



Department of
Primary Industries

Status of fisheries resources in NSW 2013–14



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STATUS OF FISHERIES RESOURCES IN NSW 2013-14

NSW DEPARTMENT OF PRIMARY INDUSTRIES

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Foreword by the Minister

I am pleased to introduce the "Status of Fisheries Resources in NSW 2013/14". This report updates the status of all key species that are harvested by commercial, recreational and indigenous fishers in the marine waters of NSW. Each species has a chapter detailing the latest available catch and biological information with a description of how this is used to assess and report on the status of the State's fisheries resources and highlights where further research may be required. This important report is a significant achievement and contributes to the Government's responsibility to publicly report on the health and sustainability of the fisheries resources of NSW.

The NSW Government is committed to better research and management of our aquatic resources which are owned by the whole community, who can be comforted by the information detailed in this report indicating that they continue to be well managed for sustainability as well as for the economic benefit and enjoyment of the people of NSW. This ongoing series provides an important mechanism that the public can use to evaluate the continued success of our fisheries management initiatives here in New South Wales.



The Hon. Niall Blair, MLC
Minister for Primary Industries
Minister for Lands and Water



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Executive Summary

The Status of Fisheries Resources in NSW report provides an overview of the state of marine and estuarine fish populations that are harvested by commercial and recreational fisheries managed by the NSW Government. The 2013/14 report contains a two to four page summary on the state of knowledge of 114 fish and invertebrate species (or species groups) caught by commercial and recreational fishers.

Species selected for inclusion in the NSW stock assessment process are those defined within the NSW commercial fishing Fishery Management Strategies, as well as those identified by NSW recreational fishery managers as being important. This report does not report on any freshwater species that are harvested in NSW.

The Status of Fisheries Resources in NSW report is published periodically to meet public reporting requirements for the Estuary General, Estuary Prawn Trawl, Ocean Hauling, Ocean Trawl and Ocean Trap & Line fisheries. The last version of the report (Status of Fisheries Resources 2008/09) was released in 2010.

Exploitation status for each species is assessed at an annual meeting of fisheries scientists and managers from NSW, after consideration of all available relevant information for the species. Fisheries scientists from adjoining jurisdictions or with expertise in a particular species are also invited to attend the meeting. Note that three assessed species, Banded Morwong, Blue Shark and School Shark, were not included in this report because of their minor contribution to harvests in NSW and a lack of local information.

Species assessed as 'Overfished'

The number of species assessed as 'Overfished' in NSW has decreased to five in 2013/14 (noting that School Shark is one of the species listed as 'Overfished' but is not included in this report). This decrease has occurred despite a steady increase in the number of species considered since adoption of the NSW exploitation status classification scheme in 2000/01.

Since the last Status Report in 2008/09, Blacklip Abalone, Eastern Sea Garfish and Jackass Morwong have been removed from the 'Overfished' category. The Dogfish species complex was assessed as being 'Overfished' in 2011/12 based on the Commonwealth's assessment and remains 'Overfished' in 2013/14. The majority of the catch of the 'Overfished' species Gemfish, Dogfish and School Shark is taken by Commonwealth-managed fisheries and stock rebuilding for these species will depend on initiatives taken under the Commonwealth jurisdiction.

For NSW-managed species, two (Grey Morwong and Mulloway) continue to be assessed as 'Overfished'. Grey Morwong have been assessed as being 'Overfished' since 2006/07 and a stock rebuilding plan is yet to be developed. Mulloway have been assessed as being 'Overfished' since 2004/05 and a stock rebuilding recovery program was implemented in November 2013.

Species assessed as 'Growth Overfished'

Since the last Status Report in 2008/09 there have been no changes to species assessed as being 'Growth Overfished'. Five species (Redfish, Silver Trevally, Snapper, Yellowtail Kingfish and Eastern King Prawn) are considered 'Growth Overfished', where harvest is being restrained by excessive fishing mortality and/or their size at capture being too small. Growth overfishing may be sustainable; however it can lead to recruitment overfishing and the status of these species is monitored closely.

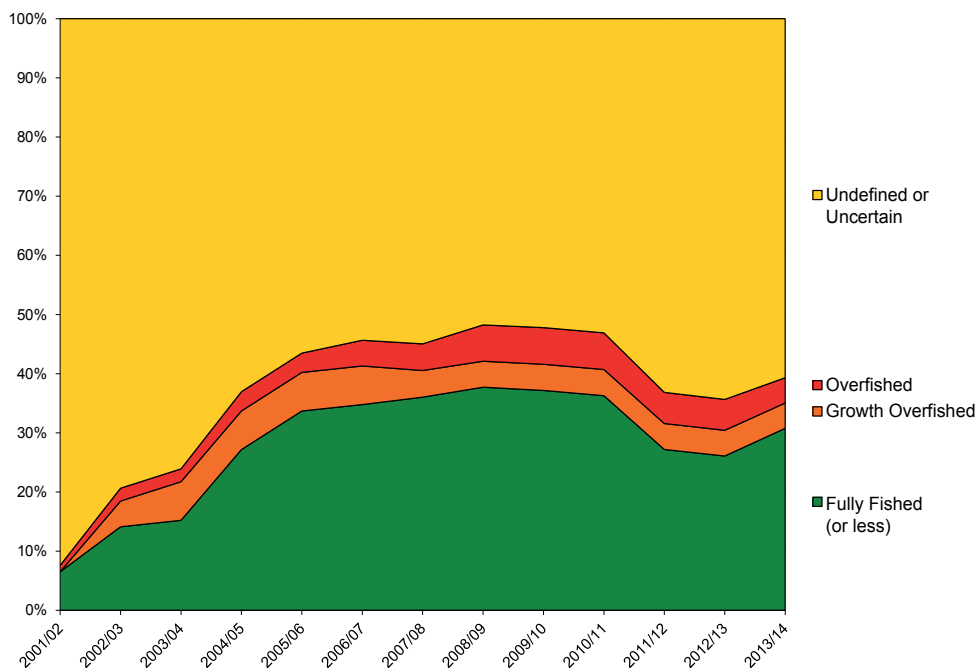
Species assessed as 'Uncertain' or 'Undefined'

More than 60% of the species that have had their status considered have been assessed as 'Uncertain' or 'Undefined'. This reflects the large number of species required to be assessed by this process (117 for 2013/14), limited resources available to do assessments, difficulties with the proper identification and correct reporting of many closely related and little studied species, and the ongoing need for detailed biological studies for many species.

Since the NSW assessment process commenced in 2000/01 there has been a significant reduction in the proportion of species whose status has been assessed as ‘Uncertain’ or ‘Undefined’ – down from more than 80% to around 60%. This has been due to dedicated efforts by fisheries scientists at NSW DPI to improve our biological knowledge for a large number of important aquatic species. The implementation of more detailed catch reporting for NSW commercial fishers in 2009 has also improved species reporting.

The assessment of species as ‘Uncertain’ or ‘Undefined’ should not be interpreted to mean that these species are being harvested unsustainably, as many of these species are landed in small quantities by commercial and recreational fisheries. Similarly, the harvesting of these species should not be considered as ‘low-risk’ until sufficient information is available to undertake more comprehensive assessments. The information reviewed for each species during the status assessment process is used to prioritise future biological and fishery research, to ensure that available resources are directed at the most important species in the ‘Uncertain’ and ‘Undefined’ categories.

Exploitation Status of Species



Summary of the exploitation status of species harvested by commercial and recreational fisheries in NSW from 2001/02 to 2013/14. Note that some similar exploitation status categories have been combined to simplify the presentation in this graph.

SPECIES	STATUS	HARVEST COMMENT	
Angel Sharks <i>Squatina</i> spp.	Fully Fished	A long history of stability in catch rates and sizes harvested has resulted in a status of Fully Fished for Angel sharks in NSW.	1
Australian Anchovy <i>Engraulis australis</i>	Undefined	Very little local biological information is available for Australian Anchovy. This lack of information and the small commercial fishery for this species has resulted in a status of Undefined.	4
Australian Bonito <i>Sarda australis</i>	Fully Fished	A very fast growing, early maturing, schooling species that supports seasonal commercial and recreational fisheries. The NSW fishery is based on a few age classes, mostly 1-3 years of age. Variable landings and catch rates are driven by variable recruitment in this species. Australian Bonito are therefore classified as being Fully Fished.	7
Australian Sardine <i>Sardinops sadax</i>	Uncertain	A lack of data on the abundance of Australian sardines off eastern Australia together with a lack of very large fish in landings during recent years, a lack of current age composition data and uncertainties around stock structure and biological parameters has resulted in a status of Uncertain.	10
Banded Rockcod <i>Epinephelus ergastularius</i>	Undefined	A substantial component of the NSW Ocean Trap and Line dropline Fishery. Recreational catch is unknown, although anecdotal evidence suggests it may be increasing. Limited information is available on the biology of the species.	14
Bass Groper <i>Polyprion americanus</i>	Undefined	Limited relevant biological information available for NSW. Commercial catch information from 1997/98 indicates annual catches are relatively stable. Limited information to assess population size and structure. NSW exploitation status has not been defined.	17
Beachworms Onuphidae	Undefined	Insufficient information exists to assess the exploitation status of the stocks of these species. Catches comprise of a complex of species. There is no data describing the species composition of harvested species. No accurate estimate of the recreational catch is available.	20
Bigeyes Priacanthidae	Undefined	Very small landings taken as byproduct of commercial ocean prawn trawling and some localised recreational catches from deep oceanic and estuarine waters. Little biological information is available.	23
Blacklip Abalone <i>Haliotis rubra</i>	Uncertain	Stock has undergone substantial rebuilding in recent years from historically low levels that occurred due to a combination of overfishing and mortality due to the parasite <i>Perkinsus</i> sp. The stock has undergone recovery and accumulated above the minimum legal length although there remains some uncertainty about the consistency of recovery throughout the state.	25

SPECIES	STATUS	HARVEST COMMENT	
Blue Mackerel <i>Scomber australasicus</i>	Moderately Fished	A fast growing, schooling small pelagic species. Total commercial landings of 300-500 t per annum from NSW waters are very small compared to the last biomass estimate of 25,000-33,000 t off the east coast of Australia in 2004. Blue mackerel are therefore classified as Moderately Fished.	29
Blue Swimmer Crab <i>Portunus pelagicus</i>	Uncertain	An important recreational and commercial species. Biological data collected for Wallis Lake indicate high fishing pressure in this estuary, with fishing mortality estimated to be greater than natural mortality. There are inconsistent or contradictory signals in commercial CPUE data that preclude determination of exploitation status.	33
Blue-eye Trevalla <i>Hyperoglyphe antarctica</i>	Fully Fished	This exploitation status considers the Commonwealth assessment of eastern stock as not overfished and uncertain if overfishing is occurring and generally stable CPUE for fish harvested using droplining in NSW. However, most recent levels of CPUE and continued declines in annual catches suggest some concern for stocks.	37
Bluespotted Flathead <i>Platycephalus caeruleopunctatus</i>	Fully Fished	A very important commercial and recreational species. Landings and catch rates were steady for over two decades, but have rapidly declined over the last 3 years.	41
Boarfish Pentacerotidae	Undefined	The Giant Boarfish is regularly reported, in small numbers, in the Ocean Trawl Fishery. Limited regular fishery information and local biological information precludes an assessment of exploitation status.	45
Brown Tiger Prawn <i>Penaeus esculentus</i>	Undefined	NSW is at the southern end of the species range. Recruitment is likely to be small and variable.	47
Bugs <i>Ibacus</i> spp.	Fully Fished	Four species of bugs are landed in NSW; however only <i>Ibacus peronii</i> and <i>Ibacus chacei</i> are regularly landed. Relatively stable landings of between 20-40 t per year since 2005/06 in combination with stable size compositions for both species and variable but flat catch rates have resulted in Bugs being classified as Fully Fished.	50
Catfish Siluriformes	Undefined	Several species of catfishes are harvested at low levels in NSW estuaries by both commercial and recreational fishers. Very little information is available to establish exploitation status.	54
Cobia <i>Rachycentron canadum</i>	Undefined	Very little information is available for Cobia in NSW waters. The lack of recreational harvest data and negligible commercial fishery has resulted in a status of Undefined.	58
Cockles Arcoida and Veneroida	Undefined	No assessment of the cockle species harvested and reported within this group has been undertaken. The accuracy of catch and effort reporting of the species harvested requires investigation. Biological information is available for some species.	61

SPECIES	STATUS	HARVEST COMMENT	
Common Jack Mackerel <i>Trachurus declivis</i>	Moderately Fished	Predominantly a Commonwealth fishery with relatively small landings taken from NSW waters. Annual landings of less than 10 tonnes in recent years against a spawning biomass of approximately 158,000 tonnes in 2014 are consistent with a status of Moderately Fished.	64
Common Silverbiddy <i>Gerres subfasciatus</i>	Uncertain	Substantial commercial catches of over 100t were historically taken from NSW estuaries as a byproduct of haul netting. Large unexplained declines in the commercial landings and catch rates over the last three years have resulted in an Uncertain status.	66
Crimsonbanded Wrasse <i>Notolabrus gymnogenis</i>	Uncertain	Some local biological information exists for Crimsonbanded wrasse however a lack of current fishery data on this mainly recreational species has resulted in a status of Uncertain.	70
Cunjevoi <i>Pyura stolonifera</i>	Undefined	No assessment of the exploitation status of Cunjevoi has been undertaken. Not commercially harvested. Harvested by recreational fishers, primarily for use as bait. A large proportion of the population occurs in inaccessible, high energy, rocky coastal habitats.	72
Cuttlefish <i>Sepia</i> spp.	Undefined	Species identification and composition issues restrict our ability to assess these stocks. All species in this group are likely to exhibit rapid growth and have a short life span.	74
Dart <i>Trachinotus</i> spp.	Undefined	Very little information is available for dart in NSW waters. The lack of recreational harvest data and very small commercial fishery has resulted in a status of Undefined.	78
Diamondfish <i>Monodactylus argenteus</i>	Undefined	Very small commercial and recreational catches and limited biological or fishery information. No detailed assessment is likely to be completed.	81
Dogfish Squaliformes	Overfished	A complex of at least 15 species, with Harrison's Dogfish (<i>Centrophorus harrissoni</i>) and Southern Dogfish (<i>C. zeehaani</i>) considered Overfished.	83
Dusky Flathead <i>Platycephalus fuscus</i>	Uncertain	Very important commercial and recreational species. Conflicting signals, including recent declines in commercial catches and catch rates, high fishing mortality estimates and stable size distributions have led to an Uncertain status.	87
Eastern Australian Salmon <i>Arripis trutta</i>	Fully Fished	Commercial landings are at historically high levels and the recreational catch is significant.	92
Eastern Blue Groper <i>Achoerodus viridis</i>	Undefined	Some local biological information exists for Eastern Blue Groper however a lack of fishery and population data on this recreational line-only species has resulted in a status of Undefined.	96
Eastern King Prawn <i>Melicertus plebejus</i>	Growth Overfished	Modelling suggests that yield from this stock could be increased by reducing fishing effort and increasing the size at first harvest for Eastern King Prawns in NSW waters.	98

SPECIES	STATUS	HARVEST COMMENT	
Eastern Pigfish <i>Bodianus unimaculatus</i>	Fully Fished	The age composition in commercial landings suggested that fishing mortality was approximately equal to natural mortality during the late 2000s. Stable commercial catch rates since that time in combination with the very small commercial harvest for this species has resulted in a status of Fully Fished.	103
Eastern Red Scorpionfish <i>Scorpaena cardinalis</i>	Undefined	Local biological information exists for Eastern Red Scorpionfish, however a lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.	106
Eastern Rock Lobster <i>Sagmariasus verreauxi</i>	Fully Fished	Species has a long history of exploitation. The commercial fishery has been managed using Total Allowable Catch and Individual Transferable Quotas since the mid 1990s and is closely monitored using fishery-dependent and independent methods. Catch, catch rates, biomass, spawner abundance and recruitment have increased over the past 15 years.	109
Eastern School Whiting <i>Sillago flindersi</i>	Fully Fished	A significant species in the NSW Ocean Trawl Fishery. The stock is shared with the Commonwealth and the status has been adopted from the Commonwealth assessment.	113
Eastern Sea Garfish <i>Hyporhamphus australis</i>	Fully Fished	Eastern Sea Garfish were listed as being Overfished between 2002/03 and 2012/13. Five consecutive years of improvements in the size and age compositions in landings and substantial increases in catch rates have resulted in a stock status of Fully Fished.	129
Estuary Perch <i>Macquaria colonorum</i>	Undefined	A recreational fishery. Some local biological information exists, however a lack of current data on the fishery has resulted in a status of Undefined.	132
Flounders Paralichthyidae and Pleuronectidae	Undefined	A species group of at least three different sand flounders. Species identification and composition issues need to be resolved before the stock status can be assessed.	135
Frigate Mackerel <i>Auxis thazard</i>	Undefined	Very little information is available for Frigate Mackerel. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.	139
Gemfish <i>Rexea solandri</i>	Overfished	Predominantly a Commonwealth fishery. Exploitation status has been adopted from the Commonwealth stock assessment.	141
Ghost Nipper <i>Trypaea australiensis</i>	Undefined	Estimates of recreational catch are not known and the spatial and temporal dynamics of recreational effort is not well understood. The commercial catch is relatively small compared to expected levels of recreational catch. The effect of fishing activity, particularly at local scales is unknown. Biology together with a component of the population inhabiting sub-tidal habitat suggests populations are resilient to harvest levels.	145

SPECIES	STATUS	HARVEST COMMENT	
Ghostsharks Chimaeriformes	Undefined	Small numbers of individuals are harvested as bycatch in the Ocean Trawl Fishery mainly from the outer continental shelf and continental slope. There is a lack of information with which to assess stock status.	147
Giant Mud Crab <i>Scylla serrata</i>	Uncertain	Significant commercial and recreational fisheries occur in NSW which is at the southernmost extent of the species' range. Local biological information has not been analysed in detail.	149
Goldspot Mullet <i>Liza argentea</i>	Uncertain	Exploitation rates vary considerably between estuaries. Commercial landings fluctuate annually, but have steadily declined since the 1980s. A lack of current data on size and age composition has resulted in an Uncertain exploitation status.	153
Gould's Squid <i>Teuthida</i>	Fully Fished	An annual stock that is likely to vary in abundance with environmental conditions. Relatively small catches are taken by ocean trawling in NSW waters. The main fishery is in Commonwealth waters and although not formally assessed, the stock is considered to be not overfished due to relatively low recent annual landings.	157
Greentail Prawn <i>Metapenaeus bennettiae</i>	Undefined	The species is similar to school prawns, but lives entirely within estuarine waters. No detailed assessment of stock status has been made.	161
Grey Morwong <i>Nemadactylus douglasii</i>	Overfished	Long term declines are evident in both landings and catch rates, and the average size of harvested fish has also decreased substantially since the 1970s. The age composition of landings strongly suggests that fishing mortality has been greater than natural mortality.	165
Gummy Shark <i>Mustelus antarcticus</i>	Fully Fished	Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment was adopted.	169
Hairtail and Frostfish Trichiuridae	Undefined	No local biological information is available for either species in this group. The relatively small commercial and recreational fisheries in NSW are not well understood which has resulted in a status of Undefined.	172
Hammerhead Sharks <i>Sphyrna</i> spp.	Undefined	Two species (Great and Scalloped Hammerhead) were recently protected from fishing in NSW and little information is available to specify the exploitation status of the third species (Smooth Hammerhead).	175
Hapuku <i>Polyprion oxygeneios</i>	Undefined	No detailed stock assessment available. NSW landings of this species are very small compared to landings by New Zealand and Australian Commonwealth fisheries.	178

SPECIES	STATUS	HARVEST COMMENT	
Jackass Morwong <i>Nemadactylus macropterus</i>	Fully Fished	The commercial harvest is predominantly by trawlers in the Commonwealth Southern and Eastern Scalefish and Shark Fishery. Commonwealth tier 1 assessment and resultant status for the eastern Jackass Morwong stock has been adopted. The assessment classifies Jackass Morwong as not overfished and not subject to overfishing.	181
John Dory <i>Zeus faber</i>	Fully Fished	Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment has been adapted for NSW. The 2013/14 Commonwealth assessment of John Dory was that stocks are not overfished and not subject to overfishing.	185
Leatherjackets-other Monacanthidae	Undefined	Very little local biological information is available for Sixspine and Estuary (Rough/Fanbelly) Leatherjackets in this species complex. This lack of information and the small commercial fishery for these species has resulted in a status of Undefined.	189
Loligo Squid <i>Uroteuthis</i> spp.	Undefined	A mixed group of at least three Loligo squid species that are taken as byproduct in estuary and ocean trawling. The species are difficult to separate visually and catch data are compromised by species identification and misreporting issues.	192
Longtail Tuna <i>Thunnus tonggol</i>	Undefined	Very little information is available for Longtail Tuna in NSW. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.	196
Luderick <i>Girella tricuspidata</i>	Fully Fished	A moderately long-lived species with significant recreational and commercial harvests. Fishing mortality is estimated to be slightly higher than natural mortality in most estuaries, but the species is still considered Fully Fished at this stage.	199
Mackerel Tuna <i>Euthynnus affinis</i>	Undefined	Very little information is available for Mackerel Tuna in NSW. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.	203
Mahi Mahi <i>Coryphaena hippurus</i>	Undefined	Mainly targeted by recreational fishers, Mahi Mahi are likely to have high growth and mortality rates, but there is a lack of local information with which to assess stock status.	205
Mako Sharks <i>Isurus</i> spp.	Undefined	Relatively small catches occur in NSW - the majority of the catch is the Shortfin Mako, which has a global distribution. Mako sharks are an important target species in the recreational gamefish fishery.	208
Mangrove Jack <i>Lutjanus argentimaculatus</i>	Undefined	Mostly a recreational fishery in northern NSW waters. Some local biological information exists, however a lack of data on the fishery has resulted in a status of Undefined.	211
Mantis Shrimps Stomatopoda	Undefined	A species group subject to identification and composition issues. Very small quantities are landed and no detailed assessment is likely to be completed.	214

SPECIES	STATUS	HARVEST COMMENT	
Mirror Dory <i>Zenopsis nebulosus</i>	Fully Fished	Predominantly a Commonwealth fishery, with seasonal landings of mature fish by NSW trawlers north of Sydney during the winter months. The Commonwealth stock assessment defined the status of Mirror Dory as not overfished and not subject to overfishing and has been adapted for NSW to describe the exploitation status as Fully Fished.	216
Mulloway <i>Argyrosomus japonicus</i>	Overfished	Age composition is indicative of an Overfished stock, the spawning potential ratio is below the recommended threshold, fishing mortality is much greater than natural mortality, and length and age distributions are excessively effected by recruitment.	219
Ocean Jacket <i>Nelusetta ayraudi</i>	Fully Fished	The Ocean Jacket is a fast growing, early maturing, and voracious species. Despite four years of declines in landings, stable catch rates across the fishery have resulted in a status of Fully Fished.	223
Ocean Perch <i>Helicolenus</i> spp.	Fully Fished	Ocean Perch consist of two relatively long-lived species (Offshore or Bigeye Ocean Perch and Inshore or Reef Ocean Perch). In NSW, landed catch is predominantly Bigeye Ocean Perch from the NSW Ocean Trap and Line Fishery. However, Commonwealth fisheries dominate annual catches and the NSW exploitation status is adapted from Commonwealth assessments. In 2013/14 Bigeye and Reef Ocean Perch were assessed as not overfished and not subject to overfishing, adapted to a NSW status of Fully Fished.	227
Octopus <i>Octopus</i> spp.	Undefined	Lack of biological and fishery information on the main species harvested precludes resource assessment at this time.	231
Pearl Perch <i>Glaucosoma scapulare</i>	Uncertain	The commercial and recreational fisheries for Pearl Perch in NSW are relatively minor. Recent declines in landings and catch rates, increases in average sizes each year since 2009/10 and uncertainty about reproduction and life-history have resulted in a status of Uncertain.	235
Pink Ling <i>Genypterus blacodes</i>	Uncertain	NSW exploitation status is determined from outcomes of the Commonwealth assessment of the Pink Ling Eastern stock and relevant NSW information. In 2013, Commonwealth assessment determined the Eastern stock was not overfished and uncertain if subject to overfishing. NSW catches have been considered a small component of the total annual harvest of the Eastern stock.	239
Pipi <i>Donax deltoides</i>	Uncertain	Commercial landings have declined from more than 500 t in 2004 to less than 65 t in recent years, despite a significant increase in price over this period. In response to the declines in landings new management arrangements were implemented in an attempt to stabilize the fishery. There is insufficient information to allow specification of an exploitation status.	242

SPECIES	STATUS	HARVEST COMMENT	
Red Gurnard and Latchets Triglidae	Undefined	Red Gurnard and Latchet have consistently been caught in the NSW Fish Trawl Fishery, with an average of about 30 t reported annually since at least 1998/99. Commonwealth fisheries annually land > 60 t and > 80 t of Red Gurnard and Latchet, respectively. However, these are not Commonwealth quota managed species and assessments of stock status and reliable local biological data are either not available or limited. Despite relatively consistent catches, a paucity of other reliable data limits an assessment of exploitation status and as such Red Gurnard and Latchets in NSW remain Undefined.	245
Red Morwong <i>Cheilodactylus fuscus</i>	Undefined	Mostly a recreational spear fishery in NSW. Some local biological information exists, however a lack of data on the fishery has resulted in a status of Undefined.	249
Red Mullet Mullidae	Undefined	Small quantities (20-40 t annually) taken as byproduct in prawn and fish trawls. Assessment is constrained by lack of biological information.	251
Redfish <i>Centroberyx affinis</i>	Growth Overfished	Predominantly a Commonwealth fishery. The population is Growth Overfished and is very much depleted. The Commonwealth status has been uncertain in recent years due to conflicting signals from population biomass models and catch rate analyses. A status of Growth Overfished has been retained in NSW because this best describes the available fishery and biological data.	254
River Eels <i>Anguilla</i> spp.	Undefined	Stock status varies between catchments, with some areas fished lightly, while others are subject to significant fishing effort. Annual commercial catches have been stable between 50-100 t for over 10 years, but trapping catch rates have declined over the last three years.	258
River Garfish <i>Hyporhamphus regularis ardelio</i>	Uncertain	A relatively small fishery that operates in only a few estuaries in NSW. Variable landings and catch rates with a lack of recent length or age monitoring has resulted in River Garfish having a status of Uncertain.	261
Rock Blackfish <i>Girella elevata</i>	Fully Fished	A long-lived coastal reef-associated species fished by recreational line and spear fishers. Local biological information in addition to fishing mortality estimates have resulted in an exploitation status of Fully Fished.	264
Royal Red Prawn <i>Haliporoides sibogae</i>	Moderately Fished	The limited targeting of this species and the recent decline in landings is associated with the low market price and lack of demand for this species.	267
Sand Mullet <i>Myxus elongatus</i>	Undefined	Taken primarily as byproduct of mesh netting in NSW estuaries. Commercial landings have declined considerably during the last 8 years. A low value species with only limited size or age composition data with which to assess stocks.	270

SPECIES	STATUS	HARVEST COMMENT	
Sand Whiting <i>Sillago ciliata</i>	Fully Fished	Sand Whiting is targeted by recreational anglers and commercial fishers throughout its range. Commercial landings and catch rates were stable until recent declines over the last 2 years.	273
Sawsharks <i>Pristiophorus</i> spp.	Undefined	There is little fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.	278
School Prawn <i>Metapenaeus macleayi</i>	Fully Fished	Modelling has established that environmental factors (river flows) generally have a major influence on landings of school prawns.	281
Sea Mullet <i>Mugil cephalus</i>	Fully Fished	A long history of stable landings in both the estuarine and ocean fisheries. The sizes and ages landed are indicative of a sustainable population and have resulted in a status of Fully Fished.	285
Sea Urchin - Green <i>Heliocidaris tuberculata</i>	Uncertain	Low commercial catches and a paucity of population and fishery information limit the ability to determine an exploitation status for this species; as such exploitation status is Uncertain.	289
Sea Urchin - Purple <i>Centrostephanus rogersii</i>	Moderately Fished	A large amount of fishery and biological information is available for this species. Outcomes from a 2003 research program suggest exploitation rates are low (< 2%), indicating an exploitation status of Moderately Fished.	289
Sea Urchin - Red <i>Heliocidaris erythrogramma</i>	Uncertain	Despite local biological information being available for this species, there is limited population and fishery information to describe exploitation status with reasonable confidence; as such exploitation status is Uncertain.	289
Shovelnose Rays Rajiformes	Undefined	A group of at least five species caught mainly by trawling. Eastern Shovelnose Ray is the most significant species in the catch of this group. A lack of local biological information and unreliable species reporting has resulted in a status of Undefined.	293
Silver Sweep <i>Scorpius lineolata</i>	Uncertain	A long lived species which may be susceptible to localised depletion. Significant declines in commercial landings and catch rates to historical lows, in association with declines in the average sizes landed, have produced concerns about the status of the stock. Variable commercial catch rates and a lack of recreational harvest data has resulted in a status of Uncertain.	296
Silver Trevally <i>Pseudocaranx georgianus</i>	Growth Overfished	Yield per recruit analyses indicate that yield from the Silver Trevally stock would be increased by increasing the size at first capture and/or by reducing fishing mortality. There are concerns for this stock due to declines in landings, variable catch rates and few larger fish in landings.	299

SPECIES	STATUS	HARVEST COMMENT	
Snapper <i>Pagrus auratus</i>	Growth Overfished	Yield per recruit analyses indicate that yield from the Snapper stock would be increased by increasing the size at first capture and/or by reducing fishing mortality. A decadal increase in commercial landings, catch rates and size and age compositions suggest improvement in the NSW snapper stock, however two recent years of declines in landings and catch rates are of some concern.	303
Soles Soleidae and Cynoglossidae	Undefined	Two species are significant in commercial catches, but little biological information and only limited size composition data are available. Catch data are compromised by poor species identification.	307
Southern Calamari <i>Sepioteuthis australis</i>	Fully Fished	A short-lived squid species that is very important in commercial and recreational catches of NSW. Relatively stable landings and catch rates over the last 8 years suggests that the stock status is Fully Fished.	310
Southern Maori Wrasse <i>Ophthalmolepis lineolatus</i>	Undefined	Mainly a recreational species, but there is a small targeted commercial fishery. There is little current biological or fishery information for Southern Maori Wrasse resulting in a status of Undefined.	314
Spanish Mackerel <i>Scomberomorus commerson</i>	Fully Fished	The majority of the harvest occurs in Queensland waters where the east coast biological stock is considered sustainable. The Queensland assessment is consistent with a status of Fully Fished.	317
Spanner Crab <i>Ranina ranina</i>	Fully Fished	Joint fishery-independent monitoring between NSW and Queensland occurs for this shared stock, and the status has been determined from the Queensland assessment.	320
Spotted Mackerel <i>Scomberomorus munroi</i>	Fully Fished	The majority of the harvest occurs in Queensland waters where the stock is considered sustainable. The Queensland assessment is consistent with a status of Fully Fished.	324
Stout Whiting <i>Sillago robusta</i>	Fully Fished	A small, fast growing species caught by trawling in northern NSW inshore waters. The stock is shared with Queensland and a status of Fully Fished is consistent with outcomes of the most recent Queensland quantitative stock assessment.	327
Striped Marlin <i>Kajikia audax</i>	Fully Fished	The NSW exploitation status for Striped Marlin was adapted from the Commonwealth assessment of not overfished and not subject to overfishing.	331
Striped Perch Terapontidae	Undefined	A group of at least four small estuary/inshore fish taken in small amounts as byproduct by commercial hauling nets and trawls. Little biological information is available to inform stock assessments, so their status remains Undefined.	334

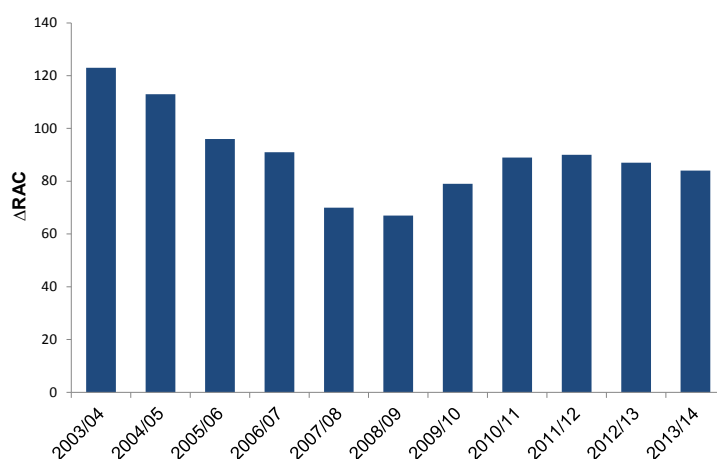
SPECIES	STATUS	HARVEST COMMENT	
Tailor <i>Pomatomus saltatrix</i>	Fully Fished	Significant recreational and commercial harvests are taken in Queensland and NSW. The most recent Queensland assessment indicated that the stock was close to the biomass at maximum sustainable yield (Bmsy), consistent with a status of Fully Fished.	337
Tarwhine <i>Rhabdosargus sarba</i>	Uncertain	A large decline in commercial landings to the lowest levels in 24 years in 2013/14, declines in fish trap landings to almost zero, a lack of data from the recreational fishery in association with a lack of recent data on sizes, ages and mortality rates have resulted in a status of Uncertain.	341
Teraglin <i>Atractoscion aequidens</i>	Uncertain	Commercial catch data suggest a long-term decline in this stock. Current commercial landings are based on relatively small, young fish with the population showing large variations in recruitment strength. Teraglin are thought to grow quickly and mature at a relatively small size; however there is insufficient biological and fishery data on which to assess the status of the stock which is therefore classified as Uncertain.	345
Tiger Flathead <i>Neoplatycephalus richardsoni</i>	Fully Fished	Predominantly a Commonwealth fishery, although significant landings are made by NSW trawlers north of Sydney. Results of the most recent Commonwealth stock assessment in 2013 indicated the stock is not overfished or being overfished and were consistent with a Fully Fished status in NSW.	349
Tiger Shark <i>Galeocerdo cuvier</i>	Undefined	Tiger sharks are an important target species in the recreational club-based gamefish fishery. Commercial catches off NSW are likely to be smaller than recreational catches. There is little local fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.	353
Tilefish <i>Branchiostegus</i> spp.	Undefined	The distribution of this two species complex is essentially limited to the temperate east Australian coast. Commercial catches are relatively low (<2 t p.a. since 2004/05). There is little fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.	355
Trumpeter Whiting <i>Sillago maculata</i>	Uncertain	Small commercial and recreational landings, mainly from a few estuaries. Large unexplained declines in the commercial landings and catch rates over the last 2 years have resulted in an Uncertain status.	358
Turban Shells <i>Turbo</i> spp.	Undefined	The NSW Turban Shell fishery consists of a complex of three species. Historical and current reporting and recording of catch information does allow individual species catch histories to be generated. Biological information for individual species is available. Determination of a reliable exploitation status is currently not possible, and as such remains Undefined.	362

SPECIES	STATUS	HARVEST COMMENT	
Whaler Sharks <i>Carcharhinus</i> spp.	Undefined	A complex of species that are very difficult to identify (particularly as juveniles). Insufficient information is available to determine status for any of the whaler shark species.	364
Whitebait - Sandy Sprat <i>Hyperlophus vittatus</i>	Undefined	Very little local biological information is available for whitebait. This lack of information and the variable commercial fishery for this species has resulted in a status of Undefined.	368
Wobbegong Sharks <i>Orectolobus</i> spp.	Undefined	The available catch data are not sufficiently accurate to use for determining stock status for any of the three species which occur off NSW.	371
Yellowfin Bream <i>Acanthopagrus australis</i>	Fully Fished	A long history of stable commercial catch rates in both the estuarine and oceanic fisheries, consistent size compositions through time and recent age compositions indicating that fishing mortality is similar to natural mortality has resulted in a status of Fully Fished	374
Yellowfin Tuna <i>Thunnus albacares</i>	Fully Fished	Mainly a Commonwealth fishery off eastern Australia, with some uncertainty about the degree of overlap with the much larger western and central Pacific stock. Status has been adopted consistent with the Commonwealth assessment -not overfished, but there is some concern about high rates of fishing in the western and central Pacific.	379
Yellowtail Kingfish <i>Seriola lalandi</i>	Growth Overfished	There are some concerns for this stock due to declines in total landings across sectors, variable catch rates and few larger fish in landings. A lack of recent age composition and fishing mortality estimates is limiting assessment of the Yellowtail Kingfish stock. Yield per recruit analyses indicate that yield from the Yellowtail Kingfish stock would be increased by increasing the size at first capture and/or by reducing fishing mortality and has resulted in a status of Growth Overfished.	382
Yellowtail Scad <i>Trachurus novaezelandiae</i>	Fully Fished	A relatively long-lived small pelagic species which is fished throughout its distribution. Recent declines in average sizes landed have caused some concerns for the stock, however age composition data indicating that fishing mortality was similar to natural mortality have resulted in a status of Fully Fished.	386

Resource Assessment Performance

Key species have a range of requirements for resource assessment. A target Resource Assessment Class (RAC, see page xxiii for explanation) was originally nominated for each species based on their importance to commercial and recreational fisheries in NSW. The current RAC is assessed and updated by scientists at the annual Resource Assessment Workshop. The following figure summarises the difference between current and target RAC for all species combined - a reduction in this indicator signifies that RACs are approaching their target levels. The table on the following page lists the current and target RACs for each species separately.

Performance Indicator for Resource Assessment



The sum of the difference between the current and target Resource Assessment Class (Δ RAC) for all key commercial and recreational species, 2003/04 to 2013/14.

Summary of the current and target Resource Assessment Classes (RAC) for all key species.

SPECIES	RAC 2013/14	RAC TARGET	SPECIES	RAC 2013/14	RAC TARGET
Angel Sharks	3	3	Hapuku	4	3
Australian Anchovy	4	3	Jackass Morwong	1	2
Australian Bonito	2	2	John Dory	3	3
Australian Sardine	3	2	Leatherjackets, Other	5	2
Banded Morwong	4	3	Loligo Squid	5	5
Banded Rockcod	3	2	Longtail Tuna	4	4
Bass Groper	4	3	Luderick	3	2
Beachworms	5	3	Mackerel Tuna	4	4
Bigeye	4	4	Mahi Mahi	4	3
Blacklip Abalone	3	1	Mako Sharks	4	3
Blue Mackerel	3	2	Mangrove Jack	4	3
Blue Shark	4	3	Mantis Shrimp	5	5
Blue Swimmer Crab	4	2	Mirror Dory	3	3
Blue-eye Trevalla	3	2	Mulloway	2	2
Bluespotted Flathead	3	2	Ocean Jacket	3	2
Boarfish	4	3	Ocean Perch	3	3
Brown Tiger Prawn	4	3	Octopus	5	2
Bugs	3	2	Pearl Perch	3	2
Catfish	5	3	Pink Ling	1	2
Cobia	4	2	Pipi	3	2
Cockles	5	3	Red Gurnard and Latchets	4	3
Common Jack Mackerel	3	3	Red Morwong	4	3
Common Silver Bidy	4	3	Red Mullet	4	3
Crimson Banded Wrasse	3	3	Redfish	3	3
Cunjevoi	4	3	River Eels	5	2
Cuttlefish	5	3	River Garfish	3	3
Dart	4	2	Rock Blackfish	2	2
Diamondfish	4	4	Royal Red Prawn	3	3
Dogfish	5	3	Sand Mullet	3	3
Dusky Flathead	3	2	Sand Whiting	3	2
Eastern Australian Salmon	3	2	Sawsharks	5	3
Eastern Blue Groper	4	3	School Prawn	3	1
Eastern King Prawn	1	1	School Shark	1	2
Eastern Pigfish	3	3	Sea Mullet	2	2
Eastern Red Scorpionfish	3	2	Sea Urchin Green	3	3
Eastern Rock Lobster	1	1	Sea Urchin Purple	3	3
Eastern School Whiting	1	2	Sea Urchin Red	3	3
Eastern Sea Garfish	2	2	Shovelnose Rays	5	2
Estuary Perch	3	3	Silver Sweep	3	2
Flounders	5	3	Silver Trevally	3	2
Frigate Mackerel	4	3	Snapper	2	1
Gemfish	1	2	Soles	4	3
Ghost Nipper	4	3	Southern Calamari	3	3
Ghostsharks	4	3	Southern Maori Wrasse	4	2
Giant Mud Crab	3	2	Spanish Mackerel	1	2
Goldspot Mullet	3	3	Spanner Crab	2	2
Gould's Squid	3	3	Spotted Mackerel	1	2
Greentail Prawn	4	3	Stout Whiting	2	2
Grey Morwong	2	2	Striped Grunters	4	3
Gummy Shark	1	2	Striped Marlin	1	2
Hairtail	4	3	Tailor	3	2
Hammerhead Sharks	5	3	Tarwhine	3	2

SPECIES	RAC 2013/14	RAC TARGET
Teraglin	3	2
Tiger Flathead	1	1
Tiger Shark	4	3
Tilefish	3	3
Trumpeter Whiting	3	3
Turban Shells	5	3

SPECIES	RAC 2013/14	RAC TARGET
Whaler Sharks	5	3
Whitebait	3	2
Wobbegong Sharks	5	3
Yellowfin Bream	3	2
Yellowfin Tuna	1	2
Yellowtail Kingfish	3	2
Yellowtail Scad	2	2



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Exploitation Status - Defined

The NSW Department of Primary Industries has developed the following scheme to classify the exploitation status of key species. At an annual Resource Assessment Workshop departmental scientists review the information available on all key species and determine an exploitation status for each species (or group of closely related species). Scientific representatives from the Commonwealth and Queensland governments are also invited. Additional information on the framework utilized is available in the report: Scandol, J.P., 2004. A framework for the assessment of harvested fish resources in NSW. 96 pages. NSW Department of Primary Industries - Fisheries Resource Assessment Series No. 15. ISSN 1449-9940.

CATEGORY	CHARACTERISTIC
OVERFISHED	<ul style="list-style-type: none"> • Recruitment is being significantly suppressed as a result of a small spawning biomass (as determined by a population model or measured stock-recruitment relationship) • Fishing mortality rates are significantly greater than natural mortality rates • Estimates of spawning biomass are less than 20-30% of the estimated unfished spawning stock • The 'Spawning Potential Ratio' is less than 20-40% (depending on life history characteristics) • Catch rates are less than 30% of the initial catch rates • Length and age distributions unstable (excessively affected by recruitment, too few age or size classes in the exploitable population given a species' life history) • Trends in length/age compositions are evident which indicate increasing (and/or excessive) fishing mortality
GROWTH OVERFISHED	<ul style="list-style-type: none"> • Yield per recruit would increase if length at first capture was increased or fishing mortality decreased • A population model has determined that sustainable yield would increase if fishing mortality was decreased or size at first capture were increased
FULLY FISHED	<ul style="list-style-type: none"> • Fishing mortality is approximately the same as natural mortality • Estimates of the spawning biomass are greater than 30% of the estimated unfished spawning biomass • Catch rates have been steady for 5-10 years and/or catch rates are greater than 30% of initial catch rates • Length and age distributions are stable • Species are fished throughout their entire geographic range
MODERATELY FISHED	<ul style="list-style-type: none"> • Fishing mortality is less than half of natural mortality • Estimates of the biomass are greater than 70% of the estimated unfished biomass • Catch rates are greater than 70% of initial catch rates • Species are fished in most of their geographic range but non-fishing areas are known to exist • Markets may limit catch and effort
UNCERTAIN	<ul style="list-style-type: none"> • A significant amount of evidence has been collected and considered, but there are inconsistent or contradictory signals in the data that preclude determination of exploitation status
UNDEFINED	<ul style="list-style-type: none"> • Commercial catch data are available but no reasonable attempt has been made to determine exploitation status • Recreational species - some data are available but no reasonable attempt has been made to determine exploitation status

Resource Assessment Classes - Defined

There is a range of socioeconomic values associated with harvested species in NSW. A species harvested in the thousands of tonnes by commercial and recreational fishers cannot be given the same priority for assessment as other species harvested in much smaller quantities. In addition to this, the conservation values associated with some species (such as sharks) are more acute than those of others (such as some invertebrates), therefore additional prioritisation is justified. To manage this situation, each key species is associated with a target and current (2013/14) Resource Assessment Class (RAC). The attributes of these classes are defined in the table below. The difference between the current and target assessment class is used in the management of the assessment program and is also a performance indicator within the Fishery Management Strategy for each of the multi-species commercial fisheries.

Attribute	Class of Resource Assessment				
	One	Two	Three	Four	Five
Current population dynamic models producing estimates of relative biomass	●				
Estimates of biological reference points (e.g. SPR, YPR, F0.1)		●			
Current estimates of total, natural and fishing mortality		●			
Time series of age composition data (finfish only)		●			
Current local (NSW) information for growth, mortality, selectivity and maturity		●			
Current qualitative risk analysis of future harvesting		●			
Current indicator of abundance			●		
Representative time-series of commercial catch			●		
Current estimate of recreational catch			●		
Time series of length-composition data			●		
Current non-local (not NSW) information for growth, mortality, selectivity and maturity				●	
Known biological stock structure				●	
Complex of related species					●

How To Read The Species Reports

The Standard Fish Name for the species, genera, order or family that is represented by this report. In the case of some invertebrates (shellfish), a Standard Fish Name may not yet have been defined, so a common name is used. Standard Fish Names have been developed to improve reporting and marketing in Australia. For more information please visit the Standard Fish Names website.

The scientific name for the species, genera, order or family that is represented by this report.

The scientist that compiled the species chapter. Generally they are considered to be the species expert within NSW DPI.

The exploitation status of the species (or group of related species) as defined by NSW DPI for the 2013/14 financial year. The quantitative and qualitative criteria that were used to specify exploitation status are described on page xxii.

A short comment summarising the status of the species (or group of related species) which provides additional context for the exploitation status.

The scientific name of the individual biological species that constitute this report. Note that these names are subject to change as researchers refine the taxonomy of these species.

The Standard Fish Name of the individual biological species that constitute this report. In the case of some invertebrates, a standard name will not yet be available.

A short comment about the individual species that constitute this report. When only a single species is reported upon, this comment is usually excluded as the information is contained elsewhere in the report.

A copyright illustration of one of the species represented by this report. These colour pencil illustrations are under license from Bernard Yau and must not be reproduced without permission.

Background information about the species. This section contains a brief biological and ecological background to the species as well as summary information about the fisheries that harvest this species in NSW.

NSW DPI STATUS OF FISHERIES RESOURCES IN NSW, 2013-14

Yellowfin Bream

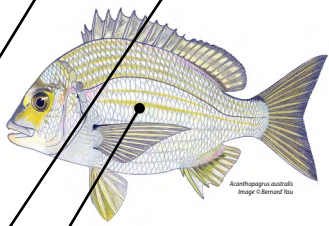
(*Acanthopagrus australis*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

A long history of stable commercial catch rates in both the estuarine and oceanic fisheries, consistent size compositions through time and recent age compositions indicating that fishing mortality is similar to natural mortality has resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Acanthopagrus australis</i>	Yellowfin Bream	



Acanthopagrus australis
Image © Bernard Yau

Background

Yellowfin Bream (*Acanthopagrus australis*) are endemic to Australia and occur from Townsville in Queensland to the Gippsland Lakes Victoria. In NSW waters, Yellowfin Bream are found primarily within estuaries and along nearshore beaches and rocky reefs, although they also occur within the lower freshwater reaches of coastal rivers. Within estuaries, Yellowfin Bream are found in association with all types of habitat, including seagrass beds, mangroves, bare substrates and rocky reefs. They eat a wide variety of foods, including small fish, molluscs, crustaceans and worms.

The timing of spawning of Yellowfin Bream varies along the east coast of Australia. They have been reported to spawn from winter to summer in southern NSW and mainly during winter in southern Queensland (Pollock 1982). There is a pre-spawning run of fish from estuaries to the ocean in NSW usually between April and July. Spawning occurs in inshore waters near estuary entrances. The larvae enter estuaries and the small juveniles subsequently live in sheltered shallow water habitats (particularly seagrass beds and mangrove channels). Larger juveniles occur in slightly deeper waters, and are particularly common around estuarine and near shore coastal reefs. Yellowfin Bream grow slowly, taking about 2 years to reach 23 cm fork length (FL). They mature at around 22 cm and appear to undertake extensive pre-spawning migrations. Maximum length is about 55 cm FL and maximum weight about 3.7 kg. Adults may return to estuarine waters after spawning.

The majority of bream taken in the Estuary General Fishery are caught in mesh and hauling nets with a smaller number taken in fish traps. The highest commercial catches of bream occur in autumn and winter. Reported commercial landings of bream declined substantially during the 1990s; however this was due to declines in effort and the phasing out of the pound (figure six) nets in Port Stephens

YELLOWFIN BREAM (P.37)

SUSTAINABLE FISH HARVEST PROGRAM

and adjoining coastal waters. Yellowfin Bream are also taken in very large quantities by recreational fishers.

Black Bream (*Acanthopagrus butcheri*) is a similar species to Yellowfin Bream and is found in estuarine waters on the NSW coast south of Myall Lakes. They are almost exclusively found in estuarine waters, and generally only enter ocean waters after periods of flood. Black bream are often reported as Yellowfin Bream during catch reporting, as distinguishing the species by visual examination can be very difficult. The differentiation between the species is made more difficult through a significant percentage of hybrids that exist as a result of the two species interbreeding.

Additional Notes

- Estuarine and ocean catch rates of Yellowfin Bream have remained relatively stable.
- The sizes of Yellowfin Bream in commercial landings have been stable since the 1950s.
- Surveys of recreational fishing showed no changes in the sizes of Yellowfin Bream retained in Lake Macquarie through time.
- The most recent age composition data for Yellowfin Bream (2009/10) indicated that Natural mortality was similar to Fishing mortality.
- The Eastern Australian biological stock of Yellowfin Bream has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal length of 25 cm total length (approximately 22.5 cm FL) for bream in NSW and a combined recreational bag limit of 10 for all bream and tarwhine combined.

Catch

Recreational Catch of Yellowfin Bream

The most recent estimate of the recreational harvest of bream (all species combined) in NSW was approximately 614,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 1.5 million fish (in the order of 940 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Yellowfin Bream

Commercial landings (including available historical records) of yellowfin/black bream for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Yellowfin Bream

Reported landings of Yellowfin Bream by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Time-series graph of the commercial landings by NSW licensed commercial fishers. Note that there have been many significant changes to the reporting requirements of commercial operators in the last 50 years which can confound changes to actual landings. These issues are either commented upon in the figure caption, or only consistently reported data are presented. Fish that are discarded (i.e. caught but not landed) are not included.

Additional notes about the species. This section contains bullet points (which are easier to maintain and keep up-to-date) on recent issues that affect the species in NSW waters. Examples include changes to regulations or the finalisation of research projects.

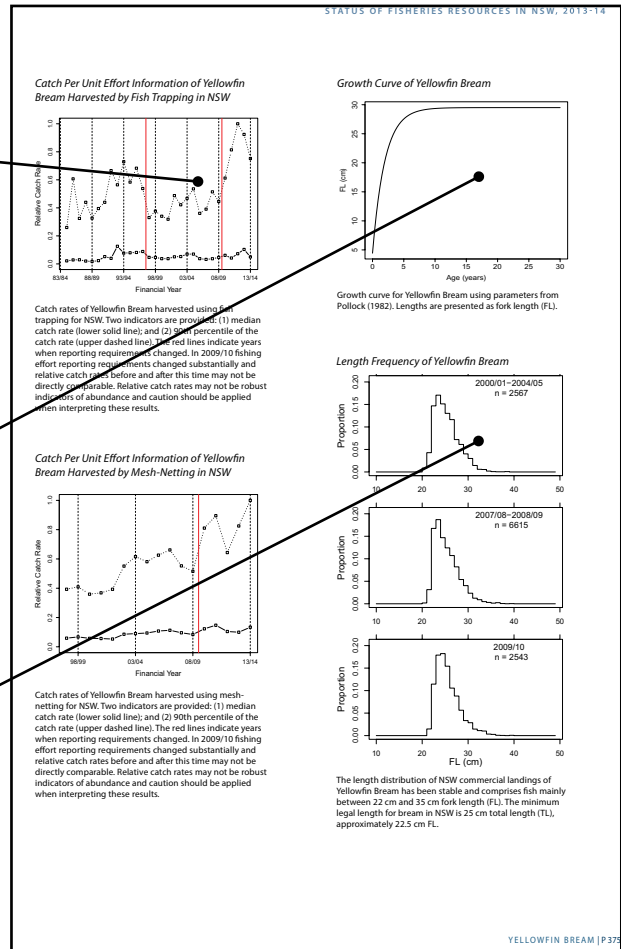
Bar graph of the commercial landings by NSW commercial fishery since 1997/98 (when these fisheries were gazetted). The legend for this figure also indicates the type of key species (primary, key secondary, target, byproduct or conditional target) that the reported species represents for each commercial fishery. Note that in some cases, the catch of a key species is so small that it cannot be included on the graph for reasons of clarity or privacy.

Statement on the recreational catch. This section contains the most recent estimate of the recreational catch in NSW waters, generally from a statewide survey done in 2013/14 (West *et al.*, 2015). Where possible this is compared with estimates from the 2000/01 National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003).

Time-series graph of the relative catch per unit of effort (CPUE or catch rate) for a suitable commercial fishing method. CPUE can be considered an indicator of abundance in some cases, but there are always significant caveats due to the behaviour of the fish and the fishers. Two time-series of CPUE are presented: the median which is the “middle-ground” of the catch rates experienced by all fishers (including those that take small incidental catches); and the 90th percentile which indicates the catch rates experienced by commercial fishers who are deemed to be targeting the species. The 90th percentile is likely to be a more sensitive indicator of abundance, but is inevitably more variable.

Growth information on individual fish. The relationship between the age and length of an individual fish provides valuable information on the productivity of a stock. The growth curve is plotted along with the raw data (if available).

Length composition histograms of landed fish. The length composition is an effective indicator of fishing pressure. For example, as fishing pressure increases, length compositions contract towards smaller fish as the larger individuals are removed from the population. In contrast, a stable length composition over decades indicates that the fishing pressure is likely to be sustainable.



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Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 330004 and 37 353003, common name or scientific name to find further information about the species.

A list of references for further reading. This list is not an exhaustive bibliography but rather an indicative guide as to where additional information on this species can be found.

The code or CAAB (Codes for Australian Aquatic Biota) of the individual biological species that constitute this report. In many cases, there is only a single species included on a report, but in other cases each report groups a number of species at a higher taxonomic level. The CAAB is a unique 8-digit code that is maintained by the CSIRO Division of Marine and Atmospheric Research, Australia. Please visit the CAAB website for more information.

Angel Sharks

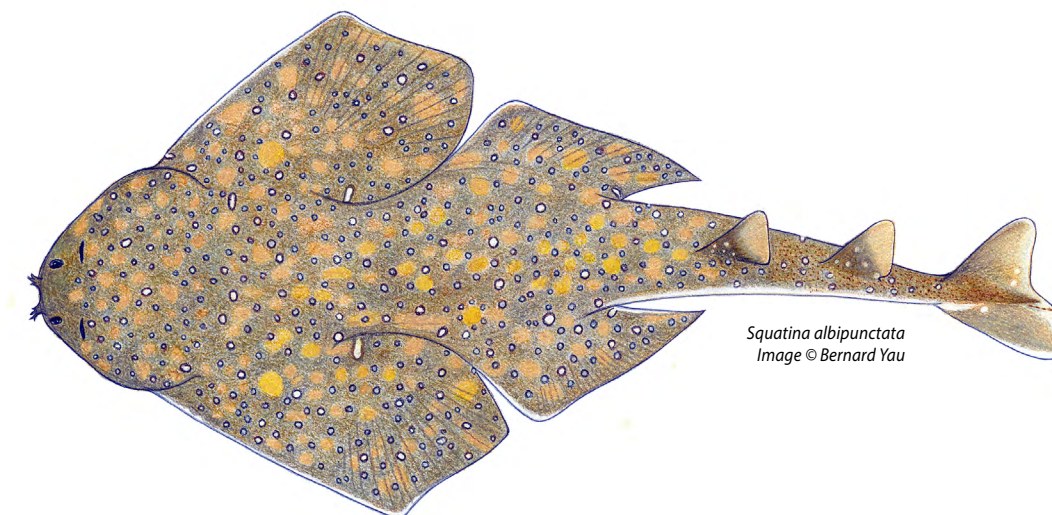
(*Squatina* spp.)

Author Vic Peddemors

EXPLOITATION STATUS FULLY FISHED

A long history of stability in catch rates and sizes harvested has resulted in a status of Fully Fished for Angel Sharks in NSW.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Squatina australis</i>	Australian Angel Shark	Caught in inshore waters south of Sydney.
<i>Squatina albipunctata</i>	Eastern Angel Shark	Offshore species that is also caught in the South East Trawl Fishery. Caught along the entire NSW coast.



Background

Two species of Angel Sharks are caught off NSW. The Australian Angel Shark (*Squatina australis*) occurs on the continental shelf mainly in depths shallower than 130 m and is found around southern Australia from central NSW to southern WA. Although a few specimens have been caught as far north as Port Macquarie, it is mainly found south of Sydney. The Eastern Angel Shark (*S. albipunctata*) occurs on the mid to outer continental shelf and the upper slope in depths to about 400 m, between Lakes Entrance in Victoria and Cairns in Queensland.

The size range for Australian Angel Sharks caught in research trawl surveys was 30-117 cm total length (TL) for females and 34-104 cm for males; the large females weighed up to 15 kg. Eastern Angel Sharks are slightly larger with the female size range 27-132 cm TL and males 30-106 cm, with the

maximum weight of females close to 20 kg. Both species feed mainly on small fish, squid and crustaceans.

The biology of the two NSW species is not well known. The small amount of biological data collected during research surveys indicated that, for both species, males matured between 80-90 cm in length. For females, Australian Angel Sharks matured between 90-100 cm and Eastern Angels between 100-110 cm. Both species have around 10-13 pups and gestation probably takes about one year. Development of direct methods to estimate ages of Angel Sharks has proven problematic - analysis of tag recapture data for a Californian species suggests longevity of at least 25 years.

The two species are not separated in NSW catch records but reported landings of Angel Sharks by the

NSW Ocean Trawl Fishery have been relatively stable at 30-50 t per annum since the late 1990s. The relative contribution of the two species to the landed catch is not accurately known, but it is believed that the Eastern Angel Shark comprises the bulk of landings off NSW. Angel Sharks are caught infrequently by recreational fishers.

Additional Notes

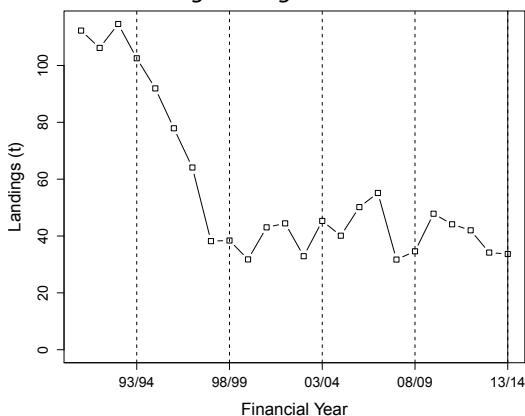
- Two species of Angel Shark are harvested by trawling in ocean waters. Both species are likely to be relatively fast growing and reasonably fecund (although study of the biology of these species was only commenced in 2011).
- *Squatina australis* is an inshore southern species not common north of Sydney and *S. albipunctata* is caught in deeper water off NSW and Queensland.
- Angel Sharks are a key secondary species in the Ocean Trawl Fishery and were assigned a 'high' risk in the Environmental Impact Assessment.
- Although apparently quickly reduced in number on the NSW upper slope by trawlers in the 1970s, catches and catch rates of Angel Sharks have recently been relatively stable off central NSW, probably because they occupy areas and depths that are not heavily trawled.

Catch

Recreational Catch of Angel Sharks

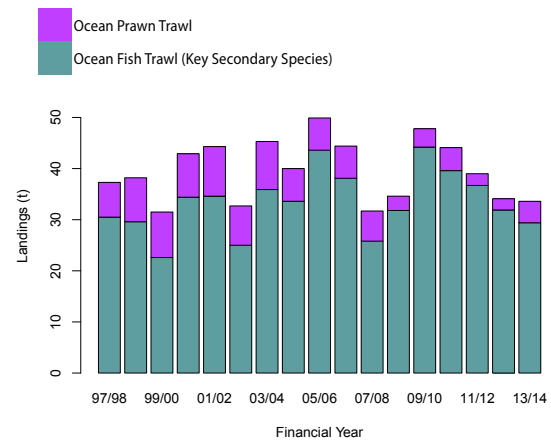
The annual recreational harvest of Angel Sharks in NSW is considered to be minor.

Historical Landings of Angel Sharks



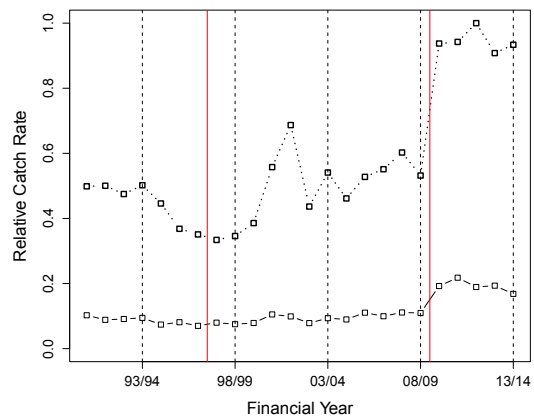
Commercial landings (including available historical records) of Angel Sharks for NSW from 1990/91 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Angel Sharks



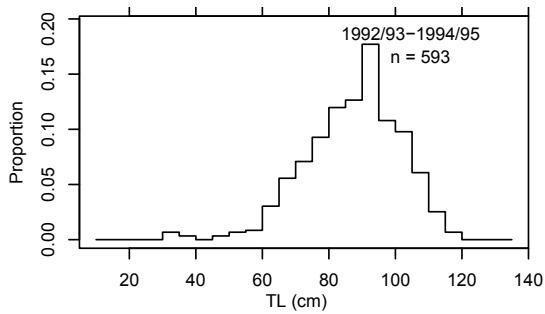
Reported landings of Angel Sharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Angel Sharks Harvested by Fish Trawling in NSW



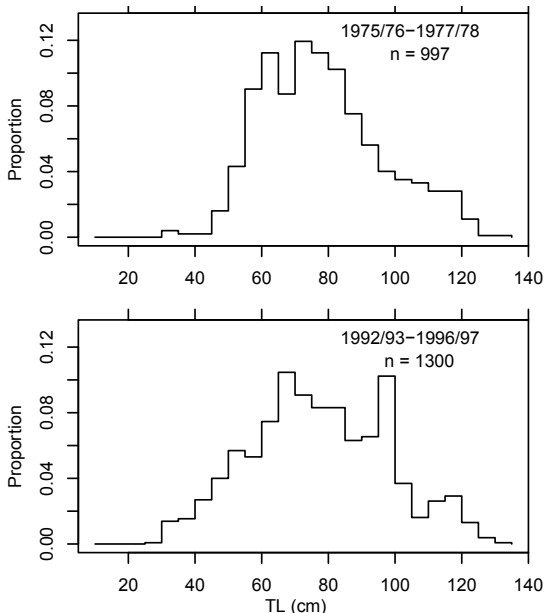
Catch rates of Angel Sharks harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Australian Angel Shark



The length distribution of Australian Angel Shark caught during trawl surveys by the Fisheries Research Vessel Kapala comprised mainly of sharks between 60-110cm TL (total length). There is no minimum legal length for Angel Shark in NSW.

Length Frequency of Eastern Angel Shark



The length distribution of Eastern Angel Shark caught during trawl surveys by the Fisheries Research Vessel Kapala comprised mainly of sharks between 50-120cm TL (total length). There is no minimum legal length for Angel Shark in NSW.

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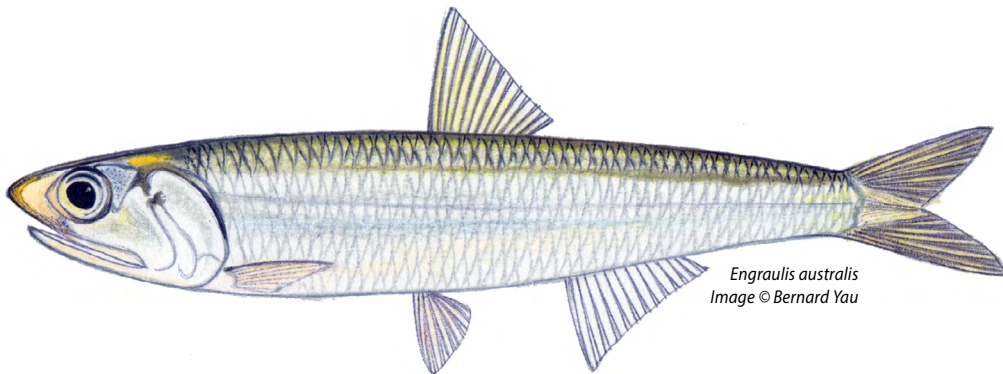


Australian Anchovy

(*Engraulis australis*)

Author John Stewart

EXPLOITATION STATUS		UNDEFINED
Very little local biological information is available for Australian Anchovy. This lack of information and the small commercial fishery for this species has resulted in a status of Undefined.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Engraulis australis</i>	Australian Anchovy	



Background

Worldwide, there are about 140 species of anchovies, most of which are found in tropical or subtropical waters. Similar in appearance to pilchards and sprats, anchovies have a distinctive undershot lower jaw and are usually smaller, rarely exceeding 12 cm in length. Anchovies often form very large schools and are commercially important in many parts of the world, being the basis of large industrial fisheries for fishmeal as well as being caught for human consumption. They feed predominantly on copepods and other zooplankton and, in turn, are important forage fish for many marine predators such as carnivorous pelagic fishes, squids, dolphins and seabirds.

The Australian Anchovy (*Engraulis australis*) is found in temperate waters from central Queensland around southern Australia to Shark Bay in WA, although its continuous distribution throughout the Great Australian Bight is still uncertain. It is also

found around Lord Howe Island and is the only species of anchovy in New Zealand, inhabiting waters around the North Island and most of the South Island. Juveniles are mainly found in estuaries and bays, whereas mature anchovies are found in open coastal waters out to water depths of 200 m as well as estuaries and bays. Around Australia, there are believed to be three distinct populations of anchovy (off western, southeastern, and eastern Australia). The eastern population, found along the Queensland and NSW coasts, begin spawning in spring and peak during summer. The anchovy in the north commence breeding some weeks before their southern counterparts. In the north, the anchovy mainly spawn in the open sea over the continental shelf, whereas in the south, they breed in inlets and harbours as well as in the open sea.

The preferred water temperatures of the Australian Anchovy range from 10-21°C, with breeding temperatures being between 14-20°C. Salinity tolerances vary greatly, from 2-37‰ salinity with at least 15‰ salinity needed for spawning to occur. Maturity is reached within one year in both the male and female anchovy, at a length of 6-7 cm. Their maximum life span is thought to be six years (based on scale readings) with a maximum length of about 16 cm. Anchovies exhibit seasonal growth, with faster growth occurring throughout spring and summer.

Anchovies in NSW are landed at low levels throughout the year, with large catches taken only sporadically. The bulk of the anchovy catch is taken in ocean waters with purse seine and Pilchard, Anchovy and Bait (PAB) nets, and smaller quantities are taken in estuarine waters using hauling and PAB nets. Only a small percentage of the commercial anchovy catch is sold for human consumption with the majority sold for bait or aquaculture feed.

Additional Notes

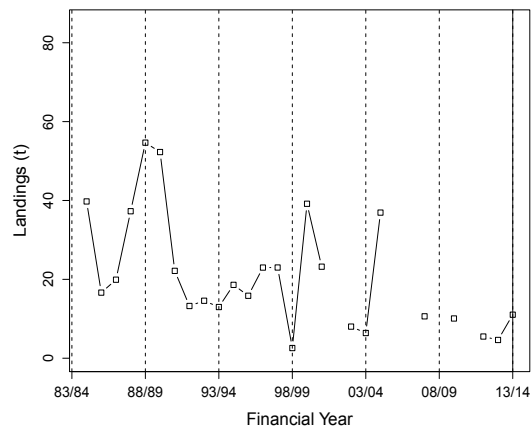
- NSW commercial catches of anchovy are minor, averaging less than 10t per year since 2003/04.
- Recreational landings are likely to be insignificant.
- There is a recreational bag limit of 100 for Australian Anchovy.

Catch

Recreational Catch of Australian Anchovy

The annual recreational harvest of Australian Anchovy in NSW is considered to be minor.

Historical Landings of Australian Anchovy



Commercial landings (including available historical records) of Australian anchovy for NSW from 1984/85 to 2013/14 for all fishing methods. Financial years where commercial catch was reported by less than six fishermen were removed due to privacy concerns.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 086001, common name or scientific name to find further information.



Australian Bonito

(*Sarda australis*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

A very fast growing, early maturing, schooling species that supports seasonal commercial and recreational fisheries. The NSW fishery is based on a few age classes, mostly 1-3 years of age. Variable landings and catch rates are driven by variable recruitment in this species. Australian Bonito are therefore classified as being Fully Fished.

SCIENTIFIC NAME

STANDARD NAME

COMMENT

Sarda australis

Australian Bonito



Sarda australis
Image © Bernard You

Background

Bonitos, genus *Sarda*, are distributed globally throughout tropical and temperate seas. The genus is characterised by fast growing, medium sized, schooling species that support large commercial and recreational fisheries. There are four species within the genus *Sarda* – the Atlantic Bonito *Sarda sarda*; the Striped Bonito *Sarda orientalis*; the Australian Bonito *Sarda australis*; and the Pacific Bonito *Sarda chiliensis* – with northern and southern Pacific Bonito subspecies recognised: *S. chiliensis lineolata* and *S. chiliensis chiliensis*, respectively.

Australian Bonito occur in waters around south-eastern Australia, Norfolk Island and occasionally northern New Zealand. Nothing is known about the stock structure within this range. Leaping Bonito (*Cybiosarda elegans*) are also caught in small numbers off NSW and can be distinguished by the yellow colour of the second dorsal and anal fins, and dark spots rather than lines on the dorsal surface.

Reproduction in Australian Bonito is poorly understood, but they are thought to mature at about 36 to 38 cm fork length and at an age of approximately 1 year. Spawning may occur during spring and summer but where this occurs is not known and little is known of their early life history. Australian Bonito are very fast growing and exhibit extreme seasonal growth, with juveniles potentially attaining around 30 cm fork length in only 3 months yet growth almost ceasing during the winter months. Australian Bonito can attain a length of 100 cm and a weight of at least 9 kg.

Australian Bonito are landed commercially throughout the year in NSW however peak landings tend to be during the summer and autumn months. Line fishing in the Ocean Trap and Line Fishery accounts for almost all of the commercial catch. Annual commercial landings fluctuate considerably and tend to range between 150-350 t per year.

Additional Notes

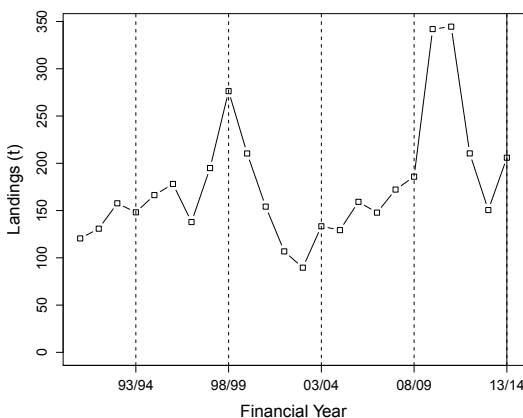
- The fishery in NSW is based on just a few age classes, mostly 1-3 year old fish.
- A strongly schooling species with availability varying between seasons, years and areas.
- A fast growing relatively short-lived species, Australian Bonito are thought to have a maximum age of 5 years.
- Bonito are a popular species with recreational fishers.
- There is no minimum legal length for bonito in NSW, but there is a recreational bag limit of 10 bonito.

Catch

Recreational Catch of Bonito

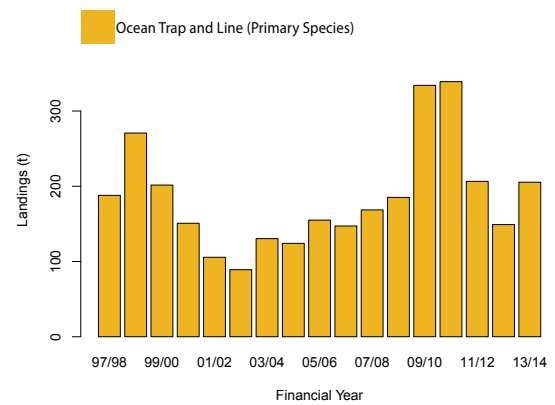
The most recent estimate of the recreational harvest of Australian Bonito in NSW is approximately 40,000 fish during 2013/14 (West *et al.*, 2015). This estimate is the same as the previous estimate of approximately 40,000 fish (in the order of 70 t in 2000/01) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Bonito



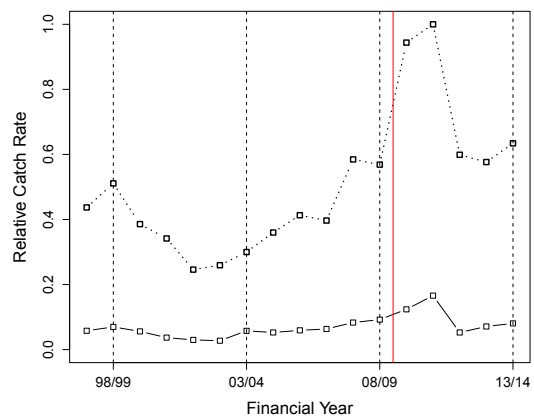
Commercial landings (including available historical records) of bonito for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Bonito



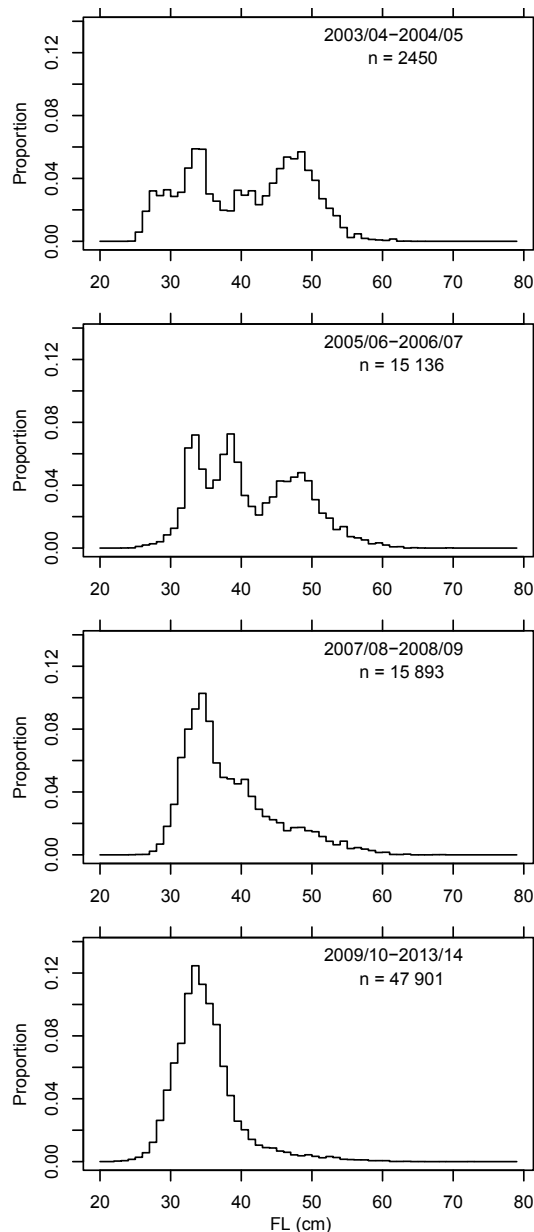
Reported landings of bonito by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Bonito Harvested by All Line Methods in NSW



Catch rates of bonito harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Australian Bonito



The length distribution of Australian Bonito in commercial landings comprises fish mainly between 25-50 cm fork length (FL). Lengths vary substantially throughout the year with smaller fish being more abundant during the spring months. Despite this seasonal variation the overall size distribution of Australian Bonito landed commercially has remained stable since the 1980s. There is no minimum legal length for Australian Bonito in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441020, common name or scientific name to find further information.



Department of
Primary Industries

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Australian Sardine

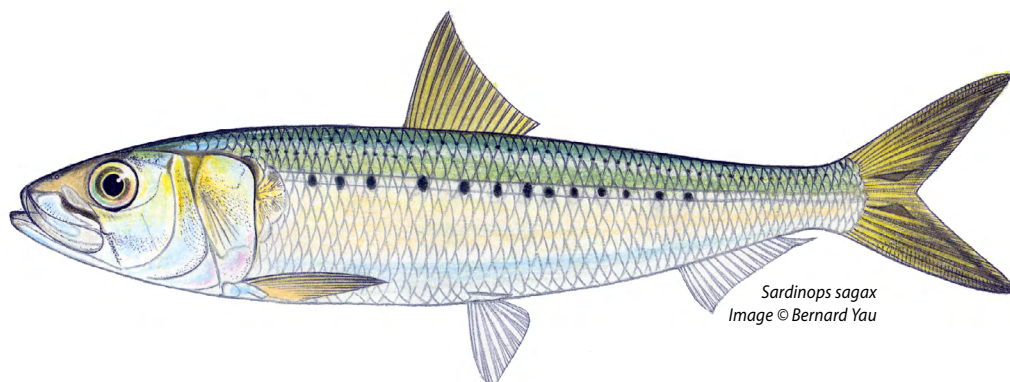
(*Sardinops sagax*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

A lack of data on the abundance of Australian Sardines off eastern Australia together with a lack of very large fish in landings during recent years, a lack of current age composition data and uncertainties around stock structure and biological parameters has resulted in a status of Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sardinops sagax</i>	Australian Sardine	Previously known as Pilchard and <i>Sardinops neopilchardus</i> .



Background

Sardines occur in many temperate regions of the world where they support very large commercial fisheries. In Australian waters, sardines are distributed around the entire southern half of the continent where they inhabit continental shelf waters and the lower reaches of estuaries. The population structure in Australian waters is complex, with evidence of broad separation between sardines in Western Australia, South Australia and eastern Australia. These areas comprise smaller size dependent shoals that effectively create a single semi-continuous Australian meta-population. In eastern Australia sardines exhibit substantial inter-annual and seasonal size- and age-based variation and the connectivity between sardines in southern Queensland/northern NSW and southern NSW/Victoria is largely unknown.

Peak spawning of east-coast sardines is reported to occur in water temperatures between 18-22°C. Spawning occurs from winter to spring in northern NSW waters and potentially through autumn to summer in southern NSW. Sardine in NSW mature at around 14 cm fork length (FL). Sardines grow rapidly, reaching a maximum length of 23 cm FL and maximum age of 8 years. The majority of sardines landed in the NSW commercial fishery are aged between 1-3 years old.

Australian Sardine in NSW are mainly caught by the Ocean Hauling Fishery in purse seine nets. Smaller quantities are also taken using general purpose hauling nets and bait nets (which are modified hauling nets). The largest landings occur during winter/spring in northern NSW and autumn/winter in southern NSW.

Mass mortality events of Australian Sardine occurred in 1995 and again in 1998 throughout southern Australia, apparently caused by a herpes virus. Closures were put in place during these periods preventing commercial catches of sardines. Since that time populations of Australian Sardine have recovered in most areas.

Sardines landed in NSW are sold for bait, pet food and for human consumption. Sardines are an important prey item for many fish, and other species including penguins and other marine birds. Sardines were previously known as Pilchards in Australia.

Additional Notes

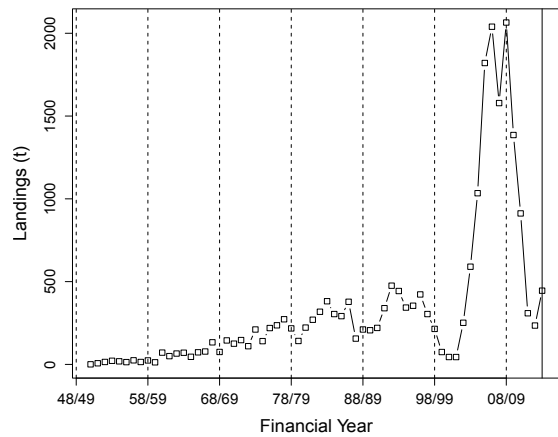
- The commercial harvest of sardines in NSW has declined in recent years due to reduced targeting as a result of a processing factory fire in late 2010.
- Results of a retrospective biomass estimate based upon the daily egg production method indicated a spawning biomass off eastern Australia in 2004 of around 25,000-35,000 t (Ward *et al.*, 2008). This estimate is considered too old to be relevant to current assessments.
- Total commercial landings in eastern Australia (catch from NSW, Victorian and Commonwealth waters) have exceeded the Recommended Biological Catch set by the Commonwealth in some recent years, however there is no evidence that current harvests are not sustainable.
- Commonwealth assessments do not consider Australian Sardines to be overfished nor subject to overfishing (Georgeson *et al.*, 2014).
- The Eastern Australian biological stock of Australian Sardine has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a recreational bag limit of 100 for Australian Sardine in NSW.

Catch

Recreational Catch of Australian Sardine

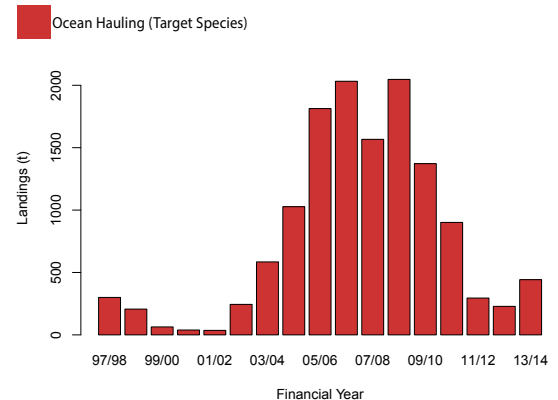
The annual recreational harvest of Australian Sardine in NSW is considered to be minor.

Historical Landings of Australian Sardine



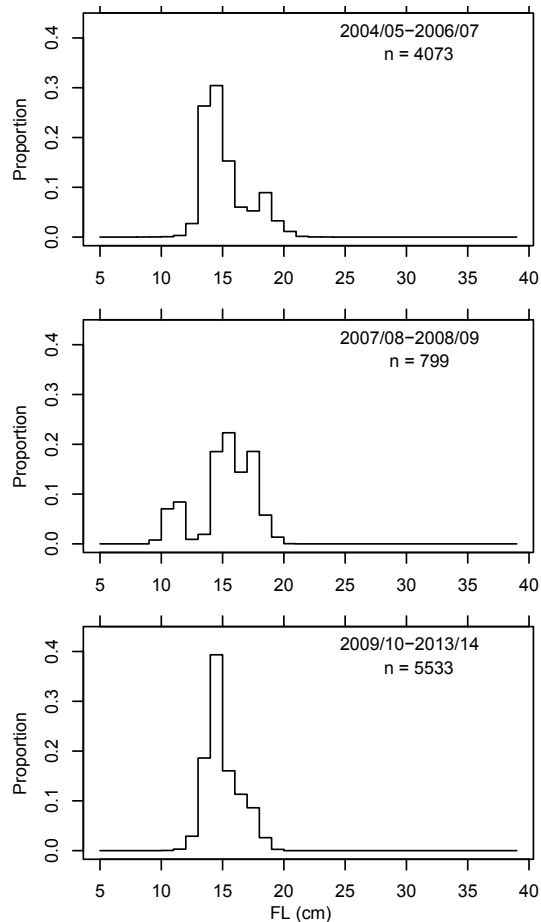
Commercial landings (including available historical records) of Australian Sardine for NSW from 1950/51 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Australian Sardine



Reported landings of Australian Sardine by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Australian Sardine



The length distribution of NSW commercial landings of Australian Sardine is generally comprised of fish between 10-20 cm fork length (FL) and in some periods shows distinct modes. The average length of Australian Sardine in NSW commercial landings has decreased in recent years with fewer fish between 15-20 cm FL. In NSW, Australian Sardine have no minimum legal length.

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 085002, common name or scientific name to find further information.



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Banded Rockcod

(*Epinephelus ergastularius*)

Author Rowan Chick

EXPLOITATION STATUS		UNDEFINED
A substantial component of the NSW Ocean Trap and Line dropline Fishery. Recreational catch is unknown, although anecdotal evidence suggests it may be increasing. Limited information is available on the biology of the species.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Epinephelus ergastularius</i>	Banded Rockcod	Previously known as Barcod.



Epinephelus ergastularius
Image © Bernard Yau

Background

Banded Rockcod (*Epinephelus ergastularius*) are only known to occur off the eastern coast of Australia between Townsville (18°S) and Batemans Bay (36°S). The taxonomy of Banded Rockcod is unclear and it is possible that fish occurring off Queensland belong to another species. A similar species, *E. octofasciatus*, occurs throughout the Indo-Pacific - as its name suggests, this species has eight dark bars on the body whereas *E. ergastularius* has seven bars. These bars become less distinct as the fish grows and adult Banded Rockcod are a uniform grey-brown in colour.

Adult Banded Rockcod are commonly found in the depth range 100-400 m while juveniles can be found as shallow as 15 m. Maximum reported total length (TL) of Banded Rock cod is about 160 cm and a weight of about 65 kg. There is little information on the biology of the species.

The Banded Rockcod is a primary species in the NSW Ocean Trap and Line Fishery which takes over 95% of the commercial harvest. This species was listed separately on commercial catch reporting forms in 1990. The annual catch of Banded Rockcod was >30 t in 2001/02 and 2002/03 and has generally fluctuated between about 10 t-30 t. Recent annual catches have ranged between about 10-15 t.

Monitoring of the NSW Ocean Trap and Line Fishery dropline catch at the Sydney Fish Market indicate lengths of fish have commonly ranged between 40-80 cm TL, equivalent to 2-5 kg in weight, with few fish >90 cm TL represented in the commercial catch.

Additional Notes

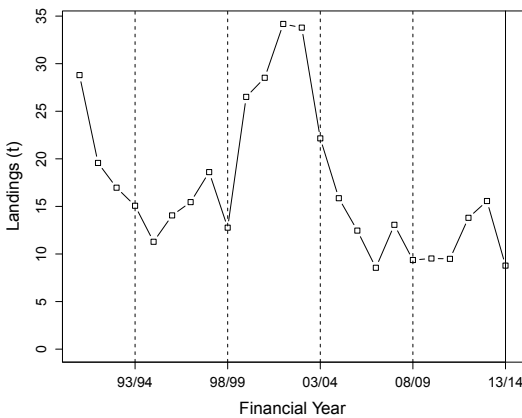
- Associated with hard reef grounds, mainly off the NSW north coast (and south to Kiama).
- Very little biological data is available - likely to be a slow-growing, long-lived species.
- Recreational catch is not well documented and is unknown. Anecdotal evidence suggests recreational catch in some areas may be greater than the commercial catch.
- There is a combined recreational bag limit of 5 Hapuku, Banded Rockcod, Bass Groper, Gemfish and Blue-eye Trevalla. Additional restrictions apply to Gemfish.

Catch

Length Frequency of Banded Rockcod

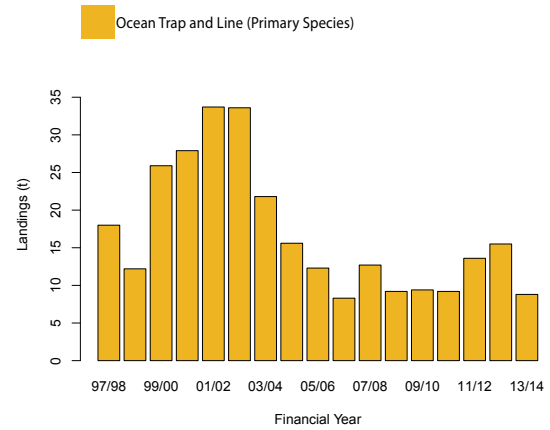
The annual recreational harvest of Banded Rockcod in NSW is likely to be less than 10 t.

Historical Landings of Banded Rockcod



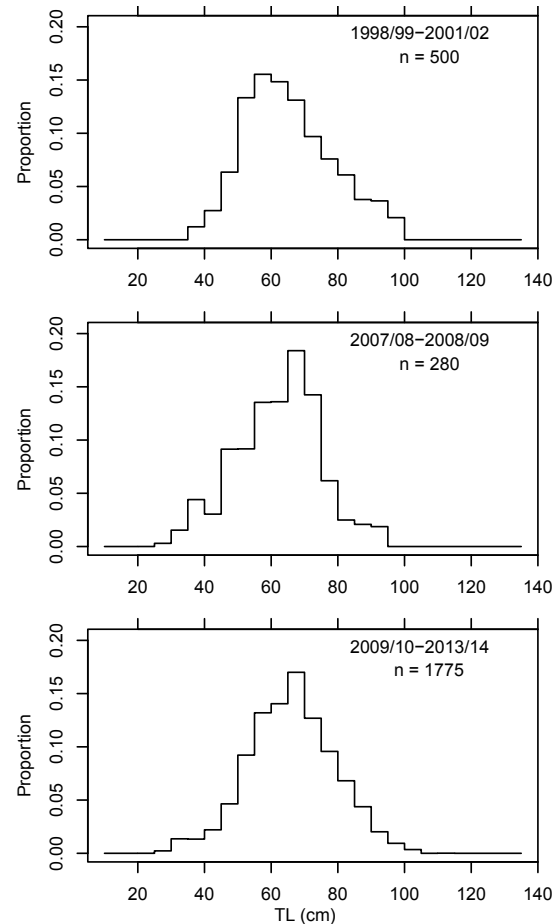
Commercial landings (including available historical records) of Banded Rockcod for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Banded Rockcod



Reported landings of Banded Rockcod by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Banded Rockcod



Length distributions of Banded Rockcod measured from the commercial fishery during different years. Total lengths commonly range between 40-80 cm TL. Sampling since 2007/08 indicates the most common total lengths of fish measured range between 60-80 cm, although the sample size during 2007/08-2008/09 was relatively small. There is no minimum legal length for Banded Rockcod in NSW.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 311147, common name or scientific name.

Australian Museum website <http://australianmuseum.net.au/> and search for Banded Rockcod



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Bass Groper

(*Polyprion americanus*)

Author Rowan Chick

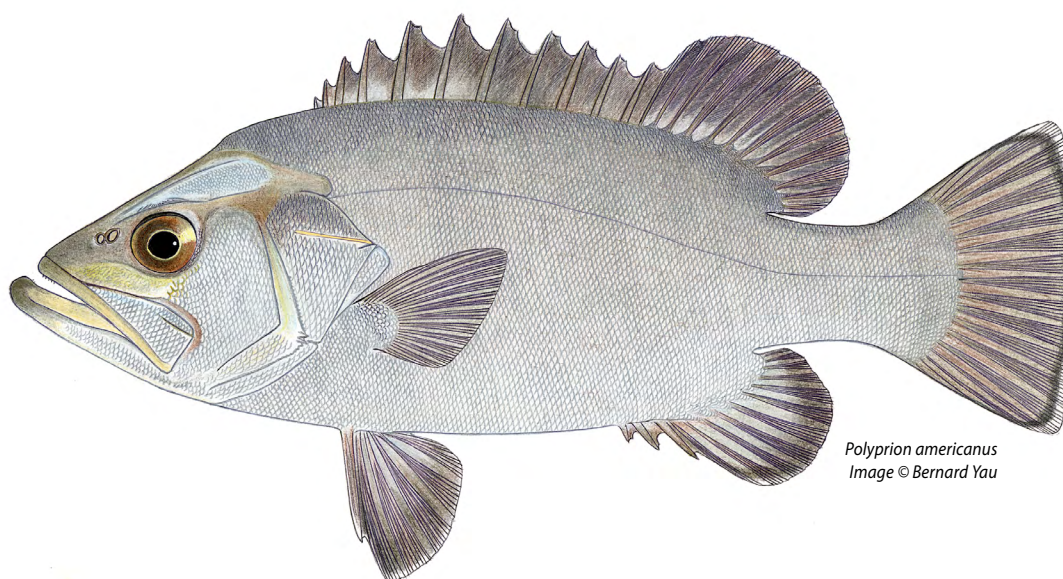
EXPLOITATION STATUS **UNDEFINED**

Limited relevant biological information available for NSW. Commercial catch information from 1997/98 indicates annual catches are relatively stable. Limited information to assess population size and structure. NSW exploitation status has not been defined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Polyprion americanus

Bass Groper



Background

The Bass Groper (*Polyprion americanus*) is a large, cosmopolitan species found in the northern and southern Atlantic Ocean, the Mediterranean Sea, southern Indian Ocean and in the south-western Pacific. Genetic studies have revealed that there are at least three distinct stocks of this species: the North Atlantic and Mediterranean group, Brazil group and the South Pacific (Australia and New Zealand) group.

