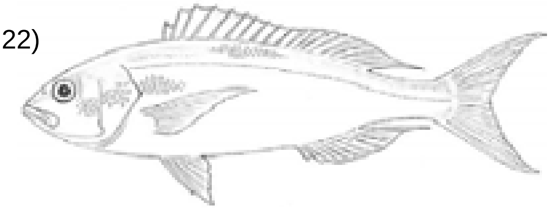
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Most likely benefits from spatial protection in the St Lucia and Maputaland MPAs in northern KZN, where it has been observed in deep water (Heemstra et al. 2006). Abundant in the vicinity of the Aliwal Shoal MPA (Connell 2012), but currently this MPA provides inadequate spatial protection for resident reef fishes

MANAGEMENT CONSIDERATIONS
Primarily a zooplanktivore and therefore difficult to target by linefishing. Consequently this species is currently of limited importance to the linefishery as shown by the catch contribution. However, slight increases in CPUE and catch contribution in the recreational sector may suggest an improvement in targeting or declines in catches of other species. It may, therefore, be necessary to increase the level of protection in the Aliwal Shoal MPA, especially for resident reef fishes, so that catches of *P. xanthura* can be sustained into the future

RESEARCH REQUIREMENTS
Very little is known about the biology and population dynamics of this species
Research priority: Low

LUTJANIDAE



SCIENTIFIC NAME: *Pristipomoides filamentosus* (Smith No. 181.22)
COMMON NAMES: Rosy jobfish, Crimson jobfish
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Indo-Pacific: East Africa to Hawaii and Tahiti, north to southern Japan, and south to eastern Australia and Lord Howe Island (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA, south to Algoa Bay (Anderson and Allen 2003, Heemstra and Heemstra 2004)

MOVEMENT: Unknown
More pelagic than most other lutjanid species and often caught in midwater (van der Elst 1993), however, it is likely to be fairly resident as with most other lutjanids (Allen 1985)

HABITAT
Adults: Occurs down to at least 270m (Anderson and Allen 2003), although sometimes found in shallower water when conditions are favourable (van der Elst 1993). Associated with reef, sandy and muddy bottom, but often seen or caught in midwater (van der Elst 1993)
Juveniles: Juveniles reported to occur over relatively flat, soft bottom (>60 m deep) in Hawaii (Parrish 1989)
Eggs and larvae: Pelagic (Leis and Rennis 2000)

FEEDING
Adults: Small fishes, mantis shrimps, mysids, squid, crabs, amphipods, ascidians and pelagic items such as salps and urochordates (Allen 1985, van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic, batch, broadcast spawner (Grimes 1987, Froese and Pauly 2012)
Breeding/spawning season: Unknown in SA, summer months from Oct-Apr, peaking in Feb in Seychelles (Mees 1993)
Breeding/spawning locality: Unknown in SA, in the Western Indian Ocean, spawning reported from the Mahé Plateau, Seychelles (Mees 1993)
Age at 50% maturity: Unknown
Length at 50% maturity: Combined sexes: 36-52cm FL; Seychelles; 1989-1990 (Mees 1993)

BIOMETRICS
Maximum recorded age: 18 years; Hawaii (Manooch 1987)
Maximum recorded weight: 8.2kg; Hawaii (Honebrink 1990). SA spearfishing record: 7kg; KZN (SAUFF 2012)
Maximum recorded length: 89cm TL; Seychelles (Mees 1993)
Length-length relationship: FL(cm) = 0.893TL(cm); derived from photograph (Froese and Pauly 2012)
Length-weight relationship: Females: Wt(g) = 0.0553 x $FL(cm)^{2.693}$; Males: Wt(g) = 0.0514 x $FL(cm)^{2.78}$; Mahé Plateau; Seychelles (Mees 1993)
Growth parameters: L_∞ = 75.8cm FL; K = 0.244; t_0 = -0.3; Mahé Plateau, Seychelles (Mees and Rosseau 1997)

FISHERY
Taken in fair numbers during summer by recreational and commercial skiboat fishers along the Zululand coast in northern KZN, also on Protea Banks on the KZN lower south coast (van der Elst 1993). Preference for deep water and generally being of small size, makes it of limited importance in the spearfishery (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.277yr^{-1}
Natural mortality rate (M): 0.534yr^{-1}
Total mortality rate (Z): 0.811yr^{-1}
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Mortality estimates based on a study done by Mees (1993) on the Mahé Plateau, Seychelles from 1989-90 using Jones' length cohort analysis

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

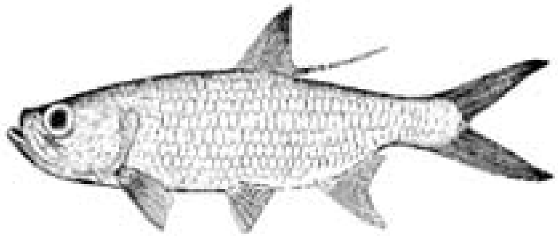
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably benefits from protection in the St Lucia and Maputaland MPAs but not recorded in the Pondoland MPA in the EC (Fennessy et al. 2003)

MANAGEMENT CONSIDERATIONS
A large proportion of the SA population is either protected in MPAs or cannot be targeted because of its preference for deeper water on the shelf-edge where strong surface currents often make linefishing difficult. However, this is an important linefish species in MOZ waters where improved management is required (Fennessy et al. 2012)

RESEARCH REQUIREMENTS
Little known about this species and better information is required on its biology and stock status, especially in MOZ waters
Research priority: Low

MEGALOPIDAE



SCIENTIFIC NAME: *Megalops cyprinoides* (Smith No. 37.1)
COMMON NAMES: Oxeye tarpon, Indo-Pacific tarpon
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Tropical Indo-West Pacific species extending into the sub-tropical waters of SA (Whitefield 1998). Red Sea south to SA (Smith 2003), eastwards to Hawaii (Whitehead 1984)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Occurs along the East African coast down to KZN (van der Elst 1993), occasionally being found as far south as Algoa Bay (Smith 2003). Recorded from as far inland as Malawi and Zimbabwe (Skelton 1993) and to a depth of 50m (Pusey et al. 2004)

MOVEMENT: Unknown
Only 69 *M. cyprinoides* have been tagged in the ORI Tagging Project and none have been recaptured. Juveniles appear to remain in estuaries (or connected freshwater bodies) until reaching maturity (Mann and van der Elst 2000). Adults presumably migrate out to sea to spawn and may re-enter estuaries once spawning is complete (Harris and Cyrus 1995). However, Harris and Cyrus (1997) classify this species as a facultative catadromous species implying flexibility in movement behaviour and habitat usage

HABITAT
Adults: Solitary species found in shallow coastal waters, but favours estuaries and mangrove swamps, completely tolerant of freshwater, often recorded from freshwater pans and rivers on the KZN north coast and MOZ, nowhere abundant (van der Elst 1993, Whitfield 1998, Smith 2003)
Juveniles: Appear to be attracted into brackish or freshwater lakes and pans, which they enter from adjacent estuaries during high rainfall periods (Whitfield 1998). Harris and Cyrus (1995) classify the leptocephali larvae as estuarine dependent. In Papua New Guinea, individuals have been recorded returning to the sea before reaching maturity (Coates 1987)
Eggs and larvae: Leptocephali larvae enter estuaries at between 17-31mm SL (Harris and Cyrus 1995)

FEEDING
Adults: Diurnal (Coates 1987), voracious feeder, consuming small pelagic fish, fry of larger species and shrimps (van der Elst 1993), crustaceans (Fischer et al. 1990) and terrestrial insects (Coates 1987)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic, external fertilisation (Coates 1987)
Breeding/spawning season: Unknown
Breeding/spawning locality: Spawning at sea (Whitfield 1998, Froese and Pauly 2012)
Age at 50% maturity: 2 years; approximate age at first maturity (Pusey et al. 2004)
Length at 50% maturity: 25-30cm SL; India; approximate length at first maturity (Talwar and Jhingran 1991, Pusey et al. 2004)

BIOMETRICS
Maximum recorded age: 44 years (Kulkarni 1983)
Maximum recorded weight: 5.7kg; SA shore angling record (SASAA 2012); 2.99kg; Australia; World angling record (IGFA 2012). Bell-Cross and Minshull (1988) reported oxeye tarpon reaching 18kg in Zimbabwe
Maximum recorded length: 100cm TL (Smith 2003); 70cm SL (Whitfield 1998). Rahman (1989) recorded oxeye tarpon reaching 150cm TL in Bangladesh but this record needs verification (Adams et al. 2012)
Length-length relationship: FL(cm) = 0.784TL(cm); SL(cm) = 0.924FL(cm); based on photograph (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.01291 \times TL(cm)^{2.885}$; KZN (van der Elst and Adkin 1991); $Wt(g) = 0.0161 \times SL(cm)^{3.052}$; SA estuaries (Harrison 2001)
Growth parameters: Unknown

FISHERY
Although relatively seldom caught, *M. cyprinoides* is sought after for its fighting qualities and is targeted by anglers using light spinning or fly tackle (van der Elst 1993). Occasionally caught in the illegal gill-net fishery in St Lucia (Mann 1995) and in the beach-seine fishery in Durban (B. Mann, ORI, pers. obs.) but is considered to be of poor eating quality (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2012 (Adams et al. 2012d)

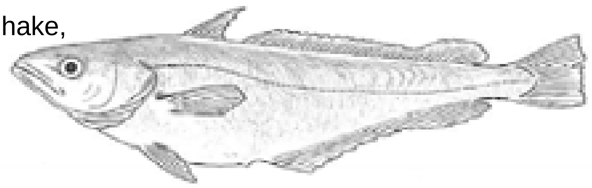
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: No evidence of effective MPAs, however, some protection may be obtained in the Lake St Lucia Wilderness Area and Lake Amanzinyama (Kosi Bay) as fishing is prohibited in both areas (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Populations of oxeye tarpon may have been reduced in KZN due to riverine and estuarine degradation. More estuarine protected areas should be considered in KZN and MOZ. As a precautionary measure, consideration should be given to managing this fish as a recreational species (i.e. no sale) and implementing a minimum size limit of 40cm TL and a daily bag limit of 5 fish pppd

RESEARCH REQUIREMENTS
Age and growth, stock assessment, early life history, maturity, fishery related trends, movement
Research priority: Low

MERLUCCIIDAE

SCIENTIFIC NAME: *Merluccius capensis* (Smith No. 89.4)
COMMON NAMES: Shallow-water hake, Shallow-water Cape hake, Cape hake (Namibia), Vlakwater-stokvis
COMPILER: RW Leslie
REVIEWER: D Durholtz
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: South-eastern Atlantic and western Indian Oceans on the continental shelf from southern Angola (Farta Bay 12° 30') on the west coast to KZN on the east coast (Cohen et al. 1990, Smith and Heemstra 1991, Lloris et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Main stock in waters shallower than 300m, but has been recorded to depths of 508m (DAFF unpubl. data). Stock structure uncertain. Differences in body and eye colour between NAM and SA populations suggest different stocks north and south of the environmental barrier off Luderitz. This proposed stock structure is supported by some, but not all genetic studies (Grant et al. 1987, 1988, von der Huyden et al. 2007, 2010, Bloomer et al. 2009)

MOVEMENT: Resident
Individuals move to deeper water with age so that the mean size increases with increasing water depth

HABITAT
Adults: Wide range of habitats from rough, rocky bottom to sandy substrates. Main population in waters shallower than 300m, but have been recorded at 508m during DAFF research cruises
Juveniles: Similar to adults, but in shallower waters. Zero-year fish often found in oxygen-deficient inshore waters e.g. off the Orange River. This could indicate a high tolerance to low oxygen conditions providing protection from predators
Eggs and larvae: Spawn over the shelf. Eggs remain at or below the thermocline

FEEDING
Adults: Mainly piscivorous, but may also eat cephalopods and crustacea. Most common prey is deep-water hake *Merluccius paradoxus* (Payne et al. 1987, Punt et al. 1992)
Juveniles: Early juveniles prey on euphausids and amphipods, but become more piscivorous with increasing size. Largely piscivorous diet from about 25cm total length (Payne et al. 1987, Punt et al. 1992)

REPRODUCTION
Reproductive style: In common with other hake species this is a batch spawner (Murua et al. 1998, Macchi et al. 2004, Osborne 2004)
Breeding/spawning season: All year, but with peak spawning in Sep-Oct
Breeding/spawning locality: Widespread on the continental shelf, but with some localised seasonal aggregations
Age at 50% maturity: Males: 2.2 years; Females: 4.1 years; SA west coast; 1986-89 (Punt and Leslie 1991); Based on macroscopic maturity staging
Length at 50% maturity: Males: 29.5cm TL; Females: 46.8cm TL; SA west coast; 1986-89 (Punt and Leslie 1991). Singh et al. (2011) found a greater length at 50% maturity for females of 53.4-57.2cm TL based on histological (microscopic) gonad staging

BIOMETRICS
Maximum recorded age: Female: 13 years; SA south coast; 1986-89 (DAFF unpubl. data). This fish was a 99cm TL female but larger fish that have not been aged have been recorded, so maximum age is likely to be greater than 13 years
Maximum recorded weight: Female: 12kg; SA west coast; 1986. This was the heaviest fish recorded in DAFF research surveys (1985-2011)
Maximum recorded length: 108cm TL; SA west coast, June 1987. This was the longest fish recorded in DAFF research surveys (1985-2011) but fish of up to 115cm TL have been seen on commercial vessels (R. Leslie, DAFF, pers. obs.)
Length-length relationship: SL(cm) = 0.9TL(cm); based on photograph measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.0057 x $TL(cm)^{3.073}$; SA West and South Coasts; Geometric mean based on a number of studies (Punt and Leslie 1991, Fairweather 2008)
Growth parameters: Males: L_∞ = 144.6cm TL; K = 0.086; t_0 = -0.449; Females: L_∞ = 260.9cm TL; K = 0.041; t_0 = -0.707; Combined sexes: L_∞ = 270.6cm TL; K = 0.039; t_0 = -0.73; SA West Coast (Punt and Leslie 1991)

FISHERY
The two hake species are the main target species of the offshore demersal trawl fishery, but about 70-80% of the hake catch is *M. paradoxus* (Glazer 2012). Although *M. capensis* is less important to this sector, it nonetheless takes more *M. capensis* than any other fishing sector. About 8% of the global hake TAC is allocated to the inshore hake trawl sector. *M. capensis* is the main target species of this fishery and is the dominant species in the catch, however the total catch is less than that taken by the offshore trawl sector. 10% of the global hake TAC is allocated to hake longline plus hake handline. The majority of the hake catch taken by the hake longline and hake handline sectors is *M. capensis*. However many of the hake longline and hake handline right holders are not currently active due to the current economic climate. Some hake (mainly *M. capensis*) is taken as unavoidable bycatch in the midwater trawl fishery for horse mackerel

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): $1.0yr^{-1}$ for juveniles and $0.4yr^{-1}$ for adults
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: The harvest reference points used to manage the hake resource differ from those generally used for linefish species (see below)

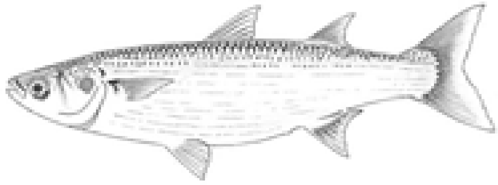
STOCK STATUS
Stock assessment method: Dynamic, age-structured production model
Year completed: 2006
Locality: SA west and south coasts
Status: 40-50% - optimally exploited. The harvest reference points used to manage the hake resources differ from those generally used for linefish species. The base case assessment in 2006 yielded the following: Pristine and Current Spawner biomass 620 and 317 thousand tons respectively; SP/K = 0.51 (Rademeyer 2012). This estimate, based on the best fit to the data, could be interpreted as indicating that *M. capensis* is underfished. However, there are some indications that the *M. capensis* estimates may be optimistic for example the estimated current biomass for *M. capensis* is 3 times higher than that for *M. paradoxus*, its major prey. This could be an artefact of the fact that the commercial catch records do not differentiate between the two hake species, so the proportion of *M. capensis* in the hake catch is estimated based on the expected hake species ratio for the fishing depth
Trend in CPUE: GLM-standardised CPUE for *M. capensis* taken by offshore trawl declined from a peak of over 1.4 $kgs.min^{-1}$ in 1992 to a minimum of about 0.4 $kg.min^{-1}$ in 2007. Has since shown a rapid increase to over 1.2 $kg.min^{-1}$ in 2011 (Glazer 2012). CPUE trend from the inshore trawl fleet is not used for assessment purposes as these data have not been standardised
Trend in catch composition: Fishery dependent
Trend in mean size: Fishery dependent
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Traditional commercial sector: 5pppd; Hake handline sector: unlimited, but annual maximum catch limit applies
Minimum size limit: None
Closed Season: None
Other regulations: Hake handline sector is managed by a TAE with a maximum catch limit for the sector. Demersal trawl and longline fisheries are managed by a TAC with individual allocations to Right Holders
MPA effectiveness: May receive some protection in large no-take MPAs off the south-eastern seaboard of SA which extend far enough out to sea to include suitable habitat for juveniles of this species

MANAGEMENT CONSIDERATIONS
Current management is fully effective and no further improvements are required. The resource is currently at a level of almost twice MSY and the spawning biomass is about 70% of pristine. EAF aspects with regard to management of the various fishery sectors which harvest *M. capensis* (e.g. vulnerable habitats, seabird mortalities, bycatch issues, etc.) require further consideration

RESEARCH REQUIREMENTS
Routine demersal surveys (and research into possible sources of error/bias); routine collection and analysis of fishery catch data; routine stock assessments; validation of age determination method; further investigation is required into maturity, fecundity, feeding, movement patterns, stock structure and impacts of climate change
Research priority: High



SCIENTIFIC NAME: *Liza richardsonii* (Smith No. 222.7)
COMMON NAMES: Harder, Southern mullet, Bokkoms (dried mullet)
COMPILER: SJ Lamberth
REVIEWER: AK Whitfield
DATE OF REPORT COMPLETION: September 2012

GLOBAL DISTRIBUTION: Lobito (Angola) to the warm temperate, subtropical transition zone on the east coast of SA. Rare in the eastern subtropical bioregion north of Port Edward or in western tropical waters to the north of Lobito
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Contributes 99% of mullet biomass on the cool temperate west coast, 70% in the cool/warm temperate transition zone, 50% on the warm temperate east coast and 4% in the warm temperate/subtropical transition zone (Lamberth and Hutchings 2011)

MOVEMENT: Nomadic
Are "resident" in the surf zone and nearshore marine environment for most of the year but form large shoals in autumn and spring prior to movement, often in no apparent direction. East coast residency usually coincides with the development of surf zone phytoplankton (*Anaulus*) patches during the summer months but disperse to feed on other food sources during winter (Lamberth et al. 1995)

HABITAT
Adults: Nearshore marine environment, surf-zone, estuaries, lower freshwater reaches of river systems but has been recorded more than 100km from the sea (Lamberth et al. 2008). Opportunistic species swimming between optimum conditions to maximise benefits (Lamberth et al. 2010). It is also tolerant of adverse physico-chemical conditions, can survive salinity levels of 90ppt and practices surface breathing during hypoxic and anoxic events (Lamberth et al. 2010, Whitfield 1998)
Juveniles: Nearshore, surf-zone, estuaries, lower reaches of river systems. Estuary fish physiologically healthier than marine ones (De Decker and Bennett 1985)
Eggs and larvae: Nearshore, surf-zone and in estuaries

FEEDING
Adults: Have the mugillid gastric mill for processing food. Feed on detritus, benthic diatoms, benthic invertebrates, zooplankton, epiphytes and surf-zone phytoplankton *Anaulus* spp. Bioturbation by the sand-prawn *Callichurus kraussi* reduces availability of benthic diatoms as food to *Liza richardsonii* (Pillay et al. 2012).
Juveniles: Zooplankton, benthic diatoms, surf-zone phytoplankton and detritus (Romer 1986). Diet of post larval fish <20 mm mainly copepods and macruran larvae (Whitfield 1998)

REPRODUCTION
Reproductive style: Gonochorist
Breeding/spawning season: Spring and summer with early and late summer peaks. Late summer peaks often intensify following atypical high summer rainfall in the winter and bimodal rainfall zones, the opening of temporarily open/closed estuaries and the escape of adults to the sea (Lamberth et al. 2008, Lamberth and Hutchings 2011)
Breeding/spawning locality: Nearshore, surf zone in the WC
Age at 50% maturity: Combined sexes: 2 years; west, south and east coast; 2010 (Lamberth and Hutchings 2011) but these data estimates need to be validated. De Villiers (1987) estimated age at maturity at 3 years for *L. richardsonii* in the Berg Estuary
Length at 50% maturity: Combined sexes: 245-283mm TL; west and south Cape coast; 2010 (Lamberth and Hutchings unpubl. data). Data need to be reanalysed. De Villiers (1987) estimated length at maturity of 210-215mm FL for *L. richardsonii* from the west coast and False Bay

BIOMETRICS
Maximum recorded age: Female: 11 years; Saldanha; 1998 (Lamberth and Hutchings unpubl. data)
Maximum recorded weight: Female: 1100g; Saldanha; 1998 (Lamberth and Hutchings unpubl. data)
Maximum recorded length: Female: 450mm TL; Saldanha; 1998 (Lamberth and Hutchings unpubl. data)
Length-length relationship: Combined sexes: FL(cm) = 1.253SL(cm) + 0.039, TL(cm) = 1.128SL(cm) + 0.228; Swartkops Estuary (Marais 1976)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00002086 \times SL(mm)^{2.976}$; Estuaries from Orange to Umtamvuna (Harrison 2001). Combined sexes: $Wt(g) = 0.00004 \times TL(mm)^{2.7478}$; west coast (S. Lamberth, DAFF, unpubl. data)
Growth parameters: Males: L_∞ = 245mm TL, K = 1.454, t_0 = -3.15; Females: L_∞ = 258mm TL, K = 0.741, t_0 = -2.367; west coast sea (Lamberth and Hutchings 2011). A range of growth estimates available for *L. richardsonii* in different areas and habitats (Lamberth and Hutchings 2011)

FISHERY
Main target of the gillnet fishery on the west coast, landing up to 1 500mt per annum. Also a substantial illegal fishery landing in excess of 400mt per annum, especially in the Berg Estuary. The legal gillnet fishery in the Olifants Estuary lands approximately 100mt per annum. Also the main target of the beach-seine fishery on the west coast, current landed catches up to 1 000mt per annum (Lamberth et al. 1994, Hutchings and Lambert 2002a, b). Caught by the recreational, commercial, artisanal and subsistence linefisheries mainly by cast net but also by line and bottle trap and mostly used as live bait (Lamberth et al. 1997). Was a legal catch of the west coast purse-seine fishery until the 1980s. Nowadays, limited to incidental catches. There is a proposed experimental small-boat purse-seine fishery to assess its merits as an alternative to the gillnet fishery. Limited use as live bait (caught by cast net) by the tuna pole fishery, also used as dead bait for yellowfin and bluefin tuna. Was a brief lucrative market for high quality individually wrapped harders as longline tuna bait. Shark longline industry has expressed interest in using harders as bait (occasionally used)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology

STOCK STATUS
Stock assessment method: Other
Year completed: 2010
Locality: WC
Status: 25-40% - overexploited (S. Lamberth, DAFF, unpubl. data)
Trend in CPUE: The reduction in effort and closure of the Berg Estuary gillnet fishery in 2001 (effectively 2003) saw fishers reporting an increase in the numbers and mean size of *L. richardsonii* caught in St Helena Bay, the centre of the fishery. In turn, continued monitoring before and after the fishery closure, reported on in Hutchings et al. (2008), saw a recovery in the numbers and size of *L. richardsonii* in the Berg Estuary. Consequently, there was a reduction in recruitment and growth overfishing in the estuary which became manifest in improved catches reported by the legal commercial netfishery in the adjacent St Helena Bay. This positive trend was short lived as observer data and buyer reports suggest that the illegal gillnet fishery in the estuary has escalated and is currently landing approximately 400mt per annum. There has also been a corresponding drop in total reported catches from 1 500mt to 600mt per annum by the legal fishery in the sea
Trend in catch composition: Most of the beach-seine and gillnet fishery is restricted to catching *L. richardsonii*, other Mugillidae and "bait species". Overall, *L. richardsonii* has contributed more than 90% of the catch within these two fisheries over the last 20 years
Trend in mean size: Females and males grow at the same fast rate until the approach of maturity in the second year, whereupon female growth slows and that of males becomes negligible. Females attain greater size-at-age in all regions and continue growing to maximise reproductive output. South coast fish are larger than west coast ones, probably due to west coast fisheries selecting for slow growth but also due to warmer temperatures and higher productivity in the south. Estuary and island associated fish are larger than those in the nearshore marine zone probably due to favourable environmental conditions, high productivity and lower fishing intensity in these areas
Trend in sex ratio: In west and south coast estuaries, as well as the nearshore marine zone, a M:F ratio of 1:9 has been recorded. Around islands, and along the west and south coast, a M:F ratio of 1:1 has been recorded. This is unlikely to be a fishery effect as gill-nets and beach-seines select for smaller fish and therefore target both sexes

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 50pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Cast-nets and beach-seine nets may only be used from sunrise to sunset. Minimum mesh sizes (48mm stretched mesh), net lengths, depth and rope lengths in the beach-seine and gillnet fisheries. These two *L. richardsonii* directed fisheries are also governed by a TAE and area restrictions
MPA effectiveness: Most MPAs on the south and west coasts which prohibit fishing are likely to provide

protection for *L. richardsonii*. The significance of differences in sex ratios between unfished island sites and fished estuaries and the nearshore marine environment has not been determined but may be partially due to the prohibition of gillnetting around islands and a greater length-at-age in unfished closed areas (Lamberth and Hutchings 2011). Overall, *L. richardsonii* in unfished areas are significantly larger than those in fished areas (seine and gillnet) (Hutchings and Lamberth 2003). Closure of the Berg Estuary to gillnetting led to recovery of the population/stock in that estuary and the adjacent sea (Hutchings et al. 2008)

MANAGEMENT CONSIDERATIONS

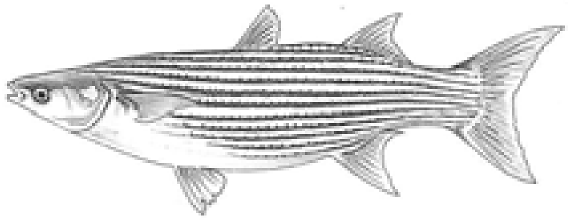
The gillnet fishery should be replaced by a small harder-directed purse-seine fishery to reduce bycatch of juveniles and prohibited species and to improve the quality of the catch. To prevent recruitment and growth overfishing, the Berg and all other estuaries should remain closed to the gillnet fishing and the remaining legal gillnet fishery in the Olifants Estuary should eventually be phased out

RESEARCH REQUIREMENTS

Biological sampling and stock assessment throughout its range. Population genetics to establish links between west, south and east coasts and bioregions. Tagging studies (barcoded tags). Experimental purse-seine fishery as an alternative to the gillnet fishery

Research priority: High

MUGILIDAE



SCIENTIFIC NAME: *Liza tricuspidens* (Smith No. 222.8)
COMMON NAMES: Striped mullet
COMPILER: AK Whitfield
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Southern African endemic (southern Angola to MOZ) (Thomson 1984, van der Elst 1993)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
As above

MOVEMENT: Unknown

HABITAT
Adults: Found in the surf-zone often near rocky areas and in estuaries (van der Elst 1993)
Juveniles: Mainly in estuaries (van der Elst 1993)
Eggs and larvae: Pelagic, non-adhesive eggs. Larvae occur in the marine environment

FEEDING
Adults: Diet in estuaries is dominated by filamentous algae, macrophytic plant material, epiphytic diatoms and foramaniferans. In the marine environment they also consume isopods and marine polychaetes (van der Elst 1993)
Juveniles: Juveniles have a similar diet to the adults, feeding mainly on filamentous algae, macrophytic plant material and epiphytic diatoms

REPRODUCTION
Reproductive style: Oviparous
Breeding/spawning season: Main spawning season is Aug-Nov in KZN (Wallace 1975)
Breeding/spawning locality: Mass spawning takes place in the marine environment in KZN (Wallace 1975)
Age at 50% maturity: Unknown
Length at 50% maturity: 42cm TL; KZN; 1969-1972 (Wallace 1975)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 4.1kg (Smith 1965). SA angling record is 2.7 kg (van der Elst 1993)
Maximum recorded length: 75cm TL (Smith 1965)
Length-length relationship: Combined sexes: FL(cm) = 1.06SL(cm) + 0.823; TL(cm) = 1.13SL(cm) + 0.436; Swartkops Estuary, EC; n=22 (Marais 1976)
Length-weight relationship: $Wt(g) = 0.01342 \times SL(cm)^{3.1024}$; Swartkops Estuary (Marais and Baird 1980); $Wt(g) = 0.00002419 \times SL(mm)^{2.943}$; SA estuaries (Harrison 2001)
Growth parameters: Unknown

FISHERY
Illegal gill netting in the Transkei region and other EC estuaries are likely to capture large numbers of striped mullet. In comparison, recreational angling will result in relatively small numbers of this species being captured. It is frequently caught by means of cast nets for use as live bait by recreational anglers (B. Mann, ORI, pers. obs.) and is the most common mullet species caught by shore anglers fishing along the KZN coast (van der Elst 1993, Mann et al. 1997a)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Not assessed

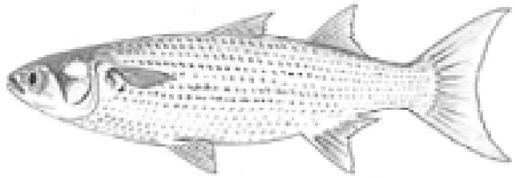
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 50 pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Striped mullet is usually found in association with rocky shores and estuaries in the warm temperate and subtropical biogeographic region (van der Elst 1993, Whitfield 1998). Although little is known about their movement behaviour, marine and estuarine protected areas are likely to provide some protection to this species

MANAGEMENT CONSIDERATIONS
Gill-netting for this and other estuarine dependent fish species should not be permitted

RESEARCH REQUIREMENTS
At present there is little information on the relative dependence of juvenile *L. tricuspidens* on estuaries versus the marine littoral environment. The question of whether the Namibian and Angolan *L. tricuspidens* are a separate population (or even a separate species) to that along the eastern and southern African coast has not been answered. This question has both scientific and management implications
Research priority: Medium

MUGILIDAE

SCIENTIFIC NAME: *Mugil cephalus* (Smith No. 222.10)
COMMON NAMES: Flathead mullet, Grey mullet, Striped mullet
COMPILER: AK Whitfield
REVIEWER: SJ Lamberth
DATE OF REPORT COMPLETION: November 2012



GLOBAL DISTRIBUTION: Cosmopolitan, occurring in coastal waters between 42°N and 42°S latitude (Thomson 1966, Whitfield et al. 2012)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Found around the entire SA coast (Whitfield 1998, Heemstra and Heemstra 2004)

MOVEMENT: Migratory
Known to migrate in large shoals down to the mouths of estuaries for spawning (Wallace 1975a). Adults also known to undertake extensive movements at sea in other parts of the world (Whitfield et al. 2012)

HABITAT
Adults: Estuaries and coastal marine environment (Wallace 1975a, Whitfield et al. 2012)
Juveniles: Juveniles are attracted to and largely dependent on estuaries as nursery areas (Wallace and van der Elst 1975, Whitfield 1998)
Eggs and larvae: Eggs and larvae are located in marine coastal waters (Wallace 1975a, 1975b, Whitfield et al. 2012)

FEEDING
Adults: Benthic microalgae, detritus and small invertebrates (Blaber 1976)
Juveniles: Larvae feed on zooplankton with the switch to a juvenile/adult diet occurring at about 20mm SL (Blaber and Whitfield 1976)

REPRODUCTION
Reproductive style: Although this species is gonochoristic it is also capable of exhibiting non-functional hermaphroditic characteristics (McDonough et al. 2005)
Breeding/spawning season: Limited data, but appears to have an extended spawning season between autumn and spring (May-Nov) in SA waters (Wallace 1975b)
Breeding/spawning locality: There is evidence that spawning along the east coast of SA takes place in the marine environment, often in the vicinity of estuary mouths (Wallace 1975b)
Age at 50% maturity: Combined sexes: 3 years; Kowie Estuary, EC; 1976-77 (Bok 1983)
Length at 50% maturity: Males: 44cm TL; Females: 48cm TL; KZN; 1969-70 (Wallace 1975b)

BIOMETRICS
Maximum recorded age: 6 years, Kowie Estuary, EC; 1969-70 (Bok 1983). However, known to reach ages of up to 16 years elsewhere (Heemstra and Heemstra 2004)
Maximum recorded weight: 8kg (Heemstra and Heemstra 2004)
Maximum recorded length: 72cm TL (Wallace 1975a)
Length-length relationship: Combined sexes: TL(cm) = 1.1FL(cm); West Australia (Thompson 1951)
Length-weight relationship: Combined sexes: Wt(g) = 0.0233 x $SL(cm)^{2.979}$; SA estuaries (Harrison 2001)
Growth parameters: L_∞ = 58.8cm TL; K = 0.19; t_0 = -0.21; Mexico (Ibanez-Aguirre et al. 1999); median record from FishBase (Froese and Pauly 2012)

FISHERY
In SA this species is mainly caught in illegal estuarine gillnet fisheries such as in the northern parts of Lake St Lucia (Mann 1995). Also caught in the artisanal trap fishery in Kosi Bay (Kyle 1986) and the beach seine-net fishery off Durban (Beckley and Fennessy 1996). Seldom caught on line but is often caught using cast nets and used for bait

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Generally unknown in SA waters. Abundance has declined considerably in Lake St Lucia due to the drought and the closure of the mouth for the past 11 years (D. Cyrus, UZ, pers. comm.)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Sex ratios usually balanced (Whitfield et al. 2012) but no information on trends

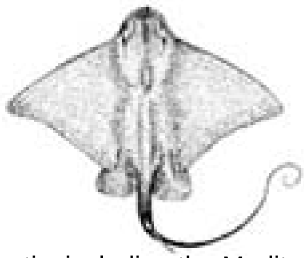
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Least Concern; 2012 (Kottelat and Freyhof 2012)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 50pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Estuarine gillnetting is illegal on the south-eastern seaboard of SA
MPA effectiveness: Estuarine protected areas are likely to play an important role in the conservation of this species

MANAGEMENT CONSIDERATIONS
Establishment of more estuarine protected areas is a priority for this and other estuarine dependent species

RESEARCH REQUIREMENTS
Recent genetics work has indicated that *Mugil cephalus* is a species complex. Research needs to be conducted on SA populations to determine whether they are *M. cephalus* and if more than one *M. cephalus* species occurs in our waters (Whitfield et al. 2012, Durand et al. 2012)
Research priority: Medium

MYLIOBATIDAE



SCIENTIFIC NAME: *Myliobatis aquila* (Smith No. 28.2)
COMMON NAMES: Eagle ray, Arendrog
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: From the North Sea to SA in the eastern Atlantic, including the Mediterranean (Smith and Heemstra 1991), also recorded off Kenya in the western Indian Ocean (Holtzhausen et al. 2009). Populations in Europe and off Kenya may be regionally different compared to elsewhere (Holtzhausen et al. 2009)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
More common along the cooler EC and WC coast than in KZN (Wallace 1967, Smith and Heemstra 1991). Although this species has been reported off Kenya, very few individuals have been recorded in MOZ (Holtzhausen et al. 2009)

MOVEMENT: Unknown
Insufficient data, only 3 recaptures from 480 animals tagged (0.63%) with a mean distance travelled of 18km (ORI Tagging Project, unpubl. data)

HABITAT
Adults: This semipelagic ray is found inshore and offshore, although it appears to prefer inshore, coastal areas (<50m), readily entering shallow lagoons and estuaries (Holtzhausen et al. 2009). Has been reported from depths of up to 537m in some areas (Whitehead et al. 1986). Large aggregations of adults have also been noted (Heemstra and Heemstra 2004)
Juveniles: Inshore and offshore similar to adults (van der Elst and Adkin 1991, Heemstra and Heemstra 2004)

FEEDING
Adults: Carnivorous on bivalves, gastropods, brachyurans, anomurans, polychaetes and small teleosts (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown, probably similar to adults

REPRODUCTION
Reproductive style: Ovoviviparous (aplacental viviparity), 3-7 young born after 6-8 month gestation (Whitehead et al. 1986)
Breeding/spawning season: Unknown in SA waters
Breeding/spawning locality: Unknown in SA waters. Probably throughout its distribution
Age at 50% maturity: Unknown
Length at 50% maturity: Males: 40-50cm DW; Females: 60-70cm DW; SA (van der Elst and Adkin 1991). Note that Holtzhausen et al. (2009) recorded 31.8 and 42.5cm DW as the size at maturity for males and females respectively in SA waters

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 59.2kg; SA West Coast; 2010; SA shore angling record (SASAA 2012)
Maximum recorded length: 147cm DW; SA West Coast; 2010; SA shore angling record (SASAA 2012)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: $Wt(kg) = 0.0000141 \times DW(cm)^{3.06}$; SA; n=40 (ORI Tagging Project, unpubl. data)
Growth parameters: Unknown

FISHERY
Commonly caught as a bycatch by recreational shore anglers (Brouwer et al. 1997) and are specifically targeted during shore angling competitions (Pradervand and Govender 2003, Pradervand 2004, Pradervand et al. 2007), but most are released. Adults and juveniles are caught as a bycatch in inshore trawls and in the beach seine fishery in the WC (Lamberth et al. 1994, Lamberth 2006). Although often captured in the KZNSB nets, 65-70% are released alive (S. Dudley, KZNSB, pers. com.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown

F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Little known. Due to low fishing pressure throughout SA the population is thought to be quite stable. Available time series on catches of this species from 1981–2001 showed no trend (Holtzhausen et al. 2009)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2009 (Holtzhausen et al. 2009). This assessment was done according to the threat status of this species throughout its global distribution. Off SA it is regarded as being of Least Concern (Holtzhausen et al. 2009)

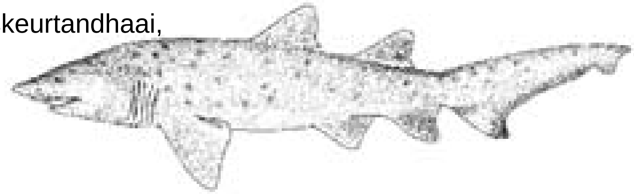
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Since it has a broad distribution, protection of this species is probably provided in many MPAs in the EC and WC with suitable habitat. However, there is little evidence of this in the literature

MANAGEMENT CONSIDERATIONS
These rays are generally released alive when caught by shore anglers or in the KZNSB nets. In SA current catches are not thought to be significantly affecting this species. However, the bycatch in trawl and beach seine fisheries should be monitored

RESEARCH REQUIREMENTS
Taxonomy, reproductive biology, age and growth, CPUE, catch composition, local stock distribution, movement and juvenile nursery areas. It is unclear whether this, or a similar species occurs along the east and west African coasts and a systematic review of the taxonomy of the species is needed (Holtzhausen et al. 2009)
Research priority: Low

ODONTASPIDAE

SCIENTIFIC NAME: *Carcharius taurus* (Smith No. 19.1)
COMMON NAMES: Spotted ragged-tooth shark, Spikkel-skeurtandhaai, Grey nurse shark, Sand tiger shark
COMPILER: SFJ Dudley
REVIEWER: M Dicken
DATE OF REPORT COMPLETION: July 2012



GLOBAL DISTRIBUTION: Wide-ranging in warm-temperate and sub-tropical coastal waters of the eastern and western Atlantic, Mediterranean Sea and Indo-West Pacific; absent from the central and eastern Pacific Oceans (Cadenat 1956, Bass et al. 1975, Compagno 1984 and 2001, Menni 1986, Soto 2001, Fergusson et al. 2002, Lucifora et al. 2002, Castro 2011, Last and Stevens 2009)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
In SA, *C. taurus* has been occasionally reported from the west coast, but is more commonly found along the east coast from Cape Town to northern KZN (Bass et al. 1975; Smale 2002; Dicken et al. 2006, 2007 and 2008)

MOVEMENT: Migratory
Mature female sharks undergo a well-defined biennial reproductive migration along the east coast, which can be traced through the spatially and seasonally distinct phases of mating, gestation and parturition (Bass et al. 1975, Smale 2002, Dicken et al. 2006, 2007)

HABITAT
Adults: Adults inhabit the continental shelf down to 190m, but are most commonly found at depths of 10-40m in sandy-bottomed gutters or gullies, and in rocky caves in the vicinity of inshore reefs and islands (Compagno 1984, 2001, Smale 2002)
Juveniles: Juveniles tend to inhabit inshore reefs primarily within Eastern and Southern Cape nursery areas (Smale 2002, Dicken et al. 2006, 2007). Tag recapture data suggests that juvenile sharks may exhibit natal nursery homing and be site-specific to summer nursery areas. They are less migratory than adult sharks and tend to remain in the nursery areas for the first 4-5 years of life (Dicken et al. 2007)

FEEDING
Adults: *C. taurus* is an opportunistic feeder, consuming a wide variety of teleost fish as well as smaller elasmobranchs. They occasionally consume invertebrates such as squid, crabs and lobsters (Bass et al. 1975, Compagno 2001, Smale 2005) and are considered to be ambush predators. Observations also suggest that this species feeds co-operatively by forming packs and concentrating prey prior to attack (Ireland 1984, Smale 2005)
Juveniles: Similar to adults

REPRODUCTION
Reproductive style: It is an ovoviviparous and aplacental species, with the developing embryos obtaining nutrition through both oophagy and uterine cannibalism (Bass et al. 1975, Gilmore et al. 1983, Gilmore 1993, Branstetter and Musick 1994). Cannibalism results in a maximum fecundity of two pups per litter after a gestation period of approximately 9-12 months (Bass et al. 1975, Gilmore et al. 1983). Pups are born at a total length between 95-120cm (Cadenat 1956, Taniuchi 1970, Bass et al. 1975). Reproductive periodicity has been a source of some contention. Gilmore (1993) and Gordon (1993) proposed an annual cycle in the north-western Atlantic and Australia respectively. A two-year reproductive cycle, allowing a 12-15 month resting stage between pregnancies, has been proposed for SA (G. Cliff, KZNSB, unpubl. data, Dicken et al. 2006 and 2007), NW Atlantic (Branstetter and Musick 1994) and SW Atlantic populations (Lucifora et al. 2002)
Breeding/spawning season: Mating occurs in Oct-Nov (Dicken et al. 2006). Pregnant females then move northward to spend the first part of their gestation in the warmer waters of northern KZN and possibly southern MOZ. From June onwards the near-term pregnant females begin to move southwards towards the cooler pupping grounds of the EC (Wallett 1973, Bass et al. 1975, Dicken et al. 2006, 2007), where they give birth to two pups from Sep-Nov (Smale 2002, Dicken et al. 2006)
Breeding/spawning locality: Females move from the EC to mating grounds on the KZN south coast (Dicken et al. 2006). Much of the pregnancy is spent in northern KZN and possibly southern MOZ, followed by a move southwards to the pupping grounds of the EC (Wallett 1973; Bass et al. 1975; Dicken et al. 2006, 2007). The pups are born at a total length of 95-120cm (Cadenat 1956; Taniuchi 1970; Bass et al. 1975). The young-of-the-year and juvenile sharks remain in the geographically distinct nursery areas for their first 4–5 years of life, before joining the subadult and adult components of the population (Dicken et al. 2006, 2007)
Age at 50% maturity: Males: 6-7 years; Females: 9-10 years; Western North Atlantic (Goldman et al. 2006). Note that this study re-assesses the findings of Branstetter and Musick (1994) who found that that males mature at 4-5 years and females mature at >6 years
Length at 50% maturity: Males: 162.9cm PCL; Females: 175.4cm PCL; SA (Dudley and Simpfendorfer 2006)

BIOMETRICS

Maximum recorded age: The oldest individual aged by Goldman et al. (2006), was a female of 17 years and they estimated longevity of 32-38 years for females and 22-27 years for males. The longest time at liberty for a tagged shark in SA waters is 22.6 years. This animal was tagged in northern KZN and was assumed to have been mature (pregnant) at the time (Wintner 2011)
Maximum recorded weight: 229kg; Female; KZN; 1986 (S. Wintner, KZN Sharks Board, unpubl. data). SA shore angling record is 253.8kg (SASAA 2012)
Maximum recorded length: Female: 326cm TL; Male: 266cm TL; SA east coast (Dicken et al. 2006; S. Wintner, KZN Sharks Board, unpubl. data)
Length-length relationship: Males: TL(mm) = 1.333PCL(mm) + 68.555 (n=287); Females: TL(mm) = 1.29PCL(mm) + 115.56 (n=438); Combined sexes: TL(mm) = 1.299PCL(mm) + 104.507 (n=725); SA east coast (Dicken et al. 2006)
Length-weight relationship: Males: Wt(kg) = 3.349×10^{-10}TL(mm)$^{3.394}$ (n=267); Females: Wt(kg) = 2.337×10^{-10}TL(mm)$^{3.445}$ (n=433); Combined sexes: Wt(kg) = 1.296×10^{-9}TL(mm)$^{3.205}$ (n=700); SA east coast (Dicken et al. 2006). Combined sexes: Wt(kg) = 0.000009PCL(cm)$^{3.13}$; KZN (Dudley and Simpfendorfer 2006)
Growth parameters: Males: L_∞ = 249.5cm TL; K = 0.16; t_0 = –3.4; Females: L_∞ = 295.8cm TL; K = 0.11; t_0 = –4.2; NW Atlantic (Goldman et al. 2006)

FISHERY

Although protected from commercial fishing in SA since 1998, bycatch in any fishery potentially poses a threat to the survival of *C. taurus*. Because this species typically inhabits shallow inshore areas, it is rarely, if ever, caught by the large-scale industrial fisheries operating on the high seas. Its near-shore distribution, however, coupled with its fish-eating habits, makes it susceptible to the small-scale, multi-species fisheries (recreational shore anglers, recreational and commercial skiboat anglers). Most catches by shore anglers are released alive. Protective legislation in the form of decommercialisation was specifically introduced to prevent its capture and sale (especially of the fins) by boat anglers. Adults are caught in fairly large numbers (168 per annum ±105 s.d., 1978-2010) in the bather protection nets of the KZN Sharks Board during their reproductive migrations (Dudley and Simpfendorfer 2006)

BIOLOGICAL REFERENCE POINTS

Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology

STOCK STATUS

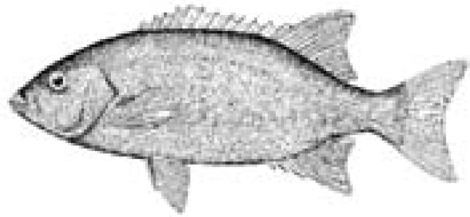
Stock assessment method: Other
Year completed: 2008
Locality: East coast SA
Status: Although recent studies have suggested a stable population (Dudley and Simpfendorfer 2006, Dicken et al. 2008), an updated analysis (up to 2010) indicates a decline in CPUE of the species and in the median length of the males caught in the shark nets (S. Dudley, KZN Sharks Board, unpubl data), suggesting that the population may be under threat
Trend in CPUE: Shark nets have been fishing off KZN since 1952 but accurate catch data are only available since 1978. There was no significant trend in catch rate 1978-2003 (Dudley and Simpfendorfer 2006). However, updated analysis showed a significant decline in catch rate 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data). CPUE by number remained relatively constant in the Border competitive shore fishery between 1982–98 (Pradervand and Govender 2003). Significant increase in CPUE recorded from Angling Week competitions, 1999-2010 (Dicken et al. 2012)
Trend in catch composition: No significant trend in the catch composition in the KZN shark nets 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data). Constitutes a mean annual 15.6% of the total catch of 14 species of large sharks in these nets
Trend in mean size: No significant trends in the length of catches in the KZN shark nets 1978-2003 (Dudley and Simpfendorfer 2006). A significant decrease in medial precaudal length of males caught in the shark nets, but no trend in mean length of males or in the mean or median length of females; 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data). Mean mass of *C. taurus* showed a non-significant increase in Angling Week catches, 1999-2010 (Dicken et al. 2012)
Trend in sex ratio: No trend in the annual sex ratio of the catch in the KZN shark nets 1978-2010 (S. Dudley, KZN Sharks Board, unpubl. data)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Vulnerable; 2009 (Pollard and Smith 2009). Regionally *C. taurus* was assessed as being Near Threatened in 2003. This review was undertaken by Dicken, van Tienhoven and Cliff at a regional (African) workshop of the IUCN Shark Specialist Group at Umhlanga in 2003. The document was never published

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: Decommercialised in SA since 1998
MPA effectiveness: Although likely to receive some protection within all no-take MPAs along the SA east coast, the Aliwal Shoal MPA is considered particularly important for mating aggregations, while the St Lucia and Maputaland MPAs are important for pregnant females. MPAs in the large bays of the EC and WC (e.g. Algoa Bay, Stilbaai) will likely provide protection for resident juveniles

MANAGEMENT CONSIDERATIONS
Prohibiting the summer capture by shore anglers in the St Lucia and Maputaland Marine Reserves as the catches are highly likely to be pregnant females. There are several factors which have and will continue to reduce fishing pressure on the stocks. They include a ban on beach driving (since 2001), which restricts the ability of the many shore anglers to catch sharks, a strong catch-and-release ethic among anglers; an on-going reduction in the number of shark nets along the KZN coast and the high release rate (31% of the shark net catch)

RESEARCH REQUIREMENTS
Further work on movement patterns and philopatry in respect of mating, pupping and gestation sites. Information is particularly lacking for adult males
Research priority: Medium



SCIENTIFIC NAME: *Oplegnathus conwayi* (Smith No. 206.1)
COMMON NAMES: Cape knifejaw, Cuckoo bass, Beaked galjoen, Black parrotfish
COMPILER: BQ Mann
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Endemic to the east coast of SA from False Bay (WC) to Thukela (KZN) (Heemstra 1984, Smith and Heemstra 1991, Chater et al. 1995)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Rarely seen north of Thukela (B. Mann, ORI, pers. obs.)

MOVEMENT: Unknown
Little known about movement behaviour but van der Elst (1993) suggests that this species forms pairs and displays strong territorial behaviour suggesting residency

HABITAT
Adults: Inshore reefs in depths from 5 to 32m (Heemstra and Heemstra 2004)
Juveniles: Bright yellow and black juveniles occur on shallow inshore reefs (van der Elst and Adkin 1991) in southern KZN, EC and WC. Small juveniles may be found in tidal pools or beneath floating objects at sea (van der Elst 1993)
Eggs and larvae: Pelagic eggs and larvae described by Connell (2012) collected in inshore waters off the KZN south coast

FEEDING
Adults: Omnivorous diet consisting of red and green algae, sponges and ascidians (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Evidence of gonadal activity throughout the year; ripe-running fish observed in Aug in KZN (Chater et al. 1995). On the KZN south coast peak spawning appears to be in spring (Sep-Oct) when most eggs were collected (Connell 2012)
Breeding/spawning locality: Spawning recorded on the KZN south coast with most eggs collected inshore suggesting that spawning occurs around the 30m depth contour (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Little known, smallest mature fish sampled by Chater et al. (1995) was 445mm FL

BIOMETRICS
Maximum recorded age: 13 years; KZN (Chater et al. 1995)
Maximum recorded weight: 5.8kg; 1961; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 90cm TL (van der Elst 1993)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.001388 x FL(mm)$^{2.318}$; KZN & EC (Chater et al. 1995)
Growth parameters: Not aged

FISHERY
This species is primarily shot by spearfishers and it makes up a large proportion of the spearfishing catch, particularly in the EC (Mann et al 1997b). It is rarely caught by linefishers (van der Elst 1989, van der Elst 1993, Chater et al. 1995, Mann et al. 1997a)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Long-term records of a single competitive spearfisher indicate significant decline in CPUE recorded off Ballito and Scottburgh on the KZN coast between 1989-97 and 2002-07 but this has been attributed to climate change and increased water temperature (Lloyd et al. 2012)
Trend in catch composition: Variable between 1984-95, better catches appear to be made when game fish are less abundant and vice versa (Mann et al. 1997). Lloyd et al. (2012) noted a decline of *O. conwayi* in the catch composition off the KZN coast between 1989-97 and 2002-07 but attributed this to increased water temperature
Trend in mean size: Mean size remained constant between 1984-95 (Mann et al. 1997b)
Trend in sex ratio: M:F sex ratio 1.6:1 in KZN and EC (Chater et al. 1995) but no information on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Thought to receive protection in most of the MPAs along the south-eastern seaboard of SA where there is suitable reef habitat and spearfishing is prohibited

MANAGEMENT CONSIDERATIONS
Cape knifejaw is almost exclusively targeted by spearfishers and is very easily approached and shot underwater. Numbers appear to have declined on inshore reefs along the KZN coast and attention should be given to conducting a detailed investigation into the biology and population status of this species. Consideration should be given to introducing a minimum size limit of 50cm TL as a precautionary measure

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, distribution and abundance, stock assessment, movement patterns, early life history
Research priority: Medium

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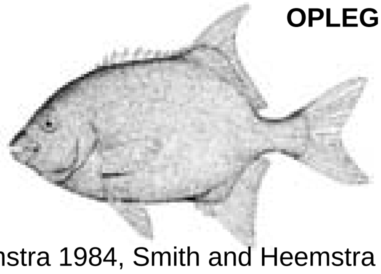


SCIENTIFIC NAME: *Oplegnathus robinsoni* (Smith No. 206.3)
COMMON NAMES: Natal knifejaw, Cuckoo bass
COMPILER: BQ Mann
REVIEWER: JQ Maggs
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Endemic to KZN and MOZ waters (Heemstra 1984, Smith and Heemstra 1991, Chater et al. 1995)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Known mainly from southern MOZ and KZN waters (Froese and Pauly 2012) but common in the Pondoland MPA in the EC (Mann et al. 2006) and juveniles seen as far south as Tsitsikamma (Heemstra and Heemstra 2004). The Mozambique knifejaw (*Oplegnathus peaolopesi*) may simply be a large Natal knifejaw (Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Thought to be a resident species (R. van der Elst, ORI, pers. comm.)

HABITAT
Adults: Inshore coral and rocky reefs in depths from 10-50m but apparently down to 100m (van der Elst 1993)
Juveniles: Small yellow and black juveniles are pelagic in currents (van der Elst and Adkin 1991), commonly found under floating objects at sea, while slightly larger juveniles are found on shallow subtidal reefs (van der Elst 1993, Chater et al. 1995)
Eggs and larvae: Pelagic eggs and larvae described by Connell (2012) collected in inshore waters off the KZN south coast

FEEDING
Adults: Diet includes ascidians, soft corals and other reef-encrusting organisms (van der Elst 1993, Chater et al. 1995)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Evidence of gonadal activity throughout the year; ripe-running fish observed in Oct-Jan in KZN (Chater et al. 1995). Connell (2012) found eggs of this species off the KZN south coast predominantly during summer
Breeding/spawning locality: Thought to occur throughout distribution range (Chater et al. 1995). Connell (2012) recorded eggs off the KZN south coast slightly offshore suggesting spawning in depths of 30-40m
Age at 50% maturity: Unknown
Length at 50% maturity: Little known, smallest mature fish sampled along the KZN coast was 355mm FL (Chater et al. 1995)

BIOMETRICS
Maximum recorded age: 10 years; KZN (Chater et al. 1995)
Maximum recorded weight: 3kg; 1987; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 60cm TL (van der Elst 1993)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.000594 x FL(mm)$^{2.479}$; KZN (Chater et al. 1995)
Growth parameters: Not aged

FISHERY
This is an important target species for spearfishers in KZN (Mann et al. 1997a, b). The Natal knifejaw is occasionally (but rarely) taken on line (van der Elst 1993, Chater et al. 1995)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Long-term records of a single competitive spearfisher indicate significant decline in CPUE recorded off Ballito and Scottburgh on the KZN coast between 1989-97 and 2002-07 despite a predicted increase for tropical species due to climate change and increased water temperature (Lloyd et al. 2012)
Trend in catch composition: Lloyd et al. (2012) noted a decline of *O. robinsoni* in catch composition of single competitive spearfisher off the KZN coast between 1989-97 and 2002-07
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio 0.53:1 in KZN (Chater et al. 1995) but no information on trends

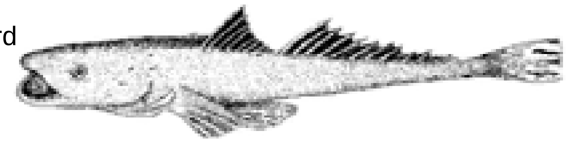
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Believed to receive protection within no-take MPAs having suitable reef habitat along the MOZ, KZN and Pondoland coast

MANAGEMENT CONSIDERATIONS
Natal knifejaw are almost exclusively targeted by spearfishers and easily approached and shot underwater. Numbers appear to have declined on shallow subtidal reefs along the KZN coast and attention should be given to conducting an investigation into the biology and population status of this species. Consideration should be given to introducing a minimum size limit of 40cm TL as a precautionary measure

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, distribution and abundance, stock assessment, movement patterns, early life history
Research priority: Medium

SCIENTIFIC NAME: *Platycephalus indicus* (Smith No. 155.6)
COMMON NAMES: Bartail flathead, River gurnard, Sand gurnard
COMPILER: BQ Mann
REVIEWER: R Kyle
DATE OF REPORT COMPLETION: January 2013



GLOBAL DISTRIBUTION: Widespread mainly tropical Indo-West Pacific species extending southwards to Mossel Bay (Smith and Heemstra 1991, Whitfield 1998). Has migrated through the Suez Canal into the Mediterranean (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, KZN, MOZ
MOZ to WC (Whitfield 1998)

MOVEMENT: Resident
Of the 234 tagged to date only five (2.14%) have been recaptured, with a mean distance moved of 4km which suggests a degree of residency (ORI Tagging Project, unpubl. data). However, adults are thought to migrate out of estuaries into the marine environment in order to spawn (Wallace 1975b)

HABITAT
Adults: Estuaries and inshore coastal waters down to 15m, found over sandy or muddy substrata, usually solitary (van der Elst 1993, Whitfield 1998)
Juveniles: Make extensive use of mangrove estuaries, but are classified as partially estuarine dependent as juveniles <10cm SL are usually rare in estuaries (van der Elst 1993, Whitfield 1998)
Eggs and larvae: Pelagic eggs and small numbers of larvae have been recorded in St Lucia Estuary, Richards Bay and Durban Harbour mouth and in the adjacent surf-zone and inshore marine environment off the KZN south coast (Harris and Cyrus 1995, 1996, 1997, 1999, Connell 2012)

FEEDING
Adults: Ambush predator feeding on shrimps, prawns, crabs, mysids, polychaete worms and small fishes (van der Elst 1993, Whitfield 1998)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Jul-Nov in KZN (Wallace 1975b, van der Elst 1993, Whitfield 1998, Connell 2012)
Breeding/spawning locality: In the marine environment in the vicinity of KZN estuaries (van der Elst 1993, Whitfield 1998), eggs and larvae predominantly found inshore of 20m (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Combined sexes: 40cm TL; KZN (Wallace 1975b)

BIOMETRICS
Maximum recorded age: 7 years; Kuwait; 1983-85 (Bawazeer 1989)
Maximum recorded weight: 3.7kg; Japan; 2007; World angling record (IGFA 2012). SA spearfishing record; 3.21kg; KZN; 2008 (SAUFF 2012)
Maximum recorded length: 100cm TL (van der Elst 1993)
Length-length relationship: SL(cm) = 0.874TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0003019 x $TL(mm)^{2.383}$; KZN (van der Elst and Adkin 1991)
Growth parameters: L_∞ = 48.9cm TL; K = 0.34; t_0 = -0.64; Kuwait (Bawazeer 1989)

FISHERY
Comprises a small component of estuarine shore and boat angler's catches in KZN (James et al. 2001, Mann et al. 2002, Pradervand et al. 2003, Everett and Fennessy 2007, Beckley et al. 2008). Small numbers are also caught in the illegal gill-net fishery in St Lucia (Mann 1995), Vetch's Pier beach-seine fishery (Beckley and Fennessy 1996) and the Kosi Bay trap fishery (Kyle 1986)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown

SBPR$_{current}$: Unknown
References & Comments: Not assessed

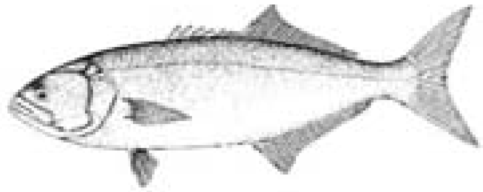
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2010 (Knapp 2010)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Some protection may be received in no-take estuarine protected areas within Lake St Lucia, Pondoland MPA and Dwesa-Cwebe MPA (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Although it comprises a small component of catches, bartail flathead is an important predator in shallow marine and estuarine environments and would ultimately benefit from improved estuarine protection and catchment management. Consideration could also be given to managing this fish as a recreational species

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, catch trends, residency and migration, stock assessment, early life history
Research priority: Low



SCIENTIFIC NAME: *Pomatomus saltatrix* (Smith No. 178.1)
COMMON NAMES: Elf, Shad, Bluefish, Tailor
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Circumglobal in warm-temperate to tropical waters. Absent from eastern and north-western Pacific (Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Occurs along the entire southern African coast but less common between Cape Point and northern NAM, except within Saldanha Bay (van der Elst 1975). Angolan stock is genetically separate (WM Potts, Rhodes University, pers. comm.)