Adult Bass Groper are commonly found in the depth range 100-600 m, typically inhabiting rocky reefs and caves. Juveniles (< 50 cm total length (TL)) occur in shallower waters around floating objects (or pieces of wreckage) giving rise to the name 'wreckfish' in other parts of the world. In Australia Bass Groper have been recorded around the south-east coast, including Tasmania where they are usually caught deeper than 300 m. They also occur around offshore seamounts.

A study of bass groper in southwestern Atlantic found that males mature between 75-80 cm TL (9-11 years of age) and females between 78-90 cm TL (10-15 years) and their maximum age exceeds 60 years. Off south-eastern Australia Bass Groper reach a maximum length of about 160 cm TL and weight of about 60 kg.

Apart from the occasional capture by trawlers, all Bass Groper landed in NSW commercial fisheries are by deepwater dropline fishers in the Ocean Trap and Line Fishery. Bass Groper are often caught in association with Blue-eye Trevalla and Hapuku. Since 1997/98, the catch of Bass Groper has been reported separately from Hapuku. The annual catch of Bass Groper was about 10 t in 2004/05. More recent annual catches have ranged between about 3-5 t. Sampling of Bass Groper landed in NSW commercial fisheries during the 1990's indicates fish were commonly between 70-120 cm TL.

Additional Notes

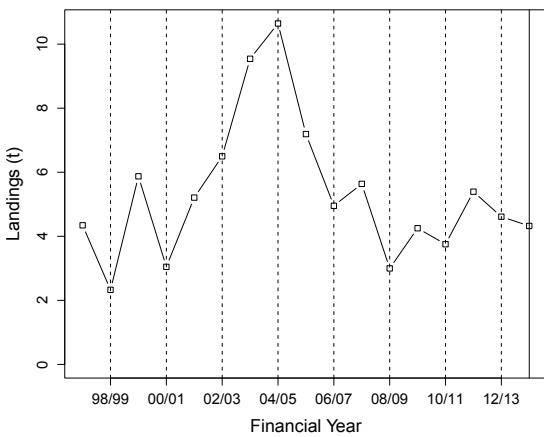
- Historical length frequency data for the mid-1990s do not suggest the population was under heavy fishing pressure, however catches and catch-rates off NSW have declined since the early years of the deepwater fishery in the 1970s.
- Although there is limited biological knowledge on this species in NSW, research recently undertaken in Queensland may help inform assessments in future.
- Assessments of stock status take into consideration information gained from studies from around the world including from Queensland and New Zealand.
- There is a combined recreational bag limit of 5 Hapuku, Banded Rockcod, Bass Groper, Gemfish and Blue-eye Trevalla. Additional restrictions apply to Gemfish.

Catch

Recreational Catch of Bass Groper

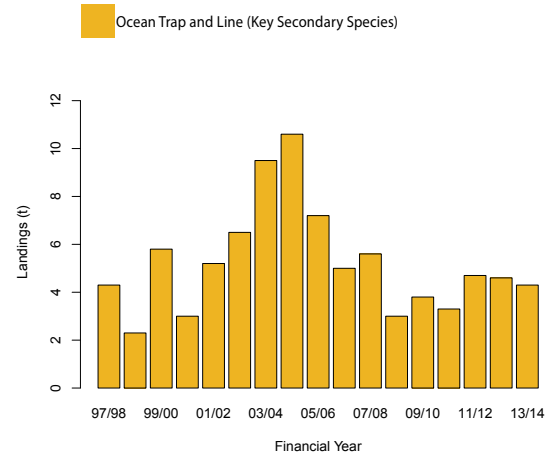
The annual recreational harvest of Bass Groper in NSW is considered to be minor.

Historical Landings of Bass Groper



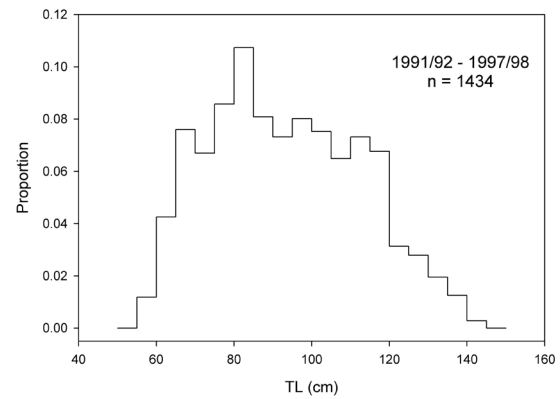
Commercial landings (including available historical records) of Bass Groper for NSW from 1997/98 to 2013/14 for all fishing methods. Note that before 1997/98, Bass Groper were reported in combination with Hapuku.

Landings by Commercial Fishery of Bass Groper



Reported landings of Bass Groper by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Bass Groper



The length distribution of Bass Groper landed by NSW commercial fishers in the 1990s comprised fish between 60-140 cm total length (TL), with a high proportion of large fish (>100cm TL) present in the catch. There are no recent length data for Bass Groper, which limits the assessment. Bass Groper do not have a minimum legal length in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 311170, common name or scientific name to find further information.



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Beachworms

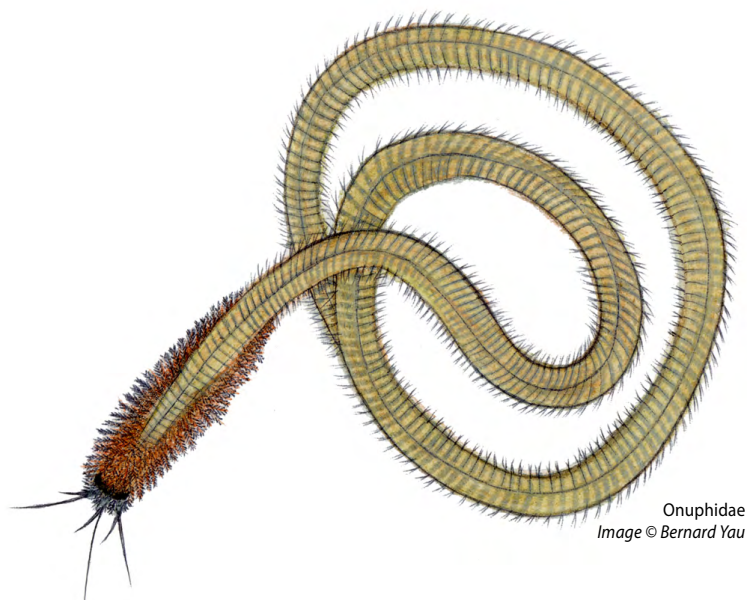
(Onuphidae)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

Insufficient information exists to assess the exploitation status of the stocks of these species. Catches comprise of a complex of species. There is no data describing the species composition of harvested species.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Australonuphis parateres</i>	[a polychaete worm]	Also known as Slimy.
<i>Australonuphis teres</i>	[a polychaete worm]	Also known as Kingworm and Stumpy.
<i>Hirsutonuphis mariahirsuta</i>	[a polychaete worm]	Also known as Wiry.



Background

Beachworms are members of the Onuphid family of polychaete worms. Three known species are considered important to NSW fishers. *Australonuphis teres*, also known as the 'Kingworm' (adult) or 'Stumpy' (juvenile), and *A. parateres*, known as the 'Slimy', are the most valued. *Hirsutonuphis mariahirsuta*, known as the 'Wiry', is less commonly caught by fishers.

Australonuphis teres is found on surf beaches from Maroochydore in Queensland to Lakes Entrance in Victoria. Similarly, *A. parateres* is found on surf beaches but commonly ranges from about Yeppoon in Queensland to Adelaide in SA. *H. mariahirsuta* occurs on protected beaches from about Yeppoon in Queensland to Camden Haven, northern NSW.

Beachworms live in inter-tidal and sub-tidal sandy habitats. They move horizontally through the sediment towards sources of food and emerge from the sand when feeding. When beachworms are at rest, they live vertically with their head towards the top of their burrow.

In contrast to other members of the Onuphidae family which build permanent tubes, beachworms build temporary burrows. For example, *H. mariahirsuta* create very thin and fragile sand encrusted tubes whilst *A. teres* and *A. parateres* strengthen the surrounding sediment with mucus.

Beachworms have biology typical of polychaete worms, with segmented bodies that absorb oxygen. These species reproduce with external fertilisation (male and female beachworms expelling gametes into the water column). Beachworm larvae live as zooplankton that feed on

phytoplankton. At about 3 cm long, the planktonic worms settle in the sandy habitat. *Australonuphis parateres* can grow up to about 300 cm long and 1.5 cm wide, whilst *A. teres* and *H. mariahirsuta* can both grow to about 100 cm long and 1.5 and 1 cm wide, respectively. *Australonuphis* spp. reach sexual maturity at a length of around 40 cm. Some preliminary studies suggesting these species may live for up to 20 years are being further investigated and may provide important information to support the management of these species, the value of this resource and subsequently the fishery.

Beachworms are scavengers that feed on dead fish, birds, molluscs, and other invertebrates and are also known to consume seaweed. The worms are a common source of food for fish and birds.

Beachworms are collected for bait by recreational fishers and harvested by commercial fishers to be sold as bait. They are collected by hand, using a bait to lure the head of the worm out of its burrow where it can then be grasped, to pull the worm from the sand.

The commercial catch of beachworms occurs primarily during summer, in response to peak demand by recreational fishers who use them as bait. From peaks in January, catch generally declines until July, before increasing again through spring. The majority of the commercial catch occurs on the north coast.

There is anecdotal evidence of high levels of catch and effort in some areas that change through time, suggesting some local populations of beachworms could be overfished. Further, commercial catches of different species are currently not required to be reported. Together with limited information of the fisheries biology of these species these issues do not support a clear assessment and the exploitation status of beachworms remains Undefined.

Additional Notes

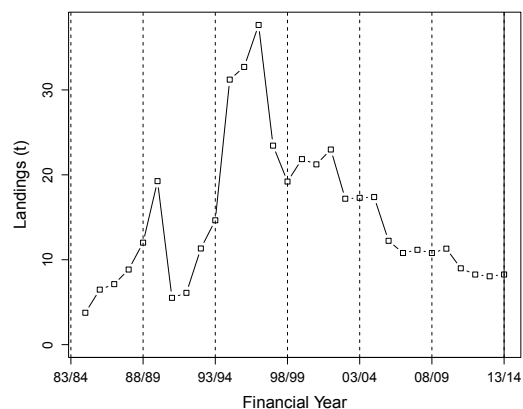
- In 2015, Fisheries NSW and the NSW Recreational Fishing Saltwater Trust, funded a 3 year research project to further understand population structures and the fishery for beachworms.
- Three species occur in commercial catches but they are not required to be reported separately.
- The annual commercial catch has declined from >20 t to <10 t in recent years, although fishing effort has also declined at a similar rate.
- Recreational catches are not accurately known, but are likely significant at local scales.
- There is a recreational bag limit of 20 beachworms.

Catch

Recreational Catch of Beachworms

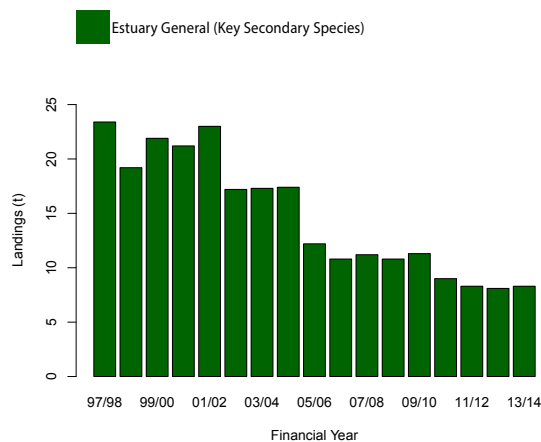
The most recent estimate of the recreational harvest of beachworms (all species combined) in NSW was approximately 239,000 beachworms during 2013/14 (West *et al.*, 2015). The annual recreational harvest of beachworms in NSW was previously estimated to be less than 10 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Beachworms



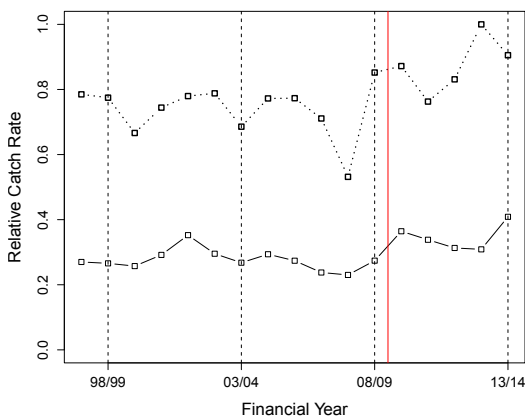
Commercial landings (including available historical records) of beachworms for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Beachworms



Reported landings of beachworms by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Beachworms Harvested by Hand Gathering in NSW



Catch rates of beachworms harvested using hand gathering for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 22 030001, 22 030002 and 22 030020, common name or scientific name to find further information.



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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Bigeyes

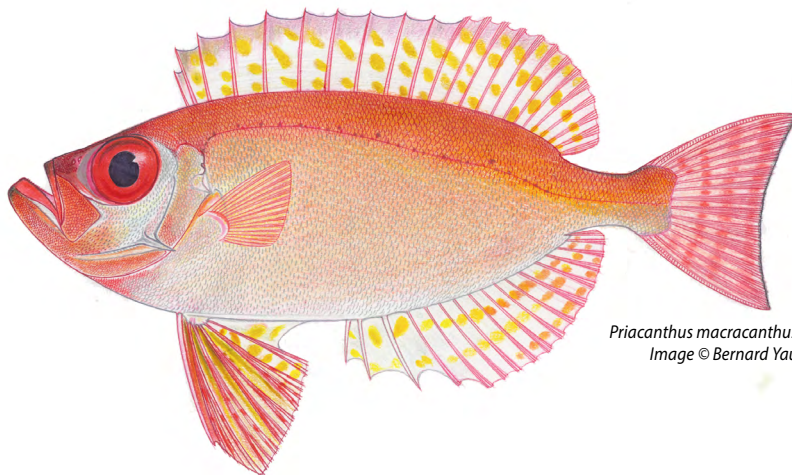
(Priacanthidae)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Very small landings taken as byproduct of commercial ocean prawn trawling and some localised recreational catches from deep oceanic and estuarine waters. Little biological information is available.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Priacanthus macracanthus</i>	Spotted Bigeye	Formerly known as Red Bullseye.
<i>Cookeolus japonicus</i>	Longfin Bigeye	
<i>Priacanthus hamrur</i>	Lunartail Bigeye	



Background

The bigeye family (Priacanthidae) contains about 17 species worldwide distributed in tropical and subtropical seas. Nine species of bigeyes are known from Australia and at least five occur in NSW waters. They are small to medium sized fishes, with very large eyes and overall reddish-brown colour. Most of the NSW catch probably comprises the Spotted Bigeye (*Priacanthus macracanthus*), with smaller quantities of the Longfin Bigeye (*Cookeolus japonicus*) and the occasional Lunartail Bigeye (*P. hamrur*).

The Spotted Bigeye is commonly found in estuaries and inshore waters along Australia's east coast, and also further north in tropical areas of the Indo-West Pacific and around Taiwan. It apparently reaches a maximum size of around 46 cm fork length (FL). Whereas juveniles (usually less than 20 cm FL) can have a dark mottled appearance when freshly caught. Larger fish tend to be plain red with light coloured fins adorned with rows of dark yellow-green spots. Off the coast of NSW, Spotted Bigeye usually occurs in depths less than 100 m, with

juveniles more common in 3-20 m depth. However, during exploratory fishing in 1982, Fisheries Research Vessel *Kapala* caught three boxes of large Spotted Bigeye (around 30 cm FL) in 275 m off the northern NSW coast.

The Longfin Bigeye also has a widespread cosmopolitan distribution, but is normally found in deeper water than the Spotted Bigeye. *Kapala* records for Longfin Bigeye on NSW trawl grounds were from depths between 30-275 m, but the majority were caught on the mid to outer continental shelf between 100-150 m depth. Longfin Bigeye has a deeper body and longer ventral fin than the Spotted Bigeye; and the fins are generally dark-coloured and without spots. Because it mostly inhabits hard substrates, it is not as commonly caught in trawls as the Spotted Bigeye, but its average size (20-30 cm FL) is usually larger.

In Taiwan, Spotted Bigeye is one of the most important commercial species, with approximately 6,000-8,000 t landed annually. Age estimates from that region using scales and skull bones suggest

females mature at about 3 years of age and 19 cm FL, and may reach a maximum age of 9 years (although no fish older than 4 years were aged from the catch). Peak spawning occurred during spring and summer.

There is no biological information available for bigeyes in Australian waters. Since about 2000, there have been small (average of 3.5 t per annum) but regular landings of 'red bullseye' in NSW primarily taken by ocean prawn trawls off the northern coast.

Additional Notes

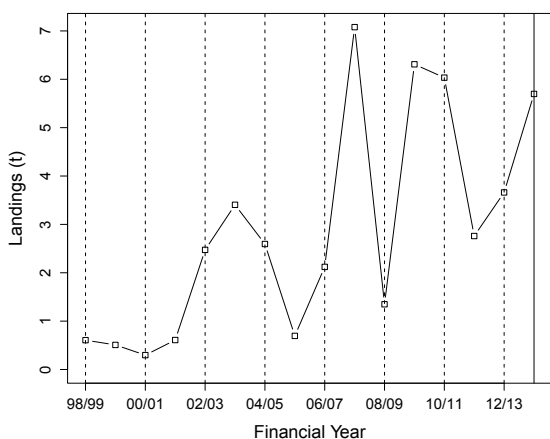
- Bigeyes are taken in small quantities as byproduct of commercial ocean prawn trawl fishing (annual landings are less than 7 t).
- Bigeyes are also harvested by the deepwater recreational fishery in small numbers at around 30 cm FL.
- Creel surveys in Lake Macquarie indicated considerable catches of Spotted Bigeye.
- Very little biological information is available for bigeyes in Australian waters

Catch

Recreational Catch of Bigeyes

The annual recreational harvest of bigeyes in NSW is likely to be minor.

Historical Landings of Bigeyes



Commercial landings (including available historical records) of bigeyes for NSW from 1998/99 to 2013/14 for all fishing methods.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 326001, 37 326002 and 37 326005, common name or scientific name to find further information.



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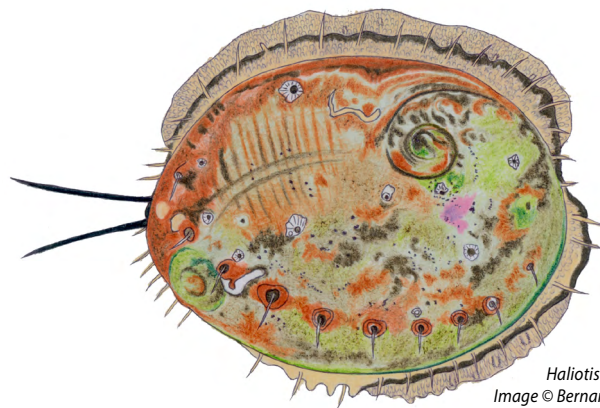
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Blacklip Abalone

(*Haliotis rubra*)

Author Rowan Chick

EXPLOITATION STATUS		UNCERTAIN
Stock has undergone substantial rebuilding in recent years from historically low levels that occurred due to a combination of overfishing and mortality due to the parasite <i>Perkinsus</i> sp. The stock has undergone recovery and accumulated above the minimum legal length although there remains some uncertainty about the consistency of recovery throughout the state.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Haliotis rubra</i>	Blacklip Abalone	



Haliotis rubra
Image © Bernard Yau

Background

Blacklip Abalone (*Haliotis rubra*) support valuable commercial, recreational and indigenous fisheries in NSW and in other southern Australian states. Outside of NSW, other Abalone species, including Greenlip Abalone (*H. laevigata*), Brownlip Abalone (*H. conicopora*) and Roe's Abalone (*H. roei*), also support valuable fisheries.

In NSW, the minimum legal length (MLL) of Blacklip Abalone is 11.7 cm. However, larger MLLs apply to the commercial fishing sector operating in different areas of the state.

Blacklip Abalone is a large, relatively sedentary, dioecious (separate sexes), broadcast spawning marine gastropod mollusc which occurs in rocky reef habitats on the south-eastern Australian coastline. Its distribution ranges from northern NSW south to Rottnest Island in Western Australia, including reefs around Tasmania. They can live for over 20 years, reaching a maximum size of 22 cm shell length (SL) and a weight of over 3 kg. They mature at about 9-10 cm SL (3-6 years of age). The spawning period is generally protracted, with some limited information for abalone suggesting some synchronicity among individuals. Growth is highly variable in terms of both rates of growth and maximum size. They may reach maximum size in as

little as 5 years. However some literature indicates populations at some locations may exhibit 'stunted growth' with few individuals ever reaching the legal size. Fertilized eggs hatch after 24 hours and larvae develop in the plankton and settle after a short time (3-10 days). Post-larvae, juveniles and adults all occur in the same habitat. Despite their planktonic development there is evidence supporting local recruitment strength being dependent on the proximity of adults. This, combined with the restricted movement of adult abalone, gives rise to stocks which are spatially highly structured. Increasingly sophisticated management regimes are either implemented or under development in attempts to account for this complex population structuring.

Recreational divers are restricted to a bag limit of 2 individual abalone above the MLL (11.7 cm) from areas that are not closed to fishing by free diving only (no use of self-contained or surface supplied breathing apparatus i.e. SCUBA or SSBA). However, there is a significant problem with illegal landings (both greater than the bag limit and abalone smaller than the minimum legal length), and efforts to improve compliance with the fishery regulations continue. Accurate estimates of the annual recreational catch are not available, although an estimate of 10 t was previously considered

reasonable. Areas available to recreational fishers have been modified through time. In 2010, areas in the north of the state (Botany Bay to Wreck Bay) became accessible on weekends and adjacent public holidays and in 2012, the area from Port Stephens to Botany Bay was opened under the same arrangements.

Commercially, Blacklip Abalone are hand gathered by endorsed divers, usually using surface supplied breathing apparatus (SSBA) and a chisel shaped abalone iron to chip the abalone from the rock surface. After landing, abalone are either kept alive or shucked (the meaty foot is removed from the rest of the body and the shell), at an abalone processing establishment, and the product is packaged for export.

The NSW Abalone Fishery developed during the 1960s and annual reported commercial landings increased to 1200 t by the early 1970s. Concerns about the sustainability of these annual catches led to the implementation of a MLL of 10 cm and controls on fishing effort during the mid-1970s. The fishery became the first restricted-entry fishery in NSW in 1980. By the late 1980s, the minimum legal length had been increased, in several increments, to 11.5 cm and a quota of 10 t per commercial diver was introduced. In 1996, provisional shares in the fishery were allocated, associated with a total allowable commercial catch (TACC) of 333 t. In 2000, share management occurred, with a TACC of 305 t shared among 37 shareholders. At this time the fishery was assessed as 'Fully fished' with adequate and stable biomass levels and a value at first point of sale of about \$15 million. During the mid-2000s declining stocks in the northern parts of the fishery, due to a combination of fishing pressure and high levels of mortality due to a protistan parasite (*Perkinsus* sp.); an increasing concentration of commercial fishing effort in the southern areas of the state; and declining catch rates throughout the state, resulted in increasingly pessimistic stock assessments and successive annual TACC reductions, to a historical low of 75 t in 2009/10 and management changes, including increases to commercial MLLs in some areas to support growth of mature stock. Subsequently, Blacklip Abalone populations in many areas of the state have improved and stocks have accumulated above the MLL, resulting in increasing catch rates and cautious increases in the TACC. In 2014, the TACC was set at 125 t, up from that of 110 t in 2011/12. Many indicators of the status of NSW Blacklip Abalone stocks show it is rebuilding, although there remain some concerns about the consistency of rebuilding across the state, ultimately resulting in the uncertainty of the current status.

Additional Notes

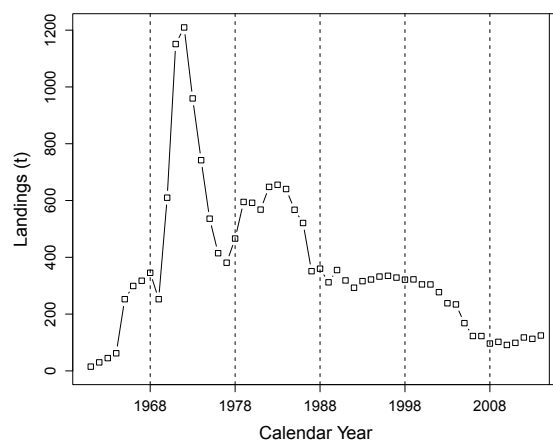
- The stock status of *Haliotis rubra* in NSW has been assessed as Transitional-recovering in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal size of 11.7 cm shell length in NSW. The recreational bag limit for abalone is 2.
- The commercial fishery is managed by TACC, annually assessed by the Total Allowable Catch Committee.
- In recent year's investment by Fisheries NSW, NSW Abalone Industry and Fisheries Research and Development Corporation has resulted in increased information available to support the assessment of the fishery – Notably, commercial fishers voluntarily operate GPS loggers to record their fishing position. These data, together with detailed daily catch reporting provides fine scale information to inform management of the fishery.

Catch

Recreational Catch of Blacklip Abalone

The most recent estimate of the recreational harvest of abalone in NSW was approximately 18,000 abalone during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Blacklip Abalone in NSW was previously estimated to be less than 20 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

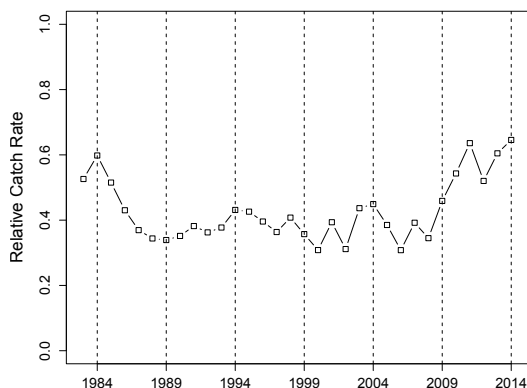
Historical Landings of Blacklip Abalone



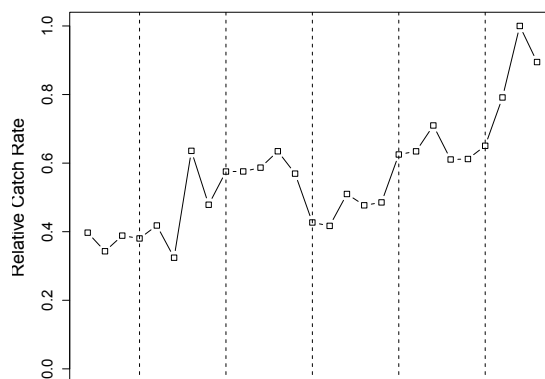
Commercial landings (including available historical records) of Blacklip Abalone for NSW from 1960 to 2014 for all fishing methods.

Catch Per Unit Effort Information of Abalone by Region in NSW

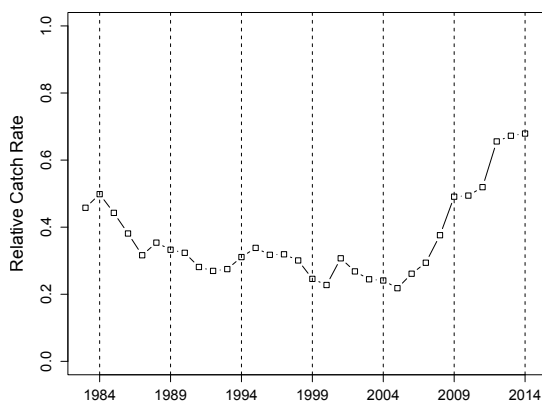
Region 1



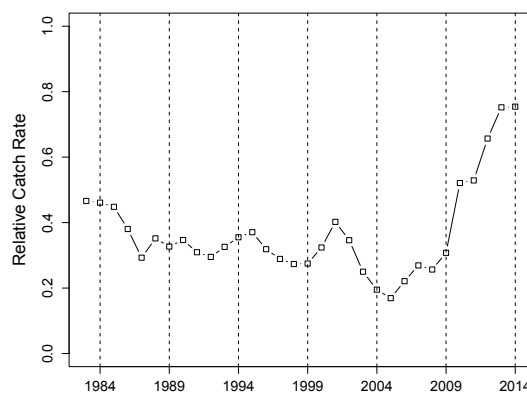
Region 4



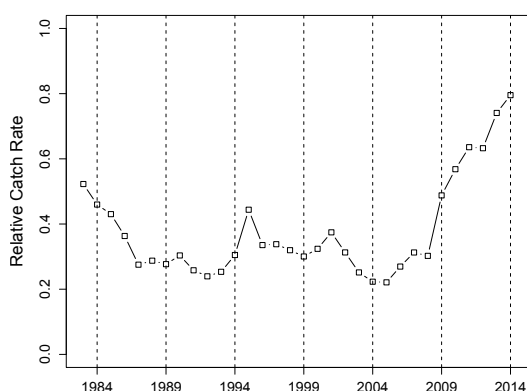
Region 2



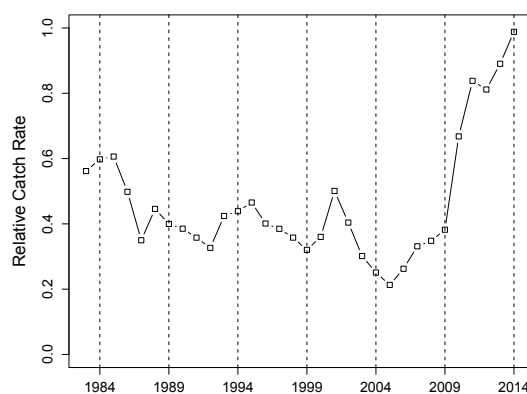
Region 5



Region 3



Region 6



Annual CPUE (kg/hr) of Blacklip Abalone from the commercial fishery in NSW, by Region, 1983 - 2014. Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Note: Increases in the minimum legal length for all sectors in 2008 (to 11.7 cm), and within some areas of the commercial fishery in 2010 and 2013. Total allowable commercial catches have changed substantially from the early 2000s.

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 24 038006, common name or scientific name to find further information.



Blue Mackerel

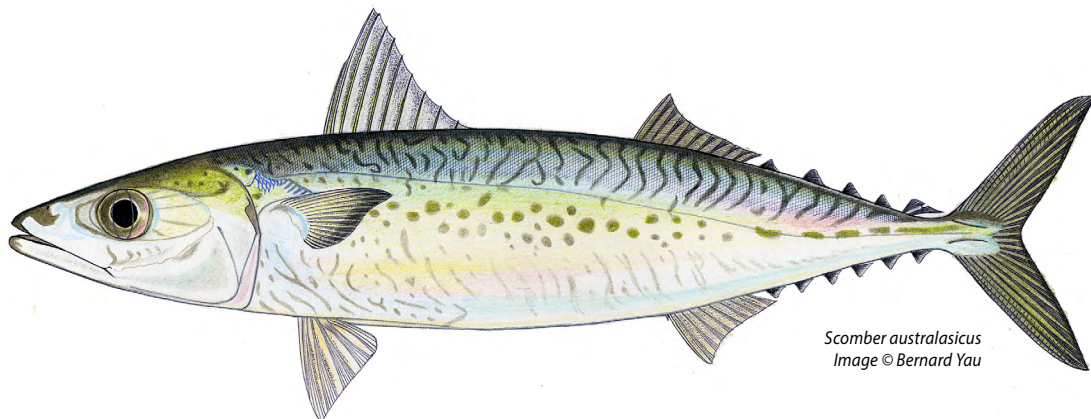
(*Scomber australasicus*)

Author John Stewart

EXPLOITATION STATUS MODERATELY FISHED

A fast growing, schooling small pelagic species. Total commercial landings of 300 t-500 t per annum from NSW waters are very small compared to the last biomass estimate of 25,000 t-33,000 t off the east coast of Australia in 2004. Blue mackerel are therefore classified as Moderately Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Scomber australasicus</i>	Blue Mackerel	Also known as Slimy Mackerel



Background

Blue Mackerel (*Scomber australasicus*) occur in subtropical and temperate waters of the Pacific and Indian Oceans. Blue Mackerel occur off all states of Australia except the NT. The species inhabits inshore and continental shelf waters, with older fish occurring further offshore. The stock structure of Blue Mackerel is complex and not fully understood. Blue Mackerel are assessed and managed at the Commonwealth level as separate stocks east and west of Bass Strait.

Blue Mackerel mature at about 24-28 cm fork length (FL) and spawning takes place during late winter and spring in outer continental shelf waters off northern NSW and southern QLD. Blue Mackerel grow relatively quickly, reaching approximately 17-22 cm FL after one year. They reach a maximum age of about 7 years and length of 50 cm in NSW waters. Off NSW the oldest fish occur offshore, beyond state waters, and may be targeted by Commonwealth licensed purse seine and mid-water trawl fishers. Blue Mackerel have been aged to be more than 20 years old in New Zealand.

Relatively young (less than 2 years old) Blue Mackerel are caught by the NSW Ocean Hauling Fishery in purse seine nets. Smaller quantities are also taken in bait nets (which are modified hauling nets) and general purpose hauling nets. Commercial landings occur in all months of the year but have peaked during the warmer months during recent years.

Commercial landings of Blue Mackerel in NSW waters since the mid 1980s have generally been between 300-500 tonnes annually but show considerable fluctuations. These fluctuations are likely to reflect changes in stock availability due to recruitment variability and may also reflect changes in the distribution of fish due to oceanographic processes. Commercial landings in NSW have declined steadily from around 500 t per year in 2008/09 to just over 211 t in 2013/14. Landings in the Commonwealth managed Small Pelagic Fishery have been negligible in recent years. Blue Mackerel are very important to recreational fishers and the recreational harvest is thought to be significant.

Additional Notes

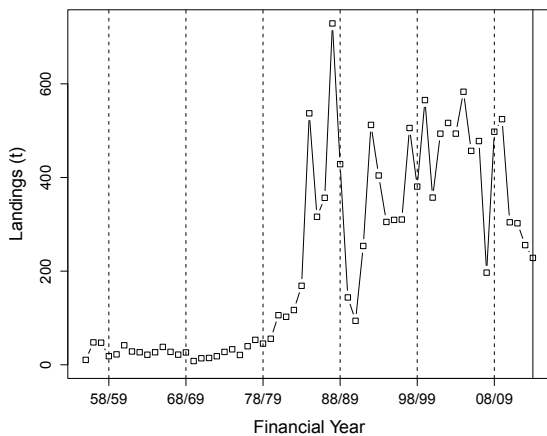
- The most recent estimate of the spawning biomass for east-coast Blue Mackerel was done in 2004 based on the daily egg-production method. That study estimated a spawning biomass of between 25,000 to 33,000 t off the east coast of Australia (Ward and Rogers, 2007).
- Commonwealth assessments do not consider Blue Mackerel to be overfished nor subject to overfishing (Georgeson *et al.*, 2014).
- There is a recreational bag limit of 50 Blue Mackerel in combination with Jack Mackerel, Yellowtail Scad, garfish (other than Eastern Sea Garfish), Hardyhead and Silverfish.
- Considerable quantities of Blue Mackerel also taken for bait in NSW waters by Commonwealth tuna fishers under permit. The little understood nature of this bait harvest adds to the uncertainty around the total harvest of east-coast Blue Mackerel.

Catch

Recreational Catch of Blue Mackerel

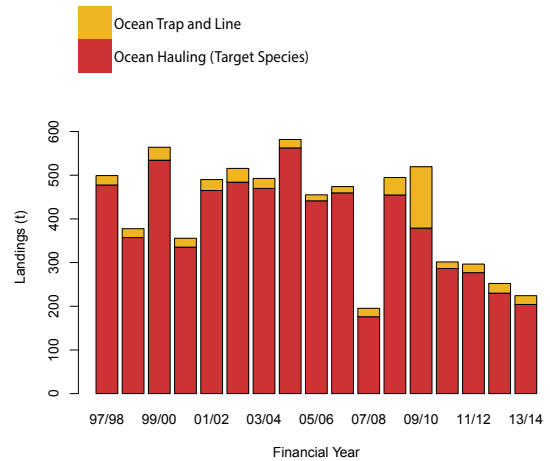
The most recent estimate of the recreational harvest of Blue Mackerel in NSW is approximately 125,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 206,000 fish (in the order of 60 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Blue Mackerel



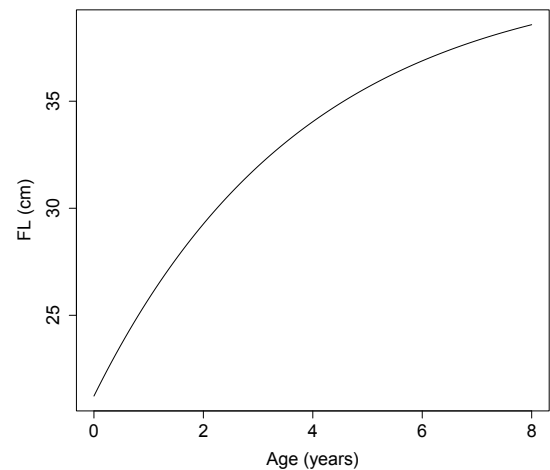
Commercial landings (including available historical records) of Blue Mackerel for NSW from 1955/56 to 2013/14 for all fishing methods. Landings were low until the commencement of purse seining in the 1980s.

Landings by Commercial Fishery of Blue Mackerel



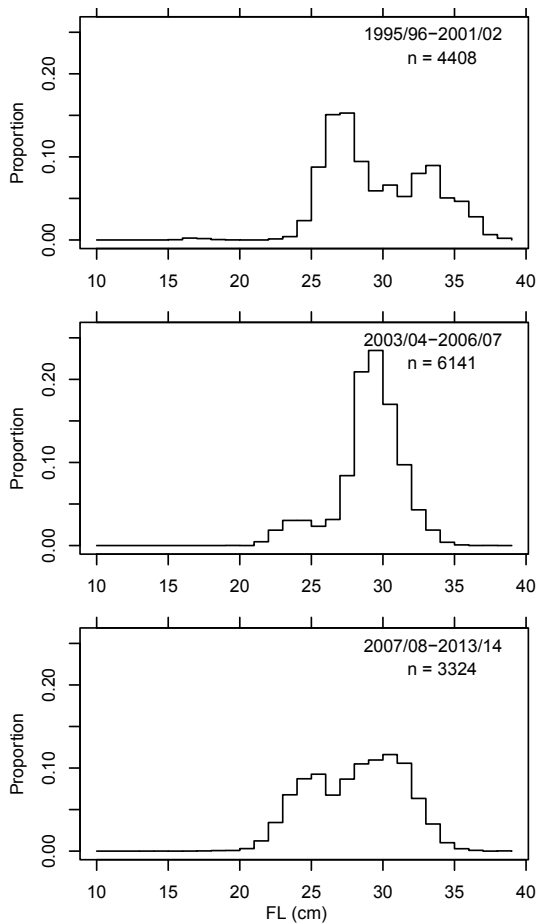
Reported landings of Blue Mackerel by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Blue Mackerel



Growth curve for Blue Mackerel (Stewart and Ferrell, 2001). Lengths are presented as fork length (FL).

Length Frequency of Blue Mackerel



The length distribution of Blue Mackerel landed by NSW commercial purse seine fishers is comprised mainly of fish between 25-35 cm fork length (FL) and in some periods shows distinct modes. The lengths of Blue Mackerel in the larger modes have been relatively stable since 2003/04. There is no minimum legal length for Blue Mackerel in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441001, common name or scientific name to find further information.



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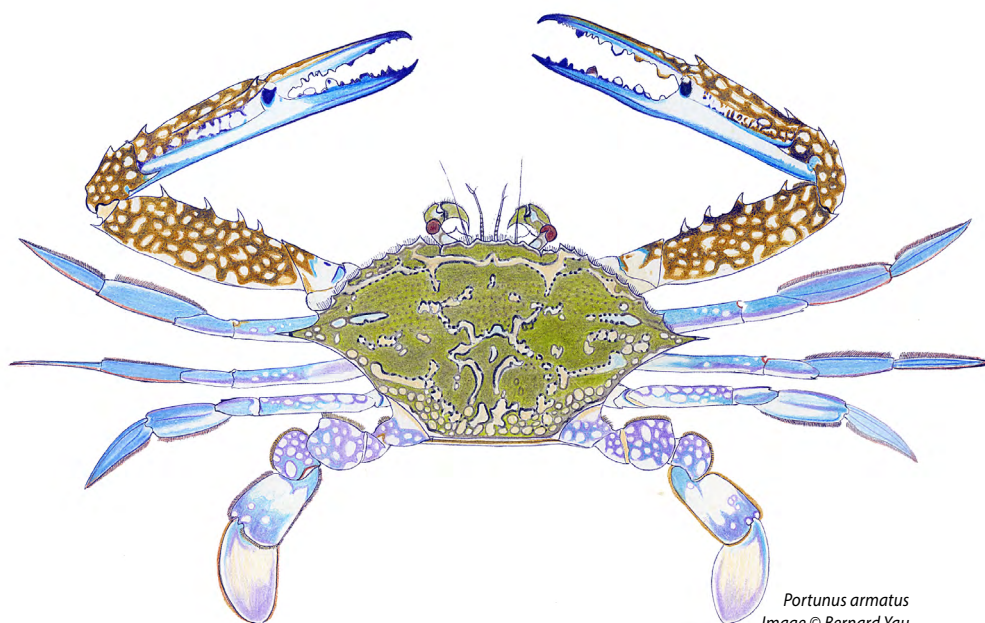
Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Blue Swimmer Crab

(*Portunus armatus*)

Author Daniel Johnson

EXPLOITATION STATUS		UNCERTAIN
An important recreational and commercial species. Biological data collected for Wallis Lake indicate high fishing pressure in this estuary, with fishing mortality estimated to be greater than natural mortality. There are inconsistent or contradictory signals in commercial CPUE data that preclude determination of exploitation status.		
SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Portunus armatus</i>	Blue Swimmer Crab	Sometimes recorded as Sand Crabs in historic catch records.



Portunus armatus
Image © Bernard Yau

Background

Blue Swimmer Crab (*Portunus armatus*) is distributed in Australia from Cape Naturaliste in Western Australia extending north to the Northern Territory, across Queensland, down the east coast and to the New South Wales/Victoria border. They are also found in the warmer waters of the South Australian gulfs. There is a single biological stock on the east coast of Australia. In NSW waters, Blue Swimmer Crabs are found primarily within estuaries and inshore coastal waters. In estuaries, they are found in mud, sand and seagrass habitats, and are often buried in the sediment. Blue Swimmer Crabs mostly prey on slow-moving invertebrates such as bivalve molluscs, crustaceans and worms, but also scavenge on material including dead fish and squid.

In NSW a number of other species of crabs are sometimes landed in smaller numbers, including the Common Sand Crab, *Ovalipes australiensis*, and the Three-Spotted Crab, *P. sanguinolentus*.

Based on research in SA and WA, Blue Swimmer Crabs are likely to spawn in both lower estuarine and oceanic waters, with peak spawning expected in spring or summer. The larvae may drift well out to sea before settling in shallow estuarine or inshore waters, similar to those inhabited by adults. Blue Swimmer Crabs reach the minimum legal size at almost 10 months of age and can grow to a maximum size in excess of 9.5 cm carapace length (CL) and live for up to 3 years. In a recent study it was found that the estimated size at which 50% of females and males reached maturity was 4.6 cm and 4.4 cm CL, respectively.

Blue Swimmer Crabs are caught in crab pots, hoop nets and mesh nets in the Estuary General Fishery, and are also caught as an incidental catch in the Estuary Prawn Trawl and Ocean Trawl Fisheries. Blue Swimmer Crabs are an important recreational species.

Additional Notes

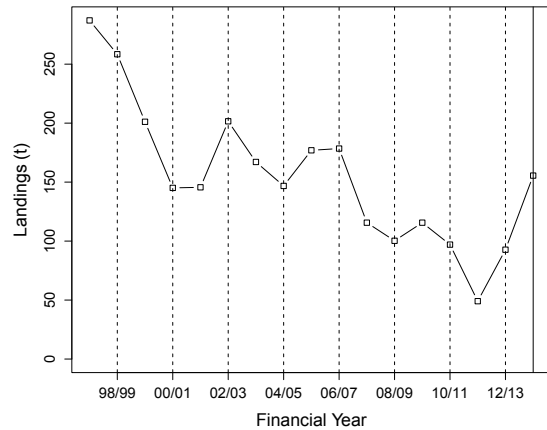
- Commercial landings and catch rates from crab trapping have declined in recent years and the majority of the catch is now reported from fish traps.
- Five estuaries account for 95% of the commercial catch, with Wallis Lake being the most important.
- NSW Blue Swimmer Crab populations are at the southern end of the species distribution and have a limited spawning period (November to February) as opposed to year round spawning in tropical areas (Johnson *et al.*, 2010)
- Populations in Wallis Lake are subject to very high levels of mortality (Johnson, 2007).
- Ocean prawn trawling appears to catch mature female crabs, but landings are small.
- Length-based monitoring of commercial catches is continuing at Wallis Lake - there has been little change in the size composition of commercial landings since 2005/06.
- There is a minimum legal length of 6 cm carapace length and a recreational bag limit of 10 Blue Swimmer Crabs.

Catch

Recreational Catch of Blue Swimmer Crab

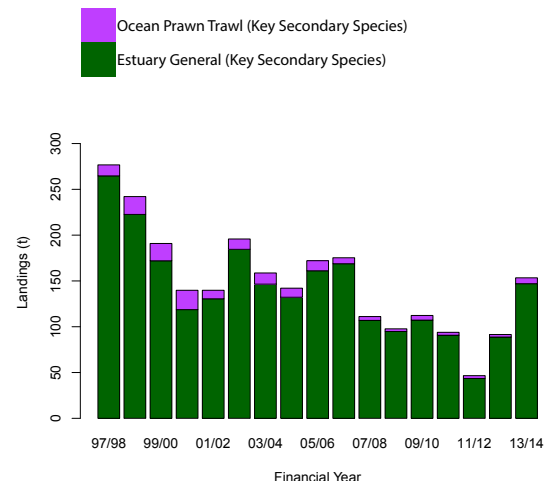
The most recent estimate of the recreational harvest of Blue Swimmer Crabs in NSW was approximately 51,000 crabs during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Blue Swimmer Crabs in NSW was previously estimated to be likely to lie between 150 and 310 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Blue Swimmer Crab



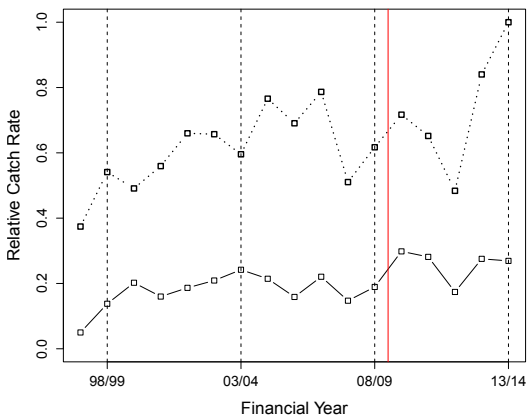
Commercial landings (including available historical records) of Blue Swimmer Crab for NSW from 1997/98 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Blue Swimmer Crab



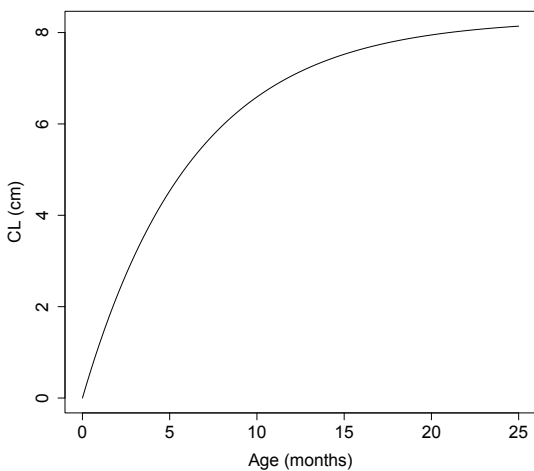
Reported landings of Blue Swimmer Crab by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Blue Swimmer Crab Harvested by Fish Trapping in NSW



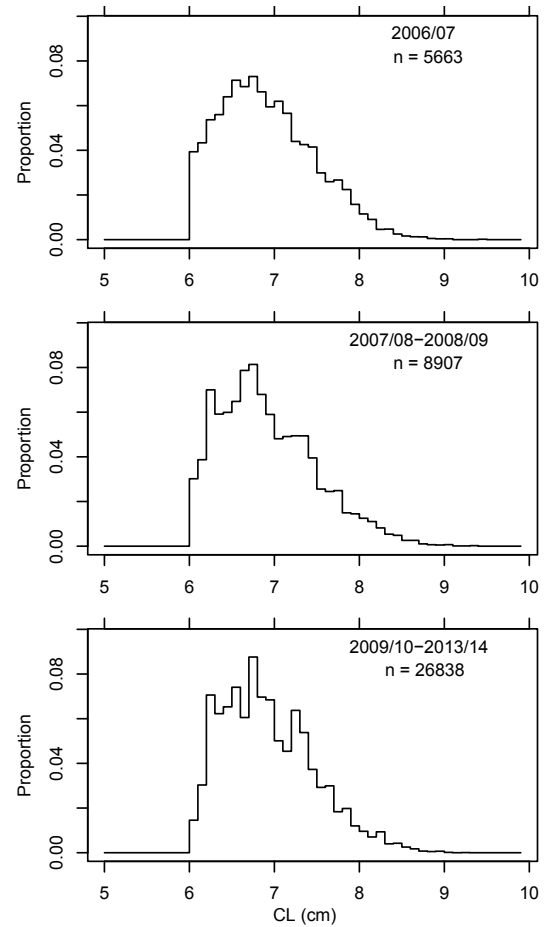
Catch rates of Blue Swimmer Crab harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve for Blue Swimmer Crab



Growth curve for Blue Swimmer Crab using parameters from Johnson (2007). Lengths are presented as carapace length (CL).

Length Frequency of Blue Swimmer Crab



The length distribution of Blue Swimmer Crabs in commercial landings from Wallis Lake ranged between 6 and 10 cm carapace length (CL), and remained relatively stable between 2006/07 and 2013/14. The minimum legal length of Blue Swimmer Crabs in NSW is 6 cm CL.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 91 1005, common name or scientific name to find further information.



Blue-eye Trevalla

(*Hyperoglyphe antarctica*)

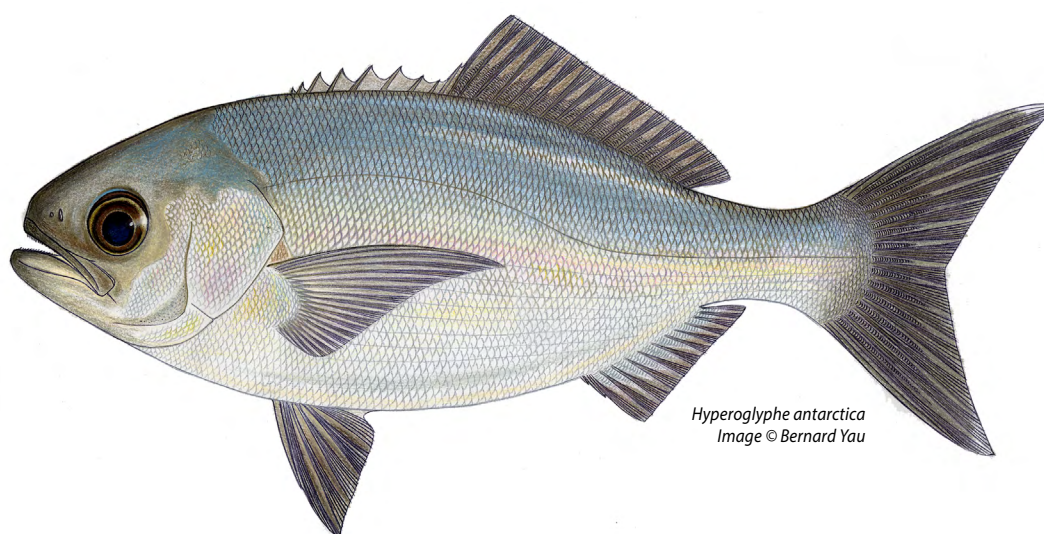
Author Rowan Chick

EXPLOITATION STATUS FULLY FISHED

This exploitation status considers the Commonwealth assessment of the eastern stock as not overfished and uncertain if overfishing is occurring and generally stable CPUE for fish harvested using droplining in NSW. However, most recent levels of CPUE and continued declines in annual catches suggest some concern for stocks.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Hyperoglyphe antarctica</i>	Blue-eye Trevalla	
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Background

Blue-eye Trevalla (*Hyperoglyphe antarctica*) are distributed in continental slope waters off South America, South Africa, New Zealand and Australia. Their Australian distribution stretches along the southern continental margin in waters from Moreton Island in Queensland to 30°S in WA. Blue-eye Trevalla also occur on the seamounts off eastern Australia and south of Tasmania, Lord Howe Island and probably Norfolk Island. The species supports a significant fishery in New Zealand, where it is known as 'Blue-nose'.

Adults and sub-adults occur in mid-water at depths of around 500 m and are associated with rocky ground on the continental slope where the majority of fish are found between 200 and 600 m, but a small number have been reported to occur at depths of up to 900 m. Juveniles have been found at the surface but may also occur in the mid-water region.

Analysis of Blue-eye Trevalla samples from Tasmania found that 72 cm fork length (FL) is the average size at maturity for females (corresponding

to about 11-12 years of age) and for males the average is 62 cm FL (8-9 years of age). Most spawning activity occurs in the waters from central NSW to north-eastern Tasmania, with evidence that spawning also takes place in southern Australia. Spawning occurs in summer and autumn but timing varies regionally, with spawning occurring in NSW waters from April to June. Female Blue-eye Trevalla are highly fecund with females producing 2-11 million eggs per year. Allozyme surveys on the genetic structure of the Blue-eye Trevalla stock found no population differentiation in samples examined from NSW, Tasmania and SA.

Obtaining accurate ages of Blue-eye Trevalla has historically been difficult because of limited contrast in the growth bands in their otoliths. Some more recent studies that have used the 'bomb carbon chromometer' to attempt to validate age support that Blue Trevalla are a moderately long-lived species, up to 76 years. Estimated ages of Blue-eye Trevalla in commercial catches are thought to range from 2 to 3 years at first capture, to 42 years for females and 39 years for males, with great variation in the geographical and seasonal variation in growth and hence size of fish at age.

Blue-eye Trevalla are caught in the NSW Ocean Trap and Line Fishery. Dropline is the primary method by which this species is taken. Blue-eye Trevalla are caught year-round but landings are greatest during autumn and winter. Annual catches have declined over the last 15 years, although changes in reporting requirements have confounded reasons for the decline. Despite this, annual catches have declined each year from 47 t in 2009/10, to 21 t in 2013/14. Levels of CPUE, from droplining in the NSW Ocean Trap and Line Fishery have been generally stable, with a substantial decline in the most recent year. The size composition of the commercial catch from 1991/92 to 2008/09 suggests relatively stable length structures in the fished stocks.

A similar species *Schedophilus velaini* (previously *S. labyrinthicus*) commonly known as 'Ocean Blue-eye Trevalla' is occasionally taken by dropline fishers off NSW. This species has a broad distribution, throughout the southern oceans and occurs off the north coast of NSW in similar depths to Blue-eye Trevalla. Little is known of the biology of this species.

Additional Notes

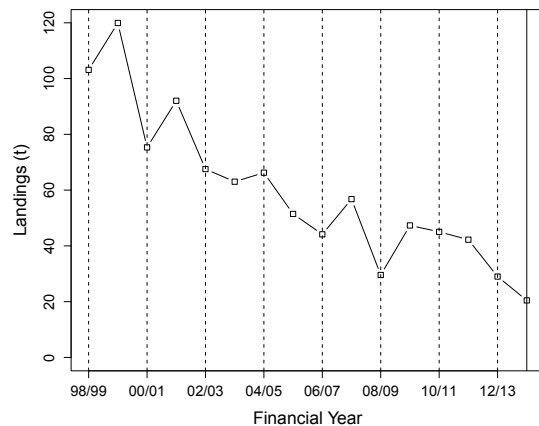
- Decline over about the last decade in directed fishing effort in the NSW continental slope line fishery has led to reduced landings but with relatively stable catch per unit effort. However, continued declines in landings and most recent declines in CPUE do suggest concerns for the stocks.
- Size composition of the NSW landed catch from 1991/92 has provided evidence of a relatively stable population.
- Significant amounts of biological and fishery data are available; however the data vary with season, area, depth and fishing method, and a reliable age-structured population model has not been developed to inform the assessment of these stocks.
- The current Commonwealth assessment is based on levels of CPUE from auto-longline and dropline fishing methods. It considers the species not overfished, yet uncertain if overfishing is occurring. This assessment included low levels of CPUE in the eastern (east of Tasmania) part of the fishery, to below the limit reference point in 2010 and 2012 (Georgeson *et al.*, 2014).
- There is a combined recreational bag limit of 5 Hapuku, Banded Rockcod, Bass Groper, Gemfish and Blue-eye Trevalla. Additional restrictions apply to Gemfish.

Catch

Recreational Catch of Blue-eye Trevalla

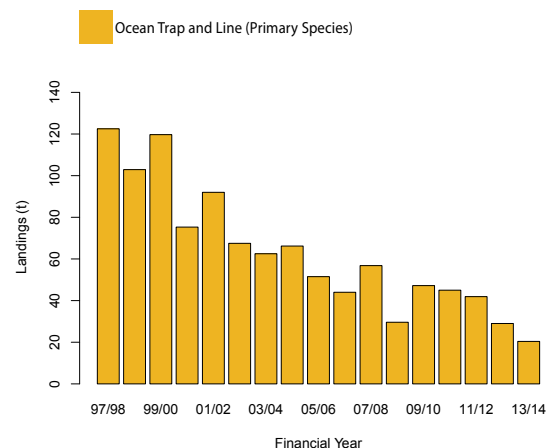
The annual recreational harvest of Blue-eye Trevalla in NSW is not accurately known but is thought to be less than 20 t.

Historical Landings of Blue-eye Trevalla



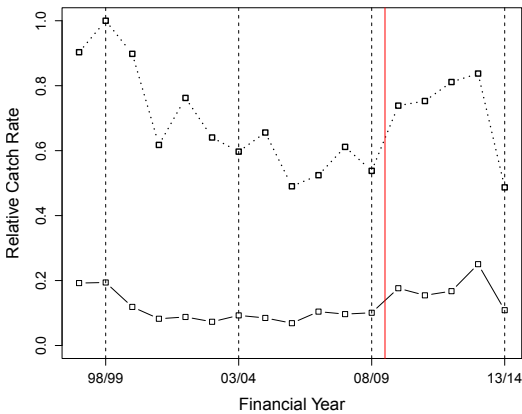
Commercial landings (including available historical records) of Blue-eye Trevalla for NSW from 1998/99 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Blue-eye Trevalla



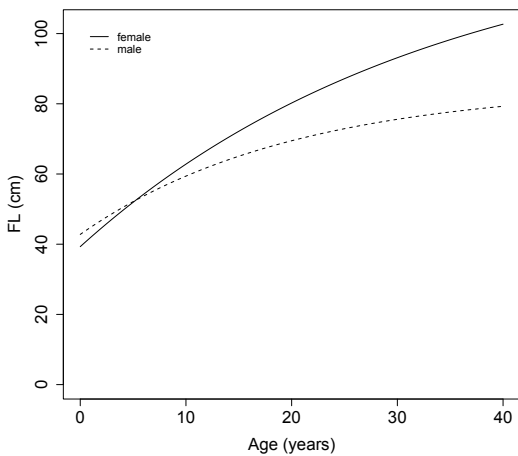
Reported landings of Blue-eye Trevalla by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Blue-eye Trevalla Harvested by Droplining in NSW



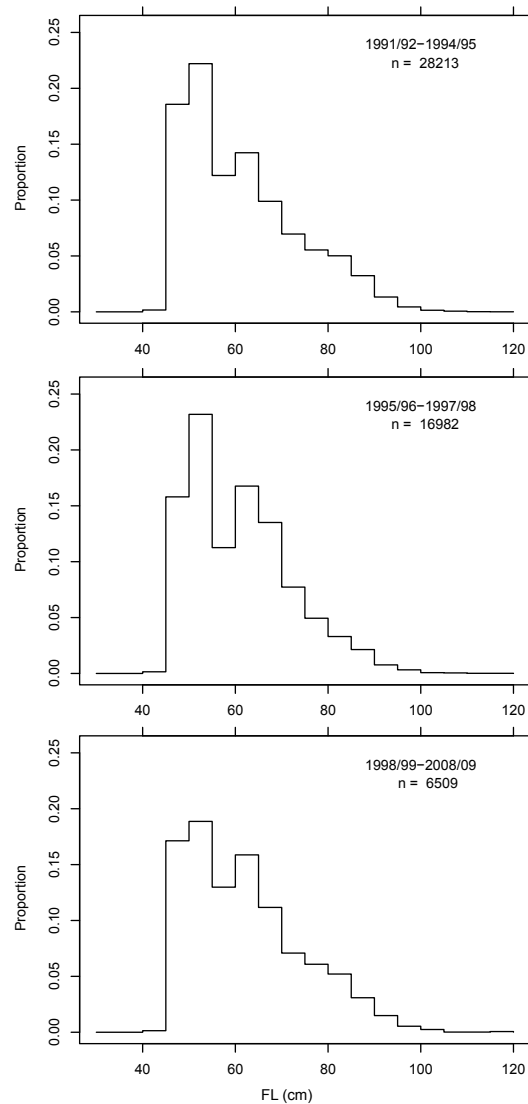
Catch rates of Blue-eye Trevalla harvested using droplining for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves for Blue-eye Trevalla



Growth curve for Blue-eye Trevalla using parameters from Morison and Robertson (1995a, b). Lengths are presented as fork length (FL).

Length Frequency of Blue-eye Trevalla



The length distribution of Blue-eye Trevalla landed by NSW commercial fishers from 1991/92 to 2008/09 is comprised mainly of fish between 45 and 100 cm fork length (FL), with strong modes at around 50-55 and 65-70 cm FL. There is no minimum legal length for Blue-eye Trevalla in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 445001, common name or scientific name to find further information.



Department of
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Bluespotted Flathead

(*Platycephalus caeruleopunctatus*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

A very important commercial and recreational species. Landings and catch rates were steady for over two decades, but have rapidly declined over the last 3 years.

SCIENTIFIC NAME

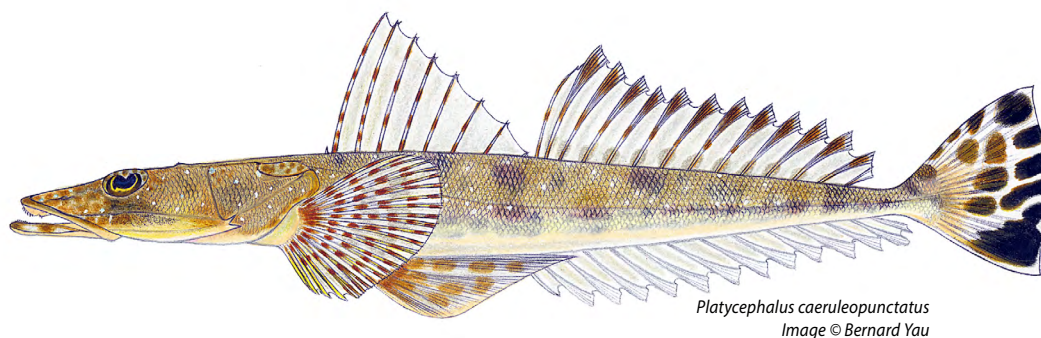
STANDARD NAME

COMMENT

Platycephalus caeruleopunctatus

Bluespotted Flathead

Formerly known as Sand Flathead.



Platycephalus caeruleopunctatus
Image © Bernard Yau

Background

The Bluespotted Flathead (*Platycephalus caeruleopunctatus*) is a coastal species occurring in deep estuarine and ocean waters to depths of about 100 m between southern Queensland and north-eastern Victoria. It is an important commercial and recreational species, growing to a maximum size of about 68 cm total length (TL) and a weight of 3 kg. Data collected by Fisheries Research Vessel *Kapala* indicate that juveniles (less than 25 cm, TL) favour depths less than 30 m while mature flathead mainly inhabit deeper waters.

Bluespotted Flathead is a relatively fast growing and short-lived species, reaching 30 cm (TL) in just 2 to 3 years and a maximum recorded age of only 9 years. Males mature quickly at about 1 year of age and 21 to 23 cm TL; while females mature later than males at 2 years of age and 28 cm TL in northern NSW and at 3 years of age and 35 cm TL in central NSW. Females also attain much larger maximum sizes than males. Spawning occurs over an extended period through late winter, spring and summer.

Most of the commercial catch of Bluespotted Flathead in NSW is taken by the Ocean Trawl Fishery. Reported commercial landings for NSW were generally stable at around 120-150 t during the 1990s and 2000s, with a peak of almost 200 t in 1998/99. Over the last 3 years, however, landings have rapidly declined to less than 100 t in 2013/14.

During the 1990s and early 2000s, the catches landed by the prawn trawl and fish trawl sectors were approximately equal; but since 2006/07, the prawn trawl catch in northern NSW has steadily declined, while the fish trawl catch in central NSW initially increased. Over the last 3 years, the landings and catch rates of both sectors have declined, such that current prawn trawl catches are considerably smaller than historical levels.

Over the same period, length and age distributions have been relatively stable, with more older fish in the population in recent years; however, some of the sampling has been quite localised and has not covered the full species range.

Bluespotted Flathead is an important recreational species, with landings estimated to be much greater than the current commercial catch.

Additional Notes

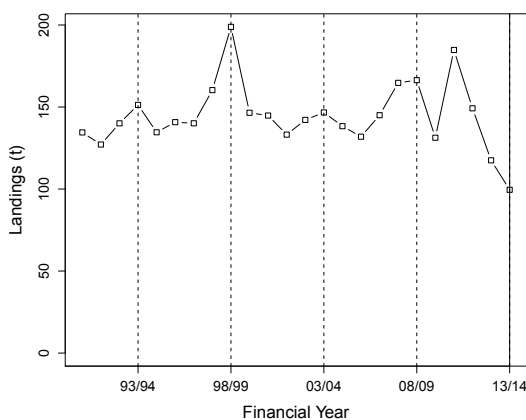
- Annual trawl landings and catch rates were relatively stable for the two decades between 1990 and 2010, but have declined rapidly in both the prawn trawl and fish trawl sectors over the last 3 years.
- Catch rates in both sectors have also rapidly declined in the last 3 years after many years of increasing rates.
- Estimates of growth rates and size at maturity are available from the northern part of the species' range.
- Length-based monitoring of commercial catches is currently taking place through the current fish trawl observer program.
- There is a minimum legal length of 33 cm TL for Bluespotted Flathead and a combined recreational bag limit of 20 for all flathead (including only 10 Dusky Flathead, *P. fuscus*).

Catch

Recreational Catch of Bluespotted Flathead

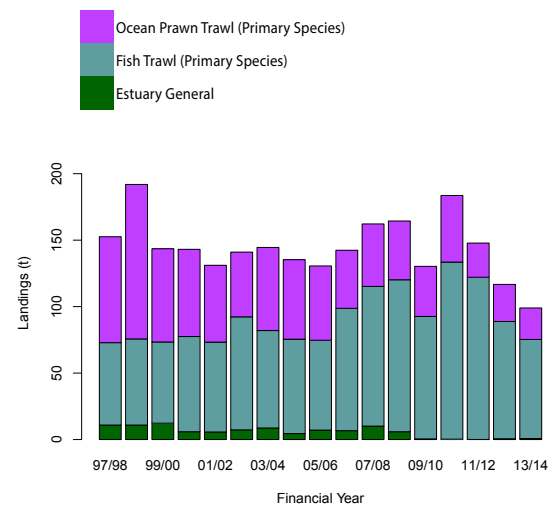
The most recent estimate of the recreational harvest of Bluespotted Flathead (combined with Southern Sand Flathead, *P. bassensis*) in NSW was approximately 441,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 966,600 fish (or between 320-450 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003).

Historical Landings of Bluespotted Flathead



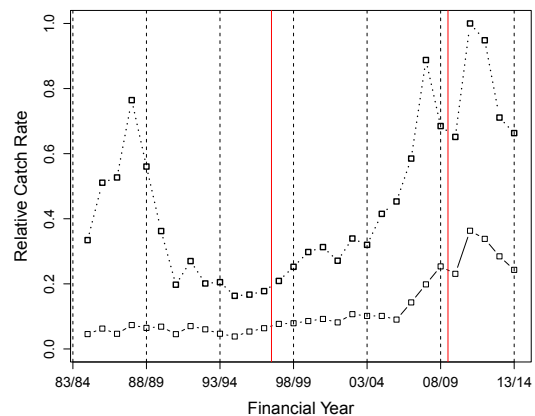
Commercial landings (including available historical records) of Bluespotted Flathead for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Bluespotted Flathead



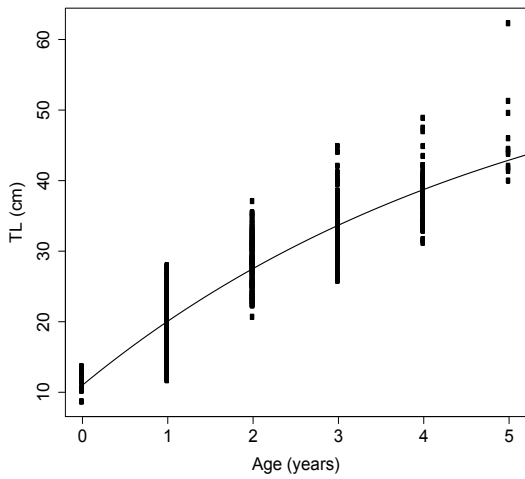
Reported landings of Bluespotted Flathead by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Bluespotted Flathead Harvested by Fish Trawling in NSW



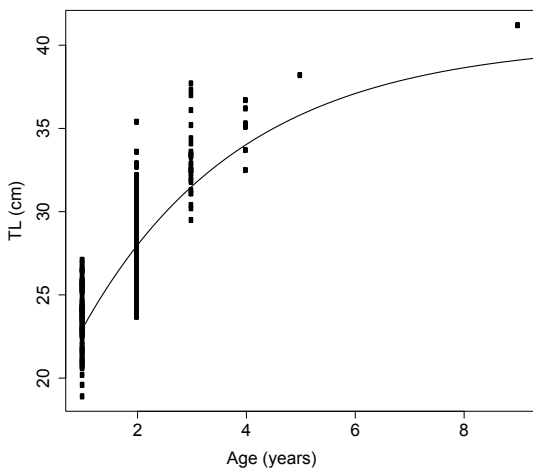
Catch rates of Bluespotted Flathead harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Bluespotted Flathead - Females



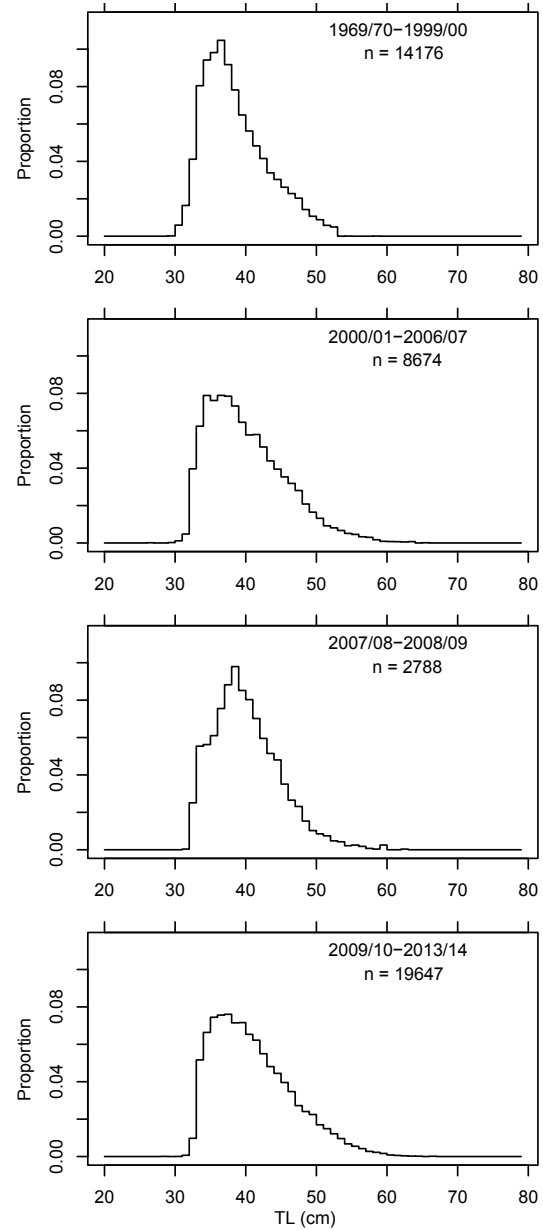
Age-length data with fitted growth curve for female Bluespotted Flathead (Barnes, 2012). Lengths are presented as total length (TL).

Growth Curve of Bluespotted Flathead - Males



Age-length data with fitted growth curve for male Bluespotted Flathead (Barnes, 2012). Lengths are presented as total length (TL).

Length Frequency of Bluespotted Flathead



The length distribution of Bluespotted Flathead landed by NSW commercial fishers has remained relatively stable since the 1970s, and is comprised mainly of fish between 35-50 cm total length (TL). The minimum legal length of Bluespotted Flathead in NSW is currently 33 cm TL.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 296007, common name or scientific name to find further information.

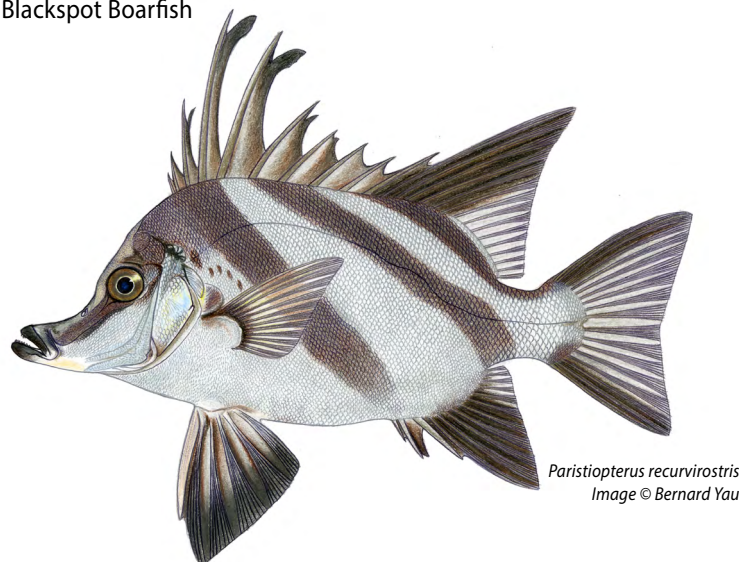


Boarfish

(Pentacerotidae)

Author Rowan Chick

EXPLOITATION STATUS		UNDEFINED
The Giant Boarfish is regularly reported, in small numbers, in the Ocean Trawl Fishery. Limited regular fishery information and local biological information precludes an assessment of exploitation status.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Paristiopterus labiosus</i>	Giant Boarfish	
<i>Pentaceroptis recurvirostris</i>	Longsnout Boarfish	
<i>Zanclistius elevatus</i>	Blackspot Boarfish	



Background

Members of the boarfish family (Pentacerotidae) are found in temperate waters of all oceans, but total only 13 species of which 10 are found in Australian waters. All species feature strong spines and heads with rough striated bony plates, giving rise to the name 'armourhead' for some deepwater species. Other features such as extended fin rays and elongation of the mouth are greatly developed in some species. Depth distribution among species varies with some restricted to deepwater and others found in coastal depths less than 50 m. The pelagic armourhead inhabits oceanic seamounts and ridges.

At least six species of boarfishes are known to inhabit NSW waters. Two are relatively small, non-commercial species including the Bigspine Boarfish (*Pentaceros decacanthus*) and the Threebar Boarfish (*Histiopertus typus*). The NSW commercial catch of boarfishes is thought to comprise three inshore species, of which, the Giant Boarfish (*Paristiopterus labiosus*) is predominantly reported. Although the Longsnout Boarfish (*Pentaceroptis recurvirostris*)

is thought to be harvested there is likely to be mistaken reporting to the Giant Boarfish. The smaller Blackspot Boarfish (*Zanclistius elevatus*) is rarely reported.

The Giant Boarfish is found in temperate waters from northern NSW to southern Tasmania, including the coastal waters of eastern Victoria to Port Philip Bay, and is also found in New Zealand waters. The habitat it is primarily associated with is sandy or muddy substrates in water depths of <100 m, but it has been recorded to depths of 170 m. Anecdotal evidence suggests juveniles form small schools but, as adults, boarfish are typically observed in pairs that are thought to be territorial. Juvenile Giant Boarfish have wide, contrasting dark bands over a silver-white coloured body. Adult females retain this colour pattern whereas males lose the banding as they mature, becoming uniformly brown with numerous yellowish spots. Giant Boarfish are characterised by their strong protruding snout and fleshy lips. The species typically use their elongated snouts to forage in

sand and mud for shell-fish and other invertebrates. The maximum recorded size for the boarfish is about 90 cm total length and 12 kg in weight but most fish caught are 45-60 cm and 1.0-2.5 kg.

The Longsnout Boarfish is more widely distributed, occurring around southern Australia from about Sydney to Rottnest Island in WA. It is similar in size and shape to the Giant Boarfish but has a more elongated and slender snout. In addition, adults of both sexes have distinctive black stripes across their silvery-white body and head.

The Blackspot Boarfish is found in depths of 50-300 m from southern Queensland throughout NSW to southern WA, including Tasmania.

Annual catches of boarfish in NSW have ranged from a maximum of about 12 t in 2001/02 to less than 1 t in 2012/13. Within the last 5 years annual catches have been less than about 1 t. There is no minimum legal length for boarfish in NSW.

Additional Notes

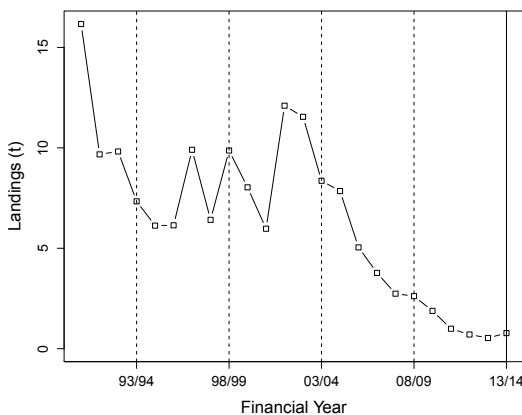
- Giant Boarfish can be targeted by spear fishers, but boarfish are not considered to be caught in substantial numbers by recreational fishers.

Catch

Recreational Catch of Boarfish

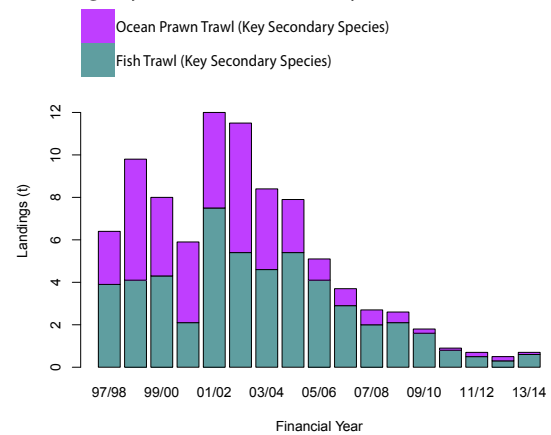
The annual recreational harvest of boarfish in NSW is considered to be minor.

Historical Landings of Boarfish



Commercial landings (including available historical records) of boarfish for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Boarfish



Reported landings of boarfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 367002, 37 367003 and 37 367005, common name or scientific name to find further information.



Department of Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Brown Tiger Prawn

(*Penaeus esculentus*)

Author Matthew Taylor

EXPLOITATION STATUS UNDEFINED

NSW is at the southern end of the species' range. Recruitment is likely to be small and variable.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Penaeus esculentus</i>	Brown Tiger Prawn	Native to NSW waters
<i>Penaeus monodon</i>	Black Tiger Prawn	Also known as leader prawn and giant tiger prawn - farmed in NSW.



Background

There are a number of large striped 'tiger' prawns known from Australian waters. Species such as the Black Tiger Prawn (*Penaeus monodon*) and Grooved Tiger Prawn (*P. semisulcatus*) have wide tropical distributions throughout the Indo-West Pacific and northern Australia. The Brown Tiger Prawn (*P. esculentus*) is also mainly tropical but appears to be endemic to Australia, inhabiting shallow coastal waters and estuaries from central NSW (Sydney), around the north of the continent, to Shark Bay in WA. This species is fished commercially throughout its range and contributes almost 30% of the ~1800 t tiger prawn fishery (the other 70% are Grooved Tiger Prawn) in the Northern Prawn Fishery of northern Australia.

The Brown Tiger Prawn is the only one of these species landed in significant quantities by fishers in NSW. Juvenile Brown Tiger Prawns settle and grow in seagrass beds in estuaries before migrating as pre-adults to the ocean for spawning. Adults occur in coastal waters in mud, sand or silt substrates less than 30 m deep. Off northern Australia, female

Brown Tiger Prawns mature between 2.5-3.5 cm carapace length (CL) and grow to a maximum of about 5.5 cm CL; males grow to a maximum of about 4 cm CL. Spawning occurs mainly in water temperatures around 28-30°C, and the resulting planktonic larvae are dispersed by coastal currents back into the estuaries to settle.

Compared to northern Australian states, the NSW tiger prawn catch is extremely small. Since 2000, reported landings have been between 2 and 9 t per year, with about half taken in estuaries (through the Estuary General and Estuary Prawn Trawl Fisheries) and half taken in the Ocean Prawn Trawl Fishery. The ocean prawn trawl catch at times includes small numbers of black tiger prawns that are believed to have escaped from prawn farms.

Additional Notes

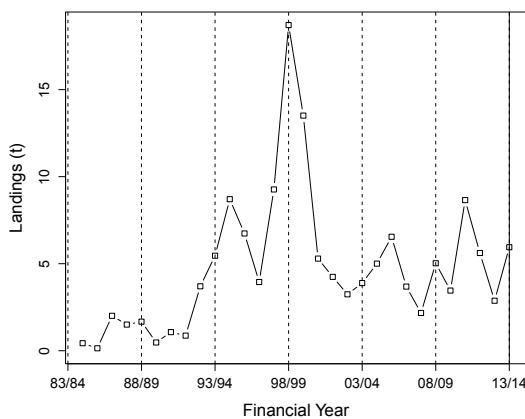
- Caught mainly by the Ocean Trawl Fishery north of Port Macquarie, the Estuary General Fishery, and the Estuary Prawn Trawl.
- *Penaeus esculentus* is endemic to sub-tropical and tropical waters around Australia. Catches are generally incidental when fishing for other species of prawn.
- There is a small fishery for *P. esculentus* in NSW waters, mostly in Wallis Lakes and off northern NSW.
- Higher temperatures have been found to influence the magnitude of *P. esculentus* catch, by increasing the duration of emergence from the sediment and associated catchability (Kienzle *et al.*, 2014).
- *P. esculentus* is the smallest of the three ‘tiger prawn’ species found in the Gulf of Carpentaria.
- There is a combined recreational bag limit of 10 litres for all prawns.
- The Commonwealth, Queensland and Western Australian stocks of Brown Tiger Prawn have been assessed as Sustainable stocks in *Status of Key Australian Fish Stocks Reports 2014*. The stock status for New South Wales was not assessed, as the catch was deemed “negligible”.

Catch

Recreational Catch of Brown Tiger Prawn

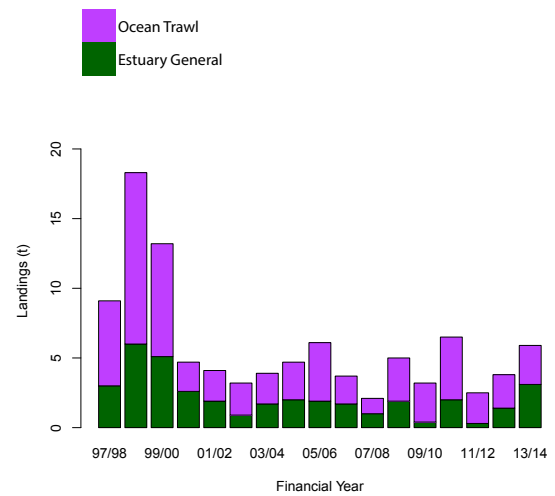
The annual recreational harvest of Brown Tiger Prawn in NSW is considered to be minor.

Historical Landings of Brown Tiger Prawn



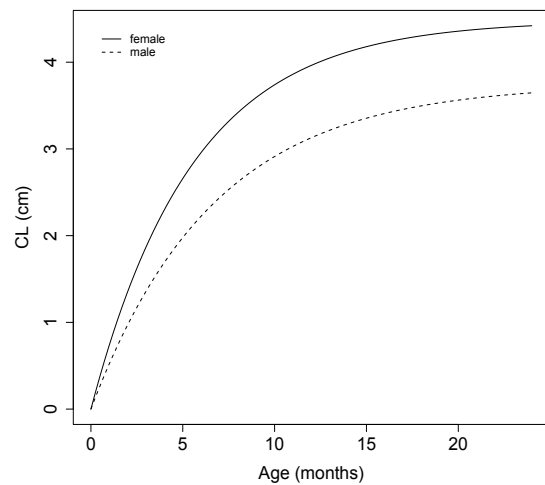
Commercial landings (including available historical records) of Brown Tiger Prawn for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Brown Tiger Prawn



Reported landings of Brown Tiger Prawn by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curves of Brown Tiger Prawn



Growth curve for Brown Tiger Prawn using parameters from Kirkwood and Somers (1984). Lengths are presented as carapace length (CL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 711044 and 28 711051, common name or scientific name to find further information.



Bugs

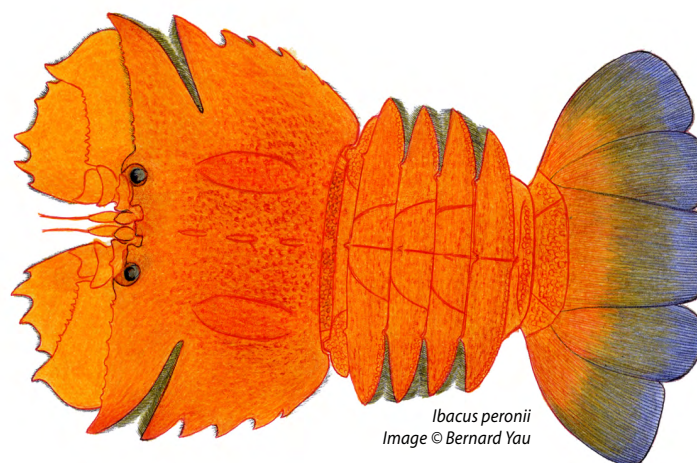
(*Ibacus* spp.)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

Four species of bugs are landed in NSW; however only *Ibacus peronii* and *Ibacus chacei* are regularly landed. Relatively stable landings of 20-40 t per year since 2005/06 in combination with stable size compositions for both species and variable but flat catch rates have resulted in bugs being classified as Fully Fished.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Ibacus chacei</i>	Smooth Bug	Inshore species found mainly off central and northern NSW.
<i>Ibacus peronii</i>	Eastern Balmain Bug	Inshore species found mainly off southern and central NSW.
<i>Ibacus brucei</i>	Honey Bug	Inhabit outer continental shelf and upper slope depths.
<i>Ibacus alticrenatus</i>	Deepwater Bug	Occurs mainly at depths of 200-400 m around southern Australia.



Background

Trawlers off NSW catch four of the eight known species of *Ibacus*, collectively marketed as 'Balmain Bugs'. The most commonly caught NSW species are the 'true' Eastern Balmain Bug (*Ibacus peronii*) and the Smooth Bug (*I. chacei*) which both grow in size to 8-9 cm carapace length (CL) and weigh between 300-400 g. The Eastern Balmain Bug occurs mainly on inshore grounds (<80 m deep) and is distributed around southern Australia from about the NSW-Queensland border to southern WA including the east coast of Tasmania and Bass Strait. The Smooth Bug is mostly caught on deeper grounds (40-120 m) and is found off eastern Australia north from about Sydney to central Queensland.

A less commonly caught species is the smaller (<

7.5 cm CL) Honey Bug (*I. brucei*) that mainly inhabits outer continental shelf and upper slope depths (120-300 m) off northern NSW and Queensland. A second small species (< 6.5 cm CL) is the Deepwater Bug (*I. alticrenatus*) which occurs mainly at depths of 200-400 m around southern Australia; it is also found in New Zealand waters. Honey Bugs are occasionally targeted by prawn trawlers off the NSW north coast and small quantities of Deepwater Bugs are caught by trawlers targeting fish or prawns on the upper continental slope.

Research into NSW bugs revealed distinct differences in life histories between the Eastern Balmain and Smooth Bugs. Eastern Balmain Bugs

may live for more than 15 years whereas Smooth Bugs have a maximum life span of about 7 years. Tagged Smooth Bugs showed a northward movement pattern that was not evident for tagged Eastern Balmain Bugs. Studies of their reproductive biology showed that maturing Smooth Bugs moved northwards to spawn in waters off Queensland, whereas Eastern Balmain Bugs spawned throughout their range along the NSW coast. It appears that Smooth Bug larvae (phyllosomata) disperse south on the East Australian Current and settle as juveniles on the NSW continental shelf.

Size at maturity for Eastern Balmain and Smooth Bugs is around 5 cm CL. In 1999, a minimum legal size of 10 cm (carapace width) was introduced for Eastern Balmain and Smooth Bugs based on their average size of female maturity. Little is known of the biology of the other species although the peak egg-bearing period for all NSW bugs is winter.

The vast majority of the 100-200 t annual catch of bugs is harvested from northern NSW and southern Queensland waters, mostly as a by-product of prawn trawling. The NSW component is generally 25-35% of this catch, with the Queensland catch comprising almost exclusively of Smooth Bugs. Balmain Bugs are also taken as an incidental catch by other trawl fisheries off southern NSW and in other states, and small quantities of bugs are caught incidentally in spanner crab traps.

Additional Notes

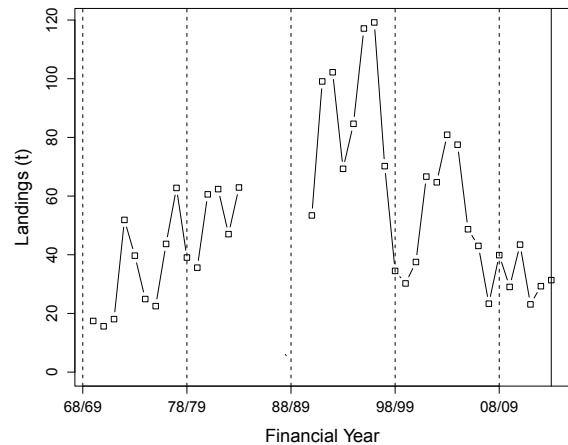
- Bugs are taken incidentally by prawn and fish trawling in ocean waters off NSW.
- The two main species, Smooth Bug, *Ibacus chacei*, and Eastern Balmain Bug, *I. peronii*, are inshore species found mainly in depths less than 100m, whereas *I. brucei* and *I. alticrenatus* are found on the outer shelf and upper slope (150-400 m). Smooth Bugs are generally a more northern species than Eastern Balmain Bugs and are abundant in Queensland waters.
- The species of bugs are not differentiated adequately in catch returns in NSW and port sampling is used to assess the catch composition.
- Balmain Bugs as a complex has been assessed as a Sustainable stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal length of 10 cm carapace width and a recreational bag limit of 20 bugs.

Catch

Recreational Catch of Bugs

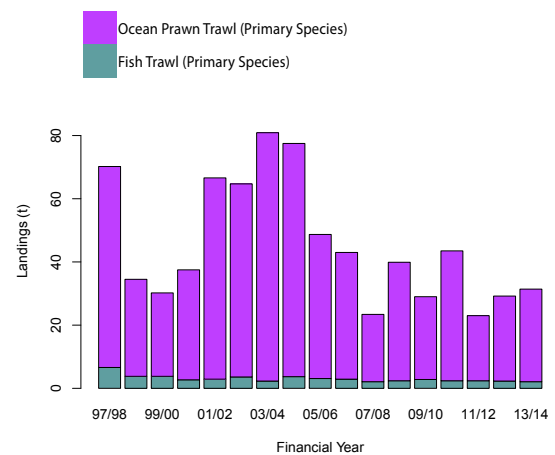
The annual recreational harvest of bugs in NSW is considered to be minor.

Historical Landings of Bugs



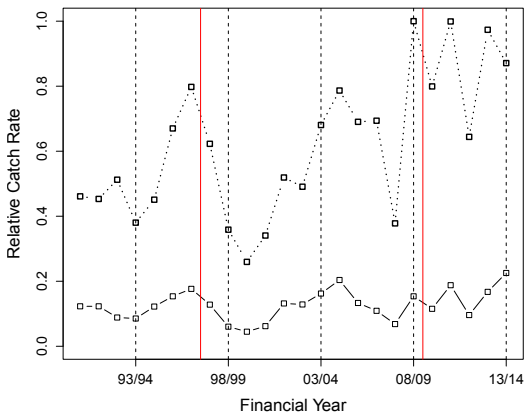
Commercial landings (including available historical records) of bugs for NSW from 1969/70 to 2013/14 for all fishing methods. Records from the mid to late 1980s are incomplete.

Landings by Commercial Fishery of Bugs



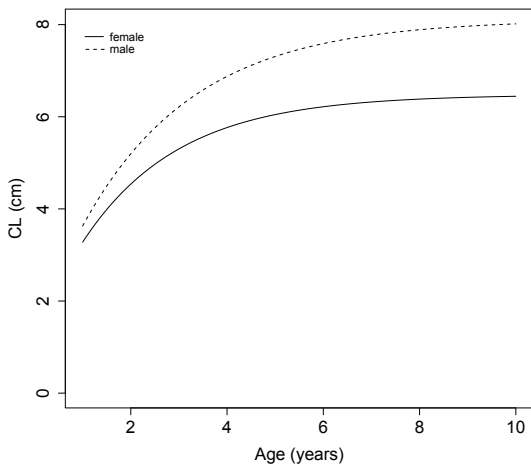
Commercial landings of bugs by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Bugs Harvested by Ocean Prawn Trawling in NSW



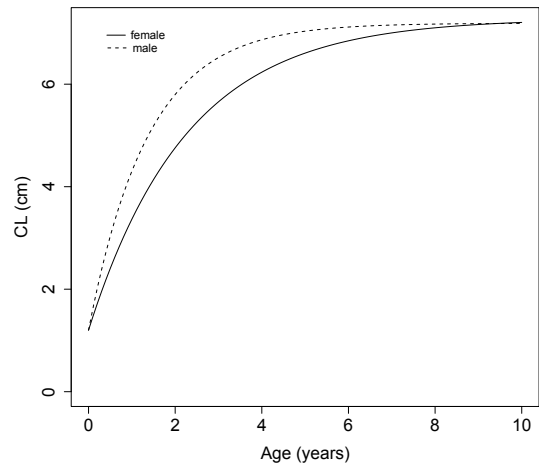
Catch rates of bugs harvested using Ocean Prawn Trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of Eastern Balmain Bugs



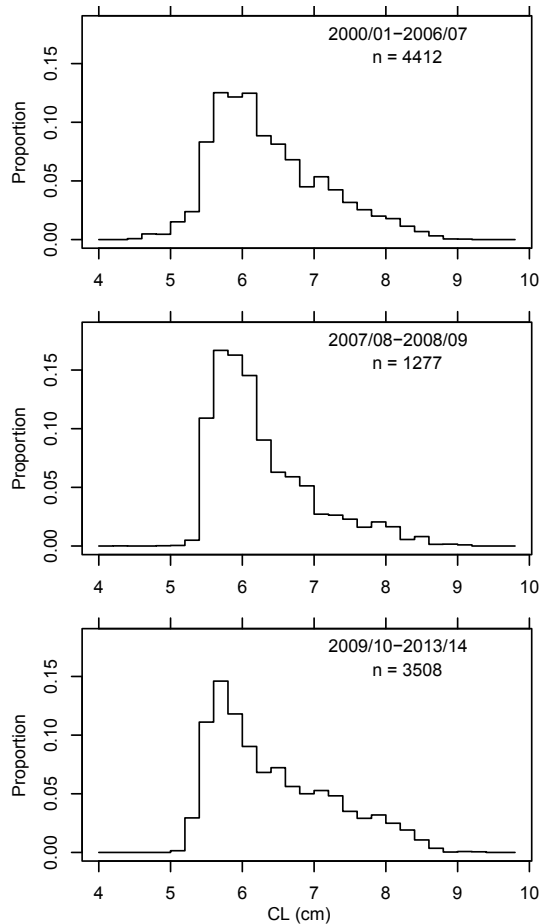
Growth curves of Eastern Balmain Bug using parameters from Stewart and Kennelly (2000). Lengths are presented as carapace length (CL).

Growth Curves of Smooth Bugs



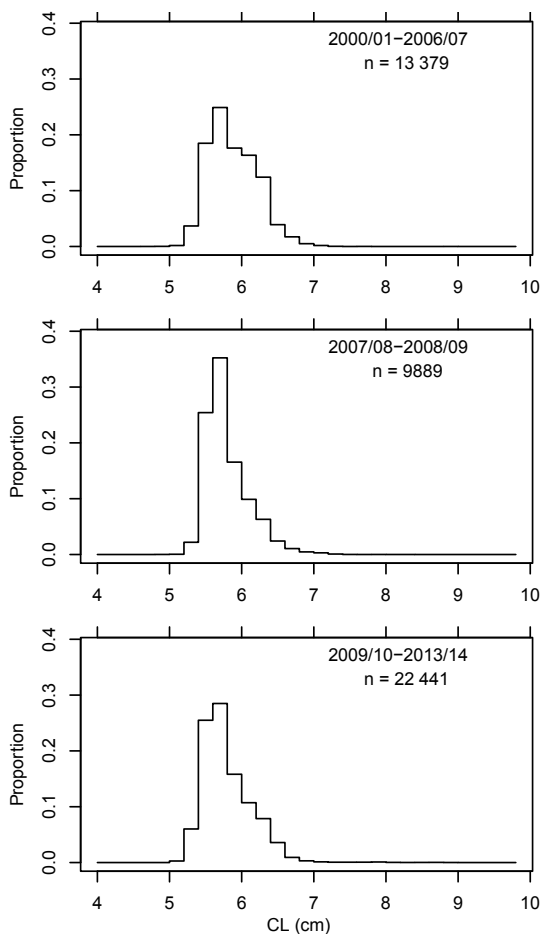
Growth curves of Smooth Bug using parameters from Stewart and Kennelly (2000). Lengths are presented as carapace length (CL).

Length Frequency of Eastern Balmain Bugs



The length distribution of Eastern Balmain Bugs in NSW commercial landings has remained remarkably stable since the early 2000s, and is mainly comprised of animals 5-9 cm carapace length (CL).

Length Frequency of Smooth Bugs



The length distribution of Smooth Bugs in NSW commercial catches has remained remarkably stable since the early 2000s, and is mainly comprised of animals 5-7 cm CL.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 821019, 28 821004, 28 821010 and 28 821001, common name or scientific name to find further information.



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Catfish

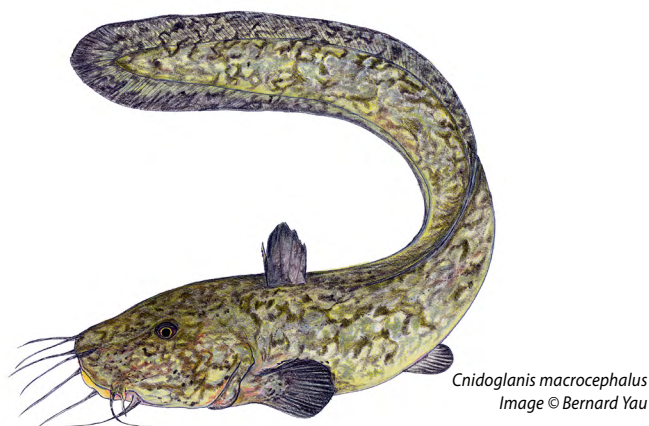
(Siluriformes)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Several species of catfishes are harvested at low levels in NSW estuaries by both commercial and recreational fishers. Very little information is available to establish exploitation status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Cnidoglanis macrocephalus</i>	Estuary Cobbler	The major component of catches.
<i>Euristhmus lepturus</i>	Longtail Catfish	A minor component of catches.
<i>Plotosus lineatus</i>	Striped Catfish	Small species infrequently caught.
<i>Arius graeffei</i>	Blue Catfish	Also known as Forktail Catfish.



Background

In NSW, two types of catfish are predominantly exploited by fishers: eeltail catfishes belonging to the family Plotosidae, which include the Estuary Cobbler (*Cnidoglanis macrocephalus*) and to a lesser extent the Longtail Catfish (*Euristhmus lepturus*) and Striped Catfish (*Plotosus lineatus*); and forktail catfishes belonging to the family Ariidae, which are mainly represented by the Blue Catfish (*Arius graeffei*).

The Estuary Cobbler is endemic to Australian waters and occurs along the east coast from southern Queensland to southern NSW and south-western coast from SA to the Houtman Abrolhos Islands in WA; the species is apparently rare in Victorian and Tasmanian waters. It inhabits estuaries and inshore coastal waters to a depth of about 30 m. It has large serrated spines on both the dorsal and pectoral fins, which are poisonous and capable of inflicting a painful wound.

The Estuary Cobbler grows to about 75 cm total length (TL) and a weight of 2.5 kg. In NSW, it matures at about 45-50 cm TL and an age of 2-3 years, and recent studies indicate that it can live for up to 20 years. Peak spawning occurs in spring and summer. In WA, estimates of fecundity have ranged from 500-3,500 eggs.

The other two eeltailed catfishes have more tropical species distributions. The Longtail Catfish is found in estuarine and inshore coastal waters of northern Australia and southern New Guinea. It can attain a maximum size of 46 cm TL. Little is known about the biology of Longtail Catfish.

The Striped Catfish is found throughout the Indo-West Pacific and along the east coast of Australia to central NSW. It commonly forms small, dense schools or 'balls' in fresh to marine waters up to 60 m deep. It attains a maximum length of about 30 cm and an age of 7 years. A Japanese study estimated it reached maturity at an age of 1-3 years and size of about 14 cm TL.

The Blue Catfish inhabits rivers, estuaries and shallow coastal waters of northern Australia and southern New Guinea. In NSW, it is only abundant in the Richmond and Clarence Rivers, but has been recorded as far south as Port Jackson. It attains a maximum size of 50 cm TL and 3 kg in weight. In the Clarence River, males and females mature at around 27-28 cm standard length (SL) and spawn annually in late spring and early summer. Like all forktail catfish, the males incubate fertilised eggs and larvae in their mouths for 6-8 weeks and have a very low fecundity of only 40-122 that varies positively with fish length.

In NSW, catfish are typically low-value, non-target species. Virtually all of the commercial catch is taken by mesh nets in the Estuary General Fishery. Commercial catches (all species combined) were stable at around 20-30 t per year until 2008/09 and then increased to 30-40 t during the last 5 years. Historically, catfish species were not differentiated in commercial catch returns; however, from 2009/10 and onwards, eeltail and forktail catfishes have been recorded separately. The resulting data suggest that the two groups each account for approximately half of the commercial catches. Large numbers of each group are also caught by recreational fishers, but most are discarded.

Additional Notes

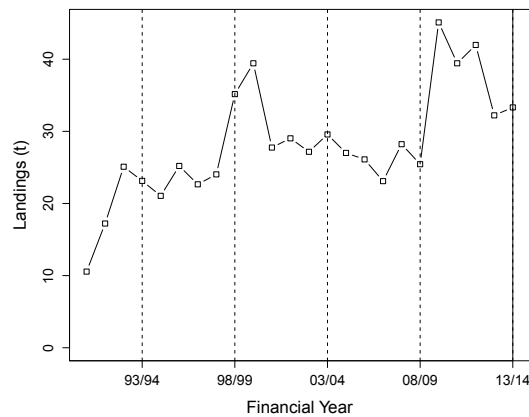
- Annual commercial catches and catch rates of mixed catfish have been stable for over 15 years, with slight increases over the last 5 years.
- Since 2009/10, commercial catches have been reported in to two separate groups: forktail catfishes ('Ariidae - undifferentiated') and eeltail catfishes ('Plotosidae - undifferentiated').
- Catfish are caught in large numbers by recreational fishers, but most are released.

Catch

Recreational Catch of Catfish

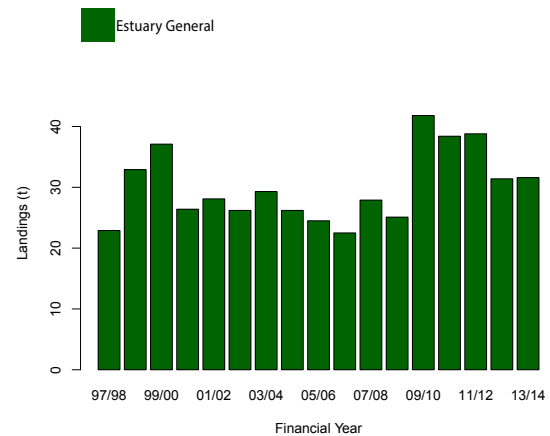
The most recent estimate of the recreational harvest of catfish in NSW is approximately 363 forktail catfish, 1,500 eeltail catfish and 37,000 unspecified catfish during 2013/14 (West *et al.*, 2015). Greater numbers were estimated to be released, including 23,000 forktail catfish and 53,000 eeltail catfish. Previously the harvest of estuarine catfish (combined species) was estimated to be approximately 33,000 (or between 30-50 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003).

Historical Landings of Catfish



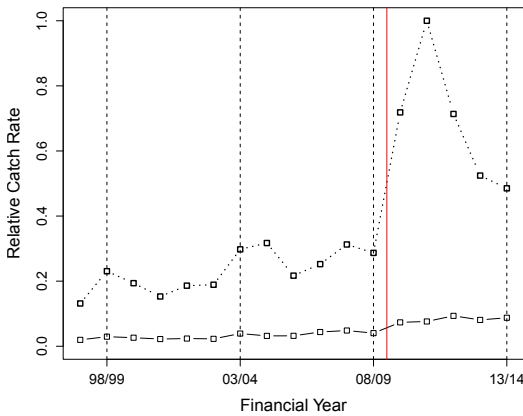
Commercial landings (including available historical records) of catfish for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Catfish



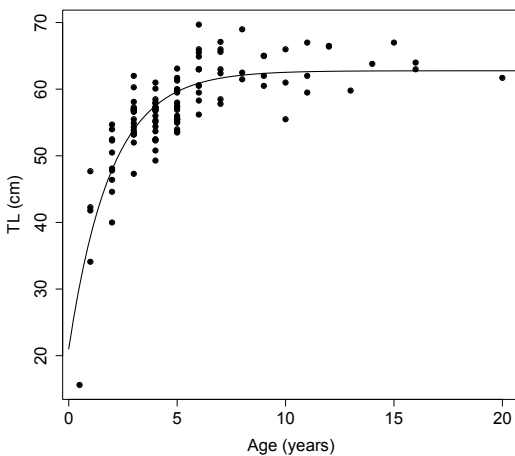
Reported landings of catfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Catfish Harvested by Mesh-Netting in NSW



Catch rates of catfish harvested by mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Estuary Cobbler



Age-length data with fitted growth curve for Estuary Cobbler (internal data). Lengths are presented as total length (TL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 192001, 37 192004, 37 192002 and 37 188005, common name or scientific name to find further information.



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Cobia

(*Rachycentron canadum*)

Author John Stewart

EXPLOITATION STATUS		UNDEFINED
Very little information is available for Cobia in NSW waters. The lack of recreational harvest data and negligible commercial fishery has resulted in a status of Undefined.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Rachycentron canadum</i>	Cobia	Previously Black Kingfish.



Background

Cobia (*Rachycentron canadum*) has an almost world-wide distribution in tropical and sub-tropical waters, except in the eastern Pacific Ocean. In Australian waters, Cobia are common around the tropical north of the country and south to south-western Western Australia and central NSW. They are a large, wide-ranging species often observed as solitary fish; however they occasionally form small schools that associate with floating objects, fixed structures and large oceanic animals including sharks, rays, turtles and whales. Cobia are often referred to as a pelagic species, although dietary studies reveal that a large portion of their diet is comprised of benthic and demersal prey including crabs, stingrays, flatfishes and stomatopods. In Australia, Cobia populations make seasonal migrations over large distances; moving north with migrating whales in winter and returning south in summer.

Cobia grow extremely quickly and can reach more than 75 cm after 3 years, and attain a maximum length of 1.8 m fork length (FL) and weight of about 60 kg, at about 13 years of age. In Queensland, Cobia have a protracted spawning season between September and June but with a peak around October to December. The length at 50% maturity for females is around 78 cm FL.

Cobia are only a minor commercial species; however their large size and excellent table qualities make them a prime recreational sport and table fish. Their rapid growth rate also makes Cobia an attractive species for aquaculture. In NSW, Cobia have no minimum legal length and a bag limit of 5. In Queensland, Cobia have a minimum legal length of 75 cm total length and a bag limit of 2.

Additional Notes

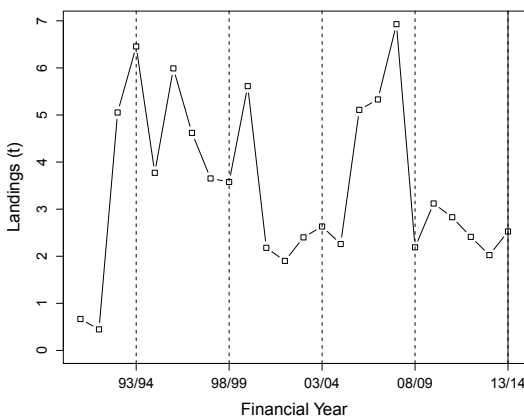
- A northern species which occurs seasonally off NSW - the annual commercial catch is minor, averaging less than 4 t per year since 2003/04.
- Cobia are mainly taken by line fishing, but there is also a small by-catch from prawn trawling.
- Cobia are highly valued by recreational fishers in NSW.
- The Queensland commercial fishery is estimated to be 20 to 40 t - the recreational fishery is significant but is not well estimated.

Catch

Recreational Catch of Cobia

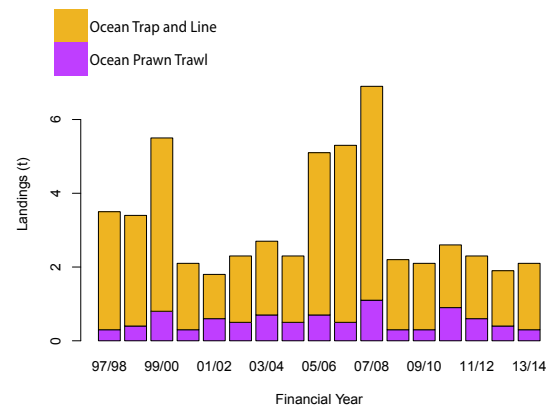
There is no robust estimate of the recreational harvest of Cobia in NSW. The annual recreational harvest of Cobia in NSW was previously estimated to be less than 20 tonnes. This estimate was based upon the results of an offshore recreational trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI.

Historical Landings of Cobia



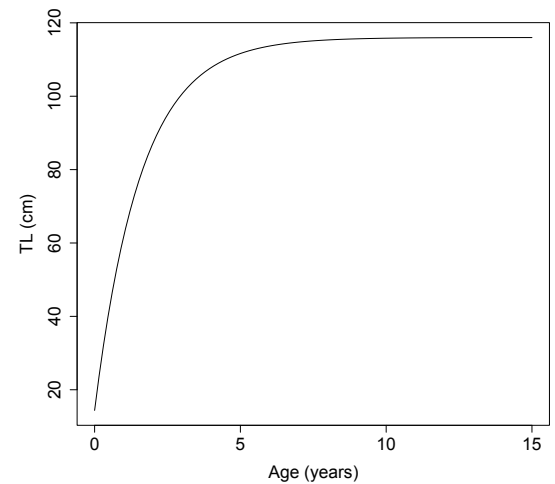
Commercial landings (including available historical records) of Cobia for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Cobia



Reported landings of Cobia by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Cobia



Growth curve of Cobia using parameters from Fry and Griffiths (2010). Lengths are presented as total length (TL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 335001, common name or scientific name to find further information.



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Cockles

(Arcoida and Veneroidea)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

No assessment of the cockle species harvested and reported within this group has been undertaken. The accuracy of catch and effort reporting of the species harvested requires investigation. Biological information is available for some species.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Anadara trapezia</i>	Sydney Cockle	Sometimes called Blood Cockles.
<i>Katelysia victoriae</i>	Sand Cockle	Marketed as Vongoli.
<i>Katelysia scalarina</i>	Sand Cockle	Marketed as Vongoli.
<i>Glycymeris flammeus</i>	Shiny Dog Cockle	Also called Flame Dog Cockle.
<i>Callista (Notocallista) kingii</i>	Strawberry Cockle	Marketed as Baby Clams.
<i>Eucrassatella kingicola</i>	King Island Crassatella	Marketed as Surf Clams.



Glycymeris flammeus
Image © Bernard Yau

Background

Cockles commercially harvested within the NSW Estuary General Fishery are principally the Sand or Estuary Cockles (*Katelysia scalarina* and *K. rhytiphora*), marketed as 'vongoli'. The Sydney Cockle, Mud ark or Blood Cockle (*Anadara trapezia*) is also harvested, although in relatively small proportions. There is also a developing fishery permitted to harvest a range of other cockles from NSW ocean waters (including the Flame Cockle: *Glycymeris flammeus*, *G. grayana*; Venus shell/ Strawberry Clam/Baby Clam: *Callista (Notocallista)*

kingii and King Island Crassatella: *Eucrassatella kingicola*).

Sand Cockles can reach shell sizes of about 4 cm (*K. scalarina*) or 6 cm (*K. rhytiphora*), while the Sydney Cockle can attain a maximum size of about 7 cm. These two types of cockles are easily distinguishable from each other by their shell sculpture and colouration. Sand Cockles are oval in shape with raised concentric ridges around the shell, which is light grey or brown in colour.

In contrast, the Sydney Cockle is more oblique in shape and has strong ribs that radiate out across the shell from the hinge; its underlying colour is plain cream or white, although this is usually partially covered by a dark, organic skin or coating (periostracum). The shells of the Sydney Cockle are thick which results in the recovery of only a small amount of meat compared to the weight of the cockle.

Sand Cockles are distributed around southern Australia from the south coast of NSW to the southern shores of WA, and including Tasmania. They inhabit fine to medium grained sand and mud habitats in protected estuarine tidal flats and are usually found less than 5 cm below the surface of the sand. The Sydney Cockle also inhabits mud, sand and seagrass beds in sheltered estuaries. Its main distribution is eastern Australia from southern Queensland to Port Philip Bay in Victoria; there is also an isolated population of *Anadara* sp. at Albany, WA.

In NSW, Sand or Estuary Cockles are harvested throughout the year with most landings in August to December. The method of harvest is by hand-gathering on mud flats and sand banks during low tide. Annual commercial catches of the Sand or Estuary Cockerle have been relatively stable for at least the last decade, at an average of about 27 t. In 2013/14 the reported catch of Estuary Cockles was about 38 t.

Additional Notes

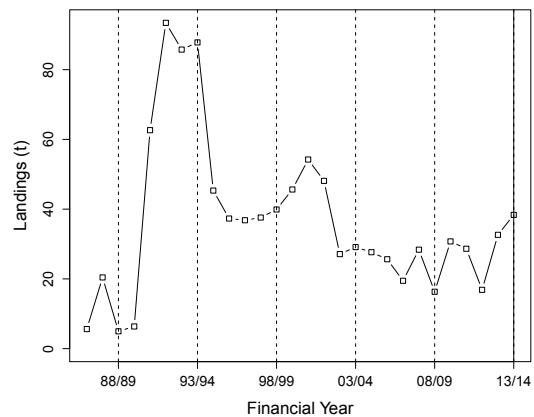
- A number of species are harvested commercially within the Estuary General Fishery and the recreational harvest of some species may be significant, although the quantity is unknown.
- Proper identification of the species and inconsistency of common names provides complications in the accuracy of reporting and assessment of these species.
- There is a combined recreational bag limit of 50 cockles, mussels and pipis.

Catch

Recreational Catch of Cockles

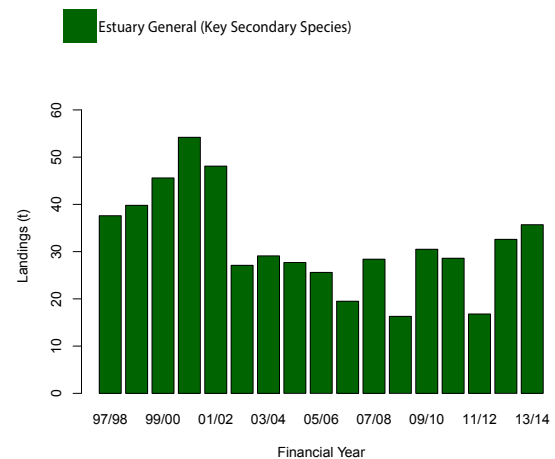
The annual recreational harvest of cockles in NSW is unknown but there may be significant fishing pressure on accessible populations.

Historical Landings of Cockles



Commercial landings (including available historical records) of cockles for NSW from 1986/87 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Cockles



Reported landings of cockles by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 226001, 23 380003, 23 380004, 23 231007, 23 380039, and 23 330004, common name or scientific name to find further information.



Common Jack Mackerel

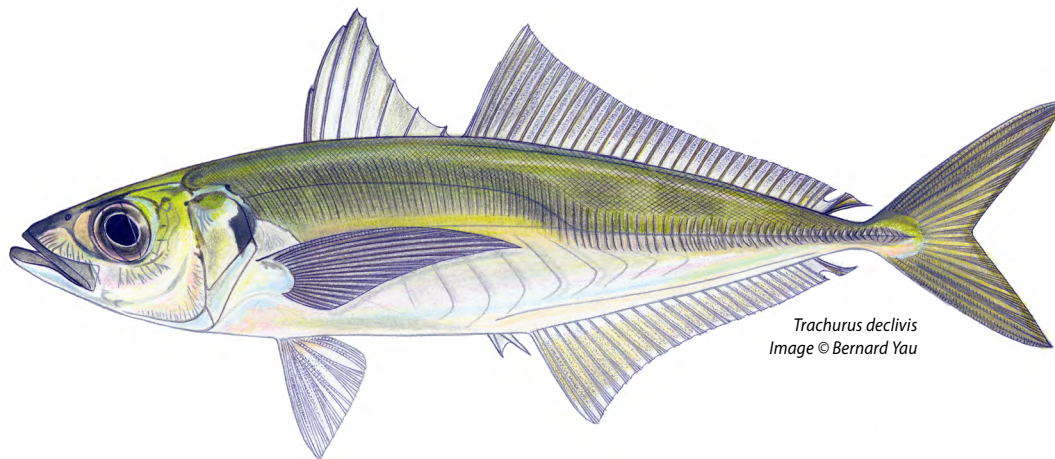
(*Trachurus declivis*)

Author John Stewart

EXPLOITATION STATUS MODERATELY FISHED

Predominantly a Commonwealth fishery with relatively small landings taken from NSW waters. Annual landings of less than 10 tonnes in recent years against a spawning biomass of approximately 158,000 tonnes in 2014 are consistent with a status of Moderately Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Trachurus declivis</i>	Common Jack Mackerel	Also known as Cowanyoung.



Background

The Common Jack Mackerel or Cowanyoung (*Trachurus declivis*) is found in coastal waters of southern Australia from Wide Bay, Queensland to Shark Bay, WA, including Tasmania. It is very similar and closely related to the common Yellowtail Scad (*Trachurus novaezelandiae*) and the larger Peruvian Jack Mackerel (*Trachurus murphyi*) which is occasionally found among jack mackerel catches off southern Australia.

The stock structure of Common Jack Mackerel is complex; however it is thought that at least two populations occur within Australian waters, whilst a third occurs in New Zealand. Common Jack Mackerel from eastern Australia, including eastern Tasmania, are considered to be separate from fish to the west of Tasmania. They are pelagic, forming schools over the continental shelf and outer shelf margin. Individuals have been found in depths of 460 m but this species is more commonly found between 20-300 m. The Common Jack Mackerel shows a preference for water temperatures less than 17°C and entire schools will move to stay below this temperature. Schools of Jack Mackerel

regularly appear during winter-spring in surface waters off southern NSW.

The Common Jack Mackerel feeds during the day primarily on planktonic crustaceans. Jack Mackerel in deeper offshore waters include light fish (Sternoptychidae) and lantern fish (Myctophidae) in their diet. The Jack Mackerel is, in turn, preyed upon by large fish such as Tuna, Barracouta and Gemfish.

Individuals grow to at least 64 cm in length (1.6 kg in weight) and 25 years of age. The Common Jack Mackerel matures between 34 years old at a length of about 27 cm and a weight of 250 g. Spawning in NSW occurs between October and January in waters above the thermocline. After spawning, the eggs and larvae travel on currents into inshore waters where most juveniles remain during early growth.

Despite its schooling behaviour, the Common Jack Mackerel is seldom targeted in NSW by commercial fishers as it has poor market acceptance. The bulk of the catch is caught by the Ocean Hauling Fishery using purse-seine nets.

Additional Notes

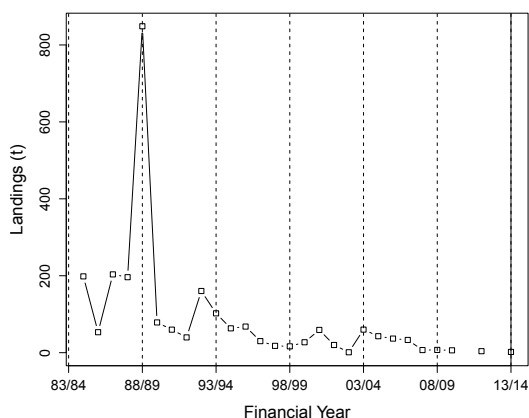
- Not the basis for a significant fishery in NSW.
- There is only a small incidental purse-seine catch in winter off Wollongong.
- There is the potential for substantial increases in harvesting of Common Jack Mackerel in the Commonwealth Small Pelagic Fishery.
- Commonwealth assessments do not consider Common Jack Mackerel to be overfished nor subject to overfishing (Georgeson *et al.*, 2014).
- The Eastern biological stock of Common Jack Mackerel has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a recreational bag limit of 50 Common Jack Mackerel in combination with Blue Mackerel, Yellowtail Scad, garfish (other than Eastern Sea Garfish), Hardyhead and Silverfish.

Catch

Recreational Catch of Common Jack Mackerel

The annual recreational harvest of Common Jack Mackerel in NSW is considered to be minor.

Historical Landings of Common Jack Mackerel



Commercial landings (including available historical records) of Common Jack Mackerel for NSW from 1984/85 to 2013/14 for all fishing methods. Financial years where commercial catch is made up of less than six fishermen were removed due to privacy concerns.

Further Reading

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- Yearsley, G.K., P.R. Last and R.D. Ward (1999). *Australian Seafood Handbook*. Hobart, CSIRO Marine Research.
- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 337002, common name or scientific name to find further information.



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Common Silverbiddy

(*Gerres subfasciatus*)

Author Karina Hall

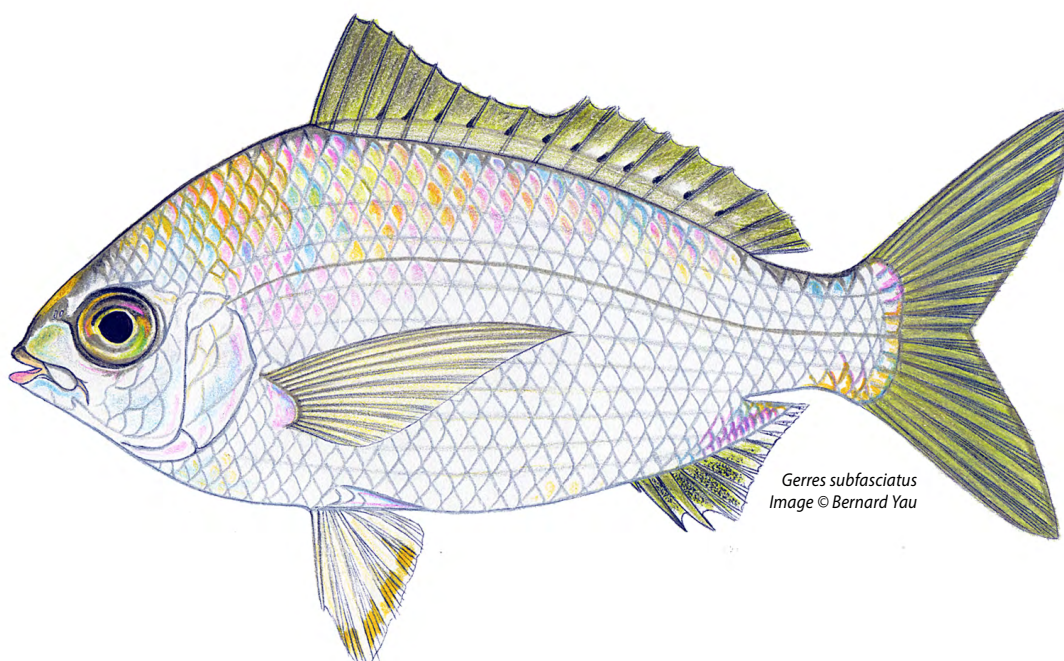
EXPLOITATION STATUS **UNCERTAIN**

Substantial commercial catches of over 100 t were historically taken from NSW estuaries as a byproduct of haul netting. Large unexplained declines in the commercial landings and catch rates over the last 3 years have resulted in an Uncertain status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Gerres subfasciatus

Common Silverbiddy



Background

The Common Silverbiddy (*Gerres subfasciatus*) is widely distributed, occurring on both the east and west coasts of Australia. Along the NSW coastline, it is found in inshore waters and estuaries, generally over sand and mud substrates. The stock structure and movement patterns of the species in NSW waters and across its species distribution is unknown.

Spawning appears to occur in inshore waters and marine-dominated estuaries, primarily during summer and early autumn. Small juveniles live in sheltered shallow water habitats, particularly where cover such as seagrass or algae are available. Larger juveniles appear to be less dependent on such cover, and are found over bare sandy substrates. They mainly feed on small invertebrates, particularly polychaetes.

The Common Silverbiddy grows to a maximum size of only 23 cm total length (TL). In NSW estuaries, the largest females recorded were larger in size (18

cm TL) and age (10 years) than males (16 cm TL and 6 years). However, there was considerable variation in size with age for both sexes. The reproductive characteristics of the species are yet to be studied.

The Common Silverbiddy is one of the smallest finfish commercially harvested in NSW. The species is taken primarily in haul nets of the Estuary General Fishery. Prior to the 1980s, it was landed in only small quantities and sold as an incidental byproduct because their market value was very low. However, increased demand by the domestic market for large Common Silverbiddy (greater than 20 cm TL) substantially increased their market price and larger quantities of this previously discarded species were retained.

Commercial catches of Common Silverbiddy rose from just over 50 t in 1978/79 to a peak of almost 200 t in the mid-1990s, before declining again to below 100 t during the early 2000s following establishment of Recreational Fishing Havens in some estuaries. Catches increased again to

a second peak of over 150 t in 2010/11, before rapidly declining over the last 3 years to just 57 t in 2013/14, the lowest catch recorded since the early 1970s. After remaining steady for many years, catch rates have also declined during the last 3 years.

Common Silverbiddy is frequently caught by recreational fishers, but is rarely retained because of its small size.

Additional Notes

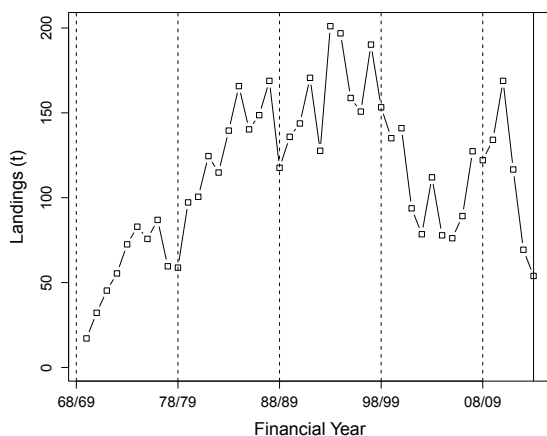
- Large Common Silverbiddy are usually cooked whole and the meat picked from the bones.
- Most of the recent declines in catches have occurred in specific estuaries.
- Local biological data for the Common Silverbiddy were collected during an independent survey of several NSW estuaries and will be further analysed to investigate current declines in landings and catch rates.

Catch

Recreational Catch of Common Silverbiddy

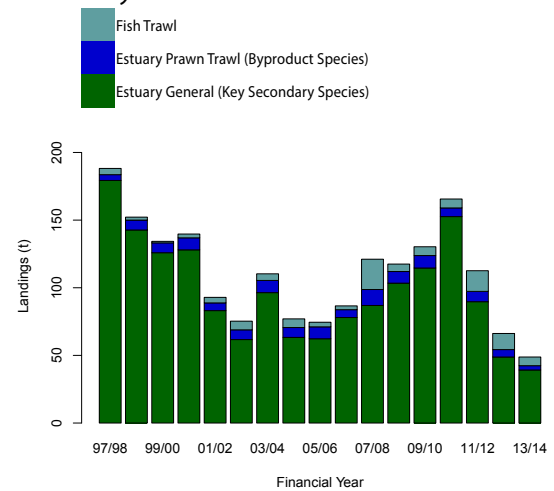
The most recent estimate of the recreational harvest of Common Silverbiddy in NSW was approximately 6,500 fish during 2013/14 (West *et al.*, 2015).

Historical Landings of Common Silverbiddy



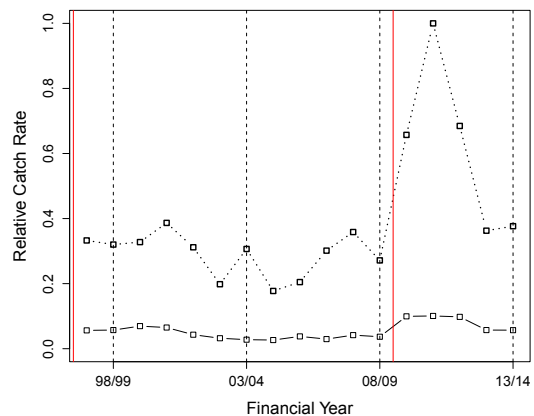
Commercial landings (including available historical records) of Common Silverbiddy for NSW from 1969/70 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Common Silverbiddy



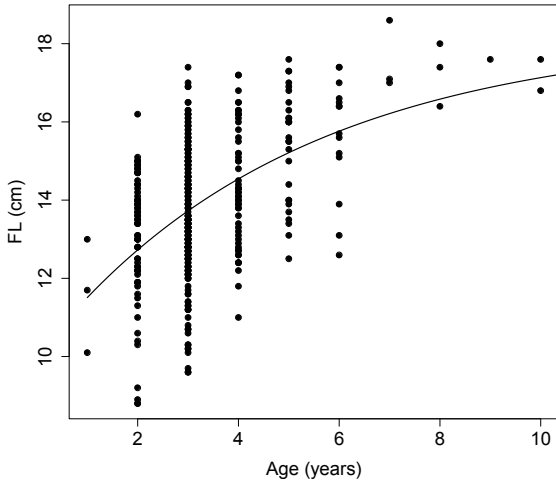
Reported landings of Common Silverbiddy by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Common Silverbiddy Harvested by Haul Nets in NSW



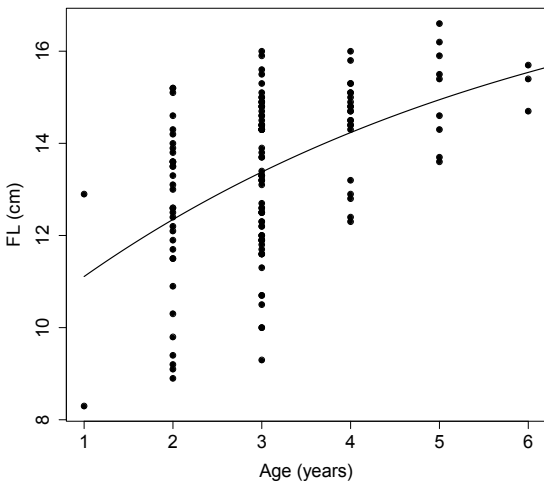
Catch rates of Common Silverbiddy harvested by haul nets for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Common Silverbiddy - Females



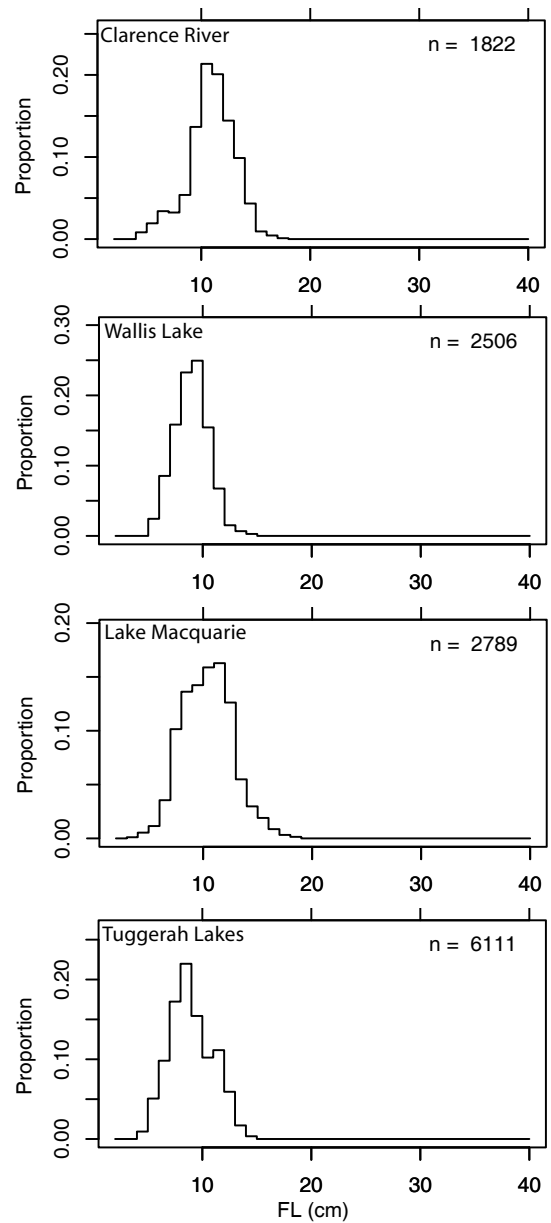
Age-length data with fitted growth curve for female Common Silverbiddy (internal data). Lengths are presented as fork length (FL).

Growth Curve of Common Silverbiddy - Males



Age-length data with fitted growth curve for male Common Silverbiddy (internal data). Lengths are presented as fork length (FL).

Length Frequency of Common Silverbiddy



The length distributions of Common Silverbiddy caught by Fishery Independent Surveys in Clarence River, Wallis Lake, Lake Macquarie and Tuggerah Lakes during 2008-11.

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- West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle (2015) *Survey of recreational fishing in New South Wales and the ACT, 2013/14*. Fisheries Final Report Series.

Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 349005, common name or scientific name to find further information.



Crimsonbanded Wrasse

(*Notolabrus gymnogenis*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

Some local biological information exists for Crimsonbanded Wrasse however a lack of current fishery data on this mainly recreational species has resulted in a status of Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Notolabrus gymnogenis</i>	Crimsonbanded Wrasse	Major component of catches.
<i>Notolabrus tetricus</i>	Bluethroat Wrasse	Minor catches in southern NSW waters.



Notolabrus gymnogenis
Image © Bernard Yau

Background

Crimsonbanded Wrasse (*Notolabrus gymnogenis*) are endemic to rocky reefs of south-eastern Australia. They are found from southern Queensland to Mallacoota (Victoria) in depths of 2 m to at least 40 m. Juveniles are cryptic - favouring reefs with high algal coverage. Individual males and loose aggregations of females are distributed over available hard substrates.

Like other members of the family Labridae, Crimsonbanded Wrasse are protogynous hermaphrodites (juveniles first develop female reproductive organs that may change into male reproductive organs in certain circumstances). They are sexually dichromatic with males exhibiting a crimson transverse band through the midsection; crimson dorsal and anal fins; white caudal peduncle; yellow caudal fin; and a head exhibiting a dark upper and light lower half.

Crimsonbanded Wrasse mature as females at approximately 18 cm total length (TL) and 2 years

of age. Females change to the terminal phase male at approximately 28 cm and 4.5 years old. The peak reproductive season is from April to October. Crimsonbanded Wrasse grow quickly initially, attaining approximately 28 cm TL after 5 years, with growth slowing thereafter. They can reach 45 cm in length and have been aged up to 10 years.

Crimsonbanded Wrasse are important to the recreational fishery in NSW and ranked within the top 25 species by number retained during both years of a survey of offshore trailerboat fishers (Steffe *et al.*, 1996). They are not considered a commercially important species with on average 1.2 t being reported each year since 2009/10 and all in the Ocean Trap and Line Fishery.

A similar species, the Bluethroat Wrasse *Notolabrus tetricus*, occurs in southern Australian coastal waters, and is taken by both recreational and commercial fishers on the far south coast of NSW.

Additional Notes

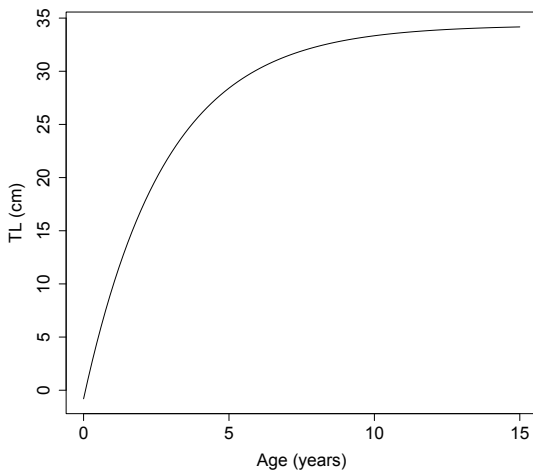
- Crimsonbanded Wrasse are caught by recreational line and commercial trap and line fishers in rocky reef habitats of NSW coastal waters.
- Known to be a sex-changing hermaphroditic species.
- Not targeted commercially - incidental catches only.

Catch

Recreational Catch of Crimsonbanded Wrasse

The most recent estimate of the recreational harvest of wrasse (all species combined) in NSW was approximately 7,700 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Crimsonbanded Wrasse in NSW was previously estimated to be less than 20 t based upon the results of an offshore recreational trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI.

Growth Curve of Crimsonbanded Wrasse



Growth curve of Crimsonbanded Wrasse using parameters from Morton *et al.*, (2008). Lengths are presented as total length (TL).

Further Reading

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West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle (2015). Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series.

Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 384041, and 37 384003, common name or scientific name to find further information.



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Cunjevoi

(*Pyura stolonifera*)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

No assessment of the exploitation status of Cunjevoi has been undertaken. Not commercially harvested. Harvested by recreational fishers, primarily for use as bait. A large proportion of the population occurs in inaccessible, high energy, rocky coastal habitats.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Pyura stolonifera</i>	Cunjevoi	



Pyura stolonifera
Image © Bernard Yau

Background

Cunjevoi (*Pyura stolonifera*) occurs abundantly on rocky substrates in the intertidal zone on exposed coastlines around southern Australia from Queensland to Western Australia. Cunjevoi also occurs in South Africa and in one bay on the west coast of Chile, South America - although a study using mitochondrial DNA suggests that this occurrence represents a recent introduction from Australia.

Adult Cunjevoi is a sessile filter-feeding animal enclosed in a tough leathery outer case or 'tunic'. Many animals can occur together in a large clump, which provides a substrate for a diverse range of intertidal invertebrate and plant species. Cunjevoi has a free-swimming larval stage which possesses a notochord (precursor of the vertebrate's backbone) and is the reason that Cunjevoi is classified in the phylum Chordata.

Little has been published on growth or mortality rates of Cunjevoi. Dalby (1995) reported reasonably fast growth from 30 mm to about 70 mm upper test

diameter over a two year period, and suggested that growth was greater when they were not closely associated with other individuals.

Cunjevoi are not harvested commercially - all harvesting is by recreational fishers, primarily for bait. In NSW recreational fishers are subject to a bag limit of 20 Cunjevoi. The National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) did not report catches of Cunjevoi separately, and there is no estimate available of the quantity taken annually by recreational fishers, but it is likely to be low in comparison to the total biomass.

Over-fishing may occur at local scales, resulting in locally depleted populations. However, in NSW, the species remains abundant and is not considered to be under threat from current harvest levels. The exploitation rate of Cunjevoi is likely to be low, as a significant proportion of the population occurs on inaccessible rocky substrates in high-energy surf zones.

For the Cunjevoi population as a whole, it is likely that environmental effects (e.g. strong storm surges removing large clumps of Cunjevoi; coverage of Cunjevoi beds by mobile sand near beaches) play a more significant role in mortality and changes to total biomass than harvesting by recreational fishers.

Additional Notes

- No commercial fishery, and no accurate estimate of the quantity harvested by recreational fishers. Catch of Cunjevoi is likely to contribute a small proportion of total mortality in comparison to the effects of storms and mobile sand on populations throughout NSW.
- For the population as a whole, fishing mortality is probably low in relation to natural mortality - however localised depletions may occur in some more heavily utilised areas.

Catch

Recreational Catch of Cunjevoi

The annual recreational harvest of Cunjevoi in NSW is not accurately known.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 35 032041, common name or scientific name to find further information.



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Cuttlefish

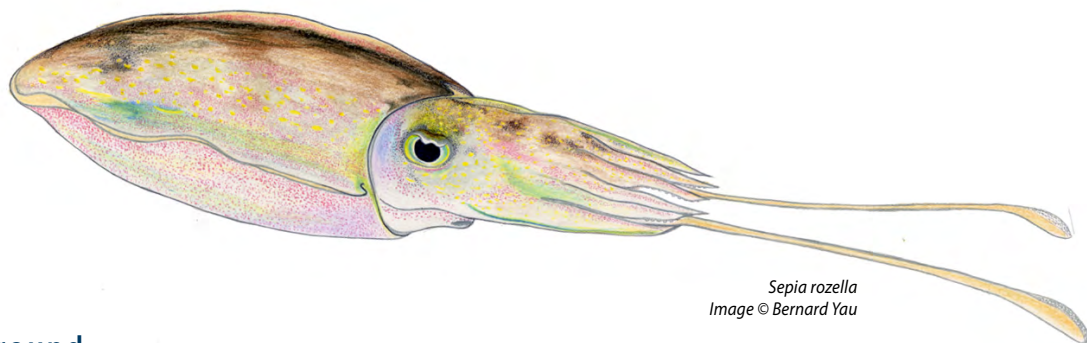
(*Sepia* spp.)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Species identification and composition issues restrict our ability to assess these stocks. All species in this group are likely to exhibit rapid growth and have a short life span.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Sepia rozella</i>	Rosecone Cuttlefish	The major species caught in ocean trawls.
<i>Sepia plangon</i>	Mourning Cuttlefish	A minor species caught in prawn trawling off northern NSW.
<i>Sepia opipara</i>	Magnificent Cuttlefish	A minor species caught in prawn trawling off northern NSW.
<i>Sepia hedleyi</i>	King Cuttlefish	A minor species caught off central and southern NSW.
<i>Sepia apama</i>	Giant Cuttlefish	A large species caught in fish trawling off southern NSW.



Background

Worldwide there are about 100 species of cuttlefish (family Sepiidae) and more than 30 are known from Australian waters. At least 12 species occur in NSW commercial trawl catches, but as with octopus, only a few species dominate the landings. Off northern NSW, the main species taken is the subtropical Rosecone Cuttlefish (*Sepia rosella*), which occurs in inshore and offshore waters to 183 m depth from southern Queensland to southern NSW. Smaller amounts of Mourning Cuttlefish (*S. plangon*) and Magnificent Cuttlefish (*S. opipara*) are also taken, which have more tropical species distributions and are also landed in significant quantities in Queensland prawn trawl fisheries.

Off central and southern NSW, the Rosecone Cuttlefish still dominates inshore catches, but Hedley's Cuttlefish (*S. hedleyi*) is also commonly caught offshore. Small numbers of the Australian Giant Cuttlefish (*Sepia apama*) are also landed, but given its large size (up to 50 cm mantle length, ML and 13 kg in weight) it accounts for a

considerable portion of the total catch weight. Both Hedley's Cuttlefish and the Giant Cuttlefish have temperate species distributions, occurring from southern Queensland to Shark Bay in WA, and including Tasmania. An assessment of cuttlefish consignments through the Sydney Fish Market indicated that almost 70% of sales were Rosecone Cuttlefish, 17% were Hedley's Cuttlefish and 10% were Giant Cuttlefish.

The biology and stock structure of the Giant Cuttlefish has been studied in southern Australian waters, where it is targeted by jig fishing. The Giant Cuttlefish has two alternative life cycles (of 1 or 2 years) that only breed once during the final 3 months of their life. The cuttlefish migrate between deeper soft sediment areas where they are more dispersed and feed during the spring and summer to concentrate in shallow, rocky reef areas during autumn and winter for breeding.

Like other cuttlefish studied in aquaria, the Giant Cuttlefish exhibits complex reproductive behaviours and mate with multiple partners during the breeding season in a head to head position. Males use specialized (hectocotylus) arms to transfer sperm packets to a receptacle below the females' mouth, where they can store sperm from multiple males until they are ready to spawn. The eggs are fertilized and laid individually in a protective casing that the female attaches to the underside of hard substrates with her arm tips. Egg size is large (approximately 1 cm diameter) and fecundity is low (about 500 eggs per female), and both vary positively with female size. The eggs develop over an extended period of 2-5 months (varying with water temperature) and hatch as fully developed juveniles, similar in form to adults.

All other species common in NSW waters, including the main commercial species, are much smaller than the Giant Cuttlefish, with maximum sizes of less than 25 cm ML and 300 g in weight. Little is known of their biology, but other cuttlefish of similar size only live for 1 or 2 years, are fast growing and breed once at the end of their life cycle. Data is currently being collected on the life history characteristics of the Rosecone Cuttlefish, Magnificent Cuttlefish and Mourning Cuttlefish in northern NSW waters.

Cuttlefish are an important byproduct species of the Ocean Trawl Fishery, particularly for the ocean prawn trawling sector, which takes around 80% of the catch off the northern coast. Reported landings of cuttlefish were consistently around 150-250 t in the mid-1980s and increased to a peak of 450 t in 1994/95. Catches declined rapidly after 2003/04 from 300 t to just 60 t in 2008/09. Since then catches have remained below 100 t. Multi-species catch rates have also gradually declined since 2003/04. Because the bulk of the catch arises from northern NSW waters, the removal of Commonwealth catches from State reporting in the 1990s is unlikely to account for the significant declines in catches.

Cuttlefish have been historically reported as a mixed species group, but since 2009/10 the Giant Cuttlefish has been reported separately. Many of the smaller species are difficult to identify to species level and are unlikely to be reliably separated by fishers in the future. The lack of accurate species composition information hampers stock assessments for cuttlefish in NSW. Giant Cuttlefish is also landed in small numbers by recreational fishers along the central and southern coasts, often as a byproduct of squid jigging.

Additional Notes

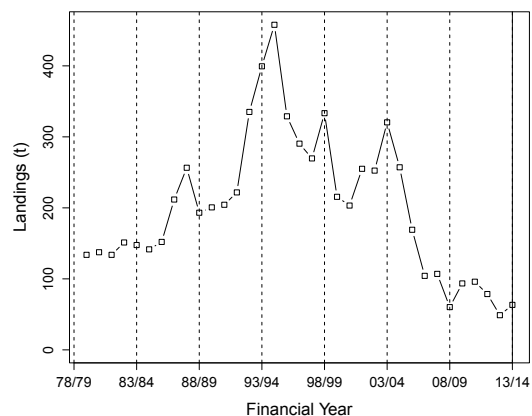
- Cuttlefish are a valuable byproduct of commercial trawl fisheries throughout NSW oceanic waters.
- Cuttlefish are typically fast growing, short-lived animals, with low fecundity.
- Like most cephalopods, cuttlefish growth rates and recruitment can vary significantly with environmental conditions, in particular water temperature and food availability.
- The Giant Cuttlefish is also landed by recreational fishers along the NSW central and southern coasts.
- There is a combined recreational bag limit of 20 squid and cuttlefish.

Catch

Recreational Catch of Cuttlefish

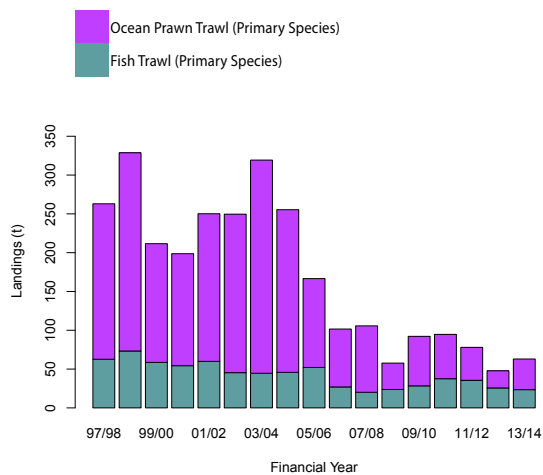
The most recent estimate of the recreational harvest of cuttlefish in NSW was approximately 6,400 fish during 2013/14 (West *et al.*, 2015). This was higher than the previous estimate of 3,300 cuttlefish (or less than 50 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003). Previous onsite surveys indicate that most of the cuttlefish harvested by recreational fishers in NSW are Giant Cuttlefish.

Historical Landings of Cuttlefish



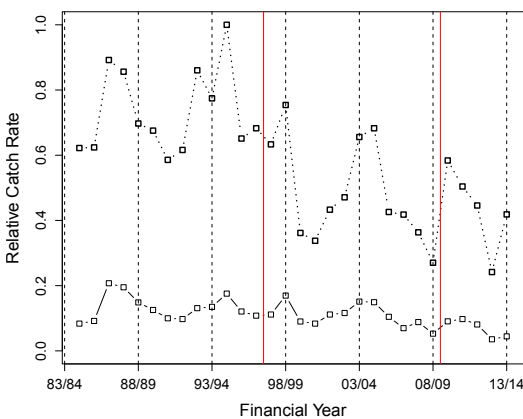
Landings (including available historical records) of cuttlefish for NSW from 1979/80 to 2013/14 for all fishing methods. Note that some of the decline in reported catch during the 1990s may have been due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Cuttlefish



Reported landings of cuttlefish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Cuttlefish Harvested by Ocean Prawn Trawling in NSW



Catch rates of cuttlefish harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website,

<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 607010, 23 607001, 23 607006, 23 607021 and 23 607001, common name or scientific name to find further information.



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Dart

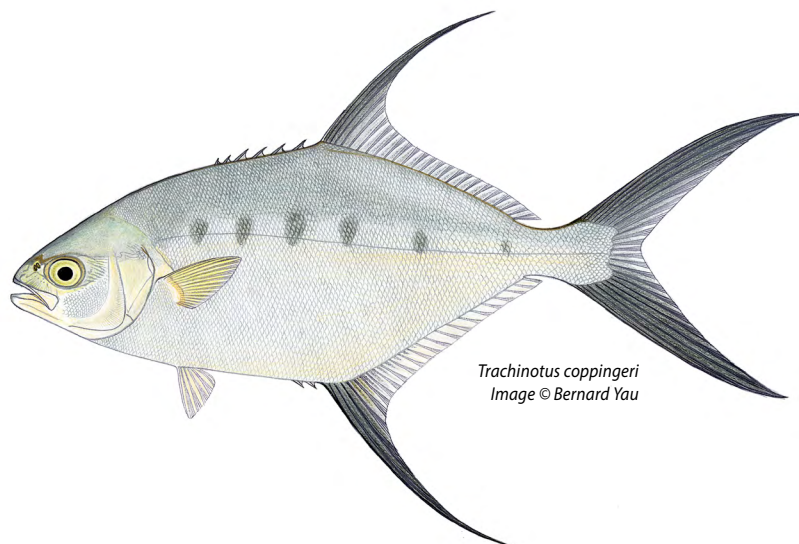
(*Trachinotus* spp.)

Author John Stewart

EXPLOITATION STATUS **UNDEFINED**

Very little information is available for dart in NSW waters. Limited recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Trachinotus coppingeri</i>	Swallowtail Dart	This species constitutes the majority of the commercial catch.
<i>Trachinotus baillonii</i>	Smallspotted Dart	Likely to form only a minor fraction of the catch.



Background

Dart belong to the genus *Trachinotus* of which there are about 20 species occurring worldwide in tropical and subtropical waters. Although they are members of the trevally family (Carangidae), dart lack the scutes (raised scales) along the lateral line that are typical of trevallies. Other distinguishing features are their long, thin and slightly curved anal, dorsal and tail fins. While juveniles are unspotted, adults have dark spots along or above the lateral line. Species found in NSW, more commonly on the north coast, include the Swallowtail Dart (*T. coppingeri*), Smallspotted Dart (*T. baillonii*), and very occasionally Snubnose Dart (*T. blochii*). Commercial catches comprise almost totally Swallowtail Dart but may include an occasional Smallspotted Dart.

Dart are wide ranging pelagic fish found in sheltered bays, estuaries, and shallow coastal

waters, particularly in the surf zone of ocean beaches; they are also known to school offshore around reefs and cays. Dart do not appear to undertake directed migrations, but adults can move considerable distances throughout the year. Some species have strong bones inside their mouths capable of cracking open oysters and other shellfish.

The Swallowtail Dart is endemic to eastern Australia, ranging from northern Queensland to the south coast of NSW, and including Lord Howe Island. It is a fast swimming, schooling fish, often found in the surf darting into waves and then back out again just before the wave breaks. It has 5-7 large dark spots just above the lateral line and can weigh up to 3 kg. The Smallspotted Dart is more widely distributed, being found north from the Solitary Islands in NSW, across northern Australia

to the Abrolhos Islands in WA. It is mainly found on the surface, and can form schools of several hundred fish. Adults have 1-4 dark spots directly on the lateral line and grow to 56 cm and 1.5 kg. In general, dart feed on small fish, worms, insects, zooplankton, and shellfish. The Smallspotted Dart is known to feed at night on small shellfish picked off beach rocks.

In NSW, dart are occasionally targeted by beach hauling crews in the northern half of the state. All commercially landed dart are reported from the Ocean Hauling Fishery, with landings since 2009/10 being very low, averaging around 2 t per year. Dart are a significant sport and food species for recreational anglers who fish from ocean beaches and rocky headlands.

Additional Notes

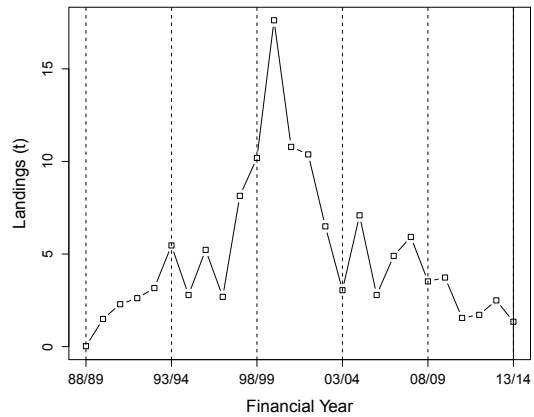
- An important recreational beach fishery on the northern and central NSW coast.
- The most commonly caught species in NSW waters is the Swallowtail Dart *Trachinotus coppingeri*.
- Swallowtail Dart are a short-lived species growing to a maximum of 6 years.

Catch

Recreational Catch of Dart

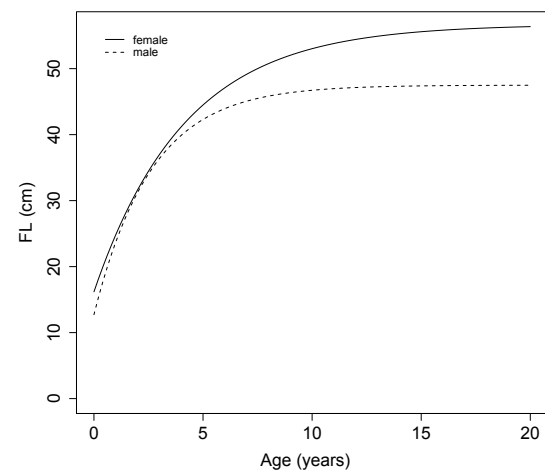
The most recent estimate of the recreational harvest of dart (Swallowtail Dart) in NSW was approximately 43,200 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of dart in NSW was previously estimated to be between 15-50 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Dart



Commercial landings (including available historical records) of dart for NSW from 1989/90 to 2013/14 for all fishing methods.

Growth Curve of Swallowtail Dart



Growth curve of Swallowtail Dart using parameters from McPhee (1999). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 337076 and 37 337074, common name or scientific name to find further information.

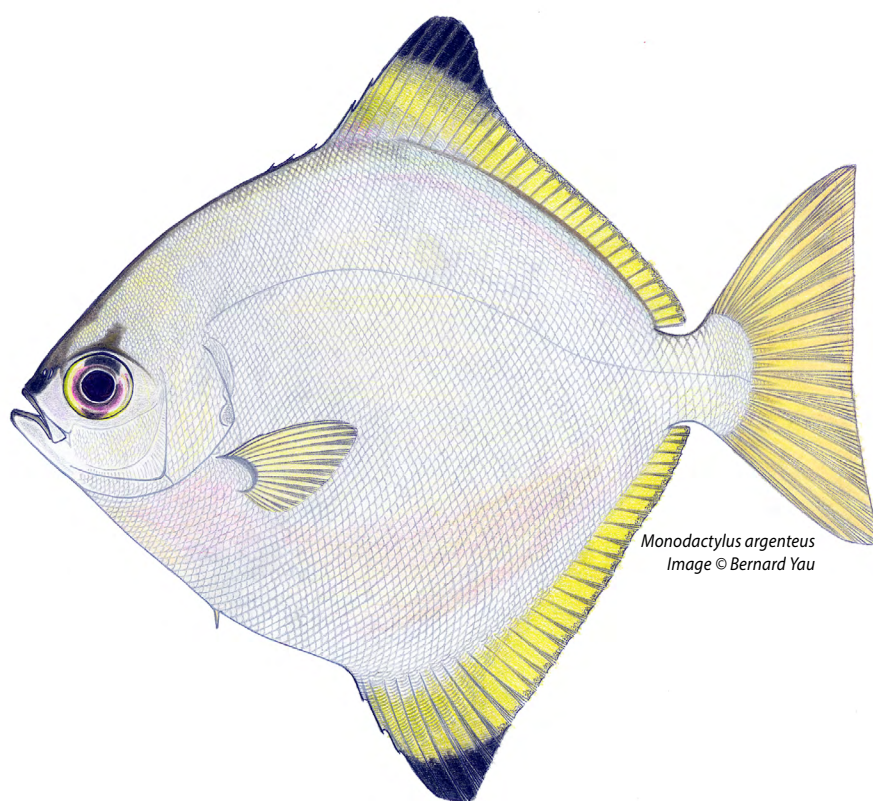


Diamondfish

(*Monodactylus argenteus*)

Author Karina Hall

EXPLOITATION STATUS		UNDEFINED
Very small commercial and recreational catches and limited biological or fishery information. No detailed assessment is likely to be completed.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Monodactylus argenteus</i>	Diamondfish	Formerly known as Silver Batfish.



Monodactylus argenteus
Image © Bernard Yau

Background

The Diamondfish is a small tropical species that belongs to the family Monodactylidae. It occurs throughout the Indo-West Pacific, east African waters and the Red Sea. In Australian waters, adults are found along the east coast south to Jervis Bay in depths to about 10 m. It mainly inhabits large coastal estuaries and often forms large schools around breakwalls and jetties. Juveniles can be found in brackish to almost fresh water.

The Diamondfish attains a maximum size of about 25 cm total length (TL), but is usually smaller than 20 cm TL. It feeds on animals and plants that live on jetty piles and surrounding substrates. Little else is known about the biology of Diamondfish.

Historically, commercial landings of Diamondfish in NSW were sporadic and very small, and until 2008/09 seldom exceeded 1 t per year. Virtually all were caught by haul and mesh nets in the Estuary General and Ocean Hauling Fisheries. Over the last 5 years, however, catches have rapidly increased to almost 4 t in 2013/14, due to an increase in fish landed by handlines in the Ocean Trap and Line Fishery.

Additional Notes

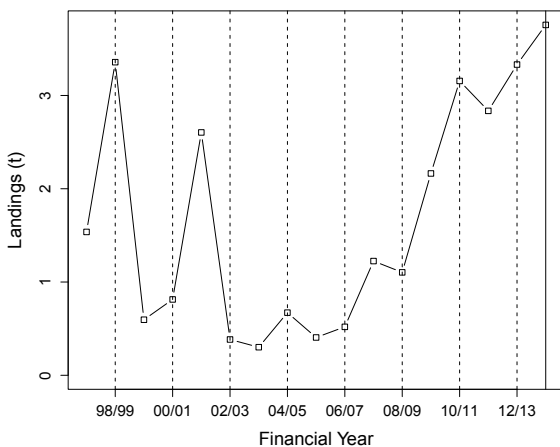
- Mainly an inshore fish found around wharfs and rocky headlands.
- Small commercial landings mainly reported in the Estuary General and Ocean Hauling fisheries, and more recently the Ocean Trap and Line Fishery.
- Of limited recreational significance.
- Despite its wide distribution and common occurrence in inshore waters, very little is known about its biology.

Catch

Recreational Catch of Diamondfish

The most recent estimate of the recreational harvest of Diamondfish in NSW was approximately 900 fish during 2013/14 (West *et al.*, 2014). Greater numbers (6,800 fish) were estimated to be released.

Historical Landings of Diamondfish



Commercial landings (including available historical records) of Diamondfish for NSW from 1997/98 to 2013/14 for all fishing methods.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 356002, common name or scientific name to find further information.



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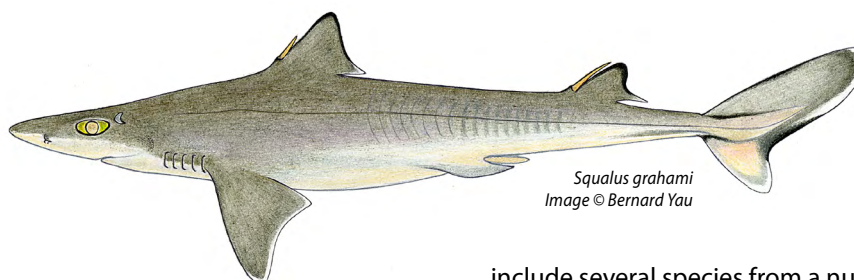
Dogfish (Squaliformes)

Author Vic Peddemors

EXPLOITATION STATUS OVERFISHED

A complex of at least 15 species, with Harrison's Dogfish (*Centrophorus harrissoni*) and Southern Dogfish (*C. zeehaani*) considered Overfished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Squalus megalops</i>	Piked Spurdog	Distribution southern Australia (QLD - WA); endemic.
<i>Squalus albifrons</i>	Eastern Highfin Spurdog	Queensland-NSW; endemic.
<i>Squalus grahami</i>	Eastern Longnose Spurdog	Queensland-NSW; endemic.
<i>Squalus montalbani</i>	Philippine Spurdog	Indo-Pacific - NSW, WA.
<i>Squalus chloroculus</i>	Greeneye Spurdog	Southern Australia; endemic.
<i>Centrophorus harrissoni</i>	Harrison's Dogfish	SW Pacific; Queensland-NSW.
<i>Centrophorus moluccensis</i>	Endeavour Dogfish	Indo-Pacific; NSW, WA.
<i>Centrophorus niaukang</i>	Taiwan Gulper Shark	Japan , Taiwan– northern Australia; recently caught off Coffs Harbour.
<i>Centrophorus squamosus</i>	Leafscale Gulper Shark	Southern Australia; cosmopolitan.
<i>Centrophorus zeehaani</i>	Southern Dogfish	Southern Australia; endemic.
<i>Centroscymnus coelelepis</i>	Portuguese Dogfish	Southern Australia; cosmopolitan.
<i>Centroscymnus owstonii</i>	Owston's Dogfish	Southern Australia; cosmopolitan.
<i>Centroselachus crepidater</i>	Golden Dogfish	Southern Australia; cosmopolitan.
<i>Deania calceus</i>	Brier Shark	Southern Australia; cosmopolitan.
<i>Deania quadrispinosa</i>	Longsnout Dogfish	Southern Australia; cosmopolitan.



Background

The taxonomy of Australian dogfishes was reviewed in 2007 by CSIRO scientists. Where previously it was thought that there was a small number of species with world-wide distributions, the study confirmed that some were a complex of species, each with relatively small regional distributions. Many Australian dogfishes are now believed to be endemic (found only in Australian waters), although a number have a cosmopolitan distribution (found in many of the world's oceans).

NSW dogfish landings are mainly from the outer shelf and upper slope depths (100-700 m) and

include several species from a number of families. They are usually marketed in three groupings: greeneye or spiky dogfish/spurdog (*Squalus* spp.; Squalidae), Endeavour sharks (most *Centrophorus* spp.; Centrophoridae) and rough-skin or platypus sharks (*Deania* spp.; Centrophoridae). Three species of 'black rough-skin sharks' (two *Centroscymnus* species and *Centroselachus crepidater*; family Somniosidae) and the Leafscale Gulper Shark (*Centrophorus squamosus*) also occur on the NSW midslope (depths > 700 m) but to date there has been only limited commercial fishing at these depths.

The most common species of dogfish in NSW is the small Piked Spurdog (spiky dog) found in relatively shallow outer-shelf and upper slope depths (100 to 580 m) around the southern half of Australia. Males mature at about 38 cm total length (TL) and grow to a maximum of about 45 cm (0.6 kg); females mature at 48 cm and reach a maximum of about 60 cm (1.5 kg). Typical of deepwater sharks, Piked Spurdog fecundity is very low with females bearing up to 5 young every two years. Several larger species of *Squalus* are also found off NSW, mostly inhabiting upper slope depths (200-700 m). These dogfishes have maximum lengths between 70 and 100 cm and fecundities between 5 and 10 young; they are also unlikely to breed more frequently than every two years.

The deepwater shark family Centrophoridae includes large dogfishes internationally referred to as gulper sharks. Five species of *Centrophorus* and two species of *Deania* have been recorded from NSW waters. Harrison's Dogfish is mainly found off eastern Australia (central Queensland to Bass Strait), the Southern Dogfish occurs between central NSW and WA, while the Endeavour Dogfish has a more northern distribution along the east and west coasts of mainland Australia. Landings of the Leafscale Gulper have recently increased off NSW in depths > 700 m, and at least two specimens of the large Taiwan Gulper Shark were recently caught off Coffs Harbour. The maximum length of Endeavour, Harrison's and Southern Dogfishes is about 100-115 cm TL whereas Leafscale and Taiwan Gulpers grow to about 170 cm. Gestation in gulper sharks takes at least two years with the smaller species producing only one or two young while the Leafscale and Taiwan Gulpers bear 4-8 pups. Studies of Leafscale Gulper Sharks from the Atlantic suggest the age at maturity is between 30-35 years, and that the species attains a maximum age in excess of 60 years.

The two species of *Deania* caught off NSW – the Longsnout Dogfish and the more common Brier Shark - are both taken on the slope, mainly in depths between 500-1000 m. Males grow to about 100 cm and females to 120 cm TL with maturity at about 80% of their maximum length. Litter sizes are relatively large with up to 17 pups recorded from Australian specimens.

The slow growth rates and low fecundities of deepwater sharks make them particularly susceptible to over-exploitation. Apart from the Spiky Dogfish and possibly the Brier Shark, offshore trawling has greatly depleted the stocks of upper slope dogfishes off NSW. A trawl survey in the 1990s found that the relative abundances of the larger spurdogs (*Squalus* spp.) had been reduced to less than 10% of the catch rates achieved 20 years

earlier, while the numbers of Endeavour sharks (*Centrophorus* spp.) were less than 1% of their earlier catch rates. Subsequently, several species have been red-listed by the International Union for the Conservation of Nature and Natural Resources (IUCN) as 'vulnerable', with Harrison's Dogfish listed as critically endangered. In Australia concerns about the severely depleted status of many species have led to increased research and management measures aimed at conserving remaining stocks.

Additional Notes

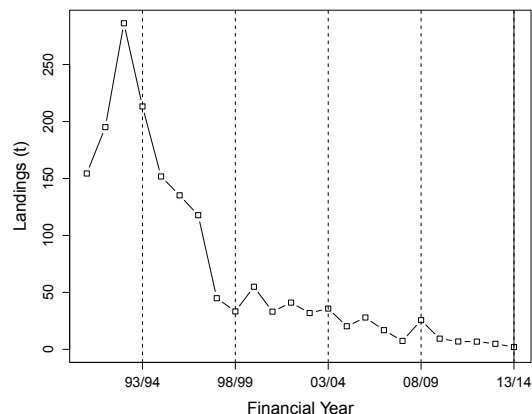
- Recent landings of this group are small. Low numbers are harvested by the Ocean Trap and Line Fishery, as well as the Ocean Trawl Fishery. Difficulties with species identification in past catch reporting makes species-based assessment difficult.
- There are three categories of conservation status for this group: *Squalus megalops* is abundant; most *Centrophorus* spp. and other deepwater *Squalus* spp. are almost totally extirpated from NSW trawl grounds (with 100% mortality when caught in trawls); and the status of other dogfish species is unknown (Graham *et al.*, 1997).

Catch

Recreational Catch of Dogfish

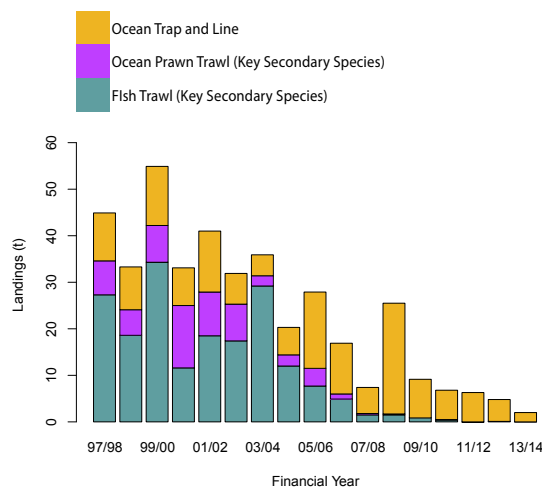
The annual recreational harvest of dogfish in NSW is likely to be less than 10 t.

Historical Landings of Dogfish



Commercial landings (including available historical records) of dogfish for NSW from 1990/91 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was in part due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Dogfish



Reported landings of dogfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 020006, 37 020038, 37 020041, 37 020047, 37 020048, 37 020010, 37 020001, 37 020023, 37 020009, 37 020011, 37 020025, 37 020019, 37 020012, 37 020003 and 37 020004, common name or scientific name to find further information. Please note that common names have been adopted from Last and Stevens (2010) and may differ to those contained on the CAAB website.



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Dusky Flathead

(*Platycephalus fuscus*)

Author Karina Hall

EXPLOITATION STATUS		UNCERTAIN
Very important commercial and recreational species. Conflicting signals, including recent declines in commercial catches and catch rates, high fishing mortality estimates and stable size distributions have led to an Uncertain status.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Platycephalus fuscus</i>	Dusky Flathead	



Background

The Dusky Flathead (*Platycephalus fuscus*) is endemic to Australia occurring from Cairns in Queensland to SA. The biological stock structure across the species distribution is unknown and the species is currently assessed and managed at a jurisdictional level. In NSW waters, Dusky Flathead occurs primarily within estuaries, but is also found in inshore ocean waters. It is a bottom dwelling fish that rests on or partially buries within soft substrates, including mud, sand and within seagrasses. It ambushes passing prey and feeds on small fish and a variety of invertebrates, including prawns, crabs and squid.

Dusky Flathead is the largest member of the family Platycephalidae and can attain maximum sizes of about 120 cm total length (TL) and 10 kg in weight; however, the majority of fish landed in NSW are only 40-50 cm TL and 0.5-1 kg. The maximum age recently recorded for any fish in the NSW commercial catch was 16 years for an 88 cm TL female, while the majority of fish were aged 2-5 years.

Females grow faster than males and attain a greater maximum length and age. They also mature later at 4.5 years of age and at a larger size (about 55-57 cm TL) than males, which mature at 1 year of age and over a range of sizes (20-30 cm TL). Therefore, the current minimum legal length of 36 cm TL is adequate for males, but does little to protect females before they reach maturity. Spawning occurs in both the lower reaches of estuaries and in the sea, typically during summer. Females produce a large number of floating eggs that hatch close to the coast. The larvae enter estuaries and subsequently grow into small juveniles that live in the same habitats as the adults.

Dusky Flathead is fished extensively throughout its range. In NSW, most of the commercial catch is taken by mesh netting in the Estuary General Fishery. The highest levels of commercial catches occur during winter when overnight setting of mesh nets is permitted. Annual commercial catches were consistently between 150-250 t for five decades, but decreased substantially in the early 2000s to below 150 t. This decline was

attributed to licence buy-outs during the creation of Recreational Fishing Havens and Marine Parks.

Since then, annual commercial catches have fluctuated around 150 t, but over the last 2 years have declined further to just 116 t in 2013/14, which is the lowest commercial catch ever recorded for Dusky Flathead in NSW. Mesh-netting catch rates also declined over the last 3 years. Meanwhile, size structures from both the commercial landings and recreational data have remained relatively stable since 2008. Estimates of fishing mortality relative to natural mortality from both the commercial and recreational catch data, suggest that the stocks are fished heavily. In 2014, the exploitation status was changed to Uncertain in NSW because of these inconsistent stock signals.

The recreational catch of Dusky Flathead in both NSW and Queensland exceeds the commercial catch. But the recreational and commercial catches of Dusky Flathead in Queensland are approximately half that of the NSW totals. Catch rates in Queensland have been stable since 1993 and age and size structure monitoring of the commercial catch indicate that recruitment is variable, but has not declined through time and that the biomass of the stock is unlikely to be overfished.

In Victoria, only small catches of Dusky Flathead are landed, primarily from the Gippsland Lakes. The most recent stock assessment (in 2011) of the population, suggests that there has been no long-term decline in the biomass and that the stock is not overfished.

Additional Notes

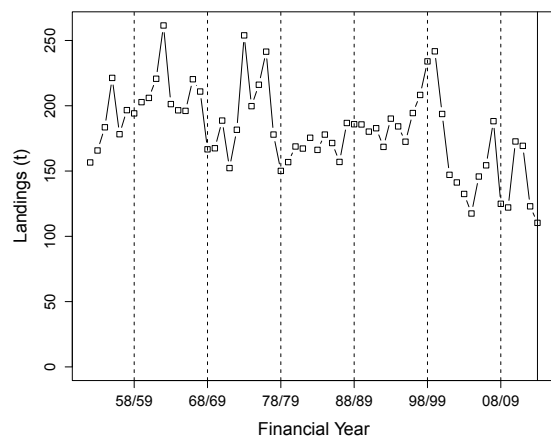
- The biological stocks of Dusky Flathead were assessed as Sustainable stocks in Queensland, NSW and Victoria in the *Status of Key Australian Fish Stocks Reports 2014*.
- Recent estimates of the recreational catch in NSW were substantially lower than previous estimates, but it is still a very important species for recreational fishers.
- Assessments for this species need to acknowledge variability in recruitment and abundance between estuaries, with limited movement of adults that could lead to localised depletions.
- There is a minimum legal length of 36 cm TL and a recreational bag limit of 10 Dusky Flathead (with only one fish greater than 70 cm TL).

Catch

Recreational Catch of Dusky Flathead

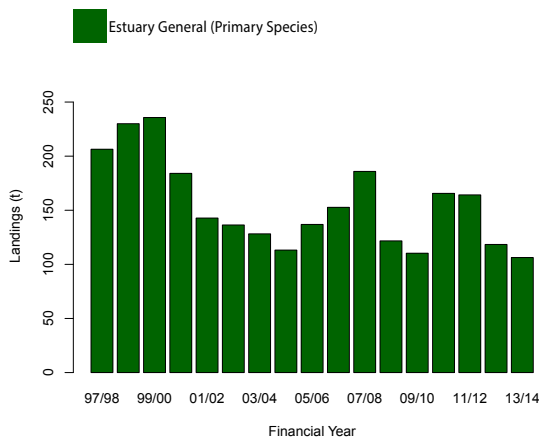
The most recent estimate of the recreational harvest of Dusky Flathead in NSW was approximately 481,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 1,130,000 fish (or between 570-830 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003).

Historical Landings of Dusky Flathead



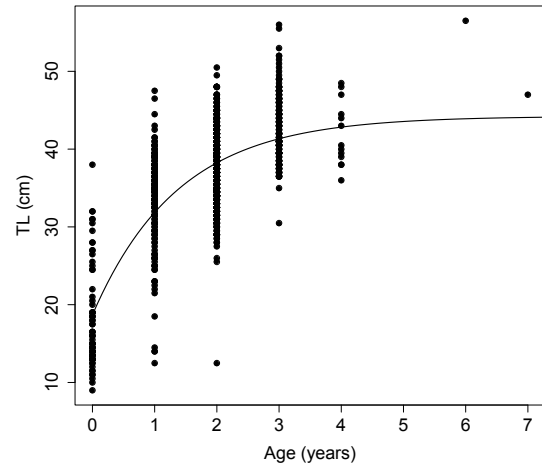
Commercial landings (including available historical records) of Dusky Flathead for NSW from 1952/53 to 2013/14 for all fishing methods. Note the decrease after 1999/00 with the introduction of Recreational Fishing Havens.

Landings by Commercial Fishery of Dusky Flathead



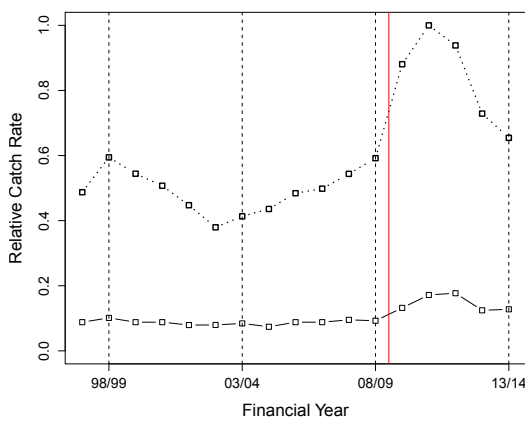
Reported landings of Dusky Flathead by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Dusky Flathead - Males



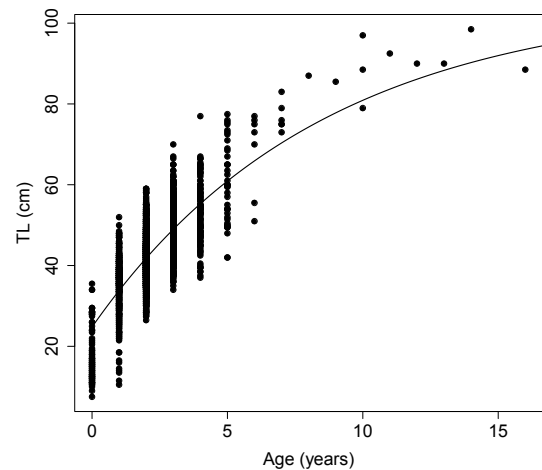
Age-length data with fitted growth curve for male Dusky Flathead (Gray and Barnes, 2008). Lengths are presented as total length (TL).

Catch Per Unit Effort Information of Dusky Flathead Harvested by Mesh-Netting in NSW



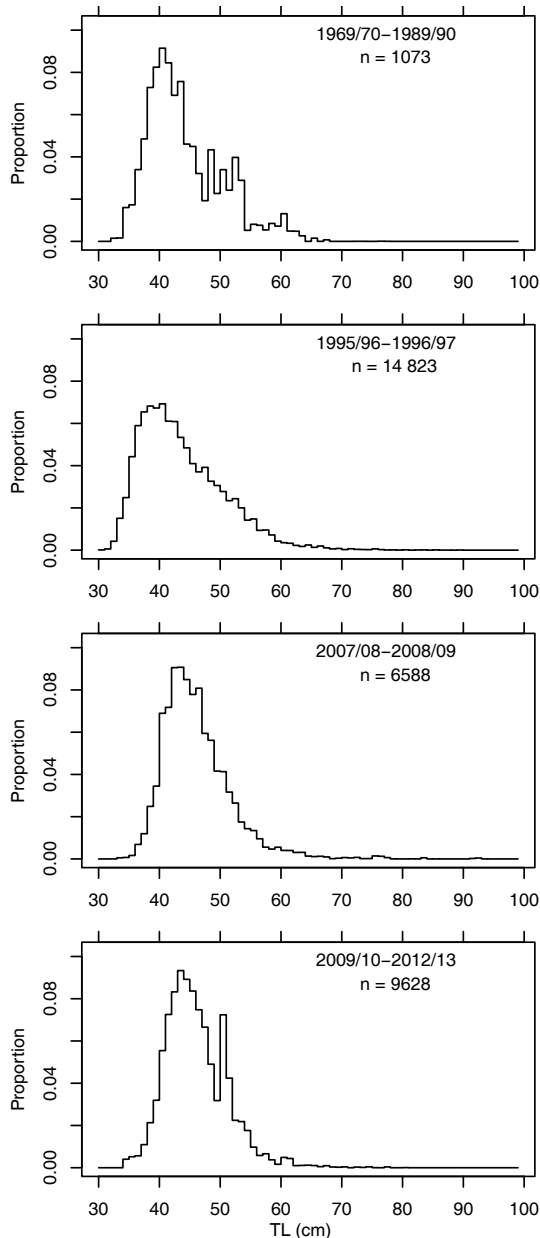
Catch rates of Dusky Flathead harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Dusky Flathead - Females



Age-length data with fitted growth curve for female Dusky Flathead (Gray and Barnes, 2008). Lengths are presented as total length (TL).

Length Frequency of Dusky Flathead



The length distribution of Dusky Flathead in NSW commercial landings was relatively stable from the 1970s to the 1990s. There was an increase in the relative proportion of larger fish (>40 cm total length (TL)) in catches during the period 1995-1997. The minimum legal length for Dusky Flathead was increased from 33-36 cm TL in July 2001.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 296004, common name or scientific name to find further information.