MOVEMENT: Migratory
Adult and subadult elf migrate seasonally between the Cape and KZN. Adults are common in Cape waters during summer and autumn, and in KZN during winter and spring (van der Elst 1975, Govender 1996). The arrival of elf in KZN coincides with the onset of spawning activity, suggestive of a spawning migration (van der Elst 1976). Northward migrating elf also feed primarily on pilchard *Sardinops sagax*, which undertake a similar annual migration northwards from the Agulhas Banks (Fennessy et al. 2010). The migration of juveniles is thought to precede that of adults (Govender and Radebe 2000). Most, but not all elf take part in the annual northward migration as some are caught all year round in the WC (Lamberth et al. 1995). Some elf also remained resident in the Langebaan Lagoon for two years (Hedger et al. 2010)

HABITAT
Adults: Sandy and rocky substrata from the surf-zone down to 100m (van der Elst 1976). Also occasionally enter estuaries and harbours
Juveniles: Young-of-the-year juveniles prefer shallow subtidal embayments, less than 20m deep, along the SE and SW Cape coasts (van der Elst 1975, Smale 1984)
Eggs and larvae: In nearshore shelf waters (30-75m) off KZN (Beckley and Connell 1996, Connell 2012)

FEEDING
Adults: Primarily piscivorous, feeding on species such as *Engraulis* spp, *Sardinops sagax* and *Pomadasys olivaceus*, but also feed on crustaceans and cephalopods (van der Elst 1993)
Juveniles: Elf <10cm consume more crustaceans than fish (Marais 1984)

REPRODUCTION
Reproductive style: Gonochoristic, batch spawner (van der Elst 1976)
Breeding/spawning season: Spawning takes place in KZN between spring (Sep) and late summer (Mar) with peak spawning from Oct-Dec (van der Elst 1975, 1976, Connell 2012)
Breeding/spawning locality: In nearshore shelf waters (30-75m) off KZN (Beckley and Connell 1996, Connell 2012). Spawning has also recently been reported in the WC (Hedger et al. 2010)
Age at 50% maturity: Combined sexes: 1 year; KZN; 1970s (van der Elst 1976)
Length at 50% maturity: Males: 24cm TL; Females: 25cm TL; KZN; 1970s (van der Elst 1976)

BIOMETRICS
Maximum recorded age: 10 years; KZN; 1970s (van der Elst 1976)
Maximum recorded weight: 14.4kg; USA; 1972; World angling record (IGFA 2012). SA angling record: 10.3kg (van der Elst 1993)
Maximum recorded length: 100cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: TL(mm) = 1.0306FL(mm) + 30.6; KZN (van der Elst 1976); Combined sexes: FL(mm) = 0.885FL(mm) + 1.19; KZN (Govender 1996)
Length-weight relationship: Combined sexes: Wt(g) = 0.000015 x FL(mm)$^{2.98}$; KZN (van der Elst 1976)
Growth parameters: Combined sexes: L_∞ = 84cm TL; K = 0.1966; t_0 = 0.03215; KZN (van der Elst 1976); Combined sexes: L_∞ = 1247mm FL; K = 0.094; t_0 = -2.09; KZN (Govender 1999)

FISHERY
Elf is the most important species caught by recreational shore anglers along the entire eastern seaboard of SA (Brouwer et al. 1997). Accounts for approximately 28-80% of the annual reported catch in the recreational KZN shore fishery (Maggs et al. 2012). Also caught in fair numbers by subsistence shore fishers in the EC and by the beach seine fishery in the WC (Lamberth et al. 1995). May be caught and sold in unlimited numbers by the traditional commercial boat-based fishery in all provinces except KZN where sale is prohibited. Generally not taken in great numbers by boat-based fisheries except those operating in areas such as False Bay and Struisbaai in the WC. Also taken as a bycatch in the KZN prawn trawl and inshore demersal trawl fisheries and occasionally by spearfishermen

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.27yr^{-1}
Natural mortality rate (M): 0.4–0.5yr^{-1}
Total mortality rate (Z): 0.67–0.77yr^{-1}
F_{MSY} yr^{-1}: 0.4 (in harvested mass); 1.4 (in harvested numbers)
F_{SB40} yr^{-1}: 0.2
F_{SB25} yr^{-1}: 0.4
$F_{0.1}$ yr^{-1}: 0.25–0.3 (in harvested mass); 0.7-1.0 (in harvested numbers)
$SBPR_{current}$: 34%
Year completed: 1996
Locality: SA
References & Comments: Mortality estimates by Hughes (1986) and Butterworth et al. (1989), per-recruit assessment by Govender (1996, 1997)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1996
Locality: SA
Status: 25-40% - overexploited (Govender 1996, 1997)
Trend in CPUE: van der Elst (1976) showed a substantial decline in competitive shore anglers catches of elf along the KZN coast between 1956-73. More recent NMLS data from the KZN recreational shore fishery (1985-2009) shows a downward trend in terms of CPUE by number with high inter-annual variability (Maggs et al. 2012)
Trend in catch composition: NMLS data from the KZN recreational shore fishery (1985-2009) shows high inter-annual variability in terms of percentage composition by number (28-80%) with no clear upward or downward trend (Maggs et al. 2012)
Trend in mean size: Slight decrease in mean weight recorded along the KZN coast from 1956-73 (van der Elst 1976). Increase in mean size recorded between 1994-96 (Mann et al. 1997) and 2009-10 (Dunlop 2011)
Trend in sex ratio: 1:1 reported by van der Elst (1976) with no change reported by Govender and Radebe (2000)

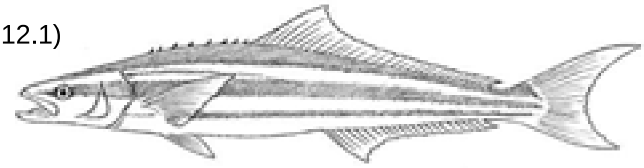
VULNERABILITY RATING
MLRA: Commercially exploitable species (No-sale recreational species in KZN)
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 4pppd; Commercial: unlimited except in KZN where no commercial catch is allowed
Minimum size limit: 30cm TL
Closed Season: 1 Oct–30 Nov
Other regulations: Elf may not be sold or landed commercially in KZN
MPA effectiveness: Although elf occur in all coastal MPAs along the SA coast, their highly migratory nature makes them less suitable for area based protection. However, recent evidence of residency in the Langebaan (Hedger et al. 2010) and De Hoop MPAs (C. Attwood, UCT, unpubl. data) suggests that some MPAs could play a protective role

MANAGEMENT CONSIDERATIONS
Elf should be managed with consideration given to their highly migratory nature. MPAs are unlikely to substantially reduce fishing mortality on this species because of their migratory behaviour. The current daily bag limit, minimum size limit and closed season, are likely to effectively reduce fishing mortality for this species if properly enforced. The two-month closed season is applied nationally between 1 Oct and 30 Nov, when the majority of elf have migrated into KZN waters. The closed season is therefore relatively ineffectual in the EC and WC. Furthermore, during summer and autumn, the majority of elf occur in the EC and WC, where they may be targeted commercially with no bag limit. More attention should thus be given to monitoring and management of elf in the EC and WC and consideration should be given to de-commercializing elf throughout its distribution as this is primarily a recreational and subsistence species

RESEARCH REQUIREMENTS
A national stock assessment is urgently required for this species. However, estimating elf abundance solely from shore-based catch rates, as has been done in the past, is probably inappropriate (Ward et al. 2003). Elf may remain further offshore during some years and are therefore not reflected in shore angling catch rates (Maggs et al. 2012). Better understanding recruitment variability is a further research challenge
Research priority: High

SCIENTIFIC NAME: *Rachycentron canadum* (Smith No. 212.1)
COMMON NAMES: Prodigal son, Cobia, Kobia
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: Worldwide in tropical and subtropical waters, but absent in the central and eastern Pacific (Shaffer and Nakamura 1989, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common in KZN but rare in waters further south of the former Transkei, EC (Smith and Heemstra 1991)

MOVEMENT: Migratory
A migratory species with peak abundance in SA waters during summer (van der Elst 1993). Only 1 recapture has been recorded out of 36 tagged (ORI Tagging Project, unpubl. data). Elsewhere, considered migratory, either for spawning or food availability (Shaffer and Nakamura 1989)

HABITAT
Adults: A pelagic, coastal species usually found in association with reefs or floating objects on the surface (Shaffer and Nakamura 1989, Heemstra and Heemstra 2004). Usually in shallow water (2-25m) but have been taken at depths of 50m (Shaffer and Nakamura 1989). Often found swimming with whale sharks and manta rays (van der Elst 1993)
Juveniles: Early juveniles inhabit coastal areas, near beaches, river mouths, barrier islands, lower reaches of bays and inlets, or bays of relatively high salinities (Shaffer and Nakamura 1989)
Eggs and larvae: Pelagic, offshore (Shaffer and Nakamura 1989). Very few larvae have been recorded in SA waters (Connell 2012)

FEEDING
Adults: Almost exclusively planktonic crustaceans such as portunid crabs, but benthic invertebrates, squid and teleosts are also taken (Shaffer and Nakamura 1989, van der Elst 1993)
Juveniles: Unknown, presumably mainly planktonic organisms (Shaffer and Nakamura 1989)

REPRODUCTION
Reproductive style: Gonochoristic, batch spawners (Shaffer and Nakamura 1989). No external sexual dimorphism has been reported (Shaffer and Nakamura 1989)
Breeding/spawning season: Little known locally. May-Sep in the north central Gulf of Mexico (Shaffer and Nakamura 1989, Lotz et al. 1996), Jun-Aug in the mid-western Atlantic Ocean (Richards 1967, Shaffer and Nakamura 1989) and Oct-Dec in NE Australia (van der Velde et al. 2010)
Breeding/spawning locality: Not known locally. A female with maturing eggs was collected from Malagasy waters in Oct 1964 (Richards 1967)
Age at 50% maturity: Males: 1-2 years; Females: 2-3 years; various localities and studies (Shaffer and Nakamura 1989, Lotz et al. 1996, van der Velde et al. 2010). Male cobia mature at a younger age than females, normally in their first year (van der Velde et al. 2010). Male cobia from Chesapeake Bay (USA) reached earliest maturity in their second year while females reached earliest maturity in their third year (Shaffer and Nakamura 1989)
Length at 50% maturity: Males: 518-640mm FL; Females; 696-840mm FL; various localities and studies (Shaffer and Nakamura 1989, Lotz et al. 1996, van der Velde et al. 2010). In the Gulf of Mexico the smallest mature male was 640 mm FL and 1 year old, while females larger than 840 mm FL were all mature (Lotz et al. 1996)

BIOMETRICS
Maximum recorded age: 15 years; Gulf of Mexico; 1985 (Shaffer and Nakamura 1989)
Maximum recorded weight: 68kg (Robins and Ray 1986). World angling record is 61.5kg; Australia; 1985 (IGFA 2012)
Maximum recorded length: 200cm TL; Male (Quéro 1990, Heemstra and Heemstra 2004)
Length-length relationship: FL(cm) = 0.995TL(cm) + 0.892; TL(cm) = 1.666FL(cm) + 1.109; USA; n=930 (Franks et al. 1999)
Length-weight relationship: Combined sexes: Wt(g) = 0.00562 x FL(cm)$^{3.16}$; SA (Torres 1991a); Combined sexes: Wt(g) = 0.00153 x FL(cm)$^{3.428}$; Gulf of Mexico; n=915 (Franks et al. 1999); Combined sexes: Wt(g) = 0.0042 x FL(cm)$^{3.1}$; geometric mean based on seven studies (Froese and Pauly 2012)
Growth parameters: Males: L_∞ = 113cm FL; K = 0.49; t_0 = -0.49; Females: L_∞ = 129cm FL; K = 0.56; t_0 = 0.11; Western Louisiana (Franks and Brown-Peterson 2002). Median record from a number of studies reported on FishBase (Froese and Pauly 2012)

FISHERY

Throughout SA, cobia is an incidental catch in the various fisheries (van der Elst 1993). Forms a small component of the catch by the recreational boat sector in KZN (Mann et al. 1997a, Dunlop and Mann 2013). Also forms a small percentage of the catch in the KZN spearfishery (Mann et al. 1997b). Has global potential for mariculture and is already being successfully farmed in many parts of the world (Holt et al. 2007)

BIOLOGICAL REFERENCE POINTS

Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.35yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA. Assessed by Fry and Griffiths (2010) in Australian waters

STOCK STATUS

Status: Not assessed in SA
Trend in CPUE: Not known in SA waters - it is likely that the low fishing pressure in SA is having little effect on the overall population. Due to its mostly solitary behaviour, it is caught in relatively small quantities throughout its distribution (Williams 2001)
Trend in catch composition: Little known in SA waters. Comprises a very small percentage of the catch in the recreational boat sector in KZN (Dunlop and Mann 2013), no detailed comparisons between years are available
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING

MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS

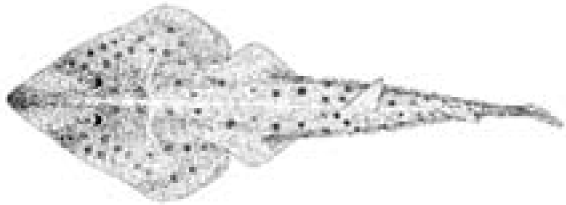
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Little protection provided in MPAs due to its highly migratory behaviour

MANAGEMENT CONSIDERATIONS

Due to its migratory habit, very fast growth rate and high fecundity, stocks are thought to be healthy and underexploited in SA waters

RESEARCH REQUIREMENTS

Information on stock distribution and catches by foreign fishing vessels in SA waters is needed
Research priority: Low



SCIENTIFIC NAME: *Rhinobatos annulatus* (Smith No. 27.2)
COMMON NAMES: Lesser guitarfish, Lesser sandshark, Kleiner sandkruiper
COMPILER: CG Attwood
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Endemic, southern Angola to KZN in depths of 1-118m (Rossouw 1983, Compagno et al. 1989, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, WC, EC, KZN
Previously thought to extend northwards up the west coast into NAM (Compagno et al. 1989) but this may be as a result of misidentification with *R. blochii* (C. Attwood, UCT, pers. obs.). There is thus a possibility of two separate stocks, one in southern Angola to NAM and one along the south-eastern seaboard of SA (Burgess et al. 2006). The latter population appears to have different colour variants with those in KZN having simple dark spots, while those in the EC and WC have brown spots ringed with white (Compagno et al. 1989)

MOVEMENT: Unknown
Possible inshore offshore migration. Lesser guitarfish are common in the surf-zone along sandy beaches during summer, but not in winter (Rossouw 1983). It is possible that they move offshore into deeper water where they are taken as bycatch by inshore trawlers (Buxton et al. 1984). A long shore movement is also possible and the 70 recaptures (1.1%) obtained to date have shown a mean distance travelled of 42km (ORI Tagging Project unpubl. data)

HABITAT
Adults: Sandy habitat - from the shallowest surf to inshore trawl grounds at depths of up to 73m (Buxton et al. 1984). Recorded at a depth of 118m off Sodwana (Heemstra and Heemstra 2004)
Juveniles: Sandy surf-zone used as a nursery (Rossouw 1983)

FEEDING
Adults: Diet includes benthic invertebrates such as small crustaceans, sand mussels and polychaete worms (Heemstra and Heemstra 2004, Burgess et al. 2006). The study by Harris et al. (1988) of the guitarfish diet incorrectly names *R. annulatus*. Most recent work shows that their subject was most likely *R. blochii* (C. Attwood, UCT, unpublished data)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Aplacental viviparity giving birth to 2-10 pups (Rossouw 1983, Compagno et al. 1989)
Breeding/spawning season: Pupping season is from Mar-Apr (Rossouw 1983)
Breeding/spawning locality: Shallow inshore waters off sandy beaches throughout range (Rossouw 1983)
Age at 50% maturity: Combined sexes: 3 years; Algoa Bay (Rossouw 1983)
Length at 50% maturity: Males: 580mm TL; Females: 615-650mm TL; Algoa Bay (Rossouw 1983)

BIOMETRICS
Maximum recorded age: 7 years; Algoa Bay (Rossouw 1984)
Maximum recorded weight: 9.1kg; SA shore angling record (SASAA 2012). van der Elst (1993) recorded the maximum weight as 27.7kg
Maximum recorded length: 1400mm TL (Rossouw 1983). Out of 2033 lesser guitarfish measured over a 28 year period in the De Hoop MPA, the largest was only 1150mm TL. The maximum length and weight estimate recorded by van der Elst (1993) is thus possibly unreliable as no present-day measurements come close to these maxima (CG Attwood, UCT, unpubl. data)
Length-length relationship: Combined sexes: DW(mm) = 0.344TL(mm) + 1.91; Algoa Bay (Rossouw 1983)
Length-weight relationship: Combined sexes: Wt(g) = 0.00000108 x $TL(mm)^{3.18}$; Algoa Bay (Rossouw 1983)
Growth parameters: Combined sexes: L_∞ = 109cm TL; K = 0.24; Algoa Bay; von Bertalanffy model inappropriate (Rossouw 1984)

FISHERY
Shore anglers catch this species mostly as bycatch, although they are sometimes targeted in catch and release angling competitions (Pradervand and Govender 2003). Caught as a bycatch in the beach seine fishery in False Bay but most returned alive (Lamberth et al. 1995). Approximately 18mt taken annually as bycatch in the inshore trawl grounds, most of which is discarded (Attwood et al. 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: No assessments have been attempted. Because the species is not consistently targeted, it is unlikely that an assessment based on fishery dependant data will be possible

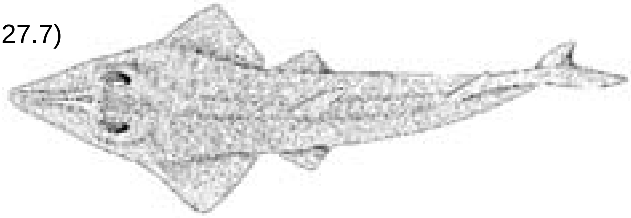
STOCK STATUS
Status: Not assessed
Trend in CPUE: In the Border competitive shore fishery lesser guitarfish showed a slight decreasing trend in CPUE both in terms of number and weight between 1989-98 (Pradervand and Govender 2003). In the De Hoop Marine MPA there has been no consistent trend in CPUE (C. Attwood, UCT, unpubl. data)
Trend in catch composition: Lesser guitarfish showed an increase in percentage contribution by number in the Border competitive shore fishery between 1989-98 (Pradervand and Govender 2003). Trends in De Hoop MPA have been stable over the period 1995-2012 (C. Attwood, UCT, unpubl. data)
Trend in mean size: Lesser guitarfish showed a significant decline in mean mass in the Border competitive shore fishery over the period 1982-98 (Pradervand and Govender 2003). No trend was observed in mean size in the De Hoop MPA between 1995-2012 (C. Attwood, UCT, unpubl. data)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2006 (Burgess et al. 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Lesser guitarfish are likely to receive protection in most no-take MPAs along the south-eastern seaboard containing suitable habitats (Bennett and Attwood 1993, Lamberth et al. 1995, Pradervand and Hiseman 2006, Venter and Mann 2012)

MANAGEMENT CONSIDERATIONS
Monitoring of bycatch levels in the inshore trawl and commercial beach seine fisheries is required. With the potential development of shark fisheries this species could become of increasing importance in future as fins from Rhinobatids command high prices in Asia

RESEARCH REQUIREMENTS
Spatial delineation between *R. blochii* and *R. annulatus* is unclear. The possibility of two separate stocks requires further investigation. There also appears to be some taxonomic confusion within the *Rhinobatos* genus as a whole (N. Kistnasamy, ORI, pers. comm.)
Research priority: Low



SCIENTIFIC NAME: *Rhynchobatus djiddensis* (Smith No. 27.7)
COMMON NAMES: Giant guitarfish, Giant sandshark, Reuse sandkruiper
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Restricted to the Red Sea and tropical waters of the WIO south to SA (Wallace 1967, Smith and Heemstra 1991). May comprise a complex of three or more species (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common in KZN and the Pondoland area of the EC during summer, known to occur as far south as Knysna (Heemstra and Heemstra 2004) but seldom found south of Port St Johns (Wallace 1967)

MOVEMENT: Nomadic
Based on tagging data and shore anglers' catches, adults of this species appear to be fairly mobile (mean distance moved by 194 recaptures was 33km) and although movement patterns are difficult to interpret, it is likely that they move southwards down the coast during the summer months and return to northern KZN and MOZ with the onset of winter (Wallace 1967, Bullen and Mann 2003, Pradervand et al. 2007). Juveniles appear to show some resident behaviour (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Occurs in shelf waters over muddy and sandy bottoms to 70m (Dudley and Cavanagh 2006) but mainly off sandy beaches, where it is most abundant in the surf zone but does occur along the edges of reefs down to 30m (van der Elst 1993)
Juveniles: Mainly found in the surf zone along sandy beaches (Wallace 1967)

FEEDING
Adults: Benthic molluscs, crustaceans, polychaetes, squid and small fish (Wallace 1967, van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Thought to be similar to the diet of adults

REPRODUCTION
Reproductive style: Ovoviviparous, producing four young ~60cm TL at birth (Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
Breeding/spawning season: Dec-Feb (summer) in northern KZN (Wallace 1967, Smith and Heemstra 1991, van der Elst 1993)
Breeding/spawning locality: Little known, but thought to breed in shallow waters off sandy beaches in northern KZN and MOZ (Wallace 1967)
Age at 50% maturity: Based on the approximate length of males and females at first maturity (Wallace 1967), the corresponding age would be about 1-2 years and 2-3 years for males and females respectively (van der Elst 1993) but ages need verification
Length at 50% maturity: Observed length at first maturity for males and females in KZN was 156 and 177cm TL respectively (Wallace 1967)

BIOMETRICS
Maximum recorded age: Based on the maximum length (280cm TL) recorded in SASAA angling records, the corresponding maximum age would be approximately 12-13 years (van der Elst 1993) but ageing needs verification
Maximum recorded weight: 123.9kg; 2008; SA shore angling record (SASAA 2012); van der Elst (1993) reported a maximum weight of 127.4kg
Maximum recorded length: 280cm TL (SASAA 2012); Dudley and Cavanagh (2006) reported a maximum length of 310cm TL
Length-length relationship: SL(cm) = 0.894TL(cm); FL(cm) = 0.935TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(kg) = 0.00000522 x $TL(cm)^{3.0141}$; SA; n=542 (ORI Tagging Project, unpubl. data)
Growth parameters: Unknown

FISHERY
Commonly caught by shore anglers in KZN and forms an important component of the competitive shore fishery where most fish are released (Pradervand et al. 2007). Also taken in shark nets along the KZN coast but most

(74%) are released alive (Young 2001). Comprises a small percentage (1.6%) of the bycatch taken by inshore prawn trawls off the Thukela Banks during summer (Fennessy 1994). However, due to an extended closed trawl season implemented between Aug-Feb each year and diminished inshore prawn catches (Olbers and Fennessy 2007), the impact of the prawn trawl fishery on *R. djiddensis* has greatly diminished. In MOZ and other East African countries, both artisanal fisheries operating inshore and foreign vessels offshore (longliners) target *R. djiddensis* for its flesh and high value fins (Dudley and Cavanagh 2006). Although this species faces fewer threats in SA, catches are seasonal and it is possible that animals may also move to MOZ, where they are being increasingly targeted (Dudley and Cavanagh 2006)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Catch rates for *R. djiddensis* in the KZN competitive shore fishery showed a general increase by number (fish.angler^{-1}.hour^{-1}) and weight (kg.angler^{-1}.hour^{-1}) between 1977-2000 (Pradervand et al. 2007) but this may have been as a result of improved targeting for this species (i.e. slide traces). More recently records from the ORI Tagging Project indicate a sharp decline in the number of individuals tagged each year since 1992 (ORI Tagging Project, unpubl. data) and anglers have expressed concern regarding the status of this species (M. Bellis, KZNCAU, pers. comm.). The mean annual catch rates of *R. djiddensis* in the KZN protective shark nets also showed a decline during the 1990s (Young 2001)
Trend in catch composition: Between 1977-2000 *R. djiddensis* comprised 2.8% of the catch by number and 8.8% of the catch by weight in the KZN competitive shore fishery (Pradervand et al. 2007). Over this period catch composition increased significantly by number but this may have been as a result of improved targeting (Pradervand et al. 2007). Between 1981-2000 *R. djiddensis* catches constituted 33.5% of the total batoid catches in the protective shark nets along the KZN coast (Young 2001)
Trend in mean size: *R. djiddensis* showed a significant decline in mean weight from 1977-2000 (Pradervand et al. 2007). Catch records from the protective shark nets in KZN between 1981-2000 indicate that the median size of females caught (175cm PCL) was significantly greater than that of males (148cm PCL) but there was no significant change in size of animals caught over this period (Young 2001)
Trend in sex ratio: Unknown, but records of catches from the protective shark nets in KZN between 1981-2000 indicate that females dominate catches (M:F=1:1.95) (Young 2001)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2006 (Dudley and Cavanagh 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Mann and Pradervand (2007) noted the occurrence of this species in the St Lucia Marine Reserve, however, due to its nomadic behaviour MPA protection is probably minimal. However, juveniles, which appear to be more resident, may receive some protection in in the St Lucia and Maputaland MPAs and the Ponto do Ouro Partial Marine Reserve in MOZ (B. Mann, ORI, pers. obs., Pereira 2000)

MANAGEMENT CONSIDERATIONS
Since the flesh and particularly the fins of *R. djiddensis* are highly sought after in Asian fish markets and the fact that the life history of this species makes it vulnerable to overexploitation, urgent management interventions are needed (Dudley and Cavanagh 2006). Due to its nomadic behaviour and potential migration into MOZ waters, urgent harvest and trade management is also needed such as precautionary curtailment of commercial exploitation throughout its range (i.e. possible decommercialisation). This is especially since *R. djiddensis* is targeted freely and often illegally by foreign longliners across a large proportion of its home range (Dudley and Cavanagh 2006)

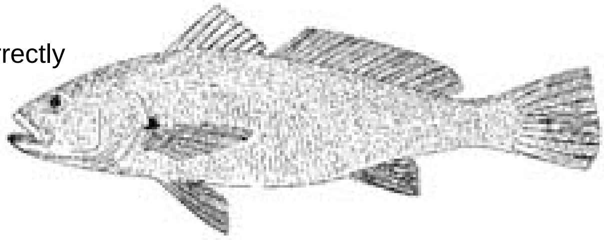
RESEARCH REQUIREMENTS

This species appears to be vulnerable to overfishing and therefore requires detailed research to determine reproductive biology, age and growth, catch trends, stock distribution (taxonomy and genetics), movement patterns, stock assessment, early life history and juvenile nursery areas

Research priority: High

SCIAENIDAE

SCIENTIFIC NAME: *Argyrosomus inodorus* (previously incorrectly identified as *A. hololepidotus* Smith No. 199.1)
COMMON NAMES: Silver kob, Kabeljou, Mild meagre
COMPILER: B Donovan
REVIEWER: SE Kerwath
DATE OF REPORT COMPLETION: October 2012



GLOBAL DISTRIBUTION: Endemic to southern Africa from northern NAM to southern Transkei (Griffiths and Heemstra 1995, Kirchner 1998)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Three separate stocks have been identified in SA waters. One in the SEC, one in SC and one in SWC (Griffiths 1996a, 1997a). Furthermore, a separate stock was identified in NAM (Kirchner 1998, Kirchner and Voges 1999)

MOVEMENT: Migratory
Inshore (<60m) in summer dispersing further offshore in winter in response to oceanographic patterns (Griffiths 1997a, Kirchner 1998)

HABITAT
Adults: Mostly moderate/low profile reef in 20-120m depth in SEC and SC and 2-120m in the SWC (Griffiths 1997a)
Juveniles: Sand/mud substrata, recruiting into shallow embayments (5-10m depth) but moving offshore with growth (Griffiths 1997a)
Eggs and larvae: Largely unknown; pelagic larvae

FEEDING
Adults: Pelagic fish, shrimp and squid (Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochorist (Griffiths 1997a)
Breeding/spawning season: Although breeding and spawning activity occurs continuously throughout the year, the main spawning season is from Aug-Dec with a peak between Sep-Nov (Griffiths 1997a)
Breeding/spawning locality: Inshore throughout distribution (Griffiths 1997a)
Age at 50% maturity: Females: 1.3 years (SEC); 2.4 years (SC); 1.5 years (NAM) (Griffiths 1996a, Kirchner 2001)
Length at 50% maturity: Males: 290mm TL (SEC); 325mm TL (SC); 360mm TL (NAM). Females: 310mm TL (SEC); 375mm TL (SC); 350mm TL (NAM) (Griffiths 1997a, Kirchner 2001)

BIOMETRICS
Maximum recorded age: Griffiths (1996a) recorded a maximum age of 25 years in SA waters, while Kirchner and Voges (1999) recorded a maximum age of 28 years in NAM waters
Maximum recorded weight: 36.3kg (Griffiths and Heemstra 1995)
Maximum recorded length: 1450mm TL (Griffiths and Heemstra 1995)
Length-length relationship: Combined sexes: SL(mm) = 0.8999TL(mm) - 20.96; SA (Griffiths 1996a)
Length-weight relationship: Combined sexes: Wt(g) = 0.000006 x $TL(mm)^{3.07}$; SA (Griffiths 1996a)
Growth parameters: Combined sexes: L_∞ = 1086.8mm TL; K = 0.409; t_0 = 3.34; SWC; Logistic growth model (Griffiths 1996a). Combined sexes: L_∞ = 1141.8mm TL; K = 0.646; t_0 = 6.928; SEC & SC; Richards growth model (Griffiths 1996a). Combined sexes: L_∞ = 103cm TL; K = 0.136; t_0 = -1.58; NAM; vonB growth model (Kirchner and Voges 1999)

FISHERY
An important component of the commercial skiboat fishery in the SWC, SC and SEC (Smale and Buxton 1985, Griffiths 1997a,c, Brouwer and Buxton 2002). A sought after species for many recreational boat-based anglers, particularly in the SEC (Brouwer and Buxton 2002, Donovan 2010). Important component of the bycatch of inshore trawlers along the SEC coast (Griffiths 1997c, Attwood et al. 2011). The inshore trawl catch is in the same order of magnitude as the linefish catch, but is not restricted by size limits. Caught from the shore mainly to the west of Cape Agulhas (Brouwer et al. 1997, Brouwer and Buxton 2002), important in both the commercial and recreational linefishery in NAM (Kirchner 1998, Kirchner and Beyer 1999, Holtzhausen et al. 2001). Caught in the beach seine-net fishery in SWC (Lamberth et al. 1997)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.67yr^{-1}$ (SEC); $0.42yr^{-1}$ (SC); $0.46yr^{-1}$ (SWC); $0.21yr^{-1}$ (NAM)
Natural mortality rate (M): $0.16yr^{-1}$ (SA); $0.21yr^{-1}$ (NAM)
Total mortality rate (Z): $0.83yr^{-1}$ (SEC); $0.58yr^{-1}$ (SC); $0.62yr^{-1}$ (SWC); $0.42yr^{-1}$ (NAM)
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: $0.11yr^{-1}$ (SEC); $0.12yr^{-1}$ (NAM)
F_{SB25} yr^{-1}: $0.19yr^{-1}$ (SEC); $0.21yr^{-1}$ (NAM)
$F_{0.1}$ yr^{-1}: 0.1-$0.13yr^{-1}$(SA); $0.13yr^{-1}$ (NAM)
$SBPR_{current}$: 2.9-9.8% (SEC); 6.5-12.5% (SC); 4.4-10.4% (SWC); 23% (NAM)
Year completed: 1994 in SA; 1995-96 in NAM
Locality: SA and NAM
References & Comments: Assessed using per-recruit methodology by Griffiths (1997c) in SA waters and by Kirchner (2001) in NAM waters. More recently assessed by Winker et al. (2012) using a biomass production model

STOCK STATUS
Stock assessment method: Other
Year completed: 2011
Locality: SA
Status: <25% - collapsed. Winker et al. (2012) modelled the three SA stocks with a biomass production model. All three stocks are still overexploited and the effort is still greater than E_{MSY} for the SC and SWC stocks
Trend in CPUE: Substantial declines were recorded during the 20th Century (Griffiths 2000). Recent CPUE data (post 2002) shows an increasing trend in the CPUE countrywide and there is evidence of stock recovery (Winker et al. 2012). This is largely believed to be the result of changes to the legislation and the cut in commercial effort post 2002 (Winker et al. 2012). Despite a recent increase in CPUE since 2002, there is still a decreasing trend over the last 30 years in the SEC (i.e. 1.69kg.$fisher^{-1}$.$hour^{-1}$ in 1986 to 0.86kg.$fisher^{-1}$.$hour^{-1}$ in 2007; Donovan 2010)
Trend in catch composition: In SEC short term catch composition for commercial fishers is largely driven by availability of other species (in particular geelbek, *Atractoscion aequidens*) but silver kob remains the 'mainstay' species in the SEC composing a mean of 30% of commercial landings between 1985-2007 (Donovan 2010)
Trend in mean size: There has been an increase in the mean size of fish landed by commercial and recreational fishers in the SEC due to the change in the minimum legal size limit (i.e. 40 to 50cm TL in April 2005) (Donovan 2010)
Trend in sex ratio: Not assessed

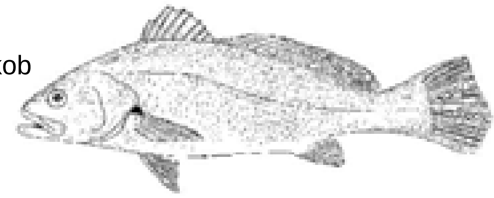
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd (shore and boat anglers west of Cape Agulhas but only 1pppd for shore anglers east of Cape Agulhas); Commercial: unlimited
Minimum size limit: 50cm TL
Closed Season: None
Other regulations: No more than one fish >110cm TL pppd (applies to both commercial and recreational anglers). The inshore trawlers need to move away at least 5nm if the catch taken in a drag exceeds 20% of the sole directed or 2% of the hake directed catch
MPA effectiveness: Although silver kob is known to occur in several MPAs, a positive effect of MPAs on this species has yet to be shown as the majority of silver kob are caught further offshore than the seaward boundaries of most coastal MPAs

MANAGEMENT CONSIDERATIONS
Current management measures appear to have had a positive impact on the stocks (Donovan 2010, Winker 2012). However, the trawl catch needs to be closely monitored and precautionary upper catch limits introduced to facilitate the stagnating recovery of the stock on the SC coast. Effective monitoring and control of regulations (in particular of recreational skiboat anglers in SEC) remains a concern (Donovan 2010)

RESEARCH REQUIREMENTS
Assessment of the impact of the trawl catch and development of a management protocol for all fisheries impacting on this species. Verification of the three stock hypothesis by means of genetics
Research priority: Medium

SCIAENIDAE



SCIENTIFIC NAME: *Argyrosomus japonicus* (Smith No. 199.1)
COMMON NAMES: Dusky kob, Daga salmon, Kabeljou, Kob, Giant kob
COMPILER: A-R Childs
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: May 2012

GLOBAL DISTRIBUTION: Eastern seaboard of SA, southern and eastern seaboard of Australia; northern Indian Ocean off Pakistan and northwest coast of India; northern Pacific from Hong Kong northwards along Chinese coast to southern Korea and Japan (Trewavas 1977, Griffiths and Heemstra 1995 and original references therein)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
In SA, *A. japonicus* is found along the southeast coast from Cape Point to southern MOZ, although it is most abundant from Cape Agulhas to northern KZN (Griffiths and Heemstra 1995)

MOVEMENT: Migratory
Based on several tagging studies (i.e. ORI Tagging Project, unpubl. data and Childs in prep.), some *A. japonicus* are resident in specific estuaries and adjacent surf-zones and exhibit low levels of dispersal. However, a large proportion of the adult population from the EC and WC migrate to KZN to spawn in winter/spring (Griffiths 1996b)

HABITAT
Adults: Adults are found predominantly in the near-shore marine environment, from the surf-zone down to 50m and possibly even 100m, but also frequent the lower-middle reaches of turbid estuaries (mostly deeper areas) (Griffiths and Heemstra 1995, Griffiths 1996b, Childs in prep.). *A. japonicus* show a strong affinity to estuarine habitats during early adulthood (up to the age/size at maturity of 6 years/~100cm TL) and reduced estuarine use thereafter
Juveniles: Juveniles are estuarine-dependent and are euryhaline (Wallace and van der Elst 1975). Early juveniles 30-150mm TL are found in estuaries only (mainly turbid and most often in the upper reaches) (Griffiths 1996b). Juveniles 150-800mm TL are predominantly found in estuaries (mainly turbid), but are also found in the inshore marine environment (mainly surf-zone). Larger juveniles (800-1 000mm TL) are predominantly found in the inshore marine environment, but are also found in estuaries (mainly turbid and most often in the lower/middle reaches) (Griffiths 1996b, Childs in prep.)
Eggs and larvae: Eggs and larvae have been regularly recorded off Park Rynie south of Durban in 30-40m of water between Jul-Feb (Connell 2012). Dispersal of the eggs and larvae to nursery areas along the eastern and southern coasts is facilitated by the southward moving shoreward edge of the Agulhas Current (Beckley 1993) and/or wind-driven surface currents on the shelf

FEEDING
Adults: Adults are primarily piscivorous (Griffiths 1997d), but also feed on cephalopods (e.g. *Sepia* spp.) and crustaceans (Marais 1984)
Juveniles: Small juveniles (<50mm TL) feed primarily on mysids and calanoid copepods (Marais 1984). Larger juveniles feed mainly on teleosts and mysids (Marais 1984, Griffiths 1997d). Diet also includes other crustaceans such as Macrura, Anomura, Brachyura, etc. (Marais 1984)

REPRODUCTION
Reproductive style: Gonochorist (Griffiths 2000)
Breeding/spawning season: Oct-Jan in the EC and WC and Aug-Nov in KZN (Griffiths 1996b). However, the presence of *A. japonicus* eggs has been documented in the coastal waters of KZN as early as July and as late as February (Connell 2012)
Breeding/spawning locality: Spawning aggregations occur on inshore reefs, pinnacles and wrecks (mainly at night) in KZN, Transkei and EC (Griffiths 1996b, Connell 2012)
Age at 50% maturity: Males: 5 years; Females: 6 years; SA; 1993-95 (Griffiths 1996b)
Length at 50% maturity: Males: 920mm TL; Females: 1070mm TL; SA; 1993-95 (Griffiths 1996b)

BIOMETRICS
Maximum recorded age: 42 years; Female (Griffiths and Hecht 1995a)
Maximum recorded weight: 80kg; Gamtoos Estuary mouth surf-zone, EC; 2011 (Anon. 2011)
Maximum recorded length: 2050mm TL; Gamtoos Estuary mouth surf-zone, EC; 2011 (Anon. 2011)
Length-length relationship: Combined sexes: SL(mm) = 0.8831TL(mm) - 15.509; SA coast (Griffiths and Hecht 1995a)
Length-weight relationship: Combined sexes: Wt(g) = 0.000008 x TL(mm)$^{3.0397}$; SA coast (Griffiths and Hecht 1995a)

Growth parameters: Females: L_∞ = 1472.9mm TL; K = 0.228; t_0 = -2.62; Males: L_∞ = 1372.3mm TL; K = 0.26; t_0 = -4.282; Combined sexes: L_∞ = 1427.3mm TL; K = 0.241; t_0 = -3.194; SA coast (Griffiths and Hecht 1995a)

FISHERY
A. japonicus is one of the most important species in the recreational (estuarine and coastal shore angling as well as estuarine and inshore boat fishing), commercial and subsistence fisheries (Griffiths 1996b). *A. japonicus* was found to be the primary target species in the EC recreational shore fishery (Brouwer et al. 1997) and is prominent in the recreational shore fishery along the entire east coast of SA (Transkei and KZN) (Pradervand 2004, Pradervand et al. 2007), particularly in estuaries (Mann et al. 2002, Beckley et al. 2008). Juveniles and sub-adults (<1100mm TL) are commonly targeted by estuarine and surf-zone anglers, while adults are caught mainly by commercial and recreational ski-boat fishermen beyond the surf-zone (Griffiths 1997b). There is specific targeting of aggregations of these adult fish by skiboats during late winter and spring in KZN, although surveys often don't reflect this as catches are landed at night

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $F_{inshore}$ = 0.63yr^{-1}; $F_{offshore}$ = 0.06yr^{-1}
Natural mortality rate (M): 0.1yr^{-1}
Total mortality rate (Z): $Z_{inshore}$ = 0.78yr^{-1}; $Z_{offshore}$ = 0.11yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.07yr^{-1} (for a size limit of 40cm)
F_{SB25} yr^{-1}: 0.11yr^{-1} (for a size limit of 40cm)
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 1.1–4.5%
Year completed: 1997
Locality: SA coast
References & Comments: $F_{inshore}$ includes juveniles in estuaries and surf-zone, while $F_{offshore}$ includes adults in the offshore marine environment (Griffiths 1997b)

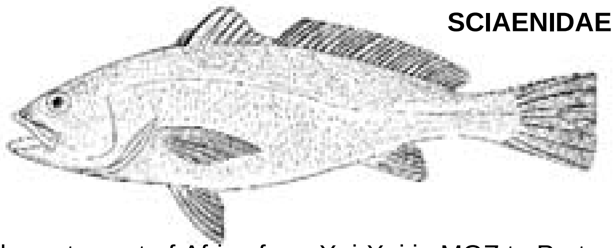
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1997
Locality: SA coast
Status: <25% - collapsed (Griffiths 1997b)
Trend in CPUE: Analysis of shore angling competition catch data from 1977-2000 showed that CPUE has declined for *A. japonicus* in KZN (Pradervand et al. 2007) and along the Transkei coast (Pradervand 2004). Similarly, analysis of competitive shore angling data from 1982-98 from the Border region of the EC showed that *A. japonicus* exhibited a marked decline in CPUE by number and mass from 1993-98 (Pradervand and Govender 2003). An assessment of the recreational fishery in the St Lucia estuarine system, KZN, showed that CPUE by number for *A. japonicus* had declined from 1986-99 (Mann et al. 2002). KZN shore-angling, kept fish only, fish.angler^{-1}.day^{-1}: 1994-96: 0.01 (Mann et al. 1997a) decreasing to 0.002 in 2008-09 (Dunlop 2011); KZN boat-based CPUE considered unreliable because of under-representation of this species (owing to lack of night surveys)
Trend in catch composition: Analysis of shore angling competition catch data from 1977-2000 showed that the percentage contribution by number and mass has declined for *A. japonicus* in KZN (Pradervand et al. 2007) and along the Transkei coast (Pradervand 2004). Similarly, analysis of competitive shore angling data from 1982-98 from the Border region of the EC showed that *A. japonicus* exhibited a decline in percentage contribution by number and mass over the sampled period (Pradervand and Govender 2003). KZN shore-angling, kept fish only: 1994-96: 1.01% by no. and 6.37% by wt. (Mann et al. 1997a), decreasing to 0.24% and 1.97% in 2008-09 (Dunlop 2011). KZN boat-based catch composition considered unreliable because of under-representation of this species (owing to lack of night surveys)
Trend in mean size: Analysis of shore angling competition catch data from 1977-2000 revealed no trend in mean size (mass) for *A. japonicus* in KZN (Pradervand et al. 2007) and along the Transkei coast (Pradervand 2004). Similarly, analysis of competitive shore angling data from 1982-98 from the Border region of the EC showed no trend in mean size (mass) for *A. japonicus* over the sampled period (Pradervand and Govender 2003)
Trend in sex ratio: M:F sex ratio 1:1 (Griffiths 1996b) but no information on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Sep 2009, results awaiting review and publication. However, a recent (October 2011) national IUCN assessment classified *A. japonicus* as Vulnerable (A.1.d) (Childs in prep.)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited, but all sectors may only land or be in possession of one kob >110cm TL pppd
Minimum size limit: 60cm TL
Closed Season: None
Other regulations: Due to the similarity of the three kob species found in SA waters (i.e. *A. japonicus*, *A. inodorus* and *A. thorpei*), regional differences in the regulations exist, particularly for boat-based fishers offshore
MPA effectiveness: Owing to the resident nature of juveniles and sub-adult *A. japonicus* in estuaries and the adjacent surf-zone, this species would benefit from protection within MPAs, particularly those associated with large productive and turbid estuaries. A number of MPAs in South Africa have been shown to provide protection for *A. japonicus* including De Hoop (Griffiths and Attwood 2005), Dwesa-Cwebe (Venter and Mann 2012) and Pondoland (Mann et al. 2006). In addition, estuarine protected areas such as the no-take zones within Lake St Lucia can provide protection for juvenile kob when this system is open to the sea (Mann et al. 2002). Furthermore, deep reefs and the wreck of the Produce within the Aliwal Shoal MPA are likely to afford protection to spawning aggregations of *A. japonicus* (Connell 2012)

MANAGEMENT CONSIDERATIONS
Due to the lack of enforcement and compliance, the bag and size limit restrictions are considered to be relatively ineffective. Suggested management considerations include: 1) No-take EPAs in important turbid estuarine nursery habitats that would afford juveniles protection and prevent growth over-fishing owing to high site fidelity within estuaries (Childs in prep.); 2) No-take MEPAs (joint Marine and Estuarine Protected Areas) in important turbid estuaries and their adjacent surf-zones (e.g. Sundays, Gamtoos and Breede Estuaries) would afford protection to all life-history stages (juveniles, sub-adult and adults) of *A. japonicus* given the low connectivity and high residency and affinity to estuaries and adjacent surf-zones (Childs in prep.); 3) A three-month closed season in KZN during the spawning season (Jul– Sep) would protect adult fish during their vulnerable spawning aggregations and prevent recruitment over-fishing. If these measures do not promote recovery then a moratorium (zero bag limit) and a shift to catch and release angling would be the only other option to ensure recovery of this collapsed stock

RESEARCH REQUIREMENTS
Accurate evaluation and development of alternative management strategies (EPAs and MEPAs) for *A. japonicus*, particularly in large turbid estuaries, is needed. Recent estuarine telemetry studies have confirmed that juvenile *A. japonicus* are extremely dependent on estuarine nursery habitats and early adults show a strong fidelity to adjacent surf-zones. Exceedingly high recapture statistics in these studies (e.g. 48%, 33%) have highlighted the vulnerability of both life-history stages of *A. japonicus* to exploitation and the importance of implementing protected areas in estuaries and adjacent surf-zones (MEPAs) (Cowley et al. 2008, Childs in prep.). Information on the timing of reproduction and the location of spawning grounds is required for the development of closed seasons for *A. japonicus*, which must coincide with the timing of the vulnerable spawning aggregations. The mechanisms driving long-shore migrations should be investigated to better conserve the adult population and provide insights into the potential effects of climate change on this species. An accurate assessment of the early juvenile (<100mm TL) recruitment into estuaries is essential to identify and conserve important estuaries in the life-history of *A. japonicus*. Dedicated genetic studies should determine what proportion of the commercial catch comprises *A. japonicus* compared to *A. inodorus*. This would provide an estimate of the amount commercial fishers contribute to the total landings of *A. japonicus* and would provide insights into the viability of decommercialising the species. There is an urgent need to assess the extent of nocturnal catches by skiboats in KZN
Research priority: High



SCIENTIFIC NAME: *Argyrosomus thorpei* (Smith No. 199.2)
COMMON NAMES: Squaretail kob, Half kob
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic to southern Africa; south-east coast of Africa from Xai-Xai in MOZ to Port Elizabeth in EC (Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Rare south of Port St Johns in the EC (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Apparently fairly resident (van der Elst 1993); juveniles move from soft substrata to reefs on reaching maturity (Fennessy 1994)

HABITAT
Adults: Low relief, offshore reefs (<100m) (Fennessy 1994)
Juveniles: Relatively shallow (<50m) offshore waters over soft substrata (Fennessy 1994)
Eggs and larvae: Shelf waters off KZN (Beckley 1993, Connell 2012)

FEEDING
Adults: Mainly fish, some cephalopods and crustacea (van der Elst 1993)
Juveniles: Mainly crustaceans (S. Fennessy, ORI, unpubl. data)

REPRODUCTION
Reproductive style: Gonochorist (Denton and van der Elst 1987)
Breeding/spawning season: Jun-Sep (van der Elst et al. 1990)
Breeding/spawning locality: Thukela Banks in central KZN (Denton and van der Elst 1987); likely to spawn in the Xai-Xai area in MOZ as well (S. Fennessy, ORI, pers. obs.)
Age at 50% maturity: Females: 2.1 years; KZN (van der Elst et al. 1990). Difficulty experienced in obtaining adequate samples to positively establish age at maturity
Length at 50% maturity: Females: 329mm TL; KZN (van der Elst et al. 1990). Difficulty experienced in obtaining adequate samples to positively establish size at maturity

BIOMETRICS
Maximum recorded age: 13 years; Female; KZN; 1990 (S. Fennessy, ORI, unpublished data)
Maximum recorded weight: 17kg; KZN; 1987; South African angling record (SADSAA 2012)
Maximum recorded length: 1100mm TL; KZN; 1990 (S. Fennessy, ORI, unpubl. data)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: $Wt(g) = 0.00002 \times TL(mm)^{2.89}$; KZN (van der Elst et al. 1990)
Growth parameters: Combined sexes: $L_\infty = 518.3$mm TL; $K = 0.286$; $t_0 = -1.46$; KZN; Straight-line growth curve, so L_∞ under-estimated owing to inadequate availability of samples (van der Elst et al. 1990)

FISHERY
Comprised a substantial component of commercial skiboat catches in northern KZN during the 1980s, but catches declined sharply during the 1990s. Also caught by recreational skiboat anglers, mainly between Thukela and Richards Bay on the KZN north coast (Mann et al. 1997a). Juveniles used to be a fairly common bycatch in Thukela Bank prawn trawl catches especially between Jan-Feb (Fennessy 1994), but a 7-month closed season reduced these catches substantially. Currently very little prawn trawling is taking place on the Thukela Bank because of non-viable prawn catches (S. Fennessy, ORI, unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.92yr^{-1}
Natural mortality rate (M): 0.34yr^{-1}
Total mortality rate (Z): 1.26yr^{-1}
F_{MSY} yr^{-1}: 0.6
F_{SB40} yr^{-1}: ∞
F_{SB25} yr^{-1}: ∞
$F_{0.1}$ yr^{-1}: 0.58
$SBPR_{current}$: 37%
Year completed: 1987
Locality: KZN
References & Comments: This assessment was based on unrealistic growth parameters (van der Elst et al. 1990)

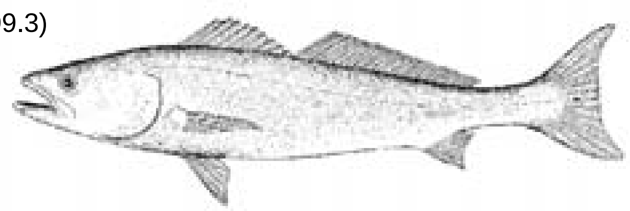
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1993
Locality: KZN
Status: <25% - collapsed. Using a more realistic L_{∞} of 1000mm TL, Fennessy (1994a) estimated that the current SBPR had been reduced to ~17% of pristine
Trend in CPUE: Total commercial catch in northern KZN declined from 132.7mt in 1990 to 14.2mt in 1998 (S. Fennessy, ORI, unpubl. data). Recreational skiboat catch rates declined from 0.2 fish and 0.17kg per outing to 0.02 and 0.01 respectively from 1994-96 to 2008-09; similarly commercial catch rates declined from 0.34 fish and 0.37kg per outing to 0.24 and 0.25 respectively from 1994-96 to 2008-09 (Mann et al. 1997a, Dunlop 2011)
Trend in catch composition: Percentage composition in the commercial catch from northern KZN declined from 37% by wt in 1990 to 5% in 1998 (S. Fennessy, ORI, unpubl. data). Catches by KZN recreational skiboats in 1994-96 (8.8% by no. and 3.9% by wt) declined to (0.6% by no. and 0.29% by wt) by 2008-09. Commercial catches in 1994-96 (1.9% by no. and 2.5% by wt) declined to (0.46% by no. and 0.61% by wt) by 2008-09 (Mann et al. 1997a, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence offshore boat fishers: 5pppd (note that because of the similarity of all *Argyrosomus* species, shore and estuarine fishers are limited to a daily bag limit of 1pppd east of Cape Agulhas); Commercials: unlimited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: Fishers from all sectors are limited to a daily bag limit of 1pppd for fish >110cm TL. Seven-month (Sep-Mar) closed season for prawn trawling on the shallow (<50m) Thukela Banks
MPA effectiveness: The St Lucia/Maputaland MPAs are important as they provide some protection in the range of this species although it is not the preferred habitat; the Ponta do Ouro Partial Marine Reserve also provides some protection in southern MOZ waters. *A. thorpei* also receives some protection within the Pondoland MPA (B. Mann, ORI, unpubl. data)

MANAGEMENT CONSIDERATIONS
Given the extreme declines in CPUE and despite uncertainties in the per-recruit assessment, the stock probably collapsed in late 1980s as a result of commercial overfishing of a relatively small stock, exacerbated by prawn trawling bycatch. Concerningly, eggs (presumed to be) of this species have not been observed off Park Rynie since 2002, despite regular collecting (Connell 2012). MPA protection is urgently required in the main habitat of this species (i.e. in the northern half of the KZN Bight). Collaborative negotiation is also required towards the declaration of an MPA in the Xai-Xai area, MOZ, where suitable habitat exists. Reduced Thukela River flow in future may compromise productivity (Lamberth et al. 2009, Turpie and Lamberth 2010), and further ecological stresses could be imposed by the proposed offshore mining in this area

RESEARCH REQUIREMENTS
Size at maturity, growth parameters and stock assessment need to be updated urgently
Research priority: High



SCIENTIFIC NAME: *Atractoscion aequidens* (Smith No. 199.3)
COMMON NAMES: Geelbek, Cape salmon, Silver jewfish, Corvina, Teraglin
COMPILER: SE Kerwath
REVIEWER: H Winker
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Gulf of Guinea to Angola, False Bay to southern MOZ, NW Africa and SE Australia (Fischer and Bianchi 1984, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Cape Point to southern MOZ, separated from stock off Angola by cool waters off the west coast of SA and southern NAM (Griffiths and Hecht 1995b)

MOVEMENT: Migratory
Adults undertake a seasonal migration from the WC to KZN where they spawn in spring (Garratt 1988, Griffiths and Hecht 1995b)

HABITAT
Adults: Adults (>90cm) found throughout distributional range, over sandy and rocky substrata to depths of 150m (Griffiths and Hecht 1995b)
Juveniles: Sandy and rocky substrata to depths of 100m, early juveniles (<50cm) in SE Cape, while sub-adults (50-85cm) are mainly found in the SW Cape (Griffiths and Hecht 1995b)
Eggs and larvae: Pelagic eggs found inshore of the Agulhas Current in KZN and EC, transported southwards along the inshore edge of the Agulhas Current to nurseries in the SE Cape (Beckley 1993, Griffiths and Hecht 1995b, Connell 2012)

FEEDING
Adults: Sardines, mackerel and massbanker (Griffiths 1988)
Juveniles: Mysids and later anchovies (Griffiths 1988)

REPRODUCTION
Reproductive style: Gonochorist (Griffiths and Hecht 1995b)
Breeding/spawning season: Aug-Nov with peak in Sep-Oct (Garratt 1988, Griffiths and Hecht 1995b, Connell 2012)
Breeding/spawning locality: In KZN waters mainly over offshore reefs in depths of 40-60m (Griffiths and Hecht 1995b, Connell 2012)
Age at 50% maturity: Combined sexes: 5 years; SA (Griffiths and Hecht 1995b)
Length at 50% maturity: Combined sexes: 900mm FL; SA (Griffiths and Hecht 1995b)

BIOMETRICS
Maximum recorded age: 9 years; SA (Griffiths 1988)
Maximum recorded weight: 14.9kg; Algoa Bay; SA angling record (SADSAA 2012)
Maximum recorded length: 130cm TL (Heemstra and Heemstra 2004)
Length-length relationship: Combined sexes: TL(mm) = 1.06FL(mm) - 0.757; SA (Griffiths 1988)
Length-weight relationship: Combined sexes: Wt(g) = 0.00000842 x $FL(mm)^{3.01}$; SA (Griffiths 1988)
Growth parameters: Combined sexes: L_∞ = 1077.2mm FL, K = 0.31; t_0 = -0.55; SA; fitted to Schnute growth curve after Griffiths and Hecht (1995b)

FISHERY
Important catch of the boat-based commercial and recreational linefishery. Catches per area are seasonal as adult fish undertake an annual spawning migration to KZN (Sauer et al. 1997, Donovan 2010). Also taken as bycatch by the inshore demersal trawl fishery (Attwood et al. 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.65yr^{-1}$
Natural mortality rate (M): $0.5yr^{-1}$
Total mortality rate (Z): $1.15yr^{-1}$
F_{MSY} yr^{-1}: 0.49
F_{SB40} yr^{-1}: 0.25
F_{SB25} yr^{-1}: 0.37
$F_{0.1}$ yr^{-1}: 0.44
$SBPR_{current}$: 6.7%

Year completed: 1998
Locality: SA
References & Comments: These parameters are based on a VPA of the SA stock undertaken by Hutton et al. (2001). A more recent assessment has been undertaken by Winker et al. (2012) using a standardised CPUE time-series

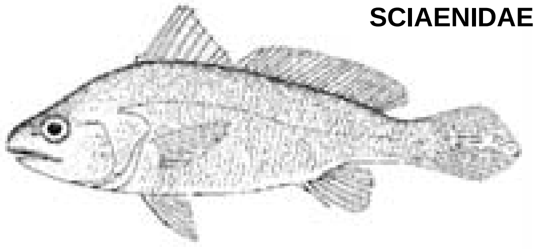
STOCK STATUS
Stock assessment method: Other
Year completed: 2011
Locality: SA
Status: <25% - collapsed. Based on a standardised CPUE time-series (Winker et al. 2012)
Trend in CPUE: CPUE for the period 1985-98 dropped to between 1.5-4.3% of historical values (Griffiths 2000). In 2000, CPUE in the WC showed an initial increase, which was likely a result of strong year classes of sub-adults that recruited into the fishery. By 2005 the CPUE had dropped back to pre-emergency levels in the WC, but increased in EC and KZN where predominantly larger and older adults are targeted. The CPUE in EC and KZN has remained elevated over the past few years (Donovan 2010, Winker et al. 2012), but low CPUE in the WC could indicate that the increased CPUE levels in EC and KZN may not persist. Connell (2012) has also shown a possible decline in egg production along the KZN south coast since 2008
Trend in catch composition: The contribution of geelbek to both linefish and inshore trawl catches declined severely throughout the 20th Century (Griffiths 2000). Currently geelbek contributes consistently between 4% and 8% of the total commercial linefish catch, with no discernible trend since 2000 (NMLS unpubl. data)
Trend in mean size: Mean size increased initially after 2000 but shows no discernible trend since 2004 (NMLS unpubl. data)
Trend in sex ratio: M:F sex ratio was 1:1 (Griffiths and Hecht 1995b) but no data on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: unlimited
Minimum size limit: 60cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Geelbek is migratory and there is no evidence to date that MPAs are effective in the management of this species. However, future spatial or temporal closures of areas where spawning aggregations occur may provide benefit

MANAGEMENT CONSIDERATIONS
Despite the cut in commercial fishing effort and the decrease in recreational bag limits, the standardised CPUE does not indicate much of an improvement. Fishing concentrated on spawning adults needs to be regulated to improve this stock. The current high level of shark predation on adults hooked in these spawning aggregations along the KZN coast is further exacerbating the problem (B. Mann, ORI, pers. comm.)

RESEARCH REQUIREMENTS
Development of a spatially explicit, age-structured stock assessment model that takes migration and spawning aggregations into account
Research priority: High



SCIENTIFIC NAME: *Johnius dorsalis* (Smith No. 199.6)
COMMON NAMES: Small kob, Mini-kob, Nondi, African croaker
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Western Indian Ocean from Kenya to SA, also in Madagascar (Sasaki 1997)
Previously referred to as *Johnius dussumieri*, which only occurs east of Pakistan (Sasaki 1997)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA, south to East London in shallow (<50m) shelf waters and estuaries (Smith and Heemstra 1991)

MOVEMENT: Unknown
Juveniles in estuaries (partially estuarine-dependent) (Wallace 1975, Whitfield 1998), movement of adults out to sea for spawning, although Connell (1996) reported some spawning in Lake St Lucia

HABITAT
Adults: Offshore soft substrata, turbid water; very common on Thukela Bank (Fennessy 2000) and in Lake St Lucia (Wallace 1975, Cyrus et al. 2005)
Juveniles: Estuaries and offshore soft substrata in turbid water; common on Thukela Bank (Fennessy 2000) and in Lake St Lucia (Wallace 1975, Whitfield 1998)
Eggs and larvae: Shelf waters (Beckley 1993); Lake St Lucia (Connell 1996)

FEEDING
Adults: Mainly crustaceans (Natantia and Anomura); also small teleosts (Fennessy 2000)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochorist (Fennessy 2000)
Breeding/spawning season: Sep-Feb (Fennessy 2000)
Breeding/spawning locality: Thukela Banks (Fennessy 2000); possibly in other areas with soft susbtrata; probability of some spawning in Lake St Lucia (Connell 1996)
Age at 50% maturity: Unknown
Length at 50% maturity: Females: 125mm TL; Thukela Bank; 1992 (Fennessy 2000)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 139g; Female; Thukela Bank; 1991 (S. Fennessy, ORI, unpubl. data)
Maximum recorded length: 230mm TL **(**K. Sasaki, unpubl. data); 220mm TL; Thukela Bank; 1990 (S. Fennessy, ORI, unpubl. data)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.00000308 x $TL(mm)^{3.28}$; Thukela Bank (Fennessy 2000)
Growth parameters: Unknown

FISHERY
Very common in shallow water prawn trawl catches on the Thukela Bank (Fennessy et al. 1994) although effort in this fishery is currently extremely low. Also commonly caught by estuarine recreational boat anglers in Lake St Lucia (Mann et al. 2002) but effort in this fishery has also been very low since 2002 owing to drought and the closure of the estuary mouth. Featured in illegal estuarine gill net catches in Lake St Lucia (Mann 1995); much less common in KZN beach seine catches over sandy substrata (Beckley and Fennessy 1996)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

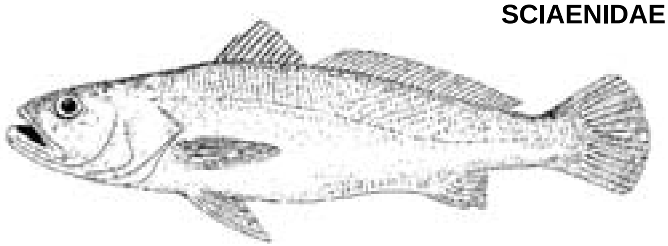
STOCK STATUS
Status: Not assessed, however the stock of *J. dorsalis* on Thukela Bank is currently assumed to be healthy as prawn trawling has been at very low levels since 2005 owing to poor recruitment of prawns from St Lucia and low economic viability of trawling owing to cheaper prices of imported prawns (S. Fennessy, ORI, pers. obs.)
Trend in CPUE: Unknown
Trend in catch composition: Thukela Bank prawn trawl catches (1989-92) comprised 20.2% of catch by no. and occurred in 97% of trawls. Between 2003-06 comprised 22% of catch by no. and occurred in 100% of trawls (S. Fennessy, ORI, unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Seven-month (Sep-Mar) closed season for prawn trawling on the shallow (<50m) Thukela Banks
MPA effectiveness: Limited MPA protection for this species, mainly in the Wilderness area of Lake St Lucia, and to a much lesser extent in the protected estuaries within the Pondoland MPA

MANAGEMENT CONSIDERATIONS
The St Lucia Estuary is an important habitat for this species, so ecological restoration of the system is required. The Thukela Bank is also a critical habitat, and at least part of this important ecosystem requires protection within a MPA from the various anthropogenic perturbations (including trawling and offshore mining); further impoundments on the Thukela River would also likely compromise the status of this species (Turpie and Lamberth 2010)

RESEARCH REQUIREMENTS
Biodiversity research towards the justification for, and promulgation of, a soft substratum MPA in the northern part of the KZN Bight
Research priority: Medium



SCIENTIFIC NAME: *Otolithes ruber* (Smith No. 199.7)
COMMON NAMES: Snapper kob, Longtooth kob, Tigertooth croaker
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Indo-West Pacific: SA to Oman (absent in Red Sea), India, Indonesia, southern China and Queensland coast of Australia (Chan et al. 1974)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
SA distribution south to Algoa Bay (Heemstra and Heemstra 2004)

MOVEMENT: Unknown

HABITAT
Adults: Offshore soft substrata, turbid water; very common on Thukela Bank (Fennessy et al. 1994); occasionally in estuaries (Heemstra and Heemstra 2004)
Juveniles: Offshore soft substrata in turbid water; common on Thukela Bank (Fennessy, 2000)
Eggs and larvae: Shelf waters (Beckley 1993)

FEEDING
Adults: Mainly crustaceans (Natantia and Brachyura); also small teleosts (Fennessy 2000)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochorist (Fennessy 2000)
Breeding/spawning season: Aug-Jan (Fennessy 2000)
Breeding/spawning locality: Thukela Banks (Fennessy 2000); possibly other areas with soft substrata such as the Sofala Banks in MOZ
Age at 50% maturity: Females: 1.7 years; Thukela Banks; 1989-94 (Brash and Fennessy 2005)
Length at 50% maturity: Females: 237mm TL; Thukela Banks; 1989-92 (Fennessy 2000)

BIOMETRICS
Maximum recorded age: 8 years; Female; Thukela Bank; 1989-92 (Brash and Fennessy 2005)
Maximum recorded weight: 1.6kg; SA shore angling record (SASAA 2012). The largest fish sampled on the Thukela Banks was a female of 1.26kg (S. Fennessy, ORI, unpubl. data)
Maximum recorded length: 485mm TL; Female; Thukela Banks; 1994 (Brash and Fennessy 2005). Heemstra and Heemstra (2004) noted that this species attains a maximum length of 50cm TL
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.00000494 x $TL(mm)^{3.13}$; KZN (Fennessy 2000)
Growth parameters: Combined sexes: L_∞ = 419mm TL; K = 0.31; t_0 = -0.96; Thukela Banks, KZN (Brash and Fennessy 2005). Combined sexes: L_∞ = 45.9cm TL; K = 0.32; Sofala Banks, MOZ (Schultz 1992, calculated using ELEFAN 1)

FISHERY
Very common in shallow water prawn trawl catches on the Thukela Bank (Fennessy et al. 1994) although effort in this fishery is currently extremely low; also fairly commonly caught by recreational paddleski fishery off Durban (Beckley and Fennessy 1996) but abundance appears to have declined since the damming of the Umgeni River (B. Mann, ORI, pers. obs.). Occasionally taken in KZN beach seine catches over sandy substrata (Beckley and Fennessy 1996)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.53yr^{-1}
Natural mortality rate (M): 0.68yr^{-1}
Total mortality rate (Z): 1.21yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.4
F_{SB25} yr^{-1}: 0.65
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 33%
Year completed: 2007 (based on 1989-92 data)
Locality: KZN
References & Comments: Olbers and Fennessy (2007)

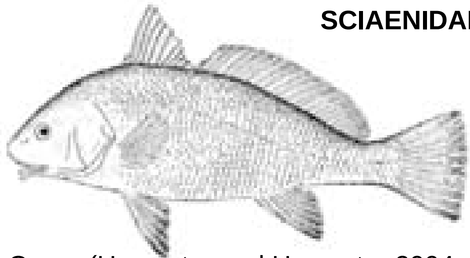
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2007
Locality: KZN
Status: 25-40% - overexploited (Olbers and Fennessy 2007). This assessment was based on 1989-92 data. Subsequently, the introduction of several measures for the trawl fishery (including a 7-month closed season and increased mesh size) resulted in recovery of the stock to optimal levels by the early 2000s. Thukela Bank prawn trawling has been at very low levels since 2005 owing to poor recruitment of prawns from St Lucia and low economic viability of trawling owing to the cheaper price of imported prawns (S. Fennessy, ORI, pers. obs.)
Trend in CPUE: Unknown
Trend in catch composition: Between 1989-92 *O. ruber* comprised 14% of catch by no. and occurred in 98% of prawn trawls on the Thukela Bank. Between 2003-06 it comprised 21.3% of catch by no. and was found in 96% of trawls (S. Fennessy, ORI, unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: IUCN Red List global assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Seven-month (Sep-Mar) closed season for prawn trawling on the shallow (<50m) Thukela Banks
MPA effectiveness: No known MPA protection for this species

MANAGEMENT CONSIDERATIONS
The Thukela Bank is a critical habitat, and at least part requires protection from the various anthropogenic perturbations (including trawling and offshore mining); further impoundments on the Thukela River would also likely compromise the status of this species (Turpie and Lamberth 2010)

RESEARCH REQUIREMENTS
Biodiversity research towards the justification for and promulgation of a soft substratum MPA in the northern part of the KZN Bight
Research priority: Medium



SCIENTIFIC NAME: *Umbrina robinsoni* (Smith No. 199.9)
COMMON NAMES: Belman, Baardman, Tasselfish
COMPILER: K Hutchings
REVIEWER: CG Attwood
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Western Indian Ocean, Cape Point in SA to Oman (Heemstra and Heemstra 2004, Hutchings and Griffiths 2005)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Previously incorrectly identified as *Umbrina ronchus*, *U. robinsoni* occurs along the entire eastern seaboard of SA (Hutchings and Griffiths 2005)

MOVEMENT: Resident
ORI and De Hoop tagging data show very limited coastwise movement, diver counts and depletion sampling indicates that *U. robinsoni* are probably philopatric at "home" caves (Hutchings 2005, Hutchings and Griffiths 2010a)

HABITAT
Adults: Sandy substrata, mixed rock and sand surf-zones and subtidal reefs; most commonly associated with high relief limestone or sandstone reef (Hutchings and Griffiths 2005)
Juveniles: Mixed rock and sand surf-zones, shallow subtidal reefs (Hutchings and Griffiths 2005)
Eggs and larvae: Larvae reared from eggs collected off the KZN south coast. Eggs more common within 1km of the coast (Connell 2012)

FEEDING
Adults: Rocky reef and soft sediment invertebrates, including polychaetes, crustaceans and molluscs (Hutchings 2005)
Juveniles: Predominantly polychaetes and small crustaceans (e.g. mysids) (Hutchings 2005)

REPRODUCTION
Reproductive style: Gonochorist (Hutchings and Griffiths 2010a)
Breeding/spawning season: KZN year round, WC during the summer months (Nov-Feb) (Hutchings and Griffiths 2010a)
Breeding/spawning locality: Throughout range
Age at 50% maturity: Males: 2-3 years; Females: 2.8-3.5 years; SA coast; 2001-02 (Hutchings and Griffiths 2010a)
Length at 50% maturity: Males: 37-43cm TL; Females: 39-48cm TL; SA coast; 2001-02 (Hutchings and Griffiths 2010a)

BIOMETRICS
Maximum recorded age: 21 years; male; Stilbaai, WC; 2004 (Hutchings and Griffiths 2010b). Generally fish in the WC had greater longevity than those in KZN
Maximum recorded weight: 12.6kg; 1956; SA spearfishing record (SAUFF 2012). The heaviest fish sampled by Hutchings (2005) was a male of 8 534g from False Bay in 2003
Maximum recorded length: 87cm TL; Kenton on sea, EC; 1989 (S. Lamberth, DAFF, unpubl. data). The largest fish sampled by Hutchings (2005) was a male of 805mm TL from False Bay in 2003
Length-length relationship: Combined sexes: TL(mm) = 1.1147SL(mm) + 37.192; De Hoop, WC; TL(mm) = 1.611SL(mm) + 22.766; off Kosi Bay, KZN (Hutchings and Griffiths 2010a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00001148 \times TL(mm)^{3.02}$; False Bay; $Wt(g) = 0.000006918 \times TL(mm)^{3.1}$; De Hoop; $Wt(g) = 0.000006025 \times TL(mm)^{3.1}$; Stilbaai; $Wt(g) = 0.00001445 \times TL(mm)^{2.94}$; off Kosi Bay (Hutchings and Griffiths 2010a)
Growth parameters: Combined sexes: L_∞ = 881mm TL; K = 0.164; t_0 = -0.864; False Bay; L_∞ = 594mm TL; K = 0.183; t_0 = -2.419; De Hoop; L_∞ = 741mm TL; K = 0.132; t_0 = -3.22; Stilbaai; L_∞ = 875mm TL; K = 0.151; t_0 = -2.498; off Kosi Bay (Hutchings and Griffiths 2010b)

FISHERY
Important target species in the spearfishery throughout its range where it ranks in the top 10 species (Mann et al. 1997b). Relatively easy to spear as it often aggregates in caves. Targeted species in the shore angling fishery in the WC and EC, particularly on sand banks or in mixed rock and sand habitat. Occasionally taken as a bycatch in beach seines along the northern shore of False Bay (K. Hutchings, UCT, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.55yr^{-1} (False Bay); 0.47yr^{-1} (Stilbaai); 0.53yr^{-1} (KZN)
Natural mortality rate (M): 0.25yr^{-1} (False Bay); 0.26yr^{-1} (Stilbaai); 0.35yr^{-1} (KZN)
Total mortality rate (Z): 0.8yr^{-1} (False Bay); 0.73yr^{-1} (Stilbaai); 0.88yr^{-1} (KZN)
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.22 (False Bay); 0.24 (Stilbaai); 0.26 (KZN)
F_{SB25} yr^{-1}: 0.45 (False Bay); 0.46 (Stilbaai); 0.45 (KZN)
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 21% (False Bay); 25% (Stilbaai); 21% (KZN)
Year completed: 2003-04
Locality: SA coast
References & Comments: (Hutchings and Griffiths 2010b)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2003-04
Locality: SA coast
Status: <25% - collapsed (Hutchings and Griffiths 2010b)
Trend in CPUE: Decline recorded in False Bay (Bennett 1991). CPUE declining in KZN and Stilbaai (Hutchings and Griffiths 2010b)
Trend in catch composition: Declining in False Bay (Hutchings 2005)
Trend in mean size: Declining in KZN (Hutchings 2005)
Trend in sex ratio: Unknown

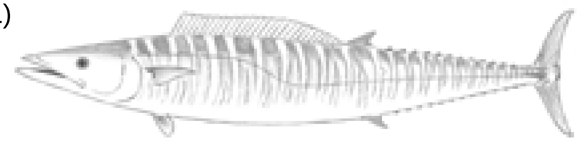
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: IUCN Red List global assessment conducted in Sep 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: All no-take MPAs on the south-eastern seaboard of SA are likely to play an important role in the conservation of this highly resident and vulnerable species

MANAGEMENT CONSIDERATIONS
Decrease bag limit to 2 pppd and increase minimum size limit to 50cm TL (Hutchings and Griffiths 2010b). Model results indicate that this management intervention will allow stock recovery to above 40% pristine spawner biomass (i.e. optimally exploited)

RESEARCH REQUIREMENTS
On-going monitoring of catch and effort is required, particularly in the SA spearfishery and in the shore fishery in the EC and WC. Early life history and recruitment requires further study
Research priority: Low

SCIENTIFIC NAME: *Acanthocybium solandri* (Smith No. 249.1)
COMMON NAMES: Wahoo
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: Widespread epipelagic and oceanic, present in the Atlantic, Indian and Pacific Oceans in tropical and subtropical waters, including the Caribbean and Mediterranean seas (Collette et al. 2011e)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common in KZN, rare in waters south of the former Transkei (Smith and Heemstra 1991) but recorded as far south as Cape Point (Heemstra and Heemstra 2004)

MOVEMENT: Nomadic
Widespread epipelagic and oceanic, with recent genetic evidence indicating that it has high global genetic connectivity (Collette et al. 2011e)

HABITAT
Adults: Widespread epipelagic and oceanic (Collette et al. 2011e). Often solitary but may form small, loose aggregations (van der Elst 1993). Normally near the surface but has been recorded to depths of 340m (Nobrega et al. 2009)
Juveniles: Little known but probably similar to adults
Eggs and larvae: Pelagic, widespread in tropical and sub-tropical waters (Collette et al. 2011e). Very few larvae have been recorded in SA waters (Beckley and Leis 2000)

FEEDING
Adults: Mainly teleosts such as anchovies, small tuna, flying fish, etc. (van der Elst 1993), but cephalopods and crustaceans supplement the diet (Vaske et al. 2003)
Juveniles: Unknown but likely to feed on planktonic crustaceans and small fish (B. Mann, ORI, pers. obs.)

REPRODUCTION
Reproductive style: Gonochoristic, multiple spawners (Brown-Peterson et al. 2000)
Breeding/spawning season: Spawning has been recorded off the east coast of Africa during most months of the year (van der Elst 1993) but not recorded in SA waters. From May-Oct in the Gulf of Mexico (Oxenford et al. 2003)
Breeding/spawning locality: Tropical waters (van der Elst 1993), presumed not to spawn in SA waters (Beckley and Leis 2000)
Age at 50% maturity: Males: 1 year; Females: 2 years; Gulf of Mexico (Brown-Peterson et al. 2000)
Length at 50% maturity: Males: ~932mm FL; Females: 1020mm FL; Gulf of Mexico (Brown-Peterson et al. 2000)

BIOMETRICS
Maximum recorded age: A 9.3 year old female (1804mm FL) and 9.1 year old male (1585 mm FL) have been recorded in the Western Atlantic (n=469) (McBride et al. 2008). Bigger fish are likely to be slightly older than this
Maximum recorded weight: 83.46kg; Mexico; 2005; World angling record (IGFA 2012)
Maximum recorded length: 200cm TL; Cape Hatteras, USA (Hogarth 1976). Reported to reach 250cm TL in the WIO (Sommer et al. 1996)
Length-length relationship: Combined sexes: FL(cm) = 0.95TL(cm) + 1.086; TL(cm) = 1.016FL(cm) + 2.452; Caribbean; n=75 (Murray 1989)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00251 \times FL(cm)^{3.19}$; SA (Torres 1991a); Combined sexes: $Wt(g) = 0.0022 \times FL(cm)^{3.25}$; geometric mean based on nine studies in FishBase (Froese and Pauly 2012)
Growth parameters: Combined sexes: L_∞ = 1701mm FL; K = 0.381; t_0 = -1.63; Atlantic (Florida and Bahamas) (McBride et al. 2008)

FISHERY
Although widespread and oceanic, there are no commercial fisheries that specifically target this species (Collette et al. 2011e). Forms a small component of the recreational ski-boat sector in KZN (Dunlop and Mann 2013). Caught as a bycatch in the tuna purse seine fishery in the SWIO (Adrill et al. 2011). Forms a small percentage of the catch in the KZN spearfishery (Mann et al. 1997b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): 0.98yr^{-1} (western North Atlantic, McBride et al. 2008)
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters

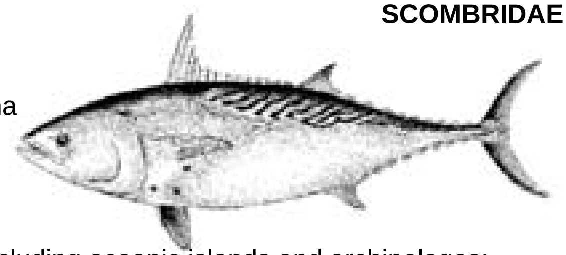
STOCK STATUS
Status: Not assessed in SA waters
Trend in CPUE: Unknown in SA waters - it is likely that the relatively low fishing pressure in SA is having little effect on the overall population. Although FAO fisheries statistics suggest an increase in landings over the past 20 years, given that this species is fast growing and early maturing, there is no current evidence of it being significantly impacted by current fishing effort, although local depletions may have occurred (Collette et al. 2011e)
Trend in catch composition: Little known in SA waters. Comprises a very small percentage of the recreational ski-boat catch in KZN both by number (0.04%) and weight (0.31%) (Dunlop and Mann 2013). No detailed comparisons between years are available
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2011 (Collette et al. 2011e)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Since this species is epipelagic and highly nomadic, little protection is offered in MPAs

MANAGEMENT CONSIDERATIONS
Due to its nomadic habit, fast growth rate and high fecundity, stocks are thought to be healthy and underexploited in SA waters. However, bycatch of tuna purse seine vessels operating in the SWIO needs to be carefully monitored

RESEARCH REQUIREMENTS
Information on stock distribution and catches by foreign vessels fishing in SA waters is needed
Research priority: Low



SCIENTIFIC NAME: *Euthynnus affinis* (Smith No. 249.4)
COMMON NAMES: Eastern little tuna, Kawakawa, Mackerel tuna
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Indo-West Pacific: in warm waters including oceanic islands and archipelagos; strays recorded from Eastern Central Pacific (Collette and Nauen 1983, Collette 2001)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA waters, extends south to Cape St Francis in the EC (Fischer and Bianchi 1984, Smith and Heemstra 1991)

MOVEMENT: Migratory
Regarded as a highly migratory species (Collette and Nauen 1983)

HABITAT
Adults: Pelagic-neritic, but remains close to shore and is seldom found in water deeper than 50m (Collette and Nauen 1983, Riede 2004)
Juveniles: Pelagic-neritic; close to shore and may enter bays and harbours (Collette and Nauen 1983, Riede 2004)
Eggs and larvae: In SA waters eggs and larvae have been recorded inshore (Connell 2012) and on the shelf edge from KZN to Algoa Bay in summer (Beckley 1993, Beckley and Leis 2000). Kawakawa larvae are generally patchy but widely distributed, close to land masses (IOTC 2011)

FEEDING
Adults: Nekton, especially clupeoids and atherinids; also squids, crustaceans and zooplankton (Collette 2001)
Juveniles: Similar to adults (Collette 2001)

REPRODUCTION
Reproductive style: Gonochorist (Collette and Nauen 1983)
Breeding/spawning season: Spawns during summer in KZN waters (Connell 2012) and elsewhere in the world is also generally regarded as a summer spawner (Collette and Nauen 1983, van der Elst 1993, IOTC 2011c)
Breeding/spawning locality: Spawns off KZN (Connell 2012), and larger larvae extend in a plume along the shelf edge down to Algoa Bay (Beckley and Leis 2000)
Age at 50% maturity: 3 years; Indian Ocean (Collette and Nauen 1983)
Length at 50% maturity: 45-65cm FL; Indian Ocean (Collette and Nauen 1983, Stequert and Marsac 1989, IOTC 2011c)

BIOMETRICS
Maximum recorded age: 6 years (Collette et al. 2011f)
Maximum recorded weight: 13.15kg; IGFA world angling record (van der Elst 1993)
Maximum recorded length: 100cm FL (Collette and Nauen 1983, van der Elst 1993)
Length-length relationship: SL(cm) = 0.928FL(cm); TL(cm) = 1.068FL(cm); Based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.00003 \times FL(mm)^{2.908}$; KZN (van der Elst and Adkin 1991)
Growth parameters: L_∞ = 82cm FL; K = 0.51; SA (Torres 1991b) based on growth curves originally published by van der Elst (1981); L_∞ = 95cm FL; K = 0.67; Persian Gulf; derived from length frequencies (Kaymaram and Darvishi 2012)

FISHERY
Unlike elsewhere where it is caught in gill-nets and purse-seines (Collette et al. 2011f), in SA this species is mainly caught by recreational and commercial linefishing, albeit often not specifically targeted. Catches by pelagic tuna longliners are insignificant in SA waters largely due to the 20 nautical mile offshore limit for longlining in KZN

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown

F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

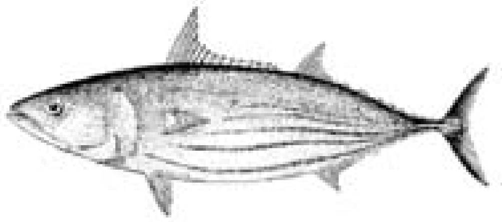
STOCK STATUS
Status: Not assessed in SA waters. IOTC (2011c) reports Indian Ocean stock status as uncertain
Trend in CPUE: Little change observed in recreational skiboat catch rates in KZN between 1994-96 (0.19 fish and 0.82kg.outing^{-1}) and 2008-09 (0.33 fish and 0.74kg.outing^{-1}). A decline seen in KZN commercial skiboat catch rates between 1994-96 (0.06 fish and 0.24kg.outing^{-1}) and 2008-09 (0.004 fish and 0.01kg.outing^{-1}) but based on a very small sample size during the 1994-96 study (Mann et al. 1997a, Dunlop 2011)
Trend in catch composition: Little change in recreational skiboat catches in KZN between 1994-96 (2.7% by no. and 6.1% by wt) and 2008-09 (3.8% by no. and 4.9% by wt). Insignificant catches made by the commercial skiboat fishery in KZN for comparison (Mann et al. 1997a, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2011 (Collette et al. 2011f)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: 20nm offshore limit for pelagic longlining in KZN waters
MPA effectiveness: Probably little benefit derived from MPAs due to the highly migratory nature of this species

MANAGEMENT CONSIDERATIONS
A widespread, fast-growing species; extensively and increasingly harvested in the Indian Ocean with catches having increased from 3 000 to 125 000mt between 1958-2007 (Collette et al. 2011f). This is a transboundary stock, which requires improved monitoring and assessment by the IOTC. In SA waters it is mainly caught by recreational skiboat anglers and the current daily bag limit of 10 fish pppd is believed to be adequate

RESEARCH REQUIREMENTS
All catches should be monitored as part of observer programmes for all fisheries in which this species occurs. Assessment of stocks in the Indian Ocean are required
Research priority: Low



SCIENTIFIC NAME: *Katsuwonus pelamis* (Smith No. 249.7)
COMMON NAMES: Skipjack tuna, Bonito, Katunkel, Lesser tunny, Ocean bonito, Penstreep-tuna
COMPILER: W West
REVIEWER: F Marsac
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: Distributed in open tropical and subtropical waters of the Pacific, Indian and Atlantic Oceans (Collette et al. 2011g)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN,MOZ
All around the SA coast but most common from Algoa Bay to Maputo (Heemstra and Heemstra 2004)

MOVEMENT: Migratory
Tag recoveries provide evidence of rapid, large scale movements of skipjack tuna in the Indian Ocean (IOTC 2011a). Their movements are influenced by environmental conditions and by their tendency to group around floating objects (McNeely and Richards 1961)

HABITAT
Adults: It generally forms large schools, often in association with other tunas of similar size such as juveniles of yellowfin tuna and bigeye tuna. Skipjack is the predominant species under fish aggregation devices (FADs) (Marsac et al. 2000). Normally inhabit waters where the surface temperature is between 20-30°C, corresponding to the mixed layer of tropical oceans which can extend to ~200m in depth depending on area. Skipjack are also associated with convergences, boundaries between cold and warm water masses, outcrops and other hydrographic discontinuities (Collette and Nauen 1983)
Juveniles: Similar to the adults, occupying surface waters and influenced by environmental conditions
Eggs and larvae: Eggs and larvae are pelagic

FEEDING
Adults: Skipjack is an opportunistic predator and its diet varies in time and space. The predominant items in their diet are fish (*Macroramphosus scolopax*, *Trachurus* spp, *Maurolicus muelleri*, *Engraulis anchiota*) cephalopods and crustaceans (Roger and Marchal 1994, Lebourges-Dhaussy et al. 2000). Cannibalism occurs occasionally (Zavala-Camin 1983)
Juveniles: Generally similar to adults, but smaller size prey

REPRODUCTION
Reproductive style: Gonochorist, multiple broadcast spawners (Muus and Nielsen 1999)
Breeding/spawning season: Spawns opportunistically throughout the year. Spawning seasons differ according to the zone where it is found (IEO 2006, IOTC 2011a)
Breeding/spawning locality: Spawns in vast sectors of the ocean during favourable conditions (surface temperature >24°C) (IEO 2006, IOTC 2011a)
Age at 50% maturity: Combined sexes: <2 years; WIO (Grande et al. 2010, Norungee and Kawol 2011)
Length at 50% maturity: Males: 43cm FL; Females: 37-44cm FL; WIO (Grande et al. 2010, Norungee and Kawol 2011); Males: 52cm FL; Females: 51cm FL; SW Atlantic (Vilela and Castello 1993)

BIOMETRICS
Maximum recorded age: 7 years; Indian Ocean (Collette and Nauen 1983, Froese and Pauly 2012)
Maximum recorded weight: 35.5kg; Indian Ocean (Collette and Nauen 1983, Froese and Pauly 2012); World angling record is currently 20.54kg; Mexico; 1996 (IGFA 2012)
Maximum recorded length: 110cm FL; Indian Ocean (Collette and Nauen 1983, Froese and Pauly 2012)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(kg) = 0.00000748 x FL(cm)$^{3.253}$; Atlantic Ocean (Cayré and Laloe 1986)
Growth parameters: Combined sexes: L_∞ = 82.5cm FL; K = 0.48; Philippines (Tandog-Edralin et al. 1990, median values given in FishBase)

FISHERY
In SA waters skipjack tuna are not specifically targeted by either pelagic longline vessels or tuna pole vessels but are kept as bycatch. Elsewhere in the Indian and Atlantic Oceans they are targeted by purse-seine vessels under drifting FADs (Marsac et al. 2000). Comprise a small percentage (0.17% by number) of recreational skiboat catches in KZN (Dunlop and Mann 2013)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): F_{2008}/F_{MSY}: most likely $<1yr^{-1}$; Atlantic Ocean (ICCAT 2011a); $F_{2011}/F_{MSY} = 0.8yr^{-1}$ (IOTC 2011a)
Natural mortality rate (M): $0.8yr^{-1}$; Atlantic Ocean (Fonteneau and Pallares 1999); $0.58yr^{-1}$; Indian Ocean (IOTC 2011a)
Total mortality rate (Z): $\sim1.4yr^{-1}$; Atlantic Ocean (ICCAT 2011a); $0.86yr^{-1}$; Indian Ocean (IOTC 2011a)
F_{MSY} yr^{-1}: ~0.6; Atlantic Ocean (ICCAT 2011a)
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology (ICCAT 2011a, IOTC 2011a)

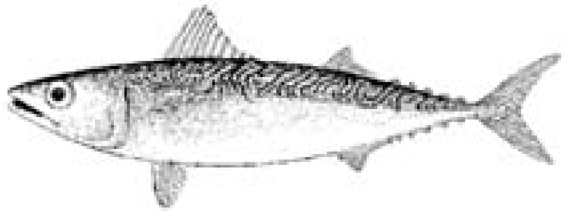
STOCK STATUS
Stock assessment method: Other
Year completed: 2010-11
Locality: Indian and Atlantic Oceans
Status: >50% - underexploited in both the Indian and Atlantic Oceans (ICCAT 2011a, IOTC 2011a). A single quantitative modelling method, “Stock Synthesis III” (SS3) was used for the stock assessment in the Indian Ocean (IOTC 2011a)
Trend in CPUE: Indian Ocean: IOTC does not fully understand the recent declines of pole and line catch and CPUE in the Indian Ocean, which may be due to the combined effects of fisheries and environmental factors affecting recruitment or catchability. Purse seine CPUEs remain variable from one year to another and are essentially driven by sets made on drifting FADs. Atlantic Ocean: the total catch obtained in 2009 in the entire Atlantic Ocean represents the catch average of the last five years. The increased use of FADs and the extension of the fishing areas in the Atlantic have increased the skipjack's catchability
Trend in catch composition: In 2010 skipjack catches formed 0.003% of the total tuna pole catches in SA
Trend in mean size: Average weight is around 2kg for the East Atlantic and 2.7- 3.0kg for the Indian Ocean
Trend in sex ratio: In all studies there is a slight but non-significant predomination of females for practically all size categories (IEO 2006)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Least Concern; 2011 (Collette et al. 2011g)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: No unwanted dead tuna are allowed to be discarded overboard. All tuna catches have to be retained on board and offloaded at port
MPA effectiveness: Skipjack tuna is an open-ocean highly migratory species with pelagic eggs and larvae. MPAs would not serve to protect such a widespread, mobile species

MANAGEMENT CONSIDERATIONS
None

RESEARCH REQUIREMENTS
Re-examine life history parameters and compare those across oceans in order to reconcile values that are often assumed. Quantify fishing efficiency changes on FADs which directly affect the CPUE trends
Research priority: High



SCIENTIFIC NAME: *Scomber japonicus* (Smith No. 249.11)
COMMON NAMES: Chub mackerel, Common mackerel, Slimy mackerel
COMPILER: BQ Mann
REVIEWER: J Coetzee
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Anti-tropical distribution: NW, NE and SE Pacific; absent from Indian Ocean except for SA waters. Replaced in the Atlantic Ocean by *Scomber colias* and by *Scomber australasicus* in the Indian Ocean and Red Sea (Collette 2001, Heemstra and Heemstra 2004, Collette et al. 2011h)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
In southern African waters chub mackerel is found from Angola to southern MOZ (Fischer and Bianchi 1984, Smith and Heemstra 1991). It was thought that a single population represents the stock in the SE Atlantic (Crawford and De Villiers 1984) but the connectivity between the Indian and Atlantic populations is uncertain

MOVEMENT: Migratory
Seasonal migrations thought to be related to breeding cycle - congregating in northern Benguela region in summer, migrating southwards during winter, and possibly migrating northward again towards the end of the year (Crawford and De Villiers 1984). Migrations could also be related to prey availability (Crawford and De Villiers 1984)

HABITAT
Adults: Coastal pelagic species and to a lesser extent epipelagic to mesopelagic over the continental shelf and shelf slope to depths of 300m (Collette and Nauen 1983, van der Elst 1993). A shoaling species often found in mixed shoals of other species such as pilchards, maasbanker or other scombrids (Heemstra and Heemstra 2004)
Juveniles: Inshore, gradually moving into deeper waters upon reaching maturity (Crawford 1981)
Eggs and larvae: Pelagic, recorded in inshore waters along the Cape west coast (Crawford 1981). The second most common egg (after *Sardinops sagax*) found in shelf waters off the KZN south coast during spring (Connell 2012)

FEEDING
Adults: Zooplankton such as euphausiids, mysids and copepods and small fish and squid (Ozawa et al. 1991, Castro 1995)
Juveniles: Mainly zooplankton (Ozawa et al. 1991, Castro 1995)

REPRODUCTION
Reproductive style: Gonochoristic (Baird 1978, Crawford 1981)
Breeding/spawning season: Jun-Sep on the EC and WC coasts (Baird 1977, Heemstra and Heemstra 2004) and Jul-Dec off the KZN coast (Connell 2012)
Breeding/spawning locality: Primary spawning area is between Lambert's Bay and Dassen Island on the West Coast (Crawford 1989). However, spawning occurs along the entire SA coast (van der Elst and Adkin 1991, Heemstra and Heemstra 2004, Connell 2012). Off the KZN south coast spawning occurs across the shelf but mainly in the 40-50m depth range (Connell 2012)
Age at 50% maturity: Combined sexes: 3 years; SA West Coast (Baird 1977)
Length at 50% maturity: Combined sexes: 39cm FL; SA West Coast (Baird 1977)

BIOMETRICS
Maximum recorded age: 8 years; SA West Coast (Baird 1977). The maximum age reported in the literature is 18 years (Castro Hernandez and Santana Ortega 2000)
Maximum recorded weight: 5kg (Crawford and De Villiers 1984) but generally much smaller. SA angling record is 2.85kg (SADSAA 2012)
Maximum recorded length: 70cm TL (van der Elst 1993) but seldom greater than 50cm TL
Length-length relationship: Combined sexes: TL(cm) = 1.1925SL(cm) + 0.8807; FL(cm) = 1.065SL(cm) + 0.2113; SA West Coast (Baird 1977); Combined sexes: FL(cm) = 1.01TL(cm) - 2.47; Aegean Sea (Moutopoulos and Stergiou 2002)
Length-weight relationship: Combined sexes: Wt(g) = 0.0049 x $SL(cm)^{3.3112}$; SA West Coast (Baird 1977); Combined sexes: Wt(g) = 0.0044 x $FL(cm)^{3.26}$; Geometric mean based on 22 studies (Froese and Pauly 2012)
Growth parameters: Combined sexes: L_∞ = 68cm SL; K = 0.207; t_0 = -0.9845; SA West Coast (Baird 1977)

FISHERY
Historically taken mainly on handline. Since 1954 was an important pelagic species caught by commercial purse-seine and beach-seine net fisheries, also taken by mid-water and bottom trawlers, especially in NAM waters. However, very little caught by commercial purse-seiners since the mid-1970s and direct targeting by

these vessels is not allowed. On average less than 350mt per annum caught as a bycatch since 2000, contributing less than 1% to the entire purse-seine catch (DAFF, unpubl. data). Frequently landed by recreational skiboat anglers who often use them as bait (Crawford 1989, van der Elst 1993).

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed using per-recruit methodology

STOCK STATUS
Stock assessment method: Other
Year completed: 2012
Locality: SA West Coast
Status: 25-40% - overexploited. Not effectively assessed due to the difficulty associated with sampling mackerel populations (J. Coetzee, DAFF, pers. obs.). Recent acoustic surveys suggest that the biomass of mackerel is currently very low but it has fluctuated greatly from a low of 525mt in 1988 to a high of 44 361mt in 2000 (Twatwa et al. 2009). The most recent estimate (2012) was 1 243mt (DAFF, unpubl. data)
Trend in CPUE: No record of trends in line-caught chub mackerel. Trends in annual catches of purse-seiners are highly variable due to intermittent strong year classes (Crawford 1989). First purse-seine catches were made in 1954 when 4 000mt were landed. During the ensuing 12 years annual catches averaged 30 000mt. In 1967 a record harvest of 130 000mt was taken mainly due to the use of spotter planes. Purse-seine catches decreased after 1969 and have been low since 1976. Total catch of chub mackerel in the SE Atlantic has shown a similar decline. Chub mackerel were able to tide the inshore pelagic fishery over between the collapse of the pilchard resource in the early 1960s and the increase in anchovies during the mid-1970s (Crawford 1989). Recent catches of chub mackerel contribute less than 1% of the commercial purse-seine landings
Trend in catch composition: Considerable decrease in the contribution of chub mackerel to small pelagic fish catches along the WC coast between 1949-2011 (Crawford 1989, Hutchings et al. 2012)
Trend in mean size: Unknown. Because larger mackerel are thought to evade the small pelagic trawl used to sample pelagic fish during bi-annual abundance surveys, the length distribution of mackerel from these surveys are biased to smaller pelagic fish (Hutchings et al. 2012)
Trend in sex ratio: M:F sex ratio was 1:1.14 during the 1970s (Baird 1978), data on current trends unknown

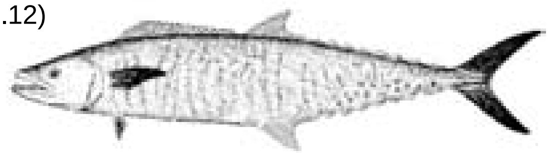
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Least Concern; 2011 (Collette et al. 2011h)

CURRENT REGULATIONS
Daily bag limit: None (unrestricted baitfish species applicable to all sectors)
Minimum size limit: None
Closed Season: None
Other regulations: International TAC of 200 000mt introduced for the SE Atlantic in 1980. TAC halved to 100 000mt in 1986 and in 1988 the TAC was dispensed with as a restrictive measure (Crawford 1989). No direct targeting of mackerel by purse-seine vessels is allowed in SA waters and they may only be landed as a bycatch
MPA effectiveness: MPAs are unlikely to be effective in protecting this species due to their migratory nature

MANAGEMENT CONSIDERATIONS
Effective management of the chub mackerel requires effective enforcement of permit conditions (i.e. no opportunistic targeting when fish are locally available). A healthy mackerel stock will ultimately be dependent on the maintenance of suitable levels of abundance of forage species (especially anchovy *Engraulis capensis*) (Crawford 1989)

RESEARCH REQUIREMENTS
Further research needs to be carried out on migration patterns to establish whether migrations are a result of food availability or for spawning, and to establish clear patterns of migration. Research is also needed to ascertain the causes of variability in recruitment success
Research priority: Low

SCIENTIFIC NAME: *Scomberomorus commerson* (Smith No. 249.12)
COMMON NAMES: King mackerel, Couta, Cuda,
Narrow-barred spanish mackerel, Spanish mackerel, Katonkel
COMPILER: B Lee
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2012



GLOBAL DISTRIBUTION: Widespread in warm waters of the Indo-Pacific, distributed from SA north along the east coast of Africa to the Red Sea, east along the south coast of Asia as far north as China and Japan and south to Australia (Govender 1992, Grandcourt et al. 2005). An immigrant to the eastern Mediterranean by way of the Suez Canal (Grandcourt et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common in MOZ and KZN waters, rarely extending as far south as Mossel Bay (Smith and Heemstra 1991). Based on tagging results, it appears as though the local distribution from MOZ southwards may represent a single stock (ORI Tagging Project, unpubl. data)

MOVEMENT: Migratory
Adults migrate southwards during summer (Nov-Mar) into KZN waters from MOZ and return during winter. This probably represents a feeding migration as little spawning has been recorded in KZN waters (Govender 1992)

HABITAT
Adults: Pelagic, extending from the edge of the continental slope inshore to shallow coastal waters (McPerson, 1992). Younger fish tend to shoal in single cohorts (van der Elst 1993)
Juveniles: Recorded from large marine embayments in MOZ (A. Govender, ORI, pers. obs.)
Eggs and larvae: Pelagic, little known in SA and MOZ waters. In Queensland, Australia larvae and juveniles occur in estuaries, sheltered mudflats and inshore coastal lagoon areas during the wet season (Jenkins et al. 1984, McPherson 1992)

FEEDING
Adults: Mainly feed on open water pelagic fish (e.g. Clupeidae, Carangidae and Scombridae) (McPherson 1987, B. Lee, ORI, pers. obs.) and will opportunistically feed on species such as lizardfish (van der Elst 1993)
Juveniles: Small pelagic bait fish and crustaceans (McPherson 1987, B. Lee, ORI, pers. obs.)

REPRODUCTION
Reproductive style: Gonochorist (Govender 1992)
Breeding/spawning season: Spring-summer, Sep-Jan (Lee 2013), Nov-Mar (Govender 1992)
Breeding/spawning locality: MOZ waters (Govender 1992, Lee 2013), but spawning does appear to occur further south into KZN waters during years with optimum environmental conditions (Lee 2013)
Age at 50% maturity: Males: 0.6 years; Females: 1.5 years; KZN and southern MOZ (Lee 2013). Males: 1.9 years; Females: 2.1 years; Oman (Grandcourt et al. 2005)
Length at 50% maturity: Males: 651-705mm FL; Females: 823-1096mm FL; Combined sexes: 677mm FL; KZN and southern MOZ (Govender 1992, Lee 2013). Males: 628mm FL; Females: 809mm FL; Australian west coast (Mackie et al. 2004). Males: 728mm FL; Females: 863mm FL; Oman (Grandcourt et al. 2005)

BIOMETRICS
Maximum recorded age: 14 years; Female; KZN (Lee 2013). Females aged to a maximum of 15 years in Queensland, Australia (Ballach 2010) and 16 years in Oman (Grandcourt et al. 2005)
Maximum recorded weight: 46.4kg; 1995; SA angling record (SADSAA 2012). World angling record is 42.18kg; Puerto Rico; 1999 (IGFA 2012)
Maximum recorded length: 220cm FL; KZN (van der Elst 1993)
Length-length relationship: Combined sexes: TL(cm) = 1.09FL(cm) + 4; FL(cm) = 0.91TL(cm) + 2.8; KZN and southern MOZ (Lee 2013)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0035 \times FL(cm)^{3.18}$; KZN and southern MOZ (Lee 2013); Combined sexes: $Wt(g) = 0.0091 \times FL(cm)^{2.96}$; geometric mean based on 17 studies (Froese and Pauly 2012)
Growth parameters: Males: L_∞ = 149.1cm FL; K = 0.14; t_0 = -3.5; Females: L_∞ = 156.5cm FL; K = 0.15; t_0 = -3.5; Combined sexes: L_∞ = 173.7cm FL; K = 0.11; t_0 = -4.2; KZN and southern MOZ (Lee 2013)

FISHERY
Very important in the recreational and commercial skiboat linefishery and spearfishery in KZN and MOZ (Govender 1992). Historically, *S. commerson* was a prime target of the KZN commercial linefishery, however in recent years, primarily for economic reasons, it is has become more of an opportunistic catch in this fishery. Rarely taken by recreational shore-based anglers. Juveniles are caught in the artisanal beach-seine fishery and as a bycatch of the prawn-trawl fishery in northern MOZ (A. Govender, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.21yr^{-1}
Natural mortality rate (M): 0.27yr^{-1}
Total mortality rate (Z): 0.48yr^{-1}
F_{MSY} yr^{-1}: ∞
F_{SB40} yr^{-1}: 0.29
F_{SB25} yr^{-1}: 0.59
$F_{0.1}$ yr^{-1}: 0.28
$SBPR_{current}$: 49%
Year completed: 2013
Locality: KZN and southern MOZ
References & Comments: Lee (2013)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2013
Locality: KZN and southern MOZ
Status: 40-50% - optimally exploited (Lee 2013). A previous per-recruit assessment of this stock by Govender (1995) found that it was overexploited with SBPR = 33%
Trend in CPUE: CPUE highly variable, probably driven by pulses of strong recruitment. In the KZN recreational skiboat fishery CPUE displayed an increase between 1986 (0.017 fish.$angler^{-1}$.$hour^{-1}$) and 1989 (0.043 fish.$angler^{-1}$.$hour^{-1}$) before dropping off markedly by 1995 (0.0035 fish.$angler^{-1}$.$hour^{-1}$). CPUE again increased from 1995, peaking in 2006 (0.046 fish.$angler^{-1}$.$hour^{-1}$) before dropping off to 0.0089 fish.$angler^{-1}$.$hour^{-1}$ by 2009 (Maggs 2011). It has been suggested that good recruitment may be linked with years of above-average rainfall in MOZ (Govender 1992)
Trend in catch composition: Species composition in the recreational skiboat sector in KZN has fluctuated considerably from year to year with catches of *S. commerson* in 1994-96 comprising 7.7% by number and 32.7% by weight (Mann et al. 1997a), while in 2008-09 *S. commerson* comprised only 0.94% by number and 3.4% by weight (Dunlop 2011)
Trend in mean size: Length frequency samples collected from sport fishing catches between 1972-91 off KZN (Govender 1992) ranged from 402-1902mm FL. Mean FL for males was 898mm (n=970), females 926mm (n=1753) and both sexes combined 934mm (n=5019). Length frequency samples collected along the KZN coast between 2011-12 indicate a similar exploited size range of 521-1615mm FL (B. Lee, ORI, unpubl. data). Mean FL were: male 841mm (n=167), female 962mm (n=221) and both sexes combined 907mm (n=393). Mean size of fish caught would be highly variable from year to year as this is dependent on recruitment in previous years
Trend in sex ratio: Between 1972-91 the M:F sex ratio in KZN was 1:1.81 (Govender 1992). More recently (2011-12), the sex ratio has remained similar at 1:1.36 (Lee 2013)

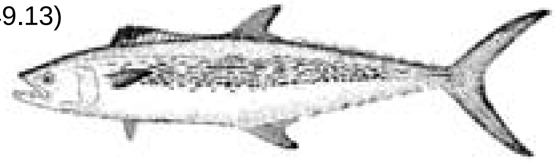
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2011 (Collette et al. 2011i)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably none due to the highly migratory nature of *S. commerson*

MANAGEMENT CONSIDERATIONS
Juveniles thought to be subjected to high mortality in MOZ as they are caught in artisanal beach seines, gill-nets and as a bycatch of the prawn-trawl fishery. There is an urgent need for improved joint management of the king mackerel stock between MOZ and SA. As the current recreational bag limit of 10pppd is considered too generous and probably encourages illegal sale by recreational fishers, a more reasonable bag limit of 5pppd is recommended which will assist in more equitable distribution of the catch

RESEARCH REQUIREMENTS
An analysis of the biology and a per-recruit stock assessment has recently been undertaken for king mackerel in KZN and southern MOZ (Lee 2013). More work is required on the stock status in MOZ including identification and possible protection of spawning areas. Work on the genetics and stock integrity of this species is urgently required throughout the SWIO
Research priority: Medium

SCIENTIFIC NAME: *Scomberomorus plurilineatus* (Smith No. 249.13)
COMMON NAMES: Queen mackerel, Natal snoek, Serra, Kanadi kingfish
COMPILER: B Lee
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: Western Indian Ocean, Kenya to SA, also west coast of Madagascar, Comoros and Seychelles (Collette and Russo 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Common in MOZ and KZN, rarely extends into EC waters but has been recorded as far south as Tsitsikamma (van der Elst and Collette 1984). Occasionally caught in Coega Harbour, EC (M. Dicken, PEM, pers. comm.)

MOVEMENT: Migratory
Adults migrate into KZN waters during early summer (Oct-Nov) and return to MOZ waters during winter (May-Sep). This is likely to be a feeding migration as very few spawning fish have been observed in KZN waters and small bait fish are common off KZN during the season of peak abundance (van der Elst and Collette 1984)

HABITAT
Adults: Epipelagic, primarily confined to the inshore zone, often just behind backline but seldom enters the active surf-zone (B. Mann, ORI, pers. obs.). Shows a strong preference for areas close to river-mouths, rip currents off sandy beaches, shallow rocky and coral reefs (van der Elst and Collette 1984)
Juveniles: Little known, probably similar to adults but small juveniles rare in KZN waters (B. Mann, ORI, pers. obs.)
Eggs and larvae: Eggs collected mainly inshore (<30m) by Connell (2012) off the KZN south coast during summer but eggs uncommon in KZN waters

FEEDING
Adults: Feeds mainly on small fish such as anchovies, clupeids as well as squid, mantis shrimp, mysids and penaeid prawns (van der Elst and Collette 1984)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochorist (Chale-Matsau 1996)
Breeding/spawning season: Spawning occurs mainly from late winter to early summer (Aug-Nov) (Williams 1964, van der Elst and Collette 1984)
Breeding/spawning locality: Spawning recorded in the Zanzibar Channel off Tanzania (Williams 1964) and thought to occur along the MOZ coast (van der Elst and Collette 1984, Chale-Matsua 1996). Few eggs recorded in southern KZN waters (Connell 2012)
Age at 50% maturity: Combined sexes: 2 years; KZN; 1996 (Chale-Matsau et al. 1999)
Length at 50% maturity: Males: 72-74cm FL; Females: 76-78cm FL; Combined sexes: 75cm FL; MOZ and KZN (van der Elst and Collette 1984)

BIOMETRICS
Maximum recorded age: 6 years; KZN (Chale-Matsau et al. 1999)
Maximum recorded weight: 12.5kg; Mapelane, KZN; 1997; IGFA all-tackle record (recorded as 'kanadi seerfish') (Heemstra and Heemstra 2004)
Maximum recorded length: 116.8cm FL; Mapelane, KZN; 1997; IGFA all-tackle record (recorded as 'kanadi seerfish') (Heemstra and Heemstra 2004)
Length-length relationship: TL(cm) = 1.149FL(cm); based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000126 \times FL(mm)^{2.94}$; KZN (van der Elst and Collette 1984)
Growth parameters: Combined sexes: $L_\infty = 935.3$mm FL; $K = 0.583$; $t_0 = -0.991$; KZN (Chale-Matsau et al. 1999)

FISHERY
Important to the recreational skiboat linefishery and the spearfishery in KZN and MOZ (van der Elst and Collette 1984). Forms a small contribution to the commercial skiboat linefishery in KZN (Chale-Matsau 1996). Important in the artisanal line and net fisheries in MOZ and other East African Countries (WIOFISH 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.28yr^{-1}
Natural mortality rate (M): 0.45yr^{-1}
Total mortality rate (Z): 0.73yr^{-1}
F_{MSY} yr^{-1}: 2.23
F_{SB40} yr^{-1}: 0.35
F_{SB25} yr^{-1}: 0.55
$F_{0.1}$ yr^{-1}: 0.65
$SBPR_{current}$: 50%
Year completed: 1999
Locality: KZN
References & Comments: Chale-Matsau et al. (1999)

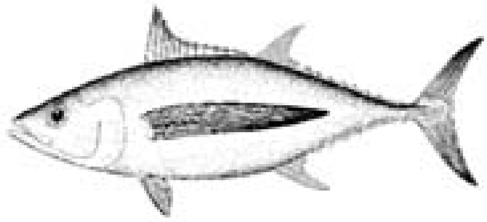
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1999
Locality: KZN
Status: 40-50% - optimally exploited (Chale-Matsau et al. 1999)
Trend in CPUE: High variability in year class strength dependent on recruitment (R. van der Elst, ORI, pers. obs.). CPUE in KZN recreational skiboat catches increased from 0.08 fish.outing^{-1} between 1994-96 to 0.22 fish.outing^{-1} between 2008-09 (Mann et al. 1997a, Dunlop 2011) but catches are variable from year to year (NMLS, unpubl. data)
Trend in catch composition: Between 1987-95 queen mackerel formed 20% (by weight) of the scrombrid catch taken by recreational skiboaters in KZN (Chale-Matsau et al. 1999). From 1984-95 it formed an average of 18.5% by number of the spearfishing catch in KZN with no clear trend (Mann et al. 1997a)
Trend in mean size: Little change in weight frequency composition between 1975-77 and 1985-95 (van der Elst and Collette 1984, Chale-Matsua et al. 1999). Little change in spearfishing catches between 1984 and 1995 with mean weight of fish around 5kg (Mann et al. 1997a)
Trend in sex ratio: Overall M:F sex ratio in KZN was 1:1.44 but no information on trends. Females predominate in catches from Jan-Oct. Only during much lower catches in Nov and Dec do male fish occasionally outnumber females (van der Elst and Collette 1984)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Data Deficient; 2011 (Collette et al. 2011j)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10 pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably little benefit derived from MPAs due to the highly migratory nature of queen mackerel

MANAGEMENT CONSIDERATIONS
Although the stock status of queen mackerel currently appears to be sound, there is a need for joint management of this and other species which are shared with MOZ. On-going monitoring of catch and effort in the recreational and commercial sectors of the linefishery should remain the main priority

RESEARCH REQUIREMENTS
Stock distribution, migration, early life history, recruitment, spawning season and spawning locality
Research priority: Low



SCIENTIFIC NAME: *Thunnus alalunga* (Smith No. 249.14)
COMMON NAMES: Albacore, Longfin tuna, Longfin tunny, Albakoor, Langvin tuna
COMPILER: W West
REVIEWER: F Marsac
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: Albacore is a highly migratory species with a wide geographical distribution. Populations are found in the Atlantic, Mediterranean, Indian and Pacific Oceans (ICCAT 2004). The species prefers cooler and deeper water in the temperature range 10–20°C (Graham and Dickinson 1981), though dependent on a minimum dissolved oxygen content of 3.7 $ml.l^{-1}$ (Graham et al. 1989)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
In SA waters schools of South Atlantic albacore occur in larger quantities along the temperate west coast compared to schools of Indian Ocean albacore which occur along the warmer south east coast (Penney 1994)

MOVEMENT: Migratory
Little information available on albacore migrations in SA waters. There are no recorded migrations of albacore from the north to the south Atlantic. There are records of transatlantic migrations and migrations from the North Atlantic into the Mediterranean, however, migration routes in the South Atlantic and the SW Indian Ocean remain uncertain (ICCAT 2004)

HABITAT
Adults: Albacore is a temperate tuna spawning in tropical waters. Its habitat is the northern and southern gyres of the oceans (only southern gyre in the Indian Ocean). Albacore migrate widely from their spawning grounds to the poleward limits of the gyres where water temperatures are below 15°C (IOTC 2011a)
Juveniles: Juvenile tuna from 2 to 35cm FL are not caught and this life stage remains virtually unknown (ICCAT 2004). From around 40cm FL albacore start appearing in surface fisheries. The underdeveloped swim bladder in juveniles gives them limited vertical movement in the water column. Juveniles concentrate in temperate areas, often in association with fronts with temperatures ranges from 15-20°C. Pre-adults (2-5 year old) appear to be more migratory than adults (IOTC 2011a)
Eggs and larvae: Eggs and larvae develop in the pelagic environment of warm tropical waters

FEEDING
Adults: Albacore are opportunistic top predators feeding on schools of sardine, anchovy, mackerel and squid (ICCAT 2004). Crustaceans have also be found in albacore stomachs
Juveniles: Similar diet to adults

REPRODUCTION
Reproductive style: Gonochorist
Breeding/spawning season: Spawning season for the South Atlantic stock is spring-summer from Sep-Mar (ICCAT 2004) and Oct-Mar for the Indian Ocean stock (Chen et al. 2005)
Breeding/spawning locality: Spawning areas in the south Atlantic are off the eastern Brazilian coast, from 5°S to 20°S (Beardsley 1969, Koto 1969). The main spawning area in the Indian Ocean occurs in waters off eastern Madagascar, from 15°S to 25°S (Koto 1969, Shiohama 1985). In both oceans, spawning takes place in water temperatures above 24°C
Age at 50% maturity: Combined sexes: 5 years; South Atlantic (Bard 1981)
Length at 50% maturity: Combined sexes: 90cm FL; South Atlantic (Bard 1981)

BIOMETRICS
Maximum recorded age: 13 years; South Atlantic (Lee and Yeh 2006)
Maximum recorded weight: 40kg; Canary Islands; 1977; World angling record (IGFA 2012)
Maximum recorded length: 130cm FL; South Atlantic (Le Gall 1974)
Length-length relationship: Combined sexes: $FL(cm) = 3.6221PDL(cm)^{0.9722}$; Gulf of Guinea (Bard 1981) (PDL = Pre-dorsal length is the straight length from the top of the snout to the insertion of the first dorsal spine)
Length-weight relationship: Combined sexes: $Wt(kg) = 0.000013718 \times FL(cm)^{3.0793}$; South Atlantic (Penney 1994); Combined sexes: $Wt(kg) = 0.00005691 \times FL(cm)^{2.7514}$; Indian Ocean (Hsu 1999)
Growth parameters: Combined sexes: $L_\infty = 147.5$cm FL; $K = 0.126$; $t_0 = -1.89$; South Atlantic (Lee and Yeh 2007)

FISHERY
The tuna pole and commercial linefishery contribute the most towards albacore catches, with 4 100mt reported in 2010. The pelagic longline and recreational linefishery catch albacore in smaller quantities, about 10% of the SA catches (ICCAT 2011b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $F_{2009}/F_{MSY} = 1.07yr^{-1}$ (South Atlantic); $F_{2010}/F_{MSY} = 1.22yr^{-1}$ (Indian Ocean)
Natural mortality rate (M): $0.3yr^{-1}$ (South Atlantic); $0.22yr^{-1}$ (Indian Ocean)
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: 0.25 (South Atlantic)
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Stocks assessed using dynamic, age-structured production modelling in the South Atlantic (ICCAT 2011b) and in the Indian Ocean (IOTC 2012a)

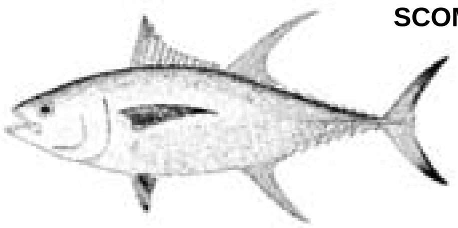
STOCK STATUS
Stock assessment method: Dynamic, age-structured production modelling
Year completed: 2011
Locality: South Atlantic and Indian Ocean
Status: 25-40% - overexploited in both the South Atlantic (ICCAT 2011b) and the Indian Ocean (IOTC 2012a)
Trend in CPUE: The CPUE in the South Atlantic shows no apparent trend in recent years, especially for the SA tuna pole and commercial linefishery (ICCAT 2011b). The CPUE in the Indian Ocean has fluctuated without trend since 1990 (IOTC 2012a)
Trend in catch composition: SA catches represent 21% of the total albacore catch in the South Atlantic Ocean. On average, 90% of the SA catches are made along the west and south west coast by the tuna pole and traditional commercial linefishing fleet. Since 2000, the albacore catches annually represent from 1.5 to 8% of the tuna and billfish production of SA (ICCAT 2011b)
Trend in mean size: Atlantic Ocean: Surface fleets showed a stable trend from 1981 onwards with an average of 12.7kg and a maximum and minimum weight of 16.5kg and 10kg, respectively. The trend in mean weight for longline fisheries showed an increase after 1996 (ICCAT 2011b). Indian Ocean: estimates are of poor quality and uncertain with mean weight oscillating between 20-23kg for purse-seine catches. There is an increasing trend in the Taiwanese pelagic longline fleet, from 12kgs in the early 1980s to 16-18kg in the 2000s (IOTC 2012a)
Trend in sex ratio: Before sexual maturity there is a 1:1 sex ratio (Bard 1981). Once sexual maturity is reached the percentage of females per size class decreases and a ratio of females to males of 1:2.1 has been observed in the Aegean Sea (Megalofonou 1990)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Near Threatened; 2011 (Collette et al. 2011k)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited (for tuna pole sector only)
Minimum size limit: None
Closed Season: None
Other regulations: South Atlantic: An annual 10 000mt albacore quota allocated by ICCAT is shared between SA and NAM. The TAC for the South Atlantic region is 29 000mt annually. Indian Ocean: There is currently no TAC for the Indian Ocean stock
MPA effectiveness: Albacore tuna is an open ocean, highly migratory species and MPAs would not serve to protect such a widespread highly mobile species

MANAGEMENT CONSIDERATIONS
South Atlantic: Results indicate that it is likely that the South Atlantic albacore stock has been overfished. Projections show that harvesting at the current TAC level (29 900mt) would further decline the stock. However, if catches continue at the level of those realised in the past few years (i.e. around 20 000mt), there is more than 50% probability that the stock will recover in the next 5 years, and more than 60% probability to do so in the next 10 years. However, catches over 24 000mt will not permit the rebuilding of the stock. Indian Ocean: projections show that a minimum reduction in fishing mortality of 20% would be required to ensure that the stock does not move into an overfished state by 2020

RESEARCH REQUIREMENTS
Noting that at present very little is known about the population structure and migratory range of albacore in the Indian Ocean, other than the possible connectivity with the southern Atlantic, it is necessary to determine albacore stock structure, migratory range and movement patterns in the Indian Ocean. Furthermore, size data analyses, simulations on alternative methods to convert catch at size into catch at age, growth rate and ageing studies and determination of spawning time and location is required in the Indian Ocean
Research priority: High



SCIENTIFIC NAME: *Thunnus albacares* (Smith No. 249.15)
COMMON NAMES: Yellowfin tuna, Geelvin tuna
COMPILER: W West
REVIEWER: F Marsac
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: A cosmopolitan species distributed in tropical and subtropical open waters of the Indian, Atlantic and Pacific Oceans. The geographical limits are 45°-50°N and S (Collette and Nauen 1983)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
The yellowfin that occur in SA waters may be from the Atlantic and/or Indian Ocean stock

MOVEMENT: Migratory
Annual movement in the Eastern Atlantic of mature fish to the spawning area off West Africa (Collette and Nauen 1983). Off southern Africa, progressively larger fish are found with increasing latitude. Three yellowfin tagged off Tanzania were recovered in SA waters, two of them off Cape Point (Indian Ocean Regional Tuna Tagging Project)

HABITAT
Adults: Adults are generally distributed in the first 350m of the ocean. However, archival tagging has shown that this species is capable of very deep dives (over 1 000m), probably to feed on mesopelagic prey (Dagorn et al. 2006, Schaefer et al. 2007). The preferred habitat is at temperatures of above 22°C and dissolved oxygen content above 3.5ml.l^{-1} (Brill 1994, Korsmeyer et al. 1996, Brill et al. 1999)
Juveniles: Juveniles spend more than 90% of their time in depths less than 100m which correspond to the mixed layer. Juveniles form schools around fish aggregating devices (FADs), either anchored FADs in coastal areas or drifting FADs in the high seas
Eggs and larvae: Eggs (0.9-1.04mm in diameter) and larvae (2.7mm) are pelagic and widely distributed by currents (Kailola et al. 1993)

FEEDING
Adults: Adults are opportunistic top predators with a broad prey spectrum. Prey items include a large diversity of epipelagic fish, mesopelagic fish (e.g. *C. pauciradiatus, D. parini*), crustaceans (e.g. *N. investigatoris, C. smithi* and crab larvae) and cephalopods (ommastrephids) (Potier et al. 2007)
Juveniles: Juvenile yellowfin tuna are opportunistic feeders on surface dwelling prey (epipelagic teleosts, squids, crustaceans). In the East Atlantic, they also feed on a small mesopelagic fish (*Vinciguerria nimbaria*) when it shoals in the mixed layer (Roger and Marchal 1994)

REPRODUCTION
Reproductive style: Gonochoristic. An intermediate pattern of reproduction implies asynchronous oocyte development (Arocha et al. 2000). One female can lay between 5 and 60 million eggs per year (Cayré et al. 1988)
Breeding/spawning season: Oct-Mar in the Eastern Atlantic (Bard et al. 1991). Dec-Mar in the West Indian Ocean (Stequert and Marsac 1989) with main spawning grounds located west of 75°E
Breeding/spawning locality: In the Eastern Atlantic the equatorial area from the coasts of the Gabon (Gulf of Guinea) to 25°W is the main spawning area (Bard et al. 1991). In the Western Indian Ocean, spawning has been recorded around the Seychelles and in the northern MOZ Channel (Stequert and Marsac 1989)
Age at 50% maturity: 2 years; Female; Eastern Atlantic (Albaret 1977). 3 years; Female; West Indian Ocean (Marsac et al. 2006)
Length at 50% maturity: 108.6cm FL; Female; Eastern Atlantic (Albaret 1977). 104cm FL; Female; West Indian Ocean (Marsac et al. 2006)

BIOMETRICS
Maximum recorded age: 9 years (Altman and Dittmer 1962)
Maximum recorded weight: 193.7kg; Mexico; 2012; World angling record (IGFA 2012)
Maximum recorded length: 239cm FL; IGFA Records 2001
Length-length relationship: SL(cm) = 0.966FL(cm); TL(cm) = 1.108 FL(cm); base on picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(kg) = 0.00002153 x FL(cm)$^{2.976}$; Atlantic Ocean (Caveriviére 1976); Combined sexes: Wt(kg) = 0.00001886 x FL(cm)$^{3.0195}$; Indian Ocean (Marsac et al. 2006)
Growth parameters: L_∞ = 190mm FL; K = 0.5; median values from FishBase (Froese and Pauly 2012)

FISHERY
Pelagic longline fisheries target large (adult) yellowfin. Juveniles are caught in surface waters by the tuna pole sector primarily along the Cape west coast. Juveniles are also caught in purse seine fisheries in tropical oceans

(Stequert and Marsac 1989, Kailola et al. 1993). Yellowfin tuna are an important gamefish targeted by the recreational skiboat fishery along the eastern seaboard of SA (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): F_{2010}/F_{MSY} = 0.87yr^{-1} (Atlantic Ocean); F_{2011}/F_{MSY} = 0.69yr^{-1} (Indian Ocean)
Natural mortality rate (M): M=0.8yr^{-1} at ages 0-1 (both oceans); M=0.6yr^{-1} for ages >1 (Atlantic Ocean); M=0.5yr^{-1} for ages >1 (Indian Ocean) although there is uncertainty as to the extent of the scales (IEO 2006)
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Stocks assessed using dynamic, age-structured production modelling in the Atlantic Ocean (ICCAT 2011a) and in the Indian Ocean (IOTC 2012b)

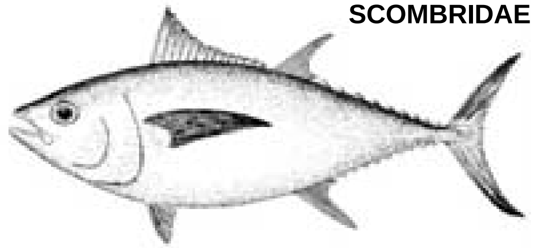
STOCK STATUS
Stock assessment method: Dynamic, age-structured production modelling
Year completed: 2010-2011
Locality: Atlantic and Indian Oceans
Status: 40-50% - optimally exploited in both the Atlantic (ICCAT 2011a) and Indian Ocean (IOTC 2012b)
Trend in CPUE: Atlantic Ocean: Overall catches have declined by nearly 50% from the peak catches in 1990 (194 000mt) to the lowest level in nearly 40 years (100 000mt) in 2007, although catches have increased by about 10% from that level in recent years. Annual purse-seine CPUE is highly variable without trend. Pole-boat CPUE is also variable with an overall declining trend. Pelagic longline CPUE fluctuates without trend since the mid-1990s (ICCAT 2011a). Indian Ocean: after 3 years of very high catches exceeding 450 000mt (2003-05), catches dropped markedly and are currently stable around 300 000mt. Japanese longline CPUE trend is declining slightly whereas Taiwanese CPUE has increased after 2009. This discrepancy between trends may be due to a sharp decline in fishing effort in the Indian Ocean (IOTC 2012b)
Trend in catch composition: Atlantic Ocean: After 3 years of record yellowfin catches exceeding 1 000mt (2005-07), the production declined and became stable around 300mt, which represents 0.3% of the total yellowfin catch in the East Atlantic Ocean. SA catches are supplied by the pole and line (75%) and pelagic longline fleets. Indian Ocean: the percentage of yellowfin in catches is not reported to the IOTC
Trend in mean size: Atlantic Ocean: the average weight, around 11-12kg in the 1980s has levelled off at around 7-9kg since the 2000s, in part due to changes in selectivity associated with fishing on floating objects. This trend is mostly driven by purse seine fisheries. Indian Ocean: The current mean weight is around 10kg, after 4 years (2003-06) when it peaked at 14-15kg. Similarly, purse seine fisheries drive the trend as the sampling rate for pelagic longline fleets is very low
Trend in sex ratio: A higher percentage of females are found for length frequency classes below 140cm FL and males dominate the length frequency classes above 140cm FL (Arocha et al. 2000)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Near Threatened; 2011 (Collette et al. 2011l)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited (for tuna pole sector only)
Minimum size limit: 3.2kg (commercial and recreational)
Closed Season: None
Other regulations: No unwanted dead tuna are allowed to be discarded overboard. All tuna catches have to be retained on board and offloaded at port
MPA effectiveness: Yellowfin tuna is an open ocean, highly migratory species and MPAs would not serve to protect such a widespread highly mobile species

MANAGEMENT CONSIDERATIONS
Recommended that effective measures be found to reduce FAD-related and other fishing mortality of small yellowfin. FAD fishing increases the risk of bycatch and reduces the yield per recruit (i.e. productivity) of the stock

RESEARCH REQUIREMENTS
Re-examine life history parameters and compare those across oceans in order to reconcile values that are often assumed. Quantify fishing efficiency changes on FADs which directly affect the CPUE trends. Establish the extent to which yellowfin tuna from the Atlantic Ocean and the Indian Ocean cross the 20° longitude boundary and mix
Research priority: High



SCIENTIFIC NAME: *Thunnus obesus* (Smith No. 249.17)
COMMON NAMES: Bigeye tuna, Bigeye tunny, Grootoog tuna
COMPILER: W West
REVIEWER: F Marsac
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: Circumglobal in tropical and subtropical waters of the Atlantic, Indian and Pacific Oceans. Absent from the Mediterranean (Collette and Nauen 1983)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
In SA this species shoals offshore and seldom approaches the coast (van der Elst 1993)

MOVEMENT: Migratory
Through tag-recapture studies it has been shown that bigeye do undertake migrations but this is dependent on the age group and may be in response to feeding and/or reproduction (Bard et al. 1991)

HABITAT
Adults: Adults (>100cm FL) are epi- and mesopelagic in open waters. Factors affecting the distribution include the depth of the deep scattering layer ('false bottom'), the temperature and the oxygen concentration (Maury 2005). Bigeye expose themselves to large temperature changes of up to 20°C, from 25°C at the surface layer to temperatures of ~5°C at 500m depth. Clear diel patterns in vertical movements were shown with archival tagging, from 0-100m during the day and 400-500m at night (Brill et al. 2005). Bigeye can withstand a lower dissolved oxygen concentration than any other tuna species, as low as 1.5 $ml.l^{-1}$ (Musyl et al. 2003)
Juveniles: Juveniles (30-70cm FL) occupy surface waters and are commonly found in schools at FADs
Eggs and larvae: Eggs and larvae are pelagic and are most frequently found in temperatures above 28°C where salinity is 33.8-36.0‰ (Ambrose 1996)

FEEDING
Adults: Bigeye are opportunistic predators that feed on oceanic mesopelagic communities (migratory and non-migratory) such as cephalopods, euphausids and mesopelagic fishes (Bertrand et al. 2002, Dagorn et al. 2000). Vertical movement to forage in the deep scattering layer has been recorded (Dagorn et al. 2000)
Juveniles: Juveniles have been recorded feeding on small-sized mesopelagic fish (e.g.*Vinciguerria nimbaria*)

REPRODUCTION
Reproductive style: Gonochorist, multiple broadcast spawners
Breeding/spawning season: Spawning season from Dec-Jan and also in June in the Eastern Indian Ocean (Nootmorn 2004). Spawning season in the South Atlantic (Congo-Angola) is from Nov-Feb (Rudomiotkina 1983). Bigeye spawning takes place mostly at night, estimated time from 18h00 to after midnight, depositing eggs daily (Matsumoto and Miyabe 2002)
Breeding/spawning locality: Bigeye tuna spawn in areas of increased biological productivity near the borders of localised eddies and local seamounts and frontal regions where temperatures are 25-26°C (Rudomiotkina 1983, Kailola et al. 1993)
Age at 50% maturity: Combined sexes: 3 years; Indian Ocean (Nootmorn 2004)
Length at 50% maturity: Combined sexes: 100cm FL; Indian Ocean (Nootmorn 2004). Female: 110cm FL; Atlantic Ocean (Matsumoto and Miyabe 2002)

BIOMETRICS
Maximum recorded age: 15 years; Female; Pacific Ocean (Farley et al. 2004)
Maximum recorded weight: 210kg; Indian Ocean (Frimodt 1995). World angling record is 178kg; Puerto Rico; 1996 (IGFA 2012)
Maximum recorded length: 250cm FL; Cape Verde (Reiner 1996)
Length-length relationship: FL(cm) = 0.913TL(cm); SL(cm) = 0.949FL(cm) (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(kg) = 0.00002396 \times FL(cm)^{2.9774}$; Eastern Atlantic (Parks et al. 1982). Combined sexes: $Wt(kg) = 0.00001592 \times FL(cm)^{3.0415}$; Indian Ocean; gilled and gutted weight, must multiply this weight by 1.13 to obtain round weight (IOTC-OFCF 2007)
Growth parameters: Combined sexes: L_∞ = 217.3cm FL; K = 0.18; t_0 = -0.709; Eastern Atlantic (Hallier et al. 2005)

FISHERY
Off SA bigeye tuna, together with yellowfin tuna, are mainly targeted by foreign-flagged pelagic longline vessels although they are caught by the entire pelagic longline fleet. Caught to a lesser extent by tuna pole and recreational and commercial linefisheries

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): F_{2009}/F_{MSY} = ~0.95yr^{-1} (Atlantic Ocean); F_{2009}/F_{MSY} = ~0.79yr^{-1} (Indian Ocean)
Natural mortality rate (M): Age dependent: 0-2 years = 0.8yr^{-1}; >2 years = 0.4yr^{-1} (Anon 2005)
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Stocks assessed using dynamic, age-structured production modelling in the Atlantic (Anon 2010) and in the Indian Ocean (IOTC 2010)

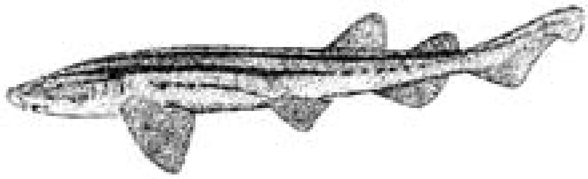
STOCK STATUS
Stock assessment method: Dynamic, age-structured production modelling
Year completed: 2010
Locality: Atlantic and Indian Ocean
Status: 40-50% - optimally exploited in both the Atlantic and Indian Oceans (Anon 2010, IOTC 2010)
Trend in CPUE: Atlantic Ocean: Bigeye tuna catches reached a historic high in 1994 at 133 000mt. Estimated and reported catch has declined since then and fell below 100 000mt in 2001. The gradual decline is continuing. These reductions in catch are related to declines in fishing fleet size (longline) as well as decline in CPUE (longline and pole boat). In 2010, bigeye tuna catch was estimated to be at ~75 800mt (ICCAT 2011a). Indian Ocean: the catch has declined from an historic high in 1999 of 152 000mt to 87 000mt in 2011. The sharpest decline from 2008 onwards is related to the expansion of piracy in the western tropical Indian Ocean, which has led to a marked drop in the level of longline effort in the core fishing area of the species. Longline CPUE has steadily declined from 1988 onwards, but the estimates since 2010 should be taken as a result of low and unusual distribution of longline effort (IOTC 2012b)
Trend in catch composition: In 2010 bigeye tuna catches formed 28.4% of the total pelagic longline catches and 0.05% of the total tuna pole catches in SA
Trend in mean size: Atlantic Ocean: Mean average weight of bigeye tuna decreased prior to 1998 but has been relatively stable, at around 10kg during the last decade. Indian Ocean: Mean weight fluctuated between 15-20kg from 1985-2007, then decreased to 10kg because of a lower proportion of large individuals taken by the longline fishery as a consequence of the piracy threat in the western tropical Indian Ocean
Trend in sex ratio: The proportion of males increases as the size increases (Miyabe 2003). The sex ratios by size are similar up to 130cm FL, males are slightly more dominant above 130cm FL (Fonteneau et al. 2005)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Vulnerable; 2011 (Collette et al. 2011n)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited (for tuna pole sector only)
Minimum size limit: 3.2kg (commercial and recreational)
Closed Season: None
Other regulations: No unwanted dead tuna are allowed to be discarded overboard. All tuna catches have to be retained on board and offloaded at port
MPA effectiveness: Bigeye tuna is an open ocean, highly migratory species and MPAs would not serve to protect such a widespread highly mobile species

MANAGEMENT CONSIDERATIONS
Joint management and collaboration between countries harvesting tuna in the Indian and Atlantic Oceans is needed via the IOTC and ICCAT respectively. In the Atlantic Ocean the assessment and subsequent management recommendations are conditional on the reported and estimated catch history for bigeye tuna. There is a need to expand current statistical data collection mechanisms to fully investigate any evidence of significant catches that have been unreported

RESEARCH REQUIREMENTS
Re-examine life history parameters and compare those across oceans in order to reconcile values that are often assumed. Quantify fishing efficiency changes on FADs which directly affect the CPUE trends. Establish the extent to which bigeye tuna from the Atlantic Ocean and the Indian Ocean cross the 20° longitude boundary and mix. Knowledge of the movement patterns and stock structure will aid the management of different stocks
Research priority: High



SCIENTIFIC NAME: *Poroderma africanum* (Smith No. 11.13)
COMMON NAMES: Pyjama shark, Striped catshark
COMPILER: J Escobar-Porras
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Endemic to SA waters in EC and WC (Compagno et al. 1989)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC
Found from Saldanha Bay to just north east of East London (Compagno et al. 1989, Heemstra and Heemstra 2004)

MOVEMENT: Resident
Based on ORI tagging data and high resolution movement data, the species shows strong site fidelity and limited dispersal (Escobar-Porras 2009)

HABITAT
Adults: Benthic species on rocky reefs from shore to 100m. Active nocturnally and known to rest in caves during the day (van der Elst 1993, Heemstra and Heemstra 2004, Compagno 2005)
Juveniles: Similar to adults
Eggs and larvae: Eggs are attached to seaweeds and kelp on rocky reefs (van der Elst 1993, J. Escobar-Porras, UKZN, pers. obs.)