Eastern Australian Salmon

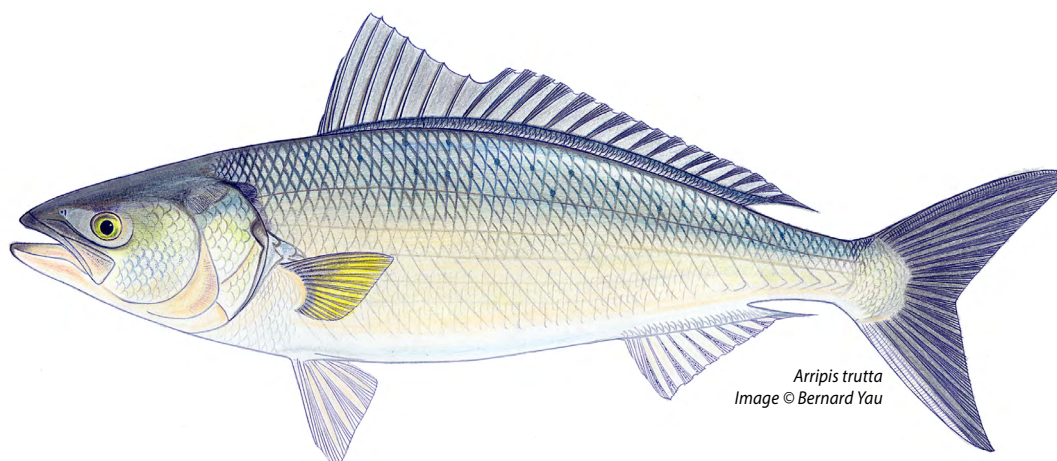
(*Arripis trutta*)

Author Julian Hughes

EXPLOITATION STATUS FULLY FISHED

Commercial landings are at historically high levels and the recreational catch is significant.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Arripis trutta</i>	Eastern Australian Salmon	



Background

Eastern Australian Salmon (*Arripis trutta*) occur in the coastal waters and estuaries of NSW, Victoria and Tasmania. Juveniles are found in estuaries and other sheltered nearshore habitats, mainly in the southern part of the species range. The diet of Eastern Australian Salmon consists primarily of small pelagic fish. Eastern Australian Salmon in NSW mature at approximately 2 years old and 30 cm fork length, and aggregate to spawn in coastal waters from November to February. Spawning is thought to occur in the surf zone.

Eastern Australian Salmon are primarily caught using haul and purse-seine nets in the Ocean Hauling Fishery. Catches occur throughout the year and the highest annual landings occur south of Sydney. Significant quantities of Eastern Australian Salmon are also taken by recreational fishers throughout the state.

Tagging in the early 1960s showed that a one-way movement of fish from Tasmania across Bass Strait to Eastern Victoria and NSW occurred via the Furneaux Group of islands with the approach of sexual maturity. A progressive northward movement of individuals occurs with increasing age in SE Australia resulting in the largest and oldest fish being found in northern NSW. In Victoria and Tasmania, there is an overlap in distribution with the Western Australian Salmon (*Arripis truttaceus*) – a similar species from the same family found on the southern and western coasts of Australia.

Additional Notes

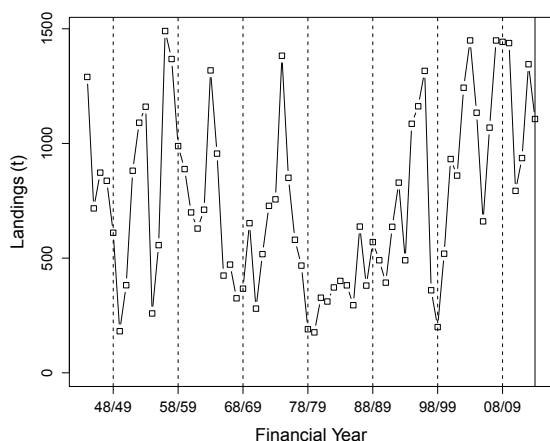
- Commercial landings are highly variable and not expected to be a good indicator of abundance.
- Current landings are in the high range of historic catches.
- Estimation of mortality rates is complicated by progressive northward movement with age, but overall F is estimated to be about equal to M.
- Eastern Australian Salmon display moderately fast growth reaching ~16 cm FL after one year, ~27 cm after 2 years and ~46 cm after 5 years of age with growth beginning to slow after reaching sexual maturity.
- There is a recreational bag limit of 5 Eastern Australian Salmon.

Catch

Recreational catch of Eastern Australian Salmon

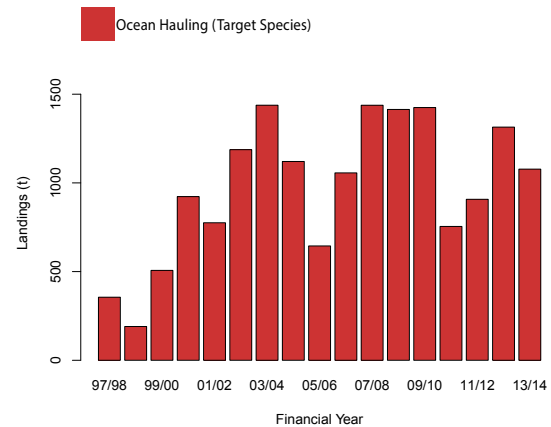
The most recent estimate of the recreational harvest of Eastern Australian Salmon in NSW was approximately 73,500 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Eastern Australian Salmon in NSW was previously estimated to lie between 150-210 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Eastern Australian Salmon



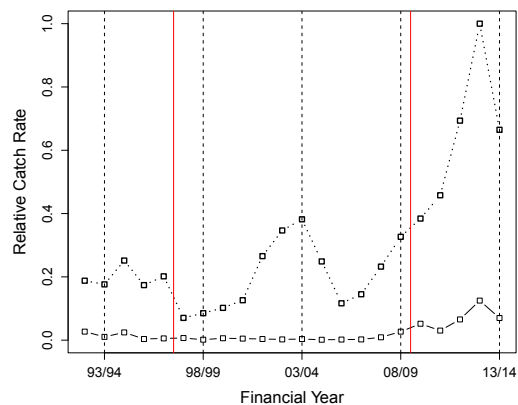
Commercial landings (including available historical records) of Eastern Australian Salmon for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Eastern Australian Salmon



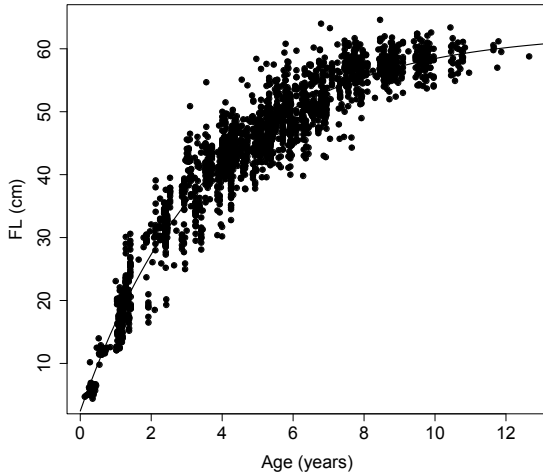
Reported landings of Eastern Australian Salmon by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Eastern Australian Salmon Harvested by Beach Hauling in NSW



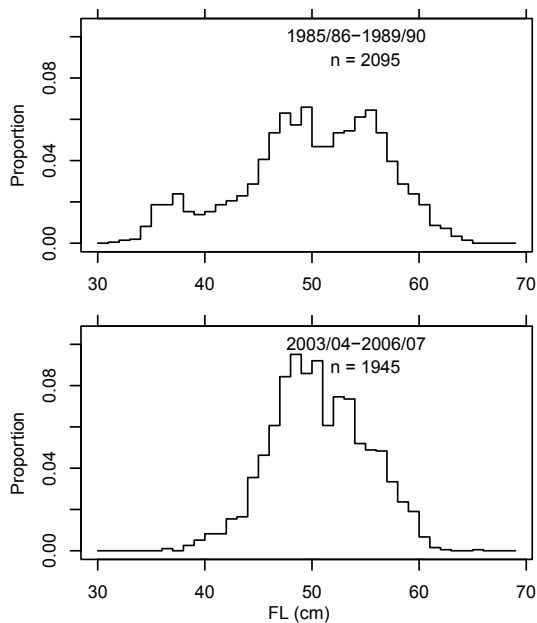
Catch rates of Eastern Australian Salmon using beach hauling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Eastern Australian Salmon



Age-length data with fitted growth curve for Eastern Australian Salmon (Stewart *et al.*, 2011). Lengths are presented as fork length (FL).

Length Frequency of Eastern Australian Salmon



The length distribution of Eastern Australian Salmon landed by NSW commercial fishers has been relatively stable since the 1980s, and comprises mainly fish between 40 and 60 cm fork length (FL). There is no minimum legal length for Eastern Australian Salmon in NSW.

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Eastern Blue Groper

(*Achoerodus viridis*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Some local biological information exists for Eastern Blue Groper however a lack of fishery and population data on this recreational line-only species has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Achoerodus viridis

Eastern Blue Groper



Achoerodus viridis
Image © Bernard Yau

Background

The Eastern Blue Groper (*Achoerodus viridis*) occurs around rocky headlands and coastal reefs from southern Queensland to eastern Victoria. A similar species, the Western Blue Groper (*A. gouldii*) occurs in coastal waters of southern Western Australia and through the Great Australian Bight. These two species are the largest members of the family Labridae (wrasses) in southern Australian waters, and are frequently seen by divers close in to the shore.

The Eastern Blue Groper can grow to over a metre in length and a weight of 25 kg. Although growth of blue groper has not been studied in detail, it is likely they are long-lived and relatively slow growing. The species is noted for its social structure, with the one large blue male often being attended by a number of smaller females,

which are red-brown in colour. Blue groper are hermaphrodites - females generally change into males at around 50 cm in length, although the timing of this change can be influenced by environmental and social factors.

In NSW, the stock of Eastern Blue Groper was considered to be significantly depleted by fishing, and a five year fishing closure was imposed between 1969 and 1973. In 1974 commercial fishing and recreational angling were permitted again, but the ban on spearfishing was continued. In 1980 the commercial sale of Eastern Blue Groper was prohibited and since then the species has been restricted solely to capture by recreational line fishing.

Additional Notes

- This long lived species is endemic to eastern Australia and occurs close inshore in rocky reef areas.
- Blue Groper in NSW have a minimum legal length of 30 cm, and a bag limit of 2 fish with a maximum of 1 fish over 60 cm.
- The Eastern Blue Groper was made the state fish emblem of New South Wales in 1998.

Catch

Recreational Catch of Eastern Blue Groper

The most recent estimate of the recreational harvest of Eastern Blue Groper in NSW was approximately 3,500 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Eastern Blue Groper in NSW was previously estimated to be between 20-50 t based upon the results of the offshore recreational trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI. Eastern Blue Groper are not permitted to be taken by commercial fishers.

Further Reading

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 384043 , common name or scientific name to find further information.



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Eastern King Prawn

(*Melicertus plebejus*)

Author Matthew Taylor

EXPLOITATION STATUS **GROWTH OVERFISHED**

Modelling suggests that yield from this stock could be increased by reducing fishing effort and increasing the size at first harvest for Eastern King Prawns in NSW waters.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Melicertus plebejus</i>	Eastern King Prawn	



Background

Eastern King Prawn is distributed throughout the waters off eastern Australia, having been recorded from Mackay (Queensland) southwards to north-east Tasmania in depths from 1-200 m, and off Lord Howe Island.

Eastern King Prawn live for a maximum of three years and in NSW waters reach maximum lengths of around 6 cm carapace length (CL) and 4.5 cm CL for females and males respectively. The shortest length at which 50% of female Eastern King Prawns carry eggs is 4.2 cm CL. Eastern King Prawn spawns predominantly in waters from northern NSW to Swains Reef in Queensland. One female may carry up to 200,000 eggs. Larger female prawns carry more eggs than smaller ones, however there is a decline in the capacity of females to produce and fertilise eggs once they grow larger than 6 cm CL.

There is no reliable information on the length of the larval phase of Eastern King Prawn in the wild, but generally for prawn species it is around three weeks. During this larval period, Eastern King Prawn is carried by prevailing currents in a southward direction along the NSW coast. Nauplius larvae hatch and develop through a series of moults into

post-larvae, at which point they settle out of the plankton.

Post-larval to adolescent Eastern King Prawn inhabit both bare and vegetated substrates in areas of marine influence within estuaries, and possibly within shallow embayments in ocean waters. In NSW, they emigrate from estuaries over summer and then move northwards over long distances prior to spawning.

Eastern King Prawn is an opportunistic omnivore. Food items are dominated by periphyton and detritus, but may also include small crustaceans, annelid worms, bivalve molluscs and foraminifers. Eastern King Prawn is an important prey for a number of piscivorous estuarine and marine species, and sea birds.

Recent genetic work indicates that Eastern King Prawn constitutes a single population along the east coast of Australia. There is a large and valuable domestic market for Eastern King Prawn for human consumption.

This species is harvested using otter trawl nets in ocean waters by the ocean trawl fishery. Within

estuaries, fishing occurs primarily in larger coastal lakes by the Estuary General Fishery (using set pocket nets, running nets, hauling and seine nets). The species is also harvested in low numbers by the Estuary Prawn Trawl Fishery.

Eastern King Prawn is also caught by recreational fishers within estuaries and are the most abundant prawn species in the catches of recreational fishers. This is probably because recreational fishers fish for prawns at night when Eastern King Prawn is most active. Methods used by recreational fishers include fishing with scoop nets, scissor nets or six metre hand haul nets. Stocking of post-larvae support the recreational harvest in some recruitment limited estuarine lagoons on the south coast of NSW.

Additional Notes

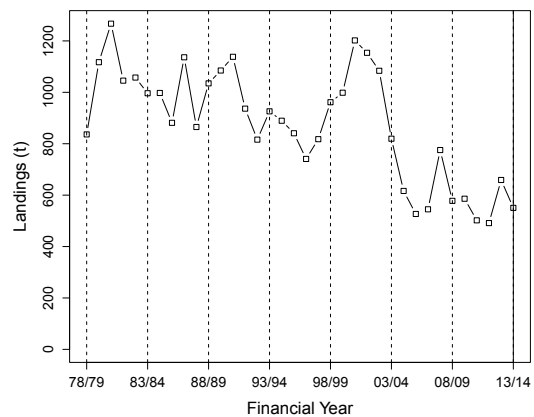
- Overall landings have decreased from 2000/01 to the present. Landings and catch rates since 2008/09 have been relatively stable.
- Strong evidence exists that fishing power in Queensland is increasing and there has been increased targeting by the Queensland fleet on the mature population well offshore.
- Yield-per-recruit modelling suggests that estuarine fisheries and oceanic fisheries south of Port Stephens take prawns below the optimum size at first capture (Montgomery, 2000), although the geographical distribution of catch has changed over the last decade and these models need to be re-evaluated.
- Population modelling (Ives and Scandol, 2007) indicated that the NSW stock was very resilient under the assumption of stable levels of recruitment from Queensland.
- A joint NSW-Queensland stock assessment has been undertaken by the Queensland Department of Employment, Economic Development and Innovation (currently the Queensland Department of Agriculture and Fisheries).
- There is a combined recreational bag limit of 10 litres for all prawns.
- A stocking program for Eastern King Prawn supports recreational harvest in some recruitment-limited estuaries on the NSW south coast.
- The eastern Australian stock of Eastern King Prawn has been assessed as a Sustainable stock in the *Status of Key Australian Fish Stocks Reports 2014*.

Catch

Recreational Catch of Eastern King Prawn

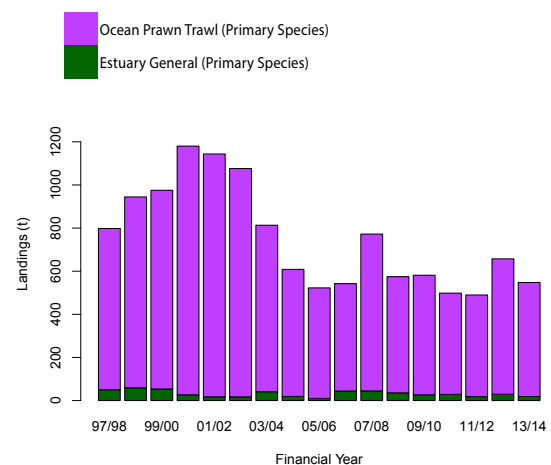
The most recent estimate of the recreational harvest of prawns (all saltwater combined) in NSW was approximately 725,000 prawns during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Eastern King Prawn in NSW was previously estimated to be less than 110 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Eastern King Prawn



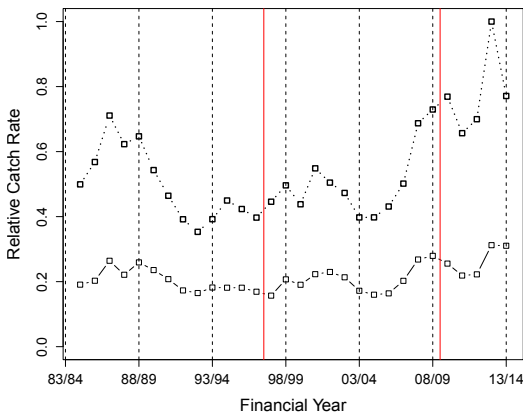
Commercial landings (including available historical records) of Eastern King Prawn for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Eastern King Prawn



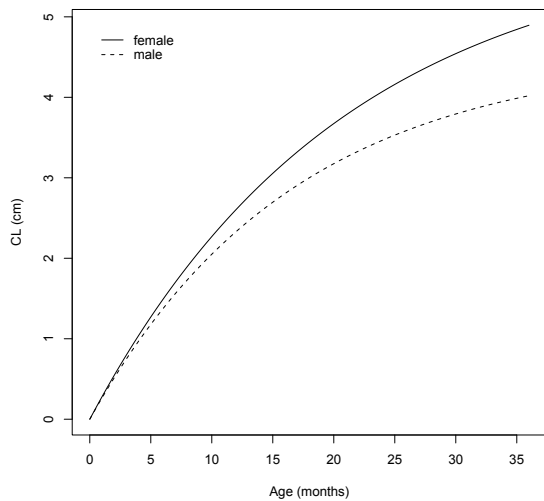
Reported landings of Eastern King Prawn by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Eastern King Prawn Harvested by Ocean Prawn Trawling in NSW



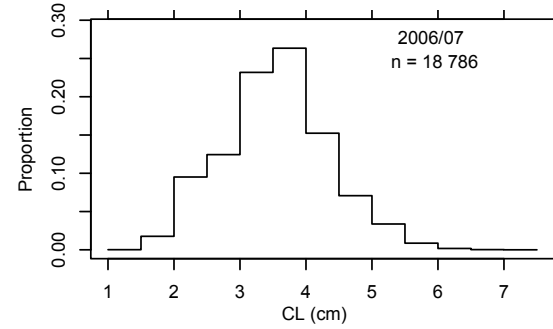
Catch rates of Eastern King Prawn harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of Eastern King Prawn



Growth curve of Eastern King Prawn using parameters from Glaister *et al.*, (1987). Lengths are presented as carapace length (CL).

Length Frequency of Eastern King Prawn



The length distribution of Eastern King Prawn landed by NSW ocean trawlers in 2006/07 was mostly comprised of prawns between 3-5 cm carapace length (CL). There is no minimum legal size for Eastern King Prawn in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 711052, common name or scientific name to find further information.



Eastern Pigfish

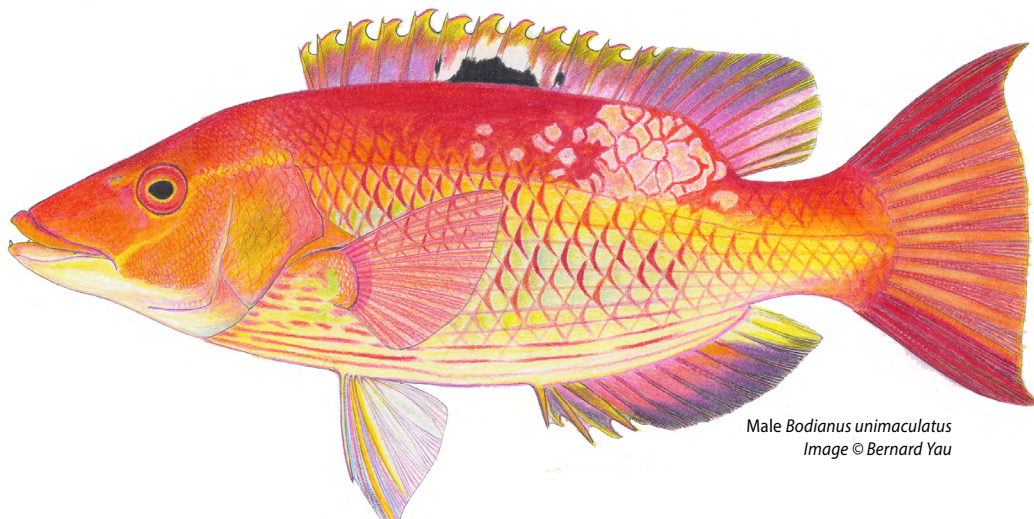
(*Bodianus unimaculatus*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

The age composition in commercial landings suggested that fishing mortality was approximately equal to natural mortality during the late 2000s. Stable commercial catch rates since that time in combination with the very small commercial harvest for this species has resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Bodianus unimaculatus</i>	Eastern Pigfish	The most commonly harvested species of pigfish in NSW.



Background

Eastern Pigfish (*Bodianus unimaculatus*) are distributed in the south-west Pacific from southern Queensland to Victoria, including Lord Howe and Norfolk Islands, and the Kermadec Islands. This eastern species was previously thought to be the same as the WA species, *Bodianus vulpinus*. Two other species are caught in small quantities in the NSW fishery. The Goldspot Pigfish (*Bodianus perditio*) is a sub-tropical species that occurs from central Queensland to the north coast of NSW. The Yellowfin Pigfish (*Bodianus flavipinnis*) is a temperate species from south-eastern Australia and New Zealand. It occurs in catches between central NSW and eastern Victoria. Nothing is known about the stock structure of Eastern Pigfish.

Eastern Pigfish are protogynous hermaphrodites, i.e. juveniles first develop female reproductive organs that may change into male reproductive

organs in certain circumstances. The two sexes have distinct colour patterns, although occasionally fish are found with an intermediate colouration. Spawning off NSW occurs during the autumn and winter months. Eastern Pigfish can live to about 30 years of age, but the majority of fish caught are between 5-15 years old.

Pigfish have been shown to be associated with kelp forests in New Zealand. They have also been found to be significantly more abundant in NZ marine parks than in adjacent areas, however this could be due to the quality of habitat within the reserve rather than a reserve effect. In Australia, pigfish are generally caught in depths greater than 50 m.

Most pigfish are taken as incidental catch in the Ocean Trap and Line Fishery, and there is a small but important recreational catch.

Additional Notes

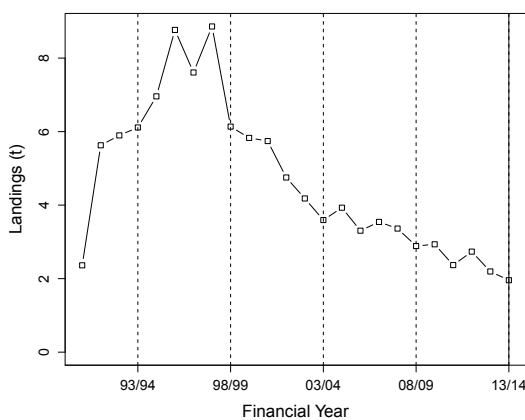
- Pigfish comprise a small but consistent catch in the commercial trap fishery and fetch high prices.
- The recreational catch is of a similar magnitude to the commercial catch.
- Pigfish mature at a relatively small size (<23 cm) and are hermaphrodites, changing sex from female to male at around 30 cm.
- Fishing mortality was estimated to be similar to natural mortality in the early 2000s.
- Commercial landings have declined since the 1990s but there has also been a decline in trap fishing effort, and catch rates of pigfish in the trap fishery have remained low and stable.
- Pigfish is a key secondary species within the Ocean Trap and Line Fishery and is not subject to any specific bag limit or minimum size regulations for recreational fishers.

Catch

Recreational Catch of Pigfish

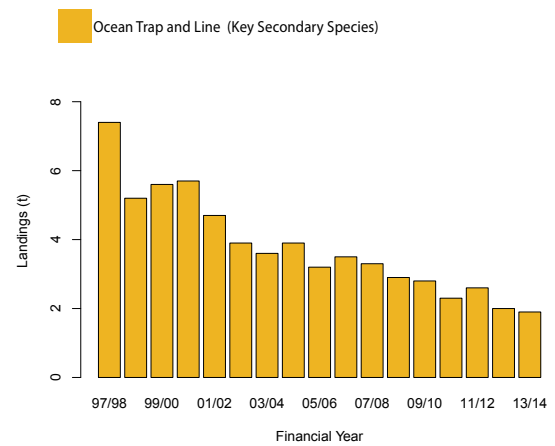
The most recent estimate of the recreational harvest of Eastern Pigfish in NSW was approximately 1,900 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of pigfish in NSW was previously estimated to be less than 20 t based upon the results of a recreational offshore trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI.

Historical Landings of Pigfish



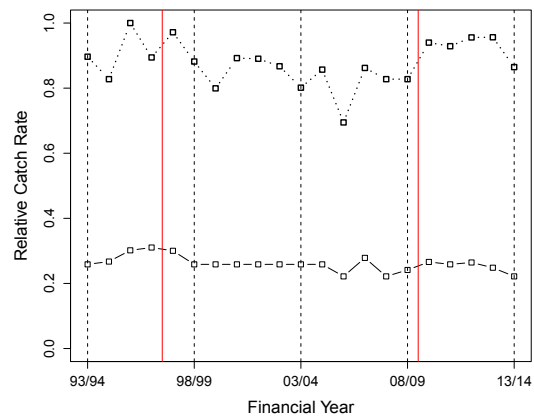
Commercial landings (including available historical records) of pigfish for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Pigfish



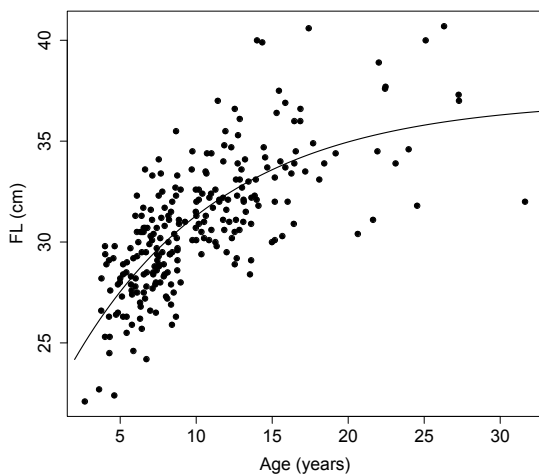
Reported landings of pigfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Pigfish Harvested by Fish Trapping in NSW



Catch rates of pigfish harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Eastern Pigfish



Age-length data with fitted growth curve for Eastern Pigfish (Stewart and Hughes, 2008). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 384061, common name or scientific name to find further information.

Further Reading

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Eastern Red Scorpionfish

(*Scorpaena jacksoniensis*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Local biological information exists for Eastern Red Scorpionfish, however a lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Scorpaena jacksoniensis</i>	Eastern Red Scorpionfish	Also known as Red Rockcod. Previously <i>Scorpaena cardinalis</i> .



Scorpaena jacksoniensis
Image © Bernard Yau

Background

The Eastern Red Scorpionfish (*Scorpaena jacksoniensis*), also known as the Red Rockcod, is a member of the scorpionfish family Scorpaenidae, a large family containing about 350 species worldwide and occurring in all temperate and tropical seas. There are 12 species of the genus *Scorpaena* recorded in Australian marine waters. The Eastern Red Scorpionfish is distributed along the east coast of Australia from southern Queensland (Noosa Heads) to eastern Victoria and is also recorded from New Zealand. The species inhabits estuarine and inshore ocean waters and is common on coastal reefs of NSW.

Eastern Red Scorpionfish mature at between 17 and 26 cm total length (TL), probably between 3 and 6 years of age. They spawn between December and April, with peak gonad development in February/March. Eastern Red Scorpionfish appear to

possess a highly specialised form of reproduction, including external fertilization and the production of eggs in a floating gelatinous mass. Eastern Red Scorpionfish grow slowly, reaching approximately 22 cm in length after 5 years. They have a maximum reported age of 33 years. Males grow faster and attain greater lengths than females.

Eastern Red Scorpionfish are taken in small numbers in the NSW Ocean Trap and Line Fishery where they are listed as a secondary species. They are also a common catch of recreational fishers. The population of Eastern Red Scorpionfish is characterized by variable recruitment patterns.

Additional Notes

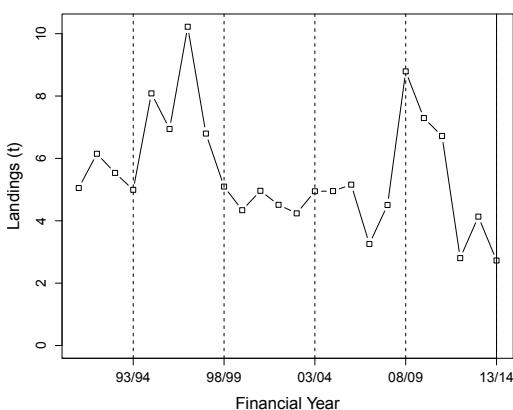
- A relatively long-lived inshore species (maximum reported age 33 years), targeted by both recreational and commercial fishers.
- Relatively high price received through Sydney Market but commercial landings remain low (5 to 10 t per annum).
- There is no minimum legal length for Eastern Red Scorpionfish in NSW, but a bag limit for recreational fishers of 5 fish was introduced in 2007.
- This species was previously referred to as *Scorpaena cardinalis* but is now known as *S. jacksoniensis* (see Motomura *et al.*, 2011).

Catch

Recreational Catch of Eastern Red Scorpionfish

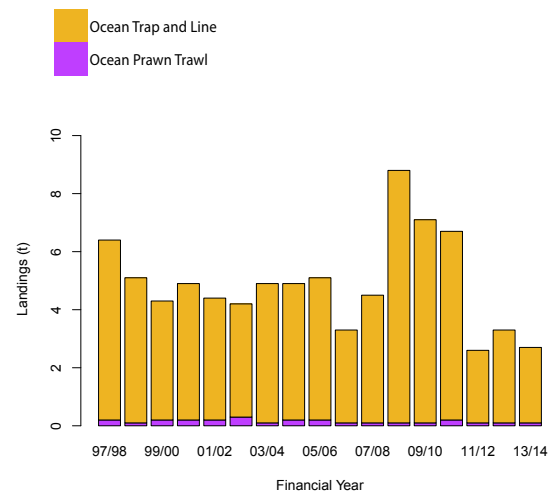
The recreational catch of Eastern Red Scorpionfish appears to have declined in recent years. The annual recreational harvest of Eastern Red Scorpionfish in NSW was previously thought to be between 20 t and 50 t based upon the results of an offshore recreational trailer boat survey (Steffe *et al.*, 1996). However, in 2013/14 only 6,430 Eastern Red Scorpionfish were estimated to be retained by recreational fishers in NSW with 145,100 fish released (West *et al.*, 2015). These results suggest that the commercial and recreational harvests of Eastern Red Scorpionfish may be similar.

Historical Landings of Eastern Red Scorpionfish



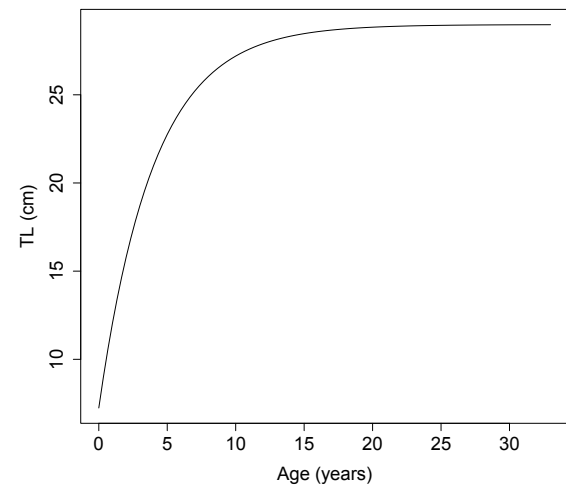
Commercial landings (including available historical records) of Eastern Red Scorpionfish for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Eastern Red Scorpionfish



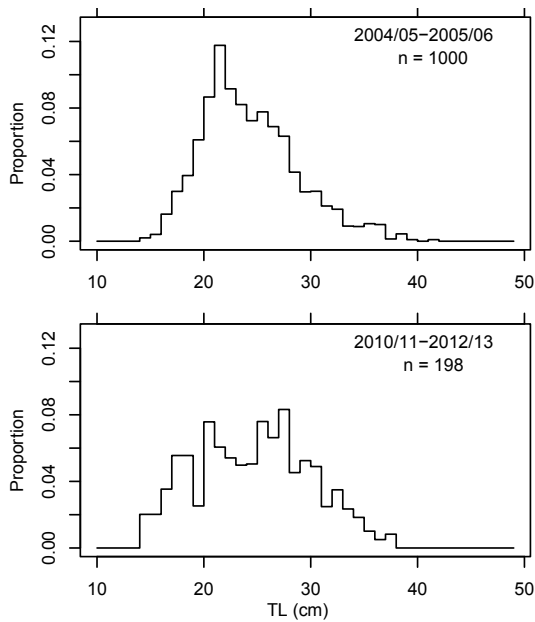
Reported landings of Eastern Red Scorpionfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Eastern Red Scorpionfish



Growth curve of Eastern Red Scorpionfish using parameters from Stewart and Hughes (2008). Lengths are presented as total length (TL).

Length Frequency of Eastern Red Scorpionfish



The length distribution of Eastern Red Scorpionfish landed by NSW commercial fishers during 2004/05 to 2005/06 comprised mainly fish between 20-40 cm total length (TL). During 2010/11 to 2012/13 there were greater numbers of smaller (15-20 cm TL) and larger (30-40cm TL) fish in landings, noting the relatively small sample numbers during the latter years. There is no minimum legal length for Eastern Red Scorpionfish in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 287066, common name or scientific name to find further information.



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Eastern Rock Lobster

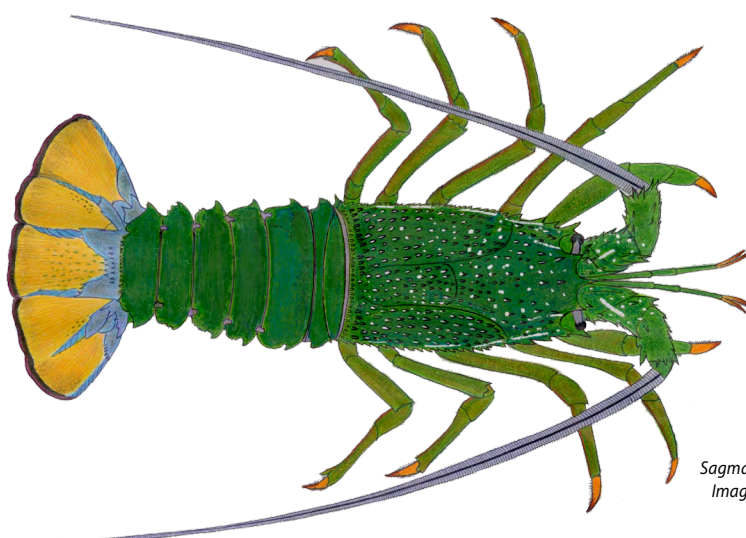
(*Sagmariasus verreauxi*)

Author Geoff Liggins

EXPLOITATION STATUS FULLY FISHED

Species has a long history of exploitation. The commercial fishery has been managed using Total Allowable Catch and Individual Transferable Quotas since the mid-1990s and is closely monitored using fishery-dependent and independent methods. Catch, catch rates, biomass, spawner abundance and recruitment have increased over the past 15 years.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sagmariasus verreauxi</i>	Eastern Rock Lobster	Previously known as <i>Jasus verreauxi</i> (see Booth and Webber, 2001)



Sagmariasus verreauxi
Image © Bernard Yau

Background

The Eastern Rock Lobster (*Sagmariasus verreauxi*) comprises about 99% of commercial landings of rock lobsters in NSW. Landings can also include small numbers of Southern Rock Lobsters *Jasus edwardsii*, and two species of Painted Rock Lobster (*Panulirus longipes* and *P. ornatus*). Eastern Rock Lobsters occur on rocky reefs and sand/mud substrates at depths from a few metres to about 200 m, from southern Queensland to Port MacDonnell in South Australia, including around Tasmania. However, greatest abundances occur along the NSW coast. The species also occurs in New Zealand.

The Eastern Rock Lobster is reported to be the largest species of rock lobster in the world and can grow to weights in excess of 7 kg at a carapace length (CL) of about 25 cm. Lobsters in NSW landings are between 10.4 cm (minimum legal length) and 18 cm CL (maximum legal length) and weigh from 0.5 kg to 2.5 kg. Female Eastern Rock Lobsters mature between 14 and 18 cm CL (16.7

cm CL on average) and mature lobsters occur in catches from the northern part of the species' range (north of about Newcastle).

Records of commercial landings of Eastern Rock Lobsters are available from the late 1800s and reported annual landings ranged between 93 t and 365 t from the early 1900s through to the late 1970s. Estimates of total landings (including non-commercial and 'unreported' catches) showed a significant decline in the late 1980s. Concerns about the sustainability of the resource led to a restriction in the number of commercial fishers allowed to take lobsters, the introduction of a maximum legal length, individually numbered management tags and the implementation of a total allowable commercial catch (TACC) in the mid-1990s. The TACC, originally set at 106 t in 1994/95, increased during the following years to 150 t by 2000/01, but was subsequently reduced to 102 t by 2005/06. In response to improvements in stock status, the TACC has increased over the past decade to 150 t in 2014-15, distributed amongst 100 shareholders.

Following the management changes in the mid-1990s, a formal Share Management Plan (SMP) for the fishery was established in 2000 and a Fishery Management Strategy (FMS) in 2007. These plans specify objectives, performance indicators and trigger-points for the lobster stock and fishery. An annual resource assessment provides an assessment of fishery performance and the status of the lobster stock and informs the annual review of the TACC. The fishery is closely monitored and supports several ongoing surveys and research projects including: (i) collection of fishery-dependent catch and effort data from the commercial fishery via a daily logbook; (ii) monitoring the annual settlement of pueruli (post-larval lobsters); (iii) a fishery-independent trap survey of the abundance of spawning stock; and (iv) an observer survey of the magnitude of retained and discarded catches of lobsters and by-catch. A length-structured model of the lobster population and fishery incorporates biological data, information about fishery selectivity and catch and abundance data from the monitoring programs.

Based on the most recent resource assessment (June 2015), all performance indicators related to CPUE and stock abundance were above the associated trigger-points. Patterns in CPUE and estimates of stock biomass from the model demonstrate that the abundance of Eastern Rock Lobsters has been increasing since the low point of the early 1990's. Catch rates achieved during each of the last 2 years (2012/13 and 2013/14) were the greatest observed during the past 39 years. Indices of abundance of spawning stock (derived from the fishery-dependent logbook and fishery-independent survey) demonstrate substantial increases in biomass since the 1990's. Abundance of spawning stock in 2014 (the most recent survey) was the greatest observed during the 17 years of the data series and approximately triple the abundance observed during the first 3 years (1998-2000) of the survey. Based on the "base-case scenario" of the length-structured model, spawning biomass at the commencement of 2014/15 was estimated to have increased to 34% of the pre-exploitation level, having quadrupled since 1994/95.

Additional Notes

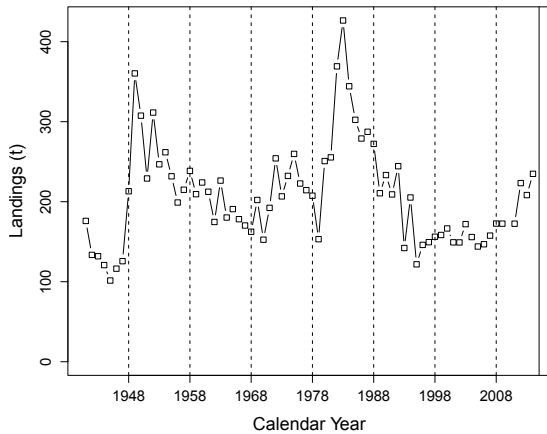
- A high value (approximately \$70 per kg in 2013/14) species caught along the length of the NSW coast, from close inshore to depths of 200 m.
- The commercial fishery is closely monitored and is managed by a TACC which is set annually by the Total Allowable Catch Committee.
- The TACC has effectively been caught (> 95% taken) each year since 2004/05 and was recently set at 160 t for the 2015/16 fishing year. This is the greatest annual TACC set since the introduction of TACs during the mid-1990s.
- There is a minimum legal size of 10.4 cm carapace length (CL) and a maximum legal size of 18 cm CL for Eastern Rock Lobsters in NSW. Recreational fishers are subject to a bag limit of 2 rock lobsters (eastern and southern combined).
- The biological stock of *S. verreauxi* was assessed as Sustainable in the *Status of Key Australian Fish Stocks Reports 2014*.

Catch

Recreational catch of Eastern Rock Lobster

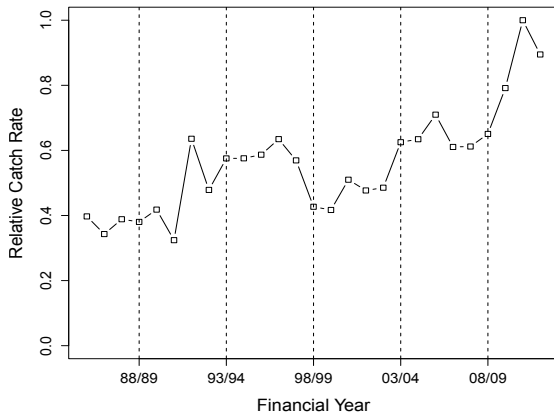
Significant numbers of Eastern Rock Lobsters are captured by recreational fishers who are allowed to use a single trap (pot) in waters less than 10 m depth, or to capture lobsters by hand while diving without the use of compressed air. The population model for Eastern Rock Lobster, used for the June 2015 resource assessment incorporates recreational catch as a component of total fishing mortality – recreational catch was assumed to be 16 t in 2013/14. This is consistent with an estimate derived from the recent survey of recreational catches in NSW. This survey provided an imprecise estimate of 23,216 (se 12,501) rock lobsters during 2013/14 and, assuming a mean weight of 0.661 kg per lobster, this equates to 15.3 t (se 8.3 t) (West *et al.*, 2015).

Historical Landings of Eastern Rock Lobster



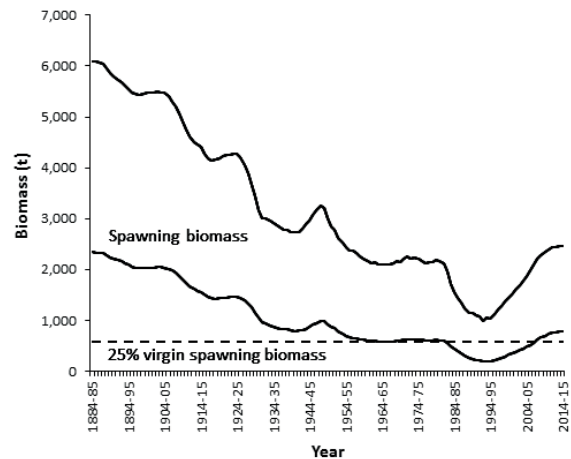
Commercial landings (including available historical records) of Eastern Rock Lobster for NSW from 1939/40 to 2013/14 for all fishing methods.

Catch Per Unit Effort Information of Eastern Rock Lobster Harvested by Lobster Trapping in NSW



Catch rates of Eastern Rock Lobster harvested using lobster trapping for NSW. Indicator provided is median catch rate. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Biomass Estimates of Eastern Rock Lobster



Median estimates of total biomass and spawning biomass 2014/15 ("base-case scenario" of the length-structured model). Dashed line indicates 25% virgin spawning biomass, the reference point above which spawning biomass is to be maintained.

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Eastern School Whiting

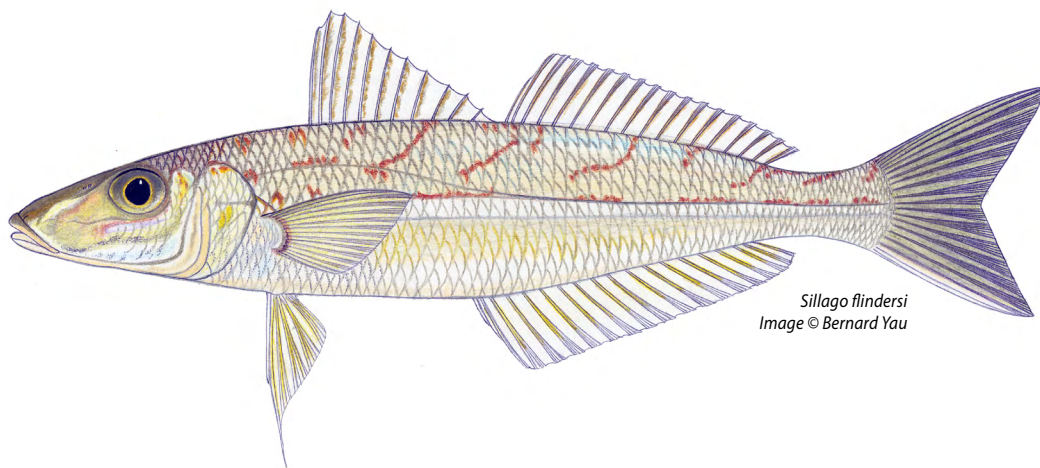
(*Sillago flindersi*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

A significant species in the NSW Ocean Trawl Fishery. The stock is shared with the Commonwealth and the status has been adopted from the Commonwealth assessment.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sillago flindersi</i>	Eastern School Whiting	Also formerly known as Redspot Whiting



Background

The Eastern School Whiting is endemic to Australian ocean waters from southern Queensland to eastern Victoria (Westernport Bay), and including north-eastern Tasmania. Although there is some evidence suggesting that there are two stocks in this range with the division between the 'northern' and 'southern' stocks in the Sydney to Jervis Bay area, current assessment and management assumes a single stock. In NSW, it occurs over sand and mud substrates to a depth of 100 m.

Eastern School Whiting is a fast growing and relatively short-lived fish, with a maximum age of 6 years recorded for fish in NSW commercial catches. It apparently reaches a maximum size of 32 cm fork length (FL), but few fish exceeding 25 cm FL are reported and most in catches are between 15-20 cm FL and less than 3 years of age. Maturity occurs at about 2 years of age and 15 cm FL for both sexes.

Eastern School Whiting is a demersal species caught almost exclusively by otter trawling and Danish seines. The northern end of the Eastern School Whiting distribution overlaps with the

southern end of the Stout Whiting (*S. robusta*) distribution, and mixtures of the two species commonly occur in trawl catches off northern NSW. Fishery independent surveys suggest that the two species are partially segregated by water depth, with Stout Whiting more common in inshore waters to about 30 m depth and Eastern School Whiting more abundant further offshore to about 60 m depth.

In northern NSW, Eastern School Whiting was historically reported by fishers as mixed 'school whiting' (combined with Stout Whiting) and catches of each species were estimated according to the latitude of capture. Since July 2009, fishers have been required to report the two species separately, but considerable quantities of Stout Whiting are still misreported as Eastern School Whiting in northern zones and recent catches continue to be estimated according to latitude, creating some uncertainty in the catch data.

In the early years of the fishery, Eastern School Whiting was mostly discarded by NSW prawn trawlers, and minimum codend mesh-sizes limited

the catch by fish trawlers to low levels. However, with the development of export markets in the 1970s, annual landings by the prawn trawl sector increased to about 600 t by the mid-1980s before declining to around 400 t in the early 1990s due to a softening of the export demand.

With a further increase in domestic and export demand, annual landings increased to over 1,000 t by the late 1990s and Eastern School Whiting was considered the most important species (by weight) in the Ocean Trawl Fishery. Increases were largely due to gear development in the fish trawl sector to specifically target whiting. In the late 2000s, Danish seine gears were also introduced and the fish trawl sector dominated catches that reached 1,000 t again. Over the last 3 years, catches and catch rates in the sector have rapidly declined, and the total reported NSW landings of Eastern School Whiting in 2013/14 were just 536 t.

In offshore waters south of Sydney, the stock is shared with the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) and other southern states. The Commonwealth fishery is managed by an annual Total Allowable Catch (TAC) that was historically over 1,000 t but was most recently set at 809 t in 2013/14. Recent catches, taken mainly by Danish seines operating off Lakes Entrance in eastern Bass Strait, have been way below the TAC and less than 500 t. Nevertheless, the most recent Commonwealth population assessment (in 2009, which included data from NSW and other jurisdictions) estimated that the spawning biomass was 50% of the unfished level, unlikely to be overfished and not currently subject to overfishing. This assessment is quite dated now, especially for such a short-lived species.

Additional Notes

- The biological stock of Eastern School Whiting was assessed as a Sustainable stock in the *Status of Key Australian Fish Stocks Report 2014*.
- The Commonwealth undertakes a robust assessment that indicated in 2009 Eastern School Whiting was not overfished and was not subject to overfishing, but this is quite dated now for such a short-lived species and recent Commonwealth catches have been well below the TAC.
- Landings for this species in northern NSW waters are confounded with Stout Whiting because the two species have overlapping distributions.

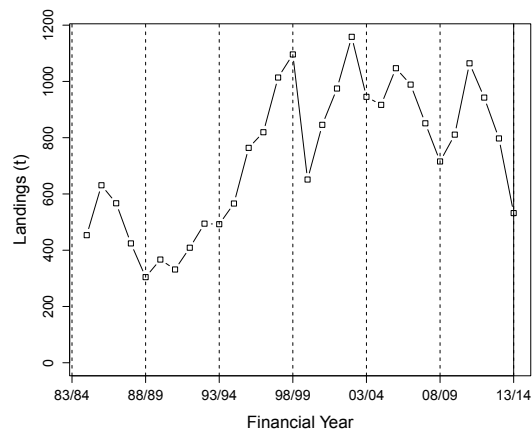
- NSW landings were relatively stable for many years, but have declined by almost 50% over the last 3 years, particularly in the fish trawl sector despite modifications to nets to increase whiting catchability.
- Monitoring of the size and age structure of NSW commercial landings commenced in 2014 through ongoing port monitoring, in response to anecdotal reports that average size has decreased in recent years.
- There is no minimum legal length for Eastern School Whiting, but the species is included in a combined recreational bag limit of 20 for all whiting species.

Catch

Recreational Catch of Eastern School Whiting

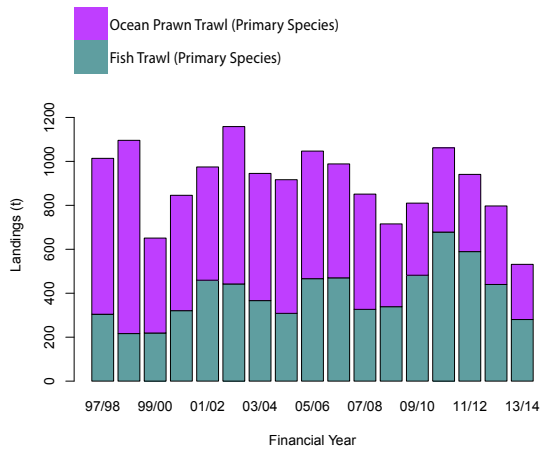
The most recent estimate of the recreational harvest of Eastern School Whiting in NSW was approximately 5,000 fish during 2013/14 (West *et al.*, 2015). Previously, the harvest was estimated to be less than 10 t based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003) and other onsite surveys by NSW DPI.

Historical Landings of Eastern School Whiting



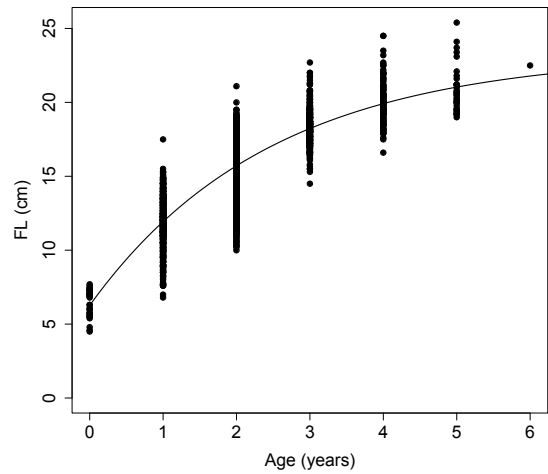
Commercial landings (including available historical records) of Eastern School Whiting for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Eastern School Whiting



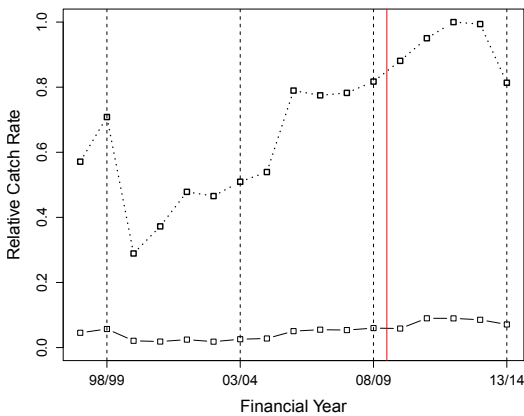
Reported landings of Eastern School Whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Eastern School Whiting



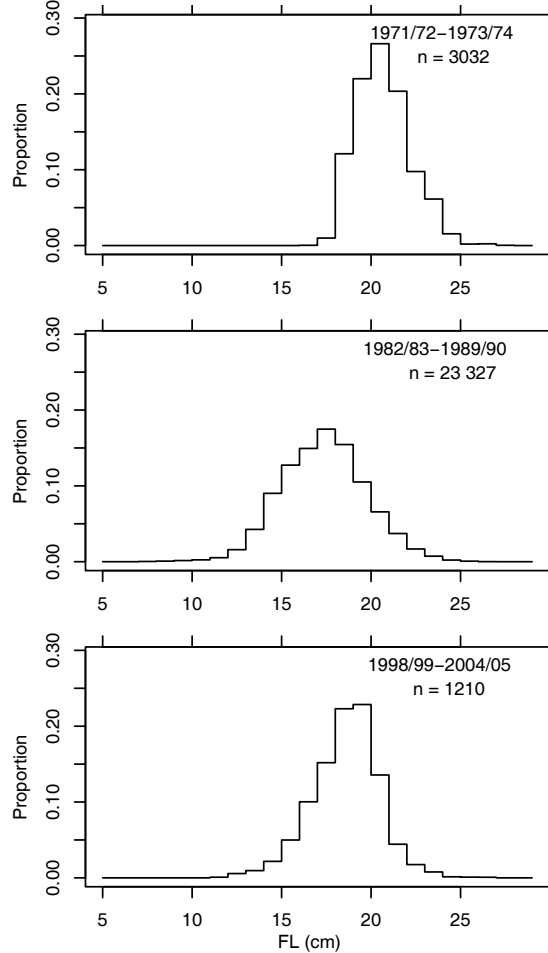
Age-length data with fitted growth curve for Eastern School Whiting (internal data). Lengths are presented as fork length (FL).

Catch Per Unit Effort Information of Eastern School Whiting Harvested by Ocean Prawn Trawling in NSW



Catch rates of Eastern School Whiting harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Eastern School Whiting



The length distribution of Eastern School Whiting landed in the 1970s comprised mainly larger fish (>20 cm fork length (FL)) as smaller fish were discarded. Since the expansion of markets in the 1980s the length distribution of landed Eastern School Whiting has been reasonably stable, comprising mostly fish between 15-25 cm FL. There is no minimum legal length for Eastern School Whiting in NSW.

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Eastern Sea Garfish

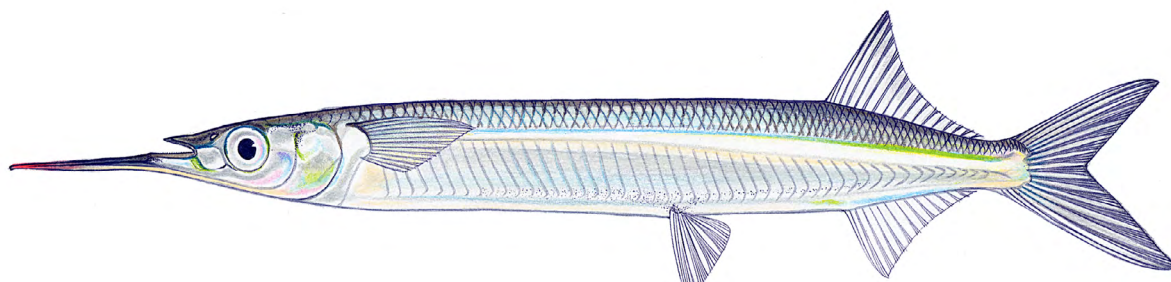
(*Hyporhamphus australis*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

Eastern Sea Garfish were listed as being Overfished between 2002/03 and 2012/13. Five consecutive years of improvements in the size and age compositions in landings and substantial increases in catch rates have resulted in a stock status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Hyporhamphus australis</i>	Eastern Sea Garfish	



Hyporhamphus australis
Image © Bernard Yau

Background

Eastern Sea Garfish (*Hyporhamphus australis*) are found in sheltered bays, coastal waters, and occasionally in the lower reaches of estuaries from Moreton Bay in Queensland, to Eden in NSW, including Lord Howe and Norfolk Islands. They are elongate, marine, surface dwelling fishes with posterior dorsal and anal fins, a deeply forked caudal fin with elongate lower lobe, and with the lower jaw much longer than the upper.

Eastern Sea Garfish are multiple batch spawners in late spring and early summer (November-December) on the south coast of NSW and in winter and spring (June-October) on the north coast. They produce relatively large eggs (~2.5 mm diameter) that are covered with filaments of 5-10 mm long that allow them to attach to floating or benthic vegetation. Batch fecundity increases linearly with fish length up to approximately 3,500 eggs. Eastern Sea Garfish mature at ~21 cm fork

length (measured from the tip of the upper jaw) and at 1 year of age. They have been reported to attain approximately 40 cm fork length and 6 years of age. Females grow faster and attain larger sizes than males.

The fishery for Eastern Sea Garfish in NSW is part of the Ocean Hauling Fishery, and uses garfish hauling nets to target schools of fish. These garfish hauling nets are designed to fish the surface layers and can be used either from boats or the shore; however the majority of fishers are currently boat-based. The fishery is distinctly seasonal, most catches being taken between December and May on the south coast and between March and June on the north coast. Reported annual commercial landings have declined from around 200 t in the early 1990s to less than 40 t in recent years, however the fishery reported more than 100 t in 2009/10. Recent landings have been characterized by greater proportions of fish aged more than 2 years old.

Additional Notes

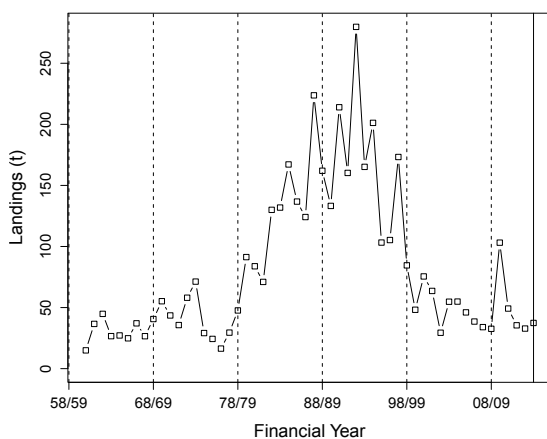
- Improved age compositions in landings (5 consecutive years of more than 20% of the catch being 2 years old or greater) suggests that fishing mortality has been constrained and is now at a sustainable level.
- Catch rates have increased, with kg/shot (boat-based) increasing substantially from 2004/05 levels.
- There has been a steady reduction in total effort in this fishery.
- The spatial distribution of landings has increased as the stock recovered.
- There is a recreational bag limit of 20 Eastern Sea Garfish.

Catch

Recreational Catch of Eastern Sea Garfish

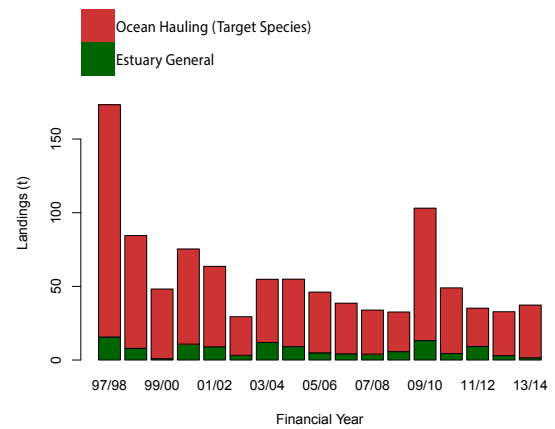
The most recent estimate of the recreational harvest of garfish (all species combined) in NSW was approximately 19,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Eastern Sea Garfish in NSW was previously estimated to be less than 10 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Eastern Sea Garfish



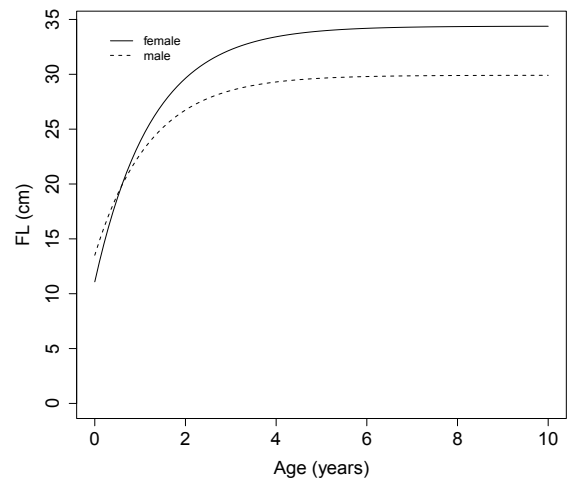
Commercial landings (including available historical records) of Eastern Sea Garfish for NSW from 1960/61 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Eastern Sea Garfish



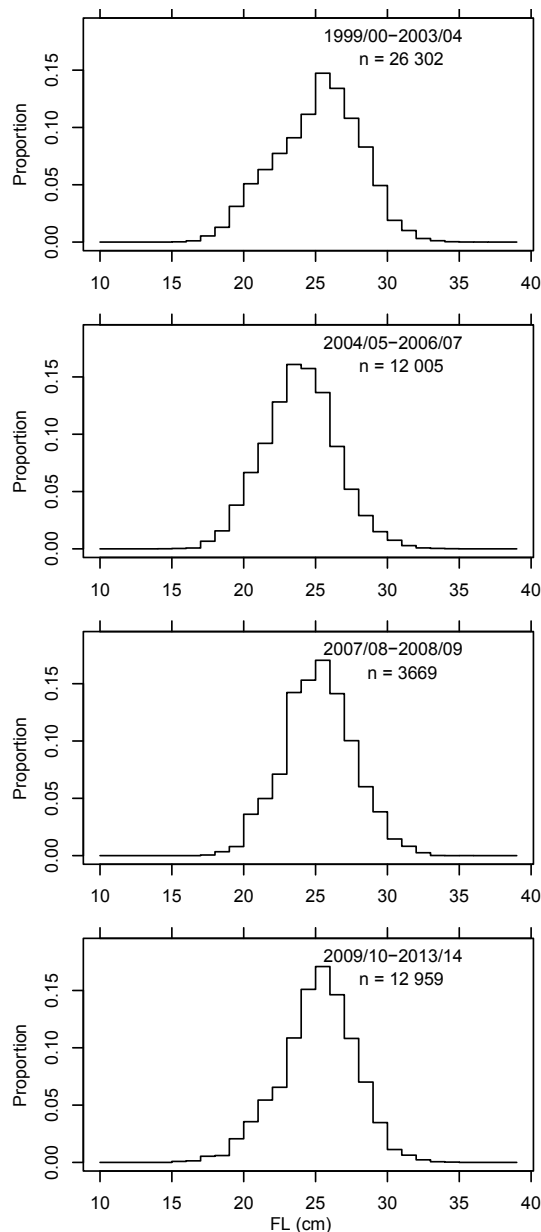
Reported landings of Eastern Sea Garfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curves of Eastern Sea Garfish



Growth curve for Eastern Sea Garfish using parameters from Stewart and Hughes (2007). Lengths are presented as fork length (FL).

Length Frequency of Eastern Sea Garfish



The length distribution of Eastern Sea Garfish in NSW commercial landings has remained reasonably stable since the previous status report in 2008/09, with the majority of fish being between 20-30 cm fork length (FL). Fork length is measured from the tip of the upper jaw to the fork in the tail in garfish. In NSW, there is no minimum legal length for Eastern Sea Garfish.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 234014, common name or scientific name to find further information.



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Estuary Perch

(*Macquaria colonorum*)

Authors John Stewart and Chris Walsh

EXPLOITATION STATUS UNDEFINED

A recreational fishery. Some local biological information exists, however a lack of current data on the fishery has resulted in a status of Undefined.

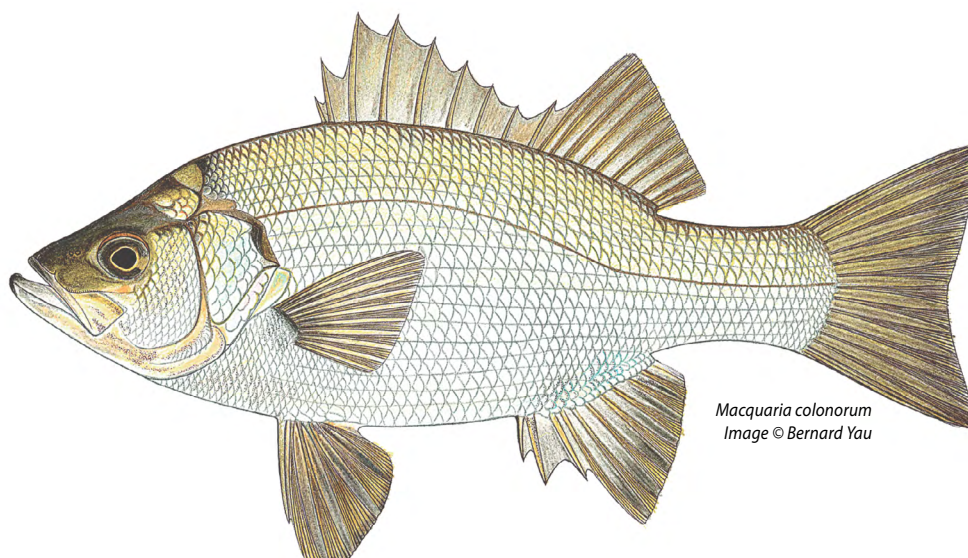
SCIENTIFIC NAME

STANDARD NAME

COMMENT

Macquaria colonorum

Estuary Perch



Macquaria colonorum
Image © Bernard Yau

Background

Estuary Perch (*Macquaria colonorum*) is distributed throughout the coastal rivers, lakes and lagoons in south-eastern Australia, from the Richmond River in northern New South Wales, through Victoria and extending to the Murray River in South Australia. The species also occurs in catchments in the north-east and west of Tasmania. Estuary Perch is an important top predator within these ecosystems.

Estuary Perch are catadromous (migrate from freshwater to seawater to spawn). Spawning occurs during winter and spring in south-eastern Australia. Females mature at slightly larger sizes (25 cm fork length (FL)) and older ages (3.75 years) than males (22 cm FL and 3.28 years). Estuary Perch is a

medium-sized species, with a recorded maximum length of 75 cm and weight of 10 kg, with fish over 3 kg considered rare. Growth is rapid during the first 3-4 years, after which it slows considerably. Females grow faster and attain larger sizes than males. The species is potentially long-lived, with the oldest fish to date estimated at 41 years.

Estuary Perch is of great interest to recreational fishers for sport and its eating qualities. There is no commercial fishery for Estuary Perch in NSW.

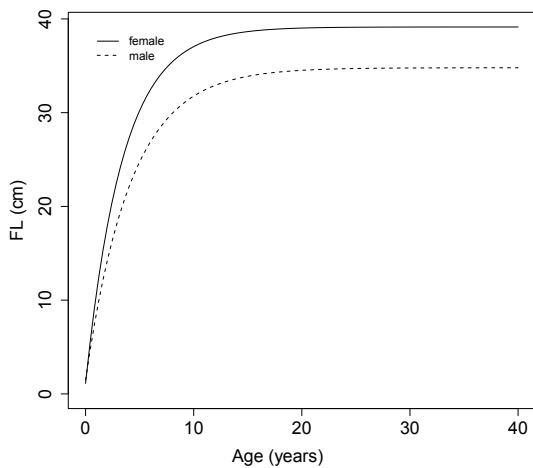
Additional Notes

- Estuary Perch is a recreational only species, with no commercial catch.
- Populations of Estuary Perch are characterized by large variations in year class strength.
- Estuary Perch are vulnerable to fishing due to their longevity and variable recruitment patterns.
- Estuarine dependency suggests that environmental flows and fishing pressure influence population structure.

Catch

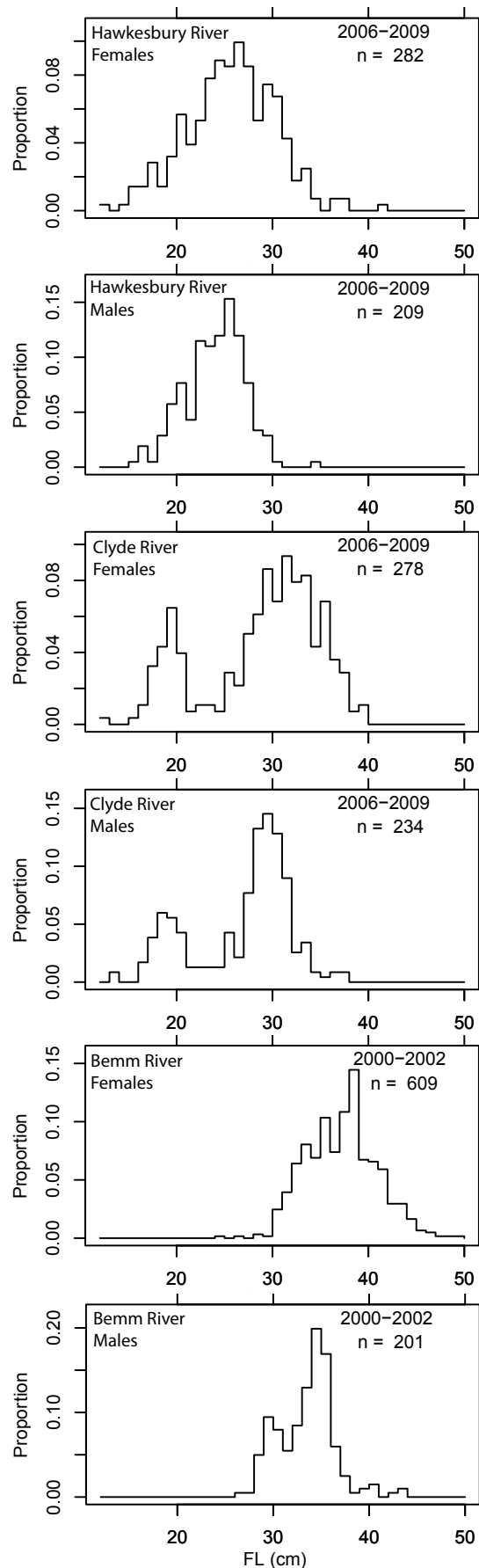
The recreational fishery for Estuary Perch tends to be highly specialized. Substantial numbers of Estuary Perch are released following capture. There is no estimate of the recreational harvest of Estuary Perch in NSW.

Growth Curve of Estuary Perch



Growth curve for Estuary Perch using parameters from Walsh *et al.*, 2010. Lengths are presented as fork length (FL).

Length Frequency of Estuary Perch



The length distributions of Estuary Perch caught by recreational fishers vary between estuaries. Females tend to be larger, on average, than males.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) common name or scientific name to find further information.



Flounders

(Paralichthyidae and Pleuronectidae)

Author Karina Hall

EXPLOITATION STATUS		UNDEFINED
A species group of at least three different sand flounders. Species identification and composition issues need to be resolved before the stock status can be assessed.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Pseudorhombus jenynsii</i>	Smalltooth Flounder	
<i>Pseudorhombus arsius</i>	Largetooth Flounder	
<i>Pseudorhombus tenuirastrum</i>	Slender Flounder	
<i>Pseudorhombus dupliciocellatus</i>	Three Twinspace Flounder	
<i>Ammotretis rostratus</i>	Longsnout Flounder	
<i>Rhombosolea tapirina</i>	Greenback Flounder	



Background

Most marketable flounders caught in NSW waters are 'left-eye' sand flounders belonging to the family Paralichthyidae. The main species include the Largetooth Flounder (*Pseudorhombus arsius*), Smalltooth Flounder (*P. jenynsii*) and Slender Flounder (*P. tenuirastrum*). A fourth sand flounder, the Three Twinspace Flounder (*P. dupliciocellatus*) is also sometimes encountered in prawn-trawl catches off northern NSW.

Largetooth Flounder and Smalltooth Flounder are widely distributed across northern Australia, and also into the Indo-West Pacific in the case of the Largetooth Flounder. Both species are found mostly in estuaries, bays and inshore ocean waters to depths of about 50 m, although occasionally

specimens are taken as deep as 100 m. The Slender Flounder is apparently confined to a limited distribution in continental shelf waters off eastern Australia and generally inhabits deeper water than the other sand flounders (common out to depths of 100 m or more); while Three Twinspace Flounder is more widely distributed from northern NSW to Japan.

NSW catches may also include small amounts of 'right-eye' flounders from the family Pleuronectidae, including the Longsnout Flounder (*Ammotretis rostratus*) and possibly Greenback Flounder (*Rhombosolea tapirina*). These temperate species are only occasionally caught in southern NSW bays and harbours and are more common off southern Australia.

Little is known about the biology of the main sand flounder species taken in NSW waters. Smallooth Flounder that were recently sampled by otter trawl from three estuaries along the NSW central coast and aged for a toxicology study had a maximum age of 4 years for fish ranging in size up to 27 cm total length (TL). The species has a maximum reported size of 30 cm TL and in NSW commercial catches most are between 22-30 cm TL.

Largetooth Flounder is a larger species, with a maximum size of 45 cm TL. In otter trawl catches from Kuwait waters a maximum age of 6 years was reported for fish ranging in size up to 39 cm TL, but 2 and 3 year old fish dominated the catches. The mean age and size at maturity were estimated to be just under 2 years and 24 cm TL. Most Largetooth Flounder in NSW commercial catches are between 15-35 cm TL.

Slender Flounder is a smaller species, with a maximum size of only 25 cm TL; whereas the Three Twinspot Flounder is another larger species, with a maximum size of 40 cm TL.

Greenback Flounder supports quite significant fisheries in SA and Tasmania. Adults are known to partition habitat by depth, with males typically occurring in slightly deeper water than females. A maximum age of 6 years was determined for Greenback Flounder from New Zealand waters. Size at maturity in Tasmanian waters was estimated to be about 19 and 21 cm TL for males and females, respectively. Spawning apparently occurs during the cooler months from autumn to spring. Fecundity estimates are very high and ranged up to almost 2 million eggs for larger females.

The sand flounder species are difficult to identify and separate and all are currently reported by fishers as mixed 'flounder'. Almost all are landed as byproduct in the Ocean Trawl Fishery, with only small amounts reported from the estuary fisheries. Commercial landings of mixed flounders were generally stable at around 30 t per year until 2003/04, after which they steadily declined. For the last 7 years, catches of around 10 t have been landed. Significant numbers of sand flounders are also caught by recreational fishers in NSW.

Additional Notes

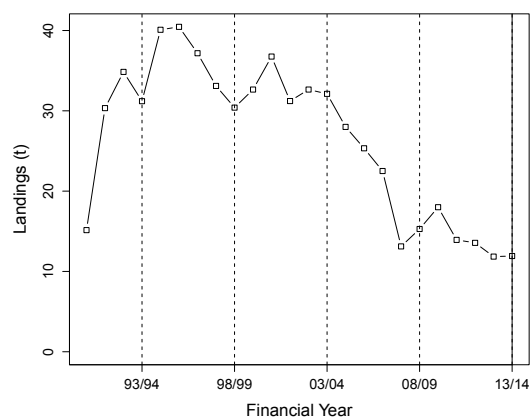
- Three sand flounder species comprise the bulk of NSW landings: the Largetooth Flounder and Smallooth Flounder, which occur in estuaries, bays and inshore waters; and the Slender Flounder, which is more common further offshore.
- All species are mainly harvested as by-product of trawling, and the two inshore species are also frequently caught by recreational anglers in estuaries.
- Very limited information is available on the species composition and biology of the main species landed in NSW.
- There is a minimum legal length of 25 cm TL for flounders and a combined recreational bag limit of 20 for all flounders and soles.

Catch

Recreational Catch of Flounders

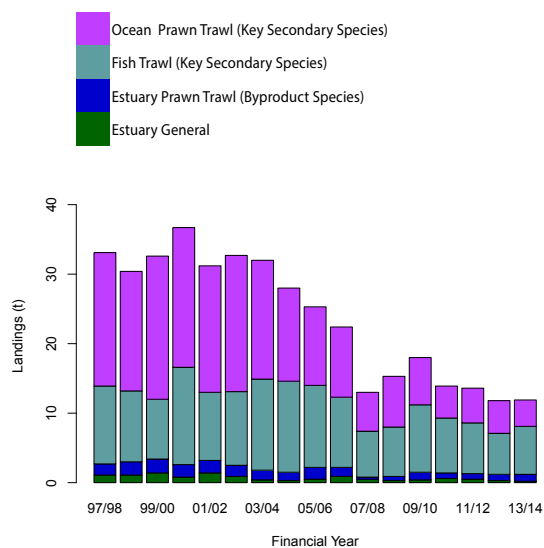
The most recent estimate of the recreational harvest of flatfish (flounders and soles, combined) in NSW was approximately 22,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 100,000 flatfish (or between 10-20 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003). Historical onsite surveys indicate that most flatfish harvested by recreational fishers in NSW are flounders.

Historical Landings of Flounders



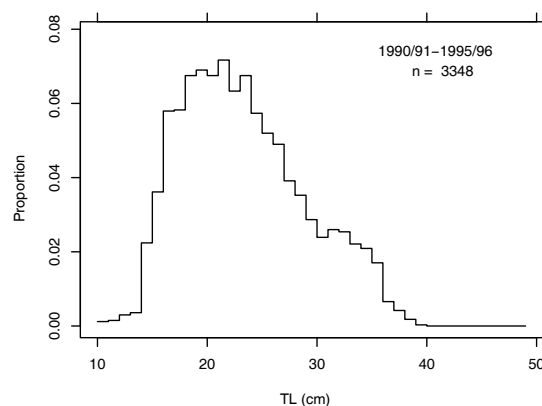
Commercial landings (including available historical records) of flounders for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Flounders



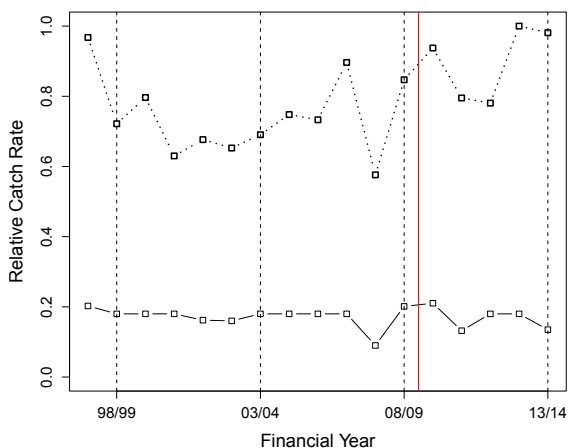
Reported landings of flounders by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Largemouth Flounder



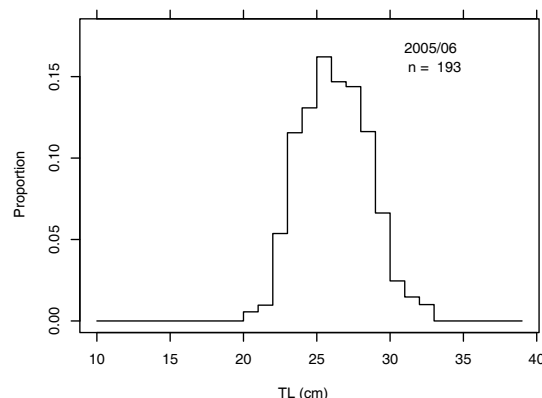
The length distribution of Largemouth Flounder caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mainly of fish between 15-35 cm total length (TL). A minimum legal length of 25 cm TL was introduced for flounders in September 2007.

Catch Per Unit Effort Information of Flounders Harvested by Ocean Prawn Trawling in NSW



Catch rates of flounders harvested using ocean prawn trawling for NSW. Indicator provided is median catch rate. The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Smalltooth Flounder



The length distribution of Smalltooth Flounder landed by NSW commercial fishers in 2005/06 was comprised mainly of fish between 22-30 cm total length (TL). A minimum legal length of 25 cm TL was introduced for flounders in September 2007.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 460002, 37 460009, 37 460031, 37 460004, 37 461001 and 37 461003, common name or scientific name to find further information.



Frigate Mackerel

(*Auxis thazard*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Very little information is available for Frigate Mackerel. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Auxis thazard</i>	Frigate Mackerel	Also known as Leadenall.



Background

The Frigate Mackerel (*Auxis thazard*) is a small, pelagic, tuna-like member of the family Scombridae which includes tunas, mackerels, and bonitos. It is a highly migratory species with a worldwide distribution through all tropical and subtropical seas. In Australia, it is found around the whole of the mainland although it is more abundant in northern waters. The Frigate Mackerel is primarily an open water species preferring coastal seas, but it is known to enter sheltered bays and harbours. It usually inhabits the top 50 m of the water column, but has been reported as deep as 200 m.

Frigate Mackerel can be distinguished from other similar species of small, striped tunas such as the true bonitos (*Sarda* spp.), Mackerel Tuna (*Euthynnus affinis*) and Skipjack Tuna (*Katsuwonus pelamis*) by its very widely spaced dorsal fins - in these other species, the dorsal fins are very close together and often almost touching at their bases. Frigate Mackerel grow to almost 60 cm fork length and a weight of nearly 4 kg but they are more commonly 25-40 cm and 0.3-1.3 kg. Because of their abundance, Frigate Mackerel are considered to be an important component of the food chain. Their

primary food sources include small fish, squids, and planktonic larval crustaceans while in turn, Frigate Mackerel are preyed upon by larger fish such as tunas and billfish.

The NSW commercial fishery for Frigate Mackerel is very seasonal, with almost all the catch taken during summer. Most is taken by the Ocean Hauling Fishery but the reported landings are highly variable, ranging between about 2-25 t per annum. Because of their dark, oily flesh, Frigate Mackerel have low market acceptance and are commonly used for bait by both commercial and recreational fishers.

Additional Notes

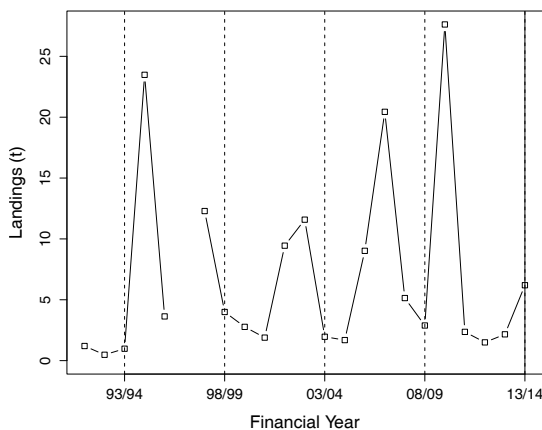
- Small species (< 3 kg) which occurs in coastal waters around all Australian states.
- Minimal local biological information is currently available.
- Frigate Mackerel are a conditional target species in the Ocean Hauling Fishery and are caught sporadically.
- Mainly utilised for bait by the commercial fishery.
- Recreational catch may be greater than commercial landings.

Catch

Recreational Catch of Frigate Mackerel

There is no recent estimate of the recreational harvest of Frigate Mackerel in NSW. The annual recreational harvest of Frigate Mackerel in NSW was previously estimated to be less than 20 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Frigate Mackerel



Commercial landings (including available historical records) of Frigate Mackerel for NSW from 1993/94 to 2013/14 for all fishing methods. Financial years where commercial catch was reported by less than six fishermen were removed due to privacy concerns.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441009, common name or scientific name to find further information.



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Gemfish

(*Rexea solandri*)

Author Rowan Chick

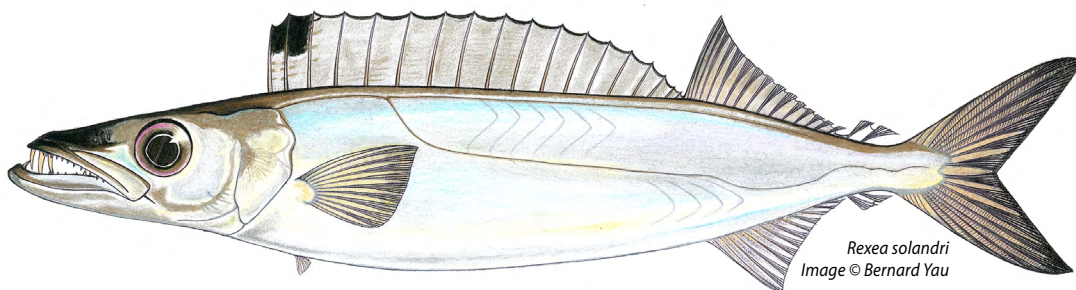
EXPLOITATION STATUS **OVERFISHED**

Predominantly a Commonwealth fishery. Exploitation status has been adopted from the Commonwealth stock assessment.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Rexea solandri

Gemfish



Background

There are two substantially different stocks of Gemfish in Australian waters. The eastern stock extends from Cape Moreton in southern Queensland to the west coast of Tasmania. The western stock is distributed from western Bass Strait to Geraldton in WA.

Mature fish in the eastern stock migrate northwards along the continental slope to spawn off central and northern NSW during a short period in early to mid-August. The biology of the western stock of gemfish is thought to be similar to that of the eastern stock except that they appear to spawn in summer instead of winter. Females mature between 4 and 6 years of age (60-75 cm fork length (FL)) while males mature between the ages of 3 and 5 (50-70 cm FL). Females can live to a maximum of about 17 years and attain a maximum length of 116 cm and weight of 13 kg. Males are shorter lived with a maximum age of about 12 years, maximum length of about 106 cm and weight of about 8 kg.

The eastern Gemfish stock was depleted through overfishing during the 1970s and 1980s. The fishery for eastern Gemfish began in the late 1970s, targeting the well-defined winter migration of mature fish along the continental slope from eastern Bass Strait to Port Stephens (latitudes 40°S-33°S) in depths of 350-450 m. Gemfish was the major harvest by trawlers operating

from NSW ports during the period 1977-87, with annual catches peaking at more than 5000 t in the early 1980s. Total annual catches then fluctuated around 3-4000 t until 1987. In 1985 the Commonwealth South East Trawl Fishery (SETF), incorporating waters outside 3 nm and south of Barrenjoey Point (Broken Bay), was implemented by the Commonwealth Government. An annual Commonwealth Total Allowable Catch (TAC) of 3000 t was imposed for Gemfish in 1988 but, with catches continuing to decline and concerns about recruitment, the Commonwealth TAC was progressively reduced to zero by 1993. Subsequent Commonwealth TACs were as high as 1000 t. Since 2005 Commonwealth TACs have been set at around 100 t to allow for Gemfish caught incidentally while targeting other species. In addition, in recent years fishers in the Commonwealth fishery have been subject to catch trip limits to reduce the catch of Gemfish.

In NSW, commercial dropline fishers in the Ocean Trap and Line Fishery account for the majority of commercially reported catch of Gemfish. Because of the overfished status of the Gemfish stock, NSW commercial fishers are subject to a 50 kg trip limit for all fishing methods. Recreational fishers are subject to a bag limit of 2 Gemfish per angler and a boat limit of 10 Gemfish. In addition, there is a combined recreational bag limit of 5 Gemfish, Hapuku, Banded Rockcod, Bass Groper and Blue-eye Trevalla.

Additional Notes

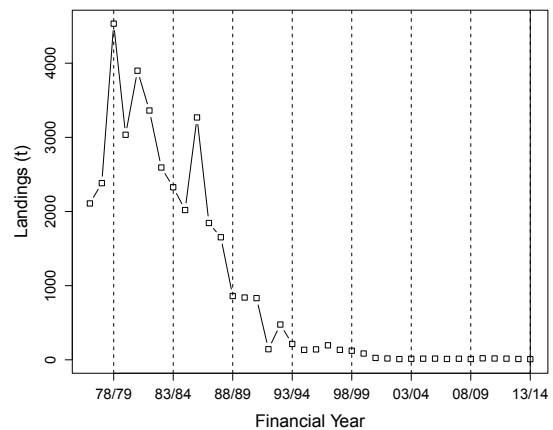
- The stock status of the Eastern Gemfish (*Rexea solandri*) has been assessed as Overfished in the *Status of key Australian fish stocks reports 2014*.
- The Commonwealth considers the eastern stock to be overfished. (Wilson *et al.*, 2009)
- The Australian Fisheries Management Authority (AFMA) has an Eastern Gemfish (*Rexea solandri*) Stock Rebuilding Strategy – Revised 2015, to support the recovery of Eastern Gemfish above 20% of their unfished spawning biomass.
- NSW Fisheries continue to support the AFMA stock assessment process through coordinated efforts to provide additional information on the distribution, number and size of Gemfish caught in NSW waters.
- Nomination of Gemfish as a threatened species is still under consideration by the NSW Fisheries Scientific Committee but Eastern Gemfish were listed as “Endangered - Conservation Dependent” by the Commonwealth in early 2009.
- An updated assessment using the results from a trawl survey in 2008 estimated current spawning biomass to be about 16% of unexploited level (likely spawning biomass of 2000-3000 tonnes) - however concerns have been expressed about the use of a ‘hyperstable’ abundance index in the assessment.
- Despite the recruitment of a ‘stronger’ 2002 cohort to the mature population, there has been little improvement in the stock from the low level following the recruitment collapse.
- NSW commercial dropline fishery now has only a small number of operators, and trawl catches are very low (both are subject to a 50 kg trip limit). Landings by the charter boat fishery are likely to be significant (subject to a 10 fish per boat limit).
- Length-based monitoring of NSW commercial catch is continuing at the Sydney Fish Market.