FEEDING
Adults: Cephalopods, crustaceans, small bony fishes, bivalves and polychaete worms (Compagno et al. 1989, van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Similar to adults

REPRODUCTION
Reproductive style: Oviparous, lays one egg per oviduct (Compagno et al. 1989). When hatching embryos are ~14 cm TL (Heemstra and Heemstra 2004)
Breeding/spawning season: It is believed that females lay eggs throughout the year (Roux 2002, Compagno 2005)
Breeding/spawning locality: Little known but likely to occur throughout distribution. However, few eggs cases observed in the northern parts of the EC (Roux 2002, J. Escobar-Porras, UKZN, pers. obs.)
Age at 50% maturity: 10-13 years (Compagno 2005)
Length at 50% maturity: Males: 845mm TL, Females: 885mm TL, Algoa Bay (Roux 2002). Bass et al. (1975a) suggested that maturity is reached in males between 58-76cm TL and in females between 65-72cm TL

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 7.9kg, SA angling record (van der Elst 1993)
Maximum recorded length: 100cm TL (Heemstra and Heemstra 2004, Escobar-Porras 2009)
Length-length relationship: Unknown
Length-weight relationship: Combined sexes: Wt(g) = 0.00674 x TL(cm)$^{2.958}$ (van der Elst and Adkin 1991)
Growth parameters: Unknown

FISHERY
Caught as an unwanted bycatch in recreational and commercial linefisheries, demersal shark longline and inshore trawl fisheries. Although edible, flesh is seldom used or marketed (van der Elst 1993, Compagno 2005)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Little known, no trend observed in competitive shore angler's catches in the Border region (Great Fish to Kei River) from 1982-98 (Pradervand and Govender 2003). Research angling in the Tsitsikamma MPA from 1995-2007 showed some seasonality with higher catches during the summer months (Escobar-Porras 2009)
Trend in catch composition: Little known, comprised 0.8% by no. and 1% by mass of competitive shore angler's catches in the Border region. Little trend in percentage contribution from 1982-98 (Pradervand and Govender 2003)
Trend in mean size: Unknown
Trend in sex ratio: A tag-recapture study near Cape St Francis between 2006-07, showed a M:F sex ratio of 2:1 (Escobar-Porras 2009)

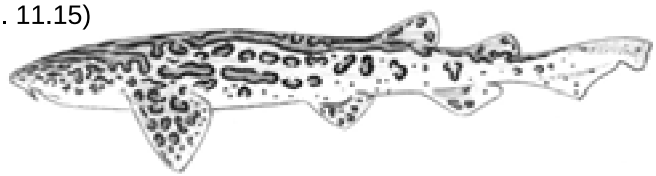
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Near Threatened; 2005 (Compagno 2005)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale recreational species
MPA effectiveness: Due to the strong site fidelity and limited dispersal of *P. africanum*, no-take MPAs with suitable reef habitat in the EC and WC will provide some protection for this species (Escobar-Porras 2009)

MANAGEMENT CONSIDERATIONS
Improved monitoring of inshore fisheries in the EC and WC is required. A rational network of MPAs protecting suitable inshore reef habitat is likely to be the most effective conservation measure for this species

RESEARCH REQUIREMENTS
Determine extent of inshore-offshore movements, assess population connectivity through genetics, age and growth, stock assessment, early life history, juvenile nursery areas
Research priority: Low

SCIENTIFIC NAME: *Poroderma pantherinum* (Smith No. 11.15)
COMMON NAMES: Leopard catshark
COMPILER: J Escobar-Porras
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013



GLOBAL DISTRIBUTION: Endemic to SA (Compagno et al. 1989). Exhibits three different spot patterns and *P. marleyi* now considered to be the same species (Compagno et al. 1989, Human 2006)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Primarily found along the WC and EC coast, rarely in KZN (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Strong site fidelity and limited dispersal, based on the ORI Tagging Project and localized tag-recapture data (Escobar-Porras 2009). Possibility of separate sub-populations along the coast (Human 2009)

HABITAT
Adults: Confined to the shelf in warm-temperate waters, from the intertidal zone to depths of 250m (Compagno 1989, van der Elst 1993). Usually found on rocky reefs and kelp forests (Human 2006) and tend to be more active nocturnally
Juveniles: Little known, likely to remain hidden amongst seaweeds and kelp on shallow subtidal reefs
Eggs and larvae: Little known, egg cases likely to be attached to seaweeds and kelp. Size at birth 10-15cm TL (van der Elst 1993)

FEEDING
Adults: Feeds on small fishes, octopus, crustaceans and polychaete worms (Compagno et al. 1989, Human 2009)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Oviparous, produces one egg per oviduct (Compagno et al. 1989)
Breeding/spawning season: No obvious breeding season but peak reproductive activity is believed to occur in autumn (Mar-May) (Roux 2002)
Breeding/spawning locality: Assumed to be throughout distribution although limited observation of eggs cases in the EC (Roux 2002, J. Escobar-Porras, UKZN, pers. obs.)
Age at 50% maturity: Combined sexes: 10-17 years; WC (Dainty 2002, Roux 2002)
Length at 50% maturity: Males: 61-77cm TL; Females: 51-67cm TL; EC (Roux 2002, Human 2009)

BIOMETRICS
Maximum recorded age: 19 years; WC (Dainty 2002)
Maximum recorded weight: 3.2kg; SA shore angling record (van der Elst 1993)
Maximum recorded length: 84cm TL (van der Elst 1993)
Length-length relationship: Unknown
Length-weight relationship: Wt(g) = 0.00802 x TL(cm)$^{2.92}$ (Torres 1991a)
Growth parameters: Unknown

FISHERY
Commonly caught by shore anglers, but often released (Compagno et al. 1989, Götz et al. 2009). Sometimes regarded as a pest by recreational and commercial skiboat fishers and killed (Human 2009). Also occasionally taken as bycatch by inshore trawlers (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

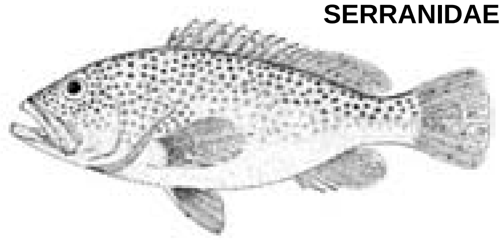
STOCK STATUS
Status: Not assessed
Trend in CPUE: Little known. Research angling data from Tsitsikamma MPA from 1995-2007 showed no trend (Escobar-Porras 2009)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio was 4:1 based on data from a tag-recapture study near Cape St Francis between 2006-07 (Escobar-Porras 2009)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Data Deficient; 2009 (Human 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale recreational species
MPA effectiveness: The strong site fidelity and limited dispersal of this species suggests that MPAs in the EC and WC provide an important means of protection (Escobar-Porras 2009)

MANAGEMENT CONSIDERATIONS
A rational network of MPAs protecting suitable inshore reef habitat is likely to be the most effective conservation measure for this species

RESEARCH REQUIREMENTS
Determine inshore-offshore movement, assess population connectivity through genetics, age and growth, morphometrics
Research priority: Low



SCIENTIFIC NAME: *Epinephelus albomarginatus* (Smith No. 166.33)
COMMON NAMES: White-edged rockcod, Captain fine
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic, south-east coast of Africa from Quissico (MOZ) to East London (EC) (Heemstra and Randall 1993)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
As above (Heemstra and Heemstra 2004, Craig et al. 2011)

MOVEMENT: Resident
Appears to be resident based on limited tag-recapture data (ORI Tagging Project). Likely to be a northward movement of pre-adults from southern to northern KZN, as no spawning occurs south of Durban, although considerable numbers of small, reproductively inactive fish are caught in southern KZN (Fennessy 2000c)

HABITAT
Adults: Deeper (>50 m) rocky reefs, to at least 120m (Fennessy 2000c)
Juveniles: Unknown, probably reefs >30m as seldom seen by divers (B. Mann, ORI, pers. obs.)
Eggs and larvae: Pelagic in shelf waters but no *Epinephelus* larvae found in the Agulhas Current (Beckley 1993)

FEEDING
Adults: Crustaceans, fish, squid (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Probably protogynous (Fennessy 2000c)
Breeding/spawning season: Summer, Oct-Feb (Fennessy 2000c)
Breeding/spawning locality: Deep reefs off northern KZN and southern MOZ (Fennessy 2000c)
Age at 50% maturity: Females: 3.1 years; Males: derived from females; southern MOZ; 1998 (Fennessy 2000c). Note that very few mature individuals were sampled in northern KZN
Length at 50% maturity: Females: 341mm TL; Males: derived from females with a minimum observed length of 591mm TL; southern MOZ; 1998 (Fennessy 2000c). Note that few mature individuals were sampled in northern KZN

BIOMETRICS
Maximum recorded age: 15 years; male; northern KZN (Fennessy 2000c)
Maximum recorded weight: 12.3kg; KZN; 1973; SA angling record (van der Elst 1993)
Maximum recorded length: 870mm TL; male; northern KZN; 1996 (Fennessy 2000c)
Length-length relationship: SL(cm) = 0.811 x TL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.00000876 x $TL(mm)^{3.085}$; KZN (Fennessy 2000c)
Growth parameters: Combined sexes: L_∞ = 789mm TL; K = 0.214; t_0 = 0.09; KZN (Fennessy 2000c); note that sex change was not incorporated into the growth model

FISHERY
Makes a fairly small contribution to skiboat catches in KZN i.e. 0.9% and 2% by weight to recreationals and commercials respectively (Dunlop 2011); slightly higher contribution (3-5% by weight) to semi-industrial lineboat catches in southern MOZ (IIP unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.24yr^{-1}
Natural mortality rate (M): 0.228yr^{-1}
Total mortality rate (Z): 0.468yr^{-1}
F_{MSY} yr^{-1}: 0.45
F_{SB40} yr^{-1}: 0.05
F_{SB25} yr^{-1}: 0.24
$F_{0.1}$ yr^{-1}: 0.224
$SBPR_{current}$: 23%
Year completed: 1998
Locality: KZN
References & Comments: Fennessy (2000c)

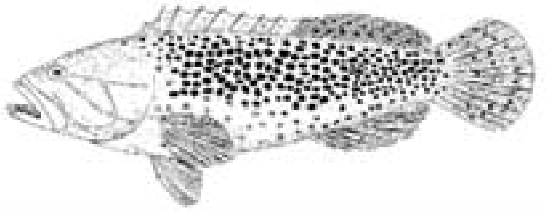
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1998
Locality: KZN
Status: <25% - collapsed (Fennessy 2000c)
Trend in CPUE: KZN, boat-based, kept fish only, per boat outing, recreationals between 1994-96: 0.01 by no. and 0.04kg by wt., increasing to 0.9 by no. and 0.3kg by wt. between 2008-09. Commercials between 1994-96: 0.37 by no. and 0.37kg by wt., increasing to 0.84 by no. and 2.1kg in wt. between 2008-09 (Mann et al. 1997, Dunlop 2011).
Trend in catch composition: KZN, boat-based, kept fish only, recreationals between 1994-96: 0.1% by no. and 0.3% by wt., increasing to 1.04% by no. and 1.99% by wt. in 2008-09. Commercials between 1994-96: 0.4% by no. and 0.4% by wt., changing to 0.27% by no. and 0.89% by wt. in 2008-09 (Mann et al. 1997, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio in mature fish 1:4.1 in northern KZN and 1:3.2 in an unexploited stock in southern MOZ (Fennessy 2000c). No data available on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Vulnerable; 2004 (Fennessy 2004a)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia and Maputaland MPAs are particularly important as they provide protection in deeper water (>30m) where this species occurs, and also where the main part of the SA spawning population is likely to occur; the Ponta do Ouro Partial Marine Reserve also provides some protection in southern MOZ waters

MANAGEMENT CONSIDERATIONS
Collaborative negotiation towards the declaration of an MPA north of Maputo, MOZ. Although this species is not particularly important in catches, it is endemic and has a very limited range; most of the spawning stock is in MOZ waters and some protection in the central region of southern MOZ is required; commercial skiboat CPUE and catch composition data from catch returns for individual serranid species are impossible to interpret because of lumping of species - regular fisheries independent linefish surveys are required to provide basic catch information

RESEARCH REQUIREMENTS
CPUE to be monitored, preferably with better spatial information on catch locality. Information required on movement behaviour and efficacy of MPAs
Research priority: Medium



SCIENTIFIC NAME: *Epinephelus andersoni* (Smith No. 166.34)
COMMON NAMES: Catface rockcod, Brown-spotted rockcod
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic, MOZ (Quissico) to Knysna in the WC (Heemstra and Randall 1993, Heemstra and Heemstra 2004). Reports of this species occurring in Madagascar are dubious (Heemstra and Randall 1993)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Recently recorded as far south as De Hoop MPA in the WC (C. Attwood, UCT, pers. comm.) but uncommon south of Knysna (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Based on tag recapture studies this species appears to be largely resident but with some individuals undertaking extensive movements >400km (Maggs 2011). There are anecdotal reports of migrating shoals (Fennessy 2000) and the possibility that this is a "pioneer" species capable of locating and occupying vacated niche space (Maggs 2011, Mann 2012). Likely to be some northward movement of pre-adults from southern to northern KZN, as no spawning occurs south of Durban, although considerable numbers of reproductively inactive fish are caught in southern KZN (Fennessy 2000c)

HABITAT
Adults: Rocky reefs from surf zone to 70m (Heemstra and Heemstra 2004). Rarely recorded on coral reefs (Chater et al. 1995)
Juveniles: Tidal pools (Beckley 2000) and inshore shallow reefs (Heemstra and Heemstra 2004)
Eggs and larvae: Inshore shelf waters, often <3 m (Connell 2012), no *Epinephelus* larvae found in the Agulhas Current (Beckley 1993)

FEEDING
Adults: Crustaceans, fish, squid (van der Elst 1993)
Juveniles: Unknown but assumed to be similar to adults

REPRODUCTION
Reproductive style: Protogynous - diandric - some males derived from mature females, others develop directly from the juvenile state (Fennessy and Sadovy 2002). Some indication that this species may form spawning aggregations (Fennessy 2004)
Breeding/spawning season: Sep-Feb in KZN (Fennessy and Sadovy 2002, Connell 2012)
Breeding/spawning locality: Reefs off northern KZN and MOZ (Fennessy 2000c). Connell (2012) reports spawning sometimes occurring inshore in depths shallower than 30m
Age at 50% maturity: Females: 3.9 years; Males: 2.7 years (minimum age with some males maturing directly from juvenile state while others are derived from mature females by means of sex change); northern KZN; 1998 (Fennessy 2000c)
Length at 50% maturity: Females: 492mm TL; Males: 430mm TL (could not be reliably estimated for males as too few immature individuals sampled); northern KZN; 1998 (Fennessy 2000c, Fennessy and Sadovy 2002)

BIOMETRICS
Maximum recorded age: 11 years; female; northern KZN; 1998 (Fennessy 2000c)
Maximum recorded weight: 9.4kg; off Durban; 2006 (S. Fennessy, ORI, unpubl. data)
Maximum recorded length: 870mm TL; male; northern KZN; 1996 (Fennessy 2000c)
Length-length relationship: TL(cm) = 1.179 x SL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000226 \times TL(mm)^{2.905}$; KZN (Fennessy 2000c)
Growth parameters: Combined sexes: L_∞ = 781mm TL; K = 0.481; t_0 = 2.76; D = -1; logistic growth curve; KZN (Fennessy 2000c)

FISHERY
Makes a moderate contribution to skiboat catches in KZN - ~3% by weight to both recreationals and commercials respectively (Dunlop 2011); around 1% to spearfishing catches (Mann et al. 1997b) and 0.3% to recreational shorefishing (Dunlop 2011); slightly lower contribution (1-2% by weight) to semi-industrial lineboat catches in southern MOZ (IIP unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.268yr^{-1}
Natural mortality rate (M): 0.416yr^{-1}
Total mortality rate (Z): 0.684yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.28
F_{SB25} yr^{-1}: 0.45
$F_{0.1}$ yr^{-1}: 0.374
$SBPR_{current}$: 42%
Year completed: 1998
Locality: KZN
References & Comments: Fennessy (2000c)

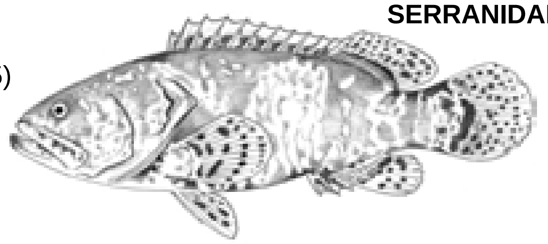
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1998
Locality: KZN
Status: 40-50% - optimally exploited (Fennessy 2000c)
Trend in CPUE: KZN skiboat fishing, kept fish only, per boat outing, recreationals, 1994-96: 0.54 by no. and 1.05kg by wt., decreasing to 0.27 by no. and 0.65kg by wt. in 2008-09. Commercials, 1994-96: 3.23 by no. and 6.32kg by wt., changing to 2.01 by no. and 7.36kg by wt. in 2008-09 (Mann et al. 1997a, Dunlop 2011). KZN shore-fishing, fish/angler/day: 0.003 (1975-77) (Joubert 1981b); 0.0001 (1994-96) (Mann et al. 1997a); 0.001 (2008-09) (Dunlop and Mann 2012)
Trend in catch composition: KZN skiboat fishing, kept fish only, recreationals, 1994-96: 7.9% by no. and 7.9% by wt., decreasing to 3.4% by no. and 4.3% by wt. in 2008-09; commercials, 1994-96: 3.1% by no. and 7.2% by wt., decreasing to 0.65% and 3.12% in 2008-09 (Mann et al. 1997a, Dunlop 2011). KZN shore-angling, kept fish only, 1994-96: 0.1% by no. and 0.2% by wt. (Mann et al. 1997a) remaining much the same at 0.1% by no. and 0.3% by wt. in 2008-09 (Dunlop and Mann 2012)
Trend in mean size: Unknown
Trend in sex ratio: M:F sex ratio for mature fish 1:2.8 in northern KZN (Fennessy 2000c), no data on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Near Threatened; 2004 (Fennessy 2004b)

CURRENT REGULATIONS
Daily bag limit: 5pppd (applies to all sectors)
Minimum size limit: 50cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia and Maputaland MPAs are important as they probably provide the only protection to the spawning component of the SA population. There are indications that this species forms spawning aggregations, and if these aggregations occur within the St Lucia/Maputaland MPAs, they would be effectively protected. The Ponta do Ouro Partial Marine Reserve also provides some protection in southern MOZ waters. This species is abundant in the Pondoland MPA and while these fish may not be reproductively active, there is some evidence of adult movement into adjacent exploited areas (Maggs 2011)

MANAGEMENT CONSIDERATIONS
Indications from catch trends are that the stock is probably no longer optimally exploited. There should be collaborative negotiation towards the declaration of an MPA north of Maputo, MOZ. This species is endemic with a limited range, and is easily accessible to all sectors of the linefisheries in both countries. Commercial skiboat CPUE and catch composition data from catch returns for individual serranid species are impossible to interpret because of lumping of species - regular linefish surveys are thus required to provide basic catch information

RESEARCH REQUIREMENTS
A genetic study is currently underway to examine the shared nature of stocks between SA and MOZ. Movement patterns, pioneer-like behaviour and possible occurrence and location of spawning aggregations requires further investigation. A second age and growth study and stock assessment is required. CPUE needs to be carefully monitored, preferably with better spatial information on catch locality
Research priority: Medium



SCIENTIFIC NAME: *Epinephelus lanceolatus* (Smith No. 166.45)
COMMON NAMES: Brindle bass, Giant grouper
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Widespread throughout the Indo-Pacific from the East African mainland to Hawaii, north to Japan and south to Australia (Heemstra and Randall 1993, Craig et al. 2011)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Southernmost limit in SA waters is Algoa Bay (Heemstra and Heemstra 2004)

MOVEMENT: Limited tag recapture data suggests that this species is likely to be fairly resident (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Large fish in estuaries and shelf waters to 100m (Heemstra and Randall 1993). Found on coral and rocky reefs, often associated with caves (van der Elst 1993). Also occasionally caught in shallow (<50m) prawn trawls on the Thukela Banks so must move onto sand-mud substrata at times (S. Fennessy, ORI, unpubl. data)
Juveniles: Small juveniles in estuaries (Heemstra and Randall 1993) and sometimes tidal rock pools (B. Mann, ORI, pers. obs.)
Eggs and larvae: Shelf waters (Beckley 1993)

FEEDING
Adults: Lobsters, crabs, fishes (including elasmobranchs) (Heemstra and Randall 1993, van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Likely protogynous, but not confirmed
Breeding/spawning season: Unknown
Breeding/spawning locality: Little known; may form spawning aggregations (Sadovy and Liu 2004). Spawning aggregation observed in deepwater (>30m) near Mafia Island, Tanzania (M. Samoilys, CORDIO, pers. comm.)
Age at 50% maturity: Unknown
Length at 50% maturity: 129cm TL; China (Lau and Li 2000)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 400kg; New Hebrides (Fourmanoir and Laboute 1976)
Maximum recorded length: 270cm TL (van der Elst 1993)
Length-length relationship: TL(cm) = 1.23 x SL(cm); derived from photo measurement (Froese and Pauly 2012)
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Once a prime target for spearfishers due to its large size, trophy status and the fact that this species is inquisitive and easy to approach underwater, this species was over-exploited and has been fully protected in SA waters since 1992. Prior to its protection this species was also occasionally caught by recreational and commercial skiboat fishers, shore anglers and occasionally taken as a bycatch by shallow prawn trawlers. Becoming increasingly popular in the live food and aquarium trade, this species is now being hatchery reared and grown in captivity (Shuk Man and Ng Wai Chuen 2006)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

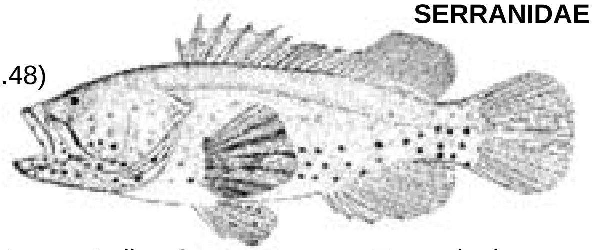
STOCK STATUS
Status: Not assessed. Increasingly rare in catches and thought to have experienced severe declines throughout its range; many brindle bass marketed in Asia are hatchery reared (Craig et al. 2011)
Trend in CPUE: Little quantitative data available. Observations by spearfishermen along the KZN coast suggested that numbers declined substantially prompting the Natal Underwater Union to motivate for their protection in 1974 (SAMLMA 1993)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Prohibited species
IUCN Red List: Vulnerable; 2006 (Shuk Man and Ng Wai Chuen 2006)

CURRENT REGULATIONS
Daily bag limit: Zero
Minimum size limit: Not applicable
Closed Season: Not applicable
Other regulations: Prohibited species
MPA effectiveness: Fully protected from fishing, so assuming there are no illegal catches retained, MPAs would only serve to reduce disturbance and post release mortality. Also fully protected in MOZ, but low compliance by artisanal sector

MANAGEMENT CONSIDERATIONS
Brindle bass is an important apex reef predator. Due to its rare status both in SA waters and globally, it should remain a prohibited species. Important estuarine nursery areas for this species such as St Lucia, Richards Bay and Durban Bay should be carefully managed to ensure maintenance of their nursery function. If farmed in SA, care should be taken not to contaminate wild stocks

RESEARCH REQUIREMENTS
Movement patterns of adults, age and growth, reproductive biology
Research priority: Medium



SCIENTIFIC NAME: *Epinephelus malabaricus* (Smith No. 166.48)
COMMON NAMES: Malabar rockcod
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Widespread in Indo-Pacific, from Western Indian Ocean across to Tonga in the east, Japan in the north and Australia in the south (Heemstra and Randall 1993)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Southern limit in SA reported as East London (Heemstra and Heemstra 2004). *E. malabaricus* often confused with *E. coioides* and *E. tauvina*

MOVEMENT: Unknown. Movement of juveniles reported from inshore and estuarine nursery habitats to depths of 150m as adults (Craig et al. 2011)

HABITAT
Adults: Variety of reef and non-reef habitats to depths of 150m (Heemstra and Randall 1993)
Juveniles: Juveniles are found on inshore reefs and in estuaries (Heemstra and Randall 1993)
Eggs and larvae: In shelf waters (Beckley 1993). Few eggs collected by Connell (2012) off Park Rynie in KZN

FEEDING
Adults: Equal mixture of fishes and crustaceans, sometimes octopus (Heemstra and Randall 1993, van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Protogynous hermaphrodite (Lau and Li 2000)
Breeding/spawning season: Aug-Oct (van der Elst 1993)
Breeding/spawning locality: Unknown
Age at 50% maturity: Males: >5 years; estimated by Cornish (2006)
Length at 50% maturity: 45-50cm TL; West Pacific (Lau and Parry-Jones 1999); van der Elst (1993) estimated length at maturity of 70-80cm TL; while Lau and Li (2000) estimated length at maturity of 114cm TL for males

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 38kg; New Caledonia; 2002 (IGFA 2012)
Maximum recorded length: 150cm TL (Craig et al. 2011)
Length-length relationship: SL(cm) = 0.841 x TL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Wt(kg) = 0.0128 x $TL(cm)^{3.034}$; New Caledonia (Letourneur et al. 1998)
Growth parameters: Unknown

FISHERY
Based on catch composition in Mann et al. (1997a) and Dunlop (2011), is not a common component of linefish catches in SA; also likely to be under-reported owing to misidentification. Elsewhere it is caught by trawls, longlines, traps, spear and hook-and-line (Heemstra and Randall 1993). Also an important aquaculture species in the Indo-Pacific region

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown

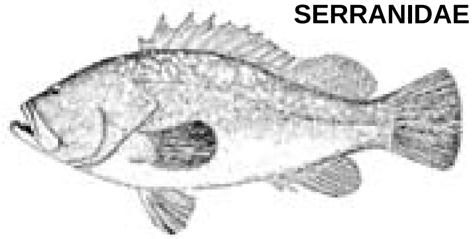
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Near Threatened; 2006 (Cornish 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia and Maputaland MPAs offer the most protection to adults; protected estuaries in the Pondoland MPA may provide some protection for juveniles

MANAGEMENT CONSIDERATIONS
Estuarine dependent, so continued degradation of KZN estuaries is problematic; rehabilitation of important KZN estuaries is required. If farmed in SA, care should be taken not to contaminate wild stocks

RESEARCH REQUIREMENTS
On-going monitoring of linefish catch and effort data is needed. Good training of monitors/observers is required to ensure correct species identification. Little published information available on age and growth, reproductive biology and movement
Research priority: Low



SCIENTIFIC NAME: *Epinephelus marginatus* (Smith No. 166.43)
COMMON NAMES: Yellowbelly rockcod, Dusky grouper
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Western Africa (Angola) to Europe (Mediterranean Sea), SA (WC) to MOZ, East coast of South America; also reports from Oman (Randall 1995) and India (Craig et al. 2011)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Cape Point to Inhambane (Heemstra and Randall 1993, Heemstra and Heemstra 2004, Craig et al. 2011)

MOVEMENT: Resident
Highly resident based on tagging data and underwater observations (Lembo et al. 1999, Fennessy 2000c, Maggs 2011, Mann 2012). Ontogenetic habitat shift with larger fish being found on deeper reefs. Likely to be a northward movement of pre-adults from the WC and EC to KZN, as no spawning occurs south of KZN; generally smaller reproductively inactive fish are caught in the former two provinces (Fennessy 2000c)

HABITAT
Adults: Rocky reefs from surf zone to 200m (Heemstra and Heemstra 2004)
Juveniles: Tidal pools (Beckley 2000) and shallow reefs in inshore waters (Berry et al. 1982, Burger 1990)
Eggs and larvae: Shelf waters - no *Epinephelus* larvae found in Agulhas Current (Beckley 1993)

FEEDING
Adults: Crustaceans, fish, squid (Smale 1983, van der Elst 1993)
Juveniles: Higher proportion of crustaceans but also small fish (Smale 1983, van der Elst 1993)

REPRODUCTION
Reproductive style: Protogynous (Fennessy 2006)
Breeding/spawning season: Oct-Feb in KZN (Fennessy 2006)
Breeding/spawning locality: Reefs off KZN and southern MOZ (Fennessy 2000c)
Age at 50% maturity: Females: 6.5 years; Males: 9.5 years (minimum age, males derived from mature females); northern KZN; 1998 (Fennessy 2006). Chauvet (1988) calculated age at maturity of females as 5 years in Tunisian waters
Length at 50% maturity: Females: 622mm TL; Males: 800mm TL (minimum length as males derived from mature females); northern KZN; 1998 (Fennessy 2000c; Fennessy and Sadovy 2002). Andrade et al. (2003) estimated length at maturity of females at 470mm TL in Brazilian waters

BIOMETRICS
Maximum recorded age: 16 years; female; northern KZN; 1998 (Fennessy 2006). Craig et al. (2011) reported the maximum age of yellowbelly rockcod as 60 years in the Mediterranean
Maximum recorded weight: 27.5kg; KZN; 1992; SA angling record (SADSAA 2012). Heemstra and Randall (1993) recorded the maximum weight as 60kg
Maximum recorded length: 1125mm TL (Fennessy 2000c). Gothel (1992) recorded the maximum length of yellowbelly rockcod as 150cm TL in the Mediterranean
Length-length relationship: SL(cm) = 0.883 + 0.741 x TL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000125 \times TL(mm)^{3.055}$; KZN (Fennessy 2000c)
Growth parameters: Combined sexes: L_∞ = 1249mm TL; K = 0.09; t_0 = -1.43; KZN; L_∞ likely to have been over-estimated as larger fish not adequately sampled (Fennessy 2000c)

FISHERY
Makes a fairly low contribution to skiboat catches in KZN - 1.3% by weight to commercials, 1.7% to recreationals (Dunlop 2011); around 1% to spearfishing catches (Mann et al. 1997b) and 0.3% to recreational shorefishing (Dunlop and Mann 2012); very low contribution (0.1% by weight) to semi-industrial lineboat catches in southern MOZ (IIP unpubl. data)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.135yr^{-1}$
Natural mortality rate (M): $0.24yr^{-1}$
Total mortality rate (Z): $0.375yr^{-1}$
F_{MSY} yr^{-1}: ~0.3
F_{SB40} yr^{-1}: 0.1
F_{SB25} yr^{-1}: 0.2

$F_{0.1}$ yr^{-1}: 0.17
$SBPR_{current}$: 33%
Year completed: 1998
Locality: KZN
References & Comments: Fennessy (2000c)

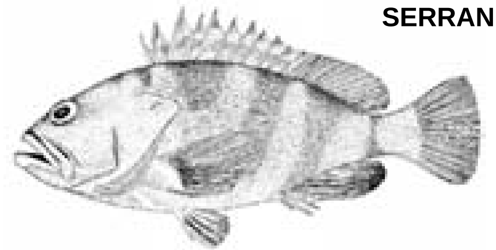
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1998
Locality: KZN
Status: 25-40% - overexploited (Fennessy 2000c)
Trend in CPUE: KZN skiboat fishing, kept fish only, per boat outing, recreationals 1994-96: 0.02 by no. and 0.07kg by wt., increasing to 0.06 by no. and 0.25kg by wt. in 2008-09; commercials 1994-96: 0.51 by no. and 1.49kg by wt., changing to 0.47 by no. and 2.98kg by wt. in 2008-09 (Mann et al. 1997a, Dunlop 2011). KZN shore-fishing, fish/angler/day: 0.001 (1975-77) (Joubert 1981b); 0.0007 (1994-96) (Mann et al. 1997a); 0.001 (2008-09) (Dunlop and Mann 2012)
Trend in catch composition: KZN skiboat fishing, kept fish only, recreationals 1994-96: 0.3% by no. and 0.5% by wt., increasing to 0.75% by no. and 1.67% by wt. in 2008-09; commercials 1994-96: 0.5% by no. and 1.7% by wt., decreasing to 0.15% by no. and 1.27% by wt. in 2008-09 (Mann et al. 1997a, Dunlop 2011). KZN shore-angling, kept fish only, 1994-96: 0.06% by no. and 0.01% by wt. (Mann et al. 1997a), increasing to 0.1% by no. and 0.34% by wt. in 2008-09 (Dunlop and Mann 2012)
Trend in mean size: Unknown
Trend in sex ratio: Mature fish M:F sex ratio 1:7.25 in KZN (Fennessy 2000), no information on trends

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Endangered; 2004 (Cornish and Harmelin-Vivien 2004)

CURRENT REGULATIONS
Daily bag limit: 1pppd (applies to all sectors)
Minimum size limit: 60cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Highly resident and well suited to protection within MPAs along the eastern seaboard of SA. The St Lucia and Maputaland MPAs are very important as they probably provide the only protection to the spawning component of the SA population. There are indications that this species forms small spawning aggregations with high site fidelity, and if such aggregations occur in the St Lucia/Maputaland MPAs, they would be effectively protected. The Ponta do Ouro Partial Marine Reserve also provides some protection in southern MOZ waters. This species is abundant in the Pondoland MPA and while these fish may not be reproductively active, there is some evidence of movement of pre-adult fish into adjacent exploited areas (Maggs 2011)

MANAGEMENT CONSIDERATIONS
Indications from catch trends are that the stock in KZN has recovered slightly or at least is no longer declining. The SA spawning component is probably mainly located in KZN waters, and it is likely that this population is reproductively isolated from the West African population, implying that there are only local recruits. The species does not appear to be common in MOZ, or, if it was more common (having recovered during the 1980s when fishing effort was low), it is no longer the case as catches there are now very low. Commercial skiboat CPUE and catch composition data from catch returns for individual serranid species are impossible to interpret because of lumping of species - regular linefish surveys are thus required to provide basic catch information

RESEARCH REQUIREMENTS
Efficacy of MPAs and possibility of northward movement of pre-adults needs to be investigated. More information is required on the possible occurrence and locality of spawning aggregations. CPUE needs to be carefully monitored, preferably with better spatial information on catch locality
Research priority: Medium



SCIENTIFIC NAME: *Epinephelus rivulatus* (Smith No. 166.60)
COMMON NAMES: Halfmoon rockcod, Witch's prick
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Indo-West Pacific from SA to Oman; also Australia northwards to Japan; apparently absent from the northern Indian Ocean (Craig et al. 2011)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Southern limit in SA is Knysna (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Based on tagging data this species undertakes limited movement (Fennessy 2000, Maggs 2011). No evidence for spawning migrations (Mackie 2000)

HABITAT
Adults: Rocky reefs, algal flats, seagrass beds, mangroves, out to 150m (Heemstra and Heemstra 2004). Rarely in the surf-zone (B. Mann, ORI, pers. obs.)
Juveniles: Reefs in shallow inshore waters (Berry et al. 1982)
Eggs and larvae: Eggs and larvae collected by Connell (2012) off Park Rynie in KZN. No *Epinephelus* larvae found in the Agulhas Current (Beckley 1993)

FEEDING
Adults: Crustaceans and small fish (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Protogynous (Fennessy 2000, Mackie 2000); socially-mediated sex change (Mackie 2000)
Breeding/spawning season: Jul-Nov in KZN (Fennessy 2000)
Breeding/spawning locality: Reefs off KZN and MOZ (Fennessy 2000). Connell (2012) suggested that spawning occurs around the 40m depth contour
Age at 50% maturity: Females: 2.1 years; Males: 4 years (minimum age as males are derived from mature females); KZN; 1998 (Fennessy 2000). Mackie (1998) estimated the age at maturity of females and males as 1 and 2 years respectively in Western Australia
Length at 50% maturity: Females: 219mm TL (could be over-estimated owing to a lack of small fish sampled); Males: 261mm TL (minimum length as males derived from mature females); KZN; 1998 (Fennessy 2000). Mackie (1998, 2000) estimated length at maturity of females and males as 194 and 221mm TL respectively in Western Australia

BIOMETRICS
Maximum recorded age: 17 years; KZN; 1998 (Fennessy 2000). Mackie (1998) estimated a maximum age of 24 years in Western Australia
Maximum recorded weight: 1.6kg; SA angling record (SADSAA 2012)
Maximum recorded length: 47cm TL (Craig et al. 2011)
Length-length relationship: SL(cm) = 0.813 x TL(cm) – 0.227; derived from picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000196 \times TL(mm)^{2.968}$; KZN (Fennessy 2000)
Growth parameters: Combined sexes: L_∞ = 332mm TL; K = 0.394; t_0 = 0.02; northern KZN (Fennessy 2000). Combined sexes: L_∞ = 366mm TL; K = 0.477; t_0 = -0.41; southern KZN (Fennessy 2000). Combined sexes: L_∞ = 307 to 338mm TL; K = 0.39 to 0.48; t_0 = -0.382 to -0.697; Western Australia (Mackie 1998)

FISHERY
Makes a small contribution to skiboat catches in KZN - 0.25% by weight to commercials and 0.6% to recreationals (Dunlop 2011). Also low contribution (1% by weight) to semi-industrial lineboat catches in southern MOZ (IIP unpubl. data). Seldom caught in the surf-zone (Mann et al. 1997a, Dunlop and Mann 2012) and generally too small for recreational spearfishers to spear

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.32yr^{-1}$
Natural mortality rate (M): $0.74yr^{-1}$
Total mortality rate (Z): $1.06yr^{-1}$
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown

F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: ~1.5
$SBPR_{current}$: 84%
Year completed: 1998
Locality: KZN
References & Comments: Age at first capture is much higher than age at 50% maturity; extremely high levels of F would be required to attain F_{SB40} and F_{SB25} at the time of assessment (Fennessy 2000)

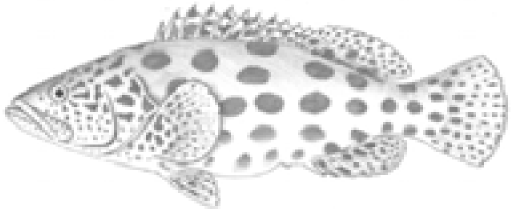
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1998
Locality: KZN
Status: >50% - underexploited (Fennessy 2000)
Trend in CPUE: KZN skiboat fishing, kept fish only, per boat outing, recreationals 1994-96: 0.04 by no. and 0.02kg by wt., increasing to 0.17 by no. and 0.09kg by weight in 2008-09; commercials 1994-96: 2.23 by no. and 1.06kg by wt., decreasing to 1.74 by no. and 0.6kg by wt. in 2008-09 (Mann et al. 1997a, Dunlop 2011)
Trend in catch composition: KZN skiboat fishing, kept fish only, recreationals 1994-96: 0.5% by no. and 0.2% by wt., increasing to 1.93% by no. and 0.6% by wt. in 2008-09; commercials 1994-96: 2.1% by no. and 1.2% by wt., decreasing to 0.6% by no. and 0.3% by wt. in 2008-09 (Mann et al. 1997, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Least Concern; 2008 (Fennessy et al. 2008)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia, Maputaland and Pondoland MPAs are important as they provide the largest area of protection to this resident species in SA waters; the Ponta do Ouro Partial Marine Reserve also provides some protection in southern MOZ waters

MANAGEMENT CONSIDERATIONS
There are conflicting indications from catch trends - recreational catches appear to have increased since the 1990s whereas commercial catches have declined; it is not apparent why this should be. The size at first capture is substantially larger than the size at first maturity and there is reasonable protection for this species in a number of large MPAs in SA. Commercial skiboat CPUE and catch composition data from catch returns for individual serranid species are impossible to interpret because of lumping of species - regular linefish surveys are thus required to provide basic catch information

RESEARCH REQUIREMENTS
CPUE to be carefully monitored, preferably with better spatial information on catch locality
Research priority: Low



SCIENTIFIC NAME: *Epinephelus tukula* (Smith No. 166.66)
COMMON NAMES: Potato bass, Potato grouper, Aartappel-baars
COMPILER: C Floros
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: May 2012

GLOBAL DISTRIBUTION: Widely (but sparsely) distributed Indo-Pacific species that can be found from the Red Sea and Gulf of Aden to Kenya, Tanzania, MOZ, SA (KZN), Comoros Islands, Seychelles, Oman, Pakistan, India, Sri Lanka, Maldives and Laccadives, as well as from northern Australia, Taiwan, Japan and Papua New Guinea (Craig et al. 2011)
SOUTHERN AFRICAN DISTRIBUTION: KZN, MOZ
Known to occur as far south as the Protea Banks off Port Shepstone in KZN (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Of the 350 potato bass tagged, 19 (5.43%) have been recaptured with an average distance moved of only 2km and a maximum distance of 14km (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Reef-associated species mainly found on deep reefs, seamounts, and other current prone areas in 10-400m (Graig et al. 2011)
Juveniles: May be found in tidal pools and gullies (Heemstra and Randall 1993), larger juveniles found on shallow subtidal reefs in the surf-zone (B. Mann, ORI, pers. comm.)
Eggs and larvae: Assumed to be pelagic (Yeh et al. 2003)

FEEDING
Adults: Diet includes a variety of reef fish, crustaceans and rays (van der Elst 1993)
Juveniles: Feed on small fish and crustaceans (B. Mann, ORI, pers. comm.)

REPRODUCTION
Reproductive style: Assumed to be protogynous (Yeh et al. 2003), but reproductive mode still uncertain
Breeding/spawning season: Spawning has been recorded during spring and summer (Nzioka 1979, van der Elst 1993, Robinson et al. 2004)
Breeding/spawning locality: Possibly northern KZN and southern MOZ (van der Elst 1993), spawning recorded in East Africa; North Kenya Banks and Mafia island (Nzioka 1979). Spawning aggregations observed by Seychellois fishermen (Robinson et al. 2004)
Age at 50% maturity: Unknown
Length at 50% maturity: ~90cm TL; SA and MOZ (van der Elst 1993)

BIOMETRICS
Maximum recorded age: 26 years; Aldabra, Seychelles; 2000 (Grandcourt 2005)
Maximum recorded weight: 77.8kg; Japan; 2011; world angling record (IGFA 2012). SA angling record is 65.8kg caught in KZN in 1956 (SADSAA 2012)
Maximum recorded length: Reported to reach over 200cm TL (van der Elst 1993, Heemstra and Heemstra 2004)
Length-length relationship: SL(cm) = 0.815 x TL(cm); derived from picture (Froese and Pauly 2012)
Length-weight relationship: $Wt(kg) = 0.00001 \times TL(cm)^{3.07}$; Aldabra; n=62 (Grandcourt 2005).
$Wt(kg) = 0.000106 \times TL(cm)^{2.56}$; SA (Torres 1991a)
Growth parameters: Combined sexes: $L_\infty = 114.9$cm TL; $K = 0.13$; $t_0 = 0$; Aldabra; Seychelles (Grandcourt 2005)

FISHERY
Once abundant on inshore reefs in northern KZN, this species was over-exploited particularly by spearfishermen due to its large size, trophy status and the fact that this species is inquisitive and easy to approach underwater (van der Elst 1993). The proclamations of the St Lucia and Maputaland MPAs in 1979 and 1986, respectively, have resulted in a strong recovery of this species (van der Elst 1993). In addition, potato bass have been fully protected in SA waters since 1992

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): $0.16yr^{-1}$
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown

F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters, natural mortality rate determined off Aldabra, Seychelles (Grandcourt 2005)

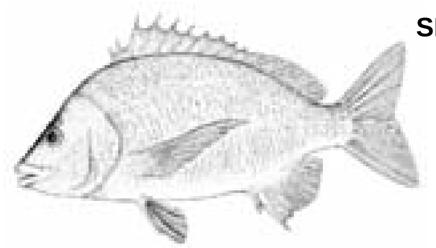
STOCK STATUS
Status: Not assessed
Trend in CPUE: Little quantitative data available. Observation by spearfishermen along the KZN coast suggested that numbers declined substantially prompting the Natal Underwater Union to motivate for their protection in 1974 (SAMLMA 1993)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Prohibited species
IUCN Red List: Least Concern; 2008; however there is little fisheries data on the species and it thus warrants close scrutiny and should be re-evaluated as more information becomes available (Fennessy et al. 2008)

CURRENT REGULATIONS
Daily bag limit: Zero
Minimum size limit: Not applicable
Closed Season: Not applicable
Other regulations: Fully protected (prohibited) species
MPA effectiveness: *E. tukula* is more abundant in the St Lucia and Maputaland Marine Reserves than anywhere else along the KZN coast. Furthermore, abundances were highest in no-take sanctuary zones compared to other used areas in the MPA (fishing and diving) (Floros 2010, Mann 2012). Also receives some protection in the Ponta do Ouro Partial Marine Reserve in southern MOZ

MANAGEMENT CONSIDERATIONS
As a top keystone predator on coral reefs, *E. tukula* is an important indicator species of reef health (Floros 2010). Due to its uncommon status outside MPAs in SA waters and its susceptibility to fishing (resident and inquisitive nature, large size and relatively slow growth), *E. tukula* should remain a prohibited species

RESEARCH REQUIREMENTS
Need to determine life history parameters such as reproductive style, size/age at maturity and sex change, movement patterns and spawning localities
Research priority: Medium



SCIENTIFIC NAME: *Acanthopagrus vagus* (Smith No. 183.1)
COMMON NAMES: Riverbream, Perch, Slim Jannie
COMPILER: NC James
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: November 2011

GLOBAL DISTRIBUTION: Endemic, southern MOZ to Knysna in SA (Iwatsuki and Heemstra 2010)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
There has recently been some taxonomic confusion over the *Acanthopagrus* genus in SA. Most *Acanthopagrus* spp. were previously misidentified as *A. berda* in SA and are in fact *A. vagus* (Heemstra and Heemstra 2004, Iwatsuki and Heemstra 2010). As a consequence, all previous literature in SA on this species incorrectly refers to *A. berda*. *A. berda* is a more widespread species, occurring throughout the tropical Indo-West Pacific from SA to India, Indonesia, northern Australia and Japan (Iwatsuki and Heemstra 2010)

MOVEMENT: Resident
Estuarine-dependent species with only a marine egg and larval phase, adults are rarely found far from estuaries in the marine environment (Wallace 1975a, van der Elst 1993). Populations in different estuaries are fairly discrete (Kyle and Robertson 1997). Based on tagging data from Kosi Bay, this species also appears to be resident to localised estuarine areas (Kyle 2000). Adults undertake an annual spawning migration down to the estuary mouth in order to spawn (Kyle 1986, Garratt 1993b, P. Cowley, SAIAB, unpubl. data)

HABITAT
Adults: Estuarine, euryhaline species (Wallace 1975b) tolerant of a wide range of salinities (Whitfield 1996) and turbidities (Cyrus and Blaber 1987a, 1987b). Adults are rarely found far from estuaries in the marine environment (Wallace 1975b, van der Elst 1993)
Juveniles: 0+ juveniles enter KZN estuaries at 10-50mm SL, between Jul-Dec (Wallace and van der Elst 1975)
Eggs and larvae: Egg and larval development takes place at sea (Wallace and van der Elst 1975). *A. vagus* eggs were the most common eggs collected in the mouth of the Durban Harbour during winter on outgoing spring tides (Connell 2012). Early larval development is described by Garratt (1993b)

FEEDING
Adults: Diet wide, includes amphipods, polychaetes, bivalves, crustaceans, gastropods, aquatic plants and small fish (Day and Morgans 1956, Day et al. 1981, Kyle 1986)
Juveniles: Diet of *A. vagus* from 20-60mm consists mainly of amphipods, planktonic copepods, chironomid larvae, tanaids and aquatic plants (Day and Morgans 1956, Day et al. 1981, Harrison 1991)

REPRODUCTION
Reproductive style: Assumed to be a protandrous hermaphrodite (Garratt 1993a)
Breeding/spawning season: In KZN, Wallace (1975a) recorded spawning (from macroscopic gonad staging) occurring from Apr-Jul, with peak spawning possibly occurring in May-Jun. Connell (2012) (from the presence of eggs) recorded peak spawning in Durban Harbour in Jul-Aug, with spawning starting as early as March
Breeding/spawning locality: Nearshore marine environment, primarily in estuary mouths and seldom in the sea (Wallace 1975a, Garratt 1993b, Connell 2012). Spawning recorded in a number of large KZN estuaries including Kosi Bay, St Lucia, Richards Bay and Durban Bay (Wallace 1975a, Garratt 1993b, Connell 2012)
Age at 50% maturity: Combined sexes: 3.6 years; KZN estuaries; 1968-1970; James et al. (2003) using length data collected by Wallace (1975a)
Length at 50% maturity: Combined sexes: 23cm TL; KZN estuaries; 1968-1973 (James 2001). Length at 50% maturity was derived from a logistic curve using data collected by Wallace (1975a)

BIOMETRICS
Maximum recorded age: 16 years; male; Richards Bay; 1968-1973 (James et al. 2003)
Maximum recorded weight: 3.2kg; 1995; SA angling record (SALTBAA 2010)
Maximum recorded length: 75cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: TL(cm) = 1.1078FL(cm) - 0.0748; KZN estuaries; n=146 (James 2001)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000128 x $TL(mm)^{3.09}$; KZN estuaries (van der Elst and Adkin 1991)
Growth parameters: Combined sexes: L_∞ = 499.9mm FL; K = 0.075; t_0 = -2.995; KZN estuaries; n=403 (James et al. 2003)

FISHERY
In SA estuaries *A. vagus* is harvested by recreational boat and shore anglers and by subsistence fishers using lines, fish traps and gill-nets. It is a particularly important component of the recreational and subsistence catch in the three large northern KZN estuaries; Kosi Bay, St Lucia and Richards Bay (James 2001, James et al. 2001, Mann et al. 2002, Beckley et al. 2008) and the Durban Harbour (Pradervand et al. 2003)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): F_{traps} = 1.64yr^{-1}; $F_{gill\text{-}nets}$ = 0.113yr^{-1}; $F_{recreational}$ = 0.132yr^{-1}; F_{total} = 1.88yr^{-1}
Natural mortality rate (M): 0.26yr^{-1}
Total mortality rate (Z): 2.14yr^{-1}
F_{MSY} yr^{-1}: 1.18
F_{SB40} yr^{-1}: 0.57
F_{SB25} yr^{-1}: 1.74
$F_{0.1}$ yr^{-1}: 0.29
$SBPR_{current}$: 24%
Year completed: 2001
Locality: Kosi Bay
References & Comments: Fishing mortality rate determined independently for fish traps, gill-nets and recreational fishing in Kosi Bay (James et al. 2008)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2001
Locality: Kosi Bay
Status: <25% - collapsed (James et al. 2008)
Trend in CPUE: Significant decrease from 0.017 $fish.angler^{-1}.hr^{-1}$ (1986) to 0.007 $fish.angler^{-1}.hr^{-1}$ (1999) in Kosi recreational catches (James et al. 2001). Of particular concern is the recent exponential increase in the number of fish traps and the number of baskets per trap, which has resulted in a drastic reduction in the number of *A. vagus* in the Kosi system (R. Kyle, EKZNW, pers. comm.). In St Lucia, van der Elst (1978) showed a downward trend in CPUE of *A. vagus* between 1956 and 1977 based on NCAU competition data. Although an overall upward trend was recorded in the St Lucia recreational fishery from 1986-99 (Mann et al. 2002), the subsequent drought and extended closure of the St Lucia system since 2002 has resulted in extremely low catches of this species in a seine and gill-net survey conducted between 2006-08 (Vivier et al. 2010)
Trend in catch composition: Contribution by mass to the Kosi recreational fishery remained constant from 1987-95, and then declined from a high of 4.1% in 1994 to a low of 0.6% in 1999 (James et al. 2001). Contribution by numbers to the St Lucia recreational fishery peaked in 1994 at 37%, and remained relatively high thereafter (Mann et al. 2002). However, after almost 5 years of estuary closure, *A. vagus* comprised only 0.2% of the catch in a seine and gill net survey of St Lucia from 2006-08 (Vivier et al. 2010)
Trend in mean size: Between 1985-98 the mean size of fish caught in monitored fish traps in Kosi Bay was 31.4cm TL. Fish caught in 2001 were smaller with a mean size of 26.9cm TL (James 2001)
Trend in sex ratio: Garratt (1993b) recorded a M:F sex ratio of 8.8:1 during a spawning aggregation at Kosi mouth but no data on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

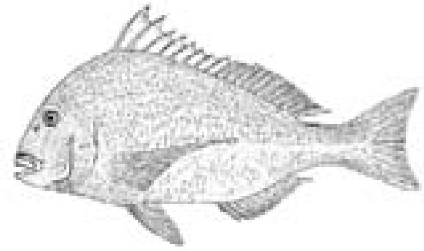
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5 pppd; Commercial: prohibited
Minimum size limit: 25cm TL
Closed Season: None
Other regulations: No sale recreational species
MPA effectiveness: As adult populations in different estuaries are fairly discreet, this species would benefit from increased protection in EPAs, particularly in KZN. The eastern side of the north lake and the top section of the narrows in Lake St Lucia, the Kosi Bay mouth and the fourth lake (Amanzinyama) and the Mhlatuze estuary are all designated no-take EPAs that should provide some protection for this species, but all three systems are exposed to illegal gill-netting (Mann et al. 1998). The Mtentu and Msikaba are no-take estuaries within the Pondoland MPA that are also likely to provide some protection for this species (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
More no-take EPAs need to be designated in KZN and illegal fishing needs to be prevented. The number of fish traps and baskets on traps in Kosi Bay should be drastically reduced. The channels between lakes should be kept open and no netting or fish traps should be allowed to extend into these channels. Within the lakes and

upper estuary, a channel should be kept open between kraals on either side. The illegal seine and gill net fisheries in the Mhlatuze Estuary need to be addressed, particularly in light of the current poor status of the *A. vagus* stock in Kosi Bay and St Lucia

RESEARCH REQUIREMENTS
The current status of the species in Kosi Bay needs to be re-assessed owing to the exponential rise in the number of fish traps and baskets on traps. Research needs to address the relative contribution of *A. berda* and *A. vagus* to catches in SA. Research needs to address whether populations of *A. vagus* in different estuaries are genetically distinct
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Argyrops spinifer* (Smith No. 183.4)
COMMON NAMES: King soldierbream
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Widespread in tropical Indo-West Pacific, Red Sea and East Africa, extending to the Indo-Malayan archipelago and northern Australia (Bauchot and Smith 1984, Smith and Smith 2003, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Extends down the east coast of Africa, occasionally reaching as far south as Knysna in SA (Smith and Smith 2003, Heemstra and Heemstra 2004). Also abundant on the SE coast of Madagascar (B. Mann, ORI, pers. obs.). May be some confusion with the closely related *A. filamentosus*, which also occurs in our area

MOVEMENT: Unknown
Some evidence of large aggregations during autumn in the Gulf of Aden (Druzhinin 1975)

HABITAT
Adults: Known to occur on a wide range of bottom substrata including soft bottoms and low relief reef in depths from 30-400m (Druzhinin 1975, Bauchot and Smith 1984, Smith and Smith 2003, Heemstra and Heemstra 2004)
Juveniles: Found in shallow waters of sheltered bays 5-30m (Bauchot and Smith 1984)
Eggs and larvae: Pelagic, little known

FEEDING
Adults: Bottom living invertebrates, mostly hard shelled molluscs, stomatopods, shrimps and crabs (Bauchot and Smith 1984, van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Probably gonochoristic, however, circumstantial evidence from sex ratios implies that this species may be a protogynous hermaphrodite (Grandcourt et al. 2004)
Breeding/spawning season: Locally unknown, but reported to be during summer and autumn in Gulf of Aden (Druzhinin 1975)
Breeding/spawning locality: Locally, spawning has been reported from northern KZN (van der Elst 1993)
Age at 50% maturity: Mean age at first maturity was 2.4 years for both females and males in the southern Arabian Gulf (Grandcourt et al. 2004)
Length at 50% maturity: Mean size at first maturity was 26.9cm FL for females and 26.7cm FL for males in the southern Arabian Gulf (Grandcourt et al. 2004)

BIOMETRICS
Maximum recorded age: 17 years; Gulf of Aden (Druzhinin 1975)
Maximum recorded weight: 6.2kg; KZN; 1964; SA angling record (SADSAA 2012)
Maximum recorded length: 700mm TL (Smith and Smith 2003)
Length-length relationship: TL(cm) = 1.125 x FL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Wt(g) = 0.0798 x $FL(cm)^{2.657}$; Gulf of Aden (Druzhinin 1975)
Wt(g) = 0.111 x $FL(cm)^{2.54}$; Gulf of Aden (Edwards et al. 1985)
Growth parameters: Combined sexes: L_∞ = 524.1mm FL; K = 0.224; t_0 = -0.44; Southern Arabian Gulf, based on trap fishery (Grandcourt et al. 2004). The selectivity of this fishery is probably the reason for the unusually small L_∞ parameter estimate relative to the maximum recorded length (700 mm TL).
Combined sexes: L_∞ = 578mm FL; K = 0.21; t_0 = 0.026; Gulf of Aden; based on a trawl fishery (Edwards et al. 1985)

FISHERY
Small numbers are occasionally caught by recreational and commercial ski-boats off northern KZN (Mann et al. 1997a) and by lineboats in MOZ but they make up a very small component of the catch in both areas

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): $0.573yr^{-1}$
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown

F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA waters. M estimated from Pauly's equation for a population in the Southern Arabian Gulf (Grandcourt et al. 2004)

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

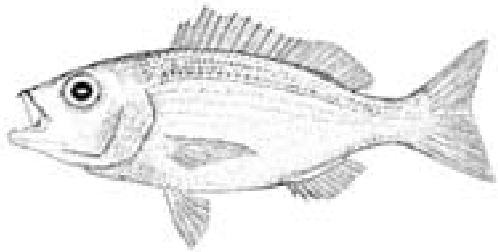
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably benefits from protection in the St Lucia and Maputaland MPAs in northern KZN

MANAGEMENT CONSIDERATIONS
Although the life-history of this species is not well understood, it most likely shares characteristics of other large sparids, which make them vulnerable to over-exploitation. For this reason, a precautionary approach to management should be taken. Its preference for deeper water also requires that some MPAs be extended seawards to include more deeper reef and soft bottom habitats

RESEARCH REQUIREMENTS
Age and growth, reproductive biology, early life-history, movement patterns, stock assessment
Research priority: Low

SPARIDAE



SCIENTIFIC NAME: *Argyrozona argyrozona* (Smith No. 183.5)
COMMON NAMES: Carpenter, Silverfish, Kaapenaar
COMPILER: SE Kerwath
REVIEWER: H Winker
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Endemic to SA, in warm temperate waters (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC
Most abundant between Cape Point and Kei Mouth (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Resident with a small percentage of fish dispersing (Griffiths and Wilke 2002, Brouwer et al. 2003)

HABITAT
Adults: Bentho-pelagic associated with high profile reef from 50–200m (Brouwer and Griffiths 2005)
Juveniles: Shallow (10-40m) inshore reefs (Brouwer and Griffiths 2005)
Eggs and larvae: Pelagic, inshore of the Agulhas Current (Brouwer et al. 2003)

FEEDING
Adults: Primarily squid, anchovy and sardine (Heemstra and Heemstra 2004)
Juveniles: Crabs, crab larvae, amphipods and polychaete worms (Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Gonochorist (Brouwer and Griffiths 2005)
Breeding/spawning season: Summer and autumn (Brouwer and Griffiths 2005)
Breeding/spawning locality: Throughout its distribution range (Brouwer and Griffiths 2005)
Age at 50% maturity: Combined sexes: 2 years (EC), 3 years (Agulhas Bank) and 5 years (Tsitsikamma) (Brouwer and Griffiths 2005)
Length at 50% maturity: Males: 222mm FL (EC), 261mm FL (Agulhas Bank), 297mm FL (Tsitsikamma); Females: 206mm FL (EC), 267mm FL (Agulhas Bank), 292mm FL (Tsitsikamma) (Brouwer and Griffiths 2005)

BIOMETRICS
Maximum recorded age: 30 years; SA (Brouwer and Griffiths 2004)
Maximum recorded weight: 4.1kg; SA angling record (SADSAA 2012)
Maximum recorded length: 80cm TL (Brouwer and Griffiths 2004)
Length-length relationship: Combined sexes: $FL(mm) = 0.8455TL(mm)^{1.0143}$; $TL(mm) = 1.1914FL(mm)^{0.9843}$; Tsitsikamma (Brouwer and Griffiths 2005)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00004 \times FL(mm)^{2.8553}$; Tsitsikamma (Brouwer and Griffiths 2005)
Growth parameters: Combined sexes: L_∞ = 524mm FL; K = 0.08, t_0 = -3.9 (EC); L_∞ = 619mm FL; K = 0.06, t_0 = -4.5 (Agulhas Bank); L_∞ = 684mm FL; K = 0.06, t_0 = -3.6 (Tsitsikamma) (Brouwer and Griffiths 2005)

FISHERY
Carpenter continues to be the most important sparid in terms of catch volume for the commercial linefishery. The demersal trawl bycatch, especially of the inshore component of this fishery continues to be significant with an estimated 80% of the linefish catch (Attwood et al. 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.11-0.3yr^{-1}
Natural mortality rate (M): 0.05-0.15yr^{-1}
Total mortality rate (Z): 0.24-0.39yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.05-0.07
F_{SB25} yr^{-1}: 0.08-0.1
$F_{0.1}$ yr^{-1}: 0.08-0.1
$SBPR_{current}$: 12-23%
Year completed: 2006
Locality: WC and EC
References & Comments: Brouwer and Griffiths (2006) used a range of per-recruit models with a combination of different area specific mortality rates for their analyses. All results indicated that the stock was heavily overfished at the time. A more recent stock assessment using a biomass production model suggests some recovery in carpenter stocks since commercial effort reduction in 2003 (Winker et al. 2012)

STOCK STATUS
Stock assessment method: Biomass production model
Year completed: 2012
Locality: WC and EC
Status: 25-40% - overexploited. Winker et al. (2012) estimated biomass to be at 32% of carrying capacity for the WC and 42% for the EC
Trend in CPUE: CPUE has improved drastically as a result of the commercial effort reduction and the removal of larger deck boats from the fishery (Winker et al. 2012, 2013)
Trend in catch composition: Carpenter contributes on average 3% to the total linefish catch with no discernible trend over the past ten years (NMLS unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

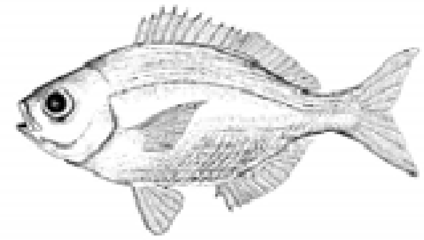
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 4 pppd; Commercial: unlimited
Minimum size limit: 35cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Large MPAs in the EC and WC with a substantial amount of reef habitat have been shown to have a positive impact on this species (Brouwer et al. 2003, Brouwer and Griffiths 2004, 2005, 2006)

MANAGEMENT CONSIDERATIONS
The trawl bycatch needs to be strictly monitored and managed, for example, by enforcing precautionary upper catch limits. The current linefish effort is estimated to below F_{MSY} for carpenter, but should remain at current levels until the resource has fully recovered. The monitoring of length-frequency data should continue to allow the use of age-structured production models for future assessments

RESEARCH REQUIREMENTS
Simulation of the impact of different management scenarios on the stock. Development of age-structured production models to facilitate more rigorous stock assessments
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Boopsoidea inornata* (Smith No. 183.6)
COMMON NAMES: Fransmadam, Karel grootoog
COMPILER: AD Wood
REVIEWER: PD Cowley
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Endemic, Cape Point to southern KZN (Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Smith and Heemstra (1991); Heemstra and Heemstra (2004)

MOVEMENT: Unknown
No tagging records available as species is too small to tag using conventional tags

HABITAT
Adults: High and low relief reefs in 5-30m depth (Trow 1982, Buxton and Smale 1984, van der Elst 1988, Burger 1990, Smith 2005)
Juveniles: Shallow subtidal reefs and gullies, particularly those covered in coralline algae (Buxton and Smale 1984, Beckley and Buxton 1989, Burger 1990, Smith 2005)
Eggs and larvae: Pelagic, found in shelf waters within the Tsitsikamma National Park (Wood 1998, Wood et al. 2000)

FEEDING
Adults: Benthic feeding habits with a diverse diet including crustaceans, ascidians, algae, polychaete worms, bryozoans and molluscs. The dominant crustaceans include amphipods, decapods, isopods and mysids. The presence of planktonic crustaceans suggest they also feed above the reef (Trow 1982)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Gonochoristic (Garratt 1986)
Breeding/spawning season: Spring and summer (Buxton and Smale 1984) but fish with ripe gonads observed throughout the year (B. Mann, ORI, pers. obs.)
Breeding/spawning locality: Subtidal reefs in the EC but likely to occur throughout distribution (B. Mann, ORI, pers. obs.)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown but all fish >140mm SL are sexually mature (Trow 1982)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 0.4kg; Tsitsikamma National Park; 1991 (B. Mann, ORI, pers. obs.)
Maximum recorded length: 30cm TL (Heemstra and Heemstra 2004)
Length-length relationship: Unknown
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Although small, *B. inornata* comprise an important component of recreational and commercial skiboat catches in the EC and WC. Primarily used as bait but increasingly being used for food as other larger reef fish species become depleted. Also frequently taken by shore anglers fishing in deep water in the EC and WC (Brouwer 1997, Lamberth 1997, King 2005, Smith 2005)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

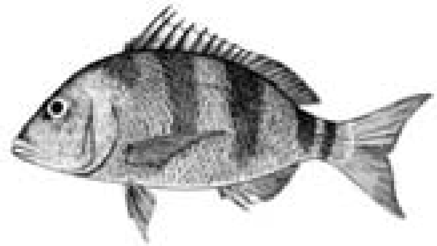
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Abundant in a number of MPAs in the EC and WC such as Pondoland (Mann et al. 2006), Tsitsikamma (Buxton and Smale 1984), Goukamma (Götz 2005), De Hoop (C. Wilke, DAFF, pers. comm.), etc. Götz (2005) recorded *B. inornata* to be less abundant inside the Goukamma MPA compared to adjacent exploited areas due to intra-specific competition

MANAGEMENT CONSIDERATIONS
Although not a prime eating fish, *B. inornata* are increasingly being caught due to the decline in abundance of other larger species. It is likely that future catches of this species will continue to increase with increased targeting (e.g. use of smaller hooks). On-going monitoring of recreational and commercial ski-boat catch and effort data is thus required

RESEARCH REQUIREMENTS
Age and growth, size at maturity, reproductive biology, length/weight relationship and early life history
Research priority: Low

SPARIDAE



SCIENTIFIC NAME: *Cheimerius nufar* (Smith No. 183.7)
COMMON NAMES: Santer, Soldier, Santer seabream
COMPILER: BQ Mann
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: April 2013

GLOBAL DISTRIBUTION: Western Indian Ocean, from the Red Sea south to SA and east to India and Sri Lanka (Fischer and Bianchi 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
From MOZ to Cape Agulhas in the WC (Garratt 1985a, b, Smale 1986)

MOVEMENT: Nomadic
Adults do not appear to undertake extensive migrations with a mean distance moved of 29km based on 57 (4.74%) recaptures (ORI Tagging Project, unpubl. data). In a separate study based on 237 recaptures (13.1%) off De Hoop and Struisbaai, Wilke and Griffiths (1999) and Griffiths and Wilke (2002) found that santer were nomadic between reef complexes with an average distance moved of 5.2km but with a relatively large proportion (22.8%) that moved over 10km. Santer are well known to undertake local movements into shallow water during stormy weather or following cold water upwelling events (Smith and Heemstra 1991)

HABITAT
Adults: Found in loose shoals primarily over deeper, low relief reefs down to 130m (Coetzee and Baird 1981a, Garratt 1985a, Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Found on shallow reefs and over sand adjacent to reefs from 7-60m (Buxton et al. 1984, van der Elst 1993, Heemstra and Heemstra 2004)
Eggs and larvae: Pelagic eggs distributed inshore of the Agulhas Current (Garratt 1985b). Larvae have been successfully reared artificially up to 30 days (Garratt et al. 1989). Have been collected off Park Rynie on the KZN south coast but eggs difficult to distinguish from *Pagellus* eggs (Connell 2012)

FEEDING
Adults: Primarily piscivorous feeding on species such as pilchards and small reef fishes but also preys on squid, octopus and crabs (Coetzee and Baird 1981b, Garratt 1986, Smale 1986)
Juveniles: Juveniles feed on mysids, penaeids, octopus and small reef fish such as gobies (Coetzee and Baird 1981b, Garratt 1986, Smale 1986)

REPRODUCTION
Reproductive style: Rudimentary hermaphrodite and functional gonochorist (Coetzee 1983, Garratt 1985b, Buxton and Garratt 1990, Garratt 1991) but spawning behaviour and early gonadal development suggest the possibility of protogynous sex change (Garratt 1993)
Breeding/spawning season: Jun-Oct peaking between Jul-Aug in MOZ (Piotrovski 1990). May-Nov peaking between Aug-Oct in KZN (Garratt 1985b, Garratt 1991). Nov-Feb peaking between Dec-Jan in the EC (Coetzee 1983)
Breeding/spawning locality: Throughout its distribution including MOZ, KZN and the EC (Coetzee 1983, Garratt 1985b, Piotrovski 1990, Garratt 1991, Garratt 1993)
Age at 50% maturity: Combined sexes: 3-4 years; EC; 1975-78 (Coetzee and Baird 1981b)
Length at 50% maturity: Females: 250mm FL; KZN; 1979-81 (Garratt 1985b); Combined sexes: 340mm TL; EC; 1975-78 (Coetzee 1983); Combined sexes: 258mm FL; MOZ; 2006-07 (Torres 2009)

BIOMETRICS
Maximum recorded age: 22 years; EC; 1979-81 (Coetzee and Baird 1981b). Druzhinin (1975) estimated maximum age of santer at 25 years in the Gulf of Aden
Maximum recorded weight: 8kg; KZN; 1987; SA angling record (SADSAA 2012)
Maximum recorded length: 75cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: TL(mm) = 1.13FL(mm) - 0.17; KZN (Garratt 1984); Combined sexes: FL(mm) = 0.8798TL(mm) – 0.9658; EC; n=368 (Coetzee and Baird 1981b); Combined sexes: SL(mm) = 0.769TL(mm) + 0.3928; EC; n=459 (Coetzee and Baird 1981b)
Length-weight relationship: Combined sexes: Wt(g) = 0.00024 x FL(mm)$^{2.571}$; KZN (Garratt 1984); Combined sexes: Wt(g) = 0.00005 x TL(mm)$^{2.7831}$; EC; n=503 (Coetzee and Baird 1981b)
Growth parameters: Combined sexes: L_∞ = 954mm TL; K = 0.0654; t_0 = -2.6177; EC (Coetzee and Baird 1981b); Combined sexes: L_∞ = 70cm TL; K = 0.17; MOZ; calculated using ELEFAN1 (Timochin 1992); Combined sexes: L_∞ = 897mm FL; K = 0.06; t_0 = -3.28; MOZ (Torres 2009)

FISHERY
Important to the commercial and recreational skiboat fishery in MOZ, KZN, EC and WC (Garratt 1985a, Smale and Buxton 1985, van der Elst 1989, Penney et al. 1989, Timochin 1992, Mann et al. 1997a, Brouwer and Buxton 2002, Fennessy et al. 2003, Dunlop and Mann 2013). Seldom taken by spearfishermen (van der Elst 1993) but occasionally caught from the shore at specific sites in the south EC (Coetzee and Baird 1981a, Hanekom et al. 1997). Also recorded infrequently from inshore bottom trawls along the southern Cape coast (Attwood et al. 2011), and off MOZ and in the Gulf of Aden (Druzhnin 1975, Piotrovski 1990, Timochin 1992)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA; assessed in MOZ waters in 2008 and in 2012 but growth parameters used were dubious (based on a maximum age of 11 years with no small fish sampled), so parameters not included (Torres 2009)

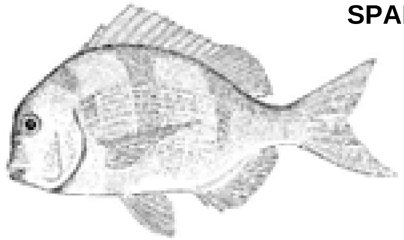
STOCK STATUS
Status: Not assessed in SA waters, but considered to be optimally exploited based on available trends in CPUE (NMLS, unpubl. data)
Trend in CPUE: Between 1985-2007 commercial linefish catches in SA remained relatively stable at around 80mt per annum but standardised CPUE over this period has shown a significant increase from 0.35 to 0.6kg.man^{-1}.hr^{-1} (NMLS unpubl. data). This increase was particularly noticeable after the commercial effort reduction in 2003-06. KZN recreational skiboat catch rates remained stable at around 0.1 fish and 0.1kg per outing between 1994-96 and 2008-09 (Mann et al. 1997a, Dunlop and Mann 2013)
Trend in catch composition: Relative contribution of santer increased from 6% to 21% in two fishery-independent surveys, 1931-33 and 1987-93, conducted on identical reef complexes in the southern Cape (Griffiths 2000). Santer also increased in importance in the KZN commercial linefishery between 1923 and 1985, but have subsequently remained relatively stable (Penney et al. 1999, NMLS unpubl. data). In recreational catches the contribution has remained similar - 5.8% by no. and 2.4% by wt (1994-96) and 3.5% by no. and 2% by wt (2008-09) (Mann et al. 1997a, Dunlop and Mann 2013). Santer has made an increasingly important contribution to both commercial and recreational linefish catches in Port Alfred between 1985-2008. In terms of the "sparid group" santer increased from 3.3% to 36.6% in commercial catches and from 17.2% to 46.4% in recreational catches (Hecht and Tilney 1989, Donovan 2010)
Trend in mean size: Mean size of commercial santer catches in KZN appear to have shown a slight increase between 1979-81 (302mm FL, n=2350) and 2007-10 (317mm FL, n=326) (Garratt 1985a, B. Mann, ORI, unpubl. data), probably as a result of the implementation of the minimum size limit of 30cm TL in 1992
Trend in sex ratio: M:F sex ratio of santer sampled from commercial catches in KZN appear to have shown little change between 1979-81 (1:2.5, n=2350) and 2007-10 (1:2.2, n=326) (Garratt 1985a, B. Mann, ORI, unpubl. data)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: 30cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Santer is likely to receive protection in the larger no-take MPAs on the south-eastern seaboard of SA and in southern MOZ that contain suitable reef habitat and that are large enough to accommodate their nomadic movement behaviour

MANAGEMENT CONSIDERATIONS
Santer is the second most important commercial linefish caught in KZN and southern MOZ and has become of increasing importance in the EC. This is likely to be a shared stock and it needs to be managed jointly by both countries. On-going monitoring of catch and effort in both recreational and commercial sectors of the linefshery should be continued and improved where possible by the implementation of an observer programme

RESEARCH REQUIREMENTS
Age and growth (in KZN), stock assessment and determination of biological reference points, movement, genetic connectivity
Research priority: High



SCIENTIFIC NAME: *Chrysoblephus anglicus* (Smith No. 183.8)
COMMON NAMES: Englishman
COMPILER: BQ Mann
REVIEWER: PA Garratt
DATE OF REPORT COMPLETION: December 2011

GLOBAL DISTRIBUTION: Endemic, southern MOZ to Algoa Bay (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Main stock assumed to be between southern MOZ and the former Transkei (van der Elst and Adkin 1991)

MOVEMENT: Resident
Based on limited tagging data, this species appears to be highly resident (ORI Tagging Project, unpubl. data)

HABITAT
Adults: Offshore reefs between 20-120m (Garratt et al. 1994)
Juveniles: Observed on shallow subtidal reefs between 10-30m in the Pondoland region of the EC (Mann et al. 2006)
Eggs and larvae: Unknown, pelagic. Not recorded on the KZN south coast by Connell (2012)

FEEDING
Adults: Benthic crustaceans and molluscs (Garratt et al. 1994)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Is assumed to be protogynous hermaphrodite (Garratt et al. 1994, Mann et al. 2005)
Breeding/spawning season: Limited data, but appears to have an extended spawning season during winter and spring (Garratt et al. 1994, Mann et al. 2005)
Breeding/spawning locality: Unknown, limited spawning recorded in KZN (Garratt et al. 1994, Mann et al. 2005)
Age at 50% maturity: Based on the approximate length at maturity of 40cm TL (van der Elst 1993), the corresponding age would be about 7 years (Mann et al. 2005)
Length at 50% maturity: van der Elst (1993) estimated size at maturity at 40cm TL. Fish sampled with active gonads ranged in length from 315-600mm FL (Mann et al. 2005)

BIOMETRICS
Maximum recorded age: 17 years; male; KZN; 2004 (Mann et al. 2005)
Maximum recorded weight: 7kg; KZN; 1996; SA angling record (SADSAA 2012)
Maximum recorded length: 80cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: TL(mm) = 1.18FL(mm) + 4.46; KZN; n=366 (Garratt et al. 1994)
Length-weight relationship: Combined sexes: $Wt(g) = 0.000127 \times FL(mm)^{2.74}$; KZN; n=672 (Garratt et al. 1994)
Growth parameters: Combined sexes: L_∞ = 650mm FL, K = 0.085, t_0 = -1.85; KZN; n=305 (Mann et al. 2005)

FISHERY
Important in the KZN commercial and recreational skiboat fishery (Mann et al. 1997a, Dunlop and Mann 2013), particularly on the KZN south coast (Garratt et al. 1994, Mann et al. 2005). Occasionally taken by competitive spearfishers (Mann et al. 1997b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.258yr^{-1}$
Natural mortality rate (M): $0.238yr^{-1}$
Total mortality rate (Z): $0.496yr^{-1}$
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.12
F_{SB25} yr^{-1}: 0.2
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 16.8%
Year completed: 2004
Locality: KZN
References & Comments: Mann et al. (2005)

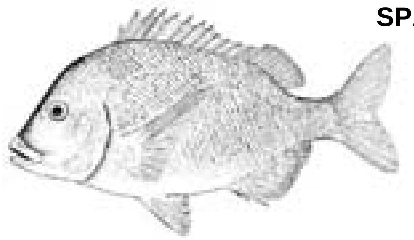
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2004
Locality: KZN
Status: <25% - collapsed (Mann et al. 2005)
Trend in CPUE: Slight increase from 58kg.man^{-1}.year^{-1} (1940-41) to 64kg.man^{-1}.year^{-1} (1985-92) in KZN (Garratt et al. 1994). Reported commercial catches have also shown a slight increase in standardised CPUE between 1985 (0.28kg.man^{-1}.hr^{-1}) and 2007 (0.34kg.man^{-1}.hr^{-1}) (NMLS, unpubl. data)
Trend in catch composition: Increase from 1.5% of total commercial KZN linefish catch in 1940-41 to 6% from 1985-92 (Garratt et al. 1994). *C. anglicus* comprised 2.1% of the monitored KZN commercial linefish catch during 2008-09 (Dunlop 2011)
Trend in mean size: Slight reduction in KZN from 350mm FL (1979-81), to 343mm FL in 1990-92 (Garratt et al. 1994). Mean size of *C. anglicus* measured between 2002-04 on the KZN south coast was 350mm FL (Mann et al. 2005)
Trend in sex ratio: Sex ratio has been heavily skewed towards females due to removal of large male fish, and the sex ratio on the KZN south coast consists of 95% females (Garratt et al. 1994). Mann et al. (2005) also found the M:F sex ratio heavily skewed by females (1:25)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: unlimited
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: It is likely that large no-take MPAs in KZN and the EC provide important protection for resident populations of this species (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS
Following completion of the stock assessment in 2004 (Mann et al. 2005) and the implementation of a minimum size limit in 2005 (40cm TL), catch and effort for this species should be carefully monitored. On-going monitoring of the effectiveness of MPAs for the protection of this species should also be continued

RESEARCH REQUIREMENTS
Need to determine size/age at maturity, confirm sex change and determine spawning locality
Research priority: Medium



SCIENTIFIC NAME: *Chrysoblephus cristiceps* (Smith No. 183.9)
COMMON NAMES: Dageraad, Daggerhead seabream
COMPILER: CD Buxton
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic, found from Durban in KZN to Cape Point in the WC, along the eastern seaboard of SA (Fischer and Bianchi 1984, Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Seldom caught in KZN waters but have been caught as far north as Richards Bay (P. Garratt, Two Oceans Aquarium, pers. comm.), more common in the EC and WC (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Tagging results suggest that *C. cristiceps* are fairly resident although there may be some nomadic movement between reefs (Buxton and Allen 1989, Buxton and Smale 1989, Griffiths and Wilke 2002, ORI Tagging Project, unpubl. data)

HABITAT
Adults: Adult *C. cristiceps* are found on offshore reefs between 20-100m (Buxton and Smale 1984, Buxton 1987)
Juveniles: Juveniles occupy shallow subtidal reefs 10-30m in the SE Cape (Buxton 1987)
Eggs and larvae: Small pelagic eggs with a large oil droplet, larvae not described (Buxton 1990). No *C. cristiceps* eggs or larvae sampled within Tsitsikamma National Park (Wood 1998)

FEEDING
Adults: *C. cristiceps* is a benthic carnivore feeding on a wide variety of reef-associated invertebrates (Buxton 1987)
Juveniles: Same as adults but smaller size of food items (Buxton 1987)

REPRODUCTION
Reproductive style: *C. cristiceps* are protogynous hermaphrodites with sex change occurring at approximately 43.5cm FL (Buxton 1987, 1989, 1990)
Breeding/spawning season: Restricted spawning season between Oct-Jan (Buxton 1990)
Breeding/spawning locality: Reef spawners with spawning recorded in the EC (Buxton 1990)
Age at 50% maturity: Females: 7.7 years; Males: 11 years (mean age at sex change); EC; 1980s (Buxton 1990)
Length at 50% maturity: Females: 27.5-36.5cm FL; Males: 43.5mm FL (mean length at sex change); EC; 1980s (Buxton 1990)

BIOMETRICS
Maximum recorded age: 22 years; male; EC; 1980s (Buxton 1993a)
Maximum recorded weight: 8.7kg, 1976; SA angling record (SADSAA 2012)
Maximum recorded length: 70cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: TL(mm) = 1.1432FL(mm) - 3.6024; EC (Buxton 1993a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00013 \times FL(mm)^{3.151}$; EC (Buxton 1993a)
Growth parameters: Combined sexes: L_∞ = 654.7mm FL; K = 0.081; t_0 = -2.35; EC (Buxton 1993a)

FISHERY
C. cristiceps is important to commercial and recreational skiboat linefisheries in the EC and WC (Crawford and Crous 1982, Smale and Buxton 1985, Hecht and Tilney 1989, Brouwer and Buxton 2002) but a decline in abundance and strict species-specific regulations have reduced its importance in the commercial linefishery (Donovan 2010). Occasionally taken by spearfishers capable of diving on deeper reefs (>20m) (B. Mann, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.426yr^{-1} (exploited site); 0.094yr^{-1} (protected site)
Natural mortality rate (M): 0.09yr^{-1} (exploited site); 0.116yr^{-1} (protected site)
Total mortality rate (Z): 0.435yr^{-1} (exploited site); 0.21yr^{-1} (protected site)
F_{MSY} yr^{-1}: 0.15 (exploited site); 0.18 (protected site)
F_{SB50} yr^{-1}: 0.06 (exploited site); 0.06 (protected site)
F_{SB25} yr^{-1}: Not calculated
$F_{0.1}$ yr^{-1}: 0.09 (exploited site); 0.1 (protected site)

$SBPR_{current}$: ~5% (exploited site); ~54% (protected site)
Year completed: 1980-86
Locality: Port Elizabeth (exploited site); Tsitsikamma MPA (protected site)
References & Comments: SBPR inferred from published curves (Buxton 1993a, b)

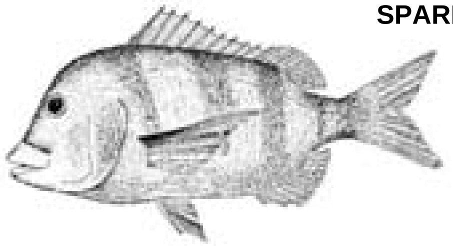
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1980-86
Locality: Port Elizabeth (exploited site)
Status: <25% - collapsed (Buxton 1993a, b)
Trend in CPUE: Strong evidence to suggest that the CPUE for *C. cristiceps* has declined substantially throughout their distributional range except within no-take MPAs such as the Tsitsikamma National Park (Crawford and Crous 1982, Hecht and Tilney 1989, Buxton 1993b, Griffiths 2000). The declining trend in CPUE is confirmed by commercial linefish catches throughout the distribution range between 1984-2007 which show greater than 50% decline over 23 years (NMLS unpubl. data). Donovan (2010) showed a significant decline of *C. cristiceps* in the Port Alfred commercial linefishery between 1998-2007 (i.e. $0.69kg.fisher^{-1}.hr^{-1}$ to $<0.1kg.fisher^{-1}.hr^{-1}$). The decline after 2005 is believed to be largely as a result of a change in the regulations (i.e. an increase in the minimum size limit to 40cm TL and a decrease in the daily bag limit to 1pppd for both recreational and commercial fishers in April 2005 (Donovan 2010)
Trend in catch composition: Drastic decline in percent composition by mass from ~65% (1940s-60s) to 2.5% (1987) in the Port Alfred linefishery (Hecht and Tilney 1989). Similar declines have been observed in the southern Cape i.e. from 11% in 1931-33 to 2% in 1987-93 (Griffiths 2000). Donovan (2010) showed a further decline in Port Alfred with *C. cristiceps* dropping from an average of 28% of the sparid group (1985-2001) to 8.5% between 2002-07. The increase in the minimum size limit to 40cm TL and the drop in the commercial and recreational bag limit to 1pppd in April 2005 were partly responsible for the observed decrease in catch composition (Donovan 2010)
Trend in mean size: Strong evidence for a decrease in mean size and age-at-sex change in exploited areas (Hecht and Tilney 1989, Buxton 1993b). Fish are recruited into the fishery before maturity
Trend in sex ratio: Skewing of sex ratio with fewer males in areas with higher fishing effort (Buxton 1993b). Also appears to be a greater abundance of smaller fish (i.e. females) in the southern part of their distribution range. Between 1978-86 adult M:I:F sex ratio was 1:0.2:2.3 (East London area), 1:0.2:4.4 (Woody Cape to St Croix), 1:0.4:13 (St Croix to Sardinia Bay), 1:0.6:3.8 (Tsitsikamma National Park), 1:0:24 (Knysna to Mossel bay) (Buxton 1993a)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: 1pppd (applies to all sectors)
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The Tsitsikamma National Park has been shown to protect a higher abundance and a larger mean size of *C. cristiceps* than adjacent exploited areas (Buxton and Smale 1989, Buxton 1993a, b). The De Hoop Marine Reserve and other MPAs off East London and the former Transkei probably also assist in protecting a portion of the *C. cristiceps* stock (Griffiths and Wilke 2002, M. Smale, PEM, pers. comm.)

MANAGEMENT CONSIDERATIONS
Evidence suggests that the population of *C. cristiceps* has declined considerably throughout its distribution. The regulations implemented in 2005 need to be strictly enforced and careful monitoring of catch and effort is required through a dedicated land-based observer programme. No increase in fishing effort is recommended and under no circumstances should existing no-take areas within the current MPA network be opened to fishing

RESEARCH REQUIREMENTS
Undertake a stock assessment to evaluate the effect of the cut in commercial fishing effort in 2003-06 and the species-specific regulations implemented in 2005. Evaluate the effectiveness of no-take MPAs in enhancing catch of this species in adjacent exploited areas
Research priority: High



SCIENTIFIC NAME: *Chrysoblephus gibbiceps* (Smith No. 183.10)
COMMON NAMES: Red stumpnose, Miss Lucy, Rooistompneus
COMPILER: CG Wilke
REVIEWER: M van Zyl
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Endemic, Cape Point to East London (Fischer and Bianchi 1984, Smith and Heemstra 1986). Has been recorded as far north as Margate on the KZN south coast (Heemstra and Heemstra 2004), although this could be a result of confusion with a similar species *C. anglicus* which is also sometimes referred to using the common name "red stumpnose" (B. Mann, ORI, pers. comm.)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC
Main areas of abundance include the SW Cape (Cape Point to Arniston), SE Cape (Jefferies Bay to East London) and the southern Transkei (NMLS, unpubl. data)

MOVEMENT: Unknown
Tagging in the De Hoop and Struisbaai area have shown *C. gibbiceps* to be extremely resident (Wilke and Griffiths 1999). Trends in commercial catches from Struisbaai reflect a seasonal increase in catches during winter (May-Jul) and early summer (Oct-Nov) suggesting some measure of aggregation (NMLS, unpubl. data). Prior to the decline in the stock, spearfishermen operating in False Bay in the 1960s to early 1970s used to target red stumpnose on deep, flat reefs (15 to 20m) along the western coast of False Bay during Mar-Aug. The average weight of the fish was between 2.5 to 3kg (Geoff Fridjohn, pers. comm.). The months that these fish were present in False Bay is supported by Biden (1930)

HABITAT
Adults: Offshore reefs to 150m (Buxton and Smale 1984)
Juveniles: Shallow reefs (Buxton and Smale 1984)
Eggs and larvae: Little known, small pelagic eggs (van Zyl 2013)

FEEDING
Adults: Diet dominated by ophiuroids, gastropods and polychaete worms (van Zyl 2013), but also feed on sea urchins, octopus and crabs (Heemstra and Heemstra 2004)
Juveniles: Red stumpnose <300 mm FL feed more on soft bodied organisms such as malacostraca, as the size of individuals increases their diet shifts to contain a higher proportion of hard prey such as gastropods (van Zyl 2013)

REPRODUCTION
Reproductive style: Late gonochorist (sensu rudimentary hermaphrodite) (Buxton 1985, van Zyl 2013)
Breeding/spawning season: Oct-Jan both in the SE Cape (CD Buxton, DIFS, unpubl. data) and on the central Agulhas Bank, peaking in Dec (van Zyl 2013)
Breeding/spawning locality: Ripe fish recorded in the SE Cape (CD Buxton, DIFS, unpubl. data) and on the Agulhas Bank (van Zyl 2013)
Age at 50% maturity: Males: 2.2 years; Females: 3.9 years; WC; 2012 (M van Zyl, UCT, unpubl. data)
Length at 50% maturity: Males: 212mm FL; Females: 249mm FL; WC; 2012 (M. van Zyl, UCT, unpubl. data)

BIOMETRICS
Maximum recorded age: 48 years; male; WC; 2012 (van Zyl 2013)
Maximum recorded weight: 8.1kg; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 75cm TL (Smith and Heemstra 1991)
Length-length relationship: Combined sexes: FL(mm) = 0.8735TL(mm) - 2.7426; Central Agulhas Bank; n=672 (van Zyl 2013)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000949 x FL(mm)$^{2.802}$; Central Agulhas Bank; n=678 (van Zyl 2013)
Growth parameters: Combined sexes: L_∞ = 429.85mm FL; K = 0.113; t_0 = -3.799; Agulhas Bank; n=183 (van Zyl 2013)

FISHERY
Seasonal component of the commercial linefishery, especially on the Agulhas Banks (Crawford and Crous 1982, van der Elst 1993). Also taken by the recreational skiboat fishery and spearfishery (Smale and Buxton 1985, Brouwer 1997, Mann et al. 1997b). Incidental catches taken by inshore trawlers operating in the Mossel Bay to Cape Infanta area (van der Elst 1993, Attwood et al. 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

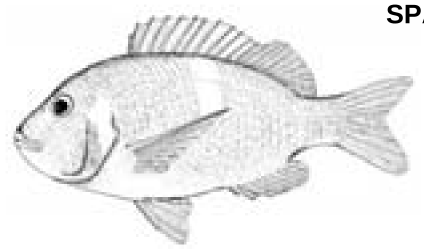
STOCK STATUS
Status: Not assessed, however Griffiths and Lamberth (2002) estimated that red stumpnose stocks had declined to between 1-5% of their historical values
Trend in CPUE: The average catch per boat year has dropped to 3.9% (SWC), 0.91% (SC) and 5.35% (SEC) of historical values (Griffiths 2000). Average catch per boat year was: 196kg (1897-1906), 187kg (1927-31) and 8kg (1986-98) in the SWC; 70kg (1897-1906), 757kg (1927-31) and 7kg (1986-98) in the SC; and 96kg (1897-1906), 382kg (1927-31) and 20kg (1986-98) in the SEC (Griffiths 2000)
Trend in catch composition: Decline in total catch at Struisbaai between 1969 and 1980 (Crawford and Crous 1982)
Trend in mean size: Unknown
Trend in sex ratio: 1:0.02:1.56 (M:I:F) SE Cape (C.D. Buxton, DIFS, unpubl. data); 1:0.02:0.64 (M:I:F) Agulhas Banks (M. van Zyl, UCT, unpubl. data)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: 30cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The De Hoop and Tsitsikamma MPAs have been shown to provide protection for this species (Wilke and Griffiths 1999, C. Buxton, DIFS, unpubl. data)

MANAGEMENT CONSIDERATIONS
Evidence suggests that this species is heavily overexploited. A stock assessment should thus be conducted for this species as a matter of urgency. The commercial CPUE data needs to be standardized and correctly interpreted. On-going catch and effort monitoring is essential. An increase of the minimum size limit to 35cm TL, implementation of a strict commercial bag limit and a two month closed season from 1 Dec to 31 Jan has been proposed (van Zyl 2013)

RESEARCH REQUIREMENTS
Age and growth needs to be validated and a stock assessment needs to be conducted as a matter of urgency. Juvenile nursery areas need to be identified. Movement patterns need to be better understood with a view to confirming spawning localities, degree of residency, etc. Genetic work is required to determine levels of connectivity between red stumpnose populations along the SA coast
Research priority: High



SCIENTIFIC NAME: *Chrysoblephus laticeps* (Smith No. 183.11)
COMMON NAMES: Roman, Red Roman
COMPILER: A Götz
REVIEWER: SE Kerwath
DATE OF REPORT COMPLETION: December 2011

GLOBAL DISTRIBUTION: Endemic, from NAM to Port St Johns but very rare on the West Coast. Also reported from southern Madagascar and Mauritius, although these records are doubtful (Fischer and Bianchi 1984, Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Distribution of stock primarily between Cape Point (WC) and Port St Johns (EC) (Buxton 1987)

MOVEMENT: Resident
Small home range (<100m linear extent) and high residency (>91%) (Buxton and Smale 1989, Kerwath 2005, Kerwath et al. 2007a, 2007b, 2008)

HABITAT
Adults: Deeper high- and low-profile inshore and offshore reefs to 100m (Buxton and Smale 1984, Buxton 1987, Götz 2005, Götz et al. 2008)
Juveniles: Shallow subtidal reefs to 30m (Penrith 1972, Buxton and Smale 1984, Buxton 1987)
Eggs and larvae: Small pelagic eggs with large oil droplet, larvae found in shelf waters off the WC and EC and have been successfully reared in captivity (Davis 1997, Wood 1998)

FEEDING
Adults: Mainly echinoderms (crinoids and ophiuroids) and cephalopods (squid and cuttlefish) with some crustaceans (decapods) and polychaetes (Buxton 1984, 1987)
Juveniles: Mainly polychaetes with some small-bodied decapods and mysids (Buxton 1984, 1987)

REPRODUCTION
Reproductive style: Protogynous hermaphrodite (Buxton 1989, Buxton 1990)
Breeding/spawning season: Oct-Jan (EC) (Buxton 1990). Spawning behaviour observed during diving surveys between Nov-Feb in the Goukamma area, WC (Götz 2005)
Breeding/spawning locality: EC (Buxton 1989, Buxton 1990) and Goukamma area, WC (Götz 2005)
Age at 50% maturity: Females: 2.5 years; EC; 1986 (Buxton 1993a); 3.5 years; Goukamma area, WC (Götz 2005)
Length at 50% maturity: Females: 172mm FL; Port Elizabeth, EC; 1986 (Buxton 1993a); 180mm FL; Tsitsikamma MPA, EC; 1986 (Buxton 1993a); 184mm FL; Goukamma area, WC; 2004 (Götz 2005)

BIOMETRICS
Maximum recorded age: 17 years; male; Tsitsikamma MPA; 1986 (Buxton 1993a); 19 years; male; Goukamma area, WC; 2004 (Götz 2005)
Maximum recorded weight: 4.57kg; 1993; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 512mm FL; Tsitsikamma MPA; 1986 (Buxton 1987)
Length-length relationship: Combined sexes: TL(mm) = 1.1144FL(mm) - 2.855; EC (Buxton 1993a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.000012 \times FL(mm)^{3.154}$; EC (Buxton 1993a); $Wt(g) = 0.00102 \times FL(mm)^{3.0743}$; WC (Götz 2005)
Growth parameters: Combined sexes: L_∞ = 425mm FL; K = 0.147; t_0 = 1.69; Tsitsikamma, EC (Buxton 1993a); L_∞ = 580.6mm FL; K = 0.069; t_0 = 3.11; Port Elizabeth, EC (Buxton 1993a); L_∞ = 512.8mm FL; K = 0.086; t_0 = 1.77; Goukamma, WC (Götz 2005)

FISHERY
Important to commercial and recreational skiboat fisheries in WC and EC (Crawford and Crous 1982, Smale and Buxton 1985, Hecht and Tilney 1989, Brouwer and Buxton 2002; Götz 2005, NMLS unpubl. data). Frequently speared by divers (Mann et al. 1997b). Occasionally taken by shore anglers fishing in deep water (Brouwer 1997; Götz et al. 2008)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.288yr^{-1} (PE area); 0.25yr^{-1} (Goukamma area)
Natural mortality rate (M): 0.108yr^{-1} (PE area); 0.19yr^{-1} (Goukamma area)
Total mortality rate (Z): 0.396yr^{-1} (PE area); 0.44yr^{-1} (Goukamma area)
F_{MSY} yr^{-1}: 0.43 (PE area); 0.46yr^{-1} (Goukamma area)
F_{SB40} yr^{-1}: Not calculated (PE area); 0.33yr^{-1} (Goukamma area)

F_{SB25} yr^{-1}: Not calculated (PE area); 0.68yr^{-1} (Goukamma area)
$F_{0.1}$ yr^{-1}: 0.18 (PE area); 0.23yr^{-1} (Goukamma area)
$SBPR_{current}$: 31% (PE area); 52% (Goukamma area)
Year completed: 1986 (PE area); 2004 (Goukamma area)
Locality: Port Elizabeth and Goukamma area
References & Comments: Parameters given are from exploited sites in the Port Elizabeth area (Buxton 1993b) and the Goukamma area (Götz 2005)

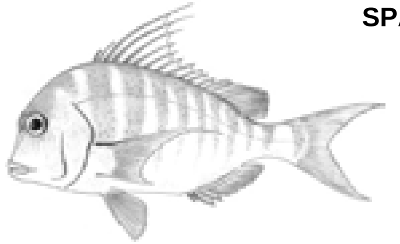
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2004
Locality: Goukamma area, WC
Status: 40-50% - optimally exploited (Götz 2005)
Trend in CPUE: Average catch per boat year was: 425kg (1897-1906), 560kg (1927-31) and 71kg (1986-98) in the SWC; 132kg (1897-1906), 229kg (1927-31) and 40kg (1986-98) in the SC; and 860kg (1897-1906), 558kg (1927-31) and 40kg (1986-98) in the SEC (Griffiths 2000). The NMLS database suggests that despite an overall decline in total commercial catch, *C. laticeps* directed CPUE has remained relatively stable between 1985-2007. The CPUE has also been stable in the centre of the Tsitsikamma MPA between 2006-2011 (A. Götz, SAEON, unpubl. data)
Trend in catch composition: Decline in species composition for "other sparids" including *C. laticeps* in the Port Alfred skiboat fishery between 1980-87 (Hecht and Tilney 1989). Decrease in catch composition in the Port Elizabeth region between 1979-80 and 1994-96 (Smale and Buxton 1985, Brouwer 1997). Percentage frequency of roman in research catches in the centre of the Tsitsikamma MPA are extremely stable (A. Götz, SAEON, unpubl. data)
Trend in mean size: Mean sizes generally and significantly lower in exploited compared to nearby protected areas (Smith 2005, Bennett 2007, Götz et al. 2008). Mean size has been stable in the centre of the Tsitsikamma MPA between 2006-11 (A. Götz, SAEON, unpubl. data)
Trend in sex ratio: In areas with low to moderate fishing pressure an even sex ratio can be maintained through a shift in size/age-at sex-change (Götz et al. 2008). Skewing of sex ratio with fewer males in areas with higher fishing effort (Buxton 1993b)

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: unlimited
Minimum size limit: 30cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: No-take MPAs in the EC and WC have been shown to be extremely effective in protecting this species. These include the Tsitsikamma MPA (Buxton 1987, 1993a, 1993b, Götz et al. 2008), De Hoop MPA (Griffiths and Wilke 2002), Goukamma MPA (Götz 2005, Götz et al. 2008), Bird Island MPA (Chalmers 2011), Table Mountain MPA (A. Bernard, SAEON, In prep.), Stilbaai MPA (L. de Vos, UCT, unpubl. data)

MANAGEMENT CONSIDERATIONS
Despite a decline in total commercial catch between 1985-2007 *C. laticeps* have sustained fishing pressure better than many other species of endemic sparid reef fish (stable CPUE for same period; NMLS unpubl. data). It has been suggested that this is largely due to the small size at maturity (~180mm FL) compared to the minimum legal size (272mm FL). Furthermore, because of their small home range (Kerwath et al. 2007a, b) *C. laticeps* can be effectively protected within small to medium sized MPAs (Götz et al. 2008). If the widespread compliance issues can be adequately addressed, retaining the current size and bag limits and the anticipated expansion of the national MPA network, should contribute sufficiently to restore *C. laticeps* populations

RESEARCH REQUIREMENTS
Long-term cpue monitoring in large MPAs for baseline assessment, systematic cpue monitoring in and adjacent to medium and small MPAs for stock assessment purposes
Research priority: Medium



SCIENTIFIC NAME: *Chrysoblephus lophus* (Smith No. 183.12)
COMMON NAMES: False englishman, False red stumpnose
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Along the east coast of Africa from southern MOZ down to East London (King and Fraser 2002, Froese and Pauly 2012), although there are reports of a wider distribution in the western Indian Ocean (van der Elst 1993) and off India (Rao et al. 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Endemic and a naturally rare species from southern MOZ to East London (King and Fraser 2002, Froese and Pauly 2012) but reports from MOZ unsubstantiated (Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Most likely displays long-term residency, typical of other similar SA sparids

HABITAT
Adults: Deeper offshore reefs, 20-150m (Bauchot and Smith 1984, van der Elst 1993, Smith and Smith 2003, Heemstra and Heemstra 2004)
Juveniles: Unknown
Eggs and larvae: Unknown

FEEDING
Adults: Gastropod molluscs, sea urchins, crabs, crayfish and occasionally small fish (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown, but some evidence of hermaphroditism (van der Elst 1993)
Breeding/spawning season: Spring (van der Elst 1993, Smith and Smith 2003)
Breeding/spawning locality: Unknown, most likely off northern KZN
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 3.1kg; KZN; 1958; SA angling record (SADSAA 2012)
Maximum recorded length: 50cm TL (Bauchot and Smith 1984, van der Elst 1993, Smith and Smith 2003)
Length-length relationship: Unknown
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Occasionally caught by commercial and recreational ski-boat anglers (Fennessy et al. 2003), but nowhere abundant (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Appears to be a naturally rare species with little information on trends in abundance (B. Mann, ORI, pers. obs.)
Trend in catch composition: Unknown

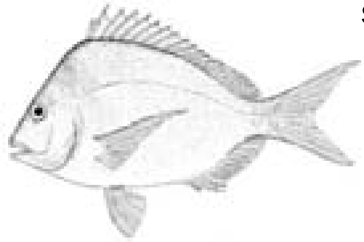
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Probably benefits from some protection in large no-take MPAs along the KZN and EC coast

MANAGEMENT CONSIDERATIONS
Ranked sixth in terms of conservation priority (Griffiths and Lamberth 2002). Although the life-history of this species is not well understood, it most likely shares characteristics of other similar SA sparids, which makes them vulnerable to over-exploitation. Appears to be a naturally rare species and it is unusual for anglers to catch more than one or two *C. lophus* per day. For this reason, a precautionary daily bag limit of 2pppd should be set for recreational and commercial fishermen. A minimum size limit is unlikely to limit fishing mortality as its preference for deeper water would most likely result in severe barotrauma limiting survival of released fish. Its preference for deeper water also suggests that some MPAs should be extended seawards to include more deeper reef habitat

RESEARCH REQUIREMENTS
Reproductive biology, early life-history, distribution and abundance, movement patterns, age and growth, fishery trends, stock assessment
Research priority: Medium



SCIENTIFIC NAME: *Chrysoblephus puniceus* (Smith No. 183.13)
COMMON NAMES: Slinger
COMPILER: BQ Mann
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: April 2013

GLOBAL DISTRIBUTION: Endemic to the south-eastern coast of Africa from central MOZ to Algoa Bay in the EC (Garratt 1985a); also reported from Madagascar (Heemstra and Heemstra 2004), although this is still to be substantiated
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Core of the stock lies between Ponta Zavora in southern MOZ and Coffee Bay in the EC (Garratt 1985a), with recent genetic work showing that this consists of one panmictic stock (Duncan 2013)

MOVEMENT: Resident
Of the 4 613 slinger tagged to date, there have been 157 (3.4%) recaptured with a mean distance moved of 8km (ORI Tagging Project, unpubl. data). These data show high levels of residency in older, larger slinger (>4 years old) relatively few of which have undertaken extensive migrations (Punt et al. 1993a). However, it is possible that young slinger (0- 4yrs) migrate northwards from juvenile nursery areas in southern KZN and northern Transkei towards MOZ (Buxton 1993b, Garratt 1993a, Maggs et al. in press). This hypothesis remains untested as small slinger (<300mm FL) are too small to tag using conventional spaghetti tags (B. Mann, ORI, pers. obs.)

HABITAT
Adults: Abundant on offshore rocky reefs from 20-130m (Garratt 1984, Heemstra and Heemstra 2004)
Juveniles: Small juveniles <50mm FL observed on shallow reefs in 10-30m off Pondoland in the EC (Mann et al. 2006), juveniles >50mm FL widespread on reefs along the KZN coast in 20-60m (Garratt 1984)
Eggs and larvae: Slinger have pelagic eggs which are assumed to be distributed southwards inshore of the Agulhas Current (Garratt 1984). Slinger eggs are difficult to distinguish from *Pagellus* and *Cheimerius* eggs and to date only 12 slinger eggs collected off Park Rynie on the KZN south coast in Oct 2009 have been positively identified using genetic barcoding (Connell 2012)

FEEDING
Adults: Opportunist benthic carnivore feeding mainly on crustaceans and molluscs, but also prey on small teleosts and echinoderms (Garratt 1986)
Juveniles: Small benthic crustaceans including decapods, amphipods, copepods, mysids, etc. and echinoderms including crinoids, ophiuroids and echinoids (Garratt 1986)

REPRODUCTION
Reproductive style: Protogynous hermaphrodite with serial spawning (Garratt 1985b, Garratt 1993b)
Breeding/spawning season: Extended spawning season with peak reproductive activity in spring (Aug-Oct) in KZN (Garratt 1985b)
Breeding/spawning locality: Offshore reefs from southern MOZ to northern KZN (Garratt 1985b)
Age at 50% maturity: Females: 3 years; KZN; 1989-90 (Garratt et al. 1993); Females: 3 years; MOZ; 1997-99 (assuming one growth ring deposited per year) (Lichucha 2001). Females change sex to male at an age of 5 years or more
Length at 50% maturity: Females: 240mm FL; KZN; 1979-81 (Garratt 1985b). Females change sex to male at a size >240mm FL. Females: 240mm FL; MOZ; 1997-99 (Lichucha 2001)

BIOMETRICS
Maximum recorded age: 11 years; male; KZN; 1979-81 (Garratt et al. 1993) but probably grow older than this. Maximum age of 9 years recorded in MOZ assuming one growth ring deposited per year (Lichucha 2001)
Maximum recorded weight: 4kg; KZN; 1979; SA angling record (SADSAA 2012)
Maximum recorded length: 522mm FL; KZN (Garratt et al. 1993). Heemstra and Heemstra (2004) state that slinger can reach 65cm FL
Length-length relationship: Combined sexes: TL(mm) = 1.26FL(mm) - 14.95; KZN (Garratt 1984)
Length-weight relationship: Females: Wt(g) = 0.000072 x $FL(mm)^{2.82}$; Males: Wt(g) = 0.000055 x $FL(mm)^{2.872}$; KZN (Garratt 1984)
Growth parameters: Females: L_∞ = 406.1mm FL; K = 0.187; t_0 = -2.253; Males (accounting for the growth spurt after age 5 which was the minimum observed age at sex change): L_∞ = 406.1mm FL; K = 2.048; t_0 = -2.67; KZN (Garratt et al. 1993). Females: 506mm FL; K = 0.11; t_0 = -2.67; MOZ (assuming one growth ring deposited per year) (Lichucha 2001)

FISHERY
Slinger is the most important species caught in the commercial linefishery off KZN and southern MOZ (Garratt 1985a, b, Lichucha 1999, 2001), but is also important to the recreational skiboat fishery in KZN and southern MOZ (Mann et al. 1997a, Penney et al. 1999, Fennessy et al. 2012, Dunlop and Mann 2013)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.4yr^{-1}
Natural mortality rate (M): 0.3yr^{-1}
Total mortality rate (Z): 0.7yr^{-1}
F_{MSY} yr^{-1}: 0.17
F_{SB40} yr^{-1}: 0.17
F_{SB25} yr^{-1}: 0.25
$F_{0.1}$ yr^{-1}: 0.08-0.1
$SBPR_{current}$: 14-16%
Year completed: 1993
Locality: KZN
References & Comments: Punt et al. (1993). This assessment has recently been updated by Winker et al. (2012). In MOZ waters SBPR was assessed at 37% assuming one growth ring per year (Lichucha 2001)

STOCK STATUS
Stock assessment method: Surplus production model
Year completed: 2012
Locality: KZN
Status: 40-50% - optimally exploited (Winker et al. 2012). Since the study conducted by Punt et al. (1993), Winker et al. (2012) using surplus production modelling and standardized CPUE data, have shown that the slinger population in KZN waters has responded well to the reduction in commercial fishing effort and has shown a ~30% recovery in biomass
Trend in CPUE: Targeting of slinger increased during the 20th Century as other larger linefish species declined (Penney et al. 1999). Between 1985-2000 CPUE of slinger in the KZN commercial linefishery was relatively stable at ~1kg.man^{-1}.hr^{-1}. However, following the emergency declared in the linefishery in 2000 and the reduction in commercial effort in KZN between 2003-06, there was an increasing trend in standardized CPUE (from 1.0 to 1.4 kg.man^{-1}.hr^{-1}) (Winker et al. 2012). KZN recreational skiboat catch rates also increased from 0.3 fish and 0.2 kg.$outing^{-1}$ to 0.9 fish and 0.7kg.$outing^{-1}$ respectively from 1994-96 to 2008-09 (Mann et al. 1997a, Dunlop and Mann 2013). Overall CPUE of commercial linefish vessels in southern MOZ (where slinger still constitutes the majority of catches) has declined over the past 20 years to around 30% of peak levels in the early 1990s (Fennessy et al. 2012)
Trend in catch composition: Slinger gradually increased in the composition of commercial catches in KZN from 15-30% between 1923-95 as other larger linefish species declined (Penney et al. 1999). Between 1994-96 and 2008-09 slinger declined from 34.2% to 21.4% by weight of the surveyed commercial catch and increased from 3.8% to 14.1% by weight of the surveyed recreational skiboat catch in KZN (Mann et al. 1997a, Dunlop 2011)
Trend in mean size: The mean size of slinger appears to have remained similar in KZN between 1979-81 (262mm FL, n=5310) and 2007-11 (265mm FL, n=697) (Garratt 1985a, B. Mann, ORI, unpubl. data). However, there has been a decrease in mean and modal size in southern MOZ (Lichucha 1999, 2001, Fennessy et al 2012)
Trend in sex ratio: The M:F sex ratio for slinger in KZN appears to have changed based on samples collected at Richards Bay on the KZN north coast between 1979-81 (1:8.1, n=1050) and 2007-11 (1:3.1, n=301) (Garratt 1985a, B. Mann, ORI, unpubl. data). While this may be a sampling bias, preliminary analyses reveal that slinger may be changing sex at an earlier age to compensate for the reduced number of males (B. Mann, ORI, pers. obs.). Lichucha (2001) reported an increase in the M:F sex ratio in southern MOZ with fewer large males being caught, with a further increase in the sex ratio to around 1:7 by 2010 (Fennessy et al. 2012)

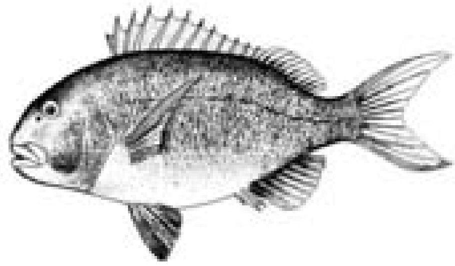
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: 25cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The St Lucia, Maputaland, Aliwal Shoal and Pondoland MPAs have been shown to provide protection for slinger (Garratt 1993a, Maggs 2011) and are critical to the long-term sustainable use of this species. It is likely that the Ponta do Ouro Partial Marine Reserve in MOZ also plays an important role in the protection of reproductively active slinger

MANAGEMENT CONSIDERATIONS
While the life history characteristics of slinger make it vulnerable to overexploitation, it has shown a positive response to management intervention by way of effort reduction in the KZN commercial linefishery (Winker et al. 2012). However, as this is a shared stock, similar reductions in commercial fishing effort are required in southern MOZ to ensure long-term sustainable use of this important resource (Fennessy et al. 2012). On-going monitoring of catch and effort is required, with regular biological sampling to determine sex. An increase in suitable reef area included in no-take MPAs in southern MOZ and northern KZN will undoubtedly benefit and add resilience to the adult spawning population of slinger

RESEARCH REQUIREMENTS
Improve assessment of the status of slinger populations in southern MOZ, determine size/age at maturity and sex change in KZN, further investigate movement behaviour of slinger to determine if there is a northward migration, particularly of juvenile fish, improve understanding of early life history and recruitment
Research priority: High

SPARIDAE



SCIENTIFIC NAME: *Cymatoceps nasutus* (Smith No. 183.15)
COMMON NAMES: Black musselcracker, Black steenbras, Poenskop, Blou biskop, Bank bloue
COMPILER: T Murray
REVIEWER: PD Cowley
DATE OF REPORT COMPLETION: May 2012

GLOBAL DISTRIBUTION: Endemic to SA, Cape Agulhas (WC) to Cape Vidal (KZN) (Fischer and Bianchi 1984, Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
MtDNA analyses has revealed that poenskop exists as a single, well-mixed stock throughout its distributional range (Murray 2012)

MOVEMENT: Resident
Based on conventional tagging data, both juveniles and adults of this species appear to be highly resident (Maggs 2010, Murray 2012). However, large adults are known to move distances of over 100 km (Dunlop and Mann 2011, Murray 2012). Buxton and Clarke (1989) also suggested the possibility of poenskop undertaking a spawning migration to Transkei waters, however this more likely involves a uni-directional movement up the coastline into Transkei and KZN waters where large adults live for the remainder of their lives (Murray 2012)

HABITAT
Adults: Deeper high-profile inshore and offshore reefs (Buxton and Smale 1984, Buxton and Clarke 1989)
Juveniles: Shallow subtidal reefs <10m (Buxton and Clarke 1989)
Eggs and larvae: Unknown despite considerable sampling effort off KZN (Connell 2012) and off the Tsitsikamma coastline (Tilney et al. 1996, Wood 1998)

FEEDING
Adults: Unspecialised diet with most important prey groups being molluscs, crustaceans and echinoderms (Buxton and Clarke 1989, Heemstra and Heemstra 2004). Gastropods and asteroids are common prey items in sub-adult and adult poenskop (Buxton and Clarke 1989, Heemstra and Heemstra 2004)
Juveniles: Also an unspecialised diet, with crustaceans being the most important prey item in the juveniles' diet (Buxton and Clarke 1989, Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Is assumed to be a protogynous hermaphrodite (Buxton and Clarke 1989)
Breeding/spawning season: Available data suggests that spawning takes place between May-Oct in Transkei waters (Buxton and Clarke 1989)
Breeding/spawning locality: Predominantly Transkei waters (Buxton and Clarke 1989)
Age at 50% maturity: Females: ~10 years based on observed size at maturity of 530mm FL; Transkei; EC (Buxton and Clarke 1989). Sex change occurs at ~18 years (Buxton and Clarke 1989)
Length at 50% maturity: Not determined, smallest reproductively active female 530mm FL; EC (Buxton and Clarke 1989). Length at sex change occurs at ~700mm FL with all fish >950mm FL being males (Buxton and Clarke 1989)

BIOMETRICS
Maximum recorded age: 45.5 years; male; EC (Buxton and Clarke 1989)
Maximum recorded weight: 37.8kg; KZN; 1955; SA angling record (SADSAA 2012)
Maximum recorded length: 1099mm FL; EC (Buxton and Clarke 1989)
Length-length relationship: Combined sexes: TL(mm) = 1.1252FL(mm) - 1.2376; EC (Buxton and Clarke 1989)
Length-weight relationship: Combined sexes: Wt(g) = 0.00002236 x $FL(mm)^{3.0355}$; EC (Buxton and Clarke 1989)
Growth parameters: Combined sexes: L_∞ = 1089.5mm FL; K = 0.0502; t_0 = -2.885; EC (Buxton and Clarke 1989). Age validation using OTC injected fish at liberty >1 year confirmed that one opaque zone is laid down per year (Potts and Cowley 2005)

FISHERY
Caught by shore anglers, spearfishers and recreational and commercial skiboat fishers throughout its distribution (Coetzee and Baird 1981, Smale and Buxton 1985, Hecht and Tilney 1989, Brouwer et al. 1997, Mann et al. 1997a, b, Fennessy et al. 2003, Mann et al. 2003). Sought after by recreational fishers but it is of little commercial importance due to low abundance, except in the Transkei, having comprised ~16% of total commercial landings in the Coffee Bay linefishery in 1985. However, this decreased to less than 1% in 1992, most likely due to a voluntary cessation of catch by commercial fishermen (Smale and Buxton 1985, Hecht and Buxton 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown from open access fisheries. Study done in the Tsitsikamma MPA (1998-2005) where Z was assumed to be equal to M for an unexploited system. Estimated values (n=460) were; Pauly's M = 0.14yr^{-1}, Butterworth's M = 0.36yr^{-1}, Hoenig's M = 0.09yr^{-1}, Catch curve M (Ricker) = 0.27yr^{-1}, Catch curve M (Pauly) = 0.32yr^{-1} (Götz et al. 2008)
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed, however Griffiths and Lamberth (2002) estimated that *C. nasutus* stocks had declined to ~20% of their historical values
Trend in CPUE: Trend in CPUE has declined significantly in KZN (Penney et al. 1999). CPUE trend in TNP (1998-2005) showed slight increasing trend with mean CPUE = 0.064 hr^{-1} (+1.156 CV) and max = 0.45 hr^{-1} (Götz et al. 2008). CPUE trends in exploited and no-take areas in the Pondoland MPA were similar: 0.22 ± 0.4 hr^{-1} (exploited) and 0.29 ± 0.44 hr^{-1} (no-take), with no significant changes between 2006-10 (Maggs 2011a)
Trend in catch composition: Although not specifically assessed, trend in catch composition is thought to have declined in KZN similar to other slow-growing sparids (Penney et al. 1999). Significant decline in catch composition recorded in Transkei between 1984-92 due to voluntary cessation of catch by commercial fishers (Hecht and Buxton 1993)
Trend in mean size: Size of retained poenskop has decreased, with almost 100% of the catch, at present, weighing less than 5kg (Murray 2012). Catches of trophy fish by coastal recreational anglers were once common (especially in the Transkei) but are now extremely rare (Murray 2012). No significant differences were reported in mean size between exploited and no-take areas in the Pondoland MPA 380.3 ± 124.3mm FL (exploited) and 419.3 ± 117.2mm FL (no-take), with no significant changes in mean length between 2006-10 (Maggs 2011a)
Trend in sex ratio: Buxton (1985) reported a M:F sex ratio of 1:6 (EC). With large male poenskop being targeted and subsequently removed from the fishery, the current trend is probably even more skewed. Although not known, it is thus suspected that females may be changing sex at a smaller length and younger age (T. Murray, DIFS, pers. obs.)

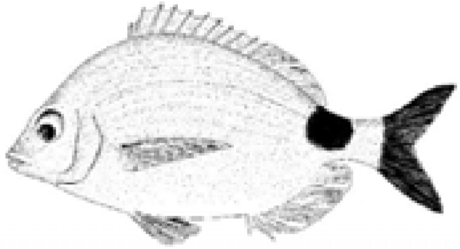
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: 1pppd (applies to all sectors)
Minimum size limit: 50cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The residency of juvenile and adult poenskop suggests that MPAs are extremely important for the conservation of this species. Therefore juveniles will probably receive some protection within the Tsitsikamma National Park and other MPAs in the EC, while adults will receive some protection in the MPAs off East London (Amathole MPA) and the former Transkei (i.e. Pondoland, Hluleka and Dwesa-Cwebe) (MJ Smale, PEM, pers. comm., Murray 2012)

MANAGEMENT CONSIDERATIONS
Consider decommercialising the species due to its low importance in the commercial fishery. Introduce a slot size limit (e.g. 500-700 mm TL) to protect small resident individuals (<500mm TL) and large adult specimens (>700mm TL). Retain the no-take status of the existing MPA network

RESEARCH REQUIREMENTS
Confirm reproductive style and the occurrence of sex change, undertake a stock assessment and investigate early life history. Conduct detailed studies on the movement behaviour of large adult poenskop
Research priority: High

SPARIDAE



SCIENTIFIC NAME: *Diplodus capensis* (Smith No. 183.17)
COMMON NAMES: Blacktail, Dassie, Kolstert, Ntimla
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Previously described under the name *Diplodus sargus capensis* being an endemic subspecies found from Angola to MOZ and southern Madagascar (Fischer and Bianchi 1984, Smith and Heemstra 1991). More recently the name was elevated to the rank of species *Diplodus capensis* (Heemstra and Heemstra 2004, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: NAM, WC, EC, KZN, MOZ
Two disjunct populations, one along the eastern seaboard of SA from Cape Point to southern MOZ (Smith and Heemstra 1991, Mann 1992) and the other from NAM to southern Angola (Richardson 2010). Genetic comparison suggests that these two populations have been separated for the past two million years and are thus likely to be separate species (W. Potts, DIFS, pers. comm.)

MOVEMENT: Resident
Tagging studies conducted in the De Hoop and Tsitsikamma MPAs have shown that adult blacktail are highly resident (Bennett and Attwood 1991, Attwood and Bennett 1995b, Cowley et al. 2002). To date a total of 8 367 blacktail have been tagged in SA and NAM waters with 208 (2.49%) recaptures with a mean distance moved of only 6km (ORI Tagging Project, unpubl. data). Similarly, juveniles have been shown to display high levels of site fidelity in rocky intertidal nursery areas (Watt-Pringle 2009)

HABITAT
Adults: Shallow rocky and sandy substrata down to 40m but predominantly in the surf-zone, usually in close association with rocky areas (Joubert 1981a, Wallace et al. 1984, Beckley and Buxton 1989, Mann 1992)
Juveniles: Intertidal rock pools, subtidal gullies, shallow subtidal reefs, sandy beach surf-zone and estuary mouths (Christensen 1978, Joubert 1981a, Lasiak 1981, 1984a,b, Beckley 1983, 1985, Berry et al. 1982, Bennett 1987, Bennett 1989, Smale and Buxton 1989, Mann 1992, Watt-Pringle 2009)
Eggs and larvae: Pelagic, distributed inshore of the Agulhas Current throughout distributional range (Brownell 1979, Wood 1998, Connell 2012)

FEEDING
Adults: Generalists feeding on a wide range of organisms including red and green algae, echinoids, polychaetes, anthozoans, gastropods, bivalves and ascideans (Joubert and Hanekom 1980, Coetzee 1986, Mann and Buxton 1992)
Juveniles: Small crustaceans such as grammarid and caprellid amphipods, harpacticoid copepods, polychaetes and echinoids (Mann and Buxton 1992)

REPRODUCTION
Reproductive style: Joubert (1981a) described blacktail in KZN as rudimentary hermaphrodites, however both Coetzee (1986) and Mann and Buxton (1998) found evidence that blacktail was a digynous hermaphrodite with partial protandry occurring in some of the male population
Breeding/spawning season: May-Dec peaking Jul-Sep in KZN (Joubert 1981a, Connell 2012), Aug-Mar peaking Sep-Dec in EC (Coetzee 1986, Mann and Buxton 1998)
Breeding/spawning locality: Inshore reefs, probably throughout distribution (B. Mann, ORI, pers. obs.). On the KZN south coast most eggs were collected inshore suggesting that spawning takes place inshore of the 30m depth contour (Connell 2012)
Age at 50% maturity: Combined sexes: 3 years; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1998); 3 years; KZN; 2000 (Burton 2000)
Length at 50% maturity: Combined sexes: 150-160mm FL; KZN; 1975-77 (Joubert 1981a); 211mm FL; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1998); 165mm FL; KZN; 2000 (Burton 2000)

BIOMETRICS
Maximum recorded age: 21 years; female; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1998). Burton (2000) recorded a maximum age of 14 years in a study conducted in KZN
Maximum recorded weight: 2.7kg; SA angling record (SASAA 2012)
Maximum recorded length: 403mm FL; Tsitsikamma MPA, EC (Götz et al. 2008)
Length-length relationship: Combined sexes: FL(mm) = 0.859TL(mm) + 0.419; KZN (Joubert 1981a); TL(mm) = 1.163FL(mm) + 2.554; Tsitsikamma, EC (Mann and Buxton 1997)
Length-weight relationship: Combined sexes: Wt(g) = 0.000033 x FL(mm)$^{2.99}$; KZN (Joubert 1981a); Wt(g) = 0.00016 x TL(mm)$^{2.613}$; Algoa Bay, EC (Coetzee and Baird 1981); Wt(g) = 0.0000074 x FL(mm)$^{3.242}$;

Tsitsikamma, EC (Mann and Buxton 1997)
Growth parameters: Combined sexes: L_∞ = 309mm FL; K = 0.247; t_0 = -1.048; Tsitsikamma, EC (Mann and Buxton 1997); Götz et al. (2008) used the age-length key developed by Mann and Buxton (1997) to estimate more realistic growth parameters for blacktail based on a much larger sample size i.e. L_∞ = 403mm FL; K = 0.142; t_0 = -1.69; Tsitsikamma, EC

FISHERY
Caught primarily in the shore fishery along the entire south-eastern seaboard of SA where it ranks as the third most important shore angling species (Joubert 1981b, van der Elst 1993, Bennett et al. 1994, Brouwer 1997, Brouwer et al. 1997, Mann et al. 2003, Dunlop and Mann 2012)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Götz et al. (2008) found a range of natural mortality estimates (0.12 - 0.63yr^{-1}) dependent on the method used
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed because of the difficulty associated in determining reliable mortality estimates

STOCK STATUS
Status: Not assessed
Trend in CPUE: Slight increase between 1975-77 (0.1 fish.$angler^{-1}$.day^{-1}), 1994-96 (0.103 fish.$angler^{-1}$.day^{-1}) and 2009-10 (0.143 fish.$angler^{-1}$.day^{-1}) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Long-term NMLS monitoring of shore anglers catches in KZN between 1985-2008 also showed a mean increase in CPUE by number from 0.03 to 0.055 fish.$angler^{-1}$ (NMLS unpubl. data). Decrease between 1985-86 (19.4g $person^{-1}$.hr^{-1}) and 1994-96 (11g $person^{-1}$.hr^{-1}) in the Port Elizabeth area (Clarke and Buxton 1989, Brouwer 1997). Increase between 1938 and 1992 in the SWC due to a change in targeting and possibly as a result of regulations implemented in 1985 (Bennett 1991, Bennett et al. 1994)
Trend in catch composition: Decrease between 1956-60 and 1978-82 in KZN (van der Elst and De Freitas 1988, van der Elst 1989). Little change between 1975-77 (9.2%) and 1994-96 (8.7%) but then increased to 14.5% during 2009-10 in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Decrease between 1985-86 (18.4%) and 1994-96 (7.6%) in the Port Elizabeth area (Clarke and Buxton 1989, Brouwer 1997). Increase between 1950-59 and 1976-85 in False Bay due to a change in targeting (Bennett 1991)
Trend in mean size: Mean size of blacktail in KZN has remained relatively constant at around 225mm FL between three discreet sampling periods (i.e. 1975-77, 1994-96 and 2009-10) (Joubert 1981a, Mann et al. 1997a, Dunlop 2011). No consistent trend observed in the SWC (Bennett et al. 1994)
Trend in sex ratio: M:F sex ratio was 1.3:1 in KZN (Joubert 1981a) and 1:1.98 in the Tsitsikamma MPA, EC (Mann and Buxton 1998) but no data available on trends

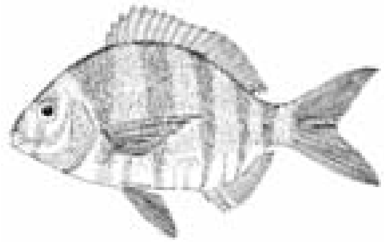
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 20cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: All no-take MPAs along the south-eastern seaboard of SA containing suitable inshore habitat will protect blacktail due to their high degree of residency (Bennett and Attwood 1991, Mann 1992, Bennett and Attwood 1993, Attwood and Bennett 1995a, Cowley et al. 2002, Götz et al. 2008, Mann 2012, Venter and Mann 2012)

MANAGEMENT CONSIDERATIONS
Despite its relatively slow growth rate, blacktail is still an extremely abundant species along the entire eastern seaboard of SA and appears to have been able to withstand increasing fishing pressure, probably mainly due to its small size/age at maturity, adaptable mode of reproduction (partial protandry), high fecundity and generalist life style (B. Mann, ORI, pers. obs.). Furthermore, indications are that fisheries management interventions

(minimum size and daily bag limits) and establishment of no-take MPAs along the SA coast have helped to sustain blacktail populations (Attwood and Bennett 1995a, b). Fish in warmer KZN waters reach maturity at a smaller size/age and do not reach the same maximum size as those in cooler Cape waters. As this species is extremely important to both recreational and subsistence shore fishers throughout its distribution, monitoring of catch and effort in the SA shore fishery should be improved

RESEARCH REQUIREMENTS
On-going catch and effort monitoring, repeat/update age and growth studies in KZN, EC and WC, stock assessment, recruitment and genetic studies
Research priority: Medium



SCIENTIFIC NAME: *Diplodus hottentotus* (Smith No. 183.16)
COMMON NAMES: Zebra, Wildeperd, Bontrok
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Previously described under the name *Diplodus cervinus hottentotus* being an endemic subspecies found along the eastern seaboard of southern Africa (Fischer and Bianchi 1984, Smith and Heemstra 1991). More recently the name was elevated to the rank of species *Diplodus hottentotus* (Heemstra and Heemstra 2004, Froese and Pauly 2012)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Endemic, False Bay to southern MOZ (Pereira 2000, Heemstra and Heemstra 2004). The species of zebra found off southern Angola is believed to be a separate species (W. Potts, DIFS, pers. comm.)