Catch

Recreational Catch of Gemfish

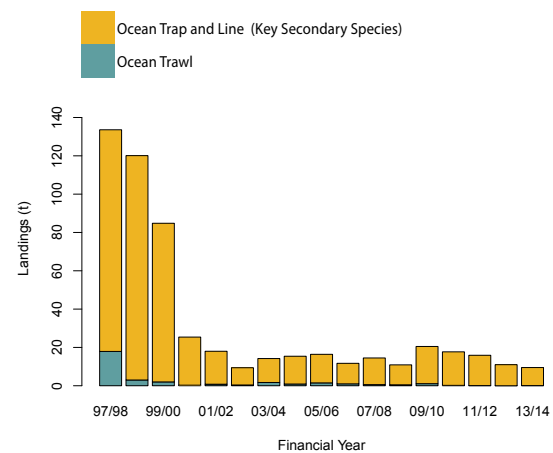
There is no recent estimate of the recreational harvest of Gemfish in NSW. The annual recreational harvest of Gemfish in NSW was previously estimated to be less than 10 t, based upon the results of offsite (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Gemfish



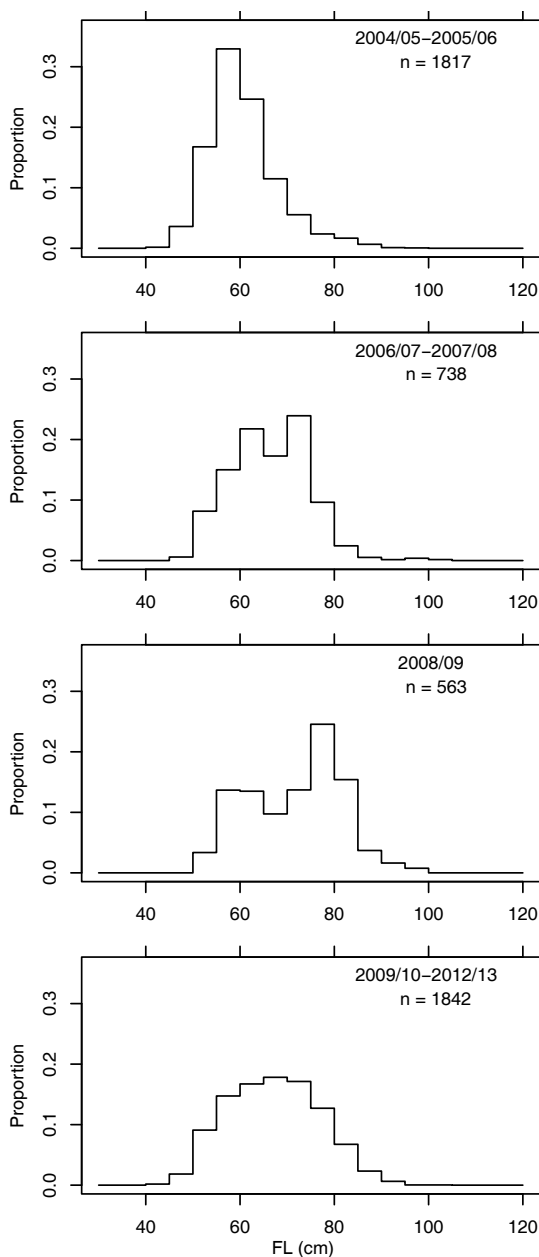
Commercial landings (including available historical records) of Gemfish for NSW from 1976/77 to 2013/14 for all fishing methods. Note that data prior to the late 1990s includes gemfish caught in Commonwealth managed fisheries.

Landings by Commercial Fishery of Gemfish



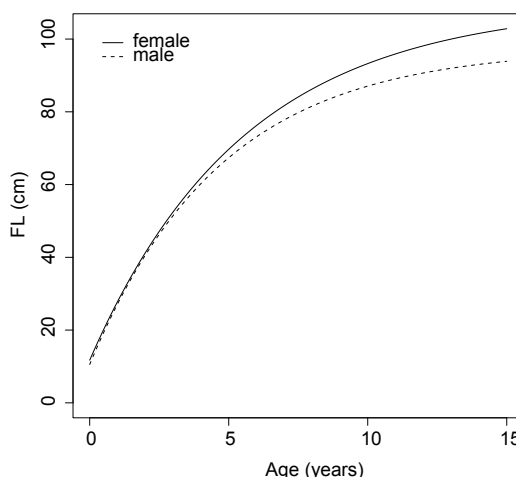
Reported landings of Gemfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy. A 50 kg trip limit was introduced for all NSW fishers in May 2000.

Length Frequency of Gemfish



The length distribution of Gemfish landed by NSW commercial dropline fishers comprises mainly fish between 50-100 cm fork length (FL). There is no minimum legal length for Gemfish in NSW.

Growth Curves of Gemfish



Growth curves of Gemfish using parameters from Rowling (1999). Lengths are presented as fork length (FL).

Further Reading

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Please visit the CSIRO website,
<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 439002, common name or scientific name to find further information.



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Ghost Nipper

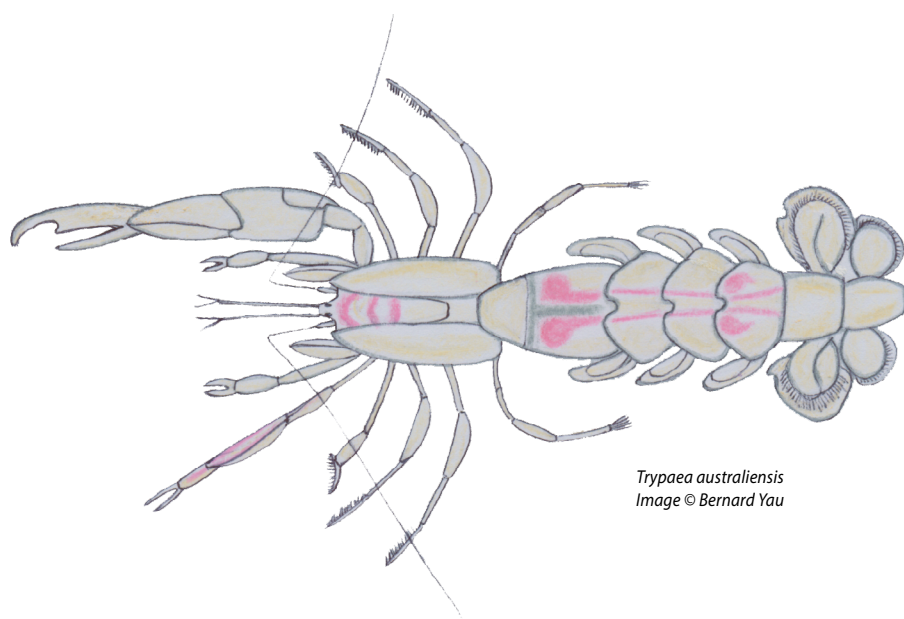
(*Trypaea australiensis*)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

The commercial catch is considered relatively small compared to the levels of recreational catch. The effect of fishing activity, particularly at local scales is unknown. Biology together with a component of the population inhabiting sub-tidal habitat suggests populations are resilient to harvest levels.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Trypaea australiensis</i>	Ghost Nipper	Also known as Pink Nipper and Yabby.



Background

A number of species of burrowing shrimps occur on intertidal sand and mud flats in NSW. The Ghost Nipper (*Trypaea australiensis*) occurs in estuaries between northern Queensland and central Victoria, and is commonly harvested for use as bait by recreational fishers. There is also a commercial fishery for Ghost Nippers which supplies to bait shops to service recreational fishery demand for the species. Ghost nippers are harvested from intertidal flats at low tide using a tubular pump, known as a 'Yabby' or 'Nipper' pump. In some areas harvest rates can be substantial, especially during peak recreational fishing periods (such as the summer holiday period). There are also sub-tidal populations of Ghost Nippers in many areas which are effectively protected from harvesting due to their habitat being relatively inaccessible.

Ghost Nippers dig complex burrow structures in soft but stable sediments, and feed on small

particles of organic matter. The claw on one side of the animal is larger than that on the other side, and males generally have a much larger claw than females. Females carry fertilized ova in clutches under the abdomen, until they hatch into free swimming larvae. Ghost Nippers are thought to be a relatively fast growing species, with a life span of less than 4 years. Because they occur in large numbers and are active burrowers to a depth of 25 cm or more, Ghost Nippers are considered to be an important component of the ecology of intertidal flats, affecting the distribution of particle sizes in the substrate and allowing oxygen penetration below the surface.

There is no accurate information describing the recreational harvest of Ghost Nippers. However, the numbers harvested by the recreational fishing sector can be substantial, and from within a relatively small area. The commercial harvest of

Ghost Nippers in NSW has averaged 3.5 t per year over the last decade, increasing in recent years. The resilience of populations to the numbers of individuals harvested is considered high, due to their demography and population dynamics. However, the overall effect of fishing activity on populations, particularly at local scales, is unknown.

Additional Notes

- Ghost Nippers are harvested for use as bait by recreational fishers.
- Annual commercial harvests have averaged 3.5 t over the last decade, increasing over recent years.
- Recreational harvests are not accurately known.
- In 2015, the NSW Recreational Fishing Trust funded a research project investigating the size and structure of Ghost Nipper populations at key locations in NSW.
- Recently, in northern NSW, a Commercial Charter Boat industry has developed to service a market for tourists to experience 'Nipper pumping' and the estuarine environment.
- A recreational bag limit of 100 Nippers was introduced in September 2007.

Catch

Recreational catch of Ghost Nipper

The most recent estimate of the recreational harvest of Ghost Nippers in NSW was approximately 1,300,000 nippers during 2013/14 (West *et al.*, 2015).

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 803004, common name or scientific name to find further information.



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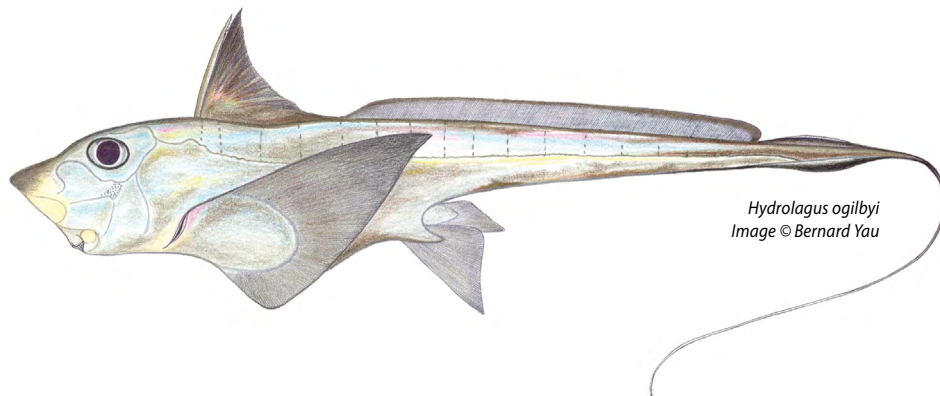
Ghostsharks (Chimaeriformes)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

Small numbers of individuals are harvested as bycatch in the Ocean Trawl Fishery from the outer continental shelf and continental slope. There is a lack of information with which to assess stock status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Callorhinchus milii</i>	Elephantfish	Occasionally caught inshore south of Sydney.
<i>Hydrolagus ogilbyi</i>	Ogilby's Ghostshark	Caught on outer shelf and upper slope (120-400 m).
<i>Hydrolagus marmoratus</i>	Marbled Ghostshark	Small species infrequently caught off northern NSW in depths of 550-1000 m.
<i>Hydrolagus lemures</i>	Blackfin Ghostshark	Caught in upper slope depths (200-700 m).
<i>Chimaera fulva</i>	Southern Chimaera	Frequently caught at 780-1000 m.
<i>Chimaera macrospina</i>	Longspine Chimaera	Caught in midslope depths (435-1300 m).
<i>Harriotta raleighana</i>	Bigspine Spookfish	Caught in midslope depths (700-900 m).
<i>Rhinochimaera pacifica</i>	Pacific Spookfish	Caught in midslope depths (760-1290 m).
<i>Chimaera obscura</i>	Shortspine Chimaera	Known only from four specimens caught in 1050 m depth off Tuncurry.



Background

Chimaeriforms include three families of mainly deepwater chondrichthyans (cartilaginous fishes), and all families are represented in NSW waters. The taxonomy of deepwater ghostsharks (Chimaeridae) in Australian and New Zealand waters has been clarified and the NSW fauna is now known to include at least nine species. There is one species of elephantfish (*Callorhinchus milii*; family Callorhinchidae), several species of shortnosed ghostsharks (*Chimaera* spp. and *Hydrolagus* spp.; family Chimaeridae), and two species of longnosed ghostsharks or spookfishes (*Rhinochimaera pacifica* and *Harriotta raleighana*;

family Rhinochimaeridae). However, despite their mainly deepwater habitat and unusual appearance, chimaeras have good eating qualities and small quantities of a variety of species are landed as incidental catches in the Ocean Trawl Fishery.

The Elephantfish is the only shallow water species of the group, occurring around southern Australia and in New Zealand. Elephantfish can grow to at least 110 cm in length and about 9 kg in weight, and are occasionally caught off the far south coast of NSW. They are bottom feeders with plate-like teeth in both jaws used to crush shellfish and other

invertebrate prey. Elephantfish are a significant by-catch in the Commonwealth Southern and Eastern Scalefish and Shark Fishery, and there is a significant recreational catch in the southern states. Commonwealth assessment indicates that Elephantfish are not overfished or subject to overfishing.

More commonly caught by NSW offshore trawlers, albeit in relatively small numbers, are several species of ghostsharks. Ogilby's Ghostshark (*Hydrolagus ogilbyi*) may be caught as shallow as 150 m but the other species inhabit continental slope depths between 500-1500 m. Some species of NSW ghostsharks grow to about 80 cm in length (not including the tail filament) and weigh up to 5 kg. All deepwater chimaeras have long filamentous tails making them weak swimmers and they are reported to feed mainly on small fish and invertebrates, including squids.

The females of all chimaeras are oviparous in that they lay single large eggs in leathery egg-cases; these eggs take up to a year to develop and hatch into a fully formed small shark. While the Elephantfish breeds annually in shallow water, little is known of the breeding biology of deepwater chimaerids. However, like most deepwater sharks, ghostsharks are likely to have slow growth rates and very low fecundity, making them vulnerable to over fishing.

Additional Notes

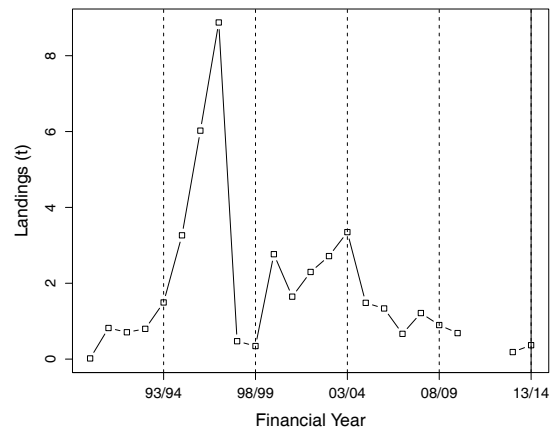
- It is likely that the abundance of these species has always been quite low off NSW.
- Most are deepwater sharks with typically low fecundity.
- Elephantfish is subject to catch limits in the Commonwealth Southern and Eastern Scalefish and Shark Fishery (Total Allowable Catch of 163 t).
- Ghostsharks are a key secondary species in the Ocean Trawl Fishery.

Catch

Recreational Catch of Ghostsharks

The annual recreational harvest of ghostsharks in NSW is considered minor.

Historical Landings of Ghostsharks



Commercial landings (including available historical records) of ghostsharks for NSW from 1991/92 to 2013/14 for all fishing methods. Financial years where commercial catch is made up of less than six fishermen were removed due to privacy concerns.

Further Reading

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- Yearsley, G.K., P.R. Last and R.D. Ward (1999). *Australian Seafood Handbook*. Hobart, CSIRO Marine Research.

Please visit the CSIRO website,

<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 042001, 37 042011, 37 042006, 37 042007, 37 043001, 37 042003, 37 044001, 37 044002 and 37 042005, common name or scientific name to find further information. Please note that common names have been adopted from Last and Stevens (2010) and may differ to those contained on the CAAB website.



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Giant Mud Crab

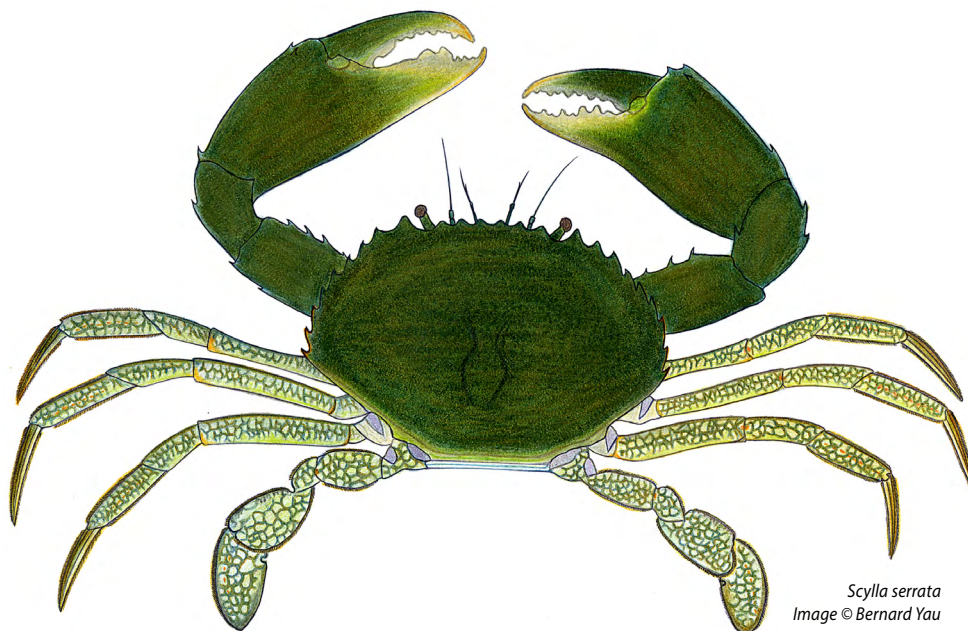
(*Scylla serrata*)

Author Daniel Johnson

EXPLOITATION STATUS **UNCERTAIN**

Significant commercial and recreational fisheries occur in NSW which is at the southernmost extent of the species' range. Local biological information has not been analysed in detail.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Scylla serrata</i>	Giant Mud Crab	Also known as Mangrove Crab.



Scylla serrata
Image © Bernard Yau

Background

The Giant Mud Crab (*Scylla serrata*), along with most species of commercially harvested crabs in Australia, belongs to the family Portunidae. Species in this family are usually referred to as swimmer or paddle crabs, and are easily recognized by their broadly flattened back legs with paddle-like last segments. The Giant Mud Crab or mangrove crab has a smooth carapace (back), is deep green in colour, and differs from other swimmer crabs by having very robust claws and 9 similarly-sized spines on each side of its carapace. It is the largest species of swimmer crab and can reach 28 cm in carapace width and 3 kg in weight but is more commonly 15-20 cm in width and 0.5-1.0 kg.

Giant Mud Crabs are widely distributed through the Indo-Pacific region and around the Indian Ocean to east Africa. In Australia, they are found from the Bega River in southern NSW north to the Gulf of Carpentaria and around to Broome in WA. Giant Mud Crabs are usually found in sheltered

waters, particularly estuaries, tidal flats and mangrove areas, and can tolerate wide variations in temperature (12-35°C) and salinity (2-50‰). However, it has been found that their activity and feeding slows greatly in temperatures less than 20°C. During the day, Giant Mud Crabs may live intertidally in burrows but most bury in the mud at subtidal levels. They forage at night for food, feeding mainly on molluscs, crustaceans and worms.

Giant Mud Crabs grow in a step-wise fashion through a succession of moults until they reach maturity after 18-24 months. The moult that marks the transition from a juvenile to a mature state is the final or terminal moult for most male and almost all female crabs. Most Giant Mud Crabs do not grow further after this terminal moult, and death is thought to occur at a maximum of 4 years. However, it has been found that about 3%

of females do moult (and breed) a second time. At maturity, the claws of male Giant Mud Crabs increase in proportion to body size, comprising up to 40% of the body weight, making them prized for the meat content.

Female Giant Mud Crabs carry between 2-5 million eggs and are thought to spawn only at sea. The young crabs hatch as zoea larvae which require marine conditions to develop properly. After a series of moults the zoea larvae metamorphose into 'megalopa' (the first stage resembling the adult crab form) which move inshore and moult into juvenile crabs.

The main fishery for Giant Mud Crabs in Australia is in Queensland where 800-1000 t is harvested annually. In NSW, yearly landings are around 100-120 t. The commercial fishery is seasonal with the greatest harvest occurring in summer, peaking in February and March. Giant Mud Crabs are sold locally and interstate, with only a small percentage exported overseas.

Recreational catches of Giant Mud Crabs are also significant, and in some areas outweigh the commercial catches. Crab pots are the primary means of capturing Giant Mud Crabs by both commercial and recreational fishers. Recreational fishers also use hoop nets or dillies. Recreational fishers are limited to using two crab trap, and/or four hoop nets ('dillies' or 'witches hats') to target a bag limit of 5 crabs.

Female Giant Mud Crabs are protected in Queensland, NT, and WA, but in NSW only females with eggs are protected, although these are rarely caught by commercial or recreational fishers. Minimum size and maximum bag limits vary between states. The minimum legal size for Giant Mud Crabs (male or female) in NSW is 8.5 cm carapace length.

Additional Notes

- NSW is at the southern extent of the species' range and our fishery is likely to be dependent upon recruitment from further north.
- NSW commercial landings and catch rates are stable - the recreational catch is significant (in the north), but not well estimated.
- A valuable commercial and recreational species in NSW, however there has been little study of the species locally.

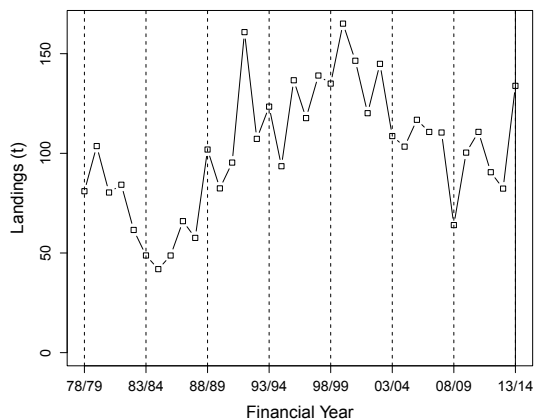
- Monitoring of the size composition of commercial catches from the Clarence River and Wallis Lakes is continuing. The size composition has been stable since 2003/04.
- There is a minimum legal length of 8.5 cm carapace length and a recreational bag limit of 5 Giant Mud Crabs.

Catch

Recreational Catch of Giant Mud Crab

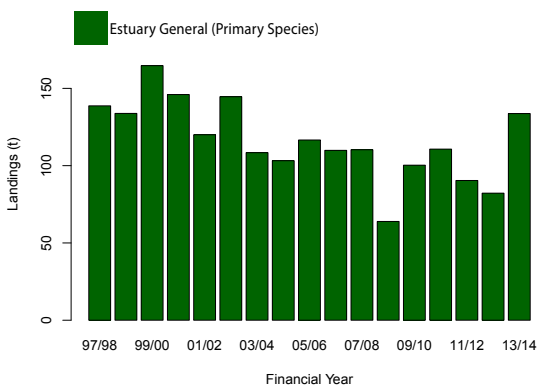
The most recent estimate of the recreational harvest of mud crabs (*Scylla* spp.) in NSW was approximately 30,100 during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Giant Mud Crab in NSW was previously estimated to lie between 30 and 60 t, based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Giant Mud Crab



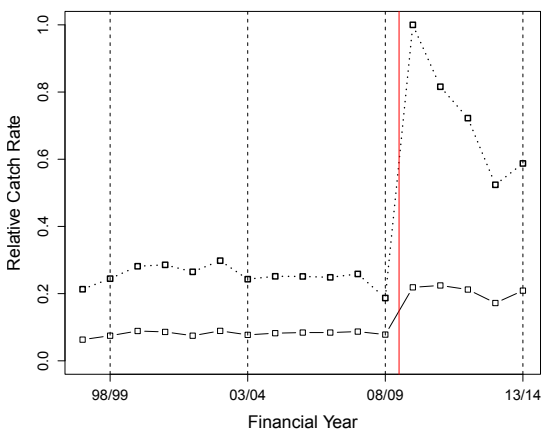
Commercial landings (including available historical records) of Giant Mud Crab for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Giant Mud Crab



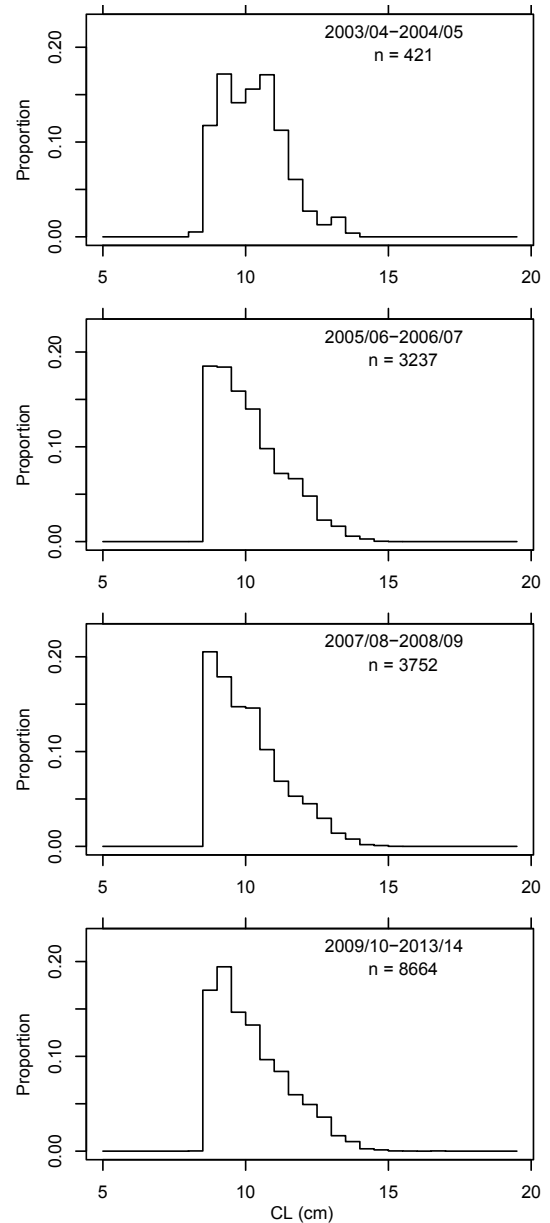
Reported landings of Giant Mud Crab by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Giant Mud Crab Harvested by Crab Potting in NSW



Catch rates of Giant Mud Crab harvested using crab potting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Giant Mud Crab



The length distribution of Giant Mud Crabs landed by NSW commercial fishers is comprised mainly of crabs between 9-14 cm carapace length (CL), and has been relatively stable in recent years. The minimum legal length of mud crabs in NSW is currently 8.5 cm CL.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 91 1008, common name or scientific name to find further information.



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Goldspot Mullet

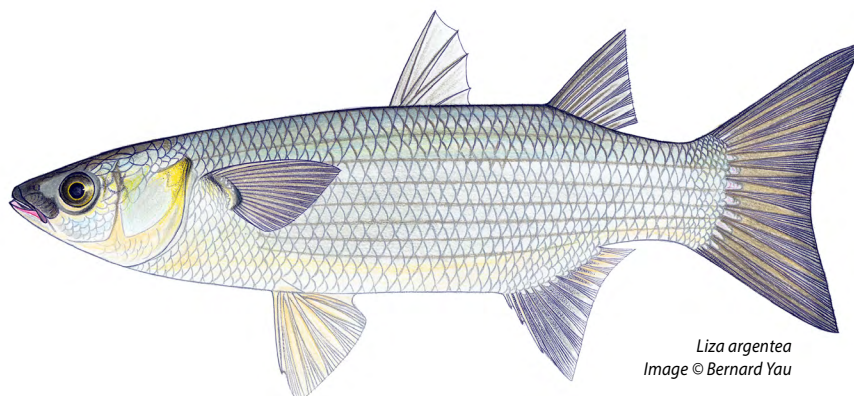
(*Liza argentea*)

Author Karina Hall

EXPLOITATION STATUS **UNCERTAIN**

Exploitation rates vary considerably between estuaries. Commercial landings fluctuate annually, but have steadily declined since the 1980s. A lack of current data on size and age composition has resulted in an Uncertain exploitation status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Liza argentea</i>	Goldspot Mullet	Formerly known as Flat-tail Mullet. Comprises the majority of landings.
<i>Paramugil georgii</i>	Fantail Mullet	Minor landings only.



Background

The Goldspot Mullet (*Liza argentea*) is an endemic species found in tropical and temperate Australian waters. Its distribution extends from the Gulf of Carpentaria around all southern states (except Tasmania) to about Perth in WA. It is principally an estuarine species found in the upper reaches during its first year before inhabiting coastal lakes and shallow inshore waters. Both as juveniles and adults, this highly active fish feeds on filamentous algae and other weeds as well as benthic crustaceans.

The Goldspot Mullet is a schooling fish that can reach a length of 45 cm fork length (FL), although it rarely exceeds 30 cm FL and 0.5 kg in weight. It is a relatively long-lived mullet species with a maximum reported age of 17 years. Males and females have similar growth patterns until 2-3 years of age, after which males on average are smaller than females. Goldspot Mullet spawn in inshore coastal waters, including the lower reaches of estuaries. They are capable of short to extended

spawning periods (over 2-9 months) which vary in timing and duration depending on location. They reach maturity at about 18-20 cm FL and 2-4 years of age.

In NSW, Goldspot Mullet are landed by commercial fishers throughout the year, with the highest catches between January and March. Over 90% of the annual catch is taken by haul and mesh nets within the Estuary General Fishery and the remainder by haul nets in the Ocean Hauling Fishery. Annual landings have steadily decreased from about 100 to 150 t during the 1980s to less than 50 t in the last 2 years. Catch rates have remained relatively stable throughout.

Landings also include very small numbers of Fantail Mullet (*Paramugil georgii*) which occur in estuaries and bays in southern Queensland and NSW. Both species are sold whole or filleted for food, and for commercial bait. In some areas, recreational fishers also target Goldspot Mullet for food and bait.

Additional Notes

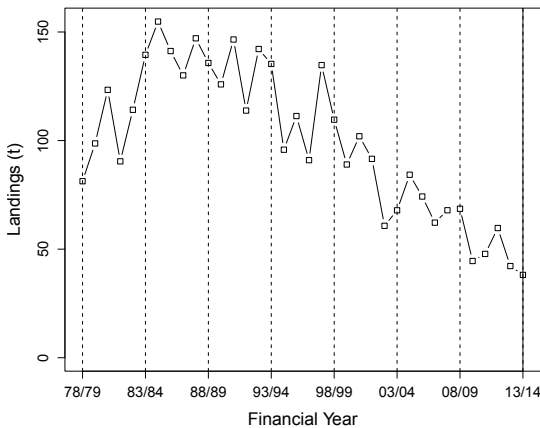
- Commercial catches have steadily declined since the 1980s, but catch rates have remained steady.
- Mortality estimates indicate that fishing mortality is similar to natural mortality in some estuaries, while harvests are very low in other estuaries.
- There is a combined recreational bag limit of 20 for all mullet species.

Catch

Recreational Catch of Goldspot Mullet

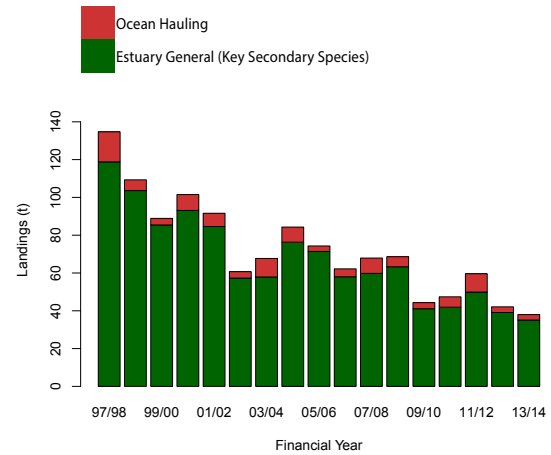
The most recent estimate of the recreational harvest of mullet (all species combined) in NSW was approximately 72,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 445,036 fish based on the results of the National Recreational and Indigenous Fishing Survey during 2000-01 (Henry and Lyle, 2003). The proportions of these totals that comprise Goldspot Mullet are unknown.

Historical Landings of Goldspot Mullet



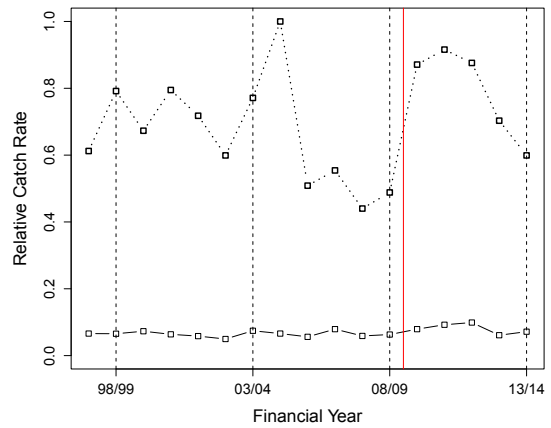
Commercial landings (including available historical records) of Goldspot Mullet for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Goldspot Mullet



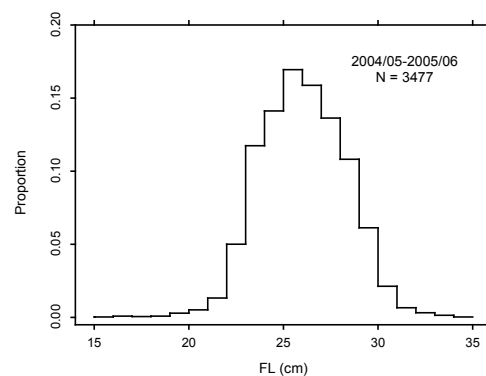
Landings of Goldspot Mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Goldspot Mullet Harvested by Mesh-Netting in NSW

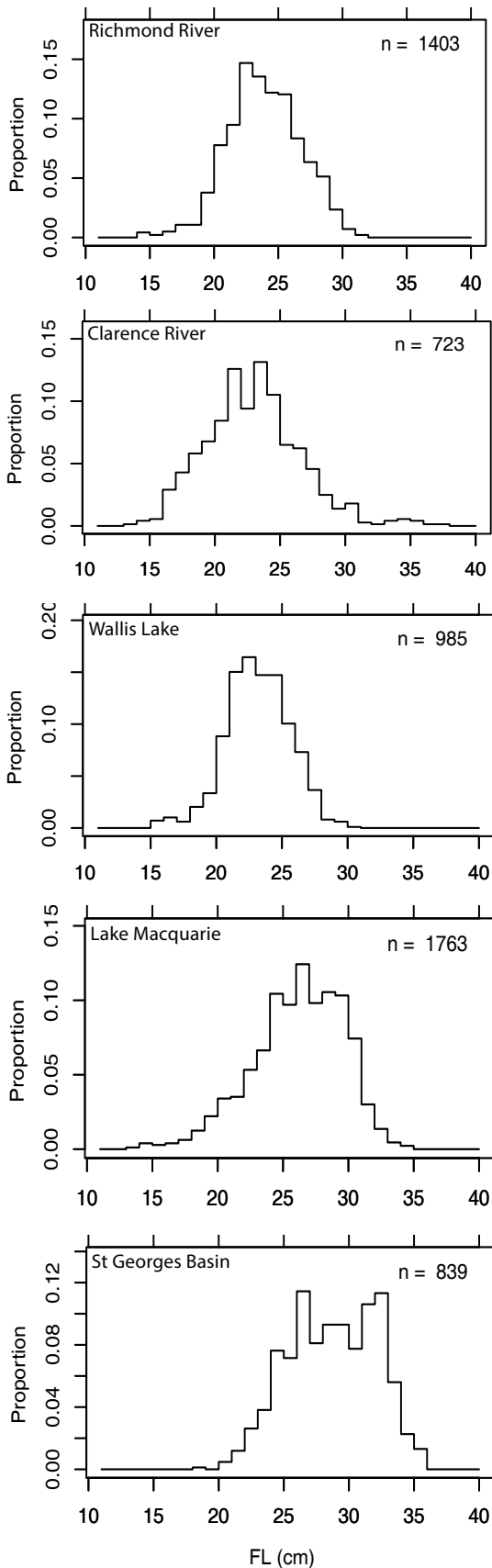


Catch rates of Goldspot Mullet harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Goldspot Mullet

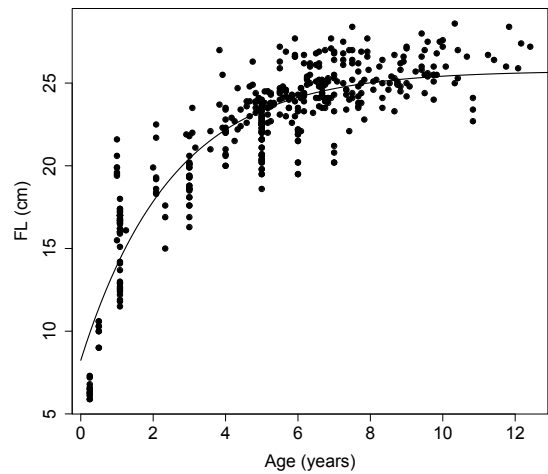


The length distribution of Goldspot Mullet landed by NSW commercial fishers shows a single mode, with the majority of fish being between 22-30 cm fork length (FL). There is no minimum legal length for Goldspot Mullet in NSW.



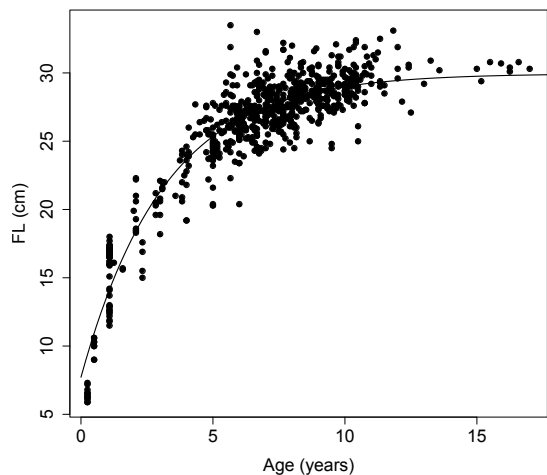
The length distributions of Goldspot Mullet caught by Fishery Independent surveys in the Richmond River, Clarence River, Wallis Lake, Lake Macquarie and St Georges Basin during 2008-11.

Growth Curve of Goldspot Mullet - Males



Age-length data with fitted growth curve for male Goldspot Mullet (Kendall, 2007). Lengths are presented as fork length (FL).

Growth Curve of Goldspot Mullet - Females



Age-length data with fitted growth curve for female Goldspot Mullet (Kendall, 2007). Lengths are presented as fork length (FL).

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Gould's Squid

(*Nototodarus gouldi*)

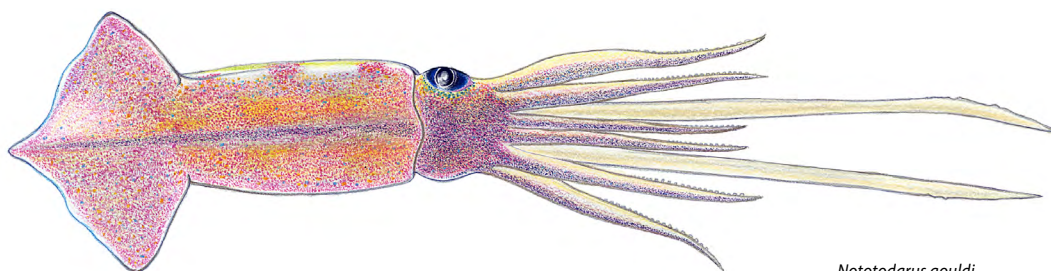
Author Karina Hall

EXPLOITATION STATUS	FULLY FISHED	
An annual stock that is likely to vary in abundance with environmental conditions. Relatively small catches are taken by ocean trawling in NSW waters. The main fishery is in Commonwealth waters and although not formally assessed, the stock is considered to be 'not overfished' due to relatively low recent annual landings.		
SCIENTIFIC NAME	COMMON NAME	COMMENT

Nototodarus gouldi

Gould's Squid

Also formerly known as Arrow Squid and Seine-boat Squid.



Nototodarus gouldi
Image © Bernard Yau

Background

Gould's Squid is distributed around southern Australia from southern Queensland to about Geraldton in WA, and also occurs around the northern half of New Zealand, where the species supports a large fishery (of about 10,000 t per year). Gould's Squid is found in depths ranging from shallow coastal bays to over 500 m on the upper continental slope, but it is most abundant between 50-400 m. Genetic studies suggest that a single stock of Gould's Squid occurs in southern Australian waters, with some suggestion of a separate stock in northern NSW waters. There is little evidence of large scale migration and spawning occurs across the species distribution.

Gould's Squid has a typical cephalopod life cycle, living for less than 1 year and breeding multiple times towards the end of its life. It displays highly variable growth rates and recruitment that are influenced by local environmental conditions. This can result in considerable inter-annual variation in population abundances. In southern Australian waters, most males are mature at 20-25 cm mantle length (ML) and females at around 30 cm ML. Males

attain maximum sizes of around 35 cm ML (1.2 kg) and females 40 cm ML (1.6 kg). North of Montague Island, Gould's Squid mature at smaller sizes than off southern Australia, and few are caught larger than about 25 cm ML.

Small quantities (typically less than 50 t per year) of Gould's Squid are landed by the NSW Ocean Trawl Fishery, mainly off the central coast. Annual landings have steadily declined since 1997/98 to historically low levels of just 5 t in 2013/14. The decline has mostly been in catches from the northern zones and across both trawl sectors. Meanwhile, catch rates have been relatively stable for both sectors, with only slight declines registered during the last 2 years for some indices.

Much larger quantities of Gould's Squid are taken from southern Australian waters by trawlers and squid jig vessels operating in the Commonwealth Southern Squid Jig Fishery and Trawl Sector as well as the Tasmanian Scalefish Fisheries. These fisheries land a combined catch of between 1,000-2,000 t per year. Although not formally assessed, the stock is not considered overfished because the current

levels of fishing effort are way below historical levels (for economic reasons). Gould’s Squid has relatively low market acceptance relative to other species, such as Southern Calamari (*Sepioteuthis australis*) and Loligo Squid (*Uroteuthis* spp.).

Gould’s Squid is occasionally caught by anglers fishing in deeper offshore waters, but are unlikely to be targeted. Given the small quantities of Gould’s Squid harvested in NSW waters relative to southern waters, the NSW status was changed to Fully Fished in 2013-14 in line with the cross-jurisdictional status of not overfished. Further population structure research is required to determine whether there is a separate northern NSW stock that requires separate assessment.

Additional Notes

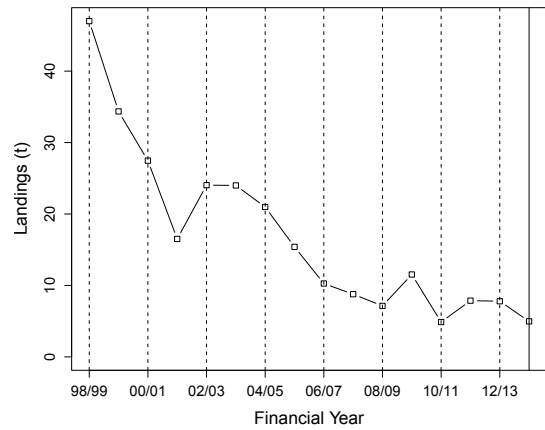
- The biological stock of Gould’s Squid was also assessed as a Sustainable stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- Gould’s Squid is a fast growing species, which lives for a maximum of about 1 year.
- Catches of Gould’s Squid in NSW waters are very small relative to the large amounts removed from southern waters by Commonwealth and Tasmanian fisheries.
- Gould’s Squid are sometimes discarded because of low market price.
- Since 1997/97, NSW landings have declined substantially, but catch rates have remained reasonably stable.
- There is a combined recreational bag limit of 20 squid and cuttlefish.

Catch

Recreational Catch of Gould’s Squid

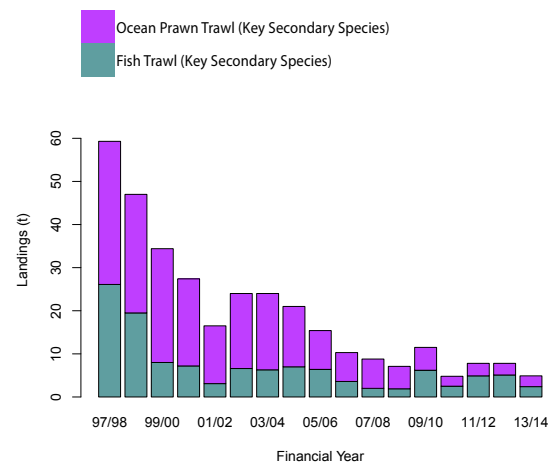
The annual recreational harvest of Gould’s Squid in NSW is considered to be minor.

Historical Landings of Gould’s Squid



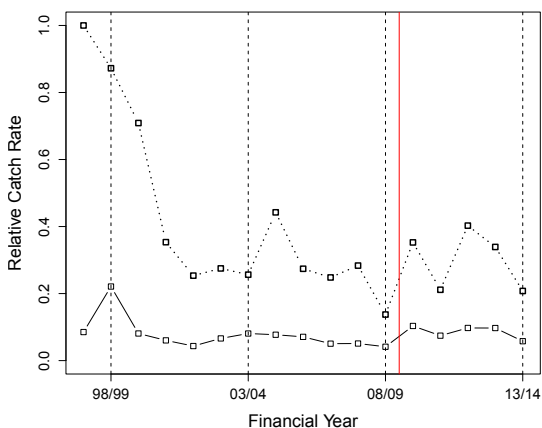
Commercial landings (including available historical records) of Gould’s Squid for NSW from 1998/99 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Gould’s Squid



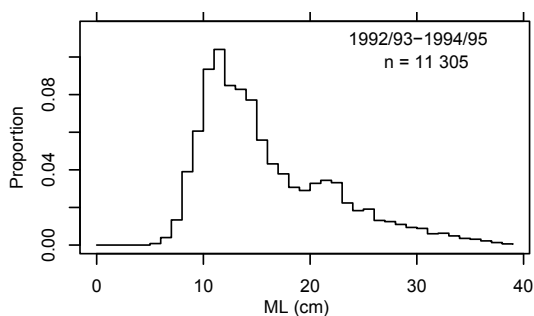
Reported landings of Gould’s Squid by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Gould's Squid Harvested by Fish Trawling in NSW



Catch rates of Gould's Squid harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Gould's Squid



The length distribution of Gould's Squid caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mainly of Gould's Squid between 10-30 cm mantle length (ML). In NSW there is no minimum legal length for squid.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 636004, common name or scientific name to find further information.



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Greentail Prawn

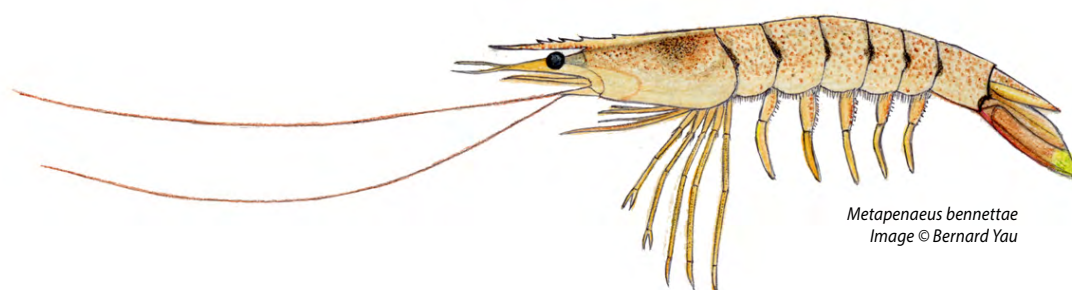
(*Metapenaeus bennettiae*)

Author Matthew Taylor

EXPLOITATION STATUS UNDEFINED

The species is similar to School Prawns, but lives entirely within estuarine waters. No detailed assessment of stock status has been made.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Metapenaeus bennettiae</i>	Greentail Prawn	Formerly known as the Greasyback Prawn.



Background

Previously known as Greasyback Prawn, the Greentail Prawn (*Metapenaeus bennettiae*) is found along eastern Australia between about Rockhampton in Queensland and the Gippsland Lakes in eastern Victoria. The Greentail Prawn is found in marine, estuarine and freshwater habitats. Juveniles have been found in rivers up to 35 km from the sea while larger juveniles are usually found in areas of the estuary nearer the coast in shallow mangrove areas. Adults are most common closer to the sea in coastal lakes, lagoons and shallow ocean waters out to depths of about 15 m, and generally moving out of the estuaries in times of flooding. They prefer mud substrates but are also found on sand. It is a relatively small prawn with females reaching a maximum length of ~13 cm; the average commercial size is less than 10 cm total length (TL) and around 8 g in weight.

Unlike other penaeid prawns which spawn offshore, the Greentail Prawn is able to complete its entire life cycle in shallow coastal lagoons. Both juveniles and adults are efficient osmoregulators which

helps explain this unusual life cycle. Juveniles move downstream towards the estuaries as they grow and mature, and breeding occurs in the marine environment of estuaries or shallow coastal waters. Sexual maturity is reached about one year after hatching, when the male is around 1.6 cm carapace length (CL; ~7.7 cm TL), and females 2 cm CL (~10 cm TL). Spawning occurs during spring and summer, with lunar phase and environmental variables such as salinity, turbidity and water temperature having a significant influence on reproductive development of the female Greentail Prawn in particular.

The main fishery for Greentail Prawn is in the Brisbane River and Moreton Bay in southern Queensland where it is a significant component of the 'bay prawn' catch of more than 500 t. In NSW, the annual Greentail Prawn catch has recently fluctuated between 20 and 50 t with most being landed during early summer (October to January). Almost all the catch is taken using seine nets by Estuary General fishers in the Wallis Lake-Hunter region, with small quantities taken in the Estuary Prawn Trawl Fishery.

Additional Notes

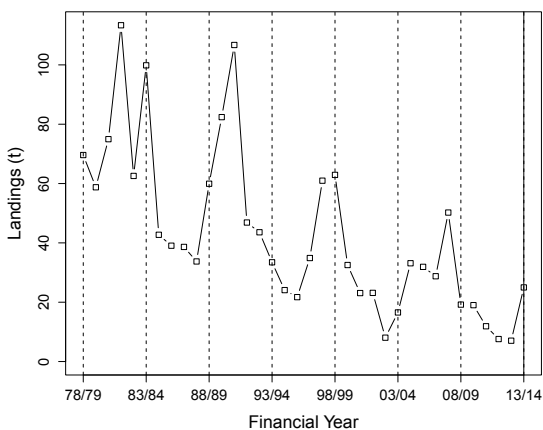
- Greentail Prawn is mainly taken by prawn seining in the Estuary General Fishery.
- The life history of this species is very similar to School Prawn, but Greentail Prawn does not generally move from the estuary to ocean waters.
- Commercial landings fluctuate between years, probably in association with rainfall. Catch rates for prawn seining have been stable to increasing in recent years.
- Effort on this species is likely to have been reduced as a result of the implementation of Recreational Fishing Havens.
- There is a combined recreational bag limit of 10 litres for all prawns.

Catch

Recreational Catch of Greentail Prawn

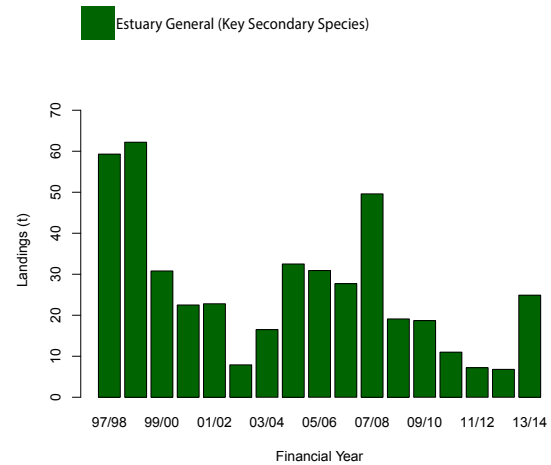
The most recent estimate of the recreational harvest of penaeid prawns (all species combined) in NSW was approximately 725,000 prawns during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Greentail Prawns in NSW was previously considered to be minor based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Greentail Prawn



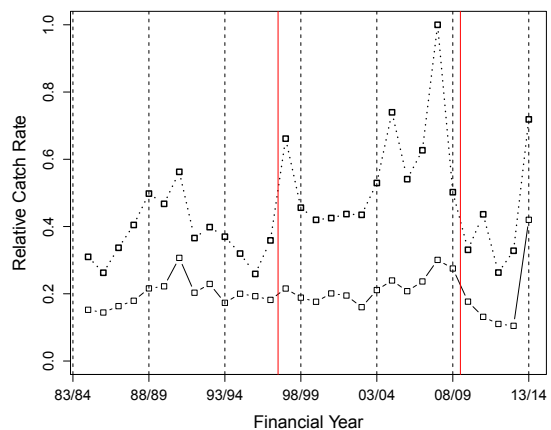
Commercial landings (including available historical records) of Greentail Prawn for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Greentail Prawn



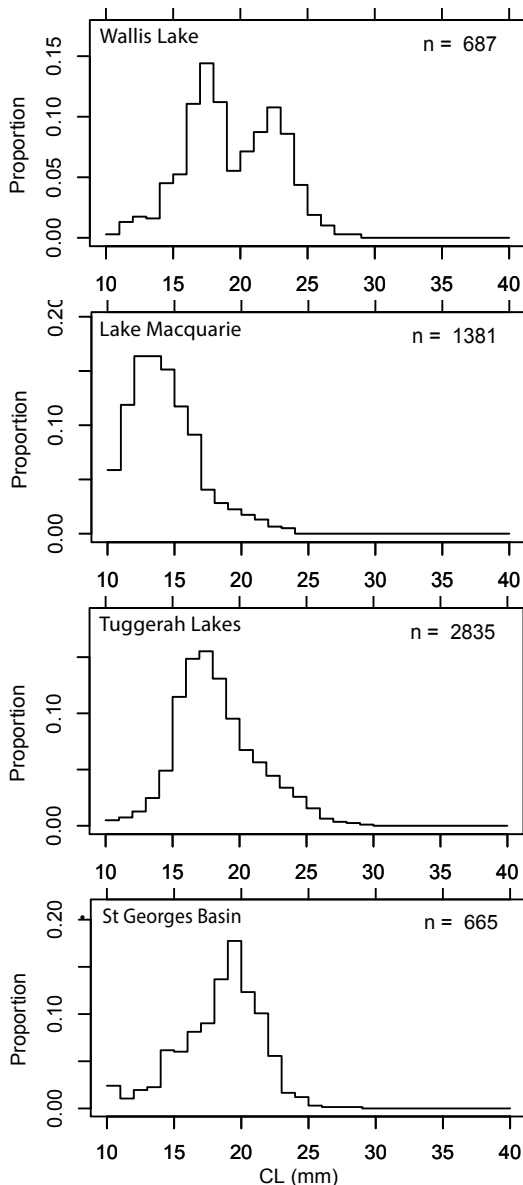
Reported landings of Greentail Prawn by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Greentail Prawn by Prawn Seining in NSW



Catch rates of Greentail Prawn harvested using prawn seining for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Greentail Prawns



The length distributions of Greentail Prawns caught by Fishery Independent surveys in Wallis Lake, Lake Macquarie, Tuggerah Lakes and St Georges Basin during 2008-11.

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Please visit the CSIRO website,
<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 71 1022, common name or scientific name to find further information.



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Grey Morwong

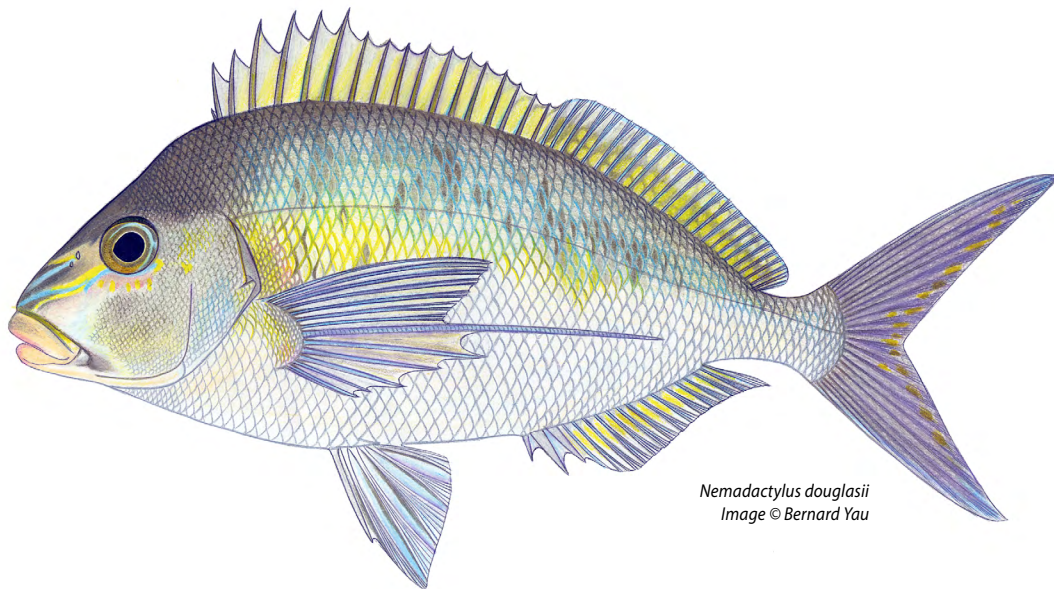
(*Nemadactylus douglasii*)

Author John Stewart

EXPLOITATION STATUS **OVERFISHED**

Long term declines are evident in both landings and catch rates, and the average size of harvested fish has also decreased substantially since the 1970s. The age composition of landings strongly suggests that fishing mortality has been greater than natural mortality.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Nemadactylus douglasii</i>	Grey Morwong	Formerly known as Rubberlip Morwong and Blue Morwong.



Background

Grey Morwong (*Nemadactylus douglasii*) are distributed along the south-eastern Australian coastline in continental shelf waters from Moreton Bay in Queensland to Wilsons' Promontory in Victoria. They can also be found along the east coast of Tasmania to Storm Bay and are also present around the north island of New Zealand, where they are known as 'porae'. The common name of this species in Australia has undergone a number of changes in the past, and it has variously been known as rubberlip, blue and Grey Morwong, and is often sold in retail outlets as 'deep sea bream'. Grey Morwong are demersal fish commonly caught near reefs at depths of 10-100 m. They feed predominantly on fish, crustaceans and invertebrates.

Grey Morwong mature at 22-25 cm fork length (FL) and spawning occurs between April and June. In common with other members of the family Cheilodactylidae, Grey Morwong have a pelagic 'paperfish' larval stage which may last for many months. After settlement to their demersal juvenile habitat, Grey Morwong reach 15 cm FL after one year and 20 cm FL after two years. Growth is variable, but on average males grow faster and attain larger sizes than females. The maximum length and weight of Grey Morwong is approximately 80 cm and 6 kg, but the majority of fish caught are between 25-35 cm FL in length and 250-500 g in weight. Current catches contain very few fish greater than 50 cm in length.

The Grey Morwong population off NSW is characterized by large fluctuations in recruitment strength from year to year. The oldest fish aged

to date was 22 years old, however it is likely the longevity of Grey Morwong is much greater than this.

In NSW, Grey Morwong are taken by trap fishers in the Ocean Trap and Line Fishery along the whole coast and by fish trawl south of Smokey Cape. A significant proportion of the total catch is taken by Commonwealth trawlers. Grey Morwong are an important catch for recreational fishers in ocean waters.

Additional Notes

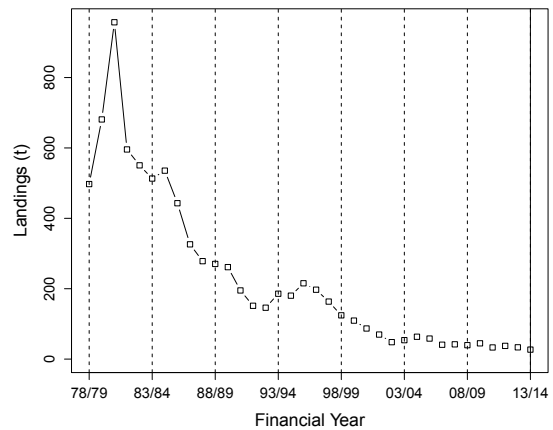
- Long term declines in the average sizes of landed fish indicates the stock is depleted.
- The size at maturity is below the current minimum legal length.
- The fishery is predominantly based upon age classes between 3 and 14 years old.
- The age composition in landings indicates variable recruitment.
- The life-history characteristics of Grey Morwong may make them susceptible to overfishing. These characteristics include relatively slow growth rates, an extended pelagic larval phase and complex social interactions.
- NSW commercial landings are at historically low levels.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 10 Grey Morwong.

Catch

Recreational Catch of Grey Morwong

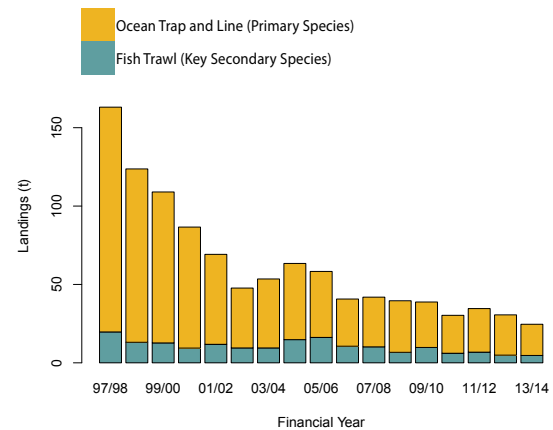
The most recent estimate of the recreational harvest of Grey Morwong in NSW was approximately 30,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 130,000 fish (in the order of 170 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Grey Morwong



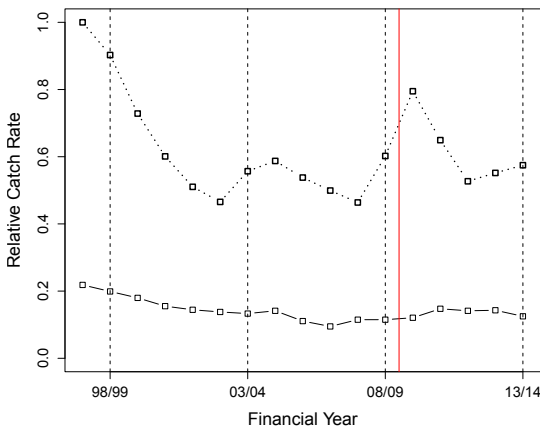
Commercial landings (including available historical records) of Grey Morwong for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Grey Morwong



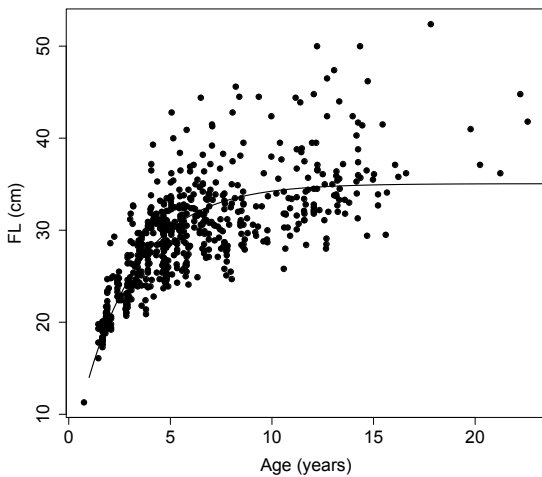
Reported landings of Grey Morwong by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Grey Morwong Harvested by Fish Trapping in NSW



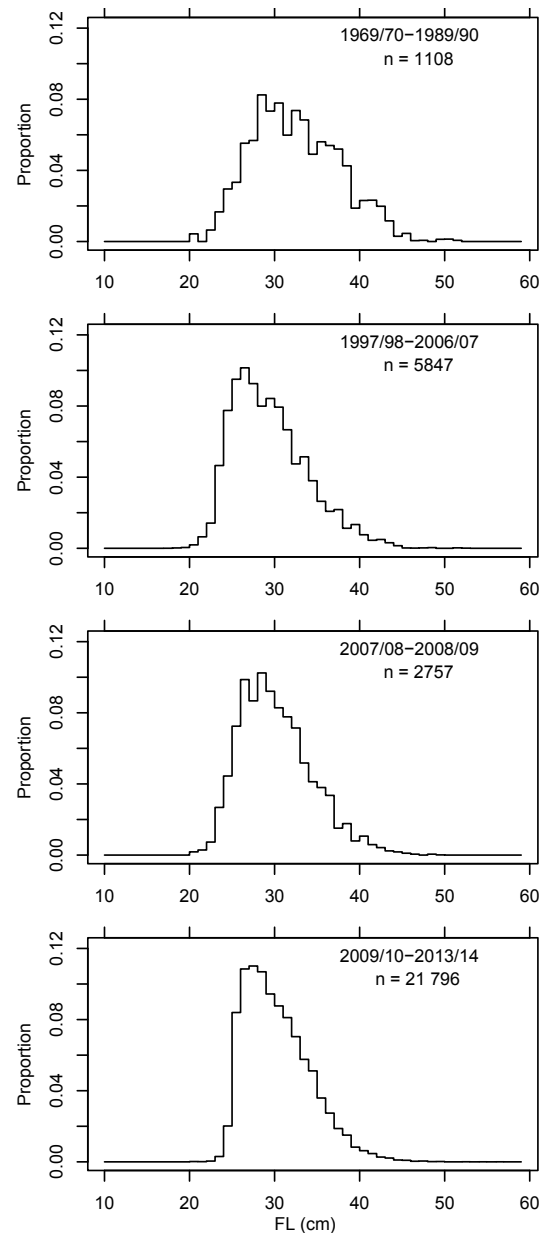
Catch rates of grey morwong harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Grey Morwong



Age-length data with fitted growth curve for Grey Morwong (Stewart and Hughes, 2008). Lengths are presented as fork length (FL).

Length Frequency of Grey Morwong



The proportion of larger (>40 cm fork length (FL)) Grey Morwong in commercial landings declined between the 1970s and the 1990s and recent landings have mainly comprised fish between 25-40 cm FL. The minimum legal length of Grey Morwong in NSW was increased from 28 to 30 cm total length in September 2007.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 377002, common name or scientific name to find further information.



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Gummy Shark

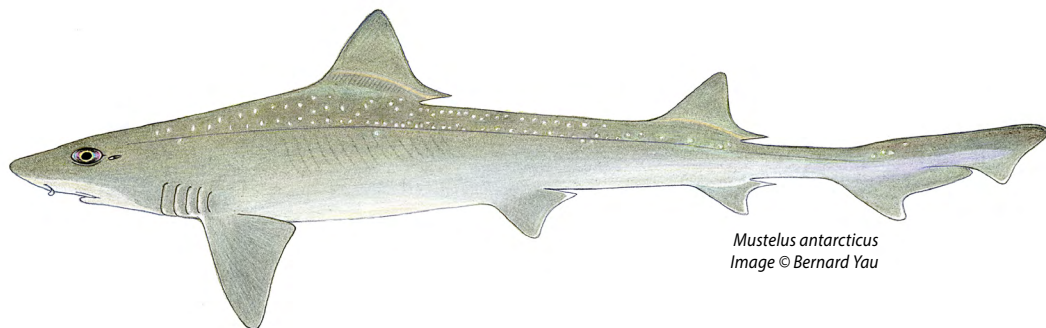
(*Mustelus antarcticus*)

Author Vic Peddemors

EXPLOITATION STATUS FULLY FISHED

Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment was adopted.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Mustelus antarcticus</i>	Gummy Shark	



Background

The Gummy Shark (*Mustelus antarcticus*) is widely distributed in Australian waters, ranging from northern NSW around the southern coast, (including Tasmania) to Geraldton in WA. Gummy Sharks are demersal and mainly found in continental shelf depths between 20-150 m; off NSW they have been recorded as deep as 450 m. Genetic and tagging studies determined that the NSW population was distinct from Gummy Sharks found along the southern Australian coast, although some overlap occurred off southern NSW.

Female Gummy Sharks in southern Australian waters grow to at least 185 cm total length (TL) and 25 kg in weight while males reach almost 150 cm and 15 kg. In contrast, Gummy Sharks off central and northern NSW rarely exceed 100 cm in length. The difference in the size structures of the two stocks is shown by their sizes at maturity. About 50% of Gummy Sharks off southern Australia are mature when they are 110-120 cm in length whereas the length at 50% maturity for NSW sharks is 65-70 cm TL.

Gummy Sharks are lecithotrophic viviparous in that the young develop internally from eggs. Large pregnant females have been found to carry as many as 57 pups but the smaller NSW females

mostly have between 5-10 young. The pups are born in early summer at a size of around 30-35 cm and, although gestation lasts 11-12 months, most females breed only once every two years.

The main fishery for gummy sharks is by the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) in Bass Strait and off SA where there is an annual allowable catch of about 1800 t. The NSW catch is mostly less than 50 t per year and is mainly taken on the south coast by the Ocean Trap and Line Fishery; the remainder is byproduct of the Ocean Trawl Fishery. Gummy shark production in the SESSF is closely monitored but the relatively small production off NSW has not warranted targeted research.

Additional Notes

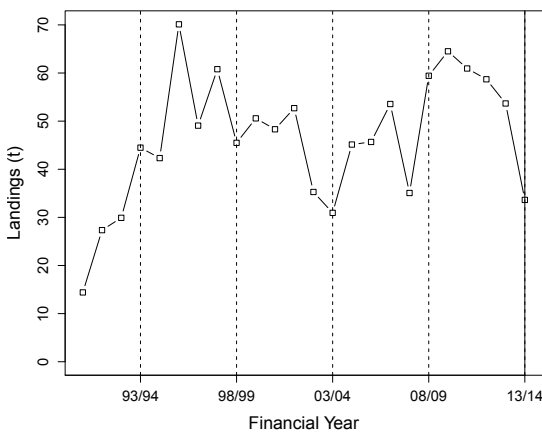
- The Commonwealth has completed extensive and detailed assessments of this species. The species is not considered overfished and there are no current concerns about the species in Australian waters.
- Relatively easily identified by commercial fishers.
- NSW commercial landings are relatively stable at 30 to 50 t per annum. Most (~90%) of the NSW catch is harvested south of Jervis Bay.

Catch

Recreational Catch of Gummy Shark

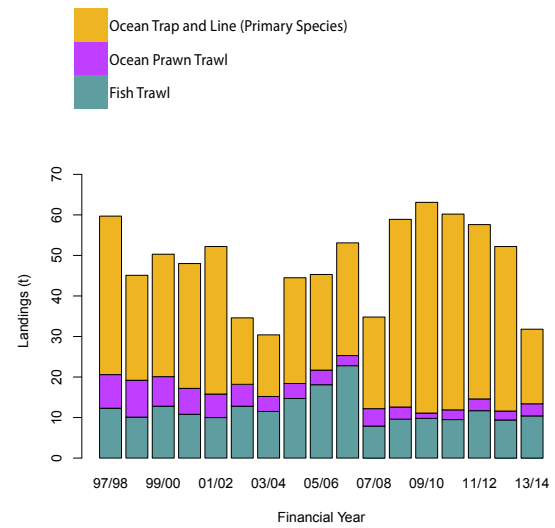
The most recent estimate of the recreational harvest of Gummy Shark in NSW was approximately 1000 fish during 2013/14 (West *et al.*, 2015).

Historical Landings of Gummy Shark



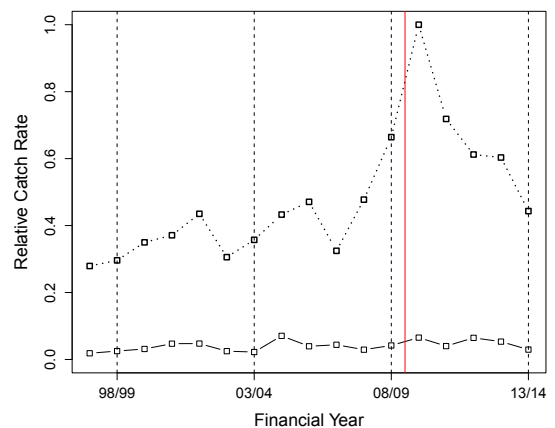
Commercial landings (including available historical records) of Gummy Shark for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Gummy Shark



Reported landings of Gummy Shark by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Gummy Shark Harvested by All Line Fishing Methods in NSW



Catch rates of Gummy Shark harvested using all line fishing methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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- Flood, M., I. Stobutzki, J. Andrews, C. Ashby, G. Begg, R. Fletcher, C. Gardner, L. Georgeson, S. Hansen, K. Hartmann, P. Hone, P. Horvat, L. Maloney, B. McDonald, A. Moore, A. Roelofs, K. Sainsbury, T. Saunders, T. Smith, C. Stewardson, J. Stewart and B. Wise (eds) (2014). Status of Key Australian Fish Stocks Reports 2014, Fisheries Research and Development Corporation, Canberra.
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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 017001, common name or scientific name to find further information.

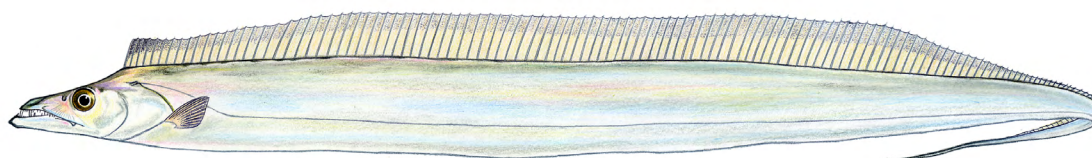


Hairtail and Frostfish

(Trichiuridae)

Author John Stewart

EXPLOITATION STATUS		UNDEFINED
No local biological information is available for either species in this group. The relatively small commercial and recreational fisheries in NSW are not well understood which has resulted in a status of Undefined.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Trichiurus lepturus</i>	Largehead Hairtail	
<i>Lepidopus caudatus</i>	Frostfish	



Trichiurus lepturus
Image © Bernard Yau

Background

The Largehead Hairtail (*Trichiurus lepturus*) belongs to the family Trichiuridae which, worldwide, includes nine genera and about 30 species generally referred to as cutlassfishes or scabbardfishes. Off NSW, at least four species of trichiurids are found in deepwater, but the most well-known member of the family to most people is the hairtail, found in shallow coastal waters and estuaries.

A cosmopolitan species, the Largehead Hairtail is subject to significant fisheries off many Asian countries, particularly China and Korea. The world catch reportedly exceeds 1.5 million t annually. In eastern Australia, hairtail occasionally school in coastal bays and estuaries where they may be targeted by commercial fishers but in most years only a small incidental catch is taken by line or trawl. However, hairtail are important to NSW recreational anglers, particularly in the Hawkesbury River system.

The Largehead Hairtail prefers shallow coastal waters, with muddy substrates, and locally is known to frequent coastal embayments such as Broken Bay to the north of Sydney. It is uniformly silver with a long, ribbon-shaped body ending in a thin whip-like tail. Its body has no scales and its teeth are sharp and prominent. The hairtail is commonly around 100 cm in length and about 2 kg

in weight but reaches a maximum length of about 220 cm and weight of 3.5 kg.

Overseas studies have observed that adults feed at the surface during the day, and retreat to deeper waters at night. In contrast, juveniles and small adults tend to feed at night at the surface, and aggregate into schools at depths during the day. The adult hairtail diet consists mainly of fish with occasional squid and crustaceans, whereas juveniles mainly feed on planktonic crustaceans, euphausiids and small fish.

Reported landings in NSW generally range between 10-25 t with catches greatest during March-May. Production has mostly been from the Estuary General Fishery, taken mainly by handline. The Fish Trawl and Ocean Trap and Line fisheries also land hairtail at times. Recent annual landings have increased slightly at between 15 and 20 t.

The Frostfish or ribbonfish (*Lepidopus caudatus*) is a closely related species caught by trawlers operating in deep water off NSW. It is a large fish reaching about 200 cm in length and weighing 3 kg and, although similar in appearance to the hairtail, can be distinguished by its small caudal fin (tail). The Frostfish migrates from the south along the NSW upper slope (300-600 m depth) during early winter on a spawning run and is occasionally trawled in very large numbers (individual catches can exceed 10 t). However, because of low market acceptance,

significant quantities of frostfish are discarded at sea and only small quantities are marketed.

Additional Notes

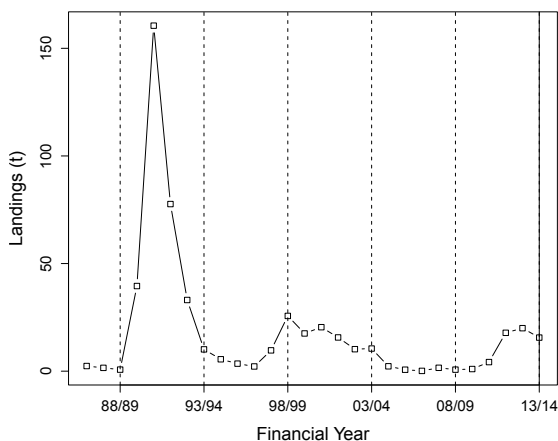
- Annual commercial landings of Largehead Hairtail spiked in the early 1990s and have been low and variable since.
- An important recreational species, it is a specialised fishery in winter.
- Caught in deep estuaries and offshore.
- Movements into estuaries are sporadic.
- NSW is at the southern end of their distribution. Note that catches in NSW are minor at a global scale.
- Recent research from Korea has described growth and size at maturity.
- Southern Frostfish, *Lepidopus caudatus*, is caught by trawling in deepwater, and a large proportion of the catch is discarded due to poor market acceptance.
- In NSW there is a recreational bag limit of 10 hairtail.

Catch

Recreational Catch of Hairtail

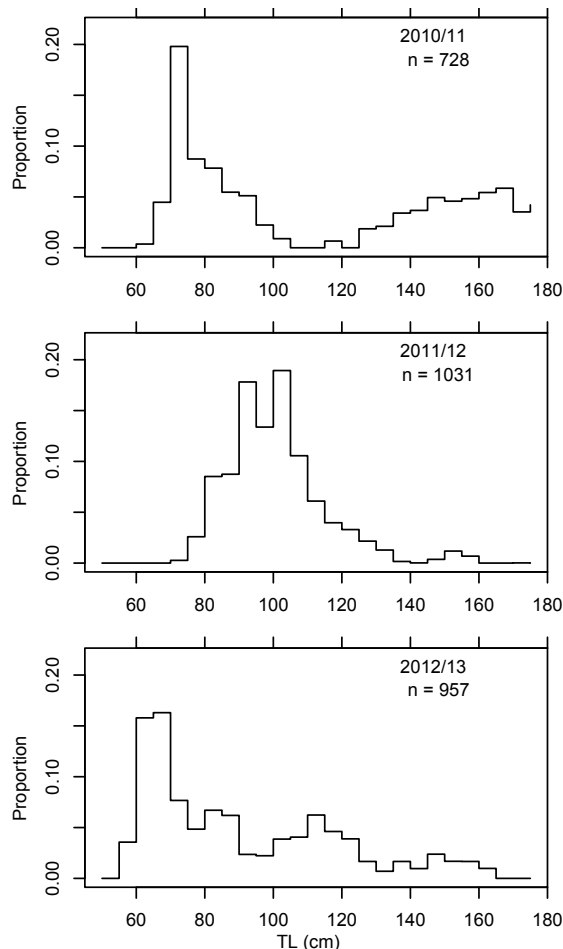
The annual recreational harvest of hairtail in NSW is variable and is considered to be minor.

Historical Landings of Hairtail



Commercial landings (including available historical records) of hairtail for NSW from 1987/88 to 2013/14 for all fishing methods.

Length Frequency of Hairtail



The length distribution of Largehead Hairtail landed by NSW commercial fishers comprises mainly fish between 60-180 cm total length (TL). The length distribution varies between years and may exhibit several modes. There is no minimum legal length for hairtail in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 440004 and 37 440002, common name or scientific name to find further information.



Hammerhead Sharks

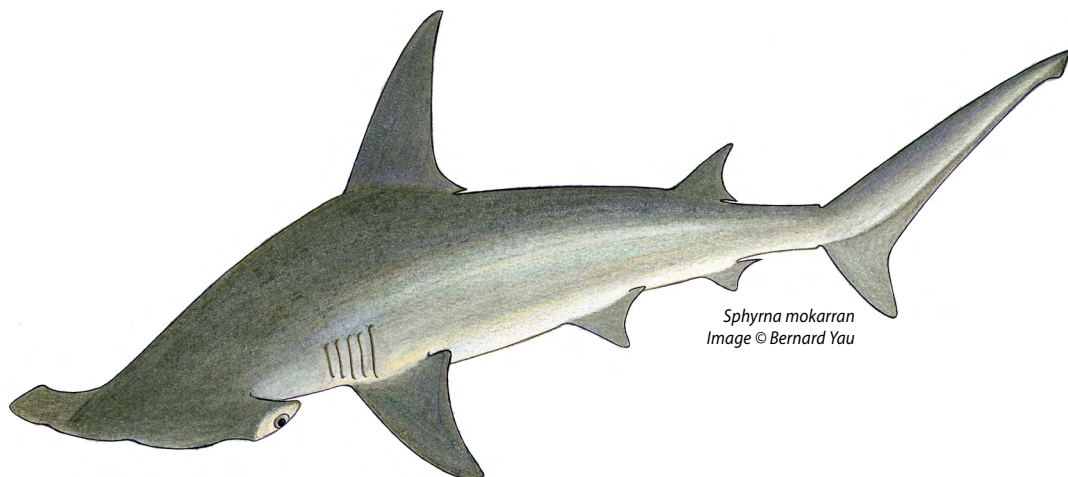
(*Sphyrna* spp.)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

Two species (Great and Scalloped Hammerhead) were recently protected from fishing in NSW and little information is available to specify the exploitation status of the third species (Smooth Hammerhead).

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sphyrna zygaena</i>	Smooth Hammerhead	
<i>Sphyrna lewini</i>	Scalloped Hammerhead	
<i>Sphyrna mokarran</i>	Great Hammerhead	



Background

Three species of hammerhead sharks are found in NSW waters, the Smooth Hammerhead (*Sphyrna zygaena*), Scalloped Hammerhead (*S. lewini*) and Great Hammerhead (*S. mokarran*). The Smooth Hammerhead occurs south from Coffs Harbour, and is the most abundant of the three species in NSW waters. It occurs over the continental shelf, from the surface to at least 60 m depth.

Smooth Hammerheads attain a maximum length of 350 cm, with males maturing at about 250 cm, and females at about 265 cm. It is likely that hammerhead sharks have at least a 2 year breeding cycle. All hammerheads give birth to free-swimming live young. Smooth Hammerheads have 20-50 pups per litter, after a 10-11 month gestation. As the name suggests, Smooth Hammerheads have a very smooth, curved, leading profile to their hammer.

The Australian distribution of the Scalloped Hammerhead covers all northern waters, extending south to ~34°S latitude on each coast (Sydney to Geographe Bay). Adult Scalloped Hammerheads inhabit deep waters adjacent to continental and insular shelves, in water depths ranging from the surface to at least 275 m. Juveniles are often found close inshore, often in large migratory schools. Adult females are rarely caught inshore. Scalloped Hammerheads produce litters of 13-41 pups after a 9-10 month gestation. Pupping takes place between October and January in Australia.

The Great Hammerhead inhabits tropical and warm temperate waters. It is found on the continental shelf north of Sydney, from inshore to at least 80 m depth. It can grow to a length of 600 cm, though rarely more than 450 cm. Males mature at about 225 cm and females at about 210 cm. Litters of 6-33 pups are produced in summer in northern Australia. The Great Hammerhead is distinguished by a very tall first dorsal fin, a large 2nd dorsal fin

and a non-curved leading edge to their hammer.

The abundances of Great and Scalloped Hammerhead have declined substantially in NSW and both species face a high risk of extinction in the region. Consequently, both species were protected from harvest in 2012 under the *NSW Fisheries Management Act 1994*. The Smooth Hammerhead is not protected and may still be harvested, subject to the restrictions of specific fisheries.

Historically, the Scalloped Hammerhead and the Smooth Hammerhead comprised the majority of NSW commercial and recreational catches. Total commercial hammerhead catch peaked in 1993/94 at 15.7 t. Annual commercial catches have averaged approximately 2.5 t in the last 5 years. Most hammerhead landings come from the Ocean Trap and Line Fishery, with smaller landings by the Ocean Trawl Fishery and occasionally by the Estuary General Fishery. Between the 1970s and 2001, the total catch of hammerhead sharks by recreational gamefishing and protective beach meshing remained at about 250 sharks per year. It was estimated that over 95% of the recreational gamefishing catches are tagged and released alive.

Additional Notes

- This subgroup of pelagic sharks is readily identifiable by all stakeholders - the three species can be differentiated by their teeth and a notch in the middle of the head, but correct identification to species level by fishers may be problematic.
- Hammerhead sharks are a key secondary species in the Ocean Trap and Line Fishery. Reported landings have generally been less than 10 t in recent years.
- There is a recreational bag limit of one Smooth Hammerhead in NSW. Scalloped and Great Hammerheads are protected and must be released without harm.
- Further information on recreational fishing rules for hammerheads, as well as a species identification guide, can be found at <http://www.dpi.nsw.gov.au/fisheries/species-protection/hammerhead-guide-for-fishers>.

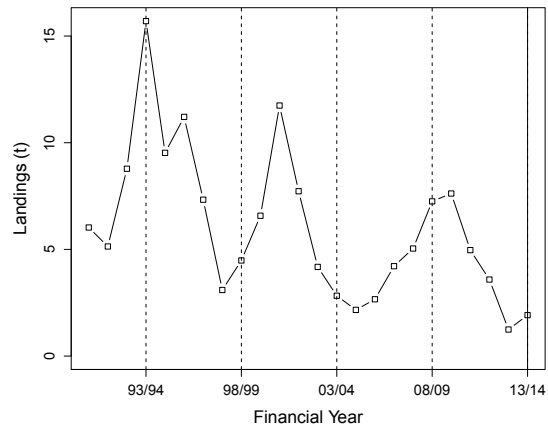
Catch

Recreational Catch of Hammerhead Sharks

The recreational harvest of Smooth Hammerhead in NSW is considered to be minor. The annual recreational harvest of hammerhead sharks (all species combined) was previously estimated to

lie between 10-50 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Hammerhead Sharks



Commercial landings (including available historical records) of Hammerhead Sharks for NSW from 1990/91 to 2013/14 for all fishing methods.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 019004, 37 019001 and 37 019002, common name or scientific name to find further information.



Hapuku

(*Polyprion oxygeneios*)

Author Rowan Chick

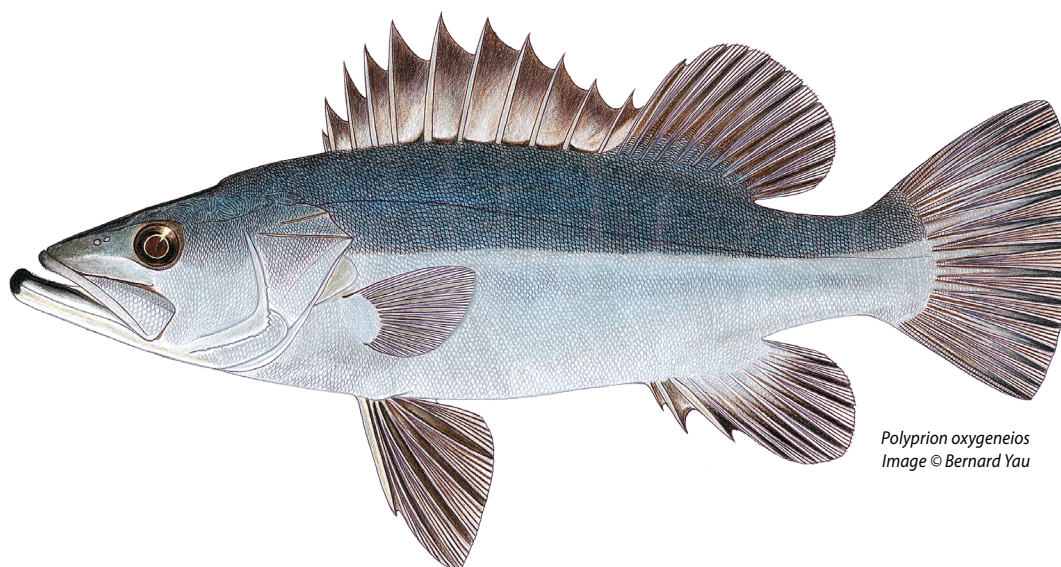
EXPLOITATION STATUS UNDEFINED

No detailed stock assessment available. NSW landings of this species are very small compared to landings by New Zealand and Australian Commonwealth fisheries.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Polyprion oxygeneios

Hapuku



Polyprion oxygeneios
Image © Bernard Yau

Background

The Hapuku or New Zealand Groper (*Polyprion oxygeneios*) is a circum-global temperate species inhabiting waters around New Zealand, the southern half of Australia, southern Chile and a number of Southern Ocean islands. Small juvenile Hapuku have a pelagic stage when they are associated with flotsam in surface waters and are rarely captured. At about 50 cm in length and (estimated) 3-4 years of age, they become demersal in habit. In New Zealand waters, they can be found in depths as shallow as 20 m but around Australia they mainly prefer continental slope depths of 200-500 m. Hapuku are large, long-lived fish with reports of specimens almost 180 cm in length and 80 kg in weight, and living longer than 60 years. New Zealand studies of Hapuku found them to

mature over a wide size range, with 50% maturity at 80-85 cm for males and 85-90 cm for females, corresponding to 10-13 years of age.

Hapuku are caught in small numbers along the entire NSW coast. Some are caught by trawlers but most are taken by deepwater dropliners in the Ocean Trap and Line Fishery when targeting Blue-eye Trevalla. Since 1997/98, Hapuku catches have been recorded separately from the similar Bass Groper (*P. americanus*), and annual catches have been <10 t over the last decade, and since 2012/13 annual catches have been about 2 t. This small catch contrasts with the New Zealand catch (combined for the two species of *Polyprion*) of more than 2 000 t per year.

Additional Notes

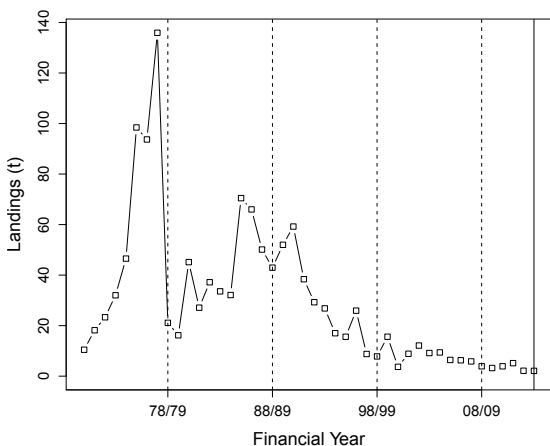
- A deepwater demersal species with a prolonged pelagic phase that lasts 2-3 years (juveniles up to about 50 cm are found near the surface).
- Landings in NSW are small (<10 t) compared with landings from Commonwealth fisheries and New Zealand.
- Commonwealth fisheries harvest this species, but catches are not managed by quota, and no stock assessment is available.
- There is a combined recreational bag limit of 5 Hapuku, Banded Rockcod, Bass Groper, Gemfish and Blue-eye Trevalla. Additional restrictions apply to Gemfish.

Catch

Recreational Catch of Hapuku

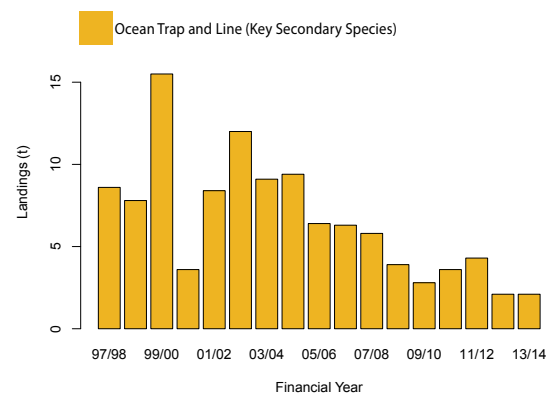
The annual recreational harvest of Hapuku in NSW is considered to be minor.

Historical Landings of Hapuku



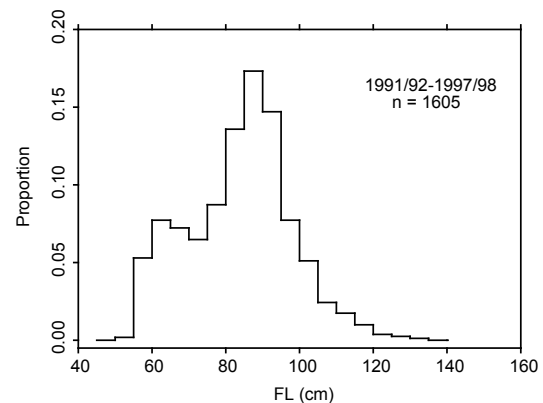
Commercial landings (including available historical records) of Hapuku for NSW from 1997/98 to 2013/14 for all fishing methods. Prior to 1997/98 Bass Groper were mainly reported in 'mixed' catches with Hapuku.