MOVEMENT: Resident
Of the 61 recaptures (2.35%) recorded to date the mean distance moved was only 3km (ORI Tagging Project, unpubl. data). Juveniles have also been shown to be highly resident in rocky intertidal nursery areas (Watt-Pringle 2009)

HABITAT
Adults: Rocky reefs from the surf-zone down to 60m (Mann 1992, van der Elst 1993). More recently observed in canyons off Sodwana Bay at depths of 120m (Heemstra and Heemstra 2004)
Juveniles: Shallow subtidal reefs, subtidal gullies, intertidal rock-pools and estuary mouths (Christensen 1978, Beckley 1983, Beckley 1985, Bennett 1987, Beckley and Buxton 1989, Smale and Buxton 1989, Mann 1992, Watt-Pringle 2009)
Eggs and larvae: Mainly inshore, probably throughout distribution range (Brownell 1979, Connell 2012)

FEEDING
Adults: Adults are benthic carnivores and specialize on polychaete worms and amphipods but also consume decapod crustaceans, ophiuroids, echinoids and gastropods (Mann and Buxton 1992)
Juveniles: Mainly amphipods and small polychaete worms but also feed on chironomid larvae and harpacticoid copepods (Mann and Buxton 1992)

REPRODUCTION
Reproductive style: Rudimentary hermaphrodite (functional gonochorist) (Mann and Buxton 1998)
Breeding/spawning season: Aug-Dec peaking in Oct in the EC (Mann and Buxton 1998)
Breeding/spawning locality: Inshore reefs probably throughout distribution (B. Mann, ORI, pers. obs.). Eggs recorded off the KZN south coast (Connell 2012) and in False Bay (Brownell 1979)
Age at 50% maturity: Combined sexes: 6 years; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1998)
Length at 50% maturity: Combined sexes: 280mm FL; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1998)

BIOMETRICS
Maximum recorded age: 33 years; male; Tsitsikamma, EC; 1989-91 (Mann and Buxton 1997)
Maximum recorded weight: 5.4kg; SA shore angling record (SASAA 2012). Biggest fish recorded by Mann and Buxton (1997) was 3.1kg
Maximum recorded length: 60cm TL (Heemstra and Heemstra 2004). Biggest fish recorded by Mann and Buxton (1997) was 480mm FL
Length-length relationship: Combined sexes: TL(mm) = 1.1607FL(mm) + 2.628; SL(mm) = 0.894FL(mm) + 2.551; Tsitsikamma, EC (Mann and Buxton 1997)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0000127 \times FL(mm)^{3.141}$; Tsitsikamma, EC; n=304 (Mann and Buxton 1997); $Wt(g) = 0.00009 \times TL(mm)^{2.7365}$; Algoa Bay, EC (Coetzee and Baird 1981)
Growth parameters: Combined sexes: L_∞ = 397mm FL; K = 0.146; t_0 = -2.148; Tsitsikamma, EC (Mann and Buxton 1997). Götz et al. (2008) used the age-length key developed by Mann and Buxton (1997) to estimate more realistic growth parameters for zebra based on a much larger sample size i.e. L_∞ = 465mm FL; K = 0.084; t_0 = -3.963; Tsitsikamma, EC

FISHERY
Caught primarily in the shore fishery where it is of moderate importance throughout its distribution, seldom caught in large numbers (Joubert 1981b, Whibley and Garratt 1989, van der Elst 1993, Brouwer 1997, Brouwer et al. 1997, Mann et al. 2003, Dunlop 2011). Larger specimens are occasionally shot by spearfishers or caught by skiboat fishers (Mann et al. 1997a, b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.12-0.25yr^{-1} (Götz et al. 2008)
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

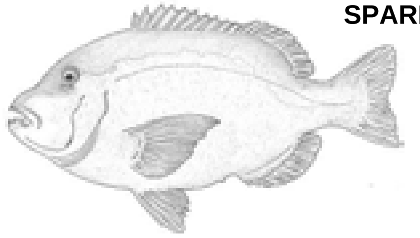
STOCK STATUS
Status: Not assessed
Trend in CPUE: Little change between 1975-77 (0.005 fish.angler^{-1}.day^{-1}), 1994-96 (0.004 fish.angler^{-1}.day^{-1}) and 2009-10 (0.006 fish.angler^{-1}.day^{-1}) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Increase recorded between 1985-86 (3.03g person^{-1}.hr^{-1}) and 1994-96 (6.0g person^{-1}.hr^{-1}) in EC (Clarke and Buxton 1989, Brouwer 1997). Long-term NMLS monitoring of shore anglers catches in KZN between 1985-2008 showed little change in CPUE averaging around 0.01 fish.angler^{-1} (NMLS unpubl. data)
Trend in catch composition: Catch composition fluctuated between 1975-77 (0.04%), 1994-96 (0.38%) and 2009-10 (0.52%) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Decrease recorded between 1985-86 (2.0%) and 1994-96 (0.7%) in the EC (Clarke and Buxton 1989, Brouwer 1997)
Trend in mean size: Unknown
Trend in sex ratio: Mann and Buxton (1998) recorded a M:F sex ratio of 1.2:1 in the EC but no data on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 30cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Zebra are likely to benefit from protection in no-take MPAs throughout their distribution due to their high level of residency (Bennett and Attwood 1991, Mann 1992, Bennett and Attwood 1993b, Hanekom et al. 1997, Cowley et al. 2002, Götz et al. 2008, Venter and Mann 2012)

MANAGEMENT CONSIDERATIONS
Zebra is a slow growing, late maturing species susceptible to overexploitation. However, catches of this species appear to have been sustained due to various fisheries management interventions and the establishment of SA's network of no-take MPAs

RESEARCH REQUIREMENTS
On-going catch and effort monitoring, stock assessment, early life history and recruitment studies
Research priority: Low



SCIENTIFIC NAME: *Gymnocrotaphus curvidens* (Smith No. 183.18)
COMMON NAMES: Janbruin, John Brown, Blue-eye JB
COMPILER: AD Wood
REVIEWER: PD Cowley
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic to SA, False Bay to Port St Johns (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC
Smith and Heemstra (1991), Heemstra and Heemstra (2004), Branch et al. (2008)

MOVEMENT: Resident
Tagging results from the Tsitsikamma National Park show high residency (P. Cowley, SAIAB, unpubl. data)

HABITAT
Adults: Mostly shallow reef areas but known to occur to depths of 50-80m (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Mostly shallow reef areas (A. Wood, Gleneagles Environ. Consulting, pers. obs.)
Eggs and larvae: Pelagic but otherwise unknown

FEEDING
Adults: Redbait, seaweed, bryozoans, polychaete worms and small crustaceans (van der Elst 1993)
Juveniles: Assumed to be similar to adults

REPRODUCTION
Reproductive style: Unknown, possible sex change (van der Elst 1993)
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 3.7kg; Cape Point; 1988; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 50cm TL (Smith and Heemstra 1991)
Length-length relationship: Unknown
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Easy to approach underwater and thus mainly taken by spearfishers diving in shallow to moderate depths (5-20m). Occasionally taken by shore anglers fishing with redbait in rocky, turbulent water. Rarely taken by recreational skiboat anglers

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

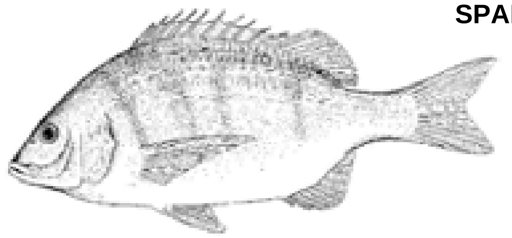
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: All MPAs within the distributional range of this species that provide protection from exploitation are considered important

MANAGEMENT CONSIDERATIONS
There is limited information about this species and it is thus difficult to make management recommendations without more knowledge on its biology and stock status. A minimum size limit of 30cm TL could be considered as a precautionary measure

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, movement patterns, stock status and fishing mortality
Research priority: Medium



SCIENTIFIC NAME: *Lithognathus aureti* (Smith No. 183.19)
COMMON NAMES: Westcoast steenbras
COMPILER: BQ Mann
REVIEWER: WM Potts
DATE OF REPORT COMPLETION: April 2013

GLOBAL DISTRIBUTION: Endemic, southern Angola to Cape Town but rarely found outside NAM's territorial marine waters (Holtzhausen 2000, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC
Two stocks occur in NAM waters, a closed and separate population in the southern region at Meob Bay (southern population) and a second stock (northern population) occurring in the central and northern regions (van der Bank and Holtzhausen 1998/1999)

MOVEMENT: Unknown
Mark-recapture results provided no clear evidence of spawning migrations in the central and northern regions. However, indications are that mature males in the northern population move considerable distances to find gravid females for reproduction (Holtzhausen 2000, Holtzhausen et al. 2001)

HABITAT
Adults: Inshore over sandy substrata to a water depth of about 10m (Holtzhausen 2000)
Juveniles: Occur primarily in the surf-zone along sandy beaches (McLachlan 1986)
Eggs and larvae: Eggs and larvae thought to drift northwards with the Benguela Current after being spawned in the surf-zone (Holtzhausen 2000)

FEEDING
Adults: Benthic invertebrates such as sand mussels, polychaete worms and crabs (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Protandrous hermaphrodite (Lucks 1970, Holtzhausen 2000)
Breeding/spawning season: Summer, Oct-Feb with peak spawning from Dec-Feb (Holtzhausen 2000)
Breeding/spawning locality: Probably in the surf-zone along the NAM coast (Holtzhausen 2000)
Age at 50% maturity: Males: 4.8 years (northern popn.); 6 years (southern popn.); Females: 7.2 years (northern popn.); 9.7 years (southern popn.); 1995-99 (Holtzhausen 2000)
Length at 50% maturity: Males: 41cm FL (northern popn.); 35cm FL (southern popn.); Females: 49.5mm FL (northern popn.); 41mm FL (southern popn.); 1995-99 (Holtzhausen 2000)

BIOMETRICS
Maximum recorded age: 50 years; female; 1995-99 (Holtzhausen 2000)
Maximum recorded weight: 16.75kg; female; 1995-99 (Holtzhausen 2000)
Maximum recorded length: 80cm FL (southern popn.); 98cm FL (northern popn.); 1995-99 (Holtzhausen 2000)
Length-length relationship: TL(cm) = 1.14FL(cm); based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.00003 x $FL(mm)^{2.944}$; northern population; 1995-99 (Holtzhausen 2000)
Growth parameters: Combined sexes: L_∞ = 73.6cm FL; K = 0.065; t_0 = -3.92; southern population; L_∞ = 84.6cm FL; K = 0.088; t_0 = -2.756; northern population (Holtzhausen and Kirchner 2001b)

FISHERY
Westcoast steenbras is an important fishery species in NAM (Kirchner et al. 2000). The northern stock is exploited primarily by recreational shore anglers in the West Coast Recreational Area and in the Skeleton Coast Park. The southern stock is occasionally targeted by commercial lineboats when kob (*Argyrosomus inodorus*) is scarce. Westcoast steenbras is generally only taken as an incidental catch by recreational skiboat anglers. The use of set gill-nets was banned in 1992 to protect the species (Holtzhausen 2000)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.12yr^{-1}
Natural mortality rate (M): 0.23yr^{-1}
Total mortality rate (Z): 0.35yr^{-1}
F_{MSY} yr^{-1}: 0.37
F_{SB40} yr^{-1}: 0.17
F_{SB25} yr^{-1}: 0.29

$F_{0.1}$ yr^{-1}: 0.26
$SBPR_{current}$: 42%
Year completed: 1995-99
Locality: Northern population
References & Comments: Beyer et al. (1999), Holtzhausen (2000), Holtzhausen and Kirchner (2001a)

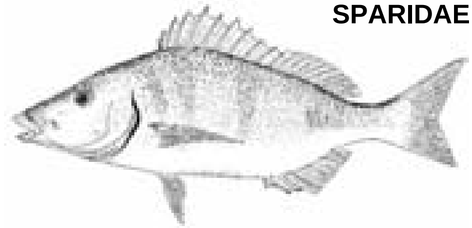
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1995-99
Locality: Northern population
Status: 40-50% - optimally exploited (Beyer et al. 1999, Holtzhausen 2000, Holtzhausen and Kirchner 2001a)
Trend in CPUE: No data prior to 1995. Recreational shore anglers in NAM perceived that the Westcoast steenbras had declined both in abundance and size (Holtzhausen and Kirchner 2001a)
Trend in catch composition: No data prior to 1995 (Holtzhausen and Kirchner 2001a). Westcoast steenbras made up 12% of the total annual recreational catch of shore anglers (northern population) during the 1996-97 season (Kirchner 1999)
Trend in mean size: No specific trend discernible between 1995-99 (Holtzhausen 2000)
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited. In NAM **e**ach angler may only have in his/her possession 10 teleost fish including kob, westcoast steenbras, blacktail and galjoen (i.e. the maximum daily bag limit is 10 if no other species are kept). No more than 2 individual fish kept may be longer than 65cm TL. Each person may transport 3 times the daily bag limit, but is limited to a maximum of 30 kob, westcoast steenbras, blacktail and galjoen, but not more than 10 of each species. All fish must be in a whole state. Of the 10 westcoast steenbras allowed, 6 may be longer than 65cm TL
Minimum size limit: 60cm TL. In NAM the minimum size limit is 40cm TL but only two fish above 65cm TL may be kept per person per day
Closed Season: None
Other regulations: No sale. In NAM for all angling species there is a limit of one rod per angler with a maximum of two hooks, the use of polychaete worms as bait is prohibited and a recreational angler may not sell his/her catch
MPA effectiveness: The recently proclaimed (2009) Namibian Islands' MPA stretches 400km along the southern coast and is the only proclaimed MPA in NAM. However, four-fifths of the NAM coastline is closed to recreational shore angling (due to the presence of restricted diamond areas), although lineboats may operate along the entire 1 500km of coastline (except within designated no-take areas within the MPA)

MANAGEMENT CONSIDERATIONS
The northern westcoast steenbras resource in NAM is small with an estimated MSY of ~134mt per year (Holtzhausen and Kirchner 2001a). Harvesting of this resource by the recreational shore fishery must therefore be carefully monitored and controlled to ensure that the MSY is not exceeded. Harvesting of the southern population by lineboats must also be carefully monitored and controlled

RESEARCH REQUIREMENTS
Monitor the size composition and catch rate in the recreational and commercial fisheries. Evaluate the impacts of ocean warming on the reproductive scope and distribution of the species. Investigate egg and larval transport by the Benguela Current, assess the northern stock on an annual basis, monitor the effect of lineboat harvests on the stock structure of the southern population
Research priority: Medium



SCIENTIFIC NAME: *Lithognathus lithognathus* (Smith No. 183.20)
COMMON NAMES: White steenbras, Pignose grunter, Witsteenbras
COMPILER: RH Bennett
REVIEWER: SJ Lamberth
DATE OF REPORT COMPLETION: June 2012

GLOBAL DISTRIBUTION: Endemic, from Orange River Mouth to KZN (Smith and Smith 1986). Some evidence for presence in NAM (Bianchi et al. 1999) but needs to be confirmed. One juvenile recorded from Kunene River Estuary, needs to be confirmed. Hypothetical historical west coast spawning population functionally extinct through beach-seine and gillnet fishery overexploitation (SJ Lamberth, DAFF, pers. obs.)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Analyses of mitochondrial and microsatellite DNA indicated that white steenbras exist as a single, well-mixed population spanning all sample populations, from Langebaan Lagoon in the west to the Transkei in the east, with no evidence of spatial genetic differentiation or isolation by distance (Bennett 2012). Main portion of the stock is located inshore and in estuaries along the EC and WC coast (Brouwer et al. 1997, Lamberth and Mann 2000, Brouwer and Buxton 2002). Rare in KZN (Beckley and Fennessy 1996, Penney et al. 1999, Maggs 2010). Low catch rates in the NC and low abundance in estuaries (Sauer and Erasmus 1996, Brouwer et al. 1997, Harrison 1998). Although claimed to be infrequently taken by shore anglers in NAM (Bianchi et al. 1999), this has not been confirmed

MOVEMENT: Migratory
Juveniles resident within estuaries for up to 2-3 years (Bennett et al. 2011, Bennett 2012). Late juveniles (post-estuarine) resident in surf zone up to 400mm FL (Cowley 1999, Bennett 2012). Late juveniles/sub-adults semi-resident in surf zone (400-500mm FL) but showing some nomadic movements up to 400km (Bennett 1993b, Bennett 2012). Sub-adults (>500mm FL) begin to undertake large-scale migrations, although a large proportion remains resident (Bennett 2012). Evidence for adult migrations eastwards in winter to eastern EC (Bennett 1993b), although not empirically confirmed, and not all mature individuals migrate (SJ Lamberth, DAFF, pers. comm., Bennett 2012)

HABITAT
Adults: Inshore marine environment to depth of 25m (Bennett 1993b), range Orange River to Mtamvuna Estuary (Smith and Smith 1986), predominantly sandy or mixed sand and rock shorelines (Smith and Smith 1986, Bennett 1991, Bennett 1993b, PD Cowley, SAIAB, unpubl. data)
Juveniles: Early juveniles obligatory estuarine-dependent nursery phase (Wallace et al. 1984), up to ~3 years (Bennett 2012). Resident within estuaries, with high site fidelity, using limited area (Bennett et al. in press). Limited mainly to estuaries from Berg Estuary (WC) to Mbhanyana (EC), constituting ~146 km^2 of estuary surface area. Use mainly lower sandy reaches of estuaries (Bennett et al. in press)
Eggs and larvae: Pelagic, spawned close inshore in eastern part of EC, drift southwards and eastwards, enter estuaries as post-flexion larvae at 18-50mm TL (Beckley 1984, Bennett 1989, Whitfield and Kok 1992)

FEEDING
Adults: Sub-adults and adults in marine environment: polychaetes, crustaceans (particularly anomura and brachyura), molluscs (mainly sand-dwelling bivalves), mysids and echinoderms (Bennett 1993b)
Juveniles: Juveniles in estuaries: annelids, algae (Mehl 1973), copepods, ostracods (Wooldridge and Bailey 1982) and brachyura (Whitfield 1985). Appear to feed on shallow banks at night in estuaries (Becker et al. 2011, Bennett et al. in press). Juveniles in surf zone: amphipods, mysids, macrurans, polychaets and bivalves (Bennett 1993b)

REPRODUCTION
Reproductive style: Rudimentary hermaphrodite, functional gonochorist (Mehl 1973, Bennett 1993b)
Breeding/spawning season: Late winter, Jul-Aug (Bennett 1993b). Single spawning period theory supported by timing of recruitment being later in the year in estuaries further west (Beckley 1984, Bennett 1989, Whitfield and Kok 1992)
Breeding/spawning locality: Eastern part of EC off the Transkei coast, inshore off estuary mouths over fluvial mud deposits (Bennett 1993b), possibly restricted to inshore areas off a few estuaries along the Transkei coast (Mbashe, Mtata, Mzimvubu and Great Kei) (van Niekerk and Turpie 2011). Restricted spawning locality theory supported by size at recruitment being larger in estuaries further west (Beckley 1984, Bennett 1989, Whitfield and Kok 1992)
Age at 50% maturity: Combined sexes: 6 years; WC and EC; n=601; range 33-109cm TL. Age at 50% maturity calculated using the length-age relationship; age at 50% maturity approximately equal for both sexes (Bennett 1993b)
Length at 50% maturity: Combined sexes: 65cm TL; WC and EC; n=601; range 33-109cm TL. Length at 50% maturity approximately equal for both sexes (Bennett 1993b)

BIOMETRICS
Maximum recorded age: 25-30 years; WC and EC (Bennett 1993b)
Maximum recorded weight: 26.3kg; SA shore angling record (SASAA 2012)
Maximum recorded length: 1376mm TL (Bennett 1993b)
Length-length relationship: Combined sexes: TL(mm) = 1.0927FL(mm) + 5.5671; WC and EC; n=410; range=62-1130 mm FL (PD Cowley, SAIAB, unpubl. data)
Length-weight relationship: Combined sexes: Wt(g) = 0.02282 x $FL(cm)^{2.8562}$; mainly juveniles from Heuningnes Estuary; n=437 (Mehl 1973); Wt(g) = 0.0000167 x $TL(cm)^{2.984}$; WC and EC (Bennett 1993a); Wt(g) = 0.00000857 x $TL(cm)^{2.053}$; WC (CG Attwood, UCT, unpubl. data)
Growth parameters: Combined sexes: L_∞ = 1283mm FL; K = 0.1008; t_0 = 0.22; Heuningnes Estuary (n=433) Mehl (1973). Large proportion of sample was juveniles, age range in sample: 1-6 years. See also Schnute growth curve in Bennett (1993a)

FISHERY
Caught primarily by shore anglers in WC and EC (Brouwer et al. 1997). Major component of shore catches in the WC from 1930s to 1990s. Responsible for approximately 50% of total annual white steenbras catch by mass and 75% by number (Bennett 1993a). Annual shore angling catch estimated at 28 000 white steenbras by late 1980s (Bennett 1993a), and 39 000 (86mt) by 1996 (Lamberth 1996). The beach seine fishery was responsible for majority of white steenbras mortality prior to 1960 (Bennett 1993a). Annual catches of white steenbras estimated at 20mt on average, peaking at 100mt in some years. Initially widespread in NC, WC and EC, but reduced to False Bay in 1982 (Penney 1991), after which total recorded white steenbras catch until 2000 was approximately 230mt (SJ Lamberth, DAFF, unpubl. data). A commercial ban on white steenbras was implemented in 2001. Bycatch of white steenbras recorded in monitored gill-net catches along the WC coast in the 1990s was negligible (Hutchings and Lamberth 2002a, b). But, under-reporting in this fishery is high, therefore the contribution of the fishery to total catch may be higher than reported (Lamberth et al. 1997). Previously taken by the purse-seine fishery, sporadic catches of white steenbras in 1970s and 1980s, peaking at 300mt in 1982, and contributing significantly to stock decline (Bennett 1993a). Subsequently banned from the harvesting of linefish after 1982 (Penney 1991). Anecdotal evidence to suggest that relatively high numbers of white steenbras are taken by individual spearfishers, usually large adults. But not an important component of recorded spearfishery landings (Mann et al. 1997b), and most likely negligible catches when compared to the recreational shore fishery or commercial beach seine fishery. Little data available regarding subsistence catches in the surf zone, but particularly low catches of white steenbras made along the former Transkei coastline (Mann et al. 2003). Evidence to suggest high catches of (undersized) white steenbras in estuarine subsistence and recreational fisheries (P. Cowley, SAIAB, pers. comm.). Negligible catches in boat-based fisheries. Formed small component of commercial lineboat catches from 1897-1906 in Walker Bay, but absent in 1985-1996 (Attwood and Farquhar 1999), and small component in commercial lineboat bycatch in False Bay until 1990s (Lamberth and Bennett 1993). Total bycatch in recreational and commercial line boats estimated at <1mt annually (Lamberth and Mann 2000). Recreational boats in estuaries land low numbers of white steenbras relative to other angling species, although the majority retained are undersized, and historically white steenbras formed a large component in recreational and competition catches in certain estuaries (Marais and Baird 1980)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.3-0.5yr^{-1}
Natural mortality rate (M): 0.2yr^{-1}
Total mortality rate (Z): 0.5-0.7yr^{-1}
F_{MSY} yr^{-1}: 0.21
F_{SB40} yr^{-1}: 0.13
F_{SB25} yr^{-1}: 0.2
$F_{0.1}$ yr^{-1}: 0.2
$SBPR_{current}$: 6%
Year completed: 1993
Locality: WC and EC
References & Comments: Bennett (1993a)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1993
Locality: WC and EC
Status: <25% - collapsed. Outdated analysis, based on data collected prior to 1993 (Bennett 1993a). Considerable changes in exploitation since then, including commercial ban in 2001. Urgently requires reassessment - possibly based on recent shore angler observer programme and roving creel surveys. "Threatened" status suggests using existing age-length keys for stock assessment
Trend in CPUE: The beach seine fishery showed an 85% decline in mean annual reported catches of white steenbras, from 23 061 fish.$year^{-1}$ during the period 1897-1906, to 3 147 fish.$year^{-1}$ by the period 1983-91

(Bennett 1993a). Shore angler CPUE followed a notable decline after 1975 (Bennett 1991) of about 90%, from 6.0 fish/100 angler hrs in the 1970s to 2.3 fish/100 angler hrs by 1984, and to 0.7 fish/100 angler hrs in the 1990s (Bennett 1993a, Bennett et al. 1994, Lamberth 1996). CPUE increased in the De Hoop MPA after closure at Koppie Alleen, from 0.42 fish/100 angler hrs in 1984-85, to 2.63 fish/100 angler hrs by 1990 (Bennett and Attwood 1991), and to 4.68 fish/100 angler hrs at Koppie Alleen and Lekkerwater by 1992 (Bennett and Attwood 1993). Some evidence to suggest improved CPUE recently in the East Kleinemonde Estuary (AK Whitfield, SAIAB, unpubl. data). Similarly, the long-term seine netting programmes in the Berg Estuary have shown increased CPUE since commercial closure in 2001 (K Hutchings, UCT, unpubl. data). CPUE along the Algoa Bay shoreline (particularly late juveniles and sub-adults) has followed an increasing trend over the last 7 years, since the ban on beach driving in 2002 (PD Cowley, SAIAB, unpubl. data)

Trend in catch composition: The numerical contribution of white steenbras to total beach seine catches declined from approximately 3.77% at the turn of the last century, to 0.57% in the period 1951-68, 0.43% by the period 1977-87, and to 0.19% by the period 1983-91 (Bennett 1993a). White steenbras contributed approximately 30% to annual angler catches by mass along the SW Cape shore fishery in the 1960s but dropped to approximately 8% in 1990-91 and declined further to as little as 0.6% by 1994-96 (Lamberth 1996). More recently white steenbras was ranked the 2nd most common teleost in angler catches during a roving creel survey of the proposed GAENP MPA in 2006-09 (Chalmers 2012), and is now ranked 1st teleost in research angling in the same area (PD Cowley, SAIAB, unpubl. data)

Trend in mean size: No apparent trend in mean size. However, recent improved CPUE along the Algoa Bay shoreline is predominantly late juveniles and sub-adults, suggesting that mean size is likely to have decreased, due to the higher numbers of juveniles

Trend in sex ratio: Bennett (1993b) found a M:I:F sex ratio of 1.3:1:1.6 but trends in this ratio are not known

VULNERABILITY RATING

MLRA: No-sale recreational species

IUCN Red List: Least Concern; 1996. This assessment, conducted by Skelton (1996) i.e. "Lower risk - conservation dependent", is considered outdated. Two IUCN assessments have been completed since. A global IUCN Red List assessment was conducted in Dec 2009 the results of which are awaiting review and publication. A national/regional assessment was conducted in 2011 which classified white steenbras as Endangered (A1a,c)

CURRENT REGULATIONS

Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited

Minimum size limit: 60cm TL

Closed Season: None

Other regulations: No sale recreational species, decommercialised in 2001

MPA effectiveness: MPAs and EPAs are considered to be of considerable importance for the conservation and management of white steenbras. The De Hoop MPA showed increased CPUE of white steenbras after closure and now has the second highest CPUE for white steenbras recorded anywhere along coastline (Bennett and Attwood 1991, 1993, Bennett 2012). The Dwesa-Cwebe MPA is potentially well-positioned to protect adults during the spawning season if suitably enforced (Venter and Mann 2012). The Amatole MPAs, Goukamma MPA and the proposed GAENP MPA could all add significantly to the protection and rebuilding of the white steenbras stock if closed to shore fishing (Bennett 2012)

MANAGEMENT CONSIDERATIONS

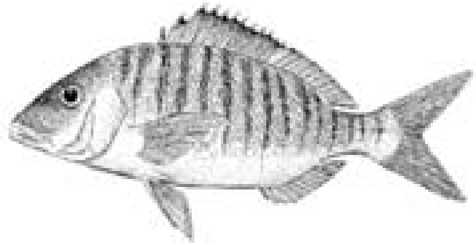
1) Requires additional marine and estuarine area protection (St Francis Bay and associated estuaries identified as suitable for new protected areas for white steenbras) (Bennett 2012). 2) Possibility of introducing a closed season should be addressed. Bennett (1993a) proposed a 6-week closed season from mid-July to end of August (will require improved understanding of adult migration patterns) 3) Closure of Amathole and Goukamma MPAs to shore angling would facilitate improved recruitment and protection from early juvenile to sub-adult life stages (Bennett 2012). 4) Level of compliance/law enforcement requires improvement (for all coastal species). 5) Illegal fishing in Dwesa-Cwebe (spawning grounds) must be stopped. 6) Retention of undersized fish in estuarine fisheries needs to be addressed (EPAs/enforcement)

RESEARCH REQUIREMENTS

Re-assess stock status using available catch data. Confirm adult migration patterns and location of spawning grounds. On-going assessment of shore angling CPUE and long-term monitoring of CPUE within MPAs and recruitment to estuaries. Undertake genetic assessment of samples recorded as white steenbras in NAM, to determine whether this was misidentification of *L. aureti* or even *L. mormyrus*, or whether these form a genetically distinct or similar stock to the SA stock

Research priority: High

SPARIDAE



SCIENTIFIC NAME: *Lithognathus mormyrus* (Smith No. 183.21)
COMMON NAMES: Sand steenbras
COMPILER: TJ Richardson
REVIEWER: SJ Lamberth
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: Mediterranean and west coast of Africa to MOZ including Canary and Cape Verde Islands; also reported from Black, Azov and Red Seas (Pajuelo et al. 2002, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, EC, KZN, MOZ
Common along WC and EC coasts of SA (Heemstra and Heemstra 2004)

MOVEMENT: Unknown

HABITAT
Adults: On sandy substrata from the surf zone down to 50m, adults tend to be found in water deeper than 10m (Buxton et al. 1984)
Juveniles: Shallow surf zone <10m, utilize large marine bays in the EC and WC as nursery areas (Lasiak 1981, 1986). Recorded from estuaries but usually associated with the mouth region of permanently open systems (Whitfield 1998)
Eggs and larvae: Pelagic, recorded from False Bay (Brownell 1979)

FEEDING
Adults: Generalist carnivores feeding on a wide variety of prey including polychaetes, bivalve molluscs, echinoderms, gastropods and fish (Kallianiotis et al. 2005)
Juveniles: Carnivorous feeding predominantly on polychaetes but become more generalistic with size (Kallianiotis et al. 2005)

REPRODUCTION
Reproductive style: Not determined in SA. Protandrous hermaphrodite off Canary Islands (Lorenzo et al. 2002), the Adriatic (Kraljevic et al. 1996) and Thracian Sea (Kallianiotis et al. 2005)
Breeding/spawning season: Summer, major period of juvenile recruitment from Sep-May in EC (Lasiak 1983, Whitfield and Kok 1992)
Breeding/spawning locality: Marine environment along the entire SA coast (Heemstra and Heemstra 2004)
Age at 50% maturity: Males: 2-2.5 years; Females: 3-3.6 years; Canary Islands and Thracian Sea, Greece; 1997-2000 (Lorenzo et al. 2002, Kallianiotis et al. 2005)
Length at 50% maturity: Males: 162-207mm TL; Females: 190-246mm TL; Canary Islands and Thracian Sea, Greece; 1997-2000 (Lorenzo et al. 2002, Kallianiotis et al. 2005)

BIOMETRICS
Maximum recorded age: 12 years; female; Adriatic (Kraljevic et al. 1996)
Maximum recorded weight: 748g; female; Canary Islands; 1999-2000 (Lorenzo et al. 2002)
M**aximum recorded length:** 372mm TL; female; Canary Islands; 1999-2000 (Lorenzo et al. 2002)
Length-length relationship: TL(mm) = 1.082FL(mm); based on measurement of picture (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(g) = 0.015 x $TL(cm)^{2.99}$; geometric mean based on 12 studies (Froese and Pauly 2012)
Growth parameters: Males: L_∞ = 399mm TL; K = 0.23; t_0 = -0.99; Females: L_∞ = 441mm TL; K = 0.18; t_0 = -1.25; Combined sexes: L_∞ = 427mm TL; K = 0.19; t_0 = -1.46; Canary Islands (Pajuelo et al. 2002)

FISHERY
Although fairly commonly caught by shore anglers along the EC and WC coasts using light tackle, they are generally not targeted due to their small size (Brouwer 1997, Lamberth 1997). Considered an important component of various fisheries in the Mediterranean, Thracian Sea, Canary Islands and Adriatic Sea (Pajuelo et al. 2002, Kallianiotis et al. 2005). Comprised a substantial component of the beach-seine fishery in False Bay up until the prohibition on night-fishing in the early 1990s. Shore-angling catches in False Bay were mostly in "runs" but few since the late 1980s, suggesting decline or distributional shift.

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown in SA
Natural mortality rate (M): 0.3-0.45yr^{-1}
Total mortality rate (Z): Unknown in SA
F_{MSY} yr^{-1}: Unknown

F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed in SA, M value considered the best estimate based on a number of methods (Lorenzo et al. 2002)

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

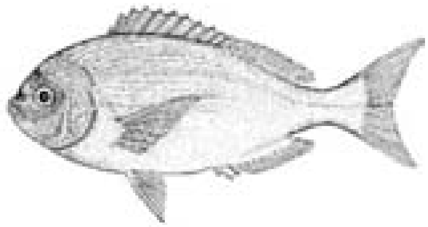
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: No MPAs have specifically been shown to provide protection for this species, but it is likely that most of SA's inshore MPAs will afford it some degree of protection

MANAGEMENT CONSIDERATIONS
This species is not considered an important target species due to its small size. Although MPAs probably provide it with some protection, size and bag limits should be implemented in order to protect it in fished areas. Direct management is probably most needed in the subsistence shore fishery. Prohibition of night-fishing in the beach-seine fishery has reduced landed catch since the early 1990s

RESEARCH REQUIREMENTS
A comprehensive life-history study is needed for this species in SA. Aspects of its age and growth, reproductive biology, movement behaviour and stock distribution should be prioritised in order to facilitate a fishery assessment and provide management advice
Research priority: Low

SPARIDAE



SCIENTIFIC NAME: *Pachymetopon aeneum* (Smith No. 183.22)
COMMON NAMES: Blue hottentot
COMPILER: BQ Mann
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Endemic to SA, False Bay to Sodwana (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Most abundant in southern KZN and the EC (Buxton and Clarke 1986, Garratt 1988)

MOVEMENT: Unknown
Seasonal component of linefish catches in southern KZN and northern Transkei, which suggests the possibility of a northward spawning migration (Garratt 1988). To date only 4 recaptures from 171 fish tagged none of which showed any movement (ORI Tagging Project, unpubl. data)

HABITAT
Adults: High-profile inshore and offshore reefs 20-80m (Buxton and Smale 1984, Buxton and Clarke 1986)
Juveniles: Shallow subtidal reefs (10-20m) (Buxton and Smale 1984, Buxton and Clarke 1986)
Eggs and larvae: Pelagic eggs recorded in shelf waters off Park Rynie in KZN (Connell 2012) and in the Tsitsikamma MPA in the EC (A. Wood, GEC, pers. comm.)

FEEDING
Adults: Benthic carnivore feeding mainly on hydrozoans, tunicates, octocorals and mysids (Buxton and Clarke 1986)
Juveniles: Similar to adults (Buxton and Clarke 1986)

REPRODUCTION
Reproductive style: Protogynous hermaphrodite with sex change occurring between 200-300mm FL (Buxton and Clarke 1986)
Breeding/spawning season: Reproductively active fish caught throughout the year but mainly in summer (Sep-Mar) in the EC (Buxton and Clarke 1986) and spring (Aug-Nov) in KZN (B. Mann, ORI, pers. obs.)
Breeding/spawning locality: Prime spawning area appears to be off the former Transkei and southern KZN (Garratt 1988) although ripe fish have been recorded in southern parts of the EC (Buxton and Clarke 1986) and in northern KZN (B. Mann, ORI, pers. obs.)
Age at 50% maturity: Females: 4.5-6 years; EC; 1980-84 (Buxton and Clarke 1986)
Length at 50% maturity: Females: 200-250mm FL; EC; 1980-84 (Buxton and Clarke 1986)

BIOMETRICS
Maximum recorded age: 12 years; male; EC; 1980-84 (Buxton and Clarke 1986)
Maximum recorded weight: 4.75kg; KZN; 1984; SA angling record (SADSAA 2012)
Maximum recorded length: 60cm TL (van der Elst 1993)
Length-length relationship: Combined sexes: FL(cm) = 0.887TL(cm) - 0.435; KZN; n=75 (B. Mann, ORI, unpubl. data)
Length-weight relationship: Combined sexes: Wt(g) = 0.00001 x $FL(mm)^{3.149}$; EC; n=47 (Buxton and Clarke 1986)
Growth parameters: Combined sexes: L_∞ = 467.1mm FL; K = 0.133; t_0 = 0.247; EC (Buxton and Clarke 1986)

FISHERY
Important component of the offshore commercial and recreational skiboat fisheries in the EC and KZN (Smale and Buxton 1985, Garratt 1988, Brouwer and Buxton 2002, Fennessy et al. 2003, Donovan 2010, Dunlop and Mann 2013). Occasionally taken by skilled spearfishers capable of diving in deeper water (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z):
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Targeted CPUE for blue hottentot has shown a significant increase in the KZN commercial skiboat linefishery between 1985-2007 (NMLS unpublished data). This increase was also reflected in two independent surveys of the KZN commercial linefishery where CPUE for blue hottentot increased from $0.43 kg.fisher^{-1}.outing^{-1}$ (1994-96) to $1.03 kg.fisher^{-1}.outing^{-1}$ in 2008-09 (Mann et al. 1997a, Dunlop 2011)
Trend in catch composition: Percentage composition of blue hottentot by mass in the KZN commercial linefishery remained relatively stable between 1994-96 (2.9%) and 2008-09 (2.6%) (Mann et al. 1997a, Dunlop 2011). However, percentage composition of blue hottentot has increased in the Port Alfred commercial and recreational linefishery between 1985-2008 (Donovan 2010)
Trend in mean size: Decreasing trend in mean size in the Port Alfred commercial and recreational linefishery between 1984-2008 (Donovan 2010)
Trend in sex ratio: The M:F sex ratio in the EC was 1:1.39 during the early 1980s (Buxton and Smale 1984) but no data available on trends

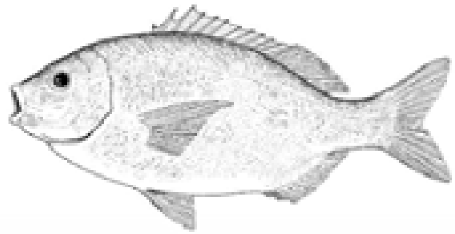
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Likely to receive protection in large no-take MPAs along the south-eastern seaboard of SA which include areas of suitable reef habitat

MANAGEMENT CONSIDERATIONS
Blue hottentot appear to becoming an increasingly important component of linefish catches, particularly in the EC. For this reason greater emphasis should be placed on the management of this species and a stock assessment should be conducted. Introduction of a minimum size limit of 30cm TL could be considered as a precautionary measure

RESEARCH REQUIREMENTS
Re-do age and growth, stock assessment, reproductive biology, movement patterns
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Pachymetopon blochii* (Smith No. 183.23)
COMMON NAMES: Hottentot, Hottentot seabream
COMPILER: SE Kerwath
REVIEWER: H Winker
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Endemic, Angola to Port Alfred (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Most abundant between Port Nolloth and Cape Agulhas (van der Elst 1993, DAFF unpubl. data)

MOVEMENT: Resident
Nepgen (1977), ORI Tagging Project unpubl. data

HABITAT
Adults: Rocky reefs and kelp beds to depths of 55m (Pulfrich 1987, Heemstra and Heemstra 2004)
Juveniles: Shallow water in kelp beds (Pulfrich 1987)
Eggs and larvae: Pelagic, found in inshore waters off the Cape Peninsula (Brownell 1979)

FEEDING
Adults: Omnivorous, adults feed mainly on algae but also take amphipods, crabs, shrimp, worms, hydroids, molluscs, sea urchins, redbait and occasionally fish (Pulfrich 1987)
Juveniles: Omnivorous, especially small crustaceans (Pulfrich 1987)

REPRODUCTION
Reproductive style: Gonochorist (Pulfrich and Griffiths 1988a)
Breeding/spawning season: Throughout the year with peaks in winter and summer (Pulfrich and Griffiths 1988a)
Breeding/spawning locality: Throughout its distribution range (Pulfrich and Griffiths 1988a)
Age at 50% maturity: Females: 4 years; WC (Goodman 2001); Combined sexes: 5 years (Pulfrich and Griffiths 1988a)
Length at 50% maturity: Females: 202mm FL; WC (Goodman 2001); Combined sexes: 220mm FL; WC (Pulfrich and Griffiths 1988a)

BIOMETRICS
Maximum recorded age: 21 years; WC (Goodman (2001)
Maximum recorded weight: 2.67kg; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 54cm TL (Heemstra and Heemstra 2004)
Length-length relationship: Combined sexes: TL(mm) = 1.0913FL(mm) + 2.6022; FL(mm) = 0.9134FL(mm) - 1.677; WC (Goodman 2001)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000331 x $FL(mm)^{2.9467}$; WC (Goodman 2001); Combined sexes: Wt(g) = 0.00003064 x $FL(mm)^{2.967}$; WC (Pulfrich and Griffiths 1988a)
Growth parameters: Combined sexes: L_∞ = 398.77mm FL; K = 0.13; t_0 = -1.29; WC (Goodman 2001); Combined sexes: L_∞ = 538mm FL; K = 0.097; t_0 = -0.431; WC (Pulfrich and Griffiths 1988a) – note that this study used whole otoliths which is likely to have under-estimated age

FISHERY
Important component of the artisanal linefishery in the WC, especially when higher-value species such as snoek and yellowtail are not available. Also important to recreational shore anglers and ski-boat fishers in the WC (Brouwer et al. 1997, Pulfrich and Griffiths 1988b). Also caught as a bycatch of the gill-net fishery on the West Coast (Lamberth, DAFF, pers. comm.) and occasionally speared (Mann et al. 1997b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.395yr^{-1}$
Natural mortality rate (M): $0.338yr^{-1}$
Total mortality rate (Z): $0.733yr^{-1}$
F_{MSY} yr^{-1}: 0.395
F_{SB40} yr^{-1}: Not calculated
F_{SB25} yr^{-1}: Not calculated
$F_{0.1}$ yr^{-1}: 0.28
$SBPR_{current}$: >40%
Year completed: 1988
Locality: WC
References & Comments: Stock was considered optimally exploited by Pulfrich and Griffiths (1988b)

STOCK STATUS
Stock assessment method: Biomass production model
Year completed: 2011
Locality: WC
Status: 40-50% - optimally exploited. Biomass in 2010 was estimated to be at 55% of carrying capacity for the WC (Winker et al. 2012)
Trend in CPUE: During the 20th Century average catch rates dropped to 22-38% of historical levels (Griffiths 2000). CPUE was fairly stable from 1985 until after the emergency in 2000, when the values fluctuated more widely. Most recent years indicate an increase in CPUE. The total commercial linefish catches decreased from about 1 000mt to a minimum of less than 100mt in 2006. Most recent years showed a slight increase in landings with just over 200mt reported in 2010 (NMLS unpubl. data, Winker et al. 2012)
Trend in catch composition: Hottentot is the most commonly landed reef fish on the West Coast, but only comprised 1-2% of the total commercial landings with no apparent trend in the last ten years (NMLS unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

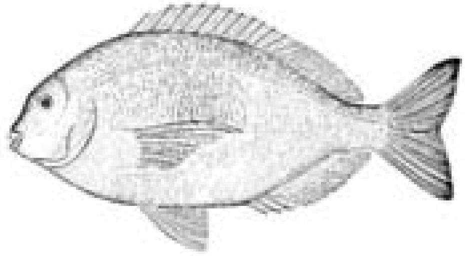
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: 22cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: As a resident inshore species, hottentot should benefit from protection within all MPAs within its distributional range

MANAGEMENT CONSIDERATIONS
Hottentot biomass seems to have recovered to levels close to BMSY. However, unmonitored subsistence and 'interim relief' catches have not been considered in these analyses. With the introduction of the small-scale fisheries policy, careful monitoring of catch and effort is required through a dedicated land-based observer programme

RESEARCH REQUIREMENTS
Analyses of the potential impact of an increase in subsistence/artisanal fishing targeting this species is required
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Pachymetopon grande* (Smith No. 183.24)
COMMON NAMES: Bronze bream, Copper bream, Bluefish, Bruin hottentot, Pens-en-derms
COMPILER: M Mwale
REVIEWER: PD Cowley
DATE OF REPORT COMPLETION: May 2012

GLOBAL DISTRIBUTION: Endemic, found from southern MOZ to Struisbaai in the WC (Fisher and Bianchi 1984, Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Genetic analyses suggest significant regional population sub-structuring between KZN, Transkei and the SE Cape (M. Mwale, SAIAB, unpubl. data). Reports of the bronze bream in Madagascar (Fisher and Bianchi 1984) have not been substantiated (Heemstra and Heemstra 2004)

MOVEMENT: Resident
Adults are extremely resident with high site fidelity (Cowley 1999, Cowley et al. 2002, ORI Tagging Project, unpubl. data). Mean displacement by 40 recaptured fish in the TNP was 75m (P. Cowley, SAIAB, unpubl. data)

HABITAT
Adults: Shallow intertidal rocky shores and reefs down to 25m (Beckley and Buxton 1989, Buxton and Clarke 1992, Mann et al. 2006)
Juveniles: Subtidal gullies and shallow (<10m) subtidal reefs (Beckley and Buxton 1989, Smale and Buxton 1989, Buxton and Clarke 1992, Heemstra and Heemstra 2004, Mann et al. 2006)
Eggs and larvae: Pelagic eggs have been collected in the Park Rynie area on the KZN south coast from 0.5-5km off shore. The majority of eggs (62%) collected between 1987-2005 were on the inshore shelf, within 5km of the coast (Connell 2012)

FEEDING
Adults: Omnivorous browsers, algae and small invertebrates (Smith and Heemstra 1991, King and Fraser 2002). Algae comprised 62% of diet in EC (Buxton and Clarke 1992)
Juveniles: Similar to adults but with small crustaceans such as amphipods being more important in the diet of juveniles (Clarke 1988, Buxton and Clarke 1992)

REPRODUCTION
Reproductive style: Late gonochorist, rudimentary hermaphrodite (Buxton and Garratt 1990, Buxton and Clarke 1992). Males and females mature after a non-functional intersexual stage
Breeding/spawning season: Spawning in groups with reproductive activity in the EC (Port Elizabeth) between Jan-Jun (Buxton and Clarke 1992). However, on the KZN south coast the main spawning season is in winter (Connell 2012). Spawning may take place in the early morning and evening as some eggs at a late blastula stage have been recorded during midday (Connell 2012)
Breeding/spawning locality: EC, KZN and probably throughout distribution and inside the 30m depth contour (Buxton and Clarke 1992, Mann et al. 2006, Connell 2012)
Age at 50% maturity: Combined sexes: 5.5 years; EC (mostly from Port Elizabeth and Tsitsikamma regions); 1984-87; n=656 (Buxton and Clarke 1992)
Length at 50% maturity: Combined sexes: 300mm FL; EC; 1984-87 (Buxton and Clarke 1992)

BIOMETRICS
Maximum recorded age: 38+ years; EC; 1984-87 (Buxton and Clarke 1992)
Maximum recorded weight: 5.4kg; 1987; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 70cm TL (van der Elst 1993); the largest fish recorded by Buxton and Clarke (1992) was 572mm FL
Length-length relationship: Combined sexes: $TL(mm) = 1.140417FL(mm)^{0.997}$; $SL(mm) = 0.7985FL(mm)^{1.016}$; EC; n=622 (Buxton and Clarke 1992)
Length-weight relationship: Combined sexes: $Wt(g) = 0.000022 \times FL(mm)^{3.046}$; EC; n=622 (Buxton and Clarke 1992)
Growth parameters: Combined sexes: L_∞ = 461mm FL; K = 0.153; t_0 = -1.64; EC (Buxton and Clarke 1992). No significant difference between mean length-at-age of males and females except for age 6

FISHERY
Important species in the recreational shore fishery (Clarke and Buxton 1989, Brouwer et al. 1997, Pradervand and Govender 2003, Pradervand et al. 2007) and spearfishery (Mann et al. 1997b, Lloyd et al. 2012), occasionally caught in the skiboat fishery (Fennessy et al. 2003). Particularly important in recreational and

subsistence fisheries along the Transkei and EC coasts (Brouwer 1997, Mann et al. 2003, Pradervand 2004). Ranked third in terms of landed biomass by shore-anglers in the EC (Brouwer et al 1997). Second most targeted species (12.5%) being 21% of the catch by spearfishers in the EC and WC (Mann et al. 1997b)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.11-0.32yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: M calculated in the TNP from 1998-2005 (n=318) where Z was assumed to be equal to M for an unexploited system. Estimated values ranged depending on the method used (Götz et al. 2008)

STOCK STATUS
Status: Not assessed
Trend in CPUE: CPUE declined substantially (29% reduction) in the Port Elizabeth area between 1989 (i.e. 12.6g.$person^{-1}$.hr^{-1} in 1989 (Clarke and Buxton 1989) to 9g.$person^{-1}$.hr^{-1} in 1996 (Brouwer 1997). CPUE in the TNP 4.8 times higher than that in exploited areas in the EC (Cowley et al. 2002). However, CPUE from the KZN spearfishery (1989–97 and 2002–07) at Ballito and Scottburgh showed no significant change in abundance (Lloyd et al. 2012)
Trend in catch composition: Annual contribution to catch by competitive shore anglers in KZN and Transkei (1977-2000) increased and was attributed to a shift in targeting and changes in fishing techniques (Pradervand 2004, Pradervand et al. 2007). No significant change in percentage composition in the spearfishery in the KZN region (Lloyd et al. 2012)
Trend in mean size: No data on trends in mean size. Fish were marginally larger (1.03 times) in the TNP compared to exploited areas in the EC (Cowley et al. 2002)
Trend in sex ratio: Adult M:F sex ratio was 1:1.16 in the EC (Buxton and Clarke 1992) but no data on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

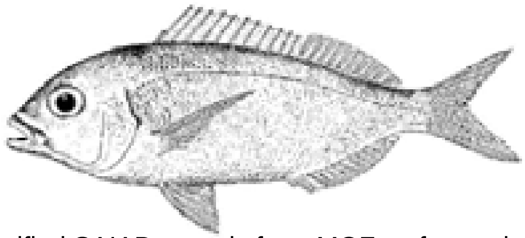
CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: prohibited
Minimum size limit: 30cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Due to their residency and slow growth, MPAs are considered to be one of the most important methods of protecting bronze bream stocks (Buxton and Clarke 1992, Cowley et al. 2002). The possibility of regional differences in stock structure (M. Mwale, SAIAB, unpubl. data), emphasizes the importance of having a suitable network of MPAs throughout the distribution of this and other similar endemic species

MANAGEMENT CONSIDERATIONS
Bronze bream is an important species for the recreational and subsistence shore fishery and the spearfishery. Better law enforcement is required to ensure compliance with the current regulations for this species. Comprehensive catch and effort monitoring of these fishery sectors should receive more attention, especially in the EC and WC

RESEARCH REQUIREMENTS
Stock assessment, genetic stock structure and verification of stock distribution, residency and movement patterns, early life history, nursery habitats
Research priority: High

SPARIDAE

SCIENTIFIC NAME: *Pagellus natalensis* (Smith No. 183.25)
COMMON NAMES: Sand soldier, Tjor-tjor
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: October 2012



GLOBAL DISTRIBUTION: SA, MOZ and southern Madagascar; verified SAIAB records from MOZ as far north as Bazaruto (E. Heemstra, SAIAB, pers. comm.); also recorded from central MOZ on Nansen surveys in the 1980s and from Nansen surveys in Tanzania
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Known to occur as far south as Mossel Bay in WC (Froese and Pauly 2012)

MOVEMENT: Unknown
Forms very large shoals (Smale and Badenhorst 1991)

HABITAT
Adults: Abundant over shallow sandy substrates, particularly in inshore bays, and down to 100m off the Cape south coast (Buxton et al. 1984, Smale and Badenhorst 1991); off KZN, recorded in large shoals over soft substrata up to 250m depth (S. Fennessy, ORI, unpubl. data)
Juveniles: Some indication that juveniles in the Cape are more abundant in shallow water with most fish <100mm FL caught at depths less than 20m (Buxton et al. 1984)
Eggs and larvae: In KZN recorded mainly in shelf waters (Beckley 1993, Connell 2012), but also found in very deep water (>600m) i.e. in the Agulhas Current (Beckley 1993)

FEEDING
Adults: Feeds on reef and sand associated benthic invertebrates including small crustaceans, echinoderms, polychaetes, fish and molluscs (Buxton et al. 1984)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Appears to be a gonochorist (S. Fennessy, ORI, unpubl. data)
Breeding/spawning season: In KZN spawning is during winter-spring, peaking between Aug-Sep (Connell 2012)
Breeding/spawning locality: In KZN, based on observations of eggs and larvae, spawning occurs in shelf waters (Connell 2012); but Beckley (1993) also recorded larvae in deep water (600m-2000m) so spawning could also occur on the shelf edge
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: Unknown
Maximum recorded length: 35cm TL (Froese and Pauly 2012)
Length-length relationship:
Length-weight relationship: Wt(g) = 0.00674 x $FL(cm)^{3.38}$; SA (Torres 1991a)
Growth parameters: L_∞ = 38.1cm FL; K = 0.21; SA (Torres 1991b). Growth curve in van der Elst (1993) based on a subspecies from Gulf of Aden (Druzhinin 1975)

FISHERY
Bycatch of the inshore hake and sole-directed trawl fishery in the southern Cape (Smale and Badenhorst 1991, Walmsley 2004), and to a much lesser extent of the KZN prawn trawl fishery (Fennessy et al. 1994). Also caught by skiboats in KZN (<1% by number) but as a bycatch (either discarded or used as bait), and a minor (<1% by no.) component of KZN shore angling catches (Mann et al. 1997a, Dunlop 2011)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown

$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: In KZN, catch composition in the shore and skiboat sectors has remained at below 1% between 1994-96 and 2008-09 (Mann et al. 1997a, Dunlop 2011) but is difficult to interpret as this species is not often retained or returned to landing sites
Trend in mean size: Unknown
Trend in sex ratio: Unknown

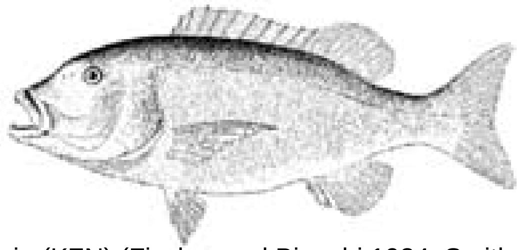
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Well represented in many MPAs throughout its range in SA, and also in the Ponta do Ouro Partial Marine Reserve in MOZ

MANAGEMENT CONSIDERATIONS
A widespread, abundant species which is currently not targeted by, or does not feature greatly in, any fishery; well protected in several MPAs; life history likely to be relatively robust

RESEARCH REQUIREMENTS
Catches should be monitored as part of observer programmes for all fisheries in which it occurs, as well as in demersal trawl research surveys
Research priority: Low

SPARIDAE



SCIENTIFIC NAME: *Petrus rupestris* (Smith No. 183.26)
COMMON NAMES: Red steenbras, Copper steenbras
COMPILER: BQ Mann
REVIEWER: SE Kerwath
DATE OF REPORT COMPLETION: April 2013

GLOBAL DISTRIBUTION: Endemic, from False Bay (WC) to St Lucia (KZN) (Fischer and Bianchi 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Stock greatly reduced and now seldom caught in KZN and WC Cape waters with the core of the remaining adult stock occurring in the former Transkei and Border regions of the EC (B. Mann, ORI, pers. obs; DAFF, unpubl. data)

MOVEMENT: Migratory
Tagging data have shown that juveniles (<700mm FL) are resident on reefs in the WC and southern parts of the EC. On attaining maturity, adults migrate eastwards to the former Transkei and southern KZN (Smale 1988, Wilke and Griffiths 1999, Brouwer 2002, Griffiths and Wilke 2002). The existence of an annual eastward spawning migration is indicated by sequential catch seasons along the Cape and Transkei coast (Penney and Wilke 1993) but there is no evidence of a return migration. An offshore migration has also been proposed between the inshore and offshore Agulhas Banks but lacks confirmation from tagging data (Penney and Wilke et al. 1993, Wilke and Griffiths 1999, Griffiths and Wilke 2002)

HABITAT
Adults: Offshore rocky reefs in 50-160m between Cape Agulhas and southern KZN (Buxton and Smale 1984, 1989, Smale 1988, Griffiths 2000)
Juveniles: Shallower inshore reefs (10-50m) between Cape Point and Kei Mouth (Buxton and Smale 1984, 1989, Smale 1988, Griffiths 2000)
Eggs and larvae: The distribution of eggs and larvae has still to be documented (van der Elst 1993) with no record from Tsitsikamma (Wood 1998) or the KZN south coast (Connell 2012)

FEEDING
Adults: Apex predators on deep reefs feeding mainly on reef fish such as cheilodactylids, clinids and small sparids. They also feed on squid, octopus and crustaceans such as slipper lobster (Smale 1986)
Juveniles: Small juveniles feed on mysids, carids and gobies, while larger juveniles feed mostly on reef fish (Smale 1986)

REPRODUCTION
Reproductive style: Late gonochorist (sensu rudimentary hermaphrodite) (Smale 1988)
Breeding/spawning season: Spawning occurs between Aug-Oct (Smale 1988)
Breeding/spawning locality: Appears to be restricted to the area between East London and southern KZN (Smale 1988, Garratt 1988) and on the offshore Agulhas Banks (Penney and Wilke 1993, Griffiths 2000)
Age at 50% maturity: Combined sexes: 7.2 years; EC and WC; 1979-87 (Smale and Punt 1991)
Length at 50% maturity: Combined sexes: 575mm FL (630mm TL); EC; 1979-87 (Smale 1988)

BIOMETRICS
Maximum recorded age: 33 years; EC; 1979-87 (Smale and Punt 1991)
Maximum recorded weight: 70kg (Smith and Heemstra 1991, Heemstra and Heemstra 2004). SA angling record is 56.6kg; 1994 (SADSAA 2012)
Maximum recorded length: 200cm TL (van der Elst 1993, Heemstra and Heemstra 2004). Largest fish sampled by Smale and Punt (1991) was 130cm FL. The biggest fish sampled since then was 129cm FL (DAFF, unpubl. data)
Length-length relationship: Combined sexes: TL(mm) = 1.0935FL(mm) + 2.8579; SL(mm) = 0.9128FL(mm) – 9.628; EC and WC; n=615 (Smale 1988)
Length-weight relationship: Combined sexes: Wt(g) = 0.000027 x $FL(mm)^{2.9519}$; n=707; Males: Wt(g) = 0.000025 x $FL(mm)^{2.9647}$; n=234; Females: Wt(g) = 0.00003 x $FL(mm)^{2.9372}$; n=220; EC and WC (Smale 1988)
Growth parameters: Combined sexes: L_∞ = 1383mm FL; K = 0.075; t_0 = -0.246; EC and WC; n=367 (Smale and Punt 1991) but poor fit of VB growth curve

FISHERY
Historically important in both recreational and commercial skiboat catches throughout its distribution (Penney et al. 1999, Griffiths 2000). More recently (prior to the closure of the fishery in Nov 2012) it only comprised a relatively small component of recreational and commercial skiboat catches in most areas except the Border and former Transkei regions of the EC where it still formed an important component of the catch (Smale and Buxton

1985, Garratt 1988, Hecht and Tilney 1989, Hecht and Buxton 1993, Penney and Wilke 1993, Fielding et al. 1994, Brouwer and Buxton 2002, Griffiths and Lamberth 2002, Fennessy et al. 2003, Donovan 2010). Historically taken by shore anglers in False Bay (Schoeman and Schoeman 1990) and occasionally taken by spearfishermen (van der Elst 1993). Incidental catches have been reported from the inshore trawl and the shark longline fleet (DAFF, unpubl. data).

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Not determinable due to the differing sizes at first capture along SA coast
Natural mortality rate (M): $0.15yr^{-1}$
Total mortality rate (Z): Not determined
F_{MSY} yr^{-1}: Not calculated
F_{SB50} yr^{-1}: 0.054
F_{SB25} yr^{-1}: Not calculated
$F_{0.1}$ yr^{-1}: 0.084
$SBPR_{current}$: Not determinable due to the differing sizes at first capture along SA coast
Year completed: 1991
Locality: EC and WC
References & Comments: Although the pre-recruit assessment for this species was inconclusive, Smale and Punt (1991) did illustrate that SBPR is reduced rapidly with small increases in fishing mortality

STOCK STATUS
Status: <25% - collapsed. Based on the >90% declines in CPUE recorded throughout the 20th Century (Griffiths 2000, Griffiths and Wilke 2002), it is believed that the red steenbras stock has been reduced to <5% of its pristine level (Griffiths and Lamberth 2002)
Trend in CPUE: A substantial decline in CPUE of this species was recorded during the 20th Century throughout its distribution with an associated range contraction (van der Elst and Garratt 1984, van der Elst et al. 1992, Penney and Wilke 1993, Penney et al. 1999, Griffiths 2000). The slight increase in CPUE in the former Transkei between 1984-92 (Hecht and Buxton 1993) was probably due to improved targeting on spawning aggregations on deep reefs (B. Mann, ORI, pers. obs.). Similarly, the increase recorded on the offshore Agulhas Banks during the 1980s was due to improved targeting by larger freezer vessels but was short lived (Penney and Wilke 1993, Griffiths 2000, Griffiths and Wilke 2002). Despite the stock already being severely depleted, nominal commercial skiboat CPUE data stored on the NMLS showed a further 90% decline between 1985 ($0.045kg.man^{-1}.hr^{-1}$) and 2007 ($0.005kg.man^{-1}.hr^{-1}$) (NMLS unpubl. data). Total commercial lineboat catch also dropped to less than 10% of 1990s values. Moreover, the frequency of encounter steadily declined to 4% of that in the late 1980s. These data were instrumental in the decision taken to close the fishery in Nov 2012
Trend in catch composition: Percentage catch composition declined dramatically in KZN and Cape waters throughout the 20th Century (Penney et al. 1999, Griffiths 2000). Between 1985-2007 reported commercial skiboat catches declined from a high of 96mt in 1991 to a low of 1.9mt in 2005 (NMLS unpubl. data). Comparison of access point survey data for the Port Alfred skiboat fishery (commercial and recreational catches) for three similar time periods 1985-87, 1996-98 and 2006-08 showed that catch composition of red steenbras in the "Sparid Group" declined from 44% to 3.3% to 9.9% for commercial catches and 15.3% to 4.6% to 5.1% for recreational catches respectively (Hecht and Tilney 1989, Donovan 2010)
Trend in mean size: Limited data available due to low numbers of fish recorded and because size distribution differs geographically (Smale and Punt 1991). No trend in size frequency of commercially caught fishes over the last 10 years (DAFF, unpubl. data)
Trend in sex ratio: Smale (1988) reported a M:F sex ratio of 1:1 in the EC and WC but no data are available on trends

VULNERABILITY RATING
MLRA: Prohibited species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Zero
Minimum size limit: Not applicable
Closed Season: Not applicable
Other regulations: Prohibited species
MPA effectiveness: Both the Tsitsikamma MPA (Buxton and Smale 1989, Brouwer 2002) and the De Hoop MPA (Smale 1988, Griffiths and Wilke 2002) have been shown to provide a refuge for this species. However, only juvenile fish are afforded the benefit of protection in these MPAs as the adults spawn in the area between East London and southern KZN and on the offshore Agulhas Banks. The Pondoland MPA (Mann et al. 2006), Dwesa-Cwebe MPA and the Amathole MPAs around East London are therefore likely to contribute towards the protection of adult fish (B. Mann, ORI, pers. obs.)