Landings by Commercial Fishery of Hapuku



Reported landings of Hapuku by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Hapuku



The length distribution of Hapuku landed by NSW commercial fishers during the 1990s comprised fish between 55-130 cm fork length (FL), with the majority of fish being between 80-100 cm FL. There are no recent length data for Hapuku, which does not have a minimum legal length.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 31 1006, common name or scientific name to find further information.



Jackass Morwong

(*Nemadactylus macropterus*)

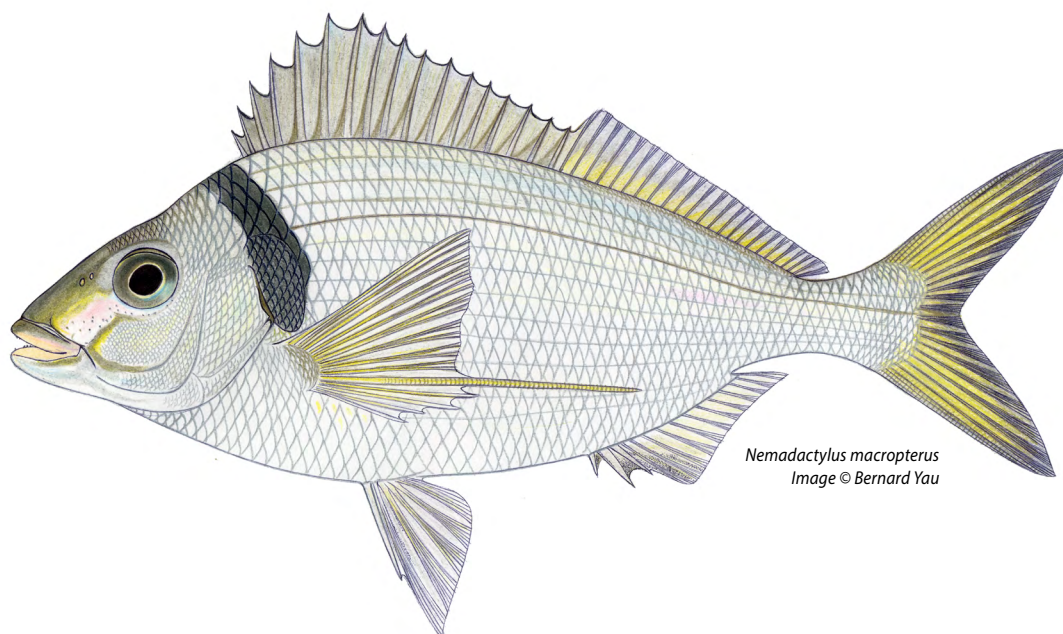
Author Rowan Chick

EXPLOITATION STATUS FULLY FISHED

The commercial harvest is predominantly by trawlers in the Commonwealth Southern and Eastern Scalefish and Shark Fishery. Commonwealth tier 1 assessment and resultant status for the eastern Jackass Morwong stock has been adopted. The assessment classifies Jackass Morwong as not overfished and not subject to overfishing.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Nemadactylus macropterus</i>	Jackass Morwong	
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Background

The worldwide distribution of Jackass Morwong (*Nemadactylus macropterus*) includes waters of New Zealand, southern South America, southern Africa and some islands in the Atlantic and Indian oceans. Jackass Morwong are distributed in Australian waters from Moreton Bay in Queensland to Perth in WA. They occur in depths to 450 m and, in Australian waters, are most abundant between 100 and 200 m.

Jackass Morwong have a summer-autumn spawning period with larger, older females being more fecund. They have an extended pelagic post-larval stage known as a 'paperfish', which can be distributed up to 250 km offshore. After settlement they are demersal fish with juveniles inhabiting the shallow reefs of Bass Strait and Tasmania.

Sampling of Jackass Morwong along the southern and eastern shelf region of Tasmania showed that

newly settled juveniles were about 10-13 cm fork length (FL). Maximum lengths observed were 43 cm FL for males and 46 cm FL for females. Growth of juveniles is rapid with fish attaining a size of about 26 cm at 3 years of age. After fish reach sexual maturity at 4-5 years of age, growth slows. A maximum age of 30 years for females and 41 years for males was recorded in this Tasmanian study, however few fish were older than 25 years.

From the 1950s to the 1970s annual landings of Jackass Morwong frequently exceeded 1500 t. There was a consistent decline in landings through the 1980s and 1990s, and by 2000 total annual landings were about 800 t, of which about 50 t were caught off NSW. More recently catches of Jackass Morwong have declined. In 2013/14 the reported catch of Jackass Morwong in Commonwealth waters was 215 t, with NSW annual catches having declined to <5 t. Most Jackass Morwong are caught by trawlers in the

Commonwealth South East Fishery. In NSW, recent catches are commonly reported from the Ocean Trap and Line Fishery, with substantial historical landings reported in the Trawl Fishery. The Commonwealth has developed a quantitative stock assessment, which considers stocks east and west of Bass Strait separately. In the most recent (2013) assessment, spawning biomass of eastern stocks was estimated to be about 40% of previously unexploited levels, and the stock was considered not overfished and not subject to overfishing. Previous assessments of these stocks were more pessimistic with regard to their status. This was due to differences in the assumptions used to model these populations. The current assessment includes a change to productivity in the eastern population before and after 1988.

Additional Notes

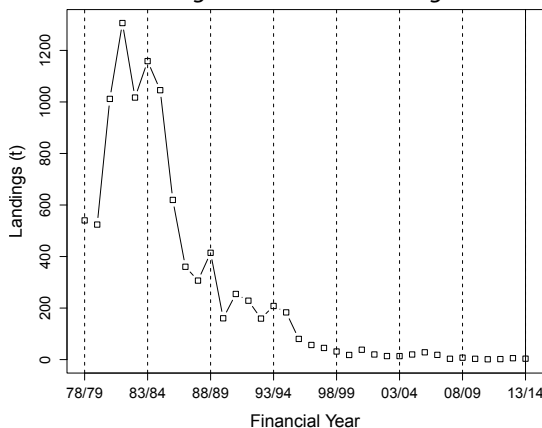
- Small quantities are caught by trap fishers in southern NSW waters.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 10 for Jackass Morwong in NSW.

Catch

Recreational Catch of Jackass Morwong

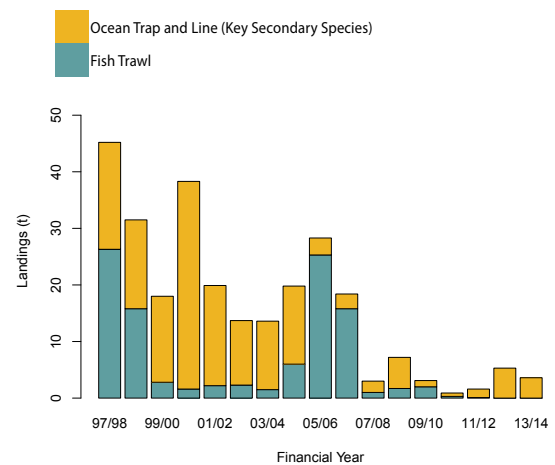
The annual recreational harvest of Jackass Morwong in NSW is considered to be minor. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI Fisheries.

Historical Landings of Jackass Morwong



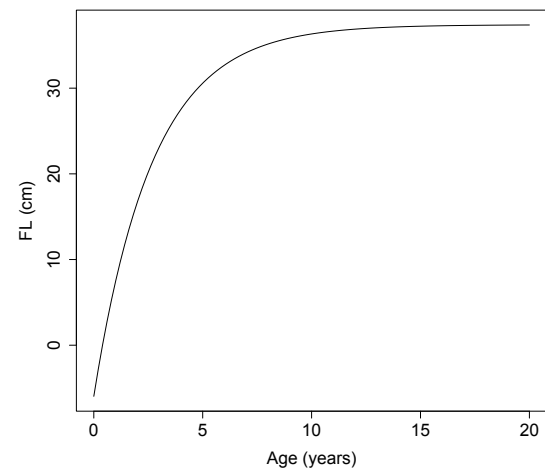
Commercial landings (including available historical records) of Jackass Morwong for NSW from 1978/79 to 2013/14 for all fishing methods. Note that the small decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Jackass Morwong



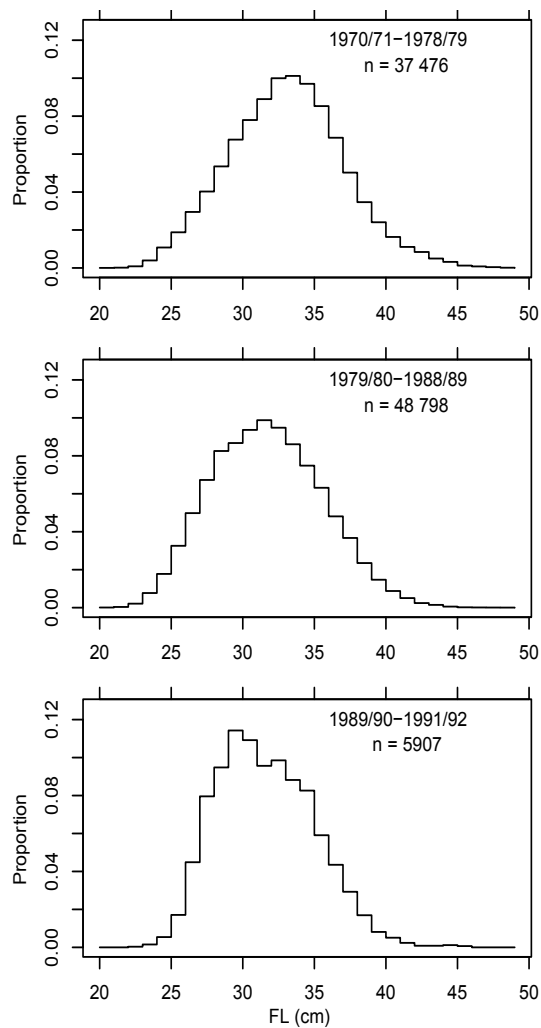
Reported landings of Jackass Morwong by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Jackass Morwong



Growth curve of Jackass Morwong using parameters from Jordan (2001). Lengths are presented as fork length (FL).

Length Frequency of Jackass Morwong



The length distribution of Jackass Morwong landed by NSW commercial fishers between 1970 and 1992 remained reasonably stable and comprised mainly fish between 25-40 cm fork length (FL). No recent length composition data are available for NSW catches. The minimum legal length for Jackass Morwong in NSW is 30 cm total length.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 377003, common name or scientific name to find further information.



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

John Dory

(*Zeus faber*)

Author Rowan Chick

EXPLOITATION STATUS FULLY FISHED

Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment has been adapted for NSW. The 2013/14 Commonwealth assessment of John Dory was that stocks are not overfished and not subject to overfishing.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Zeus faber</i>	John Dory	



Background

John Dory (*Zeus faber*) has a very wide distribution through temperate waters of most of the world's oceans. Stock structure within this range is unclear. John Dory occur from close inshore (including deeper estuarine waters) to a depth of about 400 m.

Reported catches of John Dory in the NSW Ocean Trawl Fishery have fluctuated between about 15 and 40 t per annum since the late 1990s, with small catches reported as by-product in the Ocean Prawn Trawl Fishery. John Dory are taken by trawl fisheries in adjacent jurisdictions, most notably in the Commonwealth-managed trawl fisheries, where

they are subject to a Total Allowable Catch. Annual Commonwealth catches have been below 200 t since 2000.

The biology and life history of John Dory are poorly documented. Spawning takes place off NSW in late summer and autumn at depths of 50 to 100 m, but fecundity has not been estimated. Ageing studies suggest John Dory have a reasonably fast growth rate, maturing at 3 to 5 years of age (25–30 cm in length) and reaching an age of about 12 years at a length of 50 cm. However, they have been reported to grow to 70 cm in length and in excess of 3 kg in weight, so the maximum age is probably greater than 12 years.

Commonwealth stock assessments of John Dory are complicated by the fact that they are caught as by-product within the trawl fishery, and therefore classified as a secondary species, subject to Tier 3 (catch-curve) or Tier 4 (CPUE) assessments. The current Commonwealth assessment of John Dory determines the stock is not overfished (based on recent average CPUE levels, despite the Tier 4 assessment indicating 2013 standardised CPUE being below the limit reference point) and not subject to overfishing (based on 2011 Tier 3 assessment, indicating fishing mortality rates are well below natural mortality rates).

Additional Notes

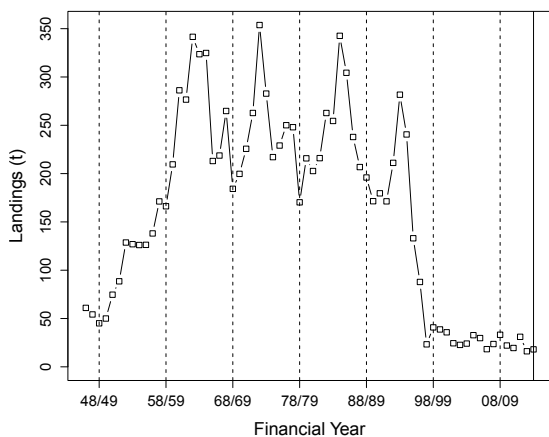
- John Dory have a worldwide distribution, stock structure is not known. They are taken incidentally by trawl fishing in continental shelf waters, and in small quantities by recreational fishers.
- Available length frequency data show no trends since the 1970s.
- Research indicates John Dory live to a maximum of about 15 years and mature at about 3-5 years of age.

Catch

Recreational Catch of John Dory

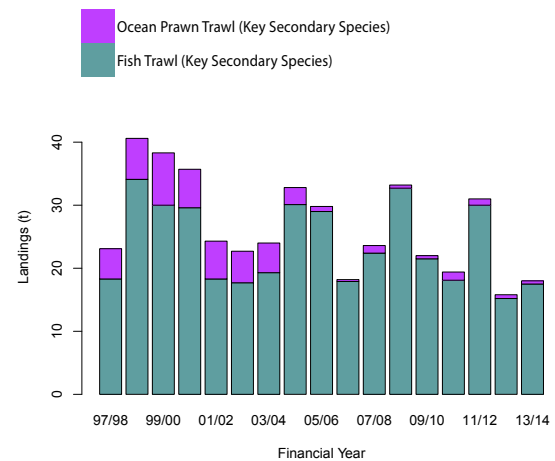
The annual recreational harvest of John Dory in NSW is considered to be minor. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI.

Historical Landings of John Dory



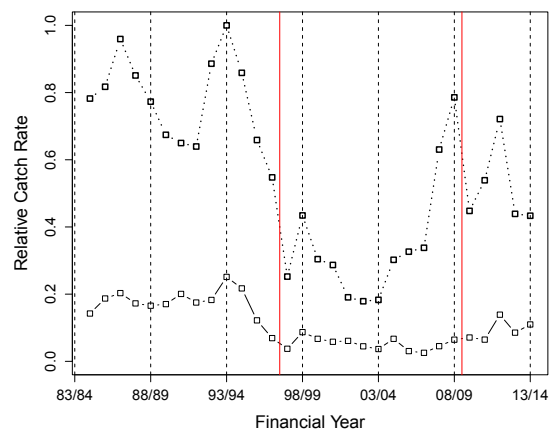
Commercial landings (including available historical records) of John Dory for NSW from 1946/47 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of John Dory



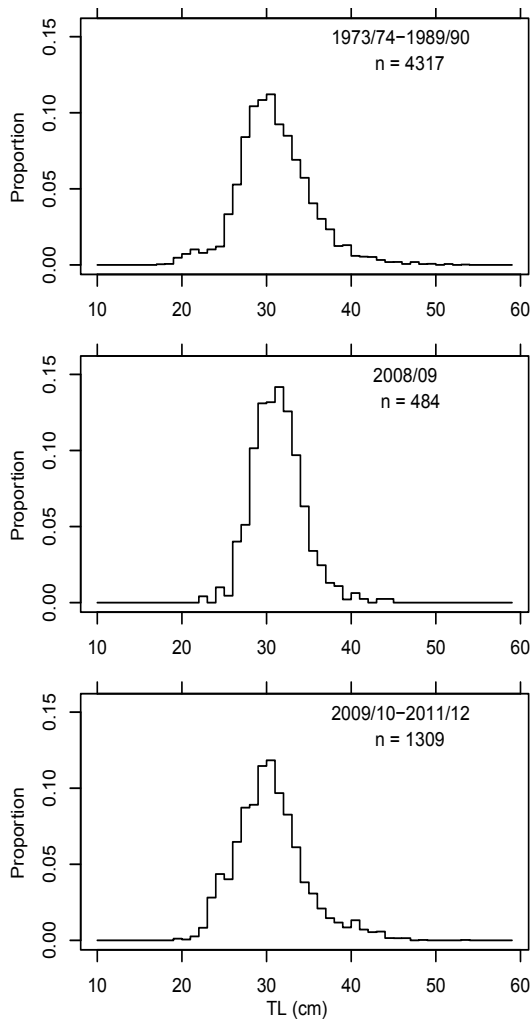
Reported landings of John Dory by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of John Dory Harvested by Fish Trawling in NSW



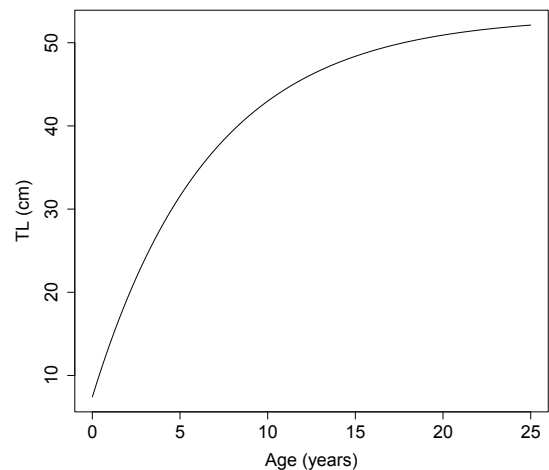
Catch rates of John Dory harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of John Dory



The length distribution of John Dory landed by NSW commercial fishers has been stable since the 1960s, and is comprised mainly of fish between 20-40 cm total length (TL). There is no minimum legal length for John Dory in NSW.

Growth Curve of John Dory



Growth curve of John Dory using parameters from Smith and Stewart (1994). Lengths are presented as total length (TL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 264004, common name or scientific name to find further information.



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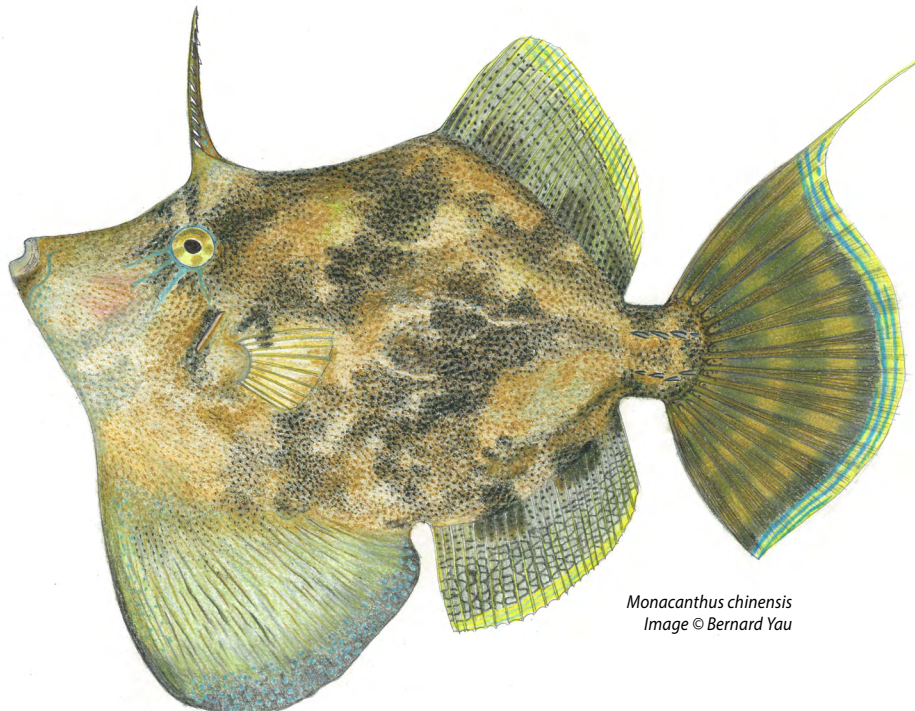
Leatherjackets - other (Monacanthidae)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Very little local biological information is available for Sixspine and Estuary (Rough/Fanbelly) Leatherjackets in this species complex. This lack of information and the small commercial fishery for these species has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Monacanthus chinensis</i>	Fanbelly Leatherjacket	reported as Estuary/Fanbelly Leatherjacket
<i>Meuschenia freycineti</i>	Sixspine Leatherjacket	reported as Sixspine (Reef) Leatherjacket
<i>Eubalichthys mosaicus</i>	Mosaic Leatherjacket	reported as Leatherjackets (other)
<i>Meuschenia scaber</i>	Velvet Leatherjacket	reported as Leatherjackets (other)
<i>Aluterus monoceros</i>	Unicorn Leatherjacket	reported as Leatherjackets (other)
<i>Eubalichthys bucephalus</i>	Black reef Leatherjacket	reported as Leatherjackets (other)
<i>Meuschenia trachylepis</i>	Yellowfin Leatherjacket	reported as Leatherjackets (other)



Monacanthus chinensis
Image © Bernard Yau

Background

A number of leatherjacket species are taken by commercial fisheries operating in NSW waters. The major species in terms of quantity and value is the Ocean Jacket; however current NSW catch returns also list Estuary/Fanbelly Leatherjacket (*Monacanthus chinensis*); Sixspine (reef) Leatherjacket (*Meuschenia freycineti*); and Leatherjackets (other).

The Fanbelly Leatherjacket (*Monacanthus chinensis*) is distributed from Malaysia and southern Japan, through Indonesia and Samoa to western, northern and eastern Australia. It is a demersal species generally found in association with estuarine and inshore rocky and seagrass habitats. It grows to around 40 cm total length (TL) and is reported to be omnivorous. Little is known of its biology.

The Sixspine Leatherjacket (*Meuschenia freycineti*) is endemic to Australia where it occurs throughout southern Australian waters from northern New South Wales to Western Australia. Very little is known of this species biology, although adults occur on the continental shelf while juveniles are found in estuaries and shallow bays.

Both Fanbelly and Sixspine Leatherjackets are minor but valued species for recreational fishers. Most commercially harvested Fanbelly Leatherjackets are taken in the Estuary General Fishery, whereas most Sixspine Leatherjackets are taken in the Ocean Trap and Line and Fish Trawl fisheries.

Additional Notes

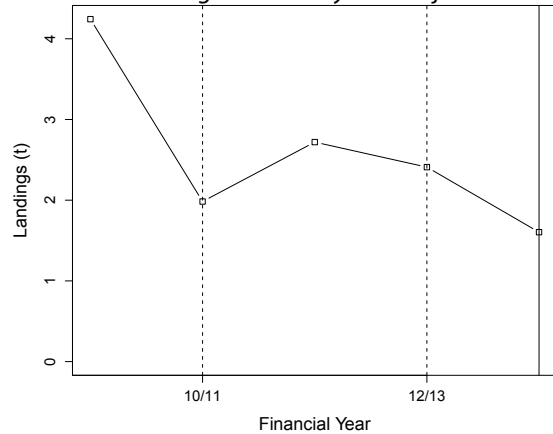
- Biological and fishery data are required to improve assessment and management of this species group.
- Other species of leatherjackets harvested within this group will require a specific monitoring or observer program to clarify the species composition.
- Creel surveys in the Recreational Fishing Havens indicated large declines in the recreational harvest of other leatherjacket species (Fanbelly (*Monacanthus chinensis*), Yellowfin and Sixspine leatherjackets).
- There is a recreational bag limit of 20 leatherjackets.

Catch

Recreational Catch of Leatherjackets

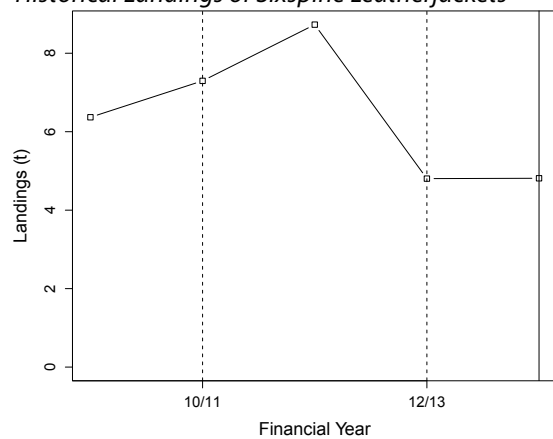
The most recent estimate of the recreational harvest of leatherjackets (all species combined) in NSW was approximately 71,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Fanbelly and Sixspine Leatherjackets is poorly known, but is likely to be relatively minor when compared to the harvest of Ocean Jacket.

Historical Landings of Fanbelly Leatherjackets



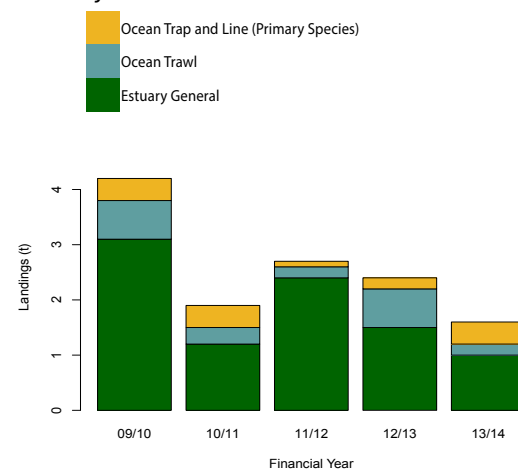
Commercial landings of Fanbelly Leatherjackets for NSW since 2009/10 for all fishing methods.

Historical Landings of Sixspine Leatherjackets



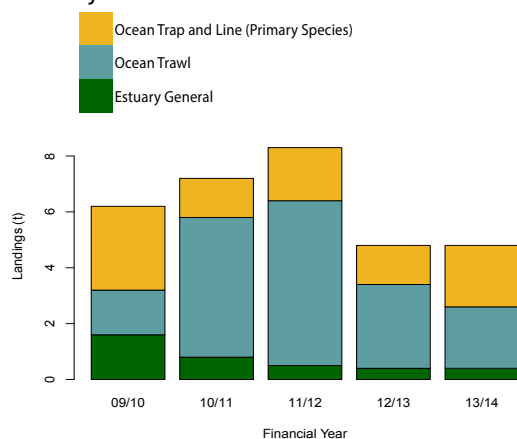
Commercial landings of Sixspine Leatherjackets for NSW since 2009/10 for all fishing methods.

Landings by Commercial Fishery of Fanbelly Leatherjackets



Reported landings of Fanbelly Leatherjackets by NSW commercial fisheries from 2009/10. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Landings by Commercial Fishery of Sixspine Leatherjackets



Reported landings of Sixspine Leatherjackets by NSW commercial fisheries from 2009/10. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 465009, 37 465036, 37 465003, 37 465005, 37 465022, 37 465039 and 37 465059, common name or scientific name to find further information.



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Loligo Squid

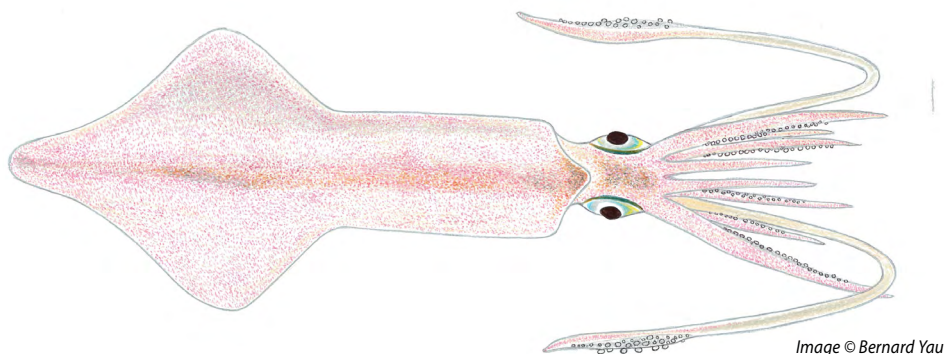
(*Uroteuthis* spp.)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

A mixed group of at least three Loligo squid species that are taken as byproduct in estuary and ocean trawling. The species are difficult to separate visually and catch data are compromised by species identification and misreporting issues.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Uroteuthis (Photololigo)</i> sp. 3	Broad Squid	Formerly known as <i>Loligo etheridgei</i> . The major component of estuarine squid catches
<i>Uroteuthis (Photololigo)</i> sp. 4	Slender Squid	Formerly known as <i>Loligo chinensis</i> . Mainly caught in offshore trawling
<i>Uroteuthis (Aestuariolus) noctiluca</i>	Luminous Bay Squid	Formerly known as Bottle Squid, <i>Loliolus noctiluca</i> . Mainly caught in inshore and estuarine trawling



Background

At least three species of loliginid squid (*Uroteuthis* spp.) occur in NSW estuaries and coastal waters. Two are relatively large tropical species – the Broad Squid [*Uroteuthis (Photololigo)* sp. 3] and the Slender Squid [*Uroteuthis (Photololigo)* sp. 4] – both of which are yet to be properly classified. They are currently included within the Asian Mitre Squid [*Uroteuthis (Photololigo) chinensis*] species complex, which extends throughout the Indo-West Pacific. However, preliminary genetic analyses suggest that they are likely to be two undescribed cryptic species with more limited distributions from Indonesia or the Gulf of Carpentaria to central NSW.

Broad Squid and Slender Squid are quite similar in appearance and often misreported in catch data. However, there is some segregation by depth, with the Broad Squid more abundant in estuaries and inshore ocean waters to depths of less than 30 m, while Slender Squid is more frequent in depths between 20–100 m.

A third loliginid squid species that occurs in shallow sandy habitats of NSW estuaries, bays and coastal waters is the Luminous Bay Squid [*Uroteuthis (Aestuariolus) noctiluca*]. It is distributed along the east-coast of Australia from the Gulf of Carpentaria to Port Philip Bay in Victoria, and including Tasmania. It is much smaller than the other species, with adults only reaching a maximum size of 9 cm mantle length (ML). However, they are still involved in species identification issues, because the adults are easily confused with the juveniles of the two larger species and all squid less than 10 cm ML are typically reported or misreported as Luminous Bay Squid.

All three species are fast growing and short lived. In the Hawkesbury River estuary, female Broad Squid reach 20 cm ML and about 6 months of age; while

males grow faster and reach larger sizes of almost 30 cm ML and ages of around 7 months. Both sexes mature at about 4-5 months and 9-11 cm ML. Spawning occurs at the end of the lifecycle, but over a protracted period. Females are capable of spawning multiple times during their final month and males mate over at least 50 days. Spawning apparently occurs throughout the year in the Hawkesbury River estuary.

Slender Squid are generally larger and live longer than Broad Squid, reaching a maximum size of 25 cm ML and an age of 7 months for females and 40 cm ML and 8.5 months for males off the Queensland coast. The size and age of maturity varies greatly, with some males and females maturing at just 8-10 cm ML, respectively, while others as large as 17 cm ML, have been immature. Back calculated hatch dates suggest spawning and recruitment occur year round off southern Queensland, while in other areas few mature individuals are found at any time.

Female Luminous Bay Squid attain a larger size (8 cm ML) than males (6 cm ML). Their growth rates and lifespan vary considerably with latitude, with fast growth to only 4 months in tropical waters off Townsville and slower growth to 9 months in the temperate waters of Port Philip Bay. Spawning and recruitment also show greater seasonality in temperate waters; whereas, they are likely to be year round in the tropics.

Loligo squid are highly valued for their tender flesh. In NSW, the main commercial catch of Broad Squid is taken by the Estuary Prawn Trawl Fishery in the Hawkesbury River system, where they are targeted. Annual landings and catch rates from the estuary have been relatively stable, with between 20-40 t taken each year. Luminous Bay Squid are also harvested in small quantities from estuaries and inshore waters and marketed for human consumption or bait.

Similar quantities of mixed Loligo squid are also landed by the Ocean Trawl Fishery, particularly from school prawn grounds. However, catches from the ocean prawn trawl sector have been steadily declining since a peak in 2003/04. Broad Squid are also important to recreational fishers, who often refer to them as Common Squid and take them from bays and estuaries in quantities similar to the commercial catch.

Additional Notes

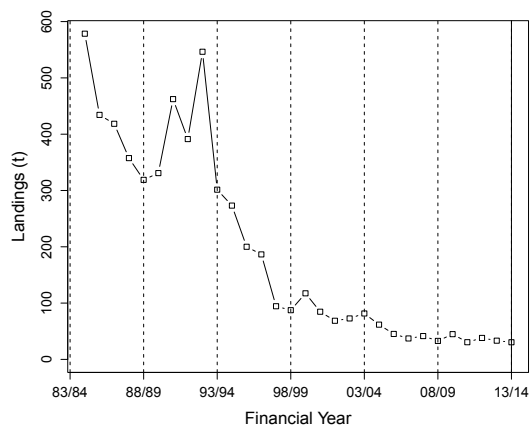
- The taxonomy of this group requires further clarification and there are issues associated with misidentification and reporting of species because they are easily confused.
- Most of the Loligo Squid catch taken in the Hawkesbury River fishery is likely to be Broad Squid.
- Luminous Bay Squid are also harvested in small quantities from estuaries and school prawn grounds, and are mainly sold for use as bait.
- Broad Squid are an important recreational species, with catches similar in size to the commercial catch.
- There is a combined recreational bag limit of 20 for all squid and cuttlefish in NSW.

Catch

Recreational Catch of Loligo Squid

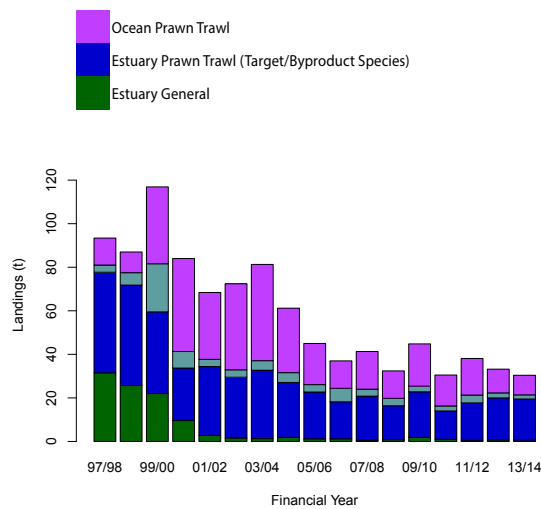
The annual recreational harvest of Loligo squids in NSW was estimated to be approximately 105,000 squid (all species combined) during 2013/14 (West *et al.*, 2015). This was higher than the previous estimate of 50,000 squid (or less than 20 t) based on the results of the National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003).

Historical Landings of Loligo Squid



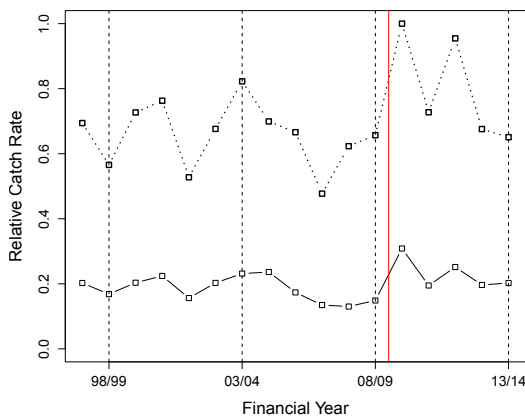
Commercial landings (including available historical records) of Loligo Squid for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Loligo Squid



Reported landings of Loligo Squid by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Loligo Squid Harvested by Estuarine Squid Trawling in NSW



Catch rates of Loligo Squid harvested using estuarine squid trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 617901, common name or scientific name to find further information.



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Longtail Tuna

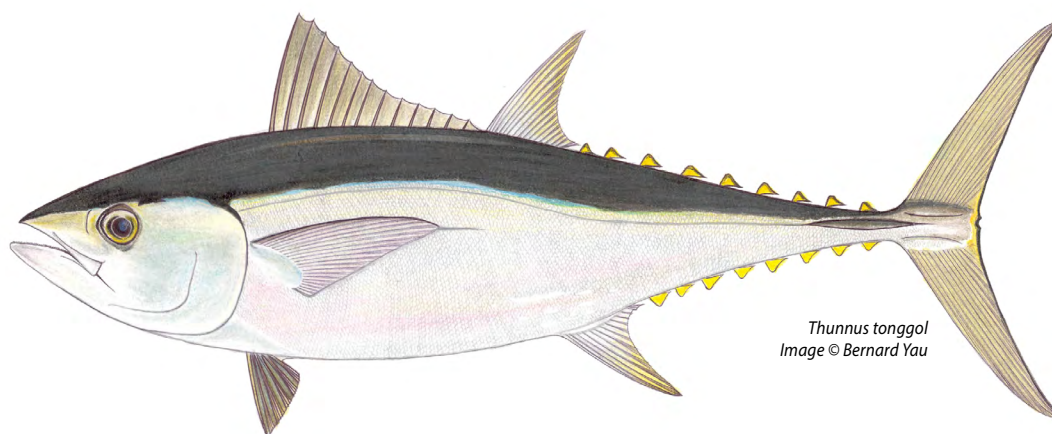
(*Thunnus tonggol*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Very little information is available for Longtail Tuna in NSW. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Thunnus tonggol</i>	Longtail Tuna	Previously, but incorrectly called Northern Bluefin Tuna.



Background

The Longtail Tuna (*Thunnus tonggol*) inhabits continental shelf and ocean waters in warm temperate and tropical regions of the Indo-west Pacific. It is a common species in Queensland waters but during the summer it can be found as far south as Twofold Bay in southern NSW. Previously called 'Northern Bluefin Tuna' in Australia, the Longtail Tuna is a relatively small, slender species that grows to a weight of 36 kg and length of 136 cm; it is more commonly 80-90 cm and 10-15 kg. In comparison, the true 'Northern Bluefin' (*Thunnus orientalis*) can exceed 500 kg in weight and reach almost 300 cm in length.

The Longtail Tuna reaches maturity at lengths of around 60-70 cm, and spawning takes place during the summer months. The main diet of the Longtail Tuna consists of small pelagic and demersal fish, but also includes crustaceans and cephalopods.

Because of their rapid acceleration, Longtail Tuna are highly regarded as sports fish but their very dark flesh gives them a low market acceptance. The NSW commercial fishery for Longtail Tuna is very small, averaging less than 1.5 t per annum since 2000. Most Longtail Tuna are reported from the Ocean Trap and Line Fishery and very small amounts reported by the Ocean Hauling and Estuary General Fisheries.

Additional Notes

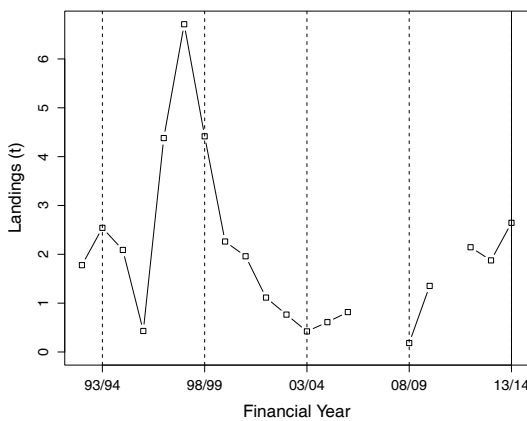
- The fishery occurs mainly off northern NSW.
- Growth parameters are summarised in Griffiths *et al.*, (2009) for samples from Australia, Papua New Guinea and Japan.
- There is a combined recreational bag limit of 5 fish under 90 cm total length (TL) and 2 fish over 90 cm TL for all tuna species in NSW.

Catch

Recreational Catch of Longtail Tuna

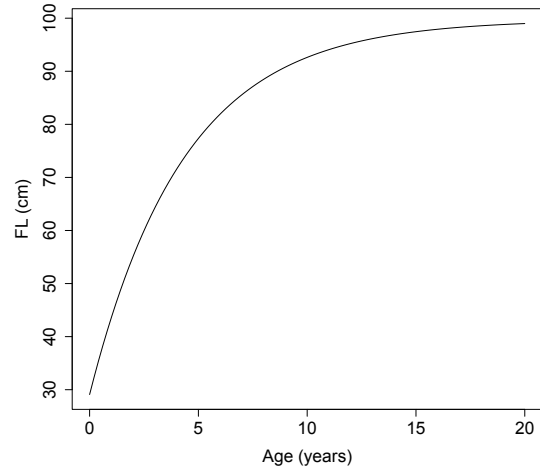
There is no robust estimate of the recreational harvest of Longtail Tuna in NSW.

Historical Landings of Longtail Tuna



Commercial landings (including available historical records) of Longtail Tuna for NSW from 1992/93 to 2013/14 for all fishing methods. Financial years where commercial catch is made up of less than six fishermen were removed due to privacy concerns.

Growth Curve of Longtail Tuna



Growth curve of Longtail Tuna using parameters from Griffiths *et al.*, (2009). Lengths are presented as fork length (FL).

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441013, common name or scientific name to find further information.



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Luderick

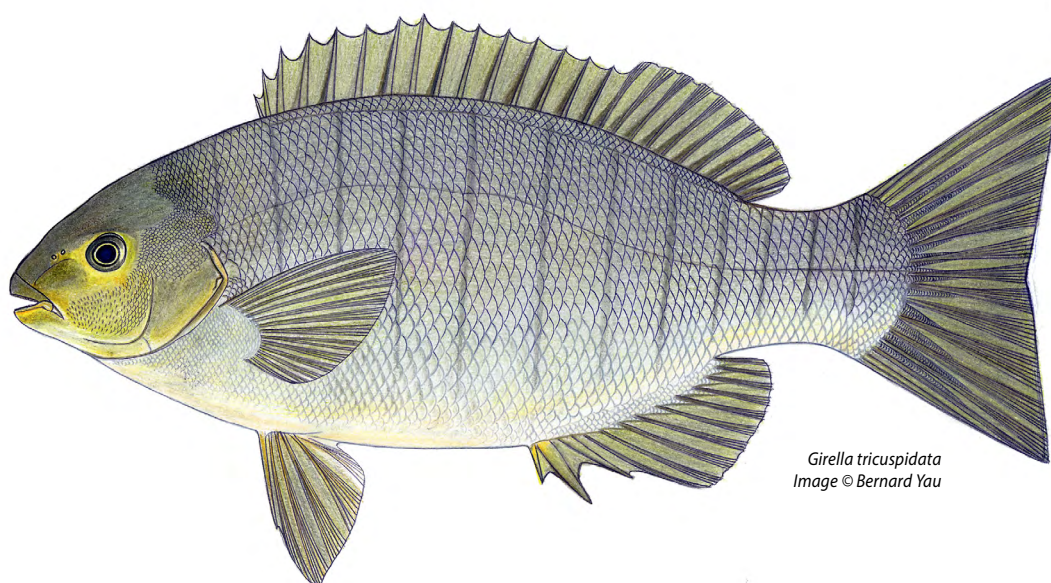
(*Girella tricuspidata*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

A moderately long-lived species with significant recreational and commercial harvests. Fishing mortality is estimated to be slightly higher than natural mortality in most estuaries, but the species is still considered Fully Fished at this stage.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Girella tricuspidata</i>	Luderick	



Background

Luderick (*Girella tricuspidata*) occurs in waters from southern Queensland to SA, including northern Tasmania and around north-eastern New Zealand. Preliminary genetic and tagging results suggest that estuarine populations of Luderick along the east coast of Australia form a single stock.

In NSW waters, Luderick is found primarily within estuaries, bays and inshore coastal areas in association with seagrass beds, rocky reefs and infrastructure such as marinas. It is primarily herbivorous, preferring to feed on certain species of green and red macroalgae, although other foods (particularly small invertebrates) form part of its diet.

Luderick is a moderately long-lived species, reaching a maximum age of 24 years and size of 56 cm fork length (FL); with females typically attaining slightly greater ages and sizes than males. However, in commercial catches taken from NSW estuaries, fish aged 2-6 years dominate along the north coast and 4-7 years along the south

coast. The species is relatively slow growing, with males and females taking 4 and 4.5 years to reach maturity at around 28 and 29 cm FL, respectively.

Once mature, fish migrate to inshore coastal waters to spawn, sometimes moving significant distances northward along the coastline. Spawning is thought to occur in surf zones or around estuary entrances, typically during winter in southern Queensland and northern NSW, spring in central NSW and summer in Victoria. The larvae enter estuaries and settle as small juveniles in sheltered shallow water habitats, particularly seagrass beds and mangrove channels. Larger juveniles occur in large schools in slightly deeper waters, and are particularly common around estuarine and inshore coastal reefs. Adults typically return to estuarine waters after spawning and can display high site fidelity to chosen patches of habitat.

Commercial catches of Luderick in NSW are primarily taken by mesh nets and hauling nets in the Estuary General Fishery, during autumn and winter. Significant quantities of Luderick are also taken on ocean beaches during autumn and winter

by ocean haul fishers. A small number of Luderick are salted and used for bait in the commercial rock lobster fishery. Annual landings have declined considerably over the past 25 years from a peak of over 800 t in 1987/88 to less than 400 t between 2003/04 and 2013/14. Meanwhile catch rates for mesh netting have remained stable and actually increased over the 4 years preceding 2013/14.

Size structures within the commercial catch were relatively stable during the 1970s and the 1980s, with most fish between 25-35 cm FL; however, greater truncation of larger sizes is evident in more recent data from the 1990s and 2000s. Luderick is also an important recreational species, and is targeted in large numbers using specialised methods that involve handlines and hooks baited with filamentous green and/or black algae (*Enteromorpha* spp.).

Additional Notes

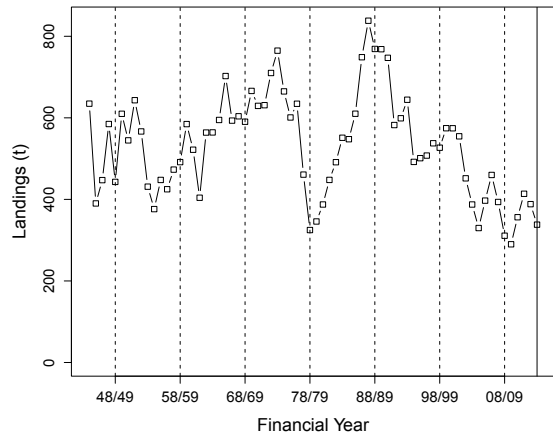
- Estimates of total mortality from size and age structure data suggest that fishing mortality is relatively high for a moderately long-lived species. In many estuaries, estimates of fishing mortality were slightly higher than natural mortality, but this varied significantly between estuaries.
- Luderick forms the basis of a highly targeted recreational fishery and is a significant component of commercial mesh net and hauling catches from NSW estuaries.
- There is a minimum legal length of 27 cm and a recreational bag limit of 20 Luderick. Considerable size grading of Luderick occurs by avid anglers once their bag limit is reached, with fish kept alive and held in keeper nets until the end of each days fishing; this causes fish considerable stress, but most released fish apparently survive.

Catch

Recreational Catch of Luderick

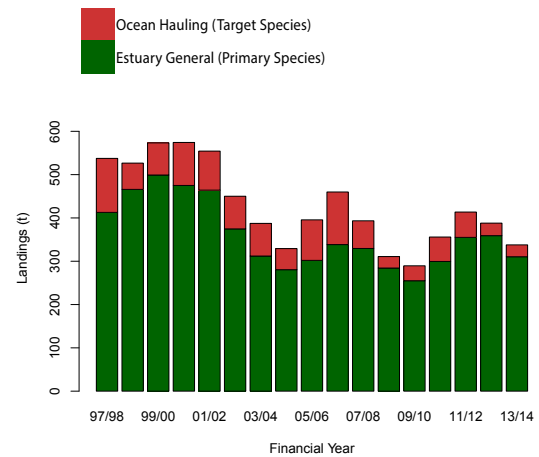
The annual recreational harvest of Luderick in NSW was approximately 250,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 622,500 fish (or between 270 and 550 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Luderick



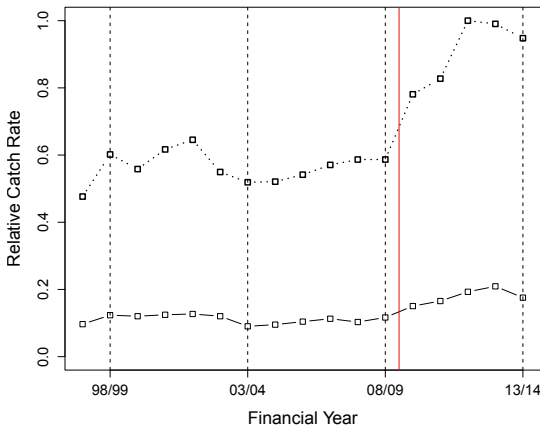
Commercial landings (including available historical records) of Luderick for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Luderick



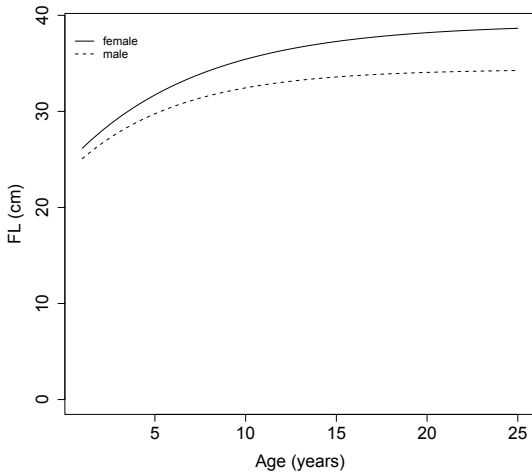
Reported landings of Luderick by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Luderick Harvested by Mesh-Netting in NSW



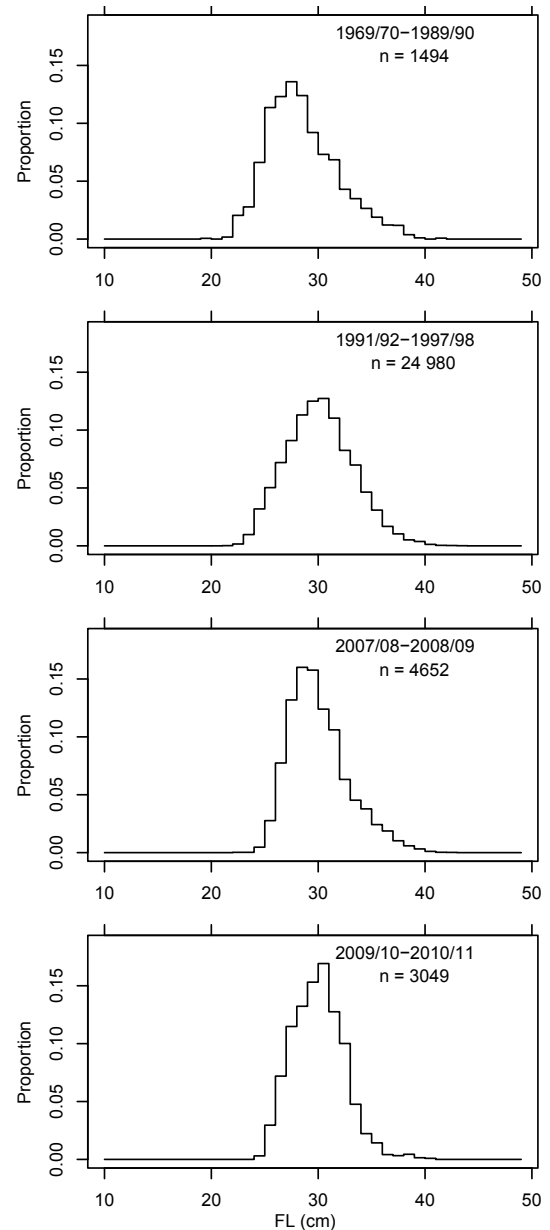
Catch rates of Luderick harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Luderick



Growth curve for Luderick using parameters from Gray *et al.*, (2010). Lengths are presented as fork length (FL).

Length Frequency of Luderick



The length distribution of Luderick in NSW commercial landings was relatively stable from the 1970s to the 1980s, and comprised mainly fish between 22-35 cm fork length (FL). Commercial landings sampled during the 1990s and 2000s contained a smaller proportion of large Luderick, with most between 22-25 cm FL. The minimum legal length for Luderick in NSW was increased from 25-27 cm total length (approximately 24 cm FL) in 2007.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 361007, common name or scientific name to find further information.



Mackerel Tuna

(*Euthynnus affinis*)

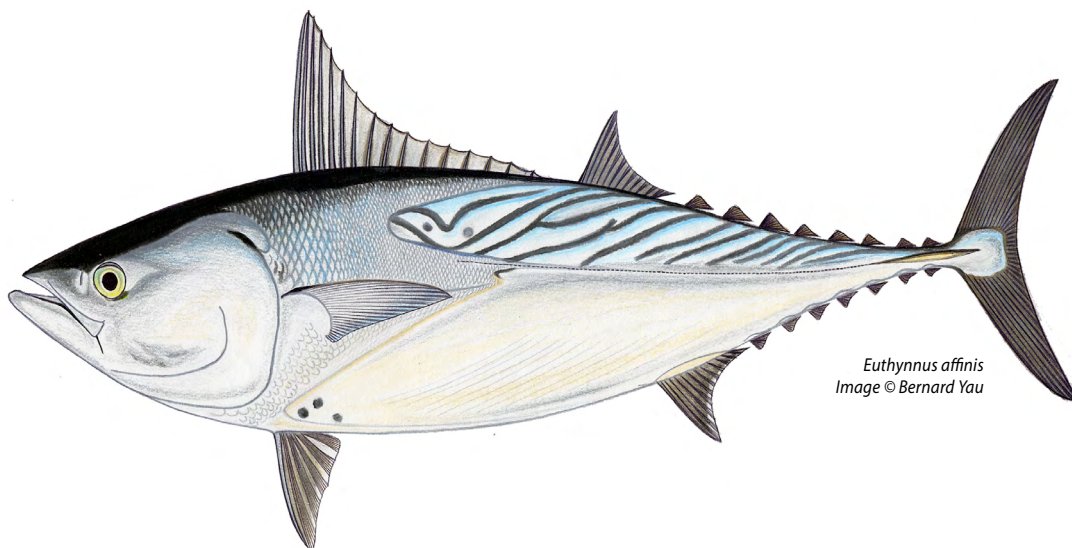
Author John Stewart

EXPLOITATION STATUS UNDEFINED

Very little information is available for Mackerel Tuna in NSW. The lack of recreational harvest data and a very small commercial fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Euthynnus affinis</i>	Mackerel Tuna	
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Background

The Mackerel Tuna (*Euthynnus affinis*), also known as the little tuna, belongs to the family Scombridae which includes the mackerels, tunas and bonitos. It is a widespread pelagic species found in the tropical waters of the Indo-Pacific. Although also inhabiting ocean waters, Mackerel Tuna prefer to stay close to the coast and juveniles are even found in bays and harbours. It is a highly migratory species and frequently forms large schools which are often mixed with other scombrid species. In Australia, Mackerel Tuna range from Cape Leeuwin, WA, around northern Australia and Queensland to the south coast of NSW.

Mackerel Tuna is a small tuna with a distinctive dark-striped pattern on its back and 2-5 dark spots above the ventral fin. It can be distinguished from similar species with striped patterns by the spots and, in the case of frigate mackerel, the lack of

space between the dorsal fins. Mackerel Tuna can grow to 100 cm fork length (FL) and about 20 kg in weight but are more commonly around 60 cm and 3 kg. They feed on small fish, particularly clupeids (herrings, pilchards) and silversides, as well as on squids, crustaceans and zooplankton. Their predators include billfish and sharks.

In NSW and Queensland, Mackerel Tuna are usually caught on lines by fishers targeting mackerel (*Scomberomorus* spp.) and larger tunas. Annually, 10-20 t of Mackerel Tuna are landed for sale in NSW with almost all the catch taken by the Ocean Trap and Line Fishery. However, it has dark flesh which deteriorates quickly resulting in poor marketability. Despite this, Mackerel Tuna are popular with recreational fishers as a light-tackle gamefish.

Additional Notes

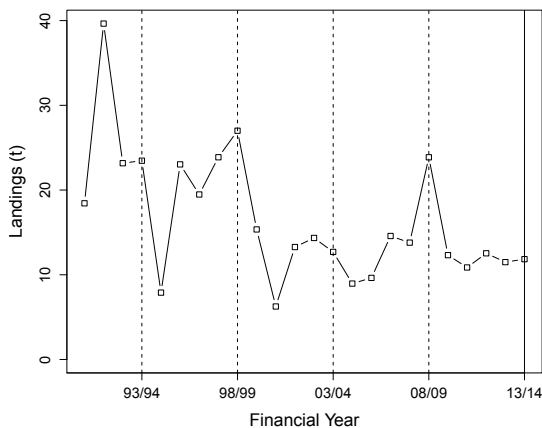
- A highly migratory small tuna species that occurs throughout the Indo-West Pacific region. NSW is at the southern extremity of its range.
- There is minimal information available on this species from fisheries in NSW waters.
- Commercial landings are low (10-20 t per annum recently).
- Mackerel Tuna may be significant in recreational catches, but accurate catch estimates are not available.

Catch

Recreational Catch of Mackerel Tuna

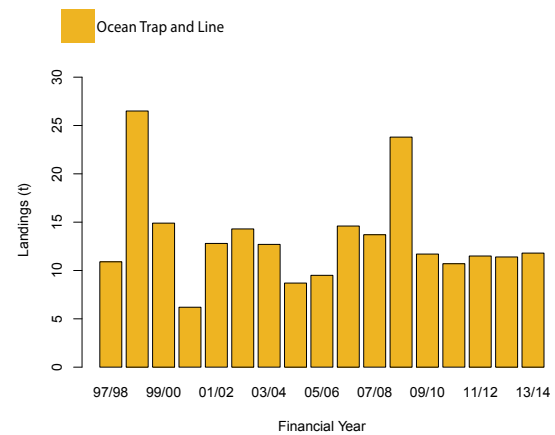
There is no robust estimate of the recreational harvest of Mackerel Tuna in NSW. The annual recreational harvest of Mackerel Tuna in NSW was previously estimated to be less than 50 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Mackerel Tuna



Commercial landings (including available historical records) of Mackerel Tuna for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Mackerel Tuna



Reported landings of Mackerel Tuna by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading

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Mahi Mahi

(*Coryphaena hippurus*)

Author Anne-Marie Hegarty

EXPLOITATION STATUS UNDEFINED

Mainly targeted by recreational fishers, Mahi Mahi are likely to have high growth and mortality rates, but there is a lack of local information with which to assess stock status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Coryphaena hippurus</i>	Mahi Mahi	Also known as common Dolphinfish.



Coryphaena hippurus
Image © Bernard Yau

Background

Mahi Mahi (*Coryphaena hippurus*) are a tropical oceanic species found in the Atlantic, Indian and Pacific oceans. In Australian waters they can be found off WA, NT, and from Queensland to Montague Island in NSW.

This pelagic species is limited in habitat by sea surface temperatures of 19-20°C and extensions of distribution occur with seasonal variations in water temperature. Mahi Mahi are also known to associate strongly with floating objects and are highly sought by recreational fishers around Fish Aggregation Devices (FADs). In NSW, significantly more Mahi Mahi were observed around offshore FADs than inshore FADs in summer and autumn. These fish are considered to be highly migratory although detailed information on migration routes and stock structure are not available for the east coast of Australia.

Studies elsewhere suggest the species grows rapidly with fish reaching 1 kg after 6 months and 10 kg after 1 year, with an estimated maximum size of 200 cm total length (TL) and weight of 25 kg. They also mature at about 6 months of age and females are believed to reach maturity at a smaller size than males. Mahi Mahi are highly

fecund, producing 58,000 – 1.5 million eggs per female, with an exponential increase in egg number with increasing fish length. They can also spawn frequently once mature. There is general agreement in the literature that this species is short lived (maximum 4 years old), with most dying before they reach 2 years of age.

A study on the diets of Mahi Mahi caught in NSW waters showed that they predominantly feed on larval or small juvenile fish and invertebrates. Many of these prey species are associated with drifting clumps of algae. Mahi Mahi also serve as the prey items of large tuna, sharks, marlin, sailfish and swordfish.

All of the Mahi Mahi harvested by commercial fishers in NSW are taken in the Ocean Trap and Line Fishery, however the recreational catch of this species is greater than the commercial catch. November to April are the months of primary commercial harvest of Mahi Mahi. This summer/autumn peak period is most likely due to their strong association with water temperature.

Additional Notes

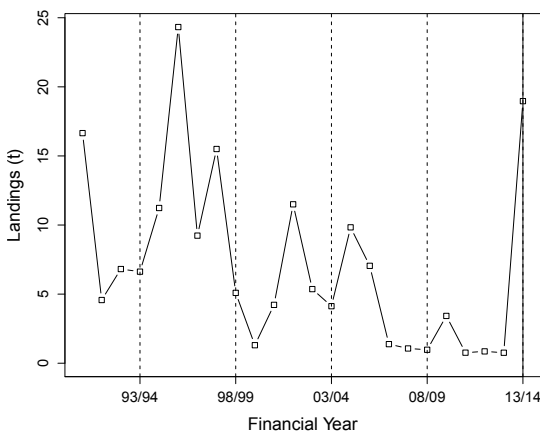
- Mahi Mahi is a minor commercial species taken by line fishing off NSW with annual landings generally less than 5 t and fluctuating catch rates.
- Mahi Mahi is more important as a recreational species with significant catches by the charter boat sector (estimated to be 5 times the commercial fishery). Offshore boat anglers and some spearfishers also target Mahi Mahi around Fish Aggregating Devices (FADs).
- Since September 2007 there has been a minimum legal length of 60 cm total length (TL) and a recreational bag limit of 10 with only one fish over 110 cm TL for Mahi Mahi.

Catch

Recreational Catch of Mahi Mahi

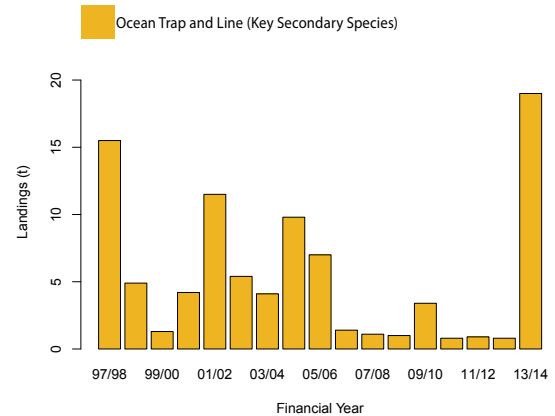
The most recent estimate of the recreational harvest of Mahi Mahi in NSW was approximately 25,500 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest Mahi Mahi in NSW was previously estimated to be around 100 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Mahi Mahi



Commercial landings (including available historical records) of Mahi Mahi for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Mahi Mahi



Reported landings of Mahi Mahi by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 338001, common name or scientific name to find further information.



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Mako Sharks

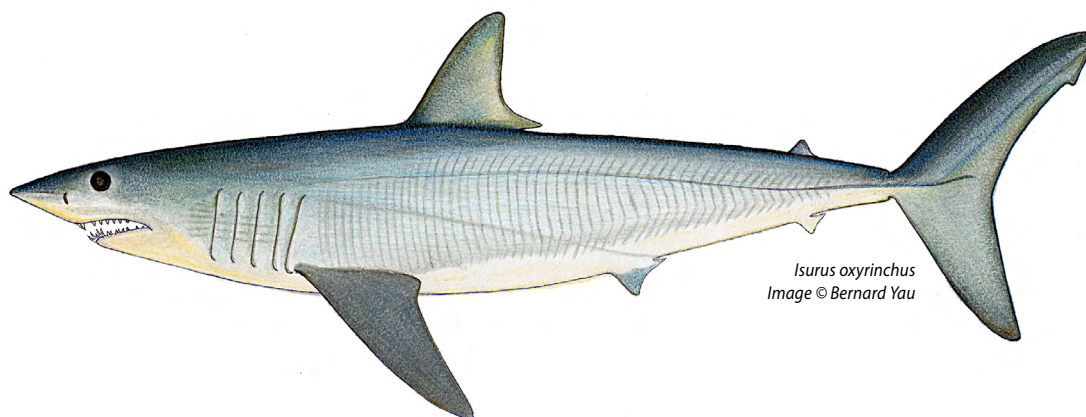
(*Isurus* spp.)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

Relatively small catches occur in NSW - the majority of the catch is the Shortfin Mako, which has a global distribution. Mako sharks are an important target species in the recreational gamefish fishery.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Isurus oxyrinchus</i>	Shortfin Mako	Oceanic and pelagic, occasionally caught close inshore.
<i>Isurus paucus</i>	Longfin Mako	Rarely reported in catches but could be understated due to mis-identification.



Background

The Shortfin Mako (*Isurus oxyrinchus*) and Longfin Mako (*I. paucus*) are both caught off NSW. The Shortfin Mako is widespread in Australian waters, and is found along the entire NSW coast. It is oceanic and pelagic, and occurs from the surface to depths of at least 650 m. The Longfin Mako is a more tropical species and has only been rarely reported in Australia, but has been recorded off central NSW.

Mako sharks are seldom found in waters below 16 °C. The Shortfin Mako reaches a maximum length of 395 cm, with both sexes growing at similar rates for the first 7 years. Thereafter, the male growth rate declines. Males mature at about 195 cm and females at 280 cm. Shortfin Makos are oophagous, where the embryos feed off a succession of eggs ovulated by the female. Litters of 12-16 pups have been recorded off NSW, where birth takes place in early summer.

Due to the very small number of specimens examined, very little is known about the biology of the Longfin Mako. From Atlantic fisheries the maximum length is reported as 417 cm, with size at maturity of 205-228 cm for males and 245 cm for females. Reproduction is also oophagous, with litters of 2-8 young, and size at birth between 97-120 cm. This species has relatively longer pectoral fins (equal to headlength), and softer flesh, which makes it of lesser commercial value.

Pelagic fisheries target mako sharks for their meat and fins across the globe. NSW commercial catches of mako sharks are generally less than 5 t and almost entirely derived from the Ocean Trap and Line Fishery. The Commonwealth Eastern Tuna and Billfish Fishery catches a higher number of mako sharks, both off NSW and on the high seas. Mako sharks are also an important target species of the recreational gamefish fishery.

Additional Notes

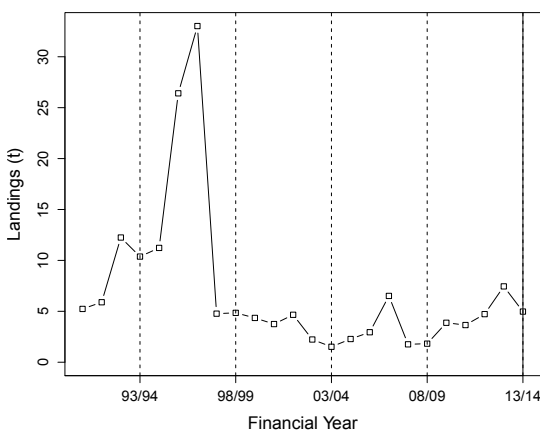
- Small commercial catches in NSW, generally less than 5 t annually.
- Commonly caught in the Commonwealth Eastern Tuna and Billfish Fishery - catches have been recently reduced by changes in gear selectivity.
- There is a recreational bag limit of one mako shark.

Catch

Recreational Catch of Mako Sharks

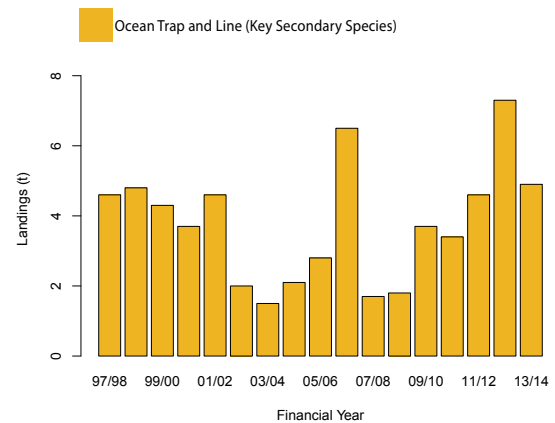
The annual recreational harvest of mako sharks in NSW is likely to lie between 30 and 140 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Mako Sharks



Commercial landings (including available historical records) of mako sharks for NSW from 1990/91 to 2013/14 for all fishing methods. Note that prior to 1997/98 sharks caught by NSW fishers operating in Commonwealth waters may have been included in reported landings.

Landings by Commercial Fishery of Mako Sharks



Reported landings of mako sharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 010001 and 37 010002, common name or scientific name to find further information.



Mangrove Jack

(*Lutjanus argentimaculatus*)

Authors John Stewart and Toby Piddocke

EXPLOITATION STATUS **UNDEFINED**

Mostly a recreational fishery in northern NSW waters. Some local biological information exists, however a lack of data on the fishery has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Lutjanus argentimaculatus</i>	Mangrove Jack	
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Background

The Mangrove Jack (*Lutjanus argentimaculatus*) is a medium to large member of the family Lutjanidae, attaining weights of at least 16 kg and lengths up to 120 cm. Mangrove Jack occur throughout the tropical and sub-tropical Indo-West Pacific, from Samoa and the Line Islands to east Africa and from northern Australia to the Ryukyu Islands, Japan. The species' Australian distribution encompasses the continent's northern coastline. In NSW, Mangrove Jack are occasionally caught off Sydney, but appear more common from Laurieton northwards.

Like many lutjanids, Mangrove Jack spend their juvenile years in coastal rivers and estuaries, sometimes entering freshwater. While resident in estuaries, Mangrove Jack usually inhabit complex underwater structure, especially rocks and snags. Around 7-8 years of age and ~50-55 cm fork length (FL), Mangrove Jack migrate from estuaries to

offshore habitats, where they apparently remain for the rest of their lives. These offshore movements can cover distances greater than 230 km, and a Mangrove Jack tagged in the Clarence River, NSW, was recently recaptured off south-east Queensland. Spawning probably occurs offshore, with eggs and larvae carried back to estuaries by wind and currents. Off tropical Australia, Mangrove Jack have been observed to depths of 175 m, but adult habitat use off NSW remains uncertain. Large Mangrove Jack (up to one metre FL) from NSW offshore reefs have been aged to 57 years.

Mangrove Jack are not targeted by any commercial fisheries in NSW, but small numbers (<1 t per year) are captured as by-product. The species is, however, popular with recreational line and spear fishers, who perceive it as a challenging sportfish. Data on recreational catch and effort are lacking, but

the recreational fishery is probably concentrated mainly on juveniles and subadults in estuaries, and, to a lesser extent, on nearshore reefs. Mangrove Jack have recently been stocked into Clarrie Hall Dam in far northern NSW in order to create a freshwater recreational sport fishery.

Additional Notes

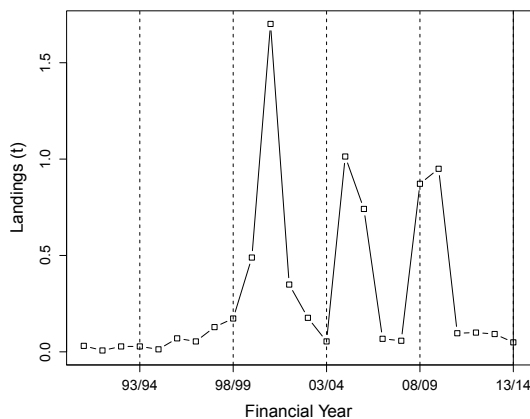
- Only basic biological information is available in NSW.
- Growth is relatively rapid during the first 8-10 years of life, but slows thereafter. Maximum size is not attained until approximately 30 years of age.
- There is no minimum legal length for Mangrove Jack in NSW, but there is a recreational bag limit of 5 fish per person.
- The recreational line fishery for Mangrove Jack in NSW is highly seasonal, with most fishing done during summer.
- Genetic studies in tropical Australia indicate a single stock. Research is currently underway in NSW to determine whether there is any genetic structuring at range limits.

Catch

Recreational Catch of Mangrove Jack

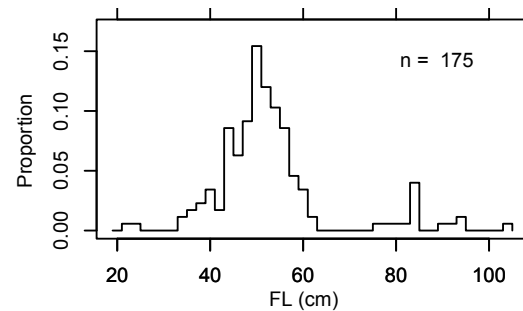
Recreational fishers in NSW view Mangrove Jack as a premium sport fish, and some fishers practice catch and release for this species. There is no estimate of the recreational harvest of Mangrove Jack in NSW.

Historical Landings of Mangrove Jack



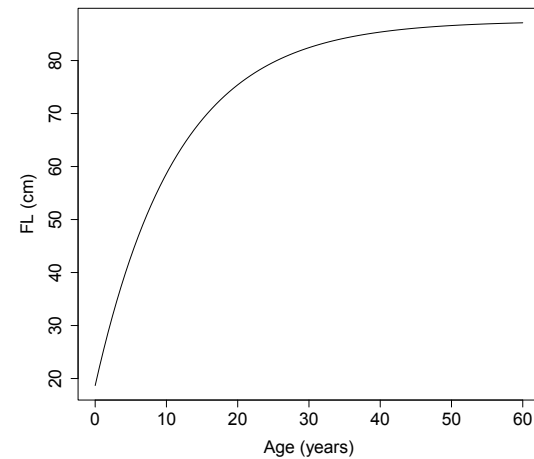
Commercial landings (including available historical records) of Mangrove Jack for NSW from 1990/91 to 2013/14 for all fishing methods.

Length Frequency of Mangrove Jack



The length frequency distribution of Mangrove Jack caught by recreational fishers in NSW comprises mainly fish between 35-60 cm fork length (FL). There is no minimum legal length for Mangrove Jack in NSW.

Growth Curve of Mangrove Jack



Growth curve for Mangrove Jack using parameters from Pidcocke *et al.*, (2015). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 346015, common name or scientific name to find further information.



Mantis Shrimps (Stomatopoda)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

A species group subject to identification and composition issues. Very small quantities are landed and no detailed assessment is likely to be completed.

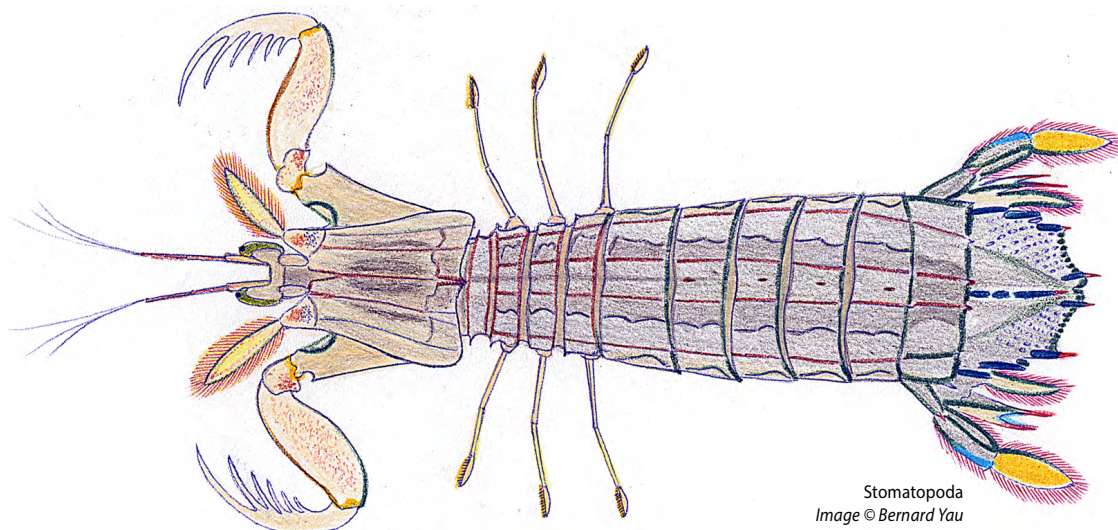
SCIENTIFIC NAME	COMMON NAME	COMMENT
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Stomatopoda-undifferentiated	mantis shrimpss (family code)	
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<i>Erugosquilla grahami</i>	[a mantis shrimps]	
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<i>Harpiosquilla harpax</i>	[a mantis shrimps]	
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<i>Oratosquilla oratoria</i>	[a mantis shrimps]	
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Background

There are at least 450 species of mantis shrimps (order Stomatopoda) worldwide, including almost 150 that are found in Australian waters. Mantis shrimps are predatory crustaceans that generally occur in shallow marine waters, but some species are known to occur out to depths greater than 1000 m.

The species composition of mantis shrimps in NSW catches is unknown, but is likely to comprise a range of species. Eight species are taken as bycatch from prawn trawling in Moreton Bay, with *Oratosquilla sephensoni* and *O. interrupta* the most abundant. *Harpiosquilla harpax* is the largest species landed, with a maximum size of 25 cm total length (TL) and weight of 166g.

Mantis shrimps are found singly or in pairs hiding in holes and self-excavated burrows in coral reefs, rocks, and soft substrates. Females lay eggs within their burrows and guard them until they hatch. Once hatched the larvae are planktonic, but settle within a few weeks to the bottom and start to build their own burrows.

Mantis shrimps actively hunt their prey with an enlarged second pair of legs, which resemble the front legs of the preying mantis insect. They can be broadly grouped into 'speakers' which use their front claws to spear prey such as worms, other shrimps and fish, or 'smashers' which use their front claws to club their prey. They feed mainly on shelled animals such as crabs and snails. All mantis shrimps lie in ambush, strike at passing prey and, when successful, drag their prey into their burrow

or hole. Some tropical species of mantis shrimps use fluorescent signalling to lure prey.

Length frequency distributions of *O. stephensoni* (maximum size of 17 cm TL) in Moreton Bay were either unimodal or bimodal and suggested a lifespan of approximately 2.5-3 years. Reproductive indices indicated a clear annual cycle with peak spawning likely during spring and/or early summer.

Aging of the commercially important Japanese mantis shrimps *O. oratoria* from Tokyo Bay used brain pigment concentrations and suggested that length frequency methods may underestimate ages due to slower growth during winter and at larger sizes, and that lifespans may be around 4 years rather than 2 years. Maturity in this species appears to be reached after 1 or 2 years, depending on early growth rates.

In NSW waters, mantis shrimps are taken in very small quantities as by-product from ocean and estuary prawn trawling. Much of the historical commercial catch came from the Port Jackson Estuary Prawn Trawl Fishery, which was closed in 2006. Recent landings have been less than 100 kg. The recreational catch of mantis shrimps is also insignificant.

Additional Notes

- Commercial catches in NSW are not identified to species level by fishers, but rather reported as a mixed group. The species composition remains unknown.
- It is likely that several families are represented in what are extremely small commercial landings.
- Annual landings are not displayed due to privacy considerations (fewer than 6 fishers currently land mantis shrimps in NSW).

Catch

Recreational Catch of Mantis Shrimps

The annual recreational harvest of mantis shrimps in NSW is considered to be minor.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 051000, 28 051032, 28 051036 and 28 051048, common name or scientific name to find further information.



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Mirror Dory

(*Zenopsis nebulosus*)

Author Rowan Chick

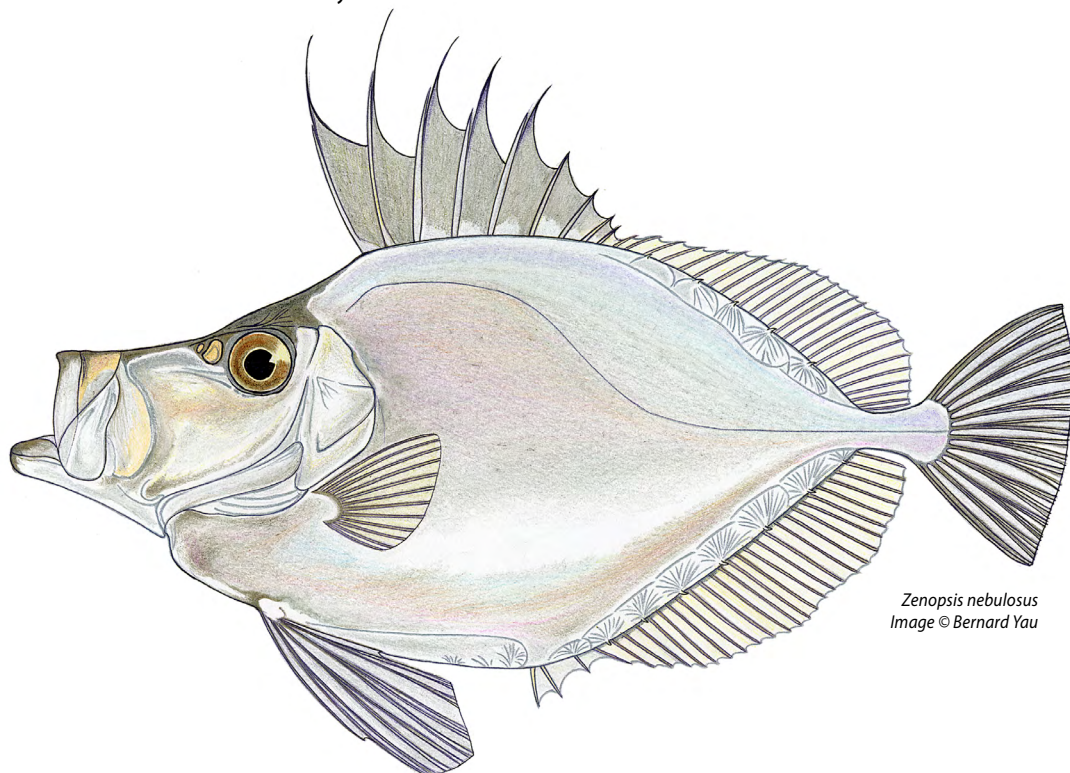
EXPLOITATION STATUS FULLY FISHED

Predominantly a Commonwealth fishery, with seasonal landings of mature fish by NSW trawlers north of Sydney during the winter months. The Commonwealth stock assessment defined the status of Mirror Dory as not overfished and not subject to overfishing and has been adapted for NSW to describe the exploitation status as Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Zenopsis nebulosus

Mirror Dory



Zenopsis nebulosus
Image © Bernard Yau

Backg

Mirror Dory (*Zenopsis nebulosus*) occur at depths of 50 m-600 m around southern Australia from northern NSW to central WA. They are caught by trawling in outer continental shelf and upper slope waters. The majority of landings come from depths between 300m m-600 m during the winter months when the fish aggregate for spawning along the NSW upper slope.

The Mirror Dory is a laterally compressed oval-shaped fish with a smooth silvery skin. They have a single row of spiny-edged scutes along the belly, and enlarged plates at the bases of the dorsal and anal fins. Large fish provide thick fillets of good quality flesh, and the species is regarded as a good table fish. Mirror Dory have a large telescopic mouth and are predatory on smaller fish, crustaceans, and cephalopods.

Mirror Dory larger than about 30 cm are marketed, and most of the catch consists of mature fish between 40cm-60 cm total length (TL) and weighing between 1.0 kg-2.5 kg. Mirror Dory reach a maximum age of about 12 years and weight of 3 kg, but most fish in landed catches are between 4-10 years of age. Females reach maturity at about 35cm TL (4-5 years of age). In NSW, Mirror Dory spawn over a protracted period throughout winter, from May to September. The eggs are large (2 mm-3 mm diameter) and it is likely the species is a serial spawner. The larval development and early life history stages are not well known.

The annual catch of Mirror Dory is dominated by that harvested in the Commonwealth Trawl Sector (CTS). In 2013/14 catch in the CTS was 293 t. Since 1997/98, the annual catches of Mirror Dory in NSW

have fluctuated between about 100 t and < 5 t. These catches are almost solely attributed to the NSW Fish Trawl Fishery, with seasonal landings of mature fish by NSW trawlers north of Sydney during the winter months. Since 2011/12, less than about 5 t per annum of Mirror Dory has been caught in NSW. The Commonwealth stock assessment defined the status of Mirror Dory as not overfished and not subject to overfishing and has been adapted for NSW to describe the exploitation status as Fully Fished.

Additional Notes

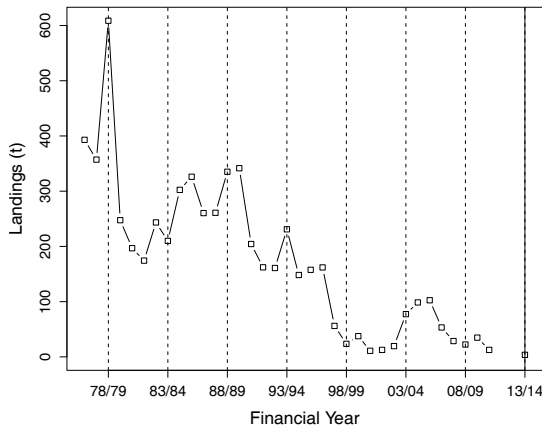
- Only present in the NSW fishery on an intermittent basis during the winter months.
- Ageing studies indicated Mirror Dory were relatively fast growing and reach a maximum age of about 12 years, with the bulk of NSW catches likely to be fish of 4-8 years of age.

Catch

Recreational Catch of Mirror Dory

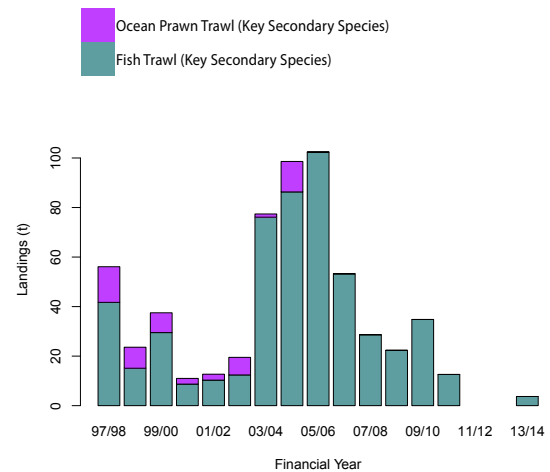
The annual recreational harvest of Mirror Dory in NSW is considered to be minor.

Historical Landings of Mirror Dory



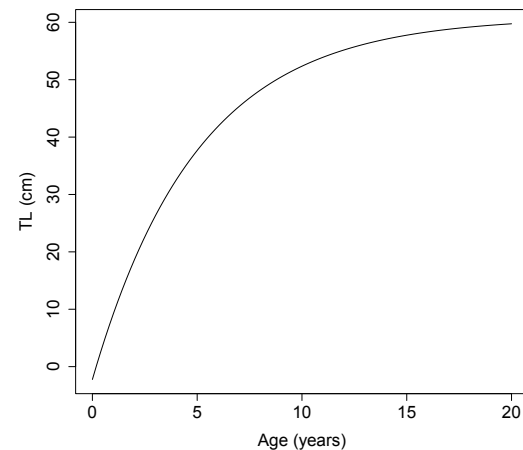
Commercial landings (including available historical records) of Mirror Dory for NSW from 1976/77 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences. Financial years where commercial catch is made up of less than six fisherman were removed due to privacy concerns.

Landings by Commercial Fishery of Mirror Dory



Reported landings of Mirror Dory by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Mirror Dory



Growth curve of Mirror Dory using parameters from Smith and Stewart (1994). Lengths are presented as total length (TL).

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 264003, common name or scientific name to find further information.



Mulloway

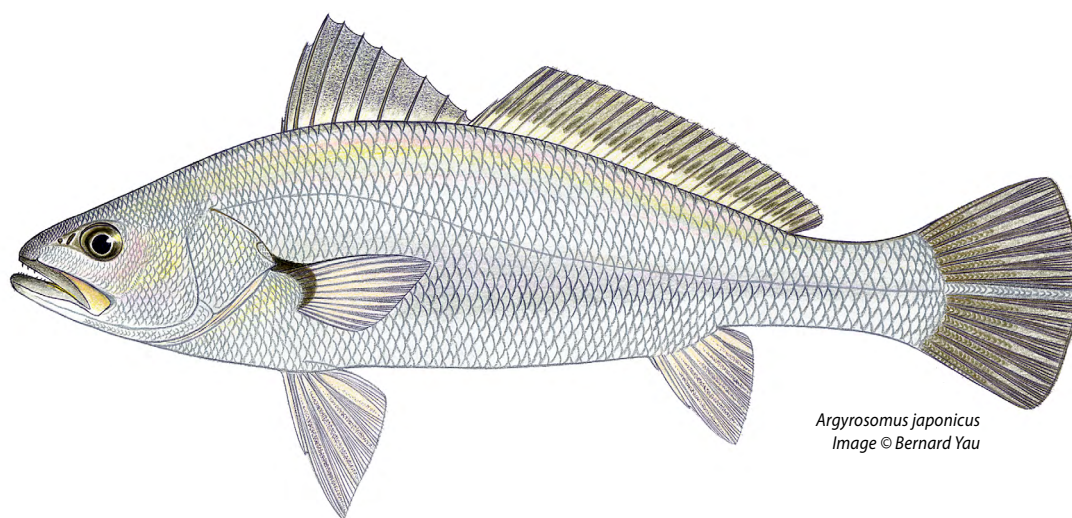
(*Argyrosomus japonicus*)

Author Julian Hughes

EXPLOITATION STATUS OVERFISHED

Age composition is indicative of an Overfished stock, the spawning potential ratio is below the recommended threshold, fishing mortality is much greater than natural mortality, and length and age distributions are excessively effected by recruitment.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Argyrosomus japonicus</i>	Mulloway	Also known as 'Jewfish'. Previously called <i>Argyrosomus hololepidotus</i> .



Background

Mulloway (*Argyrosomus japonicus*) is a coastal species found from the upper reaches of estuaries to depths up to 100-150 m offshore. In Australia, Mulloway are distributed from the Burnett River in Queensland around southern Australia to North West Cape in WA. Mulloway also occur in the north-western Pacific and through the Indian Ocean as far west as southern Africa.

Results from recent genetic analyses using microsatellite markers suggest Mulloway in southern Australia to be divisible into four populations: a west coast population, an east coast population, and western and eastern populations in the Great Australian Bight. Mulloway from southern Australia were also shown to be genetically distinct to those from southern Africa.

Small (<30 cm total length (TL)) juveniles are found in estuaries and nearshore coastal environments. Sub-adult and adult Mulloway occur in estuarine and ocean waters. In estuaries, larger juveniles and sub-adult fish (>40 cm TL) appear to be more abundant in the lower reaches where salinities are

nearer to seawater. Large individuals are caught around the mouths of estuaries, in surf zones and around rocky reefs in offshore waters.

Crustaceans account for between 14%-81% of the reported diet of juveniles. The importance of crustaceans in the diet of Mulloway appears to decrease with increasing fish size, with fish and squid being of greater relative importance in the diet of larger Mulloway.

Mulloway grow to a large size and are relatively long lived. In South Africa, the species is reported to reach 181 cm TL, 75 kg and a maximum age of 42 years. In NSW, the largest Mulloway so far recorded was 168 cm TL and the maximum age is currently 34 years. In NSW, size at 50% maturity for males is 51 cm (2+ years of age) and for females at 68 cm (3+ years of age). Mulloway are thought to spawn at the mouths of estuaries between November and March in NSW.

In NSW, significant catches of Mulloway are taken by the Estuary General, Ocean Hauling and Ocean Trap and Line fisheries. Mulloway are also a very important recreational fish species and catches by

this sector are larger than commercial landings.

Additional Notes

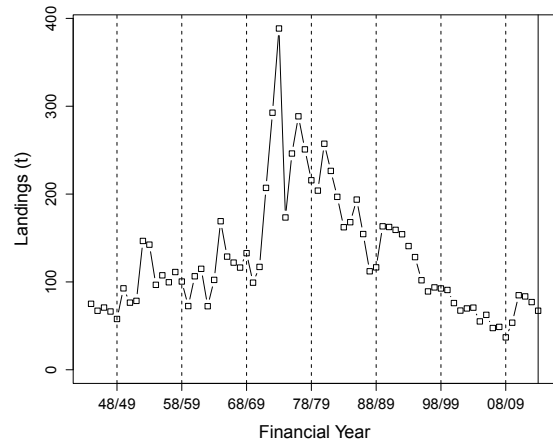
- Commercial landings remain low but catch rates have been more or less stable for the past decade.
- Length and age composition of commercial landings is indicative of a heavily fished stock (75% <70cm, 90% <5 years old).
- Fishing mortality is estimated to be much greater than natural mortality.
- Spawning potential ratio for Mulloway (11-17%) is well below the recommended threshold of 25%.
- Stock is significantly growth overfished (optimum length at first capture is in the range 80-100 cm).
- The minimum legal length for Mulloway was increased from 45 to 70 cm and a Recovery Program was introduced in November 2013.
- There is a minimum legal length of 70 cm TL and a recreational bag limit of 2 Mulloway.

Catch

Recreational Catch of Mulloway

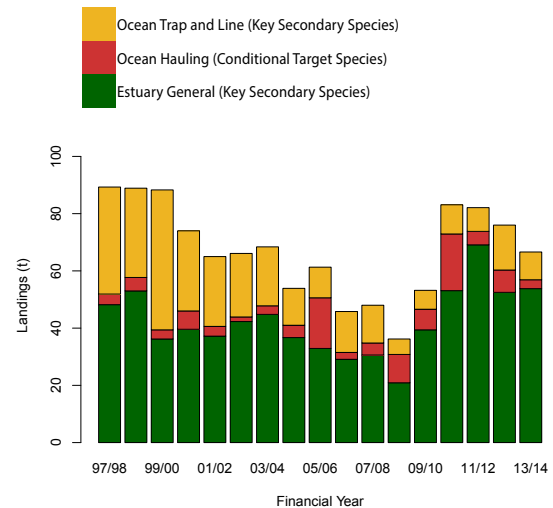
The most recent estimate of the recreational harvest of Mulloway in NSW was approximately 21,000 fish weighing approximately 103 t during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Mulloway in NSW was previously estimated to be approximately 79,000 fish (in the order of 100-500 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Mulloway



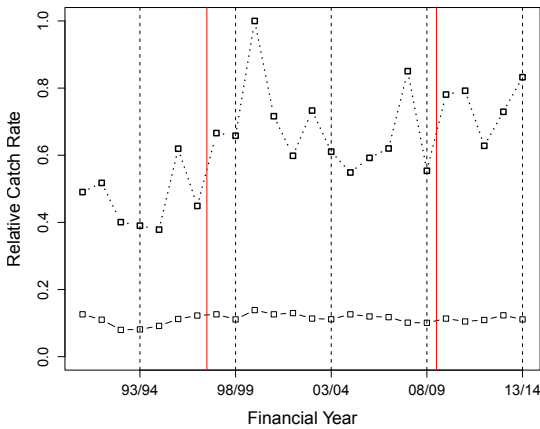
Commercial landings (including available historical records) of Mulloway for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Mulloway



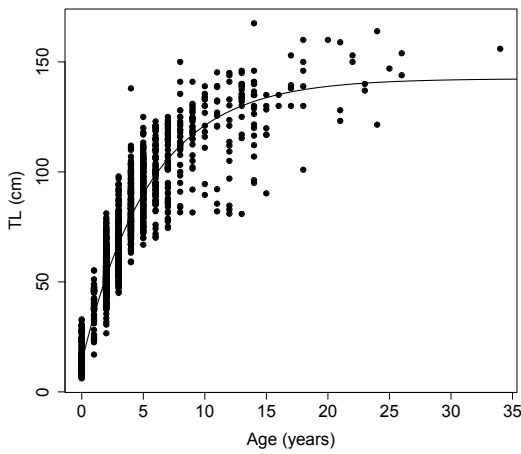
Reported landings of Mulloway by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Mulloway Harvested by Handline in NSW



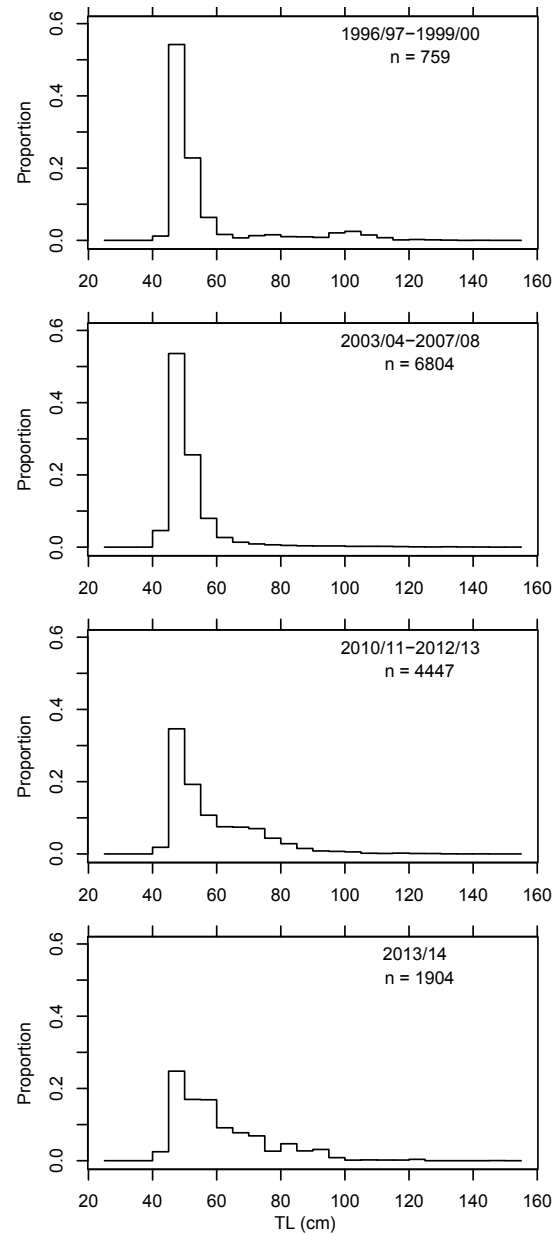
Catch rates of Mulloway harvested using handlines for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Mulloway



Age-length data with fitted growth curve for Mulloway (Data from Silberschneider and Gray (2009) and the NSW Research Angler Program). Lengths are presented as total length (TL).

Length Frequency of Mulloway



The length distributions of commercial Mulloway landings. The minimum legal length (MLL) imposed in 1992/93 was 45 cm total length (TL). This was increased to 70 cm TL in 2013/14 with the exception of commercial mesh net fishers who can retain up to 10 fish between 45 and 70 cm TL as a bycatch allowance. Since the mid-1990s the majority of Mulloway in commercial landings have been between 45-70 cm TL.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 354001, common name or scientific name to find further information.



Ocean Jacket

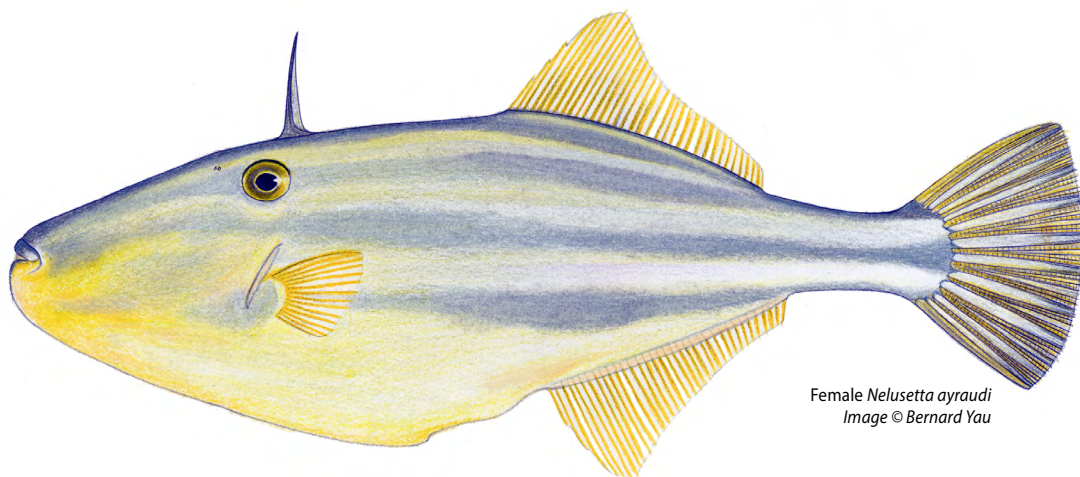
(*Nelusetta ayraudi*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

The Ocean Jacket is a fast growing, early maturing, and voracious species. Despite four years of declines in landings, stable catch rates across the fishery have resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Nelusetta ayraudi</i>	Ocean Jacket	Previously known as Chinaman Leatherjacket.



Background

The Ocean Jacket is distributed throughout southern Australian waters from Cape Moreton in Queensland to North West Cape in WA (including Tasmania). They can be found in waters from 2 m-200 m in depth. Juveniles of this species occur close to shore in bays and estuaries and have been caught in seagrass, over sand and rocky reefs. Research from the Great Australian Bight suggests that this species schools in size classes with larger fish occurring in deeper water.

The diet of Ocean Jackets has been recorded as consisting of fish, invertebrates and salps. In NSW waters both male and female Ocean Jackets mature at about 35 cm total length (TL), at about 2-3 years of age. They are a relatively fast growing and short lived species, with a maximum observed age of 6 years.

Analysis of historical steam trawl catch and effort data for 1918-23, 1937-43 and 1952-57 from the Australian South East Fishery showed that leatherjackets (assumed to be mostly Ocean Jackets) were very abundant in the early years of the fishery and then declined in abundance in later years. NSW trap fishers annually landed up to 1000 t of leatherjackets during the 1950s. Ocean Jackets are important to NSW recreational and charterboat fishers and are also significant in Commonwealth trawl landings.

Additional Notes

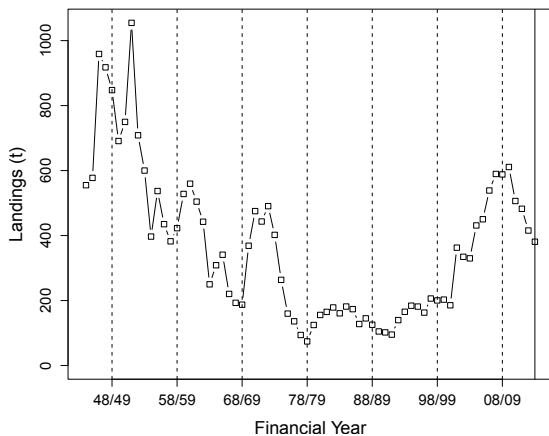
- Ocean Jackets are a short lived species (up to 6 years) and grow to 70 cm TL.
- Sexual maturity occurs at approximately 35 cm TL.
- The age structure of commercial landings of Ocean Jackets during 2003/04 was dominated by 2 and 3 year old fish. No age-based state or Commonwealth assessments have been done since that time.
- Commonwealth assessments do not consider Ocean Jackets to be overfished nor subject to overfishing (Georgeson *et al.*, 2014).
- There is a recreational bag limit of 20 leatherjackets.

Catch

Recreational Catch of Ocean Jacket

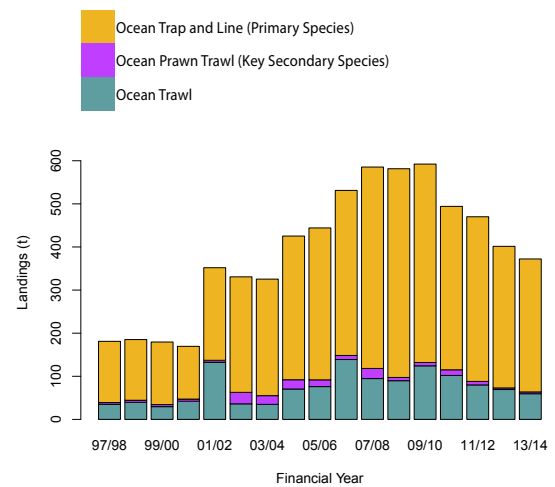
The most recent estimate of the recreational harvest of leatherjackets (all species combined) in NSW was approximately 71,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of leatherjackets (all species combined) in NSW was previously estimated to be approximately 380,000 fish (in order of 110 t–180 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Ocean Jackets



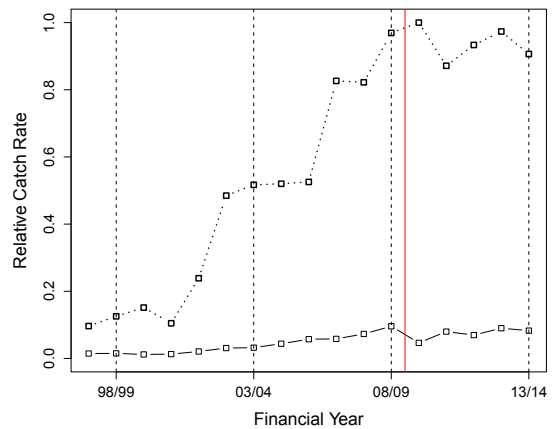
Commercial landings (including available historical records) of all species of Ocean Jackets for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Ocean Jackets



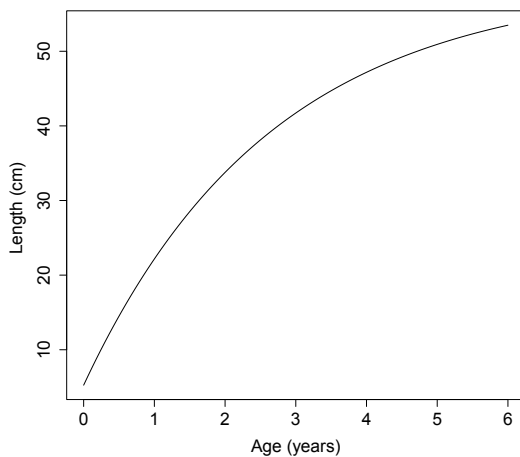
Reported landings of all species of Ocean Jackets by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Ocean Jackets Harvested by Fish Trapping in NSW



Catch rates of all species of Ocean Jackets harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Ocean Jacket



Growth curve for Ocean Jacket using parameters from Miller (2007). Lengths are presented as total length (TL).

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Ocean Perch

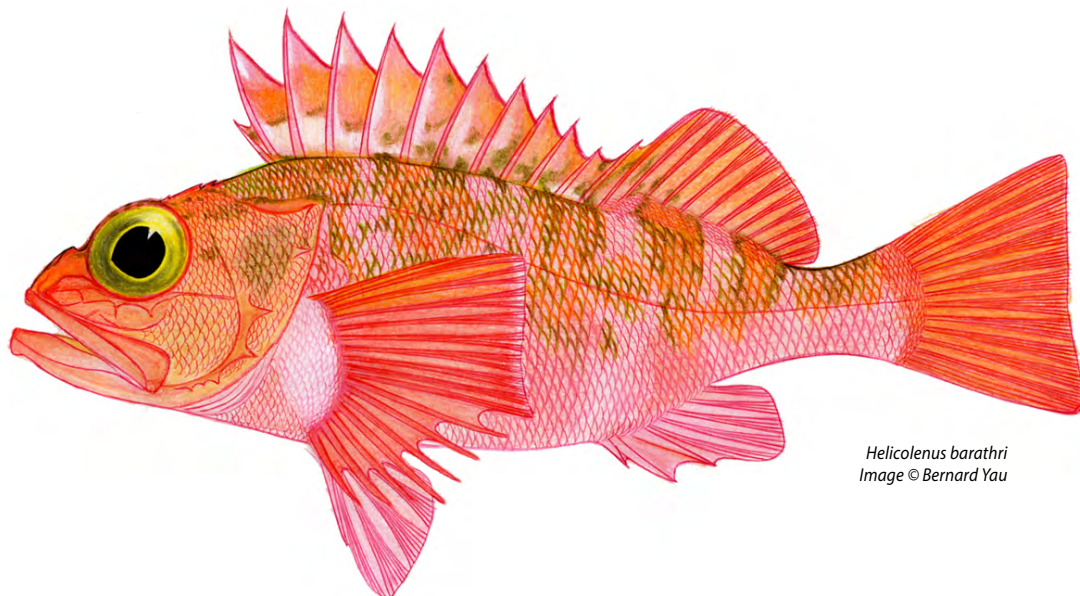
(*Helicolenus* spp.)

Author Rowan Chick

EXPLOITATION STATUS FULLY FISHED

Ocean Perch consist of two relatively long-lived species (Offshore or Bigeye Ocean Perch and Inshore or Reef Ocean Perch). In NSW, landed catch is predominantly Bigeye Ocean Perch from the NSW Ocean Trap and Line Fishery. However, Commonwealth fisheries dominate annual catches and the NSW exploitation status is adapted from Commonwealth assessments. In 2013/14 Bigeye and Reef Ocean Perch were assessed as not overfished and not subject to overfishing, adapted to a NSW status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Helicolenus barathri</i>	Bigeye Ocean Perch	Also known as Offshore Ocean Perch.
<i>Helicolenus percoides</i>	Reef Ocean Perch	Also known as Inshore Ocean Perch.



Helicolenus barathri
Image © Bernard Yau

Background

Five species of Ocean Perches (family Sebastidae) are found offshore along the NSW coast but two species (Bigeye and Reef Ocean Perch) comprise the bulk of the landings. The Bigeye Ocean Perch (*Helicolenus barathri*) is an upper-slope species found in 250-800 m while the Reef Ocean Perch (*H. percoides*) is distributed across the continental shelf and onto the upper slope in depths between about 80-350 m. The Deepsea Ocean Perch (*Trachyscorpia capensis*) occurs mostly in midslope depths greater than 800 m and, because there is little fishing at such depths off NSW, few Deepsea Ocean Perch are caught locally. Two similar species (*Neosebastes incisipinnis* and *N. scorpaenoides*) are smaller fish which occur closer inshore, and are sometimes caught incidentally by trawl fishers.

The two species of *Helicolenus* commonly landed in NSW are very similar in appearance. However, the Reef or Inshore Ocean Perch tends to be more orange in colour with small dark spots on the head and more defined darker vertical bands on the body, compared to the Bigeye or Offshore Ocean Perch which has a more overall pink-red colouration with greenish flecks on the scales. The Reef Ocean Perch seldom exceeds 30 cm in length and is commonly 20-25 cm, whereas the Bigeye Ocean Perch can reach more than 40 cm in length (1.5 kg) and live for 60 years.

Ocean Perch are lecithotrophic and viviparous, meaning that egg fertilization and larvae development occur inside the female fish. The larvae are released when they reach about 1 mm in length. The Ocean Perch breeding season extends

from June to November and a single female can produce between 150,000-200,000 larvae per season. Ocean Perch are ambush predators, rising quickly from the ocean floor to capture prey. Main food sources for Ocean Perch are Royal Red Prawns, Squid and smaller fish.

Ocean Perch inhabit reef and areas of flat, hard seabed. Commercial catches are commonly dominated by the more marketable Bigeye Ocean Perch and in NSW catches have been increasingly dominated by that from the Ocean Trap and Line Fishery. Annual catches in NSW have ranged between 21-36 t within the last 5 years. In 2013/14, 28 t of Ocean Perch was reported in NSW. Since the late 1990's Commonwealth landed annual catches of Ocean Perch have ranged between about 400 t-200 t. In 2013/14 the annual landed catch of Ocean Perch from Commonwealth fisheries was 179 t, and less than the 195 t TAC. Discarding (returning catch to the sea) has been a substantial component of the Ocean Perch fishery, with recent discards exceeding landed catches. Commonwealth assessments have recently accounted for discard rates, resulting in higher estimates of CPUE in recent years and more optimistic outcomes for both Bigeye and Reef Ocean Perch. In 2013/14, the Commonwealth assessment for both species determined they were not overfished and not subject to overfishing. These outcomes have been adapted for NSW assessment to define their exploitation status as Fully Fished.

Additional Notes

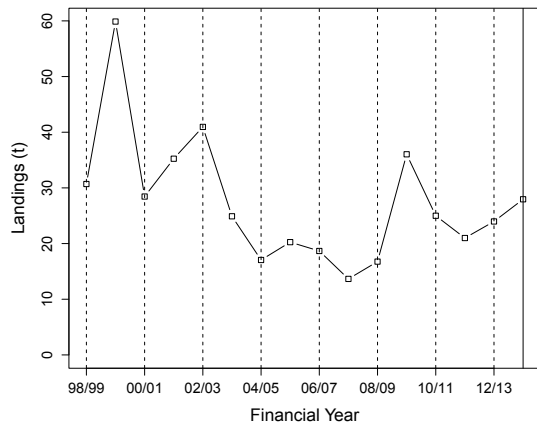
- Two main species in this group: the Inshore/ Reef Ocean Perch (*Helicolenus percooides*) and the Offshore/Bigeye Ocean Perch (*H. barathri*).
- NSW has a relatively small line fishery, which targets the Offshore/Bigeye Ocean Perch, though both species are sometimes harvested in the trawl fishery north of Sydney.
- A 2014/15 NSW fish-trawl observer program is acquiring data describing the length structure of the catch.

Catch

Recreational Catch of Ocean Perch

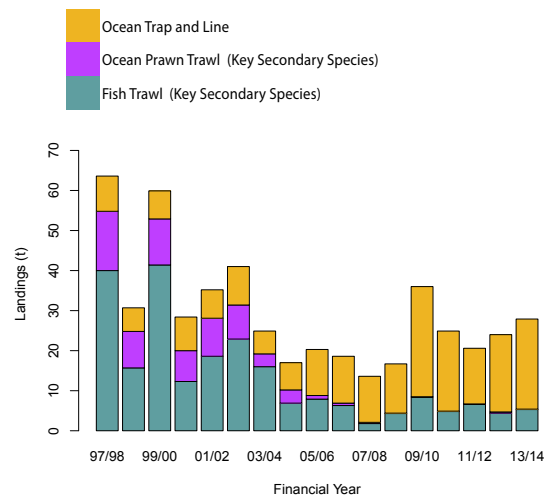
The annual recreational harvest of Ocean Perch in NSW is considered to be minor. This estimate is based upon the results of the offshore trailer boat survey (Steffe *et al.*, 1996) and onsite surveys undertaken by NSW DPI.

Historical Landings of Ocean Perch



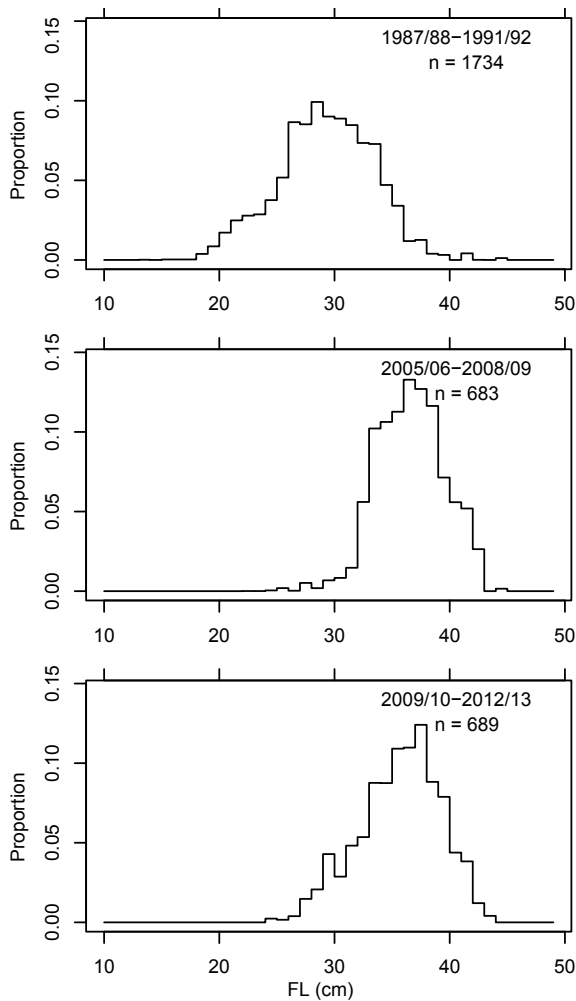
Commercial landings (including available historical records) of Ocean Perch for NSW from 1998/99 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Ocean Perch



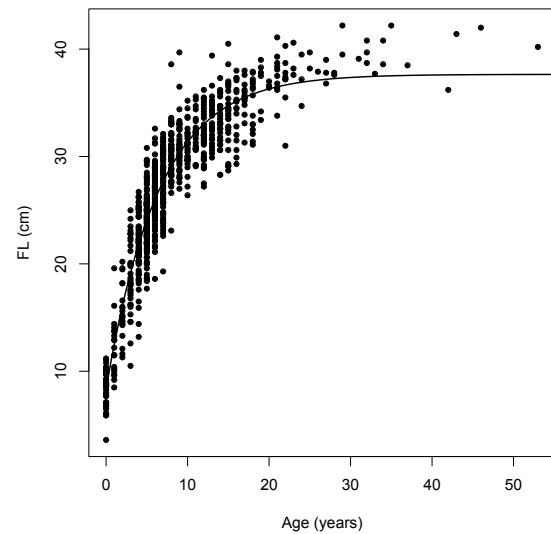
Reported landings of Ocean Perch by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Bigeye Ocean Perch



The length distribution of Bigeye Ocean Perch (*H. barathri*) landed by NSW commercial fishers was relatively stable from the late 1980s to the early 1990s, and comprised mainly fish between 20-40 cm fork length (FL). The majority of fish measured during this period were caught in demersal trawl nets. A smaller number of Ocean Perch were measured during the late 1990s and recently (2005 to 2009) - these fish were mostly caught on droplines and were larger, between 30-40 cm FL. There is no minimum legal length for Ocean Perch in NSW.

Growth Curve of Bigeye Ocean Perch



Age-length data with fitted growth curve for Bigeye Ocean Perch (internal data). Lengths are presented as fork length (FL).

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 287093 and 37 287001 common name or scientific name to find further information.



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Octopus

(*Octopus* spp.)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Lack of biological and fishery information on the main species harvested precludes resource assessment at this time.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Octopus australis</i>	Hammer Octopus	Also formerly known as Trawl Octopus or Southern Octopus. The major component (70-80%) of catches.
<i>Octopus tetricus</i>	Gloomy Octopus	Also formerly known as Sydney Octopus. A minor species caught off central and northern NSW.
<i>Octopus pallidus</i>	Pale Octopus	A minor species infrequently caught off southern NSW.
<i>Pinnoctopus cordiformis</i>	Maori Octopus	Formerly known as <i>Octopus maorum</i> . A minor species infrequently caught off southern NSW.



Octopus spp.
Image © Bernard Yau

Background

Nine species of octopus have been identified from NSW catches. Two species have limited east coast distributions, from central Queensland to southern NSW, and make up the bulk of the landings. The Hammer Octopus (*Octopus australis*) is the most abundant and accounts for around 70-80 % of NSW landings. It is a relatively small species with an adult arm span of just 40 cm. It is found in coastal waters and bays on sand or mud substrates in depths between 3 and 140 m. The Gloomy Octopus (*O. tetricus*) makes up about 10-20 % of NSW landings and is a larger species with an arm span that can reach 2 m. It mainly inhabits shallow seagrass beds and coastal reefs, but small numbers are regularly taken by trawlers in depths out to about 70 m.

Two more southerly distributed octopus species are taken in small quantities along the southern coast. The Pale Octopus (*O. pallidus*), which has an arm span reaching 60 cm, and the Maori Octopus (*Pinnoctopus cordiformis*), which is the largest Australian species with an extended arm span of over 3 m. Both are widely distributed from about Newcastle to Ceduna in SA (for the Pale Octopus) and southern WA (for the Maori Octopus), and including Tasmania. The Maori Octopus is also found in New Zealand waters. The Pale Octopus inhabits a wide depth range from shallow sandy bays (in the south) to at least 275 m. The Maori Octopus is more common around inshore rocky reefs, seaweed and seagrass beds, but can be found in offshore waters to a maximum depth of about 550 m.

The stock structure of all species in Australian waters is currently unknown. Some evidence suggests that the Pale Octopus has discrete subpopulations in Bass Strait with limited dispersal; therefore, the stock statuses of octopuses are generally assessed and managed at the jurisdictional level.

Recent aging of several Australian octopus species via thin sections of stylets (tiny, paired, residual internal shells) suggest that the Hammer Octopus has a lifespan of up to 11 months in NSW waters, Pale Octopus lives for up to 1.6 years (19 months) in Tasmanian waters and *O. (cf) tetricus*, an endemic species on the west coast, had a maximum age of almost 2 years (22.5 month). Results for the Maori Octopus were less conclusive, with very low increment counts (equivalent to ages of less than 7.3 months) that would suggest non-feasibly high growth rates.

Maturation in Pale Octopus in Tasmania varied significantly between sexes, with all males mature at 5 months of age (and less than 250 g), whereas some females had already spawned at 4 months of age while others were still immature at 15 months of age (average size at maturity was 473 g). Back calculated hatch dates suggested that spawning occurred throughout the year, with peaks in gonadal development occurring in summer. Fecundity ranged from 270 to 910 eggs per female and was positively correlated with female size. Similar details are not known for other Australian octopus species.

During the day, most octopus hide in lairs or bury in the seabed. They emerge at night to feed, preying mainly on shellfish and crustaceans. Captured prey is first injected with poison which causes paralysis, before being consumed. Large species, such as the Maori octopus, are known to enter lobster traps and consume or remove rock lobsters.

Male octopus typically inseminate females using a modified third arm or hectocotylus. With this arm, sperm packets are deposited directly into the females' mantle cavity where they are stored until spawning. Females lay eggs in rock crevices or attach them to sheltered hard surfaces and provide care for the eggs until they hatch, after which she dies. The hatchlings of some species are planktonic and travel on ocean currents before settling to the bottom; whereas, for others hatchlings settle immediately to the bottom.

In Australia, octopus are mostly marketed for human consumption, but some are used for bait. Commercial landings of octopus in NSW occur

throughout the year, but vary seasonally. Catches are greatest between January and May, with a peak in March. By far the largest quantities are harvested by the Ocean Trawl Fishery off the central and northern coasts, with smaller quantities landed by the Estuary Prawn Trawl and Ocean Trap and Line fisheries.

Annual landings of combined octopus species in NSW were typically between 400 and 800 t per year until 2003/04, after which they rapidly declined to less than 200 t per year, where they have remained until present. Hammer Octopus is also harvested at much lower levels as by-product in Queensland prawn trawl fisheries (along with a range of other tropical species). There are no biological data or stock assessments for octopus in NSW waters and the long-term effects of harvest are unknown.

The Pale Octopus, which supports small pot fisheries in Tasmania and Victoria (usually less than 100 t per year) was assessed as transitional-depleting and undefined, respectively in 2014. The Tasmanian assessment was based on declining catch rates from an independent pot survey and increased commercial fishing effort over the last 3 years.

Additional Notes

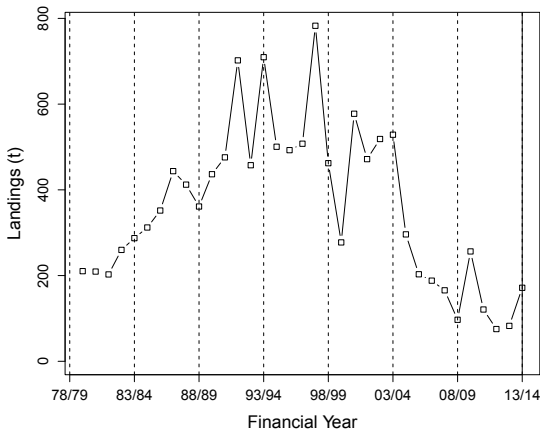
- Nine species of octopus were identified in landings at the Sydney Fish Market, some of which were as yet undescribed species.
- The most common species in NSW landings were the Hammer Octopus (estimated 80 % of landings) and Gloomy Octopus (about 10-20 % of landings) taken primarily off northern and central NSW. The Pale Octopus and Maori Octopus are taken in smaller quantities off southern NSW.
- Species composition and biological data are required for local species before an assessment of status can be attempted.
- There is a recreational bag limit of 10 octopus.

Catch

Recreational Catch of Octopus

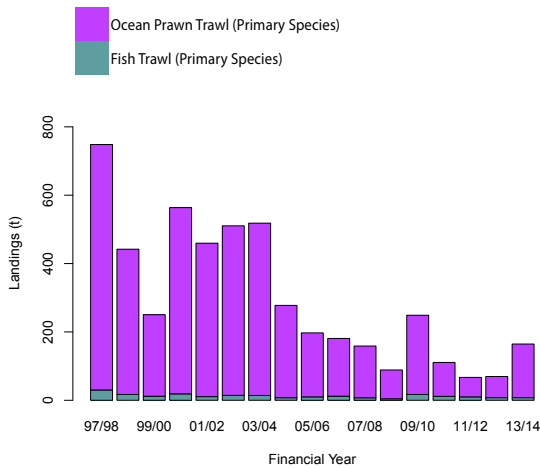
There is no robust estimate of the recreational harvest of octopus in NSW. The annual recreational harvest of octopus in NSW was previously estimated to be approximately 10,000 octopus, based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Octopus



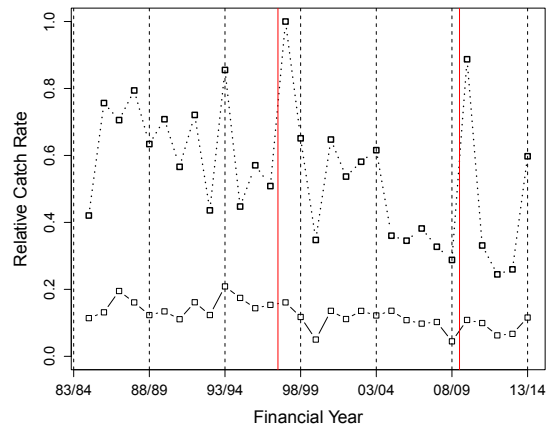
Commercial landings (including available historical records) of octopus for NSW from 1979/80 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Octopus



Reported landings of octopus by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Octopus Harvested by Ocean Prawn Trawling in NSW



Catch rates of octopus harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 659001, 23 659006, 23 659004 and 23 659003 common name or scientific name to find further information.



Pearl Perch

(*Glaucosoma scapulare*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

The commercial and recreational fisheries for Pearl Perch in NSW are relatively minor. Recent declines in landings and catch rates, increases in average sizes each year since 2009/10 and uncertainty about reproduction and life-history have resulted in a status of Uncertain.

SCIENTIFIC NAME

STANDARD NAME

COMMENT

Glaucosoma scapulare

Pearl Perch



Glaucosoma scapulare
Image © Bernard Yau

Background

Pearl Perch (*Glaucosoma scapulare*) occur in coastal and continental shelf waters (depths 10-150 m) between Rockhampton in Queensland and Sydney in NSW. They are generally found close to submerged reefs, rock ledges or rough bottom. Although individual fish are sometimes observed, most are seen in small groups or schools. This species can sometimes be a midwater feeder, moving well up from the bottom to take bait during the night, however most Pearl Perch are caught near the bottom during the day.

Reproduction in Pearl Perch is not well understood, however there is some evidence that Pearl Perch move northwards to spawn and no maturing fish have been observed in NSW waters. In Queensland, 50% of Pearl Perch are mature at approximately 27.5 cm fork length (FL) and 100% are mature

at 35 cm FL. Spawning may peak during the summer months. Pearl Perch are relatively slow growing and long-lived (> 20 years). Pearl Perch attain around 12 cm after one year, 21 cm after 2 years and 29 cm after 3 years in NSW, after which growth slows substantially. Pearl Perch can reach a maximum length of about 70 cm FL but sizes of 30-50 cm FL are more common. The largest reported weight for this species is 7.3 kg taken from the 35 fathom reefs east of Moreton Bay in July 1991.

Pearl Perch are highly regarded as a table fish and command a high market price. Almost the entire NSW commercial landings are reported in the Ocean Trap and Line Fishery. The species is targeted by recreational fishers in ocean waters off northern NSW.

Additional Notes

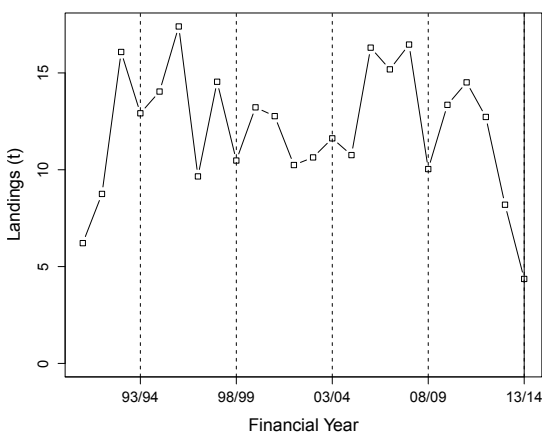
- There is concern for the stock of Pearl Perch in NSW and Queensland due to its slow growth rate, longevity, complex reproductive biology and long history of exploitation.
- NSW annual commercial landings were relatively stable at 10-15 t but have declined rapidly since 2011/12. Recreational landings of Pearl Perch in NSW have also declined markedly during the last decade.
- Pearl Perch are resilient to catch and release with an approximately 90% survival rate.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 5 Pearl Perch.

Catch

Recreational Catch of Pearl Perch

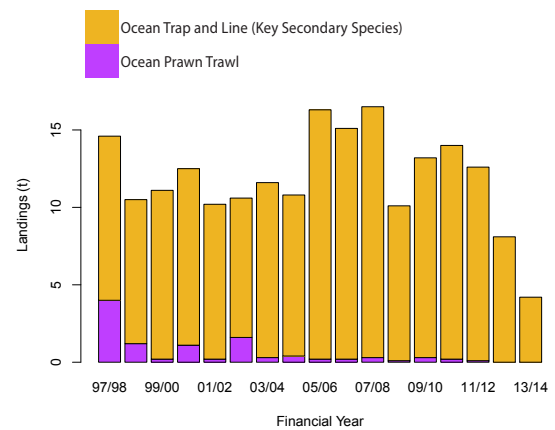
The most recent estimate of the recreational harvest of Pearl Perch in NSW was approximately 4,400 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Pearl Perch in NSW was previously estimated to be approximately 18,000 fish (in the order of 30 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Pearl Perch



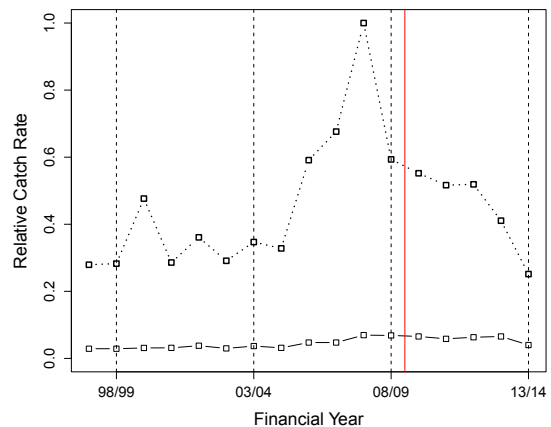
Commercial landings (including available historical records) of Pearl Perch for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Pearl Perch



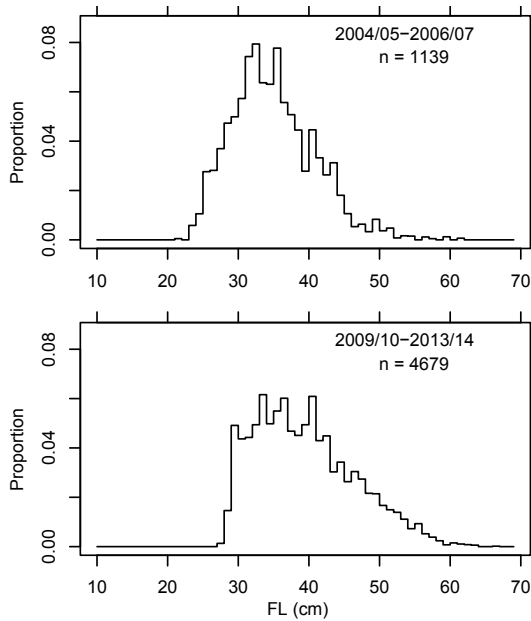
Reported landings of Pearl Perch by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Pearl Perch Harvested by All Line Methods in NSW



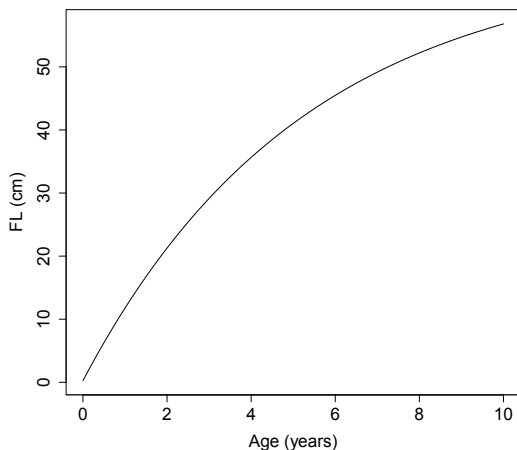
Catch rates of Pearl Perch harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Pearl Perch



The length distribution of Pearl Perch landed by NSW commercial fishers is generally comprised of fish between 30-50 cm fork length (FL). The lengths of Pearl Perch landed have been increasing since 2009/10. A minimum legal length of 30 cm total length (approximately 29 cm FL) was introduced for Pearl Perch in NSW in September 2007.

Growth Curve of Pearl Perch



Growth curve for Pearl Perch using parameters from Stewart *et al.*, (2013). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 320003, common name or scientific name to find further information.



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Pink Ling

(*Genypterus blacodes*)

Author Rowan Chick

EXPLOITATION STATUS **UNCERTAIN**

NSW exploitation status is determined from outcomes of the Commonwealth assessment of the Pink Ling Eastern stock and relevant NSW information. In 2013, Commonwealth assessment determined the Eastern stock was not overfished and uncertain if subject to overfishing. NSW catches have been considered a small component of the total annual harvest of the Eastern stock.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Genypterus blacodes

Pink Ling



Background

Pink Ling (*Genypterus blacodes*) have a southern geographic distribution around Australia, from the central NSW coast, south to southern Western Australia, including Tasmania. Pink Ling are a deep-water species, commonly associated with muddy bottom on the continental shelf and upper slope at depths of 200-900 m.

Pink Ling have an eel-like body shape (similar to Rock Ling) with obvious visible and morphological characteristics. As their name suggests, they are generally pinkish to orange in colour and their jaw reaches to just under their eye (whereas the jaw in Rock Ling reaches beyond the eye). The diet of Pink Ling is thought to vary through its development, with crustaceans being a more important dietary component of juveniles, changing to fishes as they become adult. Pink Ling can grow to a maximum

length of 1.6 m and an age of about 26 years. Males and females have been recorded to mature at about 40-46 cm and 50-58 cm total length (TL), respectively. Some data suggest females do not fully develop until 80-90 cm TL. Spawning has been suggested to peak in winter and spring, although anecdotal evidence of developed eggs in the ovaries of some females outside of this time suggests spawning may not be restricted to these months.

Pink Ling are an important component of the Commonwealth trawl and line fisheries, with two stocks having been recently (2013) defined east and west of longitude 147°E. Historical catches in the Commonwealth peaked in 1997 at 2412 t. More recently catches of Pink Ling from Commonwealth waters have been about 840 t-1000 t p.a. Assessments have indicated that Commonwealth catches

exceeded sustainable levels for the eastern stock between about 2009 and 2013. Subsequently the Australian Fisheries Management Authority has imposed strict controls (including 50 kg daily allowable catch limits) on Commonwealth commercial fishers in the east.

NSW catches of Pink Ling have been less than about 50 t p.a. Within the last 5 years annual catches in NSW have ranged between about 37-50 t, with >95% of that catch coming from demersal setline and droplines within the NSW Ocean Trap and Line Fishery.

Length frequency data obtained from independent observers operating in the NSW Ocean Trap and Line Fishery - setline and dropline, in 2007 and 2008, indicate length structures of Pink Ling ranging from about 65-1050 cm TL, with most common lengths between about 75-85 cm TL. In both years there were small numbers of fish caught >110 cm TL.

Additional Notes

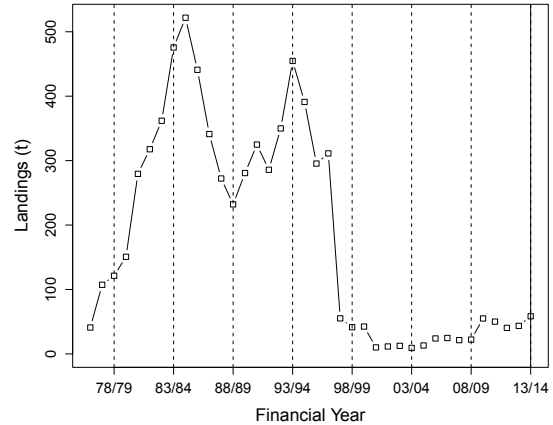
- NSW Fisheries is collecting length frequency data from the relevant fisheries to support Commonwealth assessments of the Eastern Pink Ling stocks
- In 2013, the Commonwealth assessment determined Eastern Pink Ling were not overfished but uncertain if overfishing was occurring. Estimates of spawning biomass from that assessment were between 20-30% of unfished levels but trending up over recent years.

Catch

Recreational Catch of Pink Ling

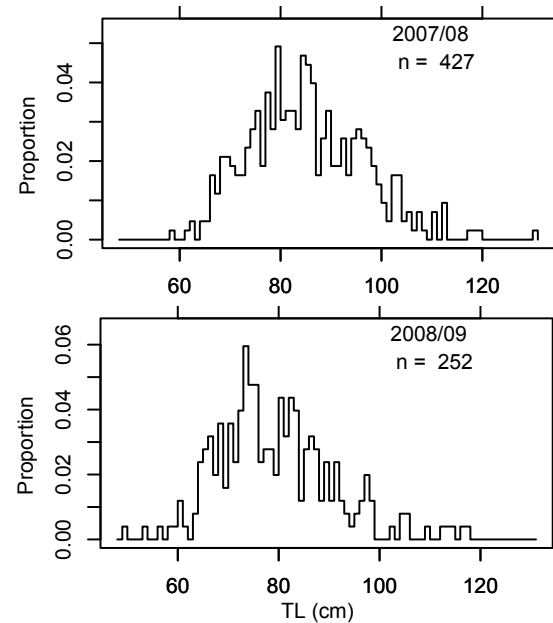
The annual recreational harvest of Pink Ling in NSW is considered to be minor.

Historical Landings of Pink Ling



Commercial landings (including available historical records) of Pink Ling for NSW from 1990/91 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Length Frequency of Pink Ling



The length-frequency distribution of Pink Ling from an independent observer program in the NSW Ocean Trap and Line Fishery in 2007 and 2008.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37228002, common name or scientific name to find further information.

Australian Museum - <http://australianmuseum.net.au/pink-ling-genypterus-blacodes-forster-1801>



Pipi

(*Donax (Plebidonax) deltooides*)

Author Daniel Johnson

EXPLOITATION STATUS **UNCERTAIN**

Commercial landings have declined from more than 500 t in 2004 to less than 65 t in recent years, despite a significant increase in price over this period. In response to the declines in landings new management arrangements were implemented in an attempt to stabilize the fishery. There is insufficient information to allow specification of an exploitation status.

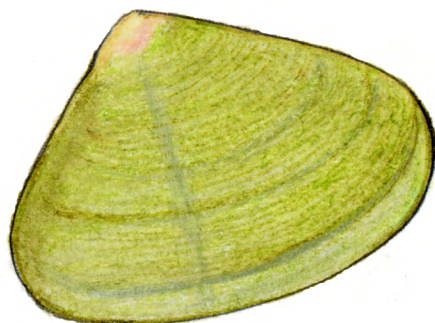
SCIENTIFIC NAME

COMMON NAME

COMMENT

Donax (Plebidonax) deltooides Pipi

The same species is known as Eugarie in Queensland and Goolwa Cockle in South Australia.



Donax (Plebidonax) deltooides
Image © Bernard Yau

Background

The Pipi (*Donax (Plebidonax) deltooides*) occurs on surf beaches from southern Queensland southwards to Eyre Peninsula in SA. They are found in the surf zone, i.e. intertidal and shallow subtidal waters along high energy beach coastlines. Whilst Papis are harvested within the Estuary General Fishery, they are not normally found in estuaries. Like most bivalve molluscs, Papis filter feed by extracting microscopic matter (particularly phytoplankton) from the water.

In NSW, Papis grow rapidly and reach sexual maturity at about 3.7 cm shell length within the first 10-12 months of life. Papis appear to be capable of spawning all year round, giving rise to 'cohorts' of recruitment of small Papis (less than 1 cm shell length) onto beaches. However, not all recruited cohorts become established in the population. Papis grow to more than 6-8 cm shell length and are believed to live for up to 4 or 5 years.

There was a considerable peak in landings of Papis in 1996/97 before several events of human sickness following consumption of Papis caused this part of the fishery to be closed periodically during 1997 and 1998. The Papis were contaminated by algal blooms occurring off some beaches in summer. Access to this part of the fishery has subsequently been limited to fishers who operate in accordance with an approved biotoxin management program. Under the program, fishers test the water regularly for the presence of algae and cease harvesting if concentrations are above threshold levels.

Commercial landings have declined from more than 500 t in 2004 to less than 65 t in recent years, despite a significant increase in price over this period. In 2011, a 6-month closure of the commercial fishery and output controls limiting catch to 40 kg per fisher per day were implemented in an attempt to stabilise the fishery. A minimum legal length of 45 mm is in place to allow spawning to occur before recruitment to the fishery.

Pipis are collected exclusively by hand in the Estuary General Fishery, by endorsement holders. Apart from human consumption in soups and chowders, Pipis are also sold as bait for recreational fishers. Considerable quantities are also collected by recreational fishers for use as bait.

Additional Notes

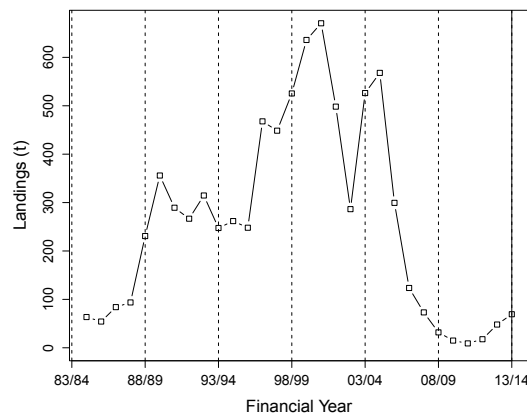
- The commercial harvest may no longer be greater than the recreational harvest, although no data are available on trends in the latter.
- Port-based monitoring of size composition of commercial catches from selected beaches commenced in 2014.
- NSW DPI implemented a two-year observer-based survey of the fishery (2013/14) to collect specific information including; (i) the location and timing (i.e. tidal phase, diurnal period) of individual fishing events; (ii) time spent searching for individual aggregations; (iii) number of aggregations fished daily; (iv) catch rates (i.e. kg/ hour) of individual aggregations; (v) size structure of landed catch; and (vi) proportion of catch below minimum legal length.
- Current management regulations, that restrict harvest to 40 kg of Pipis per fisher day, may produce hyper-stable catch rates. The aggregated nature of the Pippi fishing process implies that abundance of Pipis may decline faster than CPUE as the stock is depleted. If fishers succeed in finding aggregations of Pipis, large declines in CPUE will only be observed when the number of aggregations is greatly reduced and catching operations become more random.
- There is a combined recreational bag limit of 50 cockles, mussels and Pipis.

Catch

Recreational Catch of Pippi

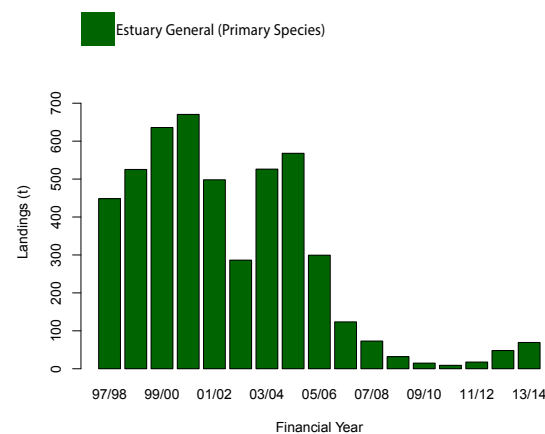
The most recent estimate of the recreational harvest of Pipis in NSW was approximately 88,000 individuals during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Pippi in NSW was previously estimated to lie between 20 and 50 t, based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI. Additional information is available from Murray-Jones and Steffe (2000).

Historical Landings of Pippi



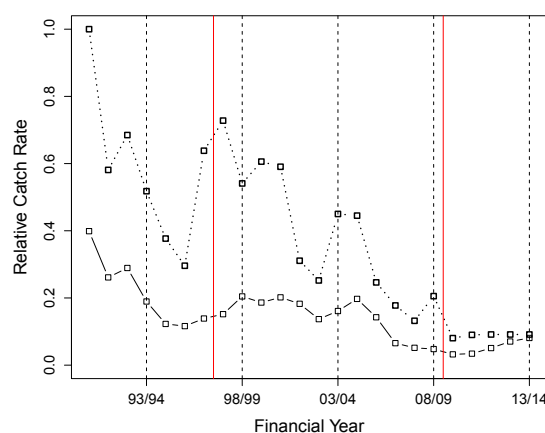
Commercial landings (including available historical records) of Pippi for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Pippi



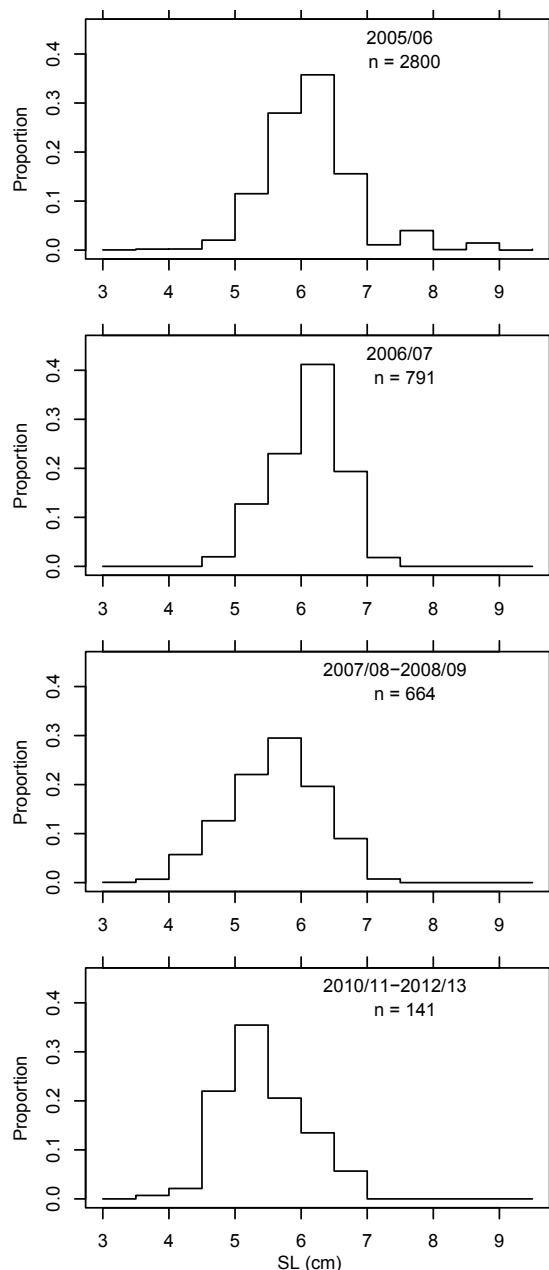
Reported landings of Pippi by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Pippi Harvested by Hand Gathering in NSW



Catch rates of Pippi harvested using hand gathering for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Pipi



The length distribution of Pipsis landed by NSW commercial fishers from Stockton Beach is comprised mainly of Pipsis between 5-8 cm shell length (SL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 359001, common name or scientific name to find further information.



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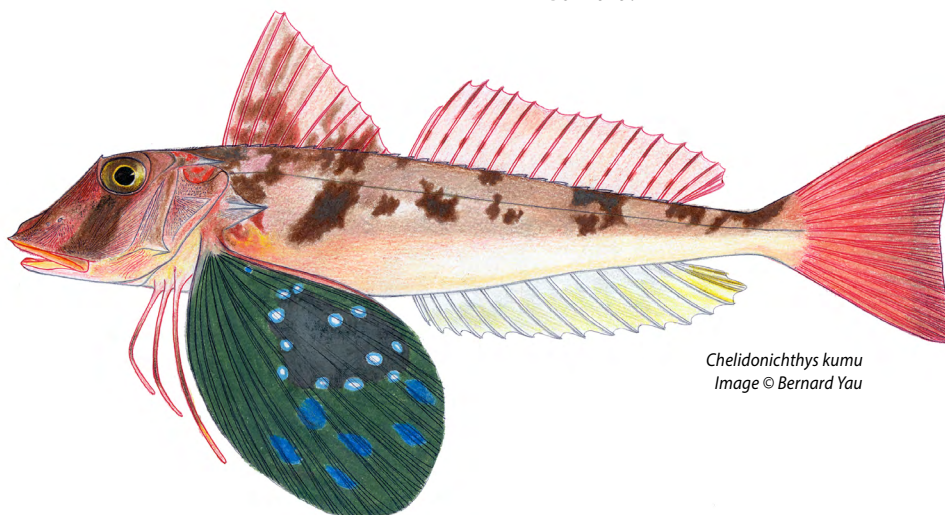
Red Gurnard and Latchets (Triglidae)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

Red Gurnard and Latchet have consistently been caught in the NSW Fish Trawl Fishery, with an average of about 30 t reported annually since at least 1998/99. Commonwealth fisheries annually land > 60 t and > 80 t of Red Gurnard and Latchet, respectively. However, these are not Commonwealth quota managed species and assessments of stock status and reliable local biological data are either not available or limited. Despite relatively consistent catches, a paucity of other reliable data limits an assessment of exploitation status and as such Red Gurnard and Latchets in NSW remain Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Chelidonichthys kumu</i>	Red Gurnard	Majority of the NSW landings.
<i>Pterygotrigla andertoni</i>	Painted Latchet	Deepwater species; minor landings only in NSW.
<i>Pterygotrigla polyommata</i>	Latchet	Minor landings in NSW. Sometimes called Sharpbeak Gurnard.



Chelidonichthys kumu
Image © Bernard Yau

Background

The gurnard family (Triglidae) comprise about 120 species worldwide with more than 30 species found in Australian waters. Gurnards are benthic fish found primarily in depths less than 200 m. Off NSW, several species of small butterfly gurnards (*Lepidotrigla* spp.) can be a substantial component of trawl fishery by-catch. However, there are three species of gurnards in NSW waters that grow large enough to be marketed. The Red Gurnard (*Chelidonichthys kumu*) occurs mainly in deeper estuarine and inner continental shelf waters in depths less than 100 m around most of Australia. Red Gurnard are also found through much of the tropical and temperate waters of the Indo-Pacific region, including New Zealand. Latchet (*Pterygotrigla polyommata*) are a more temperate species, occurring off all southern Australian states

but generally inhabiting deeper waters, from 100-400 m. The Painted Latchet (*Pterygotrigla andertoni*) is found mainly on the upper slope between 200-400 m depth, and is distributed around southern Australia and other areas of the south west Pacific, including New Zealand.

Red Gurnard grow to about 55 cm in length and almost 2 kg in weight, while the two species of Latchet seldom reach 50 cm in length. There is limited biological information on Red Gurnard or Latchet in Australia, but New Zealand studies of Red Gurnard found that they reached around 23 cm fork length (FL) after 2-3 years and could live for 15 years.

Historically in NSW, the names for Red Gurnard and Latchet were confused and reported catches were often ascribed to the wrong species. Consequently, landings of all three species were combined for catch statistics. In July 2009, a new catch reporting system was introduced that required catches of the three species to be reported separately. The NSW catch of Red Gurnard and Latchets is taken almost totally by the fish-trawl sector of the Ocean Trawl Fishery, with annual landings having remained relatively stable at about 25-30 t, since at least 2008/09. In 2013/14, about 30 t of Red Gurnard and Latchet was landed. Substantial quantities of Red Gurnard and Latchet are also taken in Commonwealth Fisheries, but these are not quota managed species and no regular, reliable assessment is available.

Additional Notes

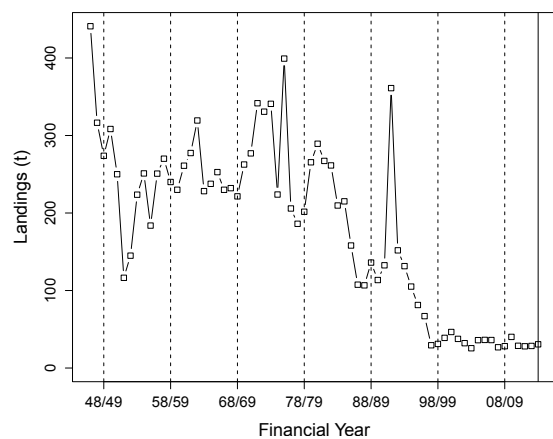
- A 2014/15 NSW fish-trawl observer program is acquiring data describing the length structure of the catch.
- Red Gurnard were measured as part of a commercial fisheries sampling program through the Sydney Fish Markets – 2008/09 to 2012/13.
- Landings by NSW trawl fishery are relatively low (< 50 t), and catch rates are reasonably stable (however, changes may be masked by the combination of past catch data for three species).
- These species are also harvested by Commonwealth fisheries. However, they are not a quota managed species and as such there are limited data available to assess the stocks. Available data suggests annual catches of Red Gurnard and Latchet in 2010, in the Commonwealth fisheries is > 60 t and > 80 t, respectively.
- These species aggregate at certain times of the year, and sometimes large catches can be taken.
- Red Gurnard are also taken incidentally by recreational fishers in both estuarine and ocean waters.

Catch

Recreational Catch of Red Gurnard and Latchets

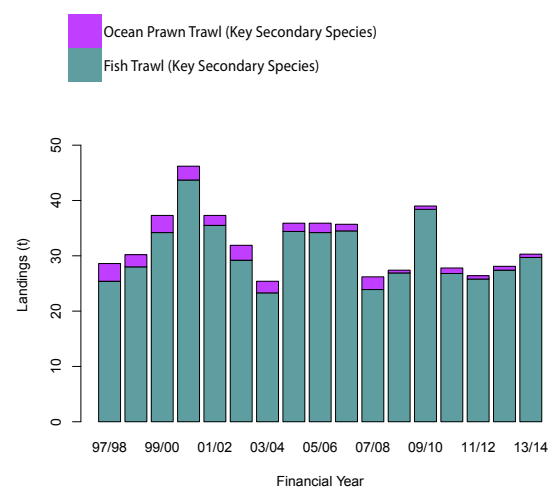
The most recent estimate of the recreational harvest of gurnards (all species combined) in NSW was approximately 1,400 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of both Red Gurnard and Latchets in NSW was previously considered to be minor, based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Red Gurnard and Latchets



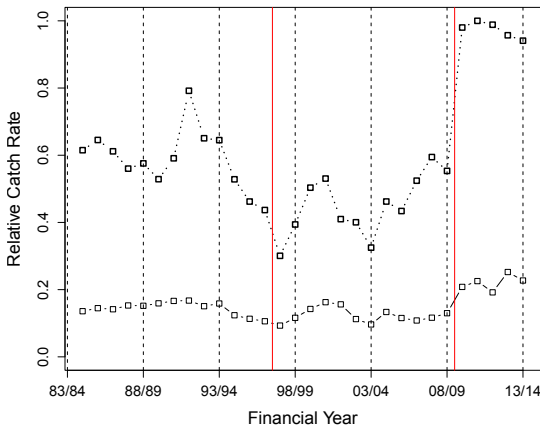
Commercial landings (including available historical records) of Red Gurnard and Latchets for NSW from 1946/47 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Red Gurnard and Latchets



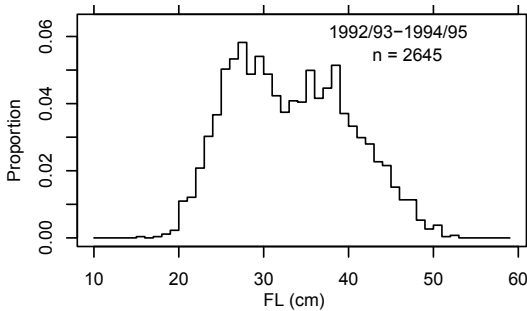
Reported landings of Red Gurnard and Latchets by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Red Gurnard and Latchets Harvested by Fish Trawling in NSW

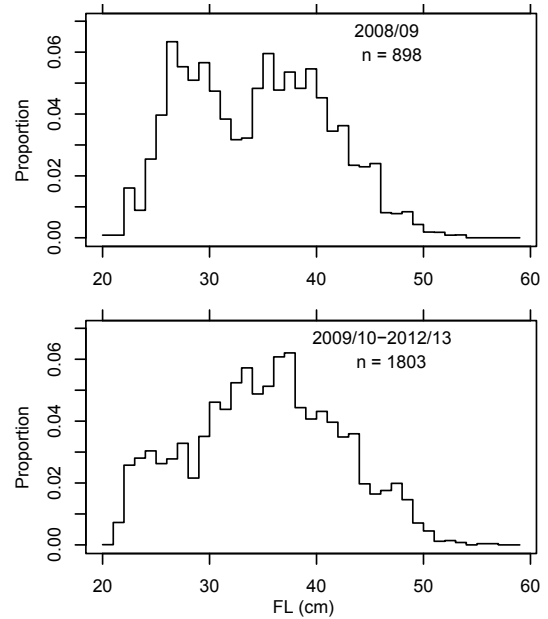


Catch rates of Red Gurnard and Latchets harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Red Gurnard



The length distribution of Red Gurnard caught during trawl surveys by the Fisheries Research Vessel Kapala was comprised mainly of fish between 20-50 cm fork length (FL).



The length distribution of Red Gurnard landed by NSW commercial fishers in 2008/09 comprised mainly fish between 25-45 cm fork length (FL). There is no minimum legal length for Red Gurnard in NSW.

Further Reading

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Red Morwong

(*Cheilodactylus fuscus*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Mostly a recreational spear fishery in NSW. Some local biological information exists, however a lack of data on the fishery has resulted in a status of Undefined.

SCIENTIFIC NAME

STANDARD NAME

COMMENT

Cheilodactylus fuscus

Red Morwong



Background

The Red Morwong (*Cheilodactylus fuscus*) is confined to the east coast of Australia, from southern Queensland to Bass Strait, with the western-most record being Queenscliff, Victoria. It is also found off north-eastern New Zealand. Red Morwong prefer shallow water, rarely any deeper than 30 metres, and electronic tracking studies have shown them to be quite territorial with relatively small home ranges. Red Morwong are a gregarious species and individuals remain affiliated with the one aggregation at a fixed location for years. This species does not form part of a significant commercial fishery, but as one of the largest resident species (maximum length 65 cm fork length (FL), and weight of 3.5 kg), it is a primary target species for spearfishers in southeast Australian waters.

Little is known about the reproductive biology of Red Morwong. In NSW they grow rapidly, reaching a length of about 30 cm FL after 5 years. They can reach ages in excess of 40 years, but the majority of fish are aged less than 15 years.

The vulnerability of this species to spearing, their limited home range and the tendency for aggregations to structure local populations in relatively shallow water all provide the opportunity for even marginal increases in mortality rates to have significant impact on local populations. Spearfishers constitute only a small percentage of recreational effort, but their catch is highly selective for the larger target species resulting in a reduction in the abundance and modal size-distribution of popular target species. There is evidence that spearing is responsible for the localised depletion of morwong populations in New Zealand.

Additional Notes

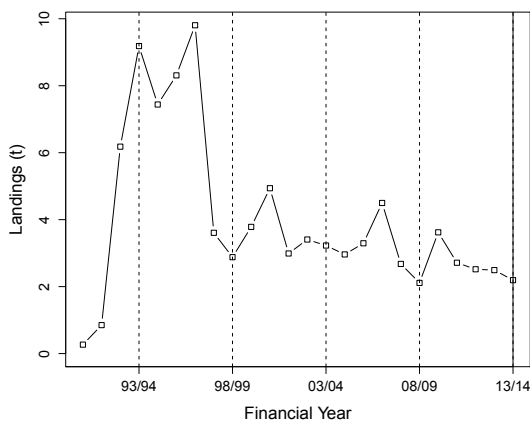
- There is a small commercial catch in NSW, about 2-3 t annually.
- The majority of the harvest is by recreational spearfishing.
- Red Morwong has a defined home range, which suggests it may be vulnerable to localised depletions.
- Red Morwong has a minimum legal length of 30 cm total length (TL) and a bag limit of 5 in NSW.

Catch

Recreational Catch of Red Morwong

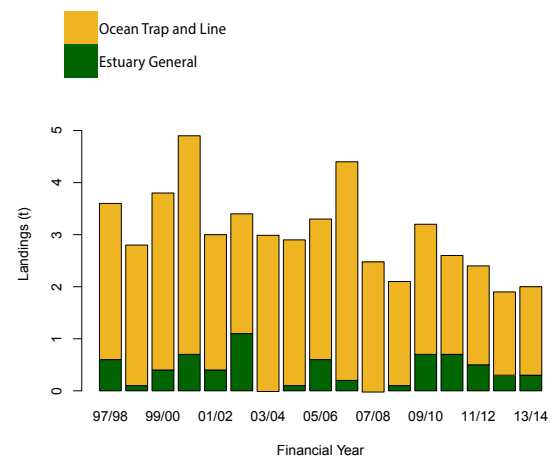
The most recent estimate of the recreational harvest of Red Morwong in NSW is approximately 10,300 fish during 2013/14 (West *et al.*, 2015).

Historical Landings of Red Morwong



Commercial landings (including available historical records) of Red Morwong for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Red Morwong



Reported landings of Red Morwong by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 377009, common name or scientific name to find further information.



Red Mullet

(*Mullidae*)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Small quantities (20-40 t annually) are taken as a by-product in prawn and fish trawls. Assessment is constrained by lack of biological information.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Upeneichthys lineatus</i>	Bluestriped Goatfish	The major component (more than 80%) of catches
<i>Parupeneus spilurus</i>	Blacksaddle Goatfish	
<i>Upeneus tragula</i>	Bartail Goatfish	



Background

At least three species of Red Mullet, also formerly known as Goatfish, are included in the NSW catch. It is estimated that at least 80% of the catch consists of the Bluestriped Goatfish (*Upeneichthys lineatus*), a small fish measuring up to 30 cm fork length (FL). Also landed are small numbers of the larger Blacksaddle Goatfish (*Parupeneus spilurus*), which can grow to more than 40 cm FL, and the Bartail Goatfish (*Upeneus tragula*), which seldom exceeds 15 cm FL.

The Bluestriped Goatfish is endemic to eastern Australia between southern Queensland and southern NSW, while the Blacksaddle Goatfish and Bartail Goatfish are more widely distributed throughout the Indo-West Pacific and down the Australian east coast to central NSW.

Red Mullet typically inhabit inshore waters where they feed on soft sandy areas of seabed using

strong barbels on the underside of their mouth to dig and to sense small prey. There have been no studies on the biology of these species in NSW waters. Size composition data from commercial landings and some independent trawl surveys in NSW waters by Fisheries Research Vessel *Kapala* indicate that most of the Bluestriped Goatfish landed in NSW are between 15-20 cm FL.

Bartail Goatfish from Vietnamese waters that measured up to 25 cm FL had a maximum age of 3 years and 99 days. Females reached sexual maturity by 10 cm FL and the species spawned throughout the year.

Annual landings of Red Mullet by NSW ocean trawlers were mostly between 20-30 t until 2003/04, after which they steadily declined to around 10 t in 2011/12 and 2012/13. Catches doubled in 2013/14 back up to 20 t. Most of the commercial catch is taken as a by-product of ocean prawn trawling. Red Mullet are also landed in small

quantities by the southern Queensland Prawn Trawl Fishery, and less than 1 t is estimated to be taken annually by NSW recreational fishers.

No stock assessment has been undertaken for any Red Mullet species in NSW and the species composition of the catch has not been accurately determined.

Additional Notes

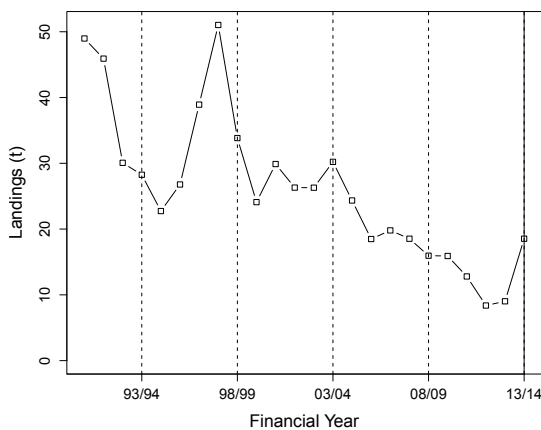
- There are three species in this reporting group, although Bluestriped Goatfish is most commonly landed.
- Bluestriped Goatfish is a widely distributed inshore species.
- Size composition data from recent commercial catch monitoring of Bluestriped Goatfish was compared with data from research trawls and no trends were apparent.
- Commercial landings have declined steadily during the past 20 years.

Catch

Recreational Catch of Red Mullet

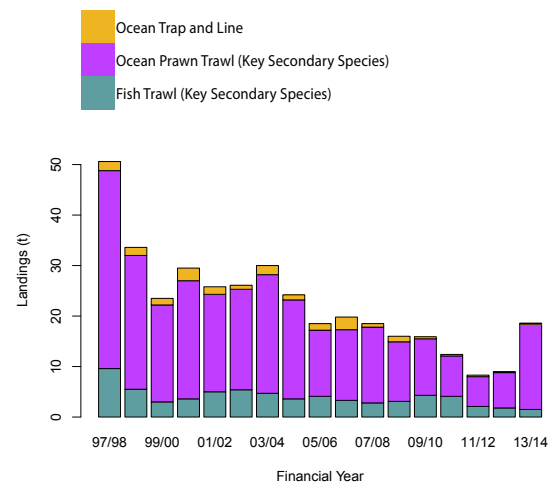
The annual recreational harvest of Red Mullet in NSW is considered to be minor.

Historical Landings of Red Mullet



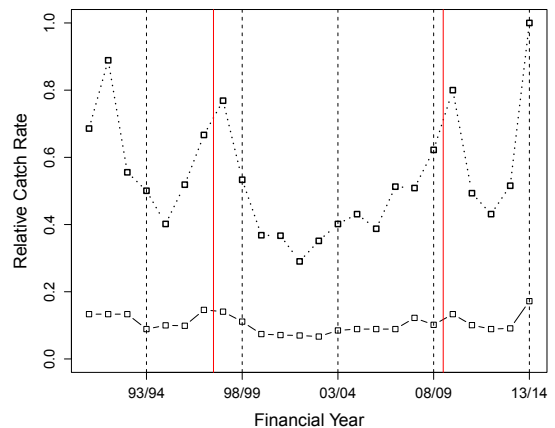
Commercial landings (including available historical records) of Red Mullet for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Red Mullet



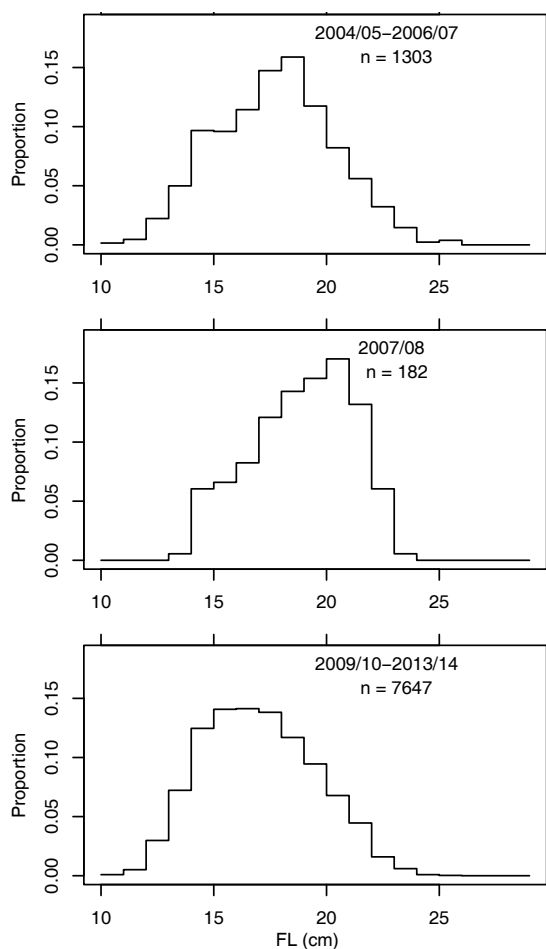
Reported landings of Red Mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Red Mullet Harvested by Ocean Prawn Trawling in NSW



Catch rates of Red Mullet harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Bluestriped Goatfish



The length distribution of Bluestriped Goatfish landed by NSW commercial fishers in recent years has shown a single mode, with the majority of fish being between 15-20 cm fork length (FL). Bluestriped Goatfish do not have a minimum legal length.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 355001, 37 355015, and 37 355014, common name or scientific name to find further information.



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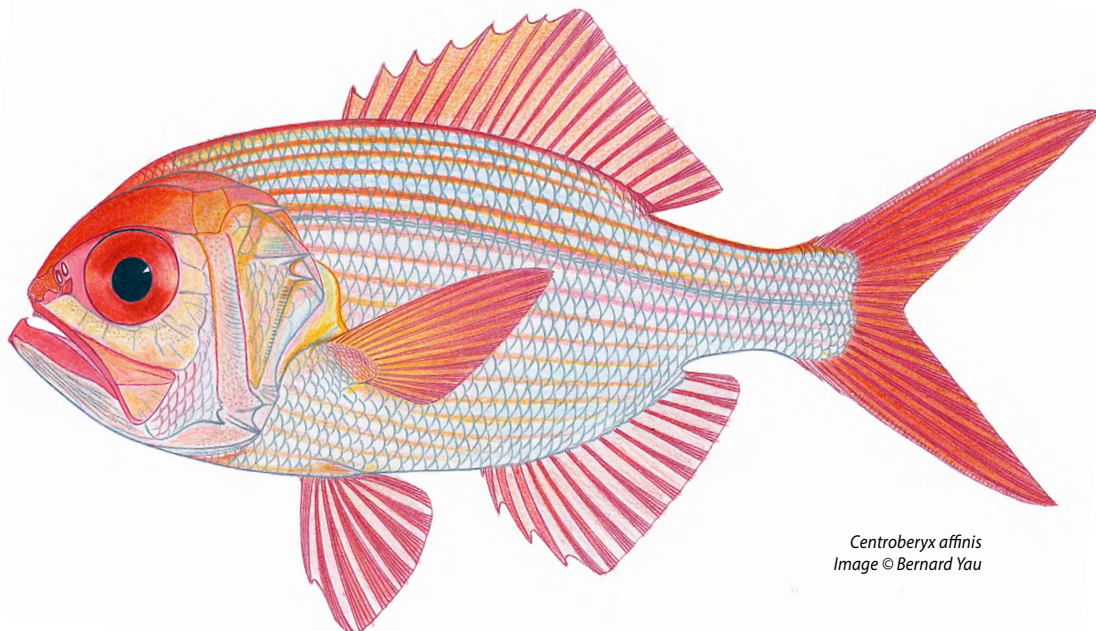
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Redfish

(*Centroberyx affinis*)

Author Karina Hall

EXPLOITATION STATUS		GROWTH OVERFISHED
<p>Predominantly a Commonwealth fishery. The population is Growth Overfished and is very much depleted. The Commonwealth status has been uncertain in recent years due to conflicting signals from population biomass models and catch rate analyses. A status of Growth Overfished has been retained in NSW because this best describes the available fishery and biological data.</p>		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Centroberyx affinis</i>	Redfish	Also formerly known as Nannygai.



Centroberyx affinis
Image © Bernard Yau

Background

Redfish (*Centroberyx affinis*) occurs in continental shelf and upper slope waters (in depths from 10-500 m) along the southeastern coast of Australia from southern Queensland to eastern Bass Strait, including northeast Tasmania and offshore ridges (e.g. Norfolk and Lord Howe islands). Redfish also occur in New Zealand. No formal stock structure studies have been done in Australian waters, but latitudinal differences in growth rates suggest there may be separate 'northern' and 'southern' stocks, with a boundary just north of Montague Island (36°S).

Redfish is a strongly schooling species, generally occurring in association with hard substrates and other structures (e.g. shipwrecks). Juveniles inhabit deep bays and estuaries and shallow inshore reefs, while adults are more abundant in deeper waters to depths of 450 m.

Redfish is slow growing and a long-lived species reaching a maximum age of up to 44 years and size of 34 cm fork length (FL). Maturity is attained at around 5-7 years of age and spawning is thought to occur on continental shelf grounds in late summer and autumn throughout most of the species range. A long time-series of monitoring data is available for Commonwealth fisheries and research trawls, and some data are available on the size composition of catches by NSW trawlers.

In NSW, most of the commercial catch of Redfish is taken as byproduct of fish trawls in the Ocean Trawl Fishery. Since the late 1990s, annual catches have been less than 80 t, and over the last 5 years less than 20 t. Size distributions have also decreased significantly since the late 1970s and suggest the population is currently growth overfished. However, catch rates have remained relatively steady. A significant number of Redfish are also taken by recreational fishers from deeper offshore waters in NSW.

Redfish is predominantly taken by Commonwealth fisheries south of Sydney, with most of the catch landed by fish trawlers of the Southern and Eastern Shark and Scalefish Fishery. Commonwealth landings peaked in the 1990s at around 2,000 t per year, but then steadily decreased after 1998 to just 73 t in 2012/13 and 91 t in 2013/14. Over the last decade, catches have consistently failed to reach the set Total Allowable Catch (TAC).

Reasonably detailed stock assessments have been completed as part of the Commonwealth TAC setting process since the early 1990s. Previous assessments indicated that Redfish was significantly growth overfished in Commonwealth fisheries, but more recent assessments have produced conflicting results and the stock status has been classified as uncertain. Tier 3 assessments (based on catch curve mortality estimates) suggest a healthy stock with a broad spread of ages, including older fish and evidence of new recruitment; whereas, Tier 4 assessments (based on catch rate analyses) indicate that catch rates have steadily declined since 2000 and the stock is now below the limit reference point.

A Tier 1 (full population) assessment in 2014 predicted that the 2015 biomass of Redfish would be just 11 per cent, well below the limit reference point of 20 per cent of the unfished biomass. Consequently, the recommended biological catch was zero, an incidental bycatch TAC of only 100 t was set for 2015/16 and a rebuilding strategy will be formulated.

Additional Notes

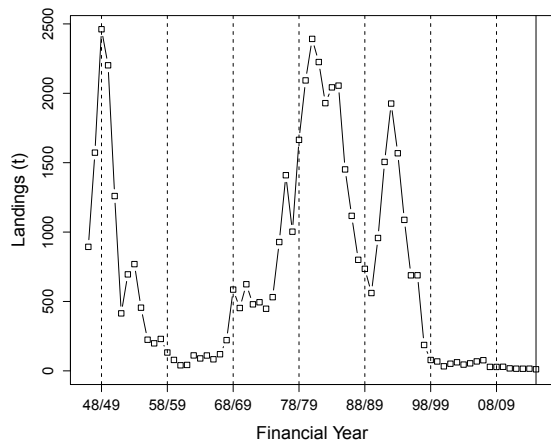
- A schooling species predominantly taken by Commonwealth trawl fisheries. In NSW Redfish is taken by the ocean trawl, ocean trap and line, and recreational sectors.
- Redfish is a long-lived, schooling species, which renders it particularly vulnerable to targeted trawl fishing.
- Redfish can show considerable variation in recruitment strength, possibly in relation to variation in environmental conditions.
- Discarding of small fish has been a serious problem following years of strong recruitment. Gear changes involving increased mesh sizes have been introduced to reduce discarding and help recover from growth overfishing, but the modal length of Redfish in recent catches was still just 17 cm FL.

Catch

Recreational Catch of Redfish

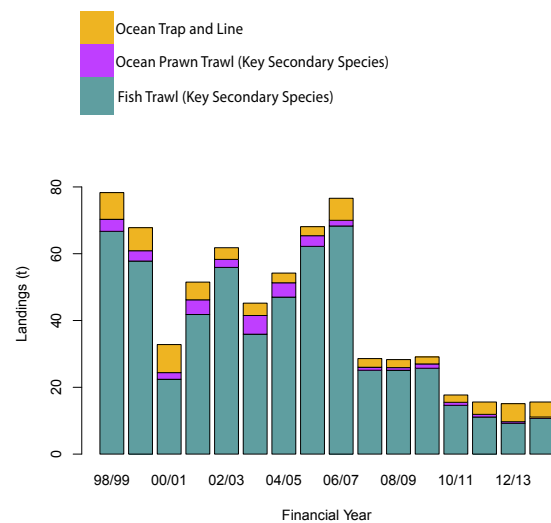
The most recent estimate of the recreational harvest of Redfish in NSW was approximately 21,500 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Redfish in NSW was previously estimated to be approximately 104,500 fish (or between 20 and 40 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Redfish



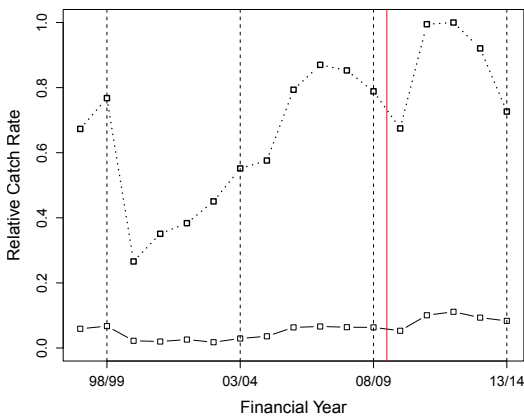
Commercial landings (including available historical records) of Redfish for NSW from 1946/47 to 2013/14 for all fishing methods. Prior to 1977 Commonwealth catches outside 3 nm are included. After 1997 only catches inside 3 nm South of Barrenjoey are included and all catches North of Barrenjoey.

Landings by Commercial Fishery of Redfish



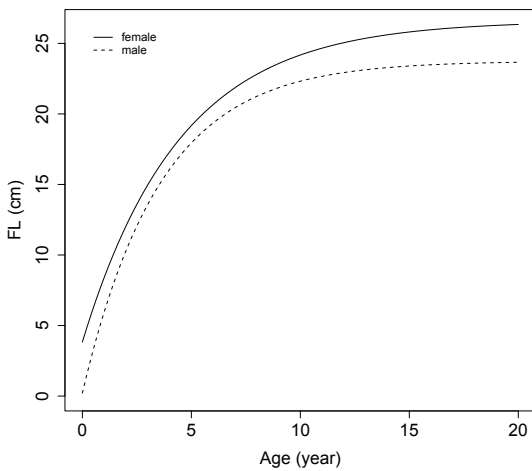
Reported landings of Redfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Redfish Harvested by Fish Trawling in NSW



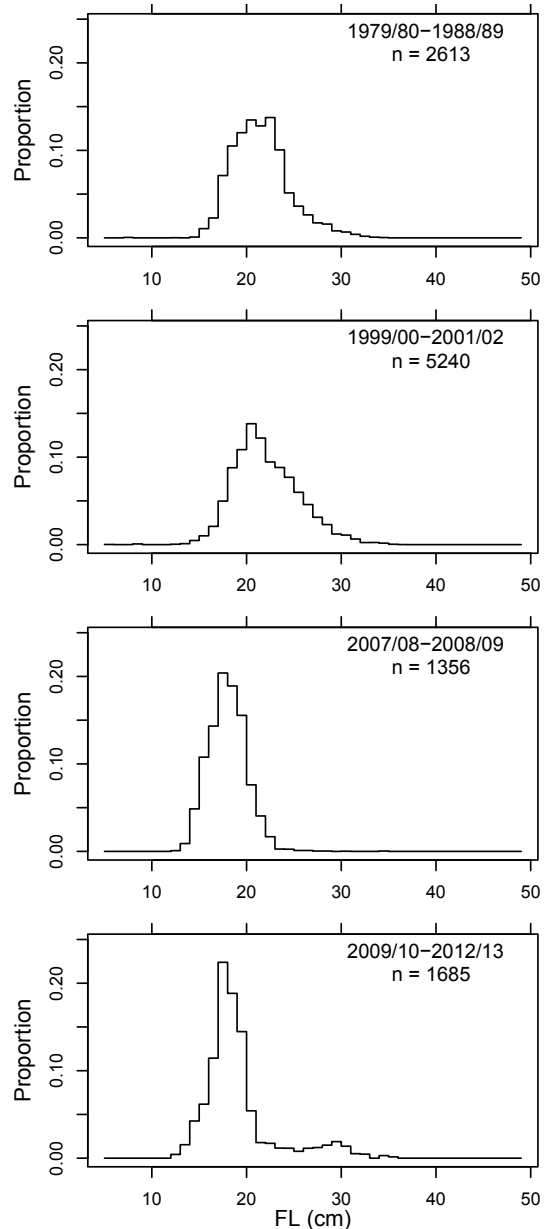
Catch rates of Redfish harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of Redfish



Growth curves of Redfish using parameters from Morrison and Rowling (2001). Lengths are presented as fork length (FL).

Length Frequency of Redfish



The modal length of Redfish landed by NSW commercial fishers declined from 23-24 cm fork length (FL) in the 1970s to about 20 cm FL by 2000. Recent data for Redfish caught by Commonwealth south east trawlers and NSW fishers shows a continuation of this trend, with a modal length of 17 cm FL. There is no minimum legal length for Redfish in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 258003, common name or scientific name to find further information.



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River Eels

(*Anguilla* spp.)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Stock status varies between catchments, with some areas fished lightly, while others are subject to significant fishing effort. Annual commercial catches have been stable between 50-100 t for over 10 years, but trapping catch rates have declined over the last 3 years.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Anguilla reinhardtii</i>	Longfinned Eel	Primary target of the commercial trap fishery
<i>Anguilla australis</i>	Southern Shortfin Eel	



Anguilla reinhardtii
Image © Bernard Yau

Background

Two species of 'River Eels' occur along the NSW coast – the Longfin Eel (*Anguilla reinhardtii*) and the Southern Shortfin Eel (*A. australis*). The Longfin Eel is the primary target of the commercial fishery (accounting for approximately 90 % of the catch). It has a more tropical species distribution, extending from New Guinea and the Solomon Islands down the east coast of Australia to Tasmania. The Southern Shortfin Eel has a more southerly distribution, from about Brisbane to Tasmania. Both species are also found at Lord Howe Island and Norfolk Island as well as New Caledonia and New Zealand. A single stock of each species is thought to occur in eastern Australian waters.

In NSW, both species occur in estuaries and in freshwaters east of the Great Dividing Range, with the Longfin Eel preferring riverine and estuarine habitats, while the Southern Shortfin Eel is more commonly found in still or slow-flowing freshwaters. River Eels are the top carnivores in upper catchment waters, feeding on crustaceans, molluscs, terrestrial and aquatic insects, and in the case of larger individuals, fish (including other eels) and small waterfowl.

River Eels grow slowly, taking up to 22 years (for males) and 52 years (for females) to reach sexual

maturity. Females of both species typically grow faster, live longer and reach a larger maximum size than males. The Longfin Eel reaches a maximum size of about 165 cm total length (TL) and the Southern Shortfin Eel about 110 cm TL. Eels spend the majority of their life in estuaries and freshwaters. Once they reach sexual maturity (at lengths of about 44-62 cm TL for males and 74-142 cm TL for females), they migrate downstream typically with the assistance of floodwaters, before swimming up to 3,000 km to reach spawning grounds. Spawning takes place over an extended period in deep tropical ocean waters (somewhere in the Coral Sea). Adults are presumed to die after spawning.