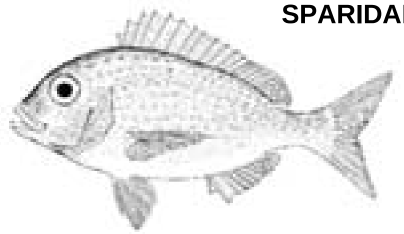
MANAGEMENT CONSIDERATIONS

The overexploited status of red steenbras has been recognised for the past 30 years and despite the gradual introduction of successively stricter regulations ending up with a minimum size limit (60cm TL), a daily bag limit (1 pppd for both recreational and commercial fishers), a 3-month closed season (1 Sep-30 Nov) and the establishment of a number of MPAs around the SA coast, no evidence of stock recovery was observed. This resulted in the implementation of a moratorium on catches in Nov 2012. With the fishery now closed, good enforcement is required to prevent illegal harvesting and improved angler awareness is required on how to correctly release red steenbras unintentionally caught in order to maximize their chance of survival. It is recommended that the moratorium should remain in place for at least 10 years during which time there should be a thorough evaluation of stock status

RESEARCH REQUIREMENTS

Monitoring the status of a fish species which has been closed to fishing is difficult as all fishery-dependent data are excluded. For this reason fishery-independent and preferably non-invasive methods (e.g. underwater videography) should be used to monitor red steenbras populations. Better information is required on the spatial and temporal occurrence of spawning aggregations and the distribution of eggs and larvae

Research priority: High



SCIENTIFIC NAME: *Polysteganus coeruleopunctatus* (Smith No. 183.29)
COMMON NAMES: Trawl soldier, Blueskin
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: January 2013

GLOBAL DISTRIBUTION: Western Indian Ocean, Red Sea south to at least Coffee Bay in the Transkei (Smith and Heemstra 1991, Iwatsuki and Heemstra 2011)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
In SA waters primarily caught off MOZ and KZN (Mastenbroek 2000)

MOVEMENT: Unknown

HABITAT
Adults: Found primarily on deeper reefs from 60-450m (Busakhin 1980, Heemstra and Heemstra 2004)
Juveniles: Unknown; a few small (~5cm) fish have been trawled on flat, hard substratum in northern KZN (S. Fennessy, ORI, unpubl. data)
Eggs and larvae: Probably in shelf waters, as sparid larvae are rarely found in waters off the shelf (Beckley 1993). Not recorded by Connell (2012)

FEEDING
Adults: Primarily crustaceans (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Protogynous hermaphrodite (S. Fennessy, ORI, unpubl. data)
Breeding/spawning season: Unknown
Breeding/spawning locality: Unknown
Age at 50% maturity: Females: 2.7 years; MOZ; 2000 (van der Elst et al. 2003)
Length at 50% maturity: Females: 190mm FL; MOZ; 2012 (Fennessy et al. 2012)

BIOMETRICS
Maximum recorded age: 18 years; male; MOZ; 1994 (Mastenbroek 2000)
Maximum recorded weight: 4.5kg, KZN; 1975; SA angling record (SADSAA 2012)
Maximum recorded length: 650mm TL (Busakhin 1980). Largest fish recorded in MOZ during 1994 was a male of 556mm TL (Mastenbroek 2000)
Length-length relationship: Combined sexes: TL(mm) = 1.115FL(mm) + 3.616; MOZ (Mastenbroek 2000)
Length-weight relationship: Combined sexes: Wt(g) = 0.000008794 x $TL(mm)^{3.102}$; MOZ (Mastenbroek 2000)
Growth parameters: Combined sexes: L_∞ = 486mm TL; K = 0.26; MOZ (Mastenbroek 2000). Very few old fish sampled forcing a logistic growth curve; parameters probably not realistic. Combined sexes: L_∞ = 358mm FL; K = 0.3; t_0 = -1.68; MOZ (van der Elst et al. 2003). Difficulty experienced with ageing this species due to uncertainty of whether one or 2 growth rings are laid down each year

FISHERY
In KZN mainly caught by commercial skiboats fishing in deeper water (Dunlop 2011). Caught in line, trawl and trap fisheries off MOZ (Fennessy et al. 2012)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Per-recruit assessments have been done in MOZ (Fennessy et al. 2012), but owing to low confidence in the parameters estimated due to ageing difficulties, these are not presented

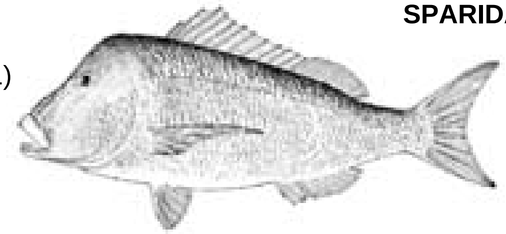
STOCK STATUS
Status: Not assessed in SA waters
Trend in CPUE: Total reported commercial linefish catch in KZN has dropped from a peak of 61.8mt in 1992 to 6.1mt in 2007, targeted CPUE has declined slightly from $1.6kg.man^{-1}.hr^{-1}$ to $1.2kg.man^{-1}.hr^{-1}$ from 1985-2007 (NMLS, unpubl. data)
Trend in catch composition: KZN commercial skiboats: 1994-96 3.6% by no. and 3.4% by weight; 2008-09 0.19% by no. and 0.51% by weight. KZN recreational skiboats: 1994-96 did not appear in surveyed catches; 2008-09 1% by no. and 0.5% by weight (Mann et al. 1997a, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: The Maputaland and St Lucia MPAs offer the most protection for this species, and to some extent the Ponta do Ouro Partial Marine Protected Area in MOZ

MANAGEMENT CONSIDERATIONS
The decline in commercial CPUE and catch composition, despite the increasing trend of fishing in deeper water, indicates that this species may well be overfished. The likelihood of this is increased by the complex life history exhibited by this species. Stricter conventional fisheries regulations should be considered (e.g. possibility of a commercial bag limit) and additional MPAs should be created - the deep reefs in the northern part of the KZN Bight are likely prime habitat for this species

RESEARCH REQUIREMENTS
Age and growth, size at maturity, reproductive biology, stock assessment
Research priority: High



SCIENTIFIC NAME: *Polysteganus praeorbitalis* (Smith No. 183.31)
COMMON NAMES: Scotsman
COMPILER: BQ Mann
REVIEWER: PA Garratt
DATE OF REPORT COMPLETION: January 2012

GLOBAL DISTRIBUTION: Endemic, from Beira in MOZ to Algoa Bay in the EC (Fischer and Bianchi 1984, Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Main stock assumed to be between southern MOZ and the former Transkei (Garratt et al. 1994)

MOVEMENT: Resident
Juveniles of this species appear to be fairly resident with a linear home range size of ~760m. However, a limited number of larger individuals have been observed to undertake substantial northward movements >300km, possibly for breeding purposes (Maggs 2011)

HABITAT
Adults: Offshore reefs between 20-120m (Garratt et al. 1994, Mann et al. 2005)
Juveniles: Observed on shallow subtidal reefs between 10-30m along the southern KZN and Pondoland coast (Garratt et al. 1994, Mann et al. 2006)
Eggs and larvae: Unknown, pelagic. Not recorded by Connell (2012)

FEEDING
Adults: Adults feed on teleosts, especially small reef fish, benthic crustaceans and cephalopods (Smale 1986, Garratt et al. 1994)
Juveniles: Unknown, assumed to be similar to adults

REPRODUCTION
Reproductive style: Unconfirmed protogynous hermaphrodite (Garratt et al. 1994, Mann et al. 2005)
Breeding/spawning season: Limited data, but appears to have an extended spawning season during winter and spring (Garratt et al. 1994, Mann et al. 2005)
Breeding/spawning locality: Little spawning activity recorded in KZN but with more reproductively active fish found from Richards Bay northwards (Garratt et al. 1994, Mann et al. 2005)
Age at 50% maturity: Based on the approximate length at maturity of 40cm FL, the corresponding age would be about 6 years (Mann et al. 2005)
Length at 50% maturity: Mann et al. (2005) estimated size at maturity at ~400mm FL. Fish with active gonads ranged in length from 405-650mm FL (Mann et al. 2005)

BIOMETRICS
Maximum recorded age: 13 years; female; KZN (Mann et al. 2005). The maximum age estimated for *P. praeorbitalis* was 13 years for a fish of 720mm FL. However, this species is known to reach lengths of over 850mm FL so it is likely that they can reach a considerably greater age
Maximum recorded weight: 10.5kg; KZN; 1988; SA angling record (SADSAA 2012)
Maximum recorded length: 90cm TL (Smith and Heemstra 1991)
Length-length relationship: Combined sexes: TL(mm) = 1.14FL(mm) + 5.02; KZN; n=132 (Garratt et al. 1994)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000589 x $FL(mm)^{2.81}$; KZN; n=215 (Garratt et al. 1994)
Growth parameters: Combined sexes: L_∞ = 850mm FL; K = 0.078; t_0 = -2.115; KZN, n=169 (Mann et al. 2005)

FISHERY
Comprise a relatively small component of catches of the KZN and EC commercial and recreational skiboat fishery (Garratt et al. 1994, Mann et al. 1997a, Penney et al. 1999, Dunlop 2011). However, are important on the lower KZN south coast and the Pondoland coast (Fennessy et al. 2003, Mann et al. 2005). Anecdotal evidence suggests a shrinking in the historical range with the catch of *P. praeorbitalis* in southern MOZ now comprising <1% of the total linefish catch (van der Elst et al. 1994)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.199yr^{-1}
Natural mortality rate (M): 0.215yr^{-1}
Total mortality rate (Z): 0.496yr^{-1}
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.115

F_{SB25} yr^{-1}: 0.175
$F_{0.1}$ yr^{-1}: Not calculated
$SBPR_{current}$: 20.9%
Year completed: 2004
Locality: KZN
References & Comments: Mann et al. (2005)

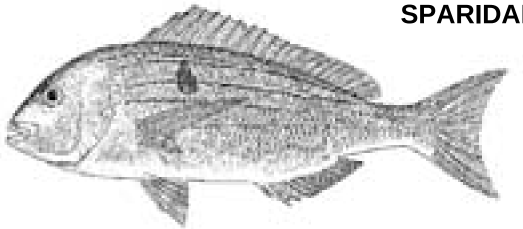
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2004
Locality: KZN
Status: <25% - collapsed. The stock status of *P. praeorbitalis* was considered to be even lower than was estimated because of the lack of sufficient samples and poorly estimated mortality rate (Mann et al. 2005)
Trend in CPUE: CPUE dropped by ~65% from $127kg.man^{-1}.yr^{-1}$ (1928-41) to $17.2kg.man^{-1}.yr^{-1}$ (1985-92) (Garratt et al. 1994). While total reported commercial catches have dropped from around $14mt.yr^{-1}$ to 3 $mt.yr^{-1}$ between 1985 and 2007, targeted CPUE only declined slightly from 0.25 to $0.2kg.man^{-1}.hr^{-1}$ (NMLS unpubl. data)
Trend in catch composition: Declined from 2.9% of total commercial KZN linefish catch (1928-41) to 1.6% (1985-92) (Garratt et al. 1994). *P. praeorbitalis* comprised 2.8% of the total monitored commercial linefish catch in KZN between 2008-09 (Dunlop 2011)
Trend in mean size: Significant change in mean size between 1979-81 (357mm FL) and 1990-92 (mean not given), with recent catches containing fewer larger fish (Garratt et al. 1994). Mann et al. (2005) found that the mean size had increased to 397mm FL during 2003 but this was likely to have been influenced by the increase in the minimum size limit from 30 to 40cm TL. Fish sampled in the Richards Bay area were significantly larger than those on the KZN south coast (Garratt et al. 1994, Mann et al. 2005)
Trend in sex ratio: Garratt et al. (1994) found that the sex ratio was heavily skewed towards females due to the removal of larger male fish. The M:F sex ratio increased with increasing latitude from Richards Bay (1:2.6) to Ramsgate (1:99). Mann et al. (2005) found an overall M:F sex ratio of 1:9 for *P. praeorbitalis* sampled primarily on the KZN south coast

VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: 1pppd (applies to all sectors)
Minimum size limit: 40cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: The Pondoland MPA has been shown to be particularly important for the protection of resident juveniles (Maggs 2011) and it is believed that deep reefs in the St Lucia and Maputaland MPAs provide important protection for adults of this species (K. Sink, SANBI, pers. comm.)

MANAGEMENT CONSIDERATIONS
Following completion of the stock assessment in 2004 (Mann et al. 2005), an increase in the minimum size limit in 2003 (30 to 40cm TL), a decrease in the recreational and commercial bag limit to 1pppd in 2005 and the proclamation of the Pondoland MPA in 2004, it is anticipated that rebuilding of the *P. praeorbitalis* stock should take place and careful monitoring of catch and effort should be conducted through the introduction of a land-based observer programme

RESEARCH REQUIREMENTS
Need to determine size/age at maturity, maximum age, spawning locality and confirm sex change. Understanding movement patterns of adults and determination of spawning locality also requires more attention
Research priority: Medium



SCIENTIFIC NAME: *Polysteganus undulosus* (Smith No. 183.32)
COMMON NAMES: Seventy-four, Seventy-four seabream
COMPILER: BQ Mann
REVIEWER: ST Fennessy
DATE OF REPORT COMPLETION: April 2013

GLOBAL DISTRIBUTION: Endemic to the south-eastern seaboard of SA from Cape Point in the WC to the mouth of the Limpopo River in southern MOZ (Ahrens 1964, Smith and Heemstra 1991, Garratt 1996)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Through overfishing the former range of seventy-four has contracted to the area between Sodwana Bay and the central Agulhas Banks with the centre of adult distribution being deep offshore reefs (>40m depth) between Durban and East London (Mann 2007)

MOVEMENT: Migratory
While juvenile seventy-four appear to be fairly resident (ORI Tagging Project, unpubl. data), adults undertake an annual migration from Cape waters into Transkei and southern KZN during winter to spawn (Ahrens 1964, Garratt 1988, Garratt 1996). This migration could also be in response to the seasonal migration of one of their prey, the sardine (*Sardinops sagax*), into KZN waters. There is also the possibly of a return migration of the adults to the Cape after spawning (Ahrens 1964) but this has not been confirmed

HABITAT
Adults: Frequent deep offshore reefs (40-160m) forming dense shoals. Often found in association with ledges and pinnacles (Ahrens 1964, van der Elst 1993, Garratt 1996)
Juveniles: On offshore reefs deeper than 20m in the EC and WC (Penny et al. 1989)
Eggs and larvae: Pelagic eggs assumed to be carried southwards inshore of the Agulhas Current (Penney et al. 1989). Surprisingly not recorded off Park Rynie on the KZN south coast after 25 years of sampling (A. Connell, pers. comm.)

FEEDING
Adults: Primarily piscivores feeding on pelagic species such as sardines and mackerel but their diet also includes reef fish, cephalopods and crustaceans (Ahrens 1964, Garratt 1996)
Juveniles: Juveniles feed mainly on invertebrates such as mysids (Pillay 2011)

REPRODUCTION
Reproductive style: Rudimentary hermaphrodites and thus functional gonochorists (Ahrens 1964, Chale-Matsau 1996, Mann 2007)
Breeding/spawning season: Late winter to spring between Jul-Nov, peaking in Aug-Oct (Ahrens 1964, Penny et al. 1989, Mann 2007)
Breeding/spawning locality: Offshore reefs in 50-100m depth off the KZN south coast and northern Transkei coast (Ahrens 1964, Garratt 1988, Mann 2007). The Illovo Banks just south of Amanzimtoti on the KZN south coast was a well-known spawning aggregation site that was heavily fished by lineboats operating out of Durban Harbour after the 2nd WW (Ahrens 1964, Penny et al. 1989, Garratt 1988, Penney et al. 1999, Mann 2007). Spawning was also known to occur on deep reefs off Umvoti mouth on the KZN north coast (Billy Clark, pers. comm.)
Age at 50% maturity: Combined sexes: 8.8 years; KZN; 1962-63 (Chale-Matsau et al. 2001). First maturity evident at 4-5 years. Mann (2007) calculated age at 50% maturity at 11 years but this was acknowledged to be an overestimate based on a small sample size (n=98)
Length at 50% maturity: Combined sexes: 650-750mm TL; KZN; 1962-63 (Chale-Matsua 1996). Mann (2007) calculated length at 50% maturity at 667mm FL but this was acknowledged to be an overestimate based on a small sample size (n=98); observed length at first maturity was 402mm FL

BIOMETRICS
Maximum recorded age: 20 years; KZN; 1962-63 (Chale-Matsau et al. 2001) but the largest fish sampled was only 11kg so maximum age may be well over 20 years (Mann 2007)
Maximum recorded weight: 16kg; SA; World angling record (IGFA 2012); SA angling record is 14.1kg caught in 1973 (SADSAA 2012)
Maximum recorded length: 100cm TL (van der Elst 1993, Heemstra and Heemstra 2004)
Length-length relationship: Combined sexes: TL(mm) = 1.1016FL(mm) + 15.514; SL(mm) = 0.8789FL(mm) – 6.4452; KZN and EC; n=251 (B. Mann, ORI, unpubl. data)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000561 x FL(mm)$^{2.8147}$; EC and KZN, n=251 (B. Mann, ORI, unpubl. data))
Growth parameters: Combined sexes: L_∞ = 942TL mm; K = 0.277; logistic growth model (Chale-Matsau et al. 2001) based on otoliths collected by Ahrens (1964) in KZN from 1962-63 (t*=5.178 for the logistic equation). Combined sexes: L_∞ = 900mm FL; K = 0.117; t_0 = -0.318; KZN and EC (Mann 2007)

FISHERY
Throughout the 20th Century seventy-four was intensively targeted by commercial and recreational linefishing vessels (firstly by lineboats and later by skiboats), especially on their spawning grounds in southern KZN. By the late 1960s the fishery in KZN, which was made up predominantly of large adult fish, had collapsed and only relatively small quantities continued to be caught in the EC (van der Elst and Garratt 1984, Penney et al. 1999, Mann 2007). Catches in the SE and S Cape also declined considerably (Griffiths 2000). A stock assessment was conducted in 1996 (Chale-Matsau et al. 2001) based on historical data collected during 1962-63 (Ahrens 1964), which showed that stocks had already collapsed by the 1960s. Based on this evidence and the fact that CPUE had declined by more than 90% throughout its distribution, a moratorium was placed on the catching of seventy-four in 1998 to allow stock rebuilding to take place. A reassessment of the seventy-four stock was conducted in 2007, 10 years after the implementation of the moratorium (Mann 2007). This study showed little evidence of recovery of the adult spawning population in KZN accept that there was a slight increase in mean size of adult fish. There was however, evidence of increasing numbers of juveniles in the EC suggesting that stock rebuilding is taking place

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.17yr^{-1}
Natural mortality rate (M): 0.16yr^{-1}
Total mortality rate (Z): 0.33yr^{-1}
F_{MSY} yr^{-1}: 0.316
F_{SB40} yr^{-1}: 0.08
F_{SB25} yr^{-1}: 0.12
$F_{0.1}$ yr^{-1}: 0.167
$SBPR_{current}$: 25%
Year completed: 1996 (based on data collected in 1962-63)
Locality: KZN
References & Comments: Based on a retrospective stock assessment, Chale-Matsau (1996) showed that the seventy-four stock had already collapsed by 1962-63. Prior to the closure of the fishery in 1998 the SBPR was believed to have been at <5% of its pristine level (A. Govender, ORI, pers. comm.)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1996 (based on data collected in 1962-63)
Locality: KZN
Status: <25% - collapsed (Chale-Matsau 1996). Mann (2007) was not able to reassess the stock status using per-recruit methodology. However, the >90% decline in CPUE over the 20th century and limited evidence of adult stock rebuilding suggested that the seventy-four stock was still in a collapsed state in 2007
Trend in CPUE: The average catch per boat year has dropped to 0.09% (SW Cape), 0.01% (S Cape) and 0.22% (SE Cape) of historical values (Griffiths 2000). Average catch per boat year was: 40kg (1897-1906), 28kg (1927-31) and 0.04kg (1986-98) in the SW Cape; 580kg (1897-1906), 200kg (1927-31) and 0.07kg (1986-98) in the S Cape; and 5 944kg (1897-1906), 339kg (1927-31) and 13kg (1986-98) in the SE Cape (Griffiths 2000)
Trend in catch composition: In 1910, seventy-four comprised 70% of the KZN commercial linefish catch, with 1 550mt being landed. Between 1921-33 it ranged from 30-50% with 337mt being caught. By 1985, 5.4mt were reported comprising <1% of the total commercial linefish catch in KZN (Penny et al. 1989, Birnie et al. 1994, Chale-Matsau 1996, Penney et al. 1999). By 1997 (the last year that the fishery remained open) a total of only 2.6mt was reported caught by the commercial linefishery throughout SA (NMLS, unpubl. data)
Trend in mean size: Although sample sizes were small, the mean size of seventy-four sampled at Port Edward in KZN during 2005-06 (Mann 2007) was significantly larger than those sampled at Port Edward in 1997-98 (Fennessy et al. 2003) which was the last year that the fishery remained open. This suggests that there has been an increase in the mean size of adult fish off southern KZN since the implementation of the moratorium in 1998 (Mann 2007). No difference was found in the mean size of seventy-four sampled at Kei Mouth between these two time periods (Mann 2007)
Trend in sex ratio: M:F sex ratio was 1:1.07 in 1962-63 (Ahrens 1964), while in 2005-06 it was 1.068:1 (Mann 2007). Both studies found that the sex ratio was not significantly different from unity and thus there was no change evident

VULNERABILITY RATING
MLRA: Prohibited species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

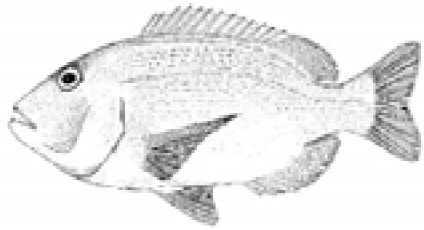
CURRENT REGULATIONS
Daily bag limit: Zero
Minimum size limit: Not applicable

Closed Season: Not applicable
Other regulations: Prohibited species
MPA effectiveness: It is likely that the Dwesa-Cwebe, Amathole and Bird Island MPAs currently play an important role in providing protection for juvenile seventy-four which appear to be fairly resident (B. Mann, ORI, pers. obs.), while the Pondoland MPA may play a role in protection of adults (Mann et al. 2006). There has been little evidence of seventy-four receiving protection in MPAs further south (i.e. Tsitsikamma, Goukamma, Stilbaai and De Hoop)

MANAGEMENT CONSIDERATIONS
The slow recovery of the seventy-four stock is not surprising given their slow growth and late age at maturity. Furthermore, due to its rarity and high price on the black market, poaching of seventy-four has continued despite the implementation of the moratorium (Mann 2007). Mann (2007) recommended that the moratorium should remain in place for a further 10 years (i.e. until end of 2017) before any decision was taken to reopen the fishery. Consideration should be given to extending the Aliwal Shoal MPA northwards to include some of the historical spawning grounds on the Illovo Banks and focus should also be placed on protecting the deep reefs in this area (40-160m), particularly between Aug-Nov.

RESEARCH REQUIREMENTS
Monitoring the status of a fish species which has been closed to fishing is difficult as all fishery-dependent data are excluded. For this reason fishery-independent and preferably non-invasive methods (e.g. underwater videography) should be used to monitor seventy-four populations. Better information is required on movement patterns and the distribution of eggs and larvae
Research priority: High

SPARIDAE



SCIENTIFIC NAME: *Porcostoma dentata* (Smith No. 183.33)
COMMON NAMES: Dane, Deen
COMPILER: ST Fennessy
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Endemic to SE Africa, mainly between Beira and Port St Johns. Strays sometimes recorded down to Algoa Bay with some small juveniles found as far south as Knysna (Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Most common off the southern MOZ, KZN and Transkei coasts (Fennessy et al. 2003, Mann et al. 2006, Dunlop 2011)

MOVEMENT: Unknown
Generally too small to tag and consequently little known. However, is believed to be fairly resident (B. Mann, ORI, pers. obs.)

HABITAT
Adults: Conflicting reports of loose shoals (van der Elst 1993) versus solitary habits (Heemstra and Heemstra 2004); occurs on offshore reefs often in the vicinity of pinnacles or steep drop-offs at depths from 20-120m
Juveniles: Small juveniles have been found on shallow (15-30m) offshore reefs in the Pondoland area (Mann et al. 2006) but occasional specimens have been observed as far south as Knysna in the WC (Smith and Heemstra 1991)
Eggs and larvae: Unknown

FEEDING
Adults: Benthic carnivore feeding on a variety of organisms such as crinoids, stomatopods, polychaetes, crabs and hermit crabs (van der Elst 1993)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Reportedly in spring (van der Elst 1993)
Breeding/spawning locality: Unknown
Age at 50% maturity: Unknown
Length at 50% maturity: 15cm FL; estimated by van der Elst (1993)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 1kg (Heemstra and Heemstra 2004)
Maximum recorded length: 42cm TL (Heemstra and Heemstra 2004)
Length-length relationship: Unknown
Length-weight relationship: Unknown
Growth parameters: Unknown

FISHERY
Appears fairly regularly in catches of the commercial and recreational sectors of the KZN and Transkei skiboat fisheries (Fennessy et al. 2003, Dunlop 2011) albeit as a bycatch as it is generally too small to be targeted. Often retained by crew as "fry" in the commercial fishery, probably mostly released in the recreational fishery. Not recorded in the MOZ semi-industrial or recreational fisheries but probably does occur (S. Fennessy, ORI, pers. obs.)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: Little change in KZN recreational skiboat catches: retained catch rates of 0.04 fish and 0.01kg.outing^{-1} from 1994-96 and 0.02 fish and 0.01kg.outing^{-1} from 2008-09 (Mann et al. 1997a, Dunlop 2011). Slight decline recorded in KZN commercial skiboat catches from 1985 (0.15kg.man^{-1}.hr^{-1}) to 2007 (0.1kg.man^{-1}.hr^{-1}) (NMLS unpubl. data)
Trend in catch composition: Little change in KZN recreational skiboat catches between 1994-96 (0.5% by no. and 0.1% by wt) and 2008-09 (0.75% by no. and 0.2% by wt). Decline recorded in KZN commercial skiboat catches between 1994-96 (0.8% by no. and 0.3% by wt) and 2008-09 (0.01% by no. and 0.01% by wt) although sample size was very small in the 1994-96 study (Mann et al 1997a, Dunlop 2011)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

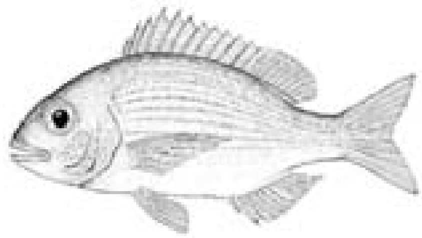
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Likely to receive some protection in the St Lucia, Maputaland and Aliwal Shoal MPAs in KZN and the Pondoland MPA in the EC (Mann et al. 2006), and probably also in the Ponta do Ouro Partial Marine Reserve in MOZ

MANAGEMENT CONSIDERATIONS
Despite its reasonably small range this is a fairly common species which is still not specifically targeted due to its small size. It likely receives good protection in several MPAs in SA; the decline in commercial catch rates and catch composition may be an aberration in the data, which is confounded by combining this species with other "red fish" in landed catches

RESEARCH REQUIREMENTS
All catches should be monitored as part of observer programmes for all fisheries in which it occurs; fisheries-independent surveys (e.g. using baited cameras) may give a better idea of abundances since this species is not always recorded in formal landed catches
Research priority: Low

SPARIDAE



SCIENTIFIC NAME: *Pterogymnus laniarius* (Smith No. 183.34)
COMMON NAMES: Panga, Dikbekkie
COMPILER: AJ Booth
REVIEWER: T Hecht
DATE OF REPORT COMPLETION: January 2012

GLOBAL DISTRIBUTION: Endemic, Yyzerfontein (WC) to Transkei in the EC (Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC
Smith and Heemstra 1991

MOVEMENT: Unknown
Juveniles and subadults found in a nursery area on the Central Agulhas Bank. After maturation adults disperse throughout range (Booth 1998)

HABITAT
Adults: Predominantly on deep, low and high-profile reef and to a lesser extent on mud and sand down to 120m (Fischer and Bianchi 1984, Smith and Heemstra 1991, Booth and Buxton 1997a). On flat reefs (>50m depth) panga comprise over 77% of the catch in traps (Gray et al. 2007)
Juveniles: Similar to adults
Eggs and larvae: Pelagic

FEEDING
Adults: Predominantly crabs with polychaetes, ophiuroids and fishes also present in the diet in smaller quantities (Hecht 1976)
Juveniles: Predominantly mysids (Hecht 1976)

REPRODUCTION
Reproductive style: Late gonochorist (sensu rudimentary hermaphrodite) (Booth and Buxton 1997a)
Breeding/spawning season: Throughout the year (Booth and Buxton 1997a) with a peak from Sep-May (Hecht and Baird 1976)
Breeding/spawning locality: Primarily on the Agulhas Bank (Booth and Buxton 1997a)
Age at 50% maturity: Combined sexes: 5.2 years; SE Cape; 1974-75 (Hecht and Baird 1977, Booth and Hecht 1998). Combined sexes: 4.3 years; SE Cape; 1994-95 (Booth and Buxton 1997a, Booth and Hecht 1998)
Length at 50% maturity: Combined sexes: 286mm TL; SE Cape; 1974-75 (Hecht and Baird 1977, Booth and Hecht 1998). Combined sexes: 204mm FL; SE Cape; 1994-95 (Booth and Buxton 1997a, Booth and Hecht 1998)

BIOMETRICS
Maximum recorded age: 16 years; SE Cape (Booth and Buxton 1997a)
Maximum recorded weight: 1.5kg; SE Cape (Booth and Buxton 1997a)
Maximum recorded length: 405mm FL; SE Cape (Booth and Buxton 1997a)
Length-length relationship: Combined sexes: FL(cm) = 1.126SL(cm) + 4.8005; FL(cm) = 0.901TL(cm) + 0.6848; Agulhas Bank (Booth and Buxton 1997a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00002 \times FL(mm)^{3.031}$; Agulhas Bank (Booth and Buxton 1997a)
Growth parameters: Combined sexes: $L_\infty = 379.4$mm FL, $K = 0.13$, $t_0 = -1.78$; Agulhas Bank (Booth and Buxton 1997a)

FISHERY
Prior to 1992 panga was targeted by foreign trawlers operating in SA waters (Crawford et al. 1987). During the period 1992-95 it comprised 63% of the SA demersal inshore trawl fishery (Booth and Buxton 1997b) and 11% of the demersal deepsea trawl fishery in the SE Cape and S Cape (Booth and Buxton 1997b, Booth and Punt 1998). Also important to the offshore commercial linefishery in the SE Cape where it made up an average of 16.5% of total landings between 1985-2007 (Hecht and Tilney 1989, Booth and Buxton 1997b, Donovan 2010). Of little importance to the recreational skiboat fishery, sometimes used as bait in SE Cape (Smale and Buxton 1985, Brouwer 1997)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.08yr^{-1}$
Natural mortality rate (M): $0.28yr^{-1}$
Total mortality rate (Z): $0.36yr^{-1}$
F_{MSY} yr^{-1}: 0.47

F_{SB40} yr^{-1}: 0.48
F_{SB25} yr^{-1}: Not calculated
$F_{0.1}$ yr^{-1}: 0.24-0.39
$SBPR_{current}$: 67%
Year completed: 1994-95
Locality: SE Cape
References & Comments: (Booth and Buxton 1997b, Booth and Punt 1998)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 1994-95
Locality: SE Cape
Status: >50% - underexploited (Booth and Buxton 1997b, Booth and Punt 1998)
Trend in CPUE: Historically there was an increase of 1.1% from 1984-95 in the demersal inshore trawl fishery (Booth and Hecht 1998). Similarly CPUE in the linefishery increased from 2g.person^{-1}.hr^{-1} in 1989 (Clarke and Buxton 1989) to 3.3g.person^{-1}.hr^{-1} in 1996 (Brouwer 1997). More recently CPUE in the Port Alfred commercial linefishery decreased significantly from 0.62 to 0.25 kg.fisher^{-1}.hr^{-1} from 1985-2007 (Donovan 2010). This is believed to be due to a change in fisher behaviour and economics rather than a decrease in actual stock abundance (Donavan 2010)
Trend in catch composition: There has been a steady decline in the contribution by panga to the commercial linefishery catch in the SE Cape from around 26% (Hecht and Tilney 1989, Booth and Buxton 1997b) to around 16% a decade later and to around 5% in 2007 (Donovan 2010)
Trend in mean size: Since 1974, there has been a decrease in mean size of fish landed in the Port Elizabeth (SE Cape) demersal inshore trawl fishery (Booth and Hecht 1998). Since 1974, there has also been a decrease in age-at-maturity (Booth and Hecht 1997) and age-at-recruitment (Booth and Hecht 1998)
Trend in sex ratio: Little change in M:F sex ratio in the SE Cape between 1974-75 (1:1.95) (Hecht 1976) and 1994-95 (1:1.7) (Booth and Buxton 1997a)

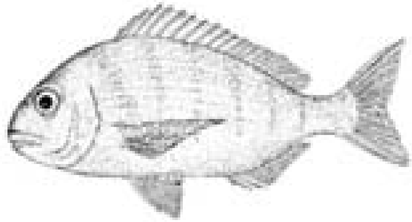
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: It is not known how much protection this species receives in SA's current MPA network

MANAGEMENT CONSIDERATIONS
Despite being subjected to directed foreign trawl fleet effort between 1964-1991, with landings as high as 18 000mt per annum (Crawford et al. 1987), panga appears to be showing evidence of a recovery (Booth and Punt 1998) with the possibility that increased catches are sustainable (Brouwer 1997, Booth et al. 1999). The more recent declines in CPUE in the commercial linefishery are considered to reflect changes in fisher behaviour and economics rather than a decline in stock abundance (Donovan 2010)

RESEARCH REQUIREMENTS
Re-assessment of stock status. Elucidation of ontogenetic movements and residency, early life-history and ontogeny
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Rhabdosargus globiceps* (Smith No. 183.35)
COMMON NAMES: White stumpnose, Witstompneus
COMPILER: CG Attwood
REVIEWER: SE Kerwath
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: SA endemic from southern Angola to Kei River (Whitfield 1998)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Four discrete areas of *R. globiceps* abundance including W Cape (Saldanha), SW Cape, S Cape and SE Cape (Griffiths et al. 2002). Also known from Luderitz in NAM (B. Mann, ORI, pers. obs.)

MOVEMENT: Migratory
Movements have been studied in Saldanha Bay (Attwood et al. 2007, Kerwath et al. 2009). Fish migrate across the bay, spending Jun-Aug in Saldanha Bay, and the remainder in Langebaan Lagoon. While in the lagoon, they display a degree of site fidelity, but undertake diel commuting behaviour. On the Cape south coast the fish migrate to deeper water offshore in winter (Griffiths et al. 2002)

HABITAT
Adults: Shallow reefs along the south and east Cape coasts, down to 50m depth in summer. Found on reef and unconsolidated sediments down to 120m depth on the Agulhas Bank in winter (Griffiths et al. 2002). An isolated population in Langebaan Lagoon (Saldanha Bay) frequents tidal channels with sandy bottoms in <10m depth (Arendse 2011)
Juveniles: Seagrass beds, coastal lagoons and estuaries (Wallace et al. 1984, Whitfield and Kok 1992, Clark 1997, Heemstra and Heemstra 2004)
Eggs and larvae: Eggs are pelagic, hatching after 36 hours at 20°C (Russell 2013). First feeding commences four days after hatching (Russell 2013)

FEEDING
Adults: Crustaceans and molluscs dominate the diet. Larger fish are capable of crushing clams, mussels and gastropods >20mm (Griffiths et al. 2002, Heemstra and Heemstra 2004)
Juveniles: Small crustaceans found in the water column of the surf zone including amphipods, isopods, ostracods and filamentous algae (Griffiths et al. 2002, Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Rudimentary hermaphrodite, functional gonochorist (Griffiths et al. 2002)
Breeding/spawning season: Summer, Sep-Mar (Griffiths et al. 2002)
Breeding/spawning locality: Throughout distribution range (Griffiths et al. 2002)
Age at 50% maturity: Males: 1.5-3.2 years; EC and WC, slower in cooler waters of the WC (Griffiths et al. 2002); Females: 2+ years; Saldanha Bay; 2005 (Attwood et al. 2010)
Length at 50% maturity: Males: 153-236mm FL; EC and WC, later in cooler waters of the WC (Griffiths et al. 2002); Females: 222mm FL; Saldanha Bay; 2005 (Attwood et al. 2010)

BIOMETRICS
Maximum recorded age: 21 years; female; SW Cape; 2001 (Griffiths et al. 2002)
Maximum recorded weight: 2 032g; female; Saldanha Bay; 2005. This was the heaviest specimen recorded at Saldanha Bay in a sample of 1 400 fish spanning 8 years (C. Attwood, UCT, unpubl. data). The fish from the south coast do not grow as large (Attwood et al. 2010). SA angling record stands at 3.2kg (SASAA 2012), but the heaviest catch on record from the Langebaan Yacht Club is 3.64kg (V. Taylor, pers. comm.)
Maximum recorded length: 472mm FL; female; 2005. This was the largest specimen recorded at Langebaan in a sample of 1 400 fish spanning 8 years (C. Attwood, UCT, unpubl. data)
Length-length relationship: Combined sexes: FL(mm) = 0.8916TL(mm) + 1.3716; Saldanha Bay to Port Alfred, Griffiths et al. (2002)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000138 x FL(mm)$^{3.079}$; EC and WC (Griffiths et al. 2002); Combined sexes: Wt(g) = 0.00002018 x FL(mm)$^{3.011}$; Saldanha Bay (Attwood et al. 2010)
Growth parameters: Combined sexes: L_∞ = 349mm FL; K = 0.114; t_0 = -3.6; SE Cape; L_∞ = 337mm FL; K = 0.207; t_0 = -1.05; S Cape; L_∞ = 379mm FL; K = 0.29; t_0 = -0.16; SW Cape (Griffiths et al. 2002); Combined sexes: L_∞ = 399mm FL; K = 0.21; t_0 = -2.0; Saldanha Bay (Attwood et al. 2010)

FISHERY
White stumpnose are caught by the inshore trawlers between Algoa Bay and Port Alfred, and off Mossel Bay (approximately 30mt per annum). Linefishermen (recreational and commercial) catch them on the south coast and in False Bay, but much larger quantities are caught on the west coast in Saldanha Bay (approximately 80mt

per annum). They used to be netted by beach seines in large quantities in Hout Bay, Blouberg and Melkbos, but these stocks have collapsed. Estuarine anglers catch juvenile fish in estuaries from the Berg River in the west to the Kowie River in the east (Whitfield 1998). Occasional bycatch of gillnet fisheries on the West coast (Hutchings and Lamberth 2002)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): 0.4yr^{-1}
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: ~22%
Year completed: 2002-06
Locality: Saldanha Bay
References & Comments: A per-recruit assessment of this species was undertaken by Arendse (2011) but results were highly speculative

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2002-06
Locality: Saldanha Bay
Status: <25% - collapsed. A per-recruit assessment of this species was undertaken by Arendse (2011). However, without a reliable measure of M, the results were highly speculative. Other than this, no reliable assessments have been made for any of the stocks of white stumpnose, although there is good evidence that the stocks on the S Cape coast and on the west of Cape Peninsula and Table Bay have collapsed. The reasons are unclear
Trend in CPUE: The average catch per boat year on traditional fishing grounds has dropped to 32% (West Coast), 48% (SW Cape) and 0.2% (S Cape) of historical values between 1897-1906 and 1986-98 (Griffiths 2000)
Trend in catch composition: Little change in the percentage composition of white stumpnose in the Western and SW Cape between 1897-1906 and 1986-98 but a substantial decline in the S Cape over this period (Griffiths 2000). Currently white stumpnose contributes less than 1% to the commercial linefish catch with no systematic change over the past 10 years (NMLS unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

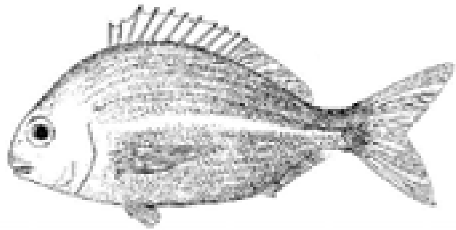
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: 25cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Kerwath et al. (2009) showed that the no-take areas within the Langebaan MPA provide protection for this species. Similarly the no-take areas within the Table Mountain National Park MPA should provide some protection. L. de Vos (UCT, unpubl. data) recorded this species in the Stilbaai MPA during a BRUV survey and trawl records indicated the presence of this species in the vicinity of the Bird Island MPA (Wallace et al. 1984)

MANAGEMENT CONSIDERATIONS
The bag limit for recreational anglers should be reduced to 5pppd, as this species is moderately long-lived and easily caught. Attention should also be given to the protection of the respective nursery grounds, particularly at Saldanha where industrial threats to the beaches are of concern. The species is poorly represented in MPAs, particularly on the Agulhas Bank

RESEARCH REQUIREMENTS
Confirmation of the functional stocks found by Griffiths et al. (2002) with genetic techniques. Assessment of the status of the individual stocks
Research priority: Medium

SPARIDAE



SCIENTIFIC NAME: *Rhabdosargus holubi* (Smith No. 183.36)
COMMON NAMES: Cape stumpnose, Silver bream
COMPILER: A Götz
REVIEWER: PC Cowley
DATE OF REPORT COMPLETION: October 2012

GLOBAL DISTRIBUTION: Endemic, found from Maputo in southern MOZ to St Helena Bay in the WC (Fischer and Bianchi 1984, Smith and Heemstra 1991, van der Elst 1993, Whitfield 1998, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
As for global distribution

MOVEMENT: Resident
Larvae and post larvae follow olfactory cues to recruit into estuaries at approximately 6-10mm SL (James et al. 2008a). Recruitment into estuaries is not dependant on season or mouth status (open/closed) as they use mouth overwashing events to enter these estuarine nursery habitats (Cowley et al. 2001, James et al. 2007). After an estuarine residency period of between 12 and 23 months sub-adults (~140mm SL) migrate out of estuaries into the marine environment and do not return (Blaber 1974, Beckley 1983, Whitfield 1998, James et al. 2008a). Movement of adults in the marine environment is not known as there has been a very low recapture rate recorded in the ORI Tagging Project. A southward summer migration into Cape waters is inferred by van der Elst (1993) but has not been substantiated

HABITAT
Adults: Primarily marine, common in shallow coastal waters <50m depth. An inshore species found in sandy areas and over shallow reefs (Wallace 1975a, Wallace et al. 1984, van der Elst 1993, Whitfield 1998, Heemstra and Heemstra 2004)
Juveniles: Dependent on estuaries as nursery areas, where they remain until just prior to reaching sexual maturity (Blaber 1974, Wallace 1975a, van der Elst 1993, Whitfield 1998). Often found in close association with seagrass beds (Heemstra and Heemstra 2004)
Eggs and larvae: One of the most abundant fish larvae found in the surf zone near EC estuary mouths with peaks in abundance during late winter (Aug), especially at dawn and dusk on the flood stage of the tidal cycle over spring tides (Cowley et al. 2001). Recorded in nearshore shelf waters off the KZN south coast (Connell 2012)

FEEDING
Adults: Echinoderms, crustaceans, molluscs, barnacles, bryozoans and polychaetes (van der Elst 1993, Heemstra and Heemstra 2004)
Juveniles: Graze on algae and seagrass, such as eelgrass but digest only epiphytic diatoms and encrusting organisms (van der Elst 1993, Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: May-Aug in KZN (Wallace 1975b), Jul-Feb in the SE Cape (Whitfield 1998). Connell (2012) recorded the occurrence of *R. holubi* larvae on the KZN south coast throughout the year with peaks in abundance during Apr-May and Aug-Dec. This may be a strategy to ensure that some larvae can recruit into estuaries that are not always open to the sea (Whitfield 1990)
Breeding/spawning locality: Spawning occurs in the nearshore marine environment, probably in close proximity to estuary mouths (Wallace 1975b, Beckley 1985, Whitfield 1998)
Age at 50% maturity: Unknown
Length at 50% maturity: Combined sexes: 190mm TL; KZN; 1969-72 (Wallace 1975b). Whitfield (1998) reported length at maturity of 150mm SL in the EC

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: The SA shore angling record is 2.4kg (SASAA 2012), however, the maximum weight of adults seldom exceeds 1kg (B. Mann, ORI, pers. obs.)
Maximum recorded length: 40-45cm TL (Smith and Heemstra 1991, van der Elst 1993, Heemstra and Heemstra 2004)
Length-length relationship: Combined sexes: FL(cm) = 1.16SL(cm) + 0.185; TL(cm) = 1.368SL(cm) – 0.218; EC (Marais and Baird 1980a)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00007 \times SL(mm)^{2.8512}$; SE Cape (Blaber 1974); Combined sexes: $Wt(g) = 0.0424 \times FL(cm)^{2.9266}$; EC (Marais and Baird 1980a)

Growth parameters: Not aged. Cape stumpnose grow to ~10cm SL in their first year and ~14cm SL in their second year (Blaber 1974, Heemstra and Heemstra 2004), with faster growth rates recorded in KZN (Wallace and van der Elst 1975)

FISHERY
Primarily caught by recreational and subsistence shore and estuarine fishers using light tackle (van der Elst 1993). Very important in several EC estuaries (Cowley et al. 2004)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: CPUE of juveniles in EC estuaries is highly variable due to variability in recruitment with no clear long-term trends (James et al. 2008b). An increase in adult CPUE was recorded between 1975-77 (0.008 $fish.angler^{-1}.day^{-1}$), 1994-96 (0.024 $fish.angler^{-1}.day^{-1}$) and 2009-10 (0.049 $fish.angler^{-1}.day^{-1}$) along the KZN coast (Joubert 1981, Mann et al. 1997, Dunlop 2011). However, recreational shore angling catches monitored by EKZNW shore patrols show a significant decline along the KZN coast between 1984-2008 (NMLS, unpubl. data) but this may be partly due to earlier misidentification with other stumpnose species
Trend in catch composition: Apparent decrease in percent composition of *R. holubi* in Swartkops estuary since earlier this century and 1972-78 (Marais and Baird 1980b). Increase recorded between 1975-77 (0.69%), 1994-96 (2.03%) and 2009-10 (4.94%) in KZN (Joubert 1981, Mann et al. 1997, Dunlop 2011). *R. holubi* now comprises the fifth most important shore angling species caught along the KZN coast (Dunlop 2011)
Trend in mean size: Juvenile mean size in estuaries highly variable due to variability in recruitment. No clear long-term trends (James et al. 2008b)
Trend in sex ratio: Unknown

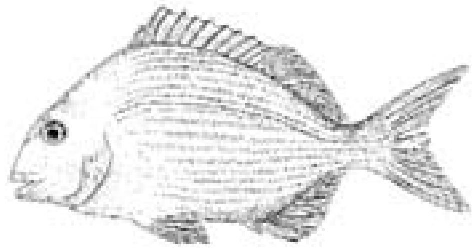
VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 20cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: Adults recorded in most MPAs along the eastern seaboard of SA and will receive protection in no-take areas. There are a limited number of EPAs which protect juveniles of this species

MANAGEMENT CONSIDERATIONS
Juveniles in EC estuaries have high production and play an important role in energy flow within estuaries and possibly in exporting estuarine production to the nearshore marine environment (Cowley and Whitfield 2002). Degradation of estuarine nursery areas along the entire south-eastern seaboard may have resulted in an overall reduction in biomass of this species. Protection of suitable marine and estuarine habitats is therefore imperative for the future status of this species

RESEARCH REQUIREMENTS
Reproductive biology, age and growth, stock assessment, adult migration/residency, recruitment
Research priority: High

SPARIDAE



SCIENTIFIC NAME: *Rhabdosargus sarba* (Smith No. 183.37)
COMMON NAMES: Natal stumpnose, Yellowfin bream, Tropical stumpnose, Goldlined seabream, Silver seabream
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: February 2013

GLOBAL DISTRIBUTION: Widespread Indo-West Pacific species in tropical and subtropical waters, East Africa and Red Sea to China, Japan and Australia (Blaber 1984, Fischer and Bianchi 1984, Smith and Heemstra 1991, Yeung and Chan 1987, Whitfield 1998). However, likely to consist of a complex of genetically distinct populations (T. Trnski, Auckland Museum, New Zealand, pers. comm.; Y. Iwatsuki, Miyazaki University, Japan, pers. comm.)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common along southern MOZ, KZN and EC coast, occasionally extending as far south as Wilderness in the WC in summer (Smith and Heemstra 1991, Whitfield 1998, Heemstra and Heemstra 2004). Also common off SE Madagascar (B. Mann, ORI, pers. obs.)

MOVEMENT: Resident
Only 35 recaptures (2.77%) out of 1 264 tagged with a mean distance travelled of 10km (ORI Tagging Project unpubl. data). Juveniles are resident in estuaries until ~20cm SL where after they disperse into the marine environment (Whitfield 1998). Adults appears to be resident within a relatively large home range of 1.1km (linear distance) in the surf-zone, with some individuals undertaking large-scale movements in excess of 200km (Mann 2012)

HABITAT
Adults: Primarily marine, common in shallow coastal waters <50m depth. An inshore species found in sandy areas and over shallow reefs (Berry et al. 1982, van der Elst 1993, Whitfield 1998), adults >350mm SL seldom recorded in estuaries (Wallace 1975a, van der Elst 1978)
Juveniles: Make extensive use of estuaries (mainly larger estuaries in KZN and further north), which serve as nursery areas, where they grow to maturity (Wallace 1975a, Blaber 1984, Kyle 1986, van der Elst 1993, Whitfield 1998)
Eggs and larvae: Nocturnal serial spawning by adults occurs in the KZN nearshore marine environment, probably off large estuary mouths (Wallace 1975b, Harris and Cyrus 1996). Eggs and larvae were most abundant in inshore waters along the KZN south coast suggesting spawning in the surf-zone (Connell 2012). Larvae attain 10mm TL in their first month and fry first start to enter estuaries at around 15-20mm SL (2-3 months) (Wallace and van der Elst 1975, Leu 1994)

FEEDING
Adults: Primarily hard-shelled invertebrates including molluscs (bivalves and gastropods), echinoderms (sand dollars and urchins) and crustaceans (crabs, mole crabs and barnacles) (Schleyer and Wallace 1986, van der Elst 1993, Whitfield 1998, Heemstra and Heemstra 2004)
Juveniles: Within estuaries juveniles feed primarily on algae, aquatic macrophytes, amphipods, small crabs and bivalves (Blaber 1984, Whitfield 1998, Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Protandrous hermaphrodite (Yeung and Chan 1987, Buxton and Garratt 1990, Garratt 1993)
Breeding/spawning season: Jul-Nov in KZN (Wallace 1975b, Whitfield 1998). Connell (2012) recorded peak egg densities from Jun-Oct along the KZN south coast
Breeding/spawning locality: KZN nearshore marine environment, close to large estuaries and river mouths (Wallace 1975b, Whitfield 1998)
Age at 50% maturity: Combined sexes: 1.8 years; KZN; 1987-99. Age at sex change occurs between 1-2.5 years (Radebe et al. 2002)
Length at 50% maturity: Combined sexes: 260mm TL; KZN; 1969-72. Males mature earlier (Wallace 1975b, Garratt 1993)

BIOMETRICS
Maximum recorded age: 16 years; KZN (Rabebe et al. 2002)
Maximum recorded weight: 7.7kg; SA angling record (van der Elst 1993). Note that Heemstra and Heemstra (2004) report a maximum weight of 12kg for this species but this is considered unlikely (B. Mann, ORI, pers. obs.)
Maximum recorded length: 80cm TL (van der Elst 1993, Heemstra and Heemstra 2004)

Length-length relationship: Combined sexes: FL(mm) = 0.8898TL(mm) - 3.0993; KZN (Wallace 1975a)
Length-weight relationship: Combined sexes: Wt(g) = 0.0000179 x $TL(mm)^{2.9729}$; KZN (van der Elst and Adkin 1991)
Growth parameters: Combined sexes: L_∞ = 715mm FL; K = 0.16; t_0 = -0.996; KZN (Radebe et al. 2002)

FISHERY
An important recreational angling fish in SA waters, sought after by recreational shore anglers, estuarine anglers and spearfishermen (van der Elst 1989, Mann et al. 1997a, b, James et al. 2001, Mann et al. 2002). Also caught by subsistence and artisanal fishers in St Lucia and Kosi Bay using fish traps and gill-nets (Kyle 1986, Mann 1995, Kyle 1999). Commercially exploited in trawl and gill-nets elsewhere in the world (Smith and Heemstra 1991, van der Elst 1993)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.13yr^{-1}$ (adults); $0.41yr^{-1}$ (juveniles)
Natural mortality rate (M): $0.33yr^{-1}$
Total mortality rate (Z): $0.46yr^{-1}$ (adults); $0.74yr^{-1}$ (juveniles)
F_{MSY} yr^{-1}: Not calculated
F_{SB40} yr^{-1}: 0.31 (adults)
F_{SB25} yr^{-1}: 0.63 (adults)
$F_{0.1}$ yr^{-1}: 0.75 (adults)
$SBPR_{current}$: 63% (adults); 34% (juveniles)
Year completed: 2004
Locality: KZN coast
References & Comments: Adults and juveniles assessed separately (James et al. 2004)

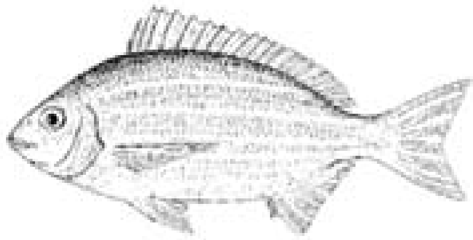
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2004
Locality: KZN coast
Status: 25-40% - overexploited. Adult population in the marine environment along the KZN coast was assessed as being underexploited prior to 2002, while the estuarine juvenile population was assessed as being overexploited (James et al. 2004)
Trend in CPUE: Prior to 2000 significant increases in CPUE were recorded in the competitive shore fishery along the KZN coast, in the St Lucia recreational fishery and in the Kosi Bay gill-net fishery (James et al. 2004). However, following 2000 on-going monitoring has revealed substantial declines in CPUE along the KZN coast (Mann and Pradervand 2007, Pradervand 2007, Dunlop 2011). This decline has been attributed to prevailing drought conditions and the closure of the St Lucia Estuary mouth thus preventing recruitment (Mann and Pradervand 2007). Subsequent on-going monitoring in the St Lucia MPA has not revealed any major change in CPUE of the adult population between 2004-12 (Mann 2012)
Trend in catch composition: Substantial decline in percentage composition of shore anglers catches along the KZN coast between 1994-96 (2.28%) and 2009-10 (0.24%) (Mann et al. 1997a, Dunlop 2011). Decline recorded in the surf-zone of the St Lucia MPA between 2001-05, attributed to closure of St Lucia Estuary mouth (Mann 2012)
Trend in mean size: Increase in mean size recorded in the St Lucia MPA between 2001 and 2005 attributed to lack of recruitment into the adult population because of the closure of St Lucia mouth (Mann and Pradervand 2007, Mann 2012)
Trend in sex ratio: Adult sex ratio (250-450mm FL) close to unity (Garratt 1993) but no data on trends

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 5pppd; Commercial: prohibited
Minimum size limit: 25cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: No-take MPAs including suitable surf-zone habitat in southern MOZ, KZN and northern parts of the EC will provide protection for adults of this species (Mann and Pradervand 2007). Similarly, no-take areas within large estuarine systems in this area will provide protection for juveniles

MANAGEMENT CONSIDERATIONS
Fishing effort is likely to have declined for this species along the SA coast due to the implementation of the beach vehicle ban in 2002 (Mann et al. 2008, Dunlop 2011). Therefore it is likely that degradation and overfishing of estuarine nursery areas along the SA coast, including the prolonged closure (>10 years) of the St Lucia Estuary mouth, have contributed to a decline in biomass of this species. Good catchment management and protection of suitable marine and estuarine habitats is therefore imperative to the future status of this and other estuarine dependent species

RESEARCH REQUIREMENTS
Clarification of taxonomy and genetically distinct populations. On-going monitoring of catch and effort is required along the KZN coast, as well as within important estuaries. Research fishing in the St Lucia MPA has provided an important benchmark for comparison and should be continued, especially since the recent re-connection of the St Lucia and the Umfolozi estuaries in July 2012 (B. Mann, ORI, pers. obs.)
Research priority: Medium



SCIENTIFIC NAME: *Sarpa salpa* (Smith No. 183.39)
COMMON NAMES: Strepie, Karranteen, Sasa
COMPILER: BQ Mann
REVIEWER: SW Dunlop
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Throughout the Mediterranean and parts of the eastern Atlantic around the SA coast to southern MOZ (Fischer and Bianchi 1984, Smith and Heemstra 1991, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Saldanha Bay in WC to Maputo in MOZ (van der Elst 1993, van der Walt 1995)

MOVEMENT: Migratory
Adults migrate from juvenile nursery areas in EC and WC to breed in warmer KZN waters. They remain in the inshore zone (<15m) and there is little evidence of a return migration to the Cape, although some of the largest specimens have been caught in Cape waters (Joubert 1981a, van der Elst 1993, van der Walt and Mann 1998)

HABITAT
Adults: Subtidal gullies and over shallow rocky reefs, largely confined to the surf-zone (Joubert and Hanekom 1980, Joubert 1981a, Berry et al. 1982, Beckley and Buxton 1989, Smale and Buxton 1989, Burger 1990, van der Walt 1995)
Juveniles: Tidal rockpools, sandy littoral, shallow reefs and estuaries in the EC and WC (Christensen 1978, Lasiak 1981, Beckley 1983, 1985, Bennett 1987, Whitfield et al. 1989). Very small juveniles (27-29mm SL) have been recorded at the sea surface about 4km offshore on the KZN south coast during Aug being driven south to juvenile nursery areas by strong NE winds (Connell 2012)
Eggs and larvae: Abundant inshore of the Agulhas Current in depths <50m during winter off Park Rynie on the KZN south coast (Connell 2012). Eggs and larvae are found near the sea surface and are distributed to nursery areas in the EC and WC (Joubert 1981a, van der Walt and Mann 1998)

FEEDING
Adults: Herbivorous feeding mainly on red algae but also occasionally on hydrozoans and bivalve molluscs (Joubert and Hanekom 1980, van der Elst 1993). An abundant and important grazer in the inshore marine environment (Berry et al. 1982)
Juveniles: Juveniles <3cm feed mainly on planktonic organisms such as copepods but with growth they change to become herbivorous with an associated change in dentition (Joubert and Hanekom 1980, van der Elst 1993)

REPRODUCTION
Reproductive style: Protandrous hermaphrodite (van der Walt and Mann 1998) but previously described as a rudimentary hermaphrodite (Joubert 1981a)
Breeding/spawning season: Winter and spring (Apr-Sep), peaking from Jun-Aug in KZN (Joubert 1981a, van der Walt and Mann 1998). Connell (2012) recorded peak numbers of eggs in plankton samples on the KZN south coast from Apr-Aug
Breeding/spawning locality: Over shallow (<15m) subtidal reefs along the KZN coast (Joubert 1981a, van der Walt and Mann 1998, Connell 2012). Some spawning has also been recorded in EC waters (Heemstra and Heemstra 2004)
Age at 50% maturity: Combined sexes: 1.5 years; KZN; 1994-95 (van der Walt and Mann 1998)
Length at 50% maturity: Males: 140-150mm FL; Females: 160-170mm FL; KZN; 1975-77 (Joubert 1981a); Combined sexes: 145mm FL; KZN; 1994-95 (van der Walt and Mann 1998)

BIOMETRICS
Maximum recorded age: 6 years; female; KZN; 1994-95 (van der Walt and Beckley 1997)
Maximum recorded weight: 0.7kg; SA shore angling record (SASAA 2012). Heemstra and Heemstra (2004) report this species reaching a maximum weight of 2kg but this is considered unlikely in SA waters (B. Mann, ORI, pers. obs.)
Maximum recorded length: 30cm TL (van der Elst 1993). Heemstra and Heemstra (2004) report this species reaching a maximum length of 45cm TL but this is considered unlikely in SA waters (B. Mann, ORI, pers. obs.)
Length-length relationship: Combined sexes: FL(mm) = 0.867TL(mm) + 2.31; TL(mm) = 1.149FL(mm) + 1.14; KZN (van der Walt 1995)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00000803 \times FL(mm)^{3.18}$; KZN (van der Walt 1995). Combined sexes: $Wt(g) = 0.018 \times SL(cm)^{3.175}$; juveniles 1.9-26.8cm SL, n=238 (Harrison 2001)
Growth parameters: Combined sexes: L_∞ = 224mm FL; K = 0.55; t_0 = -0.51; KZN (van der Walt and Beckley 1997)

FISHERY

Harvested almost exclusively by shore anglers and subsistence shore fishers throughout its distribution and is the second most important species by number (after elf/shad) caught along the KZN and EC coast (Joubert 1981b, Clarke and Buxton 1989, van der Walt and Govender 1996, Mann et al. 1997a, Brouwer 1997, Brouwer et al. 1997, Mann et al. 2003, Dunlop and Mann 2012). Used for both food and bait (van der Elst 1993)

BIOLOGICAL REFERENCE POINTS

Fishing mortality rate (F): 0.81yr^{-1}
Natural mortality rate (M): 0.6yr^{-1}
Total mortality rate (Z): 1.41yr^{-1}
F_{MSY} yr^{-1}: >2
F_{SB40} yr^{-1}: 1.6
F_{SB25} yr^{-1}: >2
$F_{0.1}$ yr^{-1}: 1.19
$SBPR_{current}$: 60%
Year completed: 1994-95
Locality: KZN
References & Comments: van der Walt and Govender (1996)

STOCK STATUS

Stock assessment method: Per-recruit analyses
Year completed: 1994-95
Locality: KZN
Status: >50% - underexploited (van der Walt and Govender 1996)
Trend in CPUE: Increase between 1975-77 (0.22 fish.angler^{-1}.day^{-1}) and 1994-96 (0.51 fish.angler^{-1}.day^{-1}) but a subsequent decline during 2009-10 (0.34 fish.angler^{-1}.day^{-1}) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). This may be as a result of subtle differences in survey design in the above studies rather than a decrease in abundance (Dunlop 2011). Increase between 1985-86 (8.98g.fisher^{-1}.hr^{-1}) and 1994-96 (13.4g.fisher^{-1}.hr^{-1}) in the EC (Clarke and Buxton 1989, Brouwer 1997). Long-term NMLS monitoring of shore anglers catches in KZN between 1985-2008 revealed a decrease in strepie CPUE over this period from 0.25 fish.angler^{-1} to 0.1 fish.angler^{-1} (NMLS unpubl. data) but this trend is likely to have been at least partly effected by the introduction of a daily bag limit of 10pppd for this species in April 2005
Trend in catch composition: Increase between 1975-77 (20.3%) and 1994-96 (42.9%) but subsequent decline from 2009-10 (34%) in KZN (Joubert 1981b, Mann et al. 1997a, Dunlop 2011). Subtle differences in survey design by these studies may have resulted in the observed changes in percentage composition (Dunlop 2011). Slight increase between 1985-86 (21.5%) and 1994-96 (23.1%) in the EC (Clarke and Buxton 1989, Brouwer 1997). Percentage composition in NMLS shore patrol data from KZN between 1985-2011 has fluctuated between 5-38% (average 18%) and generally reflects the opposite trend to elf/shad catches (van der Walt and Govender 1996, NMLS unpubl. data)
Trend in mean size: No difference in the mean size of fish caught by shore anglers was recorded between 1994-96 and 2009-10 in KZN (Mann et al. 1997a, Dunlop 2011)
Trend in sex ratio: Joubert (1981a) recorded a M:F sex ratio of 1.1:1 in KZN from 1975-77, while van der Walt and Mann (1998) recorded a 1.6:1 M:F sex ratio in KZN from 1994-95

VULNERABILITY RATING

MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS

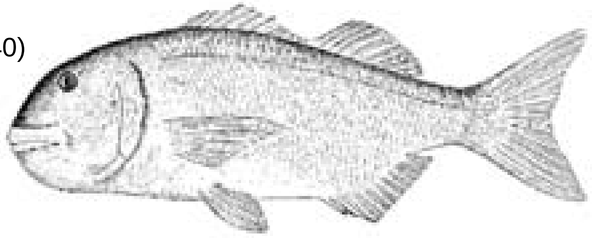
Daily bag limit: Recreational and Subsistence: 10pppd; Commercial: unlimited
Minimum size limit: 15cm TL
Closed Season: None
Other regulations: None
MPA effectiveness: Strepies are found in abundance in MPAs between Durban and Cape Town but the level of protection in these MPAs is not known due to their migratory habit. MPAs in southern KZN and Pondoland are likely to be important for protecting spawning adults (B. Mann, ORI, pers. obs.)

MANAGEMENT CONSIDERATIONS

Strepies are heavily utilized particularly by subsistence linefishers and levels of harvesting should be carefully monitored as they play an important role as grazers in the inshore marine environment

RESEARCH REQUIREMENTS

Migration and movement patterns, early life history and recruitment, on-going catch and effort monitoring
Research priority: Medium



SCIENTIFIC NAME: *Sparodon durbanensis* (Smith No. 183.40)
COMMON NAMES: White musselcracker, Brusher, Cracker, Silver steenbras, Wit biskop
COMPILER: WM Potts
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2012

GLOBAL DISTRIBUTION: Endemic to SA, Cape Point in WC to Thukela River in KZN (Fisher and Bianchi 1984, Smith and Heemstra 1991, Buxton and Clarke 1991). Also recorded from Djibouti (Bouhlel 1988) and from MOZ (Fischer et al. 1990) but there is uncertainty regarding the latter records

SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Main stock assumed to be between southern KZN and False Bay (ORI Tagging Project, unpubl. data)

MOVEMENT: Migratory (adults only)
Early juveniles <150mm resident in the intertidal and shallow inshore zone, juveniles and sub-adults (150mm-550mm FL) resident in the inshore zone, while a proportion of the adult population >600mm FL are thought to undertake a seasonal eastward spawning migration to Transkei and southern KZN (Watt-Pringle 2009)

HABITAT
Adults: High-profile, inshore reefs down to 20m (Buxton and Clarke 1991)
Juveniles: Intertidal rockpools, gullies and shallow <12m subtidal reefs (Christensen 1978, Beckley 1985a, 1985b, 1988, Smale and Buxton 1989, Buxton and Clark 1991, Watt-Pringle 2009)
Eggs and larvae: Pelagic eggs with large oil droplet, pelagic larvae described by Brownell (1979)

FEEDING
Adults: Gastropods, echinoids, chlorophytes, crustaceans and polychaetes (Buxton and Clark 1991)
Juveniles: Gastopods, ascidians, echinoids, amphineurans, pelecypods and paguirids (Buxton and Clark 1991)

REPRODUCTION
Reproductive style: Late gonochorist (sensu rudimentary hermaphrodite), known to aggregate during spawning (Buxton and Clarke 1991)
Breeding/spawning season: Aug-Jan; SE Cape (Buxton and Clarke 1991)
Breeding/spawning locality: Spawning fish recorded in WC, EC and southern KZN (Biden 1948, Buxton and Clarke 1991, B. Mann, ORI, pers. obs.)
Age at 50% maturity: Combined sexes: 5.4 years; SE Cape (Buxton and Clark 1991)
Length at 50% maturity: Combined sexes: 350mm FL; SE Cape (Buxton and Clarke 1991)

BIOMETRICS
Maximum recorded age: 31 years; male; SE Cape; 1989 (Buxton and Clark 1991)
Maximum recorded weight: 22.2kg; 1974; SA spearfishing record (SAUFF 2012)
Maximum recorded length: 1029mm FL; SE Cape; 1989 (Buxton and Clark 1991)
Length-length relationship: Combined sexes: $TL(mm) = 1.127FL(mm)^{0.999}$; $SL(mm) = 0.783FL(mm)^{1.021}$; SE Cape (Buxton and Clark 1991)
Length-weight relationship: Combined sexes: $Wt(g) = 0.000018 \times FL(mm)^{3.037}$; SE Cape (Buxton and Clark 1991)
Growth parameters: Combined sexes: L_∞ = 1021mm FL; K = 0.09; t_0 = 0.709; SE Cape (Buxton and Clark 1991)

FISHERY
Important target species in the recreational shore fishery and spearfishery (Clarke 1988, Mann et al. 1997b). Occasionally captured in the subsistence shore fishery but seldom in the coastal skiboat fishery. The sale of this species is prohibited and it is therefore of no commercial importance

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.13-0.34yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown

$SBPR_{current}$: Unknown
References & Comments: Not assessed. Natural mortality based on a range of estimates using different methods in the Tsitsikamma National Park (Götz et al. 2008)

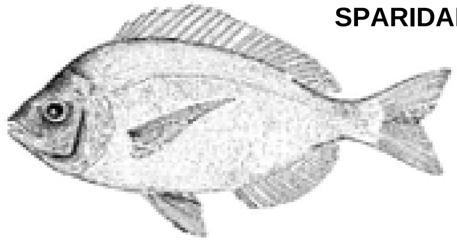
STOCK STATUS
Status: Not assessed, however Griffiths and Lamberth (2002) estimated that *S. durbanensis* stocks had declined to ~20% of their historical values
Trend in CPUE: Abundance, estimated from available CPUE values, is highest on the east coast (KZN) during winter (Jun-Jul) and on the SE Cape coast during spring and summer (Aug-Dec). CPUE has decreased sharply in the Port Elizabeth area from $30.3 g.person^{-1}.hr^{-1}$ in 1985-86 (Clarke and Buxton 1989) to $6 g.person^{-1}.hr^{-1}$ in 1995-96 (Brouwer 1997). Based on NMLS shore patrol data, Pradervand (2007) found a slight increasing trend in CPUE of white musselcracker along the KZN coast between 1985-2006, although this may be due to increased targeting of this species during winter (B. Mann, ORI, pers. obs.)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Trend unknown, adult M:F sex ratio was 1:1.07 in the SE Cape (Buxton and Clarke 1991)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 2pppd; Commercial: prohibited
Minimum size limit: 60cm TL
Closed Season: None
Other regulations: No sale
MPA effectiveness: It is likely that all no-take MPAs with suitable inshore habitat in the EC and WC provide important protection for resident populations of this species

MANAGEMENT CONSIDERATIONS
White musselcracker are an extremely important trophy fish for both the recreational shore fishery and spearfishery. Their limited inshore distribution, large size, slow growth, late maturity, longevity and aggregation during spawning events make this species extremely susceptible to overfishing. A conservative management strategy should be considered which could include a maximum size limit and a closed season

RESEARCH REQUIREMENTS
As with many linefish, accurate catch and effort monitoring is required to determine the population trends for this species. Such trends are considered essential for the monitoring the status of this species as a per-recruit stock assessment will be difficult due to the unpredictability of catches. Population genetics information is required to determine whether white musselcracker consist of one mixed population. Adult spawning grounds should be identified possibly using coastal egg and larval surveys. This information could be supplemented with additional information on the adult migration patterns, possibly through the use of acoustic telemetry
Research priority: Medium



SCIENTIFIC NAME: *Spondyliosoma emarginatum* (Smith No. 183.41)
COMMON NAMES: Steentjie
COMPILER: KL Tunley
REVIEWER: CG Attwood
DATE OF REPORT COMPLETION: March 2012

GLOBAL DISTRIBUTION: Endemic, Saldanha Bay to KZN, may also be found off the coast of Madagascar (Smith and Heemstra 1991)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN
Catch survey data compiled by Attwood (see Solano-Fernandez et al. 2012 for a full description of the data sources) shows that this species is limited to the coast off three provinces only

MOVEMENT: Unknown
The nest building behaviour and benthic eggs suggest territorial and resident behaviour (Tunley et al. 2009). There are no seasonal patterns in catch data to suggest that they are migratory. The species is too small to tag with conventional dart tags

HABITAT
Adults: Shallow reefs along the South and East Cape coasts, down to 50m depth (van der Elst and Adkin 1991). An isolated population in Langebaan Lagoon (Saldanha Bay) frequents channels with sandy bottoms in <10m depth (Fairhurst et al. 2007)
Juveniles: Shallow subtidal reefs, sometimes entering estuaries (van Bruggen 1965, Beckley 1983,1984, Whitfield et al. 1989)
Eggs and larvae: Eggs are benthic, deposited in a nest created by the male. Larvae widely distributed inshore in the EC and WC, larvae recorded entering estuaries (van Bruggen 1965, Penrith 1972, Beckley 1985, 1989, Tilney and Buxton 1994)

FEEDING
Adults: Omnivorous. Feed on a variety of invertebrates (especially crustaceans) and algae (Fairhurst et al. 2007). There is a shift towards carnivory with size
Juveniles: Fry feed on zooplankton (Whitfield 1985) but become omnivorous

REPRODUCTION
Reproductive style: Protogynous hermaphrodite (Fairhurst et al. 2007). Demersal nest builders and guarders (van Bruggen 1965)
Breeding/spawning season: Jul-Oct in the WC (Fairhurst et al. 2007)
Breeding/spawning locality: Recorded in EC and WC (van der Elst 1988) but likely to occur throughout range
Age at 50% maturity: Females: 3 years; Saldanha Bay; 2005 (Fairhurst et al. 2007)
Length at 50% maturity: Females: 235mm FL; Males: 249mm FL; Saldanha Bay; 2005 (Fairhurst et al. 2007)

BIOMETRICS
Maximum recorded age: 9 years; male; Saldanha Bay; 2006 (Tunley et al. 2009)
Maximum recorded weight: 714g; male; Saldanha Bay; 2004. This was the heaviest specimen recorded at Saldanha Bay in a sample of 538 fish spanning 8 years (C. Attwood, UCT, unpubl. data). The fish from the Cape south coast do not grow as large (Tunley et al. 2009)
Maximum recorded length: 346mm TL; male; Saldanha Bay; 2004. This was the largest specimen recorded at Saldanha Bay in a sample of 538 fish spanning 8 years (C. Attwood, UCT, unpubl. data). The fish from the Cape south coast do not grow as large (Tunley et al. 2009)
Length-length relationship: Combined sexes: TL(mm) = 1.091FL(mm) + 3.633; Saldanha Bay (Fairhurst et al. 2007)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00003 \times FL(mm)^{2.9625}$; Saldanha Bay (Fairhurst et al. 2007). Combined sexes: $Wt(g) = 0.000013 \times FL(mm)^{3.105}$; Saldanha Bay and Struisbaai (Tunley et al. 2009)
Growth parameters: Females: L_∞ = 289.15mm FL; K = 0.22; t_0 = -3.82; Males: L_∞ = 289.15mm FL; K = 1.26; t_0 = -3.82; Saldanha Bay (Fairhurst et al. 2007). This model includes a procedure to account for growth acceleration after sex change in males

FISHERY
Steentjies are not a preferred target of either the line or trawl fisheries, as they are generally too small to market. However, linefishers do retain steentjies usually for own consumption or in the absence of catches of more profitable species. Often used for bait. They are seldom taken from the shore

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed
Trend in CPUE: No CPUE trends can be detected as this species is relatively unimportant in the linefishery and the CPUE data are unreliable. At Saldanha Bay there is a time-series of survey CPUE, but this is too short to detect trends
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Sex ratio differences have been detected between Saldanha Bay and Struisbaai (Tunley et al. 2009), but no temporal trends are available. Generally sex-ratios were skewed towards more females in exploited areas compared to the no-take reserve in Langebaan (Tunley et al. 2009)

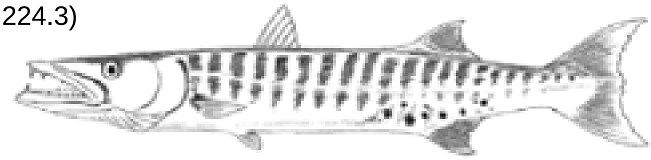
VULNERABILITY RATING
MLRA: Commercially exploitable species
IUCN Red List: Global IUCN Red List assessment conducted in Dec 2009, results awaiting review and publication

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence 10pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: Steentjies receive protection in a number of MPAs along the south EC and WC where fishing is prohibited including De Hoop (DAFF, unpubl. data), Goukamma (Götz et al. 2009), Langebaan (Tunley et al. 2009), Pondoland (Mann et al. 2006), Stilbaai (L. de Vos, UCT, unpubl. data) and Tsitsikamma (Wood et al. 2000)

MANAGEMENT CONSIDERATIONS
This species is likely to be under-exploited across most of its range. It has probably been released from predation to a large extent, with the depletion of larger species of reef-fish and sharks

RESEARCH REQUIREMENTS
The nest-building habit and early life history requires further study
Research priority: Low

SCIENTIFIC NAME: *Sphyraena barracuda* (Smith No. 224.3)
COMMON NAMES: Great barracuda
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013



GLOBAL DISTRIBUTION: Tropical and subtropical Indo-Pacific: Red Sea and east coast of Africa across to Hawaii and the Marquesan and Tuamoto islands, also in western and eastern Atlantic (Froese and Pauly 2012), but not in eastern Pacific (de Sylva and Williams 2003, Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Mainly from KZN northwards (van der Elst 1993, de Sylva and Williams 2003) but occasional specimens may be found as far south as Port Alfred (Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Evidence of nomadism in the Bahamas (O'Toole et al. 2011), but 21 recaptures reported in SA waters indicate residency in young fish, especially within the Kosi Bay estuarine lake system (ORI Tagging Project unpubl. data)

HABITAT
Adults: Mainly over coral reefs and seagrass beds (van der Elst 1993, Heemstra and Heemstra 2004), down to at least 100m (Rose et al. 1984)
Juveniles: Tropical mangrove areas and estuaries (van der Elst 1993). In the Kosi estuarine lake system, fry enter from the sea at a length of 20mm and live in reed beds until reaching a length of 300mm, when they move into open water within the estuary, all within a salinity range of 4-35‰ (Blaber 1982). Whitfield (1998) classified *S. barracuda* as a marine species with juveniles that occur mainly in estuaries, but are also found at sea
Eggs and larvae: Offshore, pelagic (van der Elst 1993)

FEEDING
Adults: Piscivorous feeding on species such as needlefish, halfbeaks, puffers, kingfish and mullet (Blaber 1982, Heemstra and Heemstra 2004)
Juveniles: Piscivorous feeding on small mullet, clupeids, pursemouths, gobies and sparids (Blaber 1982, Heemstra and Heemstra 2004)

REPRODUCTION
Reproductive style: Gonochoristic, broadcast spawner (Thresher 1984)
Breeding/spawning season: Summer (van der Elst 1993, Heemstra and Heemstra 2004)
Breeding/spawning locality: Spawning reported from tropical waters of East Africa and the Seychelles (van der Elst 1993)
Age at 50% maturity: Males: 2 years; Females: 3 years (Heemstra and Heemstra 2004)
Length at 50% maturity: Males: 55cm FL; Females: 70cm FL (Heemstra and Heemstra 2004)

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 38.6kg; Christmas Island, Kiribati; 1992; World angling record (IGFA 2012)
Maximum recorded length: 180cm FL (Rose et al. 1984)
Length-length relationship: FL(cm) = 0.886TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.0192 \times FL(cm)^{2.84}$; SA (Torres 1991a), based on graphs in van der Elst (1988)
Growth parameters: L_∞ = 134cm FL; K = 0.17; t_0 = 1.437; SA (Torres 1991b), based on graphs in van der Elst (1988)

FISHERY
Juveniles caught frequently in the fish traps and illegal gill-nets in the Kosi estuarine lake system (R. Kyle, EKZNW, pers. comm.). Larger individuals caught on live bait and lures from ski-boats, and sometimes by spearfishers. Also occasionally taken by shore anglers (van der Elst 1993). In KZN, greater barracuda are mainly caught in the north of the province

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown

F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

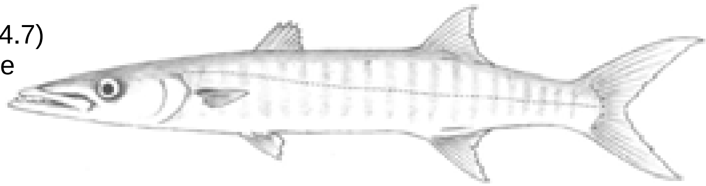
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown
Trend in catch composition: In a study on SA estuarine fisheries, Lamberth and Turpie (2003) reported that *S. barracuda* contributed <0.01% to the catch composition. This study excluded traditional trap fisheries. *S. barracuda* probably contributes a small proportion to the artisanal trap fishery in the Kosi estuarine lake system, but difficulty in identification has resulted in *S. barracuda* catches being grouped with other sphyraenids (Kyle 1986)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercials: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: *S. barracuda* may not be caught in the sanctuary areas of the Maputaland and St Lucia Marine Reserves, as well as in Lake Amanzimnyama - a small area within the Kosi estuarine lake system

MANAGEMENT CONSIDERATIONS
The Kosi estuarine lake system is an important nursery area for this species (Blaber 1982). Catches by trap fishers may be imposing a high fishing mortality on juveniles. Lamberth and Turpie (2003) reported *S. barracuda* as being vulnerable and better protection of this species may be required in SA waters

RESEARCH REQUIREMENTS
Fishery trends, particularly within the Kosi estuarine lake system, age and growth, movement patterns
Research priority: Low



SCIENTIFIC NAME: *Sphyraena jello* (Smith No. 224.7)
COMMON NAMES: Pickhandle barracuda, Sea pike
COMPILER: JQ Maggs
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Indo-West Pacific: Red Sea south to the south eastern coast of SA and east to New Caledonia and Vanuatu (Goren and Dor 1994). Recently reported from Tonga (Randall et al. 2004). Due to widespread confusion with *Sphyraena putnamae* and *Sphyraena qenie*, the exact range is uncertain (de Sylva and Williams 2003)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common in KZN, reaching as far south as Knysna in the WC (de Sylva and Williams 2003, Heemstra and Heemstra 2004)

MOVEMENT: Unknown
Of the 48 recaptures (20.4%) reported to date the mean distance moved is only 1km, although some fish moved up to 44km (ORI Tagging Project, unpubl. data). van der Elst (1993) refers to migrating shoals of *S. jello*, and Riede (2004) classifies this species as oceanodromous

HABITAT
Adults: Over coral and rocky reefs but also in bays, estuaries and turbid inner lagoons (van der Elst 1993, Weerts and Cyrus 1998, Senou 2001, Everett and Fennessy 2007)
Juveniles: Whitfield (1998) classified *S. jello* as a species where juveniles occur in estuaries but are more abundant at sea
Eggs and larvae: Pelagic eggs recorded near the surface but mainly further offshore on the KZN south coast (Connell 2012)

FEEDING
Adults: Feeds mainly on small fish and squid (Rose et al. 1984)
Juveniles: Unknown but probably similar to adults

REPRODUCTION
Reproductive style: Unknown
Breeding/spawning season: Peak spawning recorded during summer (Dec-Feb) on the KZN south coast (Connell 2012)
Breeding/spawning locality: Eggs collected mainly in deeper water off the KZN south coast suggesting that spawning occurs at depths >50m (Connell 2012)
Age at 50% maturity: Unknown
Length at 50% maturity: Unknown

BIOMETRICS
Maximum recorded age: Unknown
Maximum recorded weight: 24.2kg; SA shore angling record (SASAA 2012). However, there may be some uncertainty with this record as the World angling record is only 15kg (IGFA 2012)
Maximum recorded length: 150cm FL (Rose et al. 1984)
Length-length relationship: TL(cm) = 1.112FL(cm); SL(cm) = 0.945FL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: $Wt(g) = 0.014 \times FL(cm)^{2.81}$; SA (Torres 1991a); based on graphs from van der Elst (1988). Combined sexes: $Wt(g) = 0.0108 \times SL(cm)^{2.884}$; juveniles in SA estuaries (Harrison 2001)
Growth parameters: L_∞ = 148cm FL; K = 0.1; t_0 = 0.01; Gulf of Aden, Yemen (Edwards et al. 1985)

FISHERY
Spearfishers sometimes shoot a number of these fish when shoals are encountered, also caught from recreational boats at sea and in estuaries and harbours by shore and boat anglers (van der Elst 1993, Everett and Fennessy 2007). Also taken in fish traps in the Kosi estuarine lake system (Kyle 1986)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown

F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

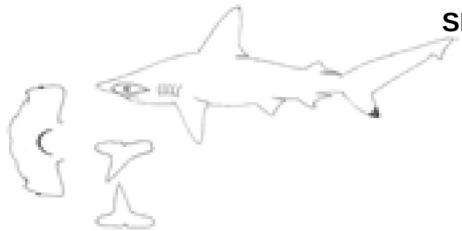
STOCK STATUS
Status: Not assessed
Trend in CPUE: Lloyd et al. (2012) reported no significant change in the CPUE of *S. jello* speared by a single competitive spearfisher along the KZN coast between 1989-97 and 2002-07
Trend in catch composition: No appreciable change in contribution of *S. jello* to catch composition recorded by a single competitive spearfisher between 1989-97 and 2002-07 along the KZN coast (Lloyd et al. 2012). Lamberth and Turpie (2003) reported that *S. jello* contributed <0.01% to the catch composition. This study excluded traditional trap fisheries
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Not assessed

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 10pppd (as part of the total daily bag limit for unlisted species); Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: None
MPA effectiveness: *S. jello* may receive some protection within no-take zones of MPAs situated along the KZN and EC coasts

MANAGEMENT CONSIDERATIONS
Previous confusion of *S. jello* with *S. putnamae* and *S. qenie* has resulted in uncertainty regarding reported catch composition and trends as well as distribution. Lamberth and Turpie (2003) reported *S. jello* as being vulnerable and it may thus require greater protection in SA waters

RESEARCH REQUIREMENTS
Age and growth, stock assessment, movement patterns, fishery trends, early life history, reproduction
Research priority: Low



SCIENTIFIC NAME: *Sphyrna lewini* (Smith No. 13.1)
COMMON NAMES: Scalloped hammerhead
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Circumglobal distribution in coastal warm temperate and tropical seas (De Bruyn et al. 2005, Baum et al. 2007)
SOUTHERN AFRICAN DISTRIBUTION: EC, KZN, MOZ
Recorded from northern MOZ to the northern region of the EC (Bass et al. 1975, De Bruyn et al. 2005)

MOVEMENT: Migratory
Only 13 recaptures (1.81%) out of 717 tagged with a mean distance travelled of 157km (ORI Tagging Project unpubl. data). These results suggest large-scale migrations within SA waters, probably in response to seasonal sea surface temperature changes (Diemer et al. 2011). Horizontal migration is observed from inshore bays to a more pelagic habitat as the sharks grow (Baum et al. 2007). This species segregates by sex, with females migrating offshore earlier and at smaller sizes than males (Baum et al. 2007)

HABITAT
Adults: Adults are found mainly over the continental shelf, ranging from the surf-zone and near the surface, to far offshore and to depths of at least 275m (Baum et al. 2007)
Juveniles: Generally sheltered coastal zones, often near the bottom, occurring at high concentrations during summer in large open estuaries and bays (Baum et al. 2007). In SA most juveniles have been recorded on the Thukela Banks and in coastal waters off the former Transkei (De Bruyn et al. 2005, Diemer et al. 2011)

FEEDING
Adults: Dominated by teleosts, but other elasmobranchs and cephalopods supplement their diet (De Bruyn et al. 2005). Crustaceans, birds and gastropods have also been recorded in a few specimens (De Bruyn et al. 2005)
Juveniles: Juveniles (<130cm PCL) seem to have a more varied diet with fewer elasmobranchs being consumed (De Bruyn et al. 2005)

REPRODUCTION
Reproductive style: Viviparous with a yolk-sac placenta (Baum et al. 2007)
Breeding/spawning season: The gestation period is around 9-12 months, with pupping in spring and summer (Oct-Mar) (De Bruyn et al. 2005, Baum et al. 2007)
Breeding/spawning locality: Thukela Bank in northern KZN and other similar shallow nursery areas (De Bruyn et al. 2005, Baum et al. 2007). Certain coastal locations in the Transkei (northern EC) are of importance to juvenile and subadult scalloped hammerhead populations year-round (Diemer et al. 2011)
Age at 50% maturity: Males: 4.3 years; Females: 5.8 years; Mexican Pacific (Anislado-Tolentino and Robinson-Mendoza 2001)
Length at 50% maturity: Males: 161.5cm PCL; Females: 183.1cm PCL; KZN; 1978-98 (De Bruyn et al. 2005)

BIOMETRICS
Maximum recorded age: 35 years; Pacific Ocean (Smith et al. 1998). Oldest *S. lewini* sampled in KZN waters was 30 years (Dudley and Simpfendorfer 2006)
Maximum recorded weight: 268kg; female; KZN (De Bruyn et al. 2005)
Maximum recorded length: 430cm TL Smith (1997). Largest *S. lewini* recorded in KZN waters was a female of 243cm PCL (De Bruyn et al. 2005)
Length-length relationship: Combined sexes: FL(cm) = 1.07PCL(cm) + 2.27; TL(cm) = 1.314PCL(cm) + 3.816; KZN, n=722 (De Bruyn et al. 2005). Combined sexes: TL(cm) = 1.3FL(cm) + 1.28; N Australia (Stevens and Lyle 1989)
Length-weight relationship: Males: Wt(kg) = 0.00001 x PCL(cm)$^{2.98}$; n=1268; Females: Wt(kg) = 0.000008 x PCL(cm)$^{3.1}$; n=353; KZN (De Bruyn et al. 2005). Combined sexes: Wt(g) = 0.0048FL(cm)$^{3.07}$; geometric mean based on 6 studies (Froese and Pauly 2012)
Growth parameters: Combined sexes: L_∞ = 329cm TL; K = 0.073; t_0 = -2.2; NW Gulf of Mexico (Branstetter 1987). Males: L_∞ = 321cm TL; K = 0.222; t_0 = -0.746; Females: L_∞ = 320cm TL; K = 0.249; t_0 = -0.413; NE Taiwan (Chen et al. 1990)

FISHERY
Commonly caught as a bycatch by recreational shore anglers (Dunlop and Mann 2012), forms an important component of the competitive shore fishery in KZN and the former Transkei (Pradervand 2004, Pradervand et al. 2007), but most are released. Occasionally caught offshore by commercial and recreational skiboat anglers (S. Dunlop, ORI, pers. obs.) and also in estuarine embayments (Everett and Fennessy 2007). Comprises a

large percentage (21%) of the elasmobranch bycatch taken by inshore prawn trawls off the Thukela Bank during summer (Fennessy 1994). However, due to an extended closed trawl season between Aug-Feb and diminishing inshore prawn catches (Olbers and Fennessy 2007), the impact of the inshore prawn trawl fishery has diminished. Third most numerous shark caught (~166.year^{-1}) in bather protection nets off certain KZN beaches (De Bruyn et al. 2005). Both artisanal fisheries operating inshore and foreign vessels offshore (longliners) off MOZ target *S. lewini* for its flesh and fins (De Bruyn et al. 2005, Dudley and Simpfendorfer 2006). A small percentage (<0.6%) of *S. lewini* are caught as bycatch in the tuna and swordfish longline fishery off SA (Petersen et al. 2009)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

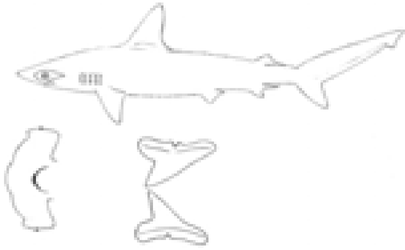
STOCK STATUS
Status: Not assessed in SA waters
Trend in CPUE: CPUE in protective gill-nets (shark nets) declined significantly from approximately 5.5/km of net.yr^{-1} in 1978 to 2/km of net.yr^{-1} in 2003 (Dudley and Simpfendorfer 2006). These data indicate a decline of approximately 64% over a 25 year period. Dudley and Simpfendorfer (2006) also reported large catches of newborn *S. lewini* being taken by prawn trawlers operating on the Thukela Bank, KZN, ranging from an estimated 3 288 in 1989 to 1 742 in 1992, with almost 98% mortality (Fennessy 1994)
Trend in catch composition: Unknown but has probably decreased as with CPUE
Trend in mean size: No change in the mean size of females caught in the KZN protective gill-nets (shark nets) between 1978 and 2003 (Dudley and Simpfendorfer 2006). Contrastingly, there was a significant increase in the mean size of males captured in the KZN protective gill-nets (shark nets) for the same period (Dudley and Simpfendorfer 2006)
Trend in sex ratio: Records of catches from the protective gill-nets (shark nets) off KZN between 1978-2003 indicate males dominate catches (2.3:1 M:F) (De Bruyn et al. 2005). Sexual segregation is well documented for this species (Baum et al. 2007). Females tend to move offshore at an early age (De Bruyn et al. 2005, Baum et al. 2007)

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Endangered; 2007 (Baum et al. 2007)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch by recreational anglers
MPA effectiveness: Due to the migratory behaviour of this species MPA protection is probably minimal. However, some protection may be provided to juveniles in the St Lucia and Pondoland MPAs (Maggs 2011, Diemer et al. 2011, Mann 2012)

MANAGEMENT CONSIDERATIONS
Due to the decreasing catch trends in SA, a stock assessment is urgently needed. Furthermore, since the flesh and particularly the fins are highly sought after in Asian fish markets and the fact that the life history of this species makes it vulnerable to overexploitation, urgent management interventions are needed (i.e. possible decommercialisation) (Baum et al. 2007). Precautionary collaborative management of target and bycatch fisheries is also needed for this highly migratory species (Baum et al. 2007), especially since it shows potential migration into MOZ waters. Establishment of a large MPA on the Thukela Banks may help to protect juveniles in an important nursery area

RESEARCH REQUIREMENTS
This species is vulnerable to overfishing and has declined alarmingly elsewhere (Baum et al. 2007). For this reason more research is needed to determine reproductive biology; age and growth; CPUE and catch composition; stock distribution, residency and migration; stock assessment; early life history; juvenile nursery areas; and taxonomy in SA waters
Research priority: High



SCIENTIFIC NAME: *Sphyrna zygaena* (Smith No. 13.3)
COMMON NAMES: Smooth hammerhead
COMPILER: SW Dunlop
REVIEWER: BQ Mann
DATE OF REPORT COMPLETION: March 2013

GLOBAL DISTRIBUTION: Widespread in temperate and tropical seas, with a wider range than other members of its family (Compagno et al. 1989, Casper et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: WC, EC, KZN, MOZ
Common off the WC and EC coasts from St Helena Bay to southern MOZ (Compagno et al. 1989, Heemstra and Heemstra 2004). However, less abundant off northern KZN and southern MOZ (Bass et al. 1975, Smith and Heemstra 1991)

MOVEMENT: Migratory
Only 20 recaptures (1.45%) out of 1 375 tagged with a mean distance travelled of 142km (ORI Tagging Project unpubl. data). Adults uncommon inshore and juveniles appear to move further offshore with increasing size (Bass et al. 1975). These results suggest large-scale migrations within SA waters, probably in response to seasonal sea surface temperature changes and other varying oceanographic conditions (Smale 1991, Diemer et al. 2011)

HABITAT
Adults: Coastal-pelagic and semi-oceanic. Mainly occurs on the continental shelf but generally further offshore to 200m depth (Ebert 2003). Smale (1991) reported that large individuals were commonly found over deep reefs on the edge of the continental shelf in the EC
Juveniles: Generally over sandy substrates in shallow, coastal waters (Casper et al. 2005). Large schools of juvenile *S. zygaena* near the surface close to land have often been reported off the EC coast (Bass et al. 1975)

FEEDING
Adults: Dominated by inshore squid (mostly *Loligo v. reynaudii*), with teleosts such as hake, horse mackerel and ribbonfish also important (Smale 1991). Crustaceans and elasmobranchs have also been reported from stomach analyses (Bass et al. 1975, Dudley and Cliff 1993)
Juveniles: Juveniles (<200cm PCL) feed mainly on squid and teleosts (Smale 1991)

REPRODUCTION
Reproductive style: Viviparous, 29-50 pups per litter, gestation 10-11 months, born at 50-60cm (Heemstra and Heemstra 2004)
Breeding/spawning season: Little known in SA waters, pupping thought to be mainly in summer (Oct-Mar) due to the increased catches over this period (Bass et al. 1975, van der Elst 1993)
Breeding/spawning locality: Not known with certainty in SA waters. However, Bass et al. (1975) reported a female specimen that appeared to have recently mated in Feb off central KZN and another female from the EC caught in Nov that contained full-term embryos. Large schools of juvenile *S. zygaena* have often been reported off the EC coast (Bass et al. 1975, Smale 1991) so it is likely that pupping occurs in this region
Age at 50% maturity: Unknown
Length at 50% maturity: Males: 250-260cm TL; Females: 265mm TL; east coast of Australia (Stevens 1984)

BIOMETRICS
Maximum recorded age: Maximum age not yet determined, thought to be 20 years or older (Casper et al. 2005)
Maximum recorded weight: 167.6kg; New Zealand; 2002; World angling record (IGFA 2012). Maximum published weight is 400kg (Frimodt 1995) but this is doubtful
Maximum recorded length: 400cm TL (Compagno et al. 1989). Maximum published length is 500cm TL (Muus and Nielsen 1999) but this is doubtful
Length-length relationship: FL(cm) = 0.8TL(cm); PCL(cm) = 0.892FL(cm); PCL(cm) = 0.713TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: Wt(kg) = 0.00142 x $TL(cm)^{3.3}$; SA (Torres 1991a), based on graphs from van der Elst (1988)
Growth parameters: Combined sexes: L_∞ = 362.25cm TL; K = 0.23; India, n=200; estimates made using ELEFAN 1 (Manjusha et al. 2011)

FISHERY
Commonly caught in the competitive shore fishery (Pradervand and Govender 2003, Pradervand 2004, Pradervand et al. 2007), but most are released. Occasionally caught as bycatch by inshore commercial and

recreational skiboat anglers (Brouwer and Buxton 2002). A number of individuals (74.8 yr^{-1}) are caught in the protective gill-nets (shark nets) off certain KZN beaches (Dudley and Simpfendorfer 2006). A small percentage are caught as bycatch (<0.6%) in the tuna and swordfish longline fishery (Petersen et al. 2009), while less than 3% of the catch in the shark directed longline fishery is made up *S. zygaena* (Basson et al. 2007)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Not assessed

STOCK STATUS
Status: Not assessed in SA waters
Trend in CPUE: CPUE from the KZN bather protective gill-nets (shark nets) between 1978-2003 showed no significant changes in the number taken/km of net.yr^{-1}, with an average of 74.8 caught each year (Dudley and Simpfendorfer 2006). Pradervand (2004) showed a decreasing trend in CPUE for *Sphyrna* spp. (both *S. zygaena* and *S. lewini*) between 1977-2000 in competitive shore angling catches from the Transkei
Trend in catch composition: Pradervand (2004) showed a decreasing trend in percentage catch composition for *Sphyrna* spp. (both *S. zygaena* and *S. lewini*) between 1977-2000 in competitive shore angling catches from the Transkei
Trend in mean size: No significant changes in the mean sizes of males and females caught in the KZN protective gill-nets (shark nets) between 1978-2003 (Dudley and Simpfendorfer 2006)
Trend in sex ratio: Unknown

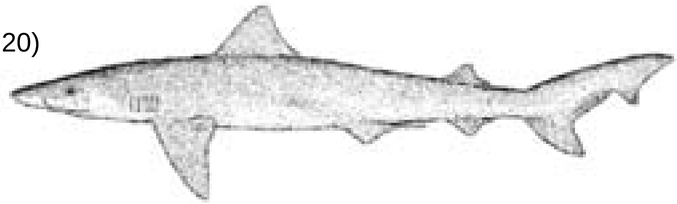
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2005 (Casper et al. 2005)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Sharks must be landed whole, although they may be headed or gutted. No sale of catch by recreational anglers
MPA effectiveness: Due to the migratory behaviour of this species MPA protection is likely to be minimal. However, some protection may be offered to juveniles within large no-take MPAs along the EC and WC coast (Diemer et al. 2011, Maggs 2011)

MANAGEMENT CONSIDERATIONS
A recent review of fisheries in the Indian Ocean (Young et al. 2006) reported that sharks in this region are considered fully to over exploited. Large numbers of longline vessels have also been reported to be operating illegally in coastal waters of the western Indian Ocean, primarily targeting hammerhead sharks and giant guitarfish (Dudley and Simpfendorfer 2006). Limited catch data available on *S. zygaena* in SA suggests that stocks may be declining and a stock assessment is advised, particularly since the flesh and fins are highly sought after in Asian fish markets and the fact that the life history of this species makes it vulnerable to overexploitation

RESEARCH REQUIREMENTS
This species is considered to be vulnerable to overfishing and therefore requires detailed research to determine reproductive biology; age and growth; CPUE, catch composition and bycatch rates; stock distribution, residency and migration; stock assessment; early life history; juvenile nursery areas; and taxonomy
Research priority: Medium

SCIENTIFIC NAME: *Galeorhinus galeus* (Smith No. 9.20)
COMMON NAMES: Soupfin shark, Tope, Vaalhaai
COMPILER: C da Silva
REVIEWER: ME McCord
DATE OF REPORT COMPLETION: October 2012



GLOBAL DISTRIBUTION: Globally distributed in temperate waters (Compagno et al. 1989, 2005)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
In SA waters occurs from East London to at least northern NAM (Compagno et al. 1989, Heemstra and Heemstra 2004)

MOVEMENT: Migratory
Seasonal variation in sex ratio is observed in commercial catches, indicating possible seasonal migration in the SA population (Freer 1992). Migration has been shown to occur in the Australian population (Compagno 1984). Population analysis indicates a degree of mixing between Australian and SA stocks, suggesting the species may be highly migratory (Walker 1999). Tagging studies indicate migrations of up to 2500km (Heemstra and Heemstra 2004)

HABITAT
Adults: Benthic species, most abundant in cold to warm temperate continental seas, from the surf-zone to offshore shelf waters. Have been found in depths ranging from 2-470m (Compagno et al. 2005)
Juveniles: Benthic, distributed from shallow bays to over the continental shelf (Kroese and Sauer 2000)

FEEDING
Adults: Piscivorous, including demersal and pelagic species (Cox and Francis 1997) but also feeds on crustaceans, cephalopods, worms and echinoderms (Compagno 1984, Heemstra and Heemstra 2004)
Juveniles: Unknown

REPRODUCTION
Reproductive style: Ovoviviparous, without yolk sac placenta. Litter size 2-52 (Compagno 1984)
Breeding/spawning season: Pupping season in austral spring (Kroese and Sauer 2000)
Breeding/spawning locality: Pups found in shallow marine bays (Kroese and Sauer 2000); anecdotal evidence from fishermen suggests that coastal bays along the S Cape coast such as Gansbaai, Walker Bay and False Bay may act as important pupping and nursery areas for the species (Freer 1992, McCord 2005)
Age at 50% maturity: Combined sexes: 6.04 years; SA (McCord 2005)
Length at 50% maturity: Combined sexes: 1100mm TL; SA (McCord 2005)

BIOMETRICS
Maximum recorded age: 33 years; SA. Due to a small sample size, this is likely an underestimate of maximum age (McCord, 2005). Maximum age has been recorded as up to 70 years in Australia (Walker 1997)
Maximum recorded weight: 33kg; New Zealand; IGFA all-tackle record (Heemstra and Heemstra 2004)
Maximum recorded length: 1734mm TL; female; SA (Freer 1992). Heemstra and Heemstra (2004) reported a maximum length of 190cm TL
Length-length relationship: FL(cm) = 0.822TL(cm); based on photo measurement (Froese and Pauly 2012)
Length-weight relationship: Combined sexes: $Wt(g) = 0.0109 \times TL(cm)^{2.83}$; SA (Torres 1991a). Combined sexes: $Wt(g) = 0.0061 \times FL(cm)^{2.04}$; New Zealand (Annala 1994)
Growth parameters: Combined sexes: L_∞ = 1560.27mm TL; K = 0.19; t_0 = -3.03; SA (McCord 2005)

FISHERY
Targeted by recreational anglers, commercial handline fishers, demersal shark longline fisheries and caught as a bycatch in inshore trawls (Kroese and Sauer 1998, McCord 2005). In the absence of high value teleosts, soupfin sharks are caught primarily for the "flake" fillet industry which is exported to Australia. High market value up to a certain size. Fins exported to Asian markets, but are relatively low in value (da Silva and Burgener 2007). Soupfin sharks used to be a major component of the Gansbaai fishery which has now collapsed (Davis 1964)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): $0.14yr^{-1}$
Natural mortality rate (M): $0.11yr^{-1}$
Total mortality rate (Z): $0.27yr^{-1}$
F_{MSY} yr^{-1}: 0.14
F_{SB40} yr^{-1}: 0.16-0.19

F_{SB25} yr^{-1}: 0.27-0.32
$F_{0.1}$ yr^{-1}: 0.21-0.29
$SBPR_{current}$: 43%
Year completed: 2005
Locality: SA
References & Comments: McCord (2005)

STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2005
Locality: SA
Status: 40-50% - optimally exploited. Although it is apparent from this stock assessment that the SA population is being optimally exploited, any further increase in fishing effort will likely result in a decline in the stock (McCord 2005)
Trend in CPUE: Reported catches show an increasing trend, however, this is difficult to interpret due to poor species identification and the large proportion of similar looking smoothhound sharks which are caught as a bycatch (DAFF unpubl. data)
Trend in catch composition: Increasing trend (DAFF unpubl. data)
Trend in mean size: Anecdotal evidence from photographs taken during the peak of the Gansbaai soupfin shark fishery in the 1960s suggest a decrease in mean size (C. da Silva, DAFF, pers. obs.)
Trend in sex ratio: M:F sex ratio 1:1.09 in pups, adult sex ratio unknown (Freer 1992)

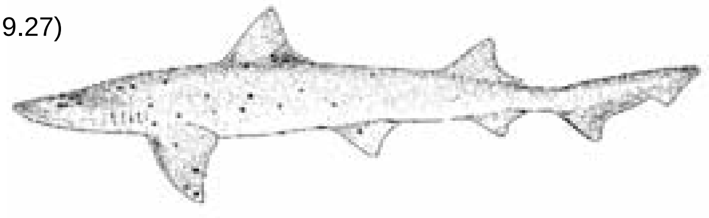
VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2006 (Walker et al. 2006)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Demersal shark longline is managed under a TAE of 6 vessels (DAFF, unpubl. data)
MPA effectiveness: Current MPA network unlikely to protect adults because of their high mobility and occurrence offshore. However, anecdotal evidence suggests that protected bays within existing MPAs such as Tsitsikamma, Stilbaai and De Hoop may provide some protection for pups and gravid females (M. McCord, SA Shark Conservancy, pers. obs.)

MANAGEMENT CONSIDERATIONS
Long generation time and late age at maturity indicate that soupfin sharks are highly susceptible to overfishing. This was confirmed by the collapse of the Gansbaai fishery in the 1960s. Maximum size restrictions are recommended to limit the targeting of larger, more fecund sharks. Area closures and offshore MPAs are also strongly advocated

RESEARCH REQUIREMENTS
Determine migration and movement patterns of soupfin sharks, establish fishery-independent biomass indices for future stock assessments, determine habitat use by juveniles and adults, locate pupping areas and juvenile nursery areas
Research priority: High

SCIENTIFIC NAME: *Mustelus mustelus* (Smith No. 9.27)
COMMON NAMES: Blackspotted smoothhound, Common smoothhound, Gummy shark, Spierhaai
COMPILER: C da Silva
REVIEWER: ME McCord
DATE OF REPORT COMPLETION: October 2012



GLOBAL DISTRIBUTION: Mediterranean, Eastern Atlantic and South-West Indian Ocean (Compagno et al. 2005)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN
Found along the entire SA coast south of Durban to NAM (Compagno et al. 1989, Heemstra and Heemstra 2004)

MOVEMENT: Resident
Adults migrate inshore to sheltered bays such as Saldanha and Algoa Bay where pupping occurs (Smale and Compagno 1997). Adults are philopatric with some large-scale seasonal movements (da Silva et al. in prep.). Little information on young sharks (Peters et al. 2000)

HABITAT
Adults: Usually found in shallow, inshore waters over sand and rocky reefs but may also be found offshore to depths >100m (Smale and Compagno 1997). Sexual segregation has been shown with large mature females making more frequent use of shallower water (Smale and Compagno 1997)
Juveniles: Normally found closer to shore in sheltered bays (Peters et al. 2000)

FEEDING
Adults: Crustaceans and other invertebrates with larger sharks taking larger prey such as octopus and spiny lobsters (Smale and Compagno 1997)
Juveniles: Similar to adults, small crustaceans and other benthic invertebrates (Smale and Compagno 1997)

REPRODUCTION
Reproductive style: Viviparous, with a yolk-sac placenta (Smale and Compagno 1997, Capape et al. 2006, Saidi et al. 2008)
Breeding/spawning season: Austral spring and summer: Oct-Jan (Smale and Compagno 1997)
Breeding/spawning locality: Throughout distribution but seldom north of Port Elizabeth (Peters et al. 2000)
Age at 50% maturity: Males: 7-9 years; Females: 10-12 years; Combined sexes: 9 years; EC and WC; 1990s and 2000s (Goosen and Smale 1997, da Silva 2007)
Length at 50% maturity: Males: 950-1300mm TL; Females: 1200-1400mm TL; Combined sexes: 1078mm TL; EC and WC; 1990s and 2000s (Smale and Compagno 1997, da Silva 2007)

BIOMETRICS
Maximum recorded age: 24 years; female; SA; 1990s (Goosen and Smale 1997)
Maximum recorded weight: 31kg; female; Langebaan Lagoon; 2010 (C. da Silva, DAFF, unpubl. data)
Maximum recorded length: 1732mm TL; SA (Goosen and Smale 1997)
Length-length relationship: PCL(mm) = 0.821TL(mm) - 21.472; SA (Smale and Compagno 1997)
Length-weight relationship: Males: Wt(g) = 0.000000987 x $TL(mm)^{3.19}$; Females: Wt(g) = 0.000001186 x $TL(mm)^{3.498}$; SA (Smale and Compagno 1997)
Growth parameters: Combined sexes: L_∞ = 1946mm TL; K = 0.08; t_0 = -3.63; Males: L_∞ = 1713mm TL; K = 0.08; t_0 = -4.36; Females: L_∞ = 2202mm TL; K = 0.05; t_0 = -4.67; EC and WC (da Silva 2007)

FISHERY
Caught by shore anglers, recreational and commercial boat fishers and by longlining and trawling (Smale and Compagno 1997). Smoothhound sharks are targeted by commercial fishers in the absence of high value teleosts, primarily for the "flake" fillet industry which exports to Australia. High market value up to a certain size. Fins are exported to Asian markets, however fins are lower value (da Silva and Burgener 2007)

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): 0.05-0.16yr^{-1}
Natural mortality rate (M): 0.16yr^{-1}
Total mortality rate (Z): 0.21-0.32yr^{-1}
F_{MSY} yr^{-1}: Not given
F_{SB40} yr^{-1}: Not given
F_{SB25} yr^{-1}: Not given

$F_{0.1}$ yr^{-1}: 0.03-0.08
$SBPR_{current}$: Not given
Year completed: 2007
Locality: EC and WC
References & Comments: da Silva (2007)

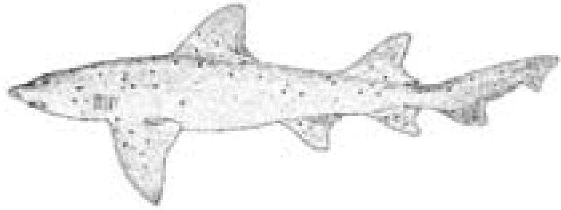
STOCK STATUS
Stock assessment method: Per-recruit analyses
Year completed: 2007
Locality: EC and WC
Status: 40-50% - optimally exploited (da Silva 2007)
Trend in CPUE: Research survey biomass indices for the SW Cape show a clear declining trend from 1986-2003 (da Silva 2007). CPUE indices for the West Coast increased from 1984-94 but then decreased to levels observed prior to 1994 (da Silva 2007). More recent reported catches suggest an increasing trend, however this is difficult to interpret because of poor species identification and the large proportion of smoothhounds caught as a bycatch rather than as target species (DAFF unpubl. data)
Trend in catch composition: More recent data suggest an increasing trend although this is difficult to interpret (DAFF unpubl. data)
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: Not listed
IUCN Red List: Vulnerable; 2009 (Serena et al. 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and subsistence: 1pppd; Commercial: unlimited
Minimum size limit: None
Closed Season: None
Other regulations: Demersal shark longline is managed under a TAE of 6 vessels (DAFF unpubl. data)
MPA effectiveness: Based on the distribution of smoothhound sharks around the SA coast, there is a number of no-take MPAs which are likely to provide protection for this species

MANAGEMENT CONSIDERATIONS
Slow growth and late age at maturity indicate that smoothhound sharks are highly susceptible to overfishing and a precautionary approach towards management is advocated. Maximum size restrictions are recommended to limit the targeting of larger, more fecund sharks. Area closures and offshore MPAs are also strongly advocated

RESEARCH REQUIREMENTS
Establish fishery-independent biomass indices for future stock assessments, determine stock identity, determine habitat use by juveniles and adults, locate pupping areas and juvenile nursery areas
Research priority: High



SCIENTIFIC NAME: *Triakis megalopterus* (Smith No. 9.36)
COMMON NAMES: Spotted gullyshark, Gespikkled sloothaai
COMPILER: MJ Smale
REVIEWER: C da Silva
DATE OF REPORT COMPLETION: March 2012

GLOBAL DISTRIBUTION: Endemic to southern Africa from central Transkei to northern NAM (Compagno et al. 2005), extending to southern Angola (Penrith 1978)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC
Mainly distributed from the WC to the EC in shallow waters (Bass et al. 1975). Prefers shallow marine reefs <50m, but may penetrate into marine dominated estuaries e.g. Kromme Estuary (Goosen 1997, Smale and Goosen 1999)

MOVEMENT: Resident
Mostly resident although a few records of movements of over 200km have been recorded (Booth et al. 2011, M. Smale, PEM, unpubl. data, ORI Tagging Project, unpubl. data)

HABITAT
Adults: Prefer inshore rocky reefs <30 m, may penetrate estuaries that are effectively marine inlets (Goosen 1997, Smale and Goosen 1999)
Juveniles: Juveniles occur on shallow reefs along the SE and S Cape coasts (M. Smale, PEM, unpubl. data)

FEEDING
Adults: Crustaceans (crabs), cephalopods and reef fish (Smale and Goosen 1999)
Juveniles: Mainly rock crabs (*Plagusia chabrus*) (Smale and Goosen 1999)

REPRODUCTION
Reproductive style: Aplacental viviparity, 5-15 pups (Smale and Goosen 1999)
Breeding/spawning season: Mating and fertilization from Oct to early Dec. Estimated gestation period is 20 months, the entire reproductive cycle may be 2-3 years (Smale and Goosen 1999)
Breeding/spawning locality: WC to the EC in shallow waters (<30m) (Smale and Goosen, 1999). High concentrations of small juveniles have been observed near East London (Goosen 1997). Pupping probably occurs along much of the S Cape coast (Bass et al. 1975)
Age at 50% maturity: Males: 10.9 years; Females: 15.3 years; SE Cape; 1981-2004 (Booth et al. 2011)
Length at 50% maturity: Males: 1320mm TL; Females: 1450mm TL; SE Cape (Smale and Goosen 1999)

BIOMETRICS
Maximum recorded age: 26 years; SE Cape; 1999 (Booth et al. 2011)
Maximum recorded weight: Male: 18kg; Female: 36kg; SE Cape (M. Smale, PEM, unpubl. data). SA shore angling record is 36.4kg (SASAA 2012)
Maximum recorded length: Male: 1520mm TL; Female: 2075mm TL; SE Cape (Smale and Goosen 1999)
Length-length relationship: Combined sexes: PCL(mm) = 0.817TL(mm) - 27.8754; SE Cape (Goosen 1997)
Length-weight relationship: Combined sexes: $Wt(g) = 0.00000022104 \times TL(mm)^{3.4307}$; SE Cape (Goosen 1997)
Growth parameters: Males: L_∞ = 1667mm TL; K = 0.12; t_0 = -2.15; Females: L_∞ = 1738mm TL; K = 0.1; t_0 = -2.67; Combined sexes: L_∞ = 1711mm TL; K = 0.11; t_0 = -2.43; SE Cape (Booth et al. 2011)

FISHERY
Mainly taken by recreational shore anglers, especially in competitions, but generally released. Confusion between this non-commercial species and *Mustelus* spp. which are harvested commercially, this may explain their occurrence in commercial catch records

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): Unknown
Natural mortality rate (M): 0.14yr^{-1}
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
References & Comments: Natural mortality rate estimated by Booth et al. (2011)

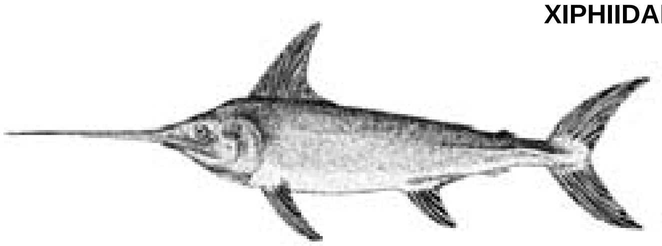
STOCK STATUS
Status: Not assessed
Trend in CPUE: Unknown, historical catch data are unreliable because of past confusion between *T. megalopterus* and *Mustelus mustelus* (Goosen 1997)
Trend in catch composition: Unknown
Trend in mean size: Unknown
Trend in sex ratio: Unknown

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Near Threatened; 2009 (Compagno 2009)

CURRENT REGULATIONS
Daily bag limit: Recreational and Subsistence: 1pppd; Commercial: prohibited
Minimum size limit: None
Closed Season: None
Other regulations: No sale
MPA effectiveness: Due to their resident nature *T. megalopterus* are likely to receive protection in most EC and WC no-take MPAs with suitable inshore reef habitat

MANAGEMENT CONSIDERATIONS
This endemic shark is distributed close inshore in temperate waters. Late age at maturity and low reproductive capacity make this species highly vulnerable to overfishing and precautionary management is advocated

RESEARCH REQUIREMENTS
More information is required on movement patterns, mating areas, nursery areas, estimates of mortality rates, monitoring of catches and size frequency, stock assessment
Research priority: Medium



SCIENTIFIC NAME: *Xiphias gladius* (Smith No. 251.1)
COMMON NAMES: Swordfish, Broadbill, Swaardvis
COMPILER: W West
REVIEWER: F Marsac
DATE OF REPORT COMPLETION: November 2012

GLOBAL DISTRIBUTION: An oceanic species found in all oceans, including the Mediterranean, Red Sea and North Sea (Heemstra and Heemstra 2004)
SOUTHERN AFRICAN DISTRIBUTION: NAM, NC, WC, EC, KZN, MOZ
Most commonly found offshore but is sometimes seen in coastal waters, generally above the thermocline (Collette 1995)

MOVEMENT: Migratory
Movement of sexually mature fish into tropical waters during winter for spawning and back into temperate or cold waters for feeding in summer (Nakamura 1985, Garcia-Cortés et al. 2003, ICCAT 2006)

HABITAT
Adults: Swordfish can tolerate a wide range of temperatures (5-27°C), the widest temperature tolerance of any billfish, but is often found in surface waters at temperatures over 13°C (Nakamura 1985). They can dive to depths of up to 1 000m
Juveniles: Juvenile swordfish are commonly found in tropical and subtropical waters and migrate to higher latitudes as they mature (IOTC 2011b)
Eggs and larvae: Eggs are pelagic. Larvae are pelagic and often found in waters with temperatures above 24°C. They are generally a few meters below the surface but can sink to as deep as 30m at night (Nishikawa and Ueyanagi 1974)

FEEDING
Adults: Swordfish feed on a wide variety of prey including groundfish, pelagic fish, deep-water fish and invertebrates (cephalopods being the preferred prey). They are believed to feed throughout the water column. The diet of swordfish is known to vary considerably, both geographically and seasonally (ICCAT 2010)
Juveniles: Juveniles will also feed opportunistically on fish and invertebrates. Larvae over 10mm feed almost exclusively on the larvae of other fish species

REPRODUCTION
Reproductive style: Gonochorist, multiple (batch) broadcast spawners (Hazin et al. 2002)
Breeding/spawning season: Nov-Mar in the South Atlantic. Oct-Apr in the Indian Ocean
Breeding/spawning locality: Southern coast of Brazil between 20 and 30°S. Also recorded off Reunion Island (Poisson and Fauvel 2009)
Age at 50% maturity: Males: 1-3 years; Females: 6-7 years; Indian Ocean (Froese and Pauly 2012)
Length at 50% maturity: Females: 156cm LJFL; South Atlantic (Hazin et al. 2002); Males: 120cm LJFL; Females: 170cm LJFL; Indian Ocean (Poisson and Fauvel 2009)

BIOMETRICS
Maximum recorded age: 30+ years; Indian Ocean (IOTC 2011b)
Maximum recorded weight: 650kg; NE Atlantic (Nakamura 1986). World angling record is 536.15kg; Chile 1953 (IGFA 2012)
Maximum recorded length: 455cm LJFL; IGFA world record (in Froese and Pauly 2012)
Length-length relationship: LJFL(cm) = 1.5312CKL(cm) + 20.0175; Istanbul (Zahit 2008). Combined sexes: LJFL(cm) = 1.066EOFL(cm) + 10.449; JLFL(cm) = 2.5407PAL(cm); LJFL(cm) = 1.2398PFL(cm) + 11.204; SWIO (Poisson 2001). CKL = a curved measurement from the clethrium to the caudal keel; EOFL = Eye orbit-fork length; PAL = Pectoral-anal length; PFL = Pectoral-fork length
Length-weight relationship: Combined sexes: Round Wt(kg) = 0.000004203 x $\text{LJFL(cm)}^{3.2134}$; SE Atlantic (Mejuto et al. 1988). Combined sexes: Gilled and gutted Wt(kg) = 0.0000058641 x $\text{LJFL(cm)}^{3.0849}$; SWIO (Poisson 2001)
Growth parameters: Males: L_∞ = 234cm LJFL; K = 0.169; t_0 = -2.181; Female: L_∞ = 275cm LJFL; K = 0.138; t_0 = -1.988; Indian Ocean (Wang et al. 2010)

FISHERY
Swordfish are targeted by SA pelagic longline vessels but are caught by the entire pelagic longline fleet, including the foreign flagged vessels. Occasionally targeted by recreational vessels at night or by using deep (>200m) down-rigged baits during the day

BIOLOGICAL REFERENCE POINTS
Fishing mortality rate (F): F_{2009}/F_{MSY} (4 models) = 0.50-0.63yr^{-1}
Natural mortality rate (M): Unknown
Total mortality rate (Z): Unknown
F_{MSY} yr^{-1}: Unknown
F_{SB40} yr^{-1}: Unknown
F_{SB25} yr^{-1}: Unknown
$F_{0.1}$ yr^{-1}: Unknown
$SBPR_{current}$: Unknown
Year completed: 2011
Locality: Indian Ocean
References & Comments: Stock assessed using dynamic, age-structured production models in the Indian Ocean (IOTC 2011b)

STOCK STATUS
Stock assessment method: Dynamic, age-structured production modelling
Year completed: 2011
Locality: Indian Ocean
Status: 40-50% - optimally exploited. A range of quantitative modelling methods were applied to the swordfish assessment in 2011, ranging from the highly aggregated ASPIC surplus production model to the age-, sex- and spatially-structured SS3 analysis (IOTC 2011b)
Trend in CPUE: South Atlantic: swordfish catches peaked in 1995 at 21 930mt. This increase of landings was, in part, due to progressive shifts of fishing effort into the South Atlantic, primarily from the North Atlantic, and due to the expansion of fishing activity by nearby countries. The reduction in catch after 1995 resulted from regulations and partly due to a shift to other oceans, other target species and effort reduction. In 2010, the 2 566mt reported catches were about 43% lower than the 1995 reported level (ICCAT 2010). CPUE trends are highly variable from one fleet to another, because of different fishing strategies (targeted swordfish or bycatch). Indian Ocean: Japanese longline CPUE have declined substantially from 1988-2006 to 25% of their initial values, but have slightly increased since then. Taiwanese longline CPUE has fluctuated without trend since 1994 (IOTC 2011b)
Trend in catch composition: After a peak high in 2002 (650mt in South Atlantic, 920mt in the Indian Ocean), the swordfish production of SA decreased and has fluctuated in the range of 140-300mt in the Atlantic and 180-280mt in the Indian Ocean, where the production has again increased since 2010. In 2010 swordfish catches formed 1% of the tuna longline vessels (foreign flagged) and 99% of the swordfish domestic longline fleet catches in SA and a total of 400mt and 145mt were caught in the Indian and Atlantic Oceans, respectively
Trend in mean size: The average size of swordfish taken in Indian Ocean longline fisheries is between 40 and 80kg (IOTC 2011b). The dominant LJFL in the Indian Ocean is 1.43-1.71m
Trend in sex ratio: The overall sex ratio is 1:1 and females predominate in sizes over 170cm FL and represent almost 100% of the catches of fish over 225cm FL (Arocha and Lee 1993)

VULNERABILITY RATING
MLRA: No-sale recreational species
IUCN Red List: Least Concern; 2011 (Collette et al. 2011)

CURRENT REGULATIONS
Daily bag limit: Recreational: 5pppd; Commercial: prohibited species for traditional commercial linefishers, pelagic longline vessels are not restricted with a bag limit
Minimum size limit: Commercial pelagic longline vessels are not allowed to catch swordfish that are smaller than 119cm LJFL. Swordfish of that size caught alive must be released. All dead undersize swordfish are retained and declared in port. Recreational fishermen are not allowed to land swordfish smaller than 25kg
Closed Season: None
Other regulations: Tuna directed pelagic longline vessels are restricted to 15% swordfish bycatch by weight of the total catch of targeted fish per trip once 500mt of swordfish has been caught by the entire fleet. The anomaly in the legislation with swordfish being listed as no-sale recreational species needs to be resolved
MPA effectiveness: Swordfish are an open-ocean, highly migratory species. MPAs would not serve to protect such a widespread, mobile species

MANAGEMENT CONSIDERATIONS
South Atlantic: The current catches are below the TAC (ICCAT 2006, 2010). No additional management action is presently considered necessary. Indian Ocean: catches need to be maintained below MSY as is the case presently. Some concern remains for the southwest Indian Ocean where the resource has been overfished in the past decade and biomass remains below the level producing MSY. There is however a low risk of exceeding MSY-based reference points by 2019 if catches reduce further or are maintained at current levels

RESEARCH REQUIREMENTS

Improve understanding of swordfish stock structure and movement rates using tagging techniques, and estimate the extent of mixing between South Atlantic and Indian Ocean stocks. Other priorities include exploration of stock status indicators from available data, CPUE standardization and understanding effects of depredation

Research priority: High

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INDEX OF SCIENTIFIC NAMES

INDEX OF COMMON NAMES

APPENDIX I

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APPENDIX II

ABBREVIATIONS

AEC	Anchor Environmental Consultants
cm	Centimetres
CPUE	Catch per unit effort
DAFF	Department of Agriculture, Forestry and Fisheries
DIFS	Department of Ichthyology and Fisheries Science, Rhodes University
DW	Disc width
EC	Eastern Cape
EEZ	Exclusive Economic Zone
EFL	Eye fork length
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EPA	Estuarine protected area
F	Fishing mortality
FAD	Fish attraction device
FL	Fork length
g	Grams
GAENP	Greater Addo Elephant National Park
GEC	Gleneagles Environmental Consulting
GSI	Gonad somatic index
hr	Hour
ICCAT	International Commission for the Conservation of Atlantic Tunas
IGFA	International Game Fish Association
IMAS	Institute for Marine and Antarctic Studies, University of Tasmania
IOTC	Indian Ocean Tuna Commission
IRD	Institut de Recherche pour le Développement
K	The curvature parameter which determines the rate the fish approaches L_∞
kg	Kilograms
KZN	KwaZulu-Natal
KZNCAU	KwaZulu-Natal Coast Anglers Union
KZNSB	KwaZulu-Natal Sharks Board
l	Litre
L	Length
L_∞	The asymptotic mean length or the theoretical maximum length
LJFL	Lower jaw fork length
L_m	Length at maturity
M	Natural mortality
ml	millilitre
mm	Millimetres
M:F	Male to female sex ratio
M:I:F	Male, intersex, female sex ratio
MOZ	Mozambique
MPA	Marine protected area
mt	Metric ton
NAM	Namibia
NC	Northern Cape
nm	Nautical mile
NMLS	National Marine Linefish System
NSW	New South Wales
ORI	Oceanographic Research Institute
PCL	Pre-caudal length
PEM	Port Elizabeth Museum, Bay World
PPF	Peace Parks Foundation
pppd	Per person per day
ppt	Parts per thousand
RFMO	Regional Fisheries Management Organization
SA	South Africa
SADSAA	South African Deep Sea Angling Association
SAEON	South African Environmental Observation Network

SAIAB	South African Institute for Aquatic Biodiversity
SAMLMA	South African Marine Linefish Management Association
SASC	South African Shark Conservancy
SASSA	South African Shore Angling Association
SAUFF	South African Underwater Fishing Federation
SBPR	Spawner biomass per recruit
SC	Southern Cape
SL	Standard length
SWIO	South West Indian Ocean
t	Age
t_0	Parameter that determines the point in time when the fish has zero length
TAC	Total Allowable Catch
TAE	Total Allowable Effort
TKI	Transkei
TL	Total length
TNP	Tsitsikamma National Park
TOA	Two Oceans Aquarium
UCT	University of Cape Town
UKZN	University of KwaZulu-Natal
UZ	University of Zululand
VPA	Virtual Population Analysis
WC	Western Cape
WIO	Western Indian Ocean
Wt	Weight/mass
YPR	Yield per recruit
Z	Total mortality