River Eels pass through two distinct larval stages: the leaf-like 'leptocephalus' larva, which lasts for 5-6 months while they are transported long distances on ocean currents; and the un-pigmented, eel-shaped post-larva known as 'glass eel' or 'elver' that they metamorphose into when they reach the continental shelf. After entering estuaries they quickly develop into fully pigmented sub-adults or 'yellow eels', which are the focus of the commercial fishery in NSW. River Eels are less affected by in-stream barriers than most finfish, and are able to ascend most dams and weirs provided suitably damp conditions are available.

In NSW, River Eels are taken commercially almost exclusively by eel trapping in the Estuary General Fishery. Landings of River Eels were first recorded separately in NSW in 1969. Annual landings remained low (less than 100 t per year) until 1991, with most of the catch taken from the Clarence River. The primary market was for locally smoked eel meat or frozen fillets exported to Europe. Prices for both markets were relatively low.

In the early 1990s, a high-value market developed for live eel exports to China. Fishing effort in the estuaries increased substantially and permits were issued for harvesting from impoundments in 1991. Since then, catches of River Eels have fluctuated, but after a sharp decline in the early 2000s have remained consistently between 50-100 t. Catch rates have also remained relatively steady, until a recent decline over the last 3 years.

Peaks in eel fishing activity vary between catchments. In the Clarence River, eel trapping is generally a winter activity. Commercial eel fishing in the Hawkesbury River, however, peaks earlier in the year, and is possibly market driven to supply the high export demand for the Chinese New Year. Most of the current catch is exported live to China, with only a very small proportion of the catch sold as whole fish through the Sydney Fish Market.

Commercial fisheries in Queensland take up to 50 t per year (recently around 20 t per year) of River Eels. Most of the catch comprises adult Longfin Eel caught by traps in impoundments. Queensland fishery-independent monitoring data over 9 years suggest that the length distributions and abundances of adult eels in the rivers sampled have been stable.

Additional Notes

- River Eels represent an economically valuable fishery, with precautionary management strategies in place because of the complex life history of these long-lived species.
- With the exception of some impoundments where fishing occurs under permit, commercial fishing is not allowed in NSW freshwaters (where the majority of female eels occur).
- Commercial landings have fluctuated over time, and after declining in the early 2000s have remained relatively stable between 50-100 t. Recent catch rates over the last 3 years have decreased.
- There is little local biological information available to assess stocks, and abundances may be influenced by other fishery-independent factors such as drought.

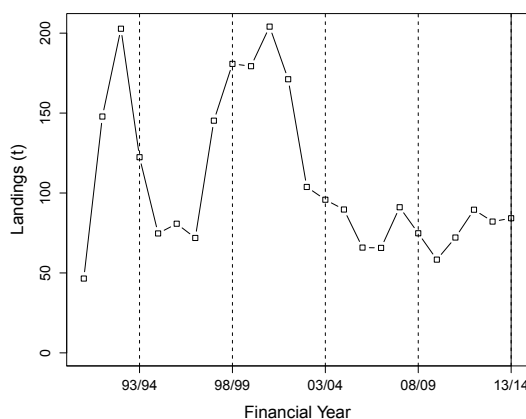
- Most eels caught by recreational fishers are released.
- There is a minimum legal length of 58 cm TL and recreational bag limit of 10 Longfin Eels and a minimum legal length of 30 cm TL and recreational bag limit of 10 Southern Shortfin Eels.

Catch

Recreational Catch of River Eels

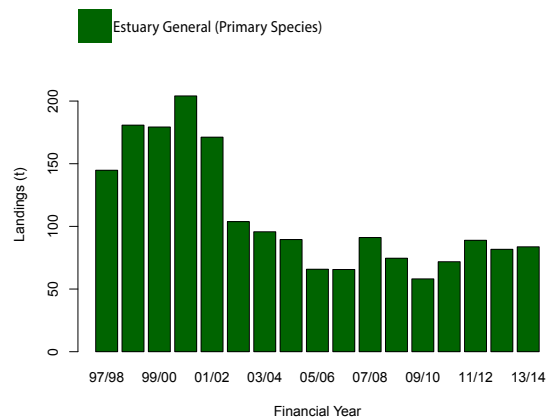
There is no robust estimate of the recreational harvest of River Eels in NSW. The annual recreational harvest of eels in NSW was previously estimated to be approximately 2,500 individuals based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of River Eels



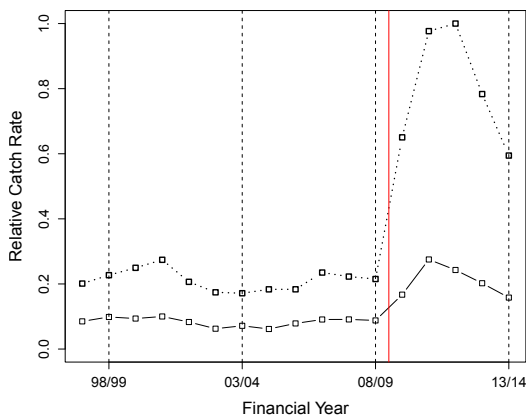
Commercial landings (including available historical records) of River Eels for NSW from 1990/91 to 2013/14 for all fishing methods. Catches from impoundments are not included in this figure.

Landings by Commercial Fishery of River Eels



Reported landings of River Eels by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy. Catches from impoundments are excluded from this figure.

Catch Per Unit Effort Information of River Eels Harvested by Eel Trapping in NSW



Catch rates of River Eels harvested using eel trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 056001 and 37 056002, common name or scientific name to find further information.



River Garfish

(*Hyporhamphus regularis ardelio*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

A relatively small fishery that operates in only a few estuaries in NSW. Variable landings and catch rates with a lack of recent length or age monitoring has resulted in River Garfish having a status of Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Hyporhamphus regularis ardelio River Garfish



Hyporhamphus regularis ardelio
Image © Bernard Yau

Background

River Garfish (*Hyporhamphus regularis ardelio*) belong to the family Hemiramphidae (commonly known as garfishes). They are found in coastal lakes and estuaries and sometimes freshwaters between Gladstone in Queensland and the Gippsland Lakes in Victoria. Typical of all garfishes, they are surface dwelling fishes with posterior dorsal and anal fins, a deeply forked caudal fin with elongate lower lobe, and with the lower jaw much longer than the upper.

River Garfish are multiple batch spawners between July and December in NSW estuaries. They produce relatively large eggs (~2.5 mm diameter) that are covered with filaments 5-10 mm long that allow them to attach to floating or benthic vegetation. Batch fecundity increases linearly with fish length up to approximately 2,300 eggs. River Garfish mature at approximately 16 cm fork length (FL) and about 1 year of age. They have been reported to attain approximately 29 cm FL and 7 years of age. Females grow faster and attain larger sizes than males. The sex ratios in commercial landings are strongly biased towards females.

The fishery for River Garfish in NSW is almost exclusively within the Estuary General Fishery. River Garfish are caught using the method of bullringing and are generally between 18-27 cm FL and 1-5 years old. Bullringing nets are boat-based encircling mesh nets that are fished in shallow water. The commercial fishery for River Garfish is distinctly seasonal and peaks during the winter months. The most important estuaries for commercial landings of River Garfish in NSW are Lake Illawarra, Wallis Lake, Tuggerah Lakes and Port Stephens. Commercial landings of River Garfish declined after 2000; however this was mainly due to a reduction in fishing effort.

Additional Notes

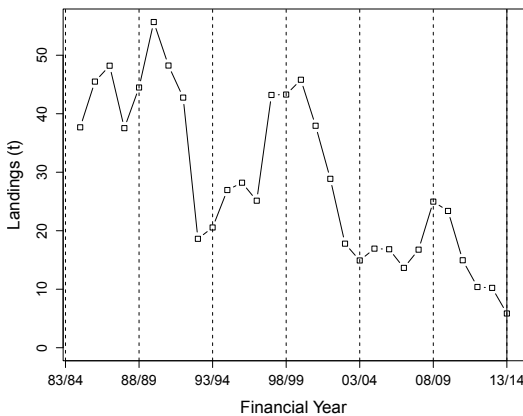
- Commercial landings of River Garfish are significant for a number of NSW estuaries, and the species is also significant in recreational catches.
- Commercial landings and catch rates have declined since 2008/09.
- River Garfish are subject to a recreational bag limit of 50 in NSW.

Catch

Recreational Catch of River Garfish

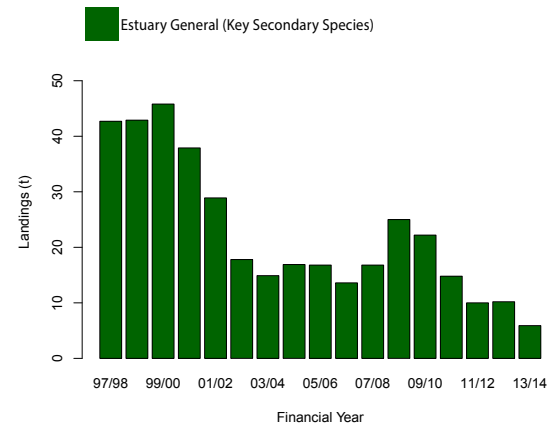
The most recent estimate of the recreational harvest of garfish (all species combined) in NSW was approximately 19,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of River Garfish in NSW was previously estimated to be less than 20 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of River Garfish



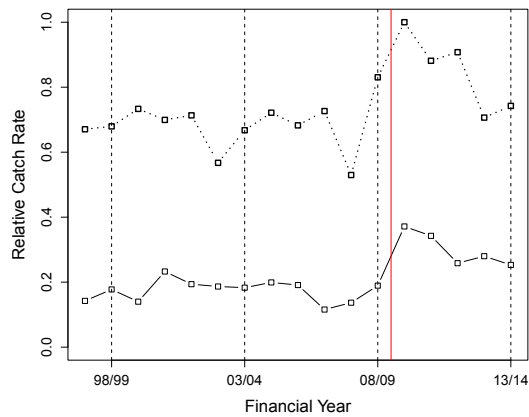
Commercial landings (including available historical records) of River Garfish for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of River Garfish



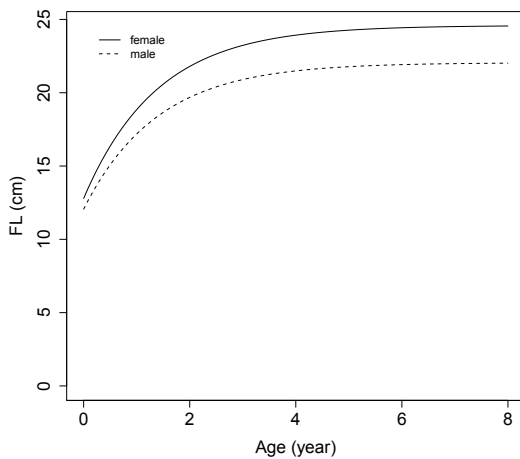
Reported landings of River Garfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of River Garfish Harvested by Mesh-Netting and Bullringing in NSW



Catch rates of River Garfish harvested using mesh-netting and bullringing for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of River Garfish



Growth curves for River Garfish using parameters from Stewart and Hughes (2007). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 234012, common name or scientific name to find further information.



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Rock Blackfish

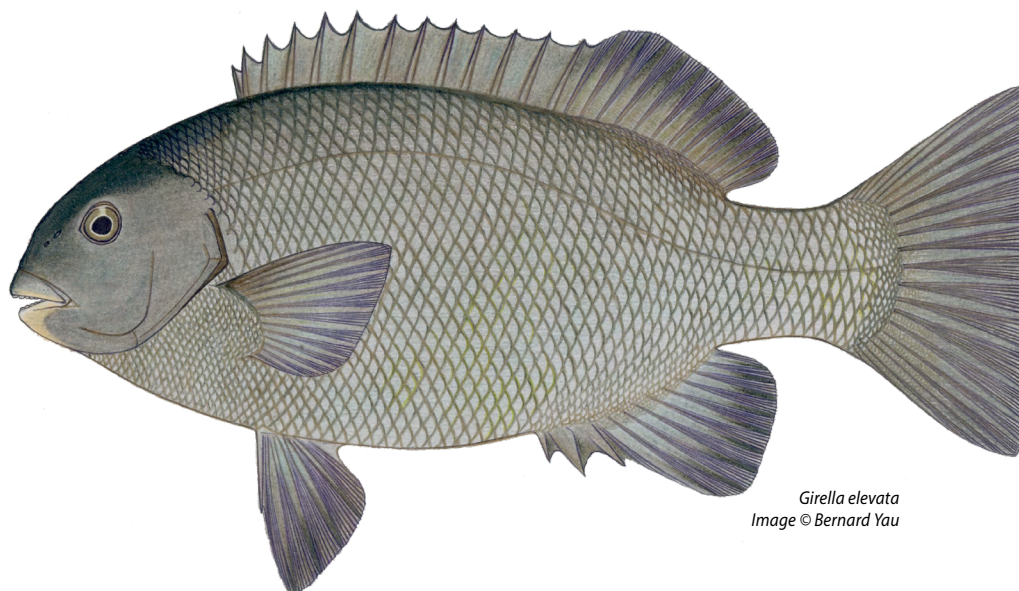
(*Girella elevata*)

Authors John Stewart and Jerom Stocks

EXPLOITATION STATUS FULLY FISHED

A long-lived coastal reef-associated species fished by recreational line and spear fishers. Local biological information in addition to fishing mortality estimates have resulted in an exploitation status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Girella elevata</i>	Rock Blackfish	Also called black drummer.



Background

Rock Blackfish (*Girella elevata*) occur from southern Queensland to eastern Tasmania and also around Lord Howe Island and New Zealand. They are closely related to Luderick (*Girella tricuspidata*) and look similar, but do not have the vertical dark bars characteristic of Luderick. Juvenile Rock Blackfish are light grey-brown in colour and commonly occur in rock pools in the intertidal zone. Adult Rock Blackfish are a uniform dark blue-black in colour and live in the wave surge zones around rocky headlands and offshore islands, generally where there is a lot of environmental structure such as caves and crevices.

Rock Blackfish are powerful swimmers, and are sought by recreational fishers because of their fighting ability and good eating qualities. They are omnivorous, and eat a wide range of species

including crabs, cunjevoi and algae. Rock Blackfish can grow to a maximum size of about 65 cm in length and 9 kg in weight, however fish greater than 3 kg are considered rare.

Rock Blackfish exhibit great longevity with a maximum recorded age of 45+ years. There is no variation in growth between sexes however growth rates are variable throughout the species distribution, with the highest growth rates along the central NSW coast. Fish of central and southern NSW spawn in the late spring and summer, with larger and older fish producing significantly more eggs than their smaller and younger counterparts. Males of southern NSW reach sexual maturity at approximately 37 cm and 7 years and females at 42 cm and 9 years of age. However earlier maturation occurs within central NSW. The species is highly fecund producing a large number of pelagic eggs. Juveniles recruit to intertidal rock pools where they

remain to approximately 1 year of age. Acoustic tracking has shown fish are site attached and use very small areas. Given the species longevity, slow growth, late maturation and site attachment, Rock Blackfish populations may be vulnerable to over exploitation in heavily fished regions.

The Silver Drummer (*Kyphosus sydneyanus*) occurs in similar habitats in southern Australian waters, and grows to a much larger size than Rock Blackfish (up to 75 cm in length and 15 kg in weight). Although superficially similar, as its name implies the Silver drummer is much lighter in colour, and is easy to distinguish from Rock Blackfish by the number of spines in the dorsal fin (11, as opposed to 13 in the Rock Blackfish). The Silver Drummer has poor eating qualities, and is not highly sought by commercial or recreational fishers.

In NSW Rock Blackfish are subject to a minimum legal length of 30 cm and a bag limit of 10 per person. There is no reported commercial catch.

Additional Notes

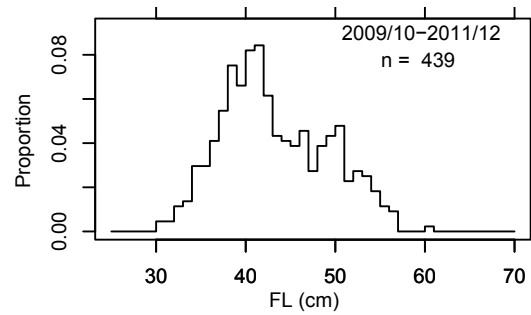
- Targeted by line and spear fishing in ocean waters near rocky headlands.
- A long lived species aged up to 45 years.
- Natural mortality estimates are approximately equal to fishing mortality estimates.
- No commercial catch reported.
- Age frequency data indicates a large proportion of older individuals are removed from the population.
- There are concerns that Rock Blackfish may be subject to significant localised depletion.
- A bag limit of 10 fish and minimum legal length of 30 cm apply to NSW recreational fishers.

Catch

Recreational Catch of Rock Blackfish

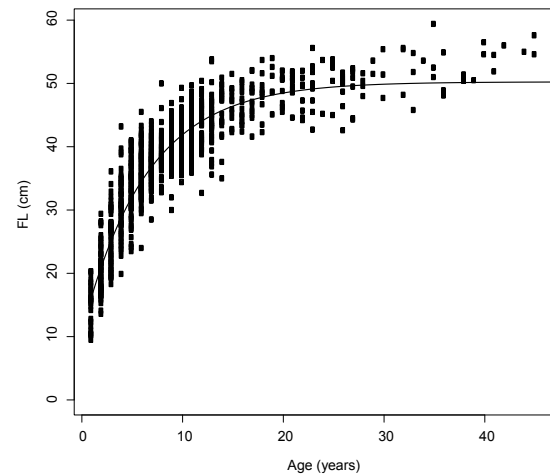
The most recent estimate of the recreational harvest of Rock Blackfish in NSW was approximately 35,000 fish during 2013/14 (West *et al.*, 2015).

Length Frequency of Rock Blackfish



The length distribution of Rock Blackfish sampled from spearfishing competitions between 2009/10 and 2011/12 showed fish mainly between 30 and 55 cm fork length (FL). There is a minimum legal length of 30 cm total length (approximately 28.5 cm FL) for Rock Blackfish in NSW.

Growth Curve of Rock Blackfish



Age-length data with fitted growth curve for Rock Blackfish (Stocks, 2015). Lengths are presented as fork length (FL).

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- West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle (2015). Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series.

Please visit the CSIRO website,
<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 361006 and 37 361001, common name or scientific name to find further information.



Royal Red Prawn

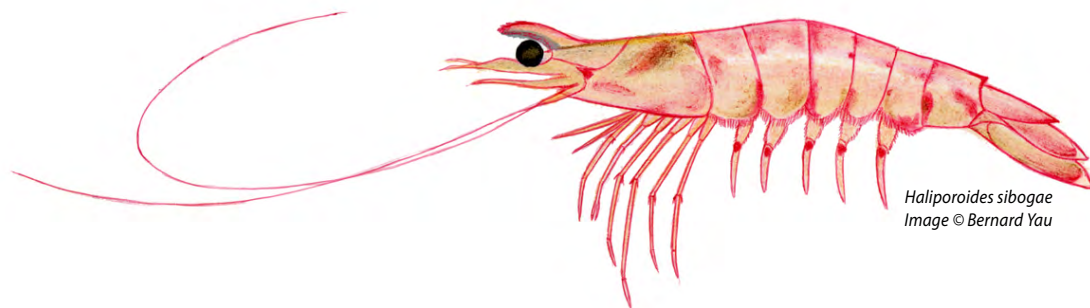
(*Haliporoides sibogae*)

Author Matthew Taylor

EXPLOITATION STATUS MODERATELY FISHED

The limited targeting of this species and the recent decline in landings is associated with the low market price and lack of demand for this species.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Haliporoides sibogae</i>	Royal Red Prawn	



Background

Royal Red Prawn (*Haliporoides sibogae*) is a deepwater species recorded from both the east and west coasts of Australia. In the west, the species ranges from the waters off Perth northwards across the North West Shelf to Indonesia. The eastern population extends from south-eastern Queensland to the waters east of Bass Strait.

Royal Red Prawn is a demersal species inhabiting soft substrates along the upper continental shelf. Off NSW, it has been found in depths between 230 and 825 m but is most abundant in 400-550 m. Females grow larger than males, having a maximum carapace length (CL) of almost 5 cm and weighing more than 40 g; males reach a maximum of about 3.5 cm. Unlike the annual life-cycle and 1-2 year life-span of most shallow-water prawn species, female Royal Red Prawns may live 3-4 years. Males become sexually mature at a CL of around 2.6 cm and most breed only once. In contrast, females reach sexual maturity at a CL of around 3.1 cm and may breed several times throughout their life. Royal Red Prawn eggs are blue and mature females are characterized by the conspicuous blue ovary running through the body to the tail. Off NSW, there are two breeding seasons each year, one around March-April and the

other in July-August. Royal Red Prawn is a benthic feeder on micro-molluscs, crustaceans, and worms, and represents an important food source for many benthic fish species.

Currently, the only significant commercial fishery for Royal Red Prawn in Australia is off NSW and is shared between the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) and the NSW Ocean Trawl Fishery. The fishery began off Wollongong in the late 1970s, and trawlers from Wollongong, Sydney, Newcastle and Port Stephens have targeted Royal Red Prawns in the period since. In past years, Royal Red Prawn was occasionally fished by vessels from Coffs Harbour and the Clarence River in the north, and Ulladulla and Bermagui in the south. For a brief period in the 1980s, trawlers worked for Royal Red Prawn off southern Queensland. The fishery is market-driven, and has been subject to a sustained period of low demand for product and low wholesale prices, resulting in a relatively lightly fished stock.

Endorsed trawlers from the central NSW ports normally use a single Royal Red Prawn trawl net while northern trawlers retain their standard triple-rig gear used for Eastern King Prawn. Royal Red Prawn can be caught during both day and night although daytime catch rates are generally higher,

and can exceed 100 kg per hour. There was a total allowable catch (TAC) of 303 t for Royal Red Prawn in the SESSF in 2013/14, but catches in recent years have consistently remained lower than the recommended biological catch.

As demand lessened for the species, annual landings by NSW ocean prawn trawl vessels from waters north of Sydney decreased from almost 600 t in 1995/96, to less than 15 t in 2006/07. The period since has seen annual landings range between 1 t and 13 t. There have been no quantitative stock assessments of the Royal Red Prawn stock in the SESSF or NSW Ocean Trawl Fishery, but Royal Red Prawn is believed to be lightly fished.

Additional Notes

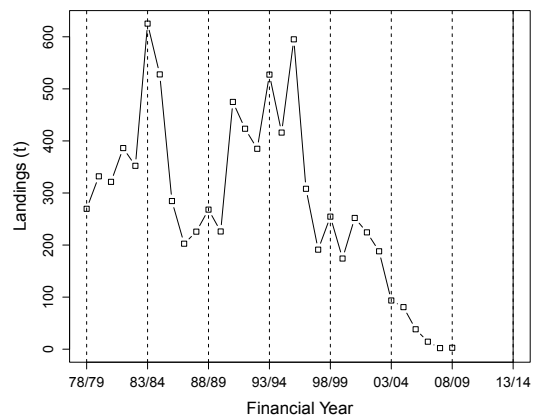
- Only sporadic fishing for Royal Red Prawn has occurred in recent years.
- Catch rates were stable prior to 2007/08, after which effort has remained below 15 days per year.
- Industry is currently seeking to develop new local and international markets for this under-utilised species, and develop more efficient post-harvest handling and processing technology.
- The Commonwealth stock status determination classifies the Royal Red Prawn stock as 'not overfished' and 'not subject to overfishing'.

Catch

Recreational Catch of Royal Red Prawn

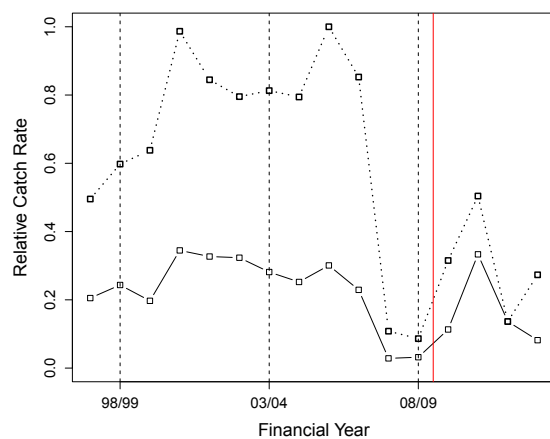
There is no recreational harvest of Royal Red Prawn in NSW.

Historical Landings of Royal Red Prawn



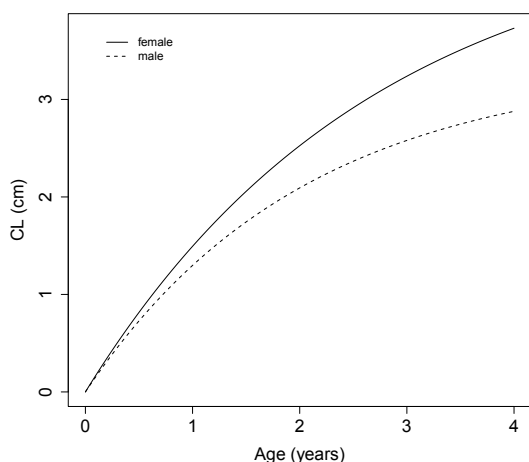
Commercial landings (including available historical records) of Royal Red Prawn for NSW from 1978/79 to 2013/14 for all fishing methods. Financial years where commercial catch was reported by less than six fishermen were removed due to privacy concerns.

Catch Per Unit Effort Information of Royal Red Prawn Harvested by Royal Red Prawn Trawling in NSW



Catch rates of Royal Red Prawn harvested using royal red prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of Royal Red Prawn



Growth curves of Royal Red Prawn using parameters from Baelde (1994). Lengths are presented as carapace length (CL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 714005, common name or scientific name to find further information.

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Department of
Primary Industries

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Sand Mullet

(*Myxus elongatus*)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Taken primarily as by-product of mesh netting in NSW estuaries. Commercial landings have declined considerably during the last 8 years. A low value species with only limited size or age composition data with which to assess stocks.

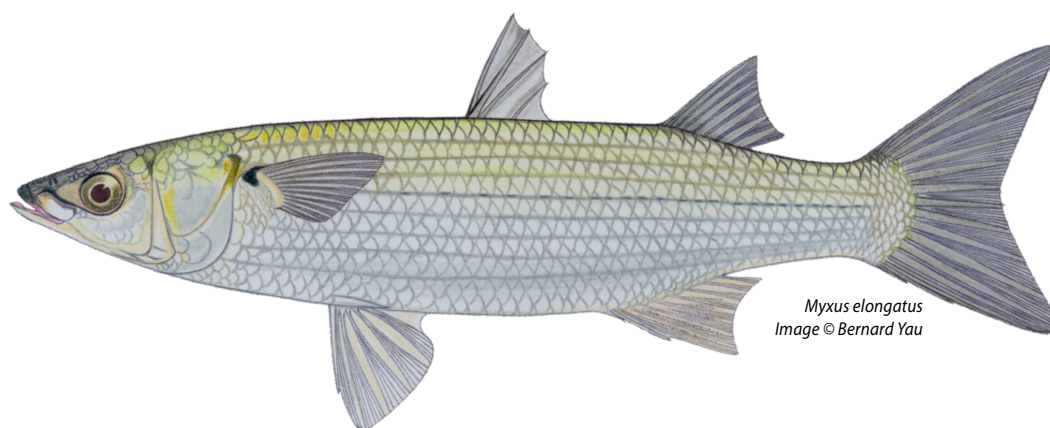
SCIENTIFIC NAME

STANDARD NAME

COMMENT

Myxus elongatus

Sand Mullet



Background

The Sand Mullet (*Myxus elongatus*) occurs in estuarine and coastal waters from Queensland to South Australia, and in the waters off Lord Howe and Norfolk Island. Sand Mullet has a more pointed snout than Sea Mullet (*Mugil cephalus*) and a black spot on the pectoral fin base. Sand Mullet also has a gold blotch on the upper gill cover similar to Goldspot Mullet (*Liza argentea*), but can be easily distinguished by the number of soft rays in the anal fin - Sand Mullet has 9 rays, whereas Goldspot Mullet has 10 rays.

Sand Mullet reaches a maximum age of about 12 years and size of about 40 cm fork length (FL) and weight of 1 kg; however, catches are mostly comprised of smaller fish of about 25-30 cm FL. Sand Mullet has a single row of small teeth in the upper jaw, which suggests a more carnivorous diet than most other mullet species, and it is frequently taken by anglers using worms or other flesh baits. Females mature at about 3 years of age and 25 cm FL, and fish with developing gonads are found near estuary mouths between November and March. Spawning is thought to occur during mid to late

summer in ocean waters, although females in spawning condition (with hydrated ova) have yet to be observed.

Sand Mullet is mainly taken by mesh netting in the Estuary General Fishery. Historical landings averaged 20-80 t per year until the mid-1990s when landings increased to between 150-200 t per year. Over the last 8 years, landings have declined again to around 50 t. It is suspected that possible confusion with and misreporting of Sea Mullet may have contributed to the period of increased landings. Most of the historical landings and more recent declines have occurred in the Clarence River fishery.

In NSW, Sand Mullet is not subject to a minimum legal length, but is included in the bag limit of 20 for all mullet species combined. Anglers are also permitted to take up to 20 'poddy' mullet (small fish of less than 15 cm TL, all species combined) for use as live bait.

Additional Notes

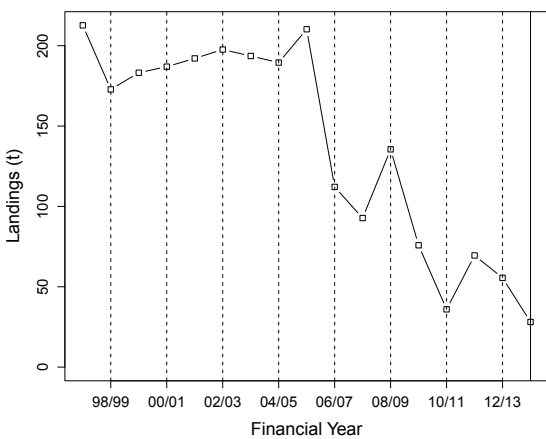
- Commercial landings of Sand Mullet have declined considerably over the last 8 years; however, possible confusion with other mullet species (e.g. Sea Mullet) may have overinflated earlier catches.
- Sand Mullet is traditionally a low value species and prices did not vary significantly during the mid-1990s, to account for the sudden increase in commercial catches.
- Recreational catches are probably significant, but data are only available for combined mullet species.
- The species is harvested by recreational fishers as juveniles ('poddy' mullet, used for bait) and also as adults.

Catch

Recreational Catch of Sand Mullet

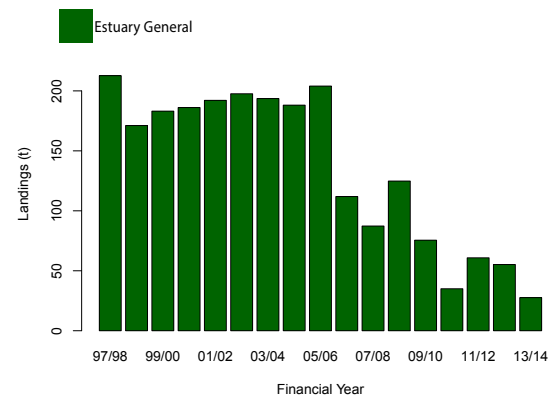
The most recent estimate of the recreational harvest of mullet (all species combined) in NSW was approximately 72,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Sand Mullet in NSW was previously estimated to be less than 10 t.

Historical Landings of Sand Mullet



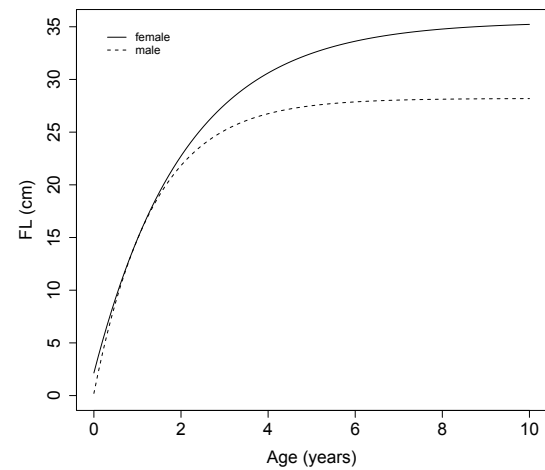
Commercial landings (including available historical records) of Sand Mullet for NSW from 1997/98 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Sand Mullet



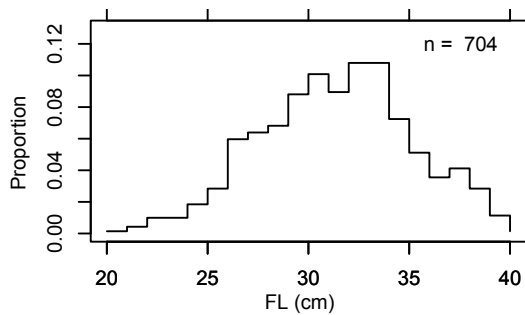
Reported landings of Sand Mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curves of Sand Mullet



Growth curves for Sand Mullet using parameters from Kendall *et al.*, (2009). Lengths are presented as fork length (FL).

Length Frequency of Sand mullet



The length distribution of Sand Mullet caught by Fishery Independent Surveys in St Georges Basin between 2007/08 and 2010/11.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 381003 , common name or scientific name to find further information.



Sand Whiting

(*Sillago ciliata*)

Author Karina Hall

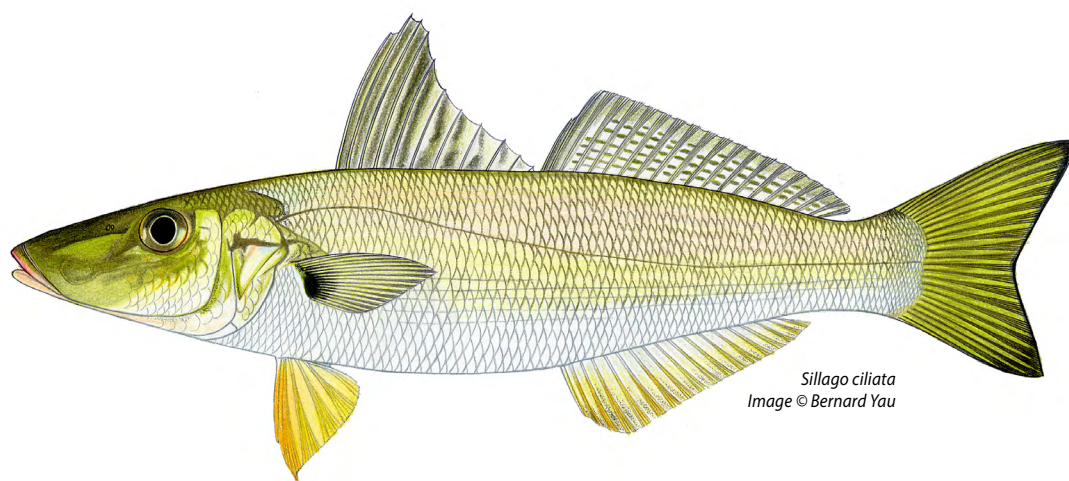
EXPLOITATION STATUS FULLY FISHED

Sand Whiting is targeted by recreational anglers and commercial fishers throughout its range. Commercial landings and catch rates were stable until recent declines over the last 2 years.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Sillago ciliata

Sand Whiting



Background

The Sand Whiting (*Sillago ciliata*) occurs along the east coast of Australia, from Cape York in Queensland to Victoria, and including eastern Tasmania. It is also found in New Caledonia and Papua New Guinea. Tagging studies indicate adult fish move between estuaries, but the stock structure across the species distribution is unknown. Stock assessment and management currently occur at a jurisdictional level, with most of the catch landed in Queensland and NSW, where the species is most abundant.

In NSW waters, Sand Whiting is found in estuaries and inshore waters off beaches. Within estuaries, the favoured habitat is bare sandy substrate. Sand Whiting eat bottom dwelling invertebrates, particularly polychaete worms, crustaceans and molluscs taken by fossicking through the sand.

Sand Whiting reportedly reaches a maximum length of 50 cm total length (TL). Juveniles grow reasonably quickly, taking about 2 years to reach

25 cm fork length (FL) after which growth slows. Growth rates also vary significantly with latitude and water temperature. Females grow slightly faster, attain larger maximum sizes and mature at a significantly larger size (19 cm FL) and older age (1.6 years) than males (at 17 cm FL and 1.1 years). Although the maximum reported age is 11 years, most fish in commercial landings in Queensland and NSW are aged 2-5 years.

Spawning occurs in the lower reaches of estuaries and in coastal waters near river mouths during spring and summer. Larvae then enter estuaries, with the small juveniles preferring shallow water, particularly along sandy shores and also in and around seagrasses and mangroves. After spawning, adults may either enter estuarine waters or remain along ocean beaches.

In NSW, most of the commercial catch of Sand Whiting is taken by hauling and mesh nets in the Estuary General Fishery. Sand Whiting is caught throughout the year, but landings peak during summer. Annual landings fluctuated around

150 t during the 1980s, 1990s and early 2000s, but then rapidly declined and have been below 100 t over the last 2 years. Catch rates have remained relatively stable, with only a slight decline over the last two years. Mortality estimates from independent surveys in the Clarence River suggested that fishing mortality was less than natural mortality.

The Queensland commercial catch is approximately four times larger than the NSW catch. In 2013, the Queensland catch was below the mean during the preceding 12 years; however, the catch rate was higher than the previous 2 years. Size and age structures have been stable since 2007 and indicate biomass is unlikely to be overfished.

Sand Whiting is a very popular species amongst recreational fishers, and the recreational catch in NSW waters is estimated to be similar to the commercial catch. In contrast, the Queensland recreational catch is estimated to be considerably smaller than their commercial catch.

Additional Notes

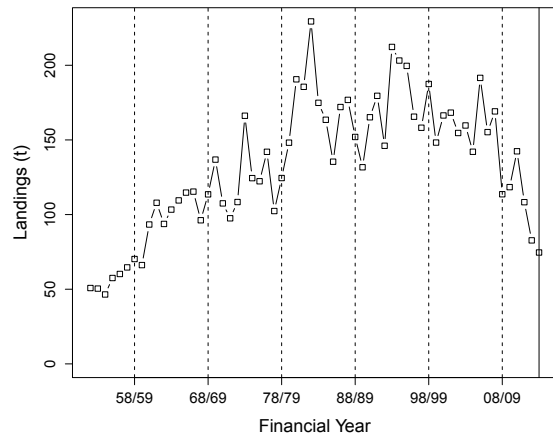
- The biological stocks of Sand Whiting were assessed as Sustainable stocks in NSW and Queensland in the *Status of Key Australian Fish Stocks Reports 2014*.
- Commercial landings in NSW have declined considerably over the last 6 years, with a drop in catch rates only over the last 2 years.
- Significant biological and monitoring data are now available for Sand Whiting in NSW.
- The size composition of the commercial catch has been relatively stable since the 1960s.
- There is a minimum legal length of 27 cm TL for Sand Whiting and a combined recreational bag limit of 20 whiting.

Catch

Recreational Catch of Sand Whiting

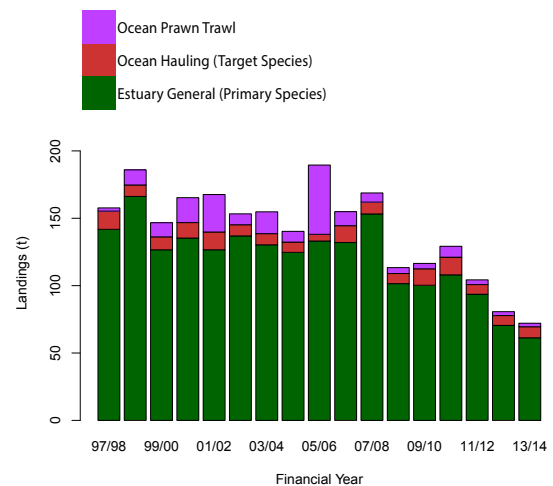
The most recent estimate of the recreational harvest of Sand Whiting in NSW was approximately 248,000 fish weighing approximately 69 t during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Sand Whiting in NSW was previously estimated to lie between 230 and 460 t based on the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Sand Whiting



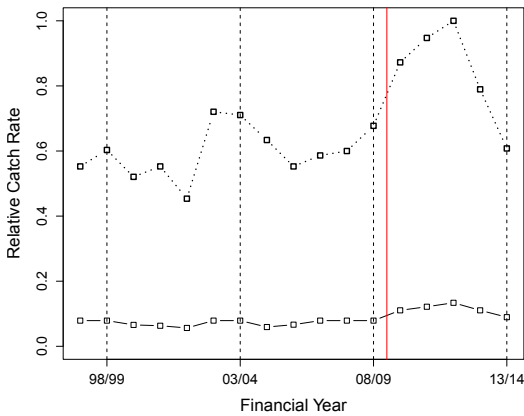
Commercial landings (including available historical records) of Sand Whiting for NSW from 1952/53 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Sand Whiting



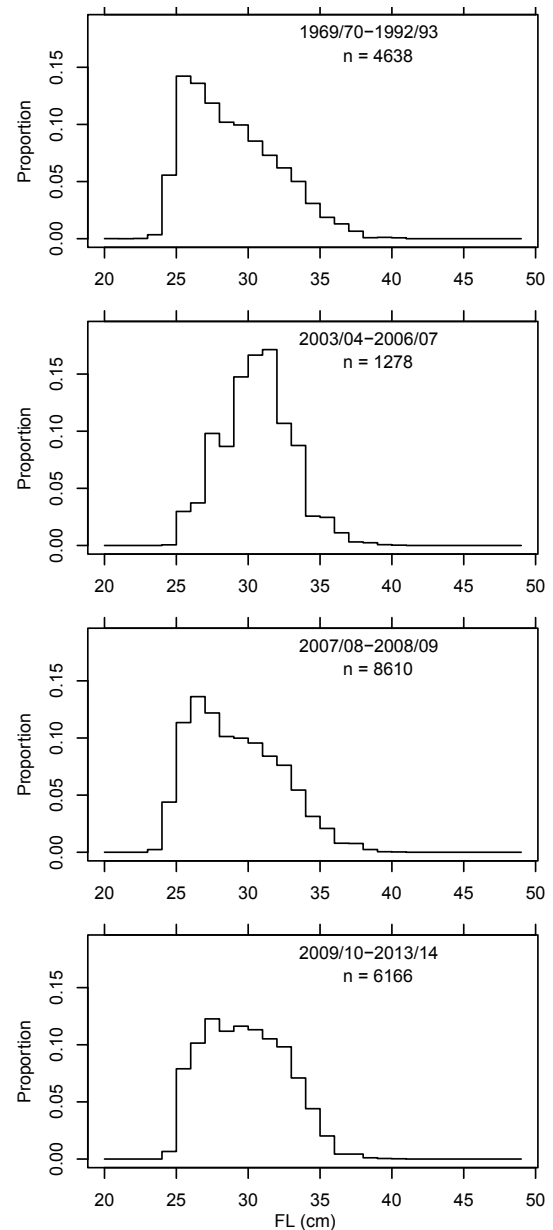
Reported landings of Sand Whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Sand Whiting Harvested by Mesh-Netting in NSW



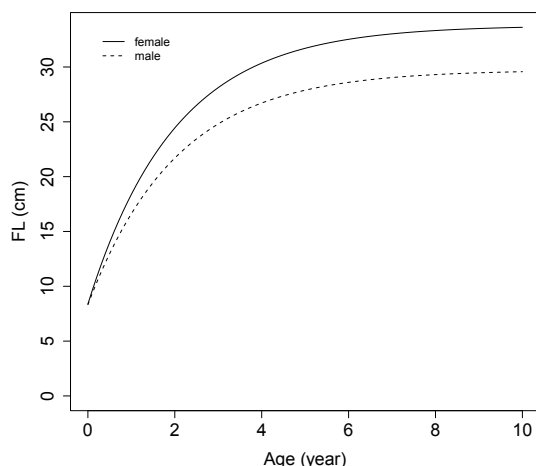
Catch rates of Sand Whiting harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Sand Whiting



The length distribution of Sand Whiting in NSW commercial landings was relatively stable from the 1960s to the 1990s, and comprised mainly fish between 25-35 cm fork length (FL). Most of the catches sampled were taken with hauling nets. Commercial landings sampled during recent years included more samples from mesh net catches, and showed an increased proportion of larger (>30 cm FL) whiting. The minimum legal length for Sand Whiting in NSW is 27 cm total length (approximately 25 cm FL).

Growth Curve of Sand Whiting



Growth curves for Sand Whiting using parameters from Ochwada *et al.*, 2014. Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 330010, common name or scientific name to find further information.



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Sawsharks

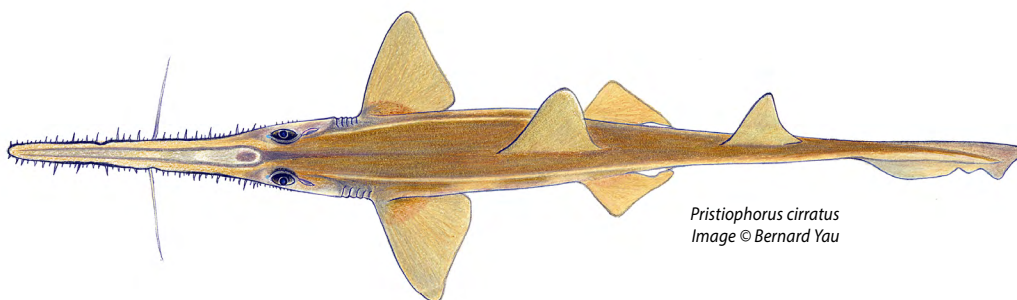
(*Pristiophorus* spp.)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

There is little fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Pristiophorus cirratus</i>	Common Sawshark	The majority of NSW catch.
<i>Pristiophorus nudipinnis</i>	Southern Sawshark	Occurs from southern NSW to central SA.



Background

Sawsharks (family Pristiophoridae) are relatively small sharks (< 150 cm total length (TL)) characterised by a narrow blade-shaped snout with numerous slender, sharp spines along its margins. Sawsharks should not be confused with the large tropical sawfishes which also possess a long saw-like snout; sawfishes live in shallow seas, estuaries and rivers, and can grow to seven metres in length.

Of the three Australian sawshark species, two are distributed around southern Australia, and the third is found in deepwater off northern Queensland. The Common Sawshark (*Pristiophorus cirratus*) is the main species caught in NSW waters. It is found mainly in outer shelf and upper slope depths (40-630 m), and its known distribution is from northern NSW (Coffs Harbour) to Jurien Bay (WA), including Tasmania. The Southern Sawshark *P. nudipinnis* occurs from central NSW to Eyre (WA) in the Great Australian Bight, in depths to at least 110 m.

Biological data collected off NSW for the Common Sawshark showed that males matured at about 80 cm TL while the largest measured was 112 cm TL weighing about 2.7 kg. Females matured at about 90 cm and grew to a maximum of about 125 cm (~3.5 kg).

Sawsharks are viviparous (trophodermic – the developing young receive some nutrients through the mother's uterine epithelium) and give birth to fully developed young after a gestation period of at least 12 months. Common Sawsharks generally give birth to about 11 pups (range 6-22) which vary in size between 35-38 cm TL. Southern Sawsharks also average about 11 pups (range 7-14) but they are smaller (30-35 cm TL).

Sawsharks are a minor component of the Commonwealth managed Southern Shark Fishery - landings by Commonwealth fishers in 2013/14 were about 180 t.

The small NSW catch is taken almost totally by trawling. Sawsharks are only occasionally taken by recreational fishers.

Additional Notes

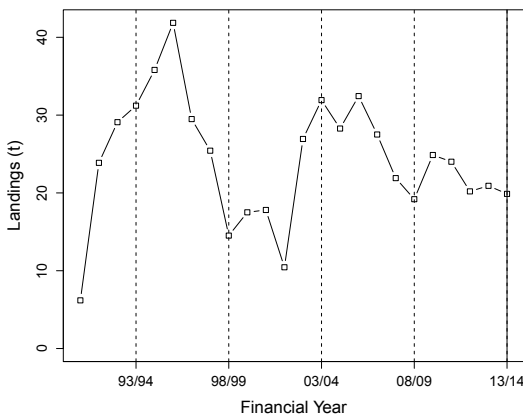
- *P. cirratus* is the main species taken off NSW - annual landings have fluctuated between 10 and 30 t in recent years.
- This group should not be confused with the sawfish family (Pristidae).
- Commonwealth assessments do not consider Sawsharks to be overfished nor subject to overfishing (Georgeson *et al.*, 2014).
- Sexed length frequency data are available from *Kapala* (Fisheries Research Vessel) data, but there are no useful size composition data from the commercial fishery.

Catch

Recreational Catch of Sawsharks

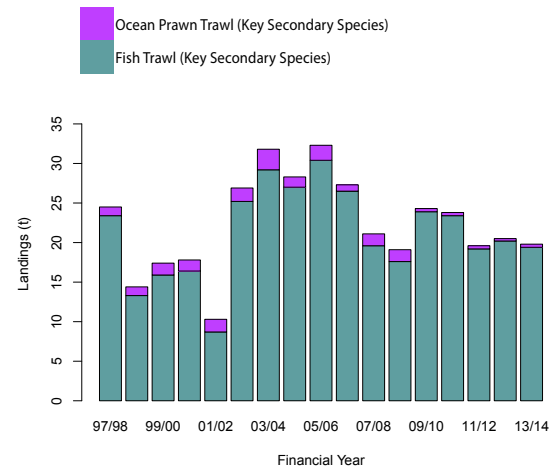
The annual recreational harvest of Sawsharks in NSW is considered to be minor.

Historical Landings of Sawsharks



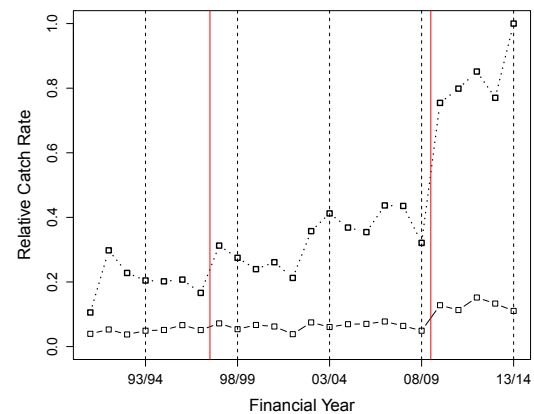
Commercial landings (including available historical records) of Sawsharks for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Sawsharks



Reported landings of Sawsharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Sawsharks Harvested by Fish Trawling in NSW



Catch rates of Sawsharks harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 023002 and 37 023001, common name or scientific name to find further information.



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School Prawn

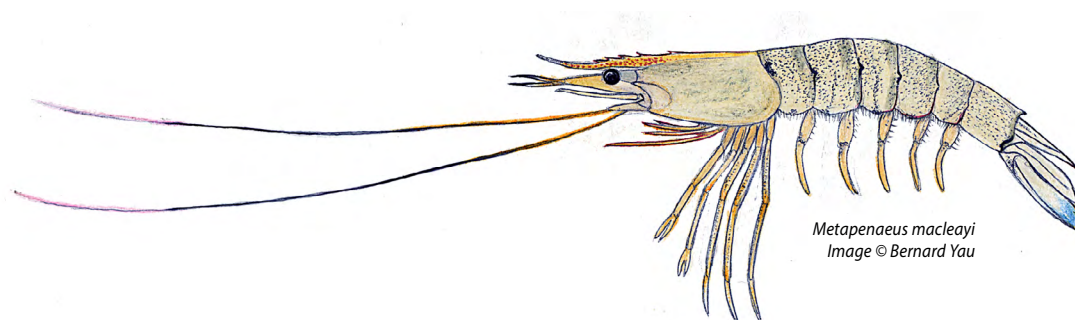
(*Metapenaeus macleayi*)

Author Matthew Taylor

EXPLOITATION STATUS FULLY FISHED

Modelling has established that environmental factors (river flows) generally have a major influence on landings of School Prawns.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Metapenaeus macleayi</i>	School Prawn	



Metapenaeus macleayi
Image © Bernard Yau

Background

School Prawn (*Metapenaeus macleayi*) occurs along the east coast of Australia, between southern Queensland and eastern Victoria. Throughout this range, School Prawns inhabit both estuaries (mostly as juveniles and sub-adults) and inshore ocean waters (as adults). Within estuaries, they prefer soft muddy substrates and areas of seagrass, and can be found well upstream into brackish and fresh waters. School Prawns consume a variety of small invertebrates and detritus.

School Prawn spawns in nearshore ocean waters off NSW between February and May. After a larval stage of about 2-3 weeks, the post-larval prawns enter estuaries and move upstream. By the following spring, the now adolescent prawns return downstream and emigrate to sea to mature and spawn. School Prawn grows to a total length of 13 cm (males) and 16 cm (females) and generally live for 12-18 months, spawning only once. Rainfall and the associated river discharge are thought to be important cues in the life cycle of School Prawn, in that significant freshwater discharge appears to facilitate downstream migration, gonad maturation and spawning success. School Prawn may undertake oceanic migrations of up to 100 km.

School Prawn is harvested mainly in estuaries by the Estuary Prawn Trawl fishery (otter trawling) and by numerous methods in the Estuary General Fishery (mainly set pocket nets, running nets, hauling and seine nets). They are also targeted in inshore ocean waters by ocean prawn trawlers after periods of high rainfall or flooding.

There is a valuable domestic market for larger school prawns for human consumption, and substantial quantities, especially from the Clarence and Hawkesbury Rivers, are sold for use as bait for recreational fishing.

Additional Notes

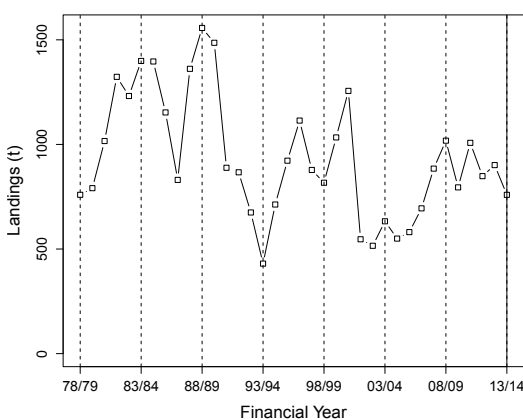
- Since 2001/02, commercial landings of School Prawn has fluctuated between 500 and 1000 t, dependent on rainfall levels.
- Effort by estuary prawn trawlers has decreased since 2001/02, and this has been accompanied by increasing catch rates over this period.
- Landings and catch rates by ocean prawn trawlers increased in the period 2009/10-2012/13, accompanied by high autumn rainfall during this period.
- There is a combined recreational bag limit of 10 litres for all prawns.
- The New South Wales stock of School Prawn has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.

Catch

Recreational Catch of School Prawn

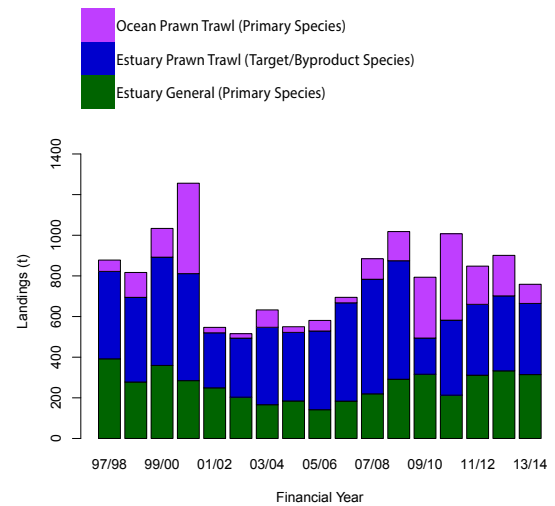
The most recent estimate of the recreational harvest of prawns (all species combined) in NSW was approximately 725,000 prawns during 2013/14 (West *et al.*, 2015). The annual recreational harvest of School Prawns in NSW was previously estimated to be less than 30 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of School Prawn



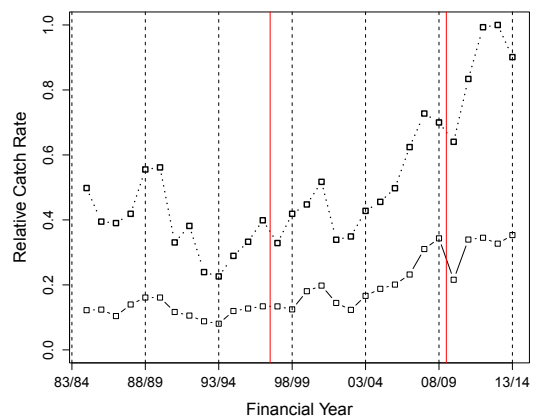
Commercial landings (including available historical records) of School Prawn for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of School Prawn



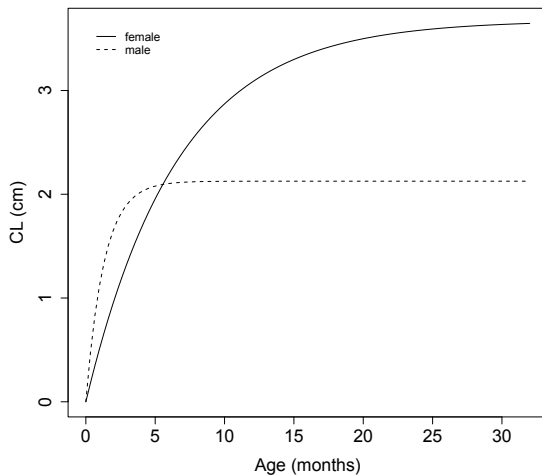
Reported landings of School Prawn by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of School Prawn Harvested by Estuarine Prawn Trawling in NSW



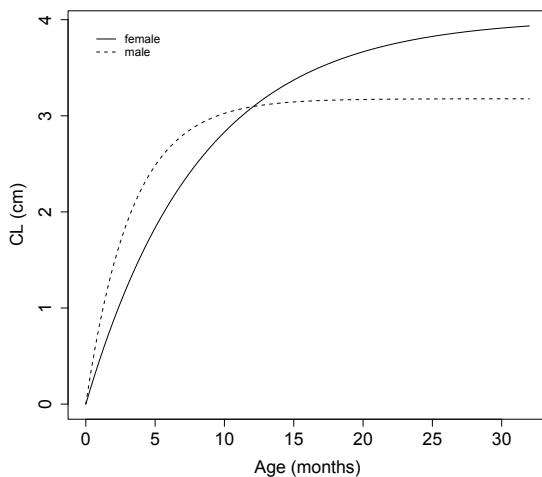
Catch rates of School Prawn harvested using estuarine prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of School Prawn - Clarence River



Growth curves for School Prawn in the Clarence River using parameters from Montgomery *et al.*, (2010). Lengths are presented as carapace length (CL).

Growth Curves of School Prawn - Hunter River



Growth curves for School Prawn in the Hunter River using parameters from Montgomery *et al.*, (2010). Lengths are presented as carapace length (CL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 711029, common name or scientific name to find further information.



Sea Mullet

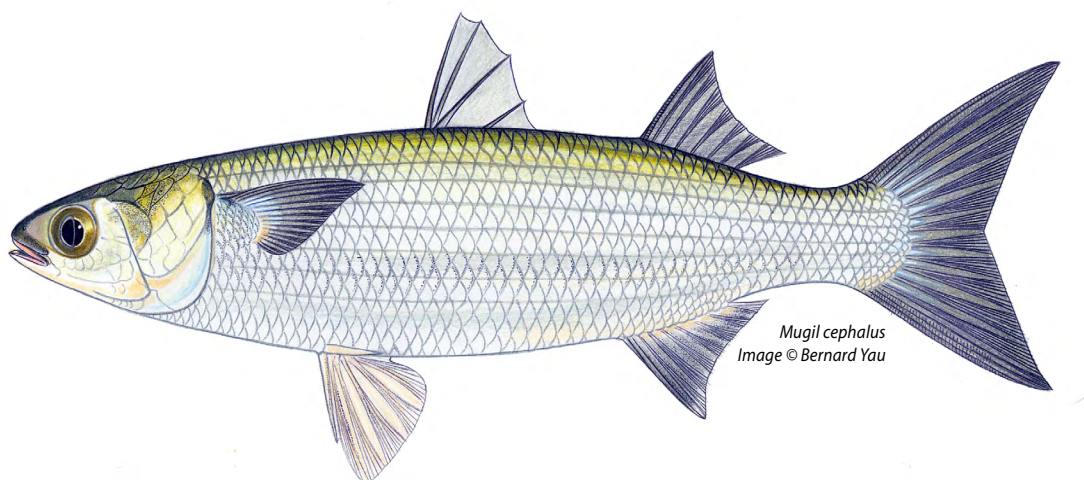
(*Mugil cephalus*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

A long history of stable landings in both the estuarine and ocean fisheries. The sizes and ages landed are indicative of a sustainable population and have resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Mugil cephalus</i>	Sea Mullet	Also known as bully mullet.



Background

The Sea Mullet (*Mugil cephalus*) occurs around much of the Australian coastline, as well as in many temperate and subtropical areas worldwide. In NSW waters, Sea Mullet are found primarily in estuaries and inshore waters, although they also occur in the freshwater reaches of coastal rivers. Within estuaries, Sea Mullet are found in association with shallow weed beds and bare substrates. They mostly eat algae and detritus, and often ingest large amounts of substrate in the process.

Spawning occurs at sea, from autumn to early winter. The larvae enter estuaries and the small juveniles subsequently live in sheltered shallow water habitats. Many Sea Mullet travel into freshwaters, where they may reside for long periods, particularly if denied passage back to the estuary. Sea Mullet grow quite quickly, taking about 4 years to reach 35 cm in length. Maximum length is approximately 60 cm but few fish greater than 50 cm are caught. Between late summer and early winter, adult Sea Mullet leave estuaries in large schools that then travel northward along the open coastline on their way to spawning grounds. This behaviour coincides with strong westerly winds

and falling water temperatures. Shorter migrations by so-called 'hard-gut' (sub-adult) mullet also occur periodically, possibly in response to heavy flooding.

Sea Mullet comprise the largest catch by weight of all species taken in commercial fisheries in NSW. Approximately half the total catch is reported from the Estuary General Fishery and half from the Ocean Hauling Fishery. The majority of the Sea Mullet harvest from NSW estuaries is sold as whole fish, but a significant quantity of the female roe (eggs) is exported to markets in South-East Asia and the Middle East. Sea Mullet are not a significant recreational species, but are targeted by a small number of specialist anglers.

Additional Notes

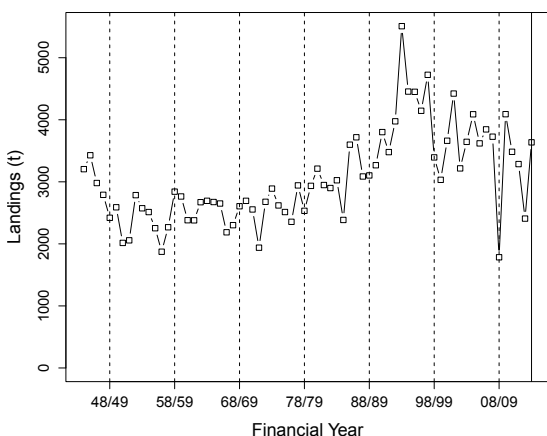
- Reasonably fast growing, short-lived species, distributed along the coast in all significant estuaries. The stock is also shared with Queensland.
- Recent catch rates in both the estuarine and ocean fisheries in NSW give no cause for concern about the status of the stock.
- Bad weather during autumn 2009 resulted in poor catches during the ocean hauling season.
- The Eastern Australian biological stock of Sea Mullet has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- In NSW there is a minimum legal length of 30 cm total length for Sea Mullet and a recreational bag limit of 20 mullet.

Catch

Recreational Catch of Sea Mullet

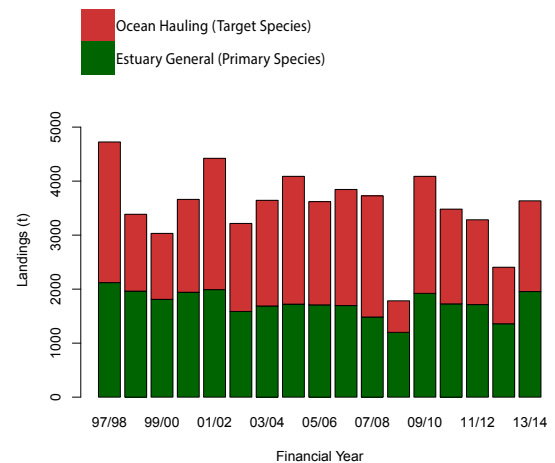
The most recent estimate of the recreational harvest of mullet (all species combined) in NSW was approximately 72,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Sea Mullet in NSW was previously estimated to be less than 10 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Sea Mullet



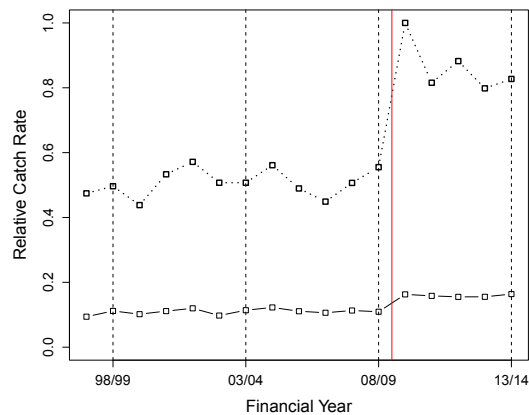
Commercial landings (including available historical records) of Sea Mullet for NSW from 1944/45 to 2013/14 for all fishing methods. During 2008/09 landings by the Ocean Hauling Fishery were significantly lower than in previous years due to very bad weather along the north coast of NSW during the short autumn spawning season.

Landings by Commercial Fishery of Sea Mullet



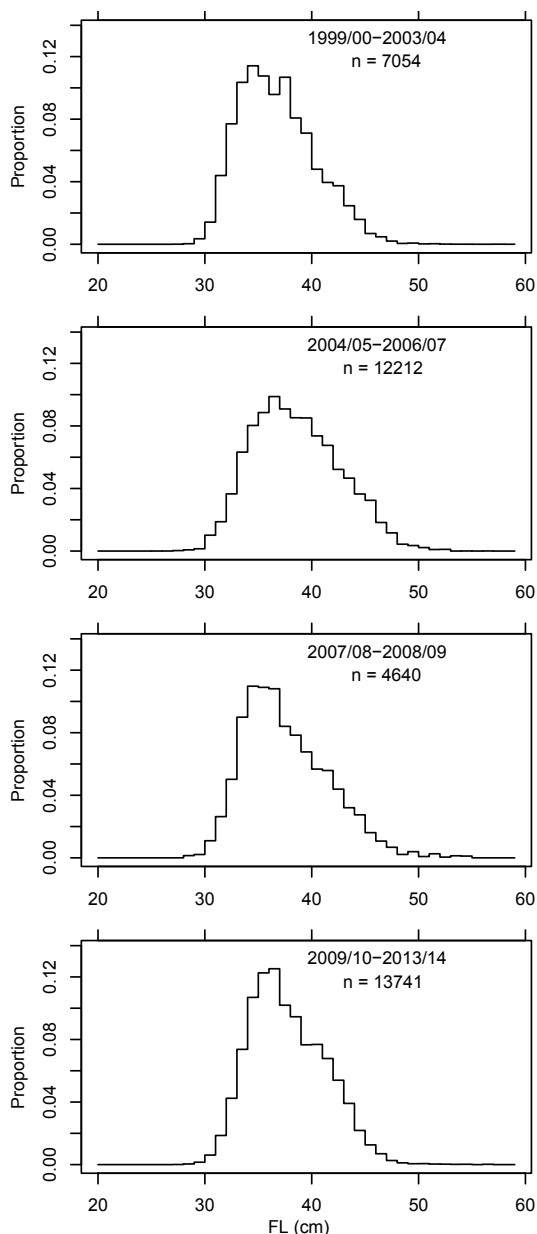
Reported landings of Sea Mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Sea Mullet Harvested by Mesh-Netting in NSW



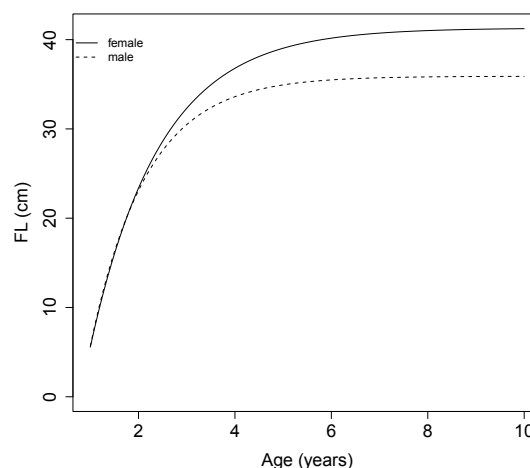
Catch rates of Sea Mullet harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Sea Mullet



The length distribution of Sea Mullet landed by NSW commercial fishers using hauling nets on ocean beaches has remained relatively stable through time and comprises mainly fish between 30 and 50 cm fork length (FL). The minimum legal length of Sea Mullet in NSW is 30 cm total length (approximately 27 cm FL).

Growth Curves of Sea Mullet



Growth curve for Sea Mullet using parameters from Smith and Deguara (2002). Lengths are presented as fork length (FL).

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 381002, common name or scientific name to find further information.



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Sea Urchins (Echinoidea)

Author Rowan Chick

EXPLOITATION STATUS Purple Sea Urchin – Moderately fished

A large amount of fishery and biological information is available for this species. Outcomes from a 2003 research program suggest exploitation rates are low (< 2%), indicating an exploitation status of Moderately Fished.

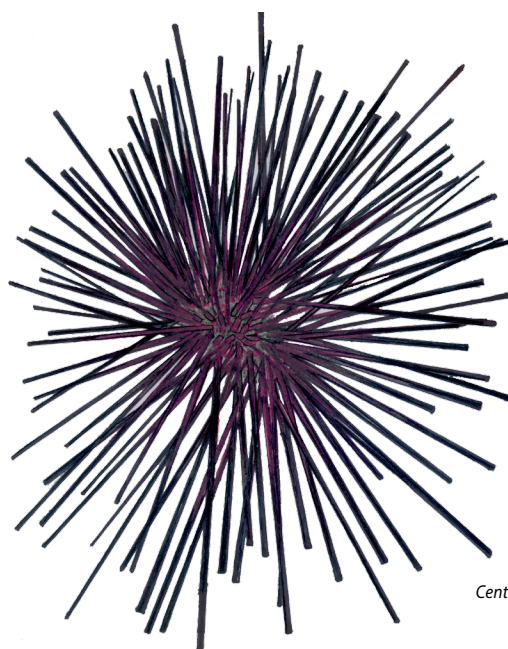
EXPLOITATION STATUS Red Sea Urchin - Uncertain

Despite local biological information being available for this species, there is limited population and fishery information to describe exploitation status with reasonable confidence; as such exploitation status is Uncertain.

EXPLOITATION STATUS Green Sea Urchin – Uncertain

Low commercial catches and a paucity of population and fishery information limit the ability to determine an exploitation status for this species; as such exploitation status is Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENTS
<i>Centrostephanus rodgersii</i>	Purple Sea Urchin	
<i>Heliocidaris tuberculata</i>	Red Sea Urchin	
<i>Heliocidaris erythrogramma</i>	Green Sea Urchin	



Centrostephanus rodgersii
Image © Bernard Yau

Background

Three species of sea urchin are the focus of commercial, recreational and indigenous fisheries in New South Wales. These species are the Purple

Sea Urchin (*Centrostephanus rodgersii*), Red Sea Urchin (*Heliocidaris tuberculata*) and Green Sea Urchin (*H. erythrogramma*). All are harvested for their roe, which is regarded as a delicacy among a number of community groups and, for the

commercial fishery, can command a high market price when in a desirable condition.

Purple Sea Urchin is an abundant species in shallow rocky reef habitats along the NSW coast, and occurs from Coffs Harbour to eastern Victoria and north-eastern Tasmania. It can grow to a maximum test diameter of over 10 cm, with thin tubular spines extending up to about 7 cm from the test. They commonly shelter in crevices during the day, and move up to 10 metres in surrounding habitat to feed during the night. Purple Sea Urchins mature at a test diameter of about 5 cm when they are about 4 years of age, and individuals may live for more than 10 years. Because Purple Sea Urchins can occur in dense concentrations, they have the ability to locally overgraze sub-tidal algal habitats, creating large areas of 'barrens'. It has been found that moving these urchins from barrens to areas with greater algal cover can increase the yield of roe.

Red and Green Sea Urchins also occur in intertidal and sub-tidal areas of rocky coastlines. The Red Sea Urchin is found from southern Queensland to the south coast of NSW, while the Green Sea Urchin is widely distributed around southern Australia, from southern Queensland to Shark Bay in Western Australia, including Tasmania. These two species are commonly less abundant than the Purple Sea Urchin and the Green Sea Urchin has a smaller test diameter (6-9 cm) and shorter spines (maximum of 3 cm in length). The spines of the Green Sea Urchin are thin and sharply pointed, while those of the Red Sea Urchin are thicker with blunt red-coloured tips.

The commercial fishery for Sea Urchins is managed through a number of input and output controls, including limited access (only a fishing business with a Sea Urchin and Turban Shell endorsement can fish), temporal and spatial closures and quota management (Red Sea Urchins only). The commercial fishery for Red Sea Urchins is subject to a total allowable commercial catch (TACC) of 60 t, which is further controlled through the limitation of total catch from defined areas, including areas closed to commercial fishing. In conjunction with the Turban Shell Fishery, the spatial and temporal closures operating in the Sea Urchin Fishery provide areas of refugia against effects of fishing.

Purple Sea Urchins are the main species harvested commercially in NSW. From 2000-2014, annual landings of the Purple Sea Urchin have ranged between about 24-74 t. Recent annual catches (2012-2014) have averaged 70 t, 20 t p.a. more than the previous 3 years (2009-2011; 50 t p.a.). Annual commercial catches of Red and Green Sea Urchins have been substantially less, with 10 year averages

of 8 t and <100 kg, respectively. However, historical annual catches of the Red Sea Urchin have been substantially higher (2000-2002; range 12-86 t, average 49 t).

The assessment of exploitation status in NSW has recently been updated. Previous assessments considered the species complex, confounding the assessment and resulting in an exploitation status of Undefined. The current assessment investigated the fishery, population and biological data available for individual species, to provide each species with an exploitation status. A general paucity of data for Green Sea Urchins and understanding of how the fishery effects populations of the Red Sea Urchin has resulted in an exploitation status for these species of Uncertain. Fishery, population and biological data available for the Purple Sea Urchin supports an exploitation status of Moderately Fished.

Additional Notes

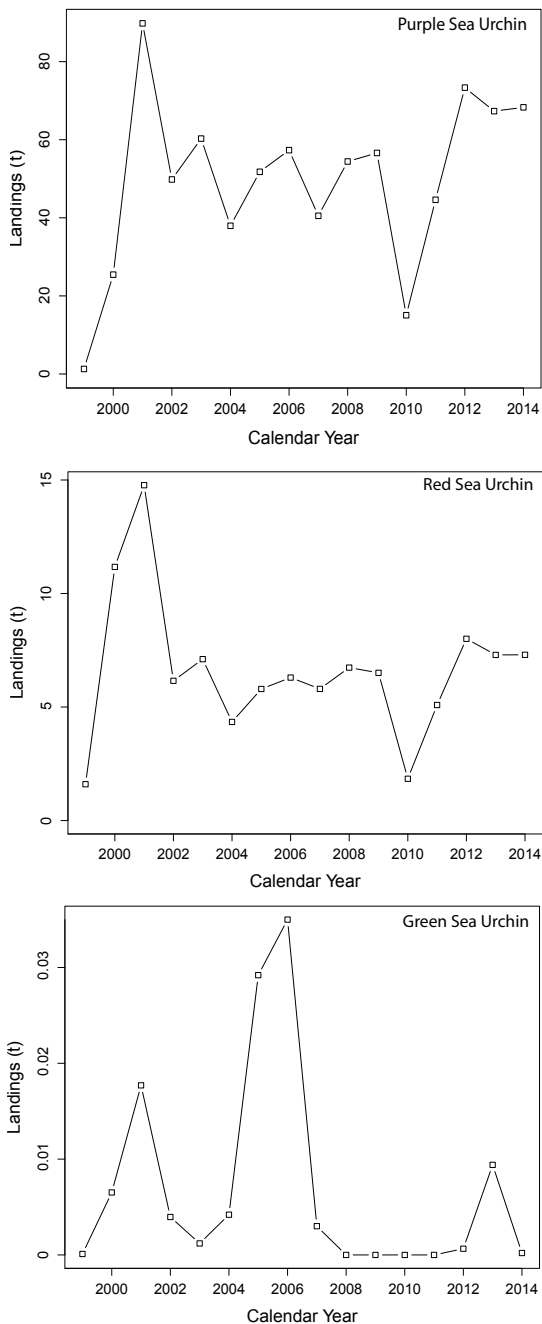
- Two species provide the bulk of landings in NSW with Purple Sea Urchins making up the majority.
- Urchins are harvested by commercial fishers for their roe – quality varies; and only the market-preferred stage provides a valuable product. Processing is a capital and labour-intensive operation and markets are limited.
- Recreational fishers are subject to a bag limit of 10 urchins (all species combined) - recreational catches are not known, but are thought to be small. However, recreational fishing pressure at local scales can have substantial effects on local urchin populations.
- Since 2002 red sea urchins have been subject to a Total Allowable Commercial Catch (TACC) of 60 t.
- Research surveys estimated the harvestable biomass of red and purple sea urchins to be 1,195 t and 55,000 t respectively (Worthington and Blount, 2003), suggesting sustainable yields at 5% harvest rate of 60 t and 2750 t respectively.

Catch

Recreational Catch of Sea Urchins

The annual recreational harvest of sea urchins in NSW is likely to be less than 5 t.

Historical Landings of Sea Urchins



Commercial landings (including available historical records) of Purple, Red and Green Sea Urchins for NSW from 1999 to 2014 for all fishing methods.

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Please visit the CSIRO website,

<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 25 211001, 25 247001 and 25 247002 common name or scientific name to find further information.



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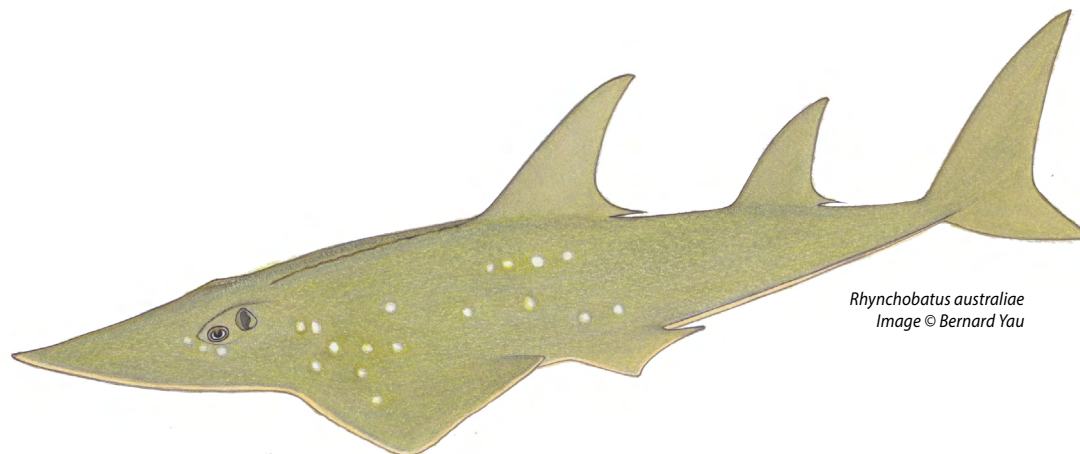
Shovelnose Rays (Rajiformes)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

A group of at least five species caught mainly by trawling. Eastern Shovelnose Ray is the most significant species in the catch of this group. A lack of local biological information and unreliable species reporting has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Aptychotrema rostrata</i>	Eastern Shovelnose Ray	Constitutes the majority of the catch of this group.
<i>Rhynchobatus australiae</i>	Whitespotted Guitarfish	There are minor landings of this species from northern NSW.
<i>Trygonorrhina fasciata</i>	Eastern Fiddler Ray	The small catches of this species are often discarded.
<i>Glaucostegus typus</i>	Giant Shovelnose Ray	Caught infrequently.
<i>Rhina ancylostoma</i>	Shark Ray	Caught infrequently.



Rhynchobatus australiae
Image © Bernard Yau

Background

Between 100 and 150 t of 'fiddler' rays are landed annually in NSW. The bulk of the catch (estimated 75%) consists of the Eastern Shovelnose Ray (*Aptychotrema rostrata*), with smaller quantities (~ 20%) of the Eastern Fiddler Ray (*Trygonorrhina fasciata*) and occasional landings of the large Whitespotted Guitarfish (*Rhynchobatus australiae*), the Giant Shovelnose ray (*Glaucostegus typus*) and the Shark Ray (*Rhina ancylostoma*).

The shovelnose and fiddler rays are endemic to the southern Queensland and NSW coasts (between

latitudes 27° and 36° S) while the guitarfish ranges from northern NSW through the tropics to southern Japan. All species mainly inhabit inshore smooth sandy substrates in depths less than 100 m and almost all the catch is taken by trawlers.

Eastern Shovelnose Ray grows to a maximum length of about 100 cm and weight of about 4 kg while fiddler rays reach 120 cm and about 10 kg. The Whitespotted Guitarfish can attain 300 cm in length and weigh more than 200 kg.

The biology of the Eastern Shovelnose Ray in Moreton Bay has been studied. Both sexes matured

at around 60 cm in length, and the females were found to breed annually with large specimens giving birth in the summer to as many as 18 young. New-born young are about 20 cm long. There is little biological information available for the fiddler ray (likely to have a similar reproductive cycle to the shovelnose ray) or the Whitespotted Guitarfish.

The commercial catch is taken almost totally by the Ocean Trawl Fishery. Significant numbers of shovelnosed rays are also taken by recreational anglers. The commercial landings have been relatively stable at around 100 to 150 t since the mid 1990s when 'fiddler/banjo shark' and 'shovelnose/sand shark' were first given separate species categories on commercial catch recording forms.

The stock status of all species is Uncertain and the species composition of the catch needs to be more accurately determined. No stock assessment is available for shovelnosed or fiddler rays in NSW waters. Length frequency data are available for the common species from Fisheries Research Vessel *Kapala* trawl surveys of inshore grounds in the 1990s.

Additional Notes

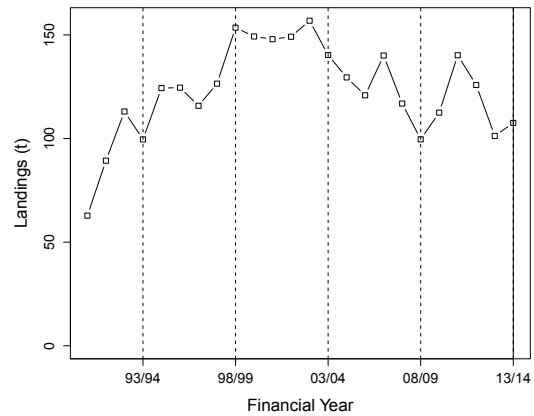
- The majority of the commercial catch is Eastern Shovelnose Ray mainly from ocean prawn trawling and ocean fish trawling. Shovelnose rays are also taken in significant quantities by recreational fishers.
- Preliminary indications are that the stock of Eastern Shovelnose Rays is more or less stable, but mortality rates are yet to be estimated.
- Female shovelnose rays have up to 18 embryos and move into shallower waters over the summer months to give birth (they are not susceptible to the trawl fishery during this stage but are taken by recreational fishers).
- These species are difficult to monitor after landing because fishers head and fin them. Onboard identification of the different species is straightforward because they have distinct morphologies.

Catch

Recreational Catch of Shovelnose Rays

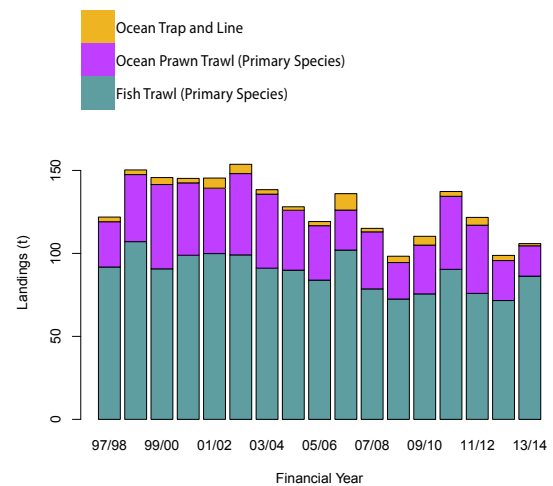
There is no robust estimate of the recreational harvest of shovelnose rays in NSW. The annual recreational harvest of shovelnose rays in NSW was previously considered to be between 20 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Shovelnose Rays



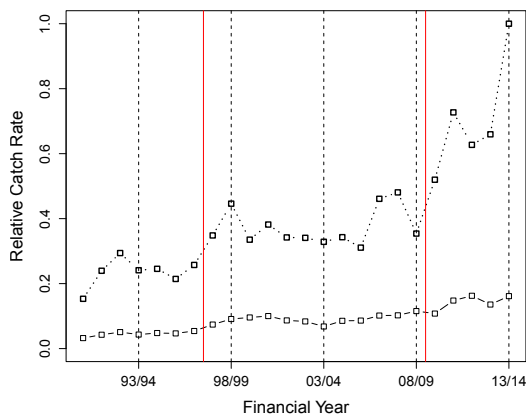
Commercial landings (including available historical records) of shovelnose rays for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Shovelnose Rays



Reported landings of shovelnose rays by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Shovelnose Rays Harvested by Fish Trawling in NSW



Catch rates of shovelnose rays harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 027009, 37 026005, 37 027006, 37 027010 and 37 026002, common name or scientific name to find further information. Please note that common names have been adopted from Last and Stevens (2010) and may differ to those contained on the CAAB website.



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Silver Sweep

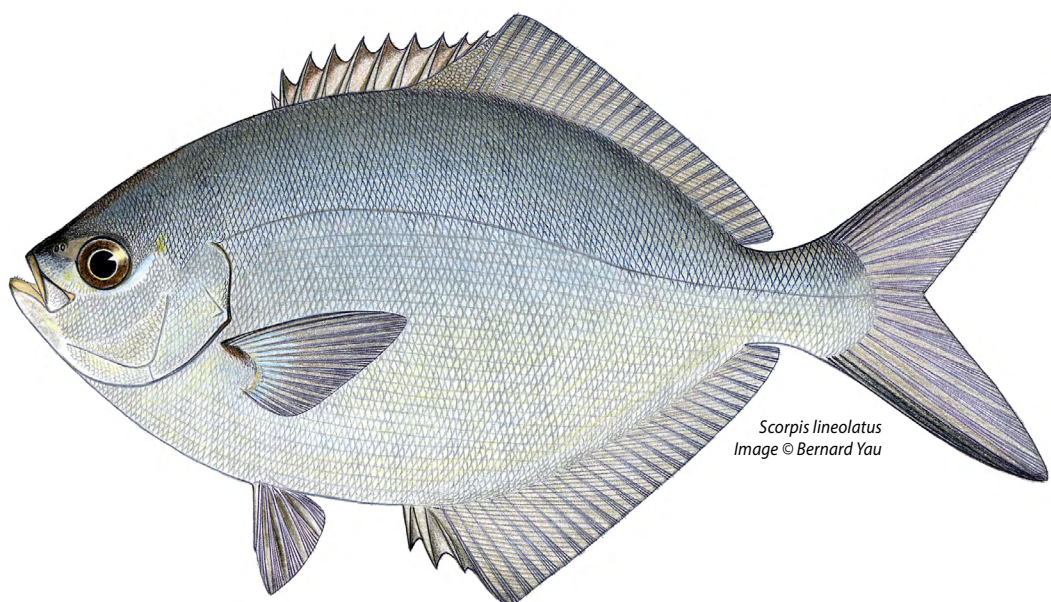
(*Scorpius lineolatus*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

A long lived species which may be susceptible to localised depletion. Significant declines in commercial landings and catch rates to historical lows, in association with declines in the average sizes landed, have produced concerns about the status of the stock. Variable commercial catch rates and a lack of recreational harvest data has resulted in a status of Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Scorpius lineolatus</i>	Silver Sweep	



Background

Silver Sweep (*Scorpius lineolatus*) is most abundant in NSW waters but also occurs in southern Queensland, Victoria and Tasmania. Adults and juveniles are associated with coastal and estuarine reefs. Silver Sweep mature at approximately 17 cm fork length (FL) at an age of 2-3 years and spawn during winter in NSW. Growth slows substantially following sexual maturity and Silver Sweep exhibit significant longevity, with a maximum estimated age of 54 years. The longevity and slow growth of this species may make it particularly vulnerable to over-harvesting.

In NSW, more than 80% of commercial landings of Silver Sweep are by fish traps in the Ocean Trap and Line Fishery, with the remaining catch taken mainly by purse seine nets in the Ocean Hauling Fishery. Trap landings are highest during spring and summer months, whereas purse seine landings tend to be higher during autumn.

Silver Sweep are caught in significant numbers by recreational and charterboat fishers in coastal waters.

Additional Notes

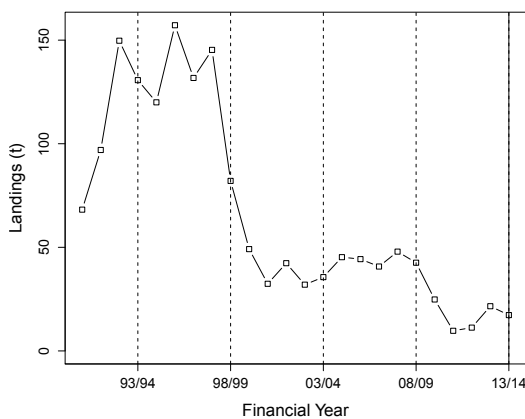
- Silver Sweep is a long-lived inshore rocky reef species taken commercially by purse-seine and trap fishers, and is a common recreational catch.
- Silver Sweep can live for more than 50 years; however they mature at a small size and early age (17 cm FL and 2-3 years).
- Silver Sweep may be susceptible to localised depletion.
- Catch rates are variable but show a long-term decline.

Catch

Recreational catch of Silver Sweep

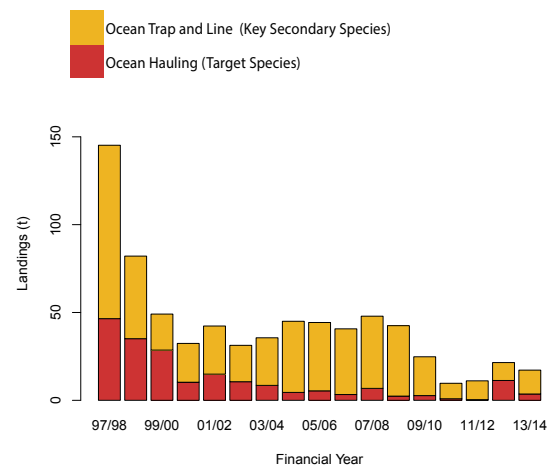
The most recent estimate of the recreational harvest of Silver Sweep in NSW was approximately 9,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 64,000 fish (in the order of 30 to 60 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Silver Sweep



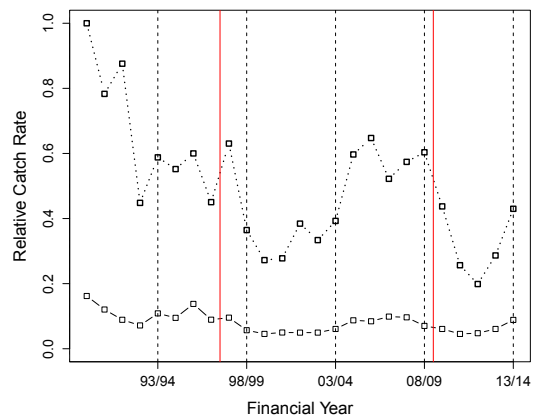
Commercial landings (including available historical records) of Silver Sweep for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Silver Sweep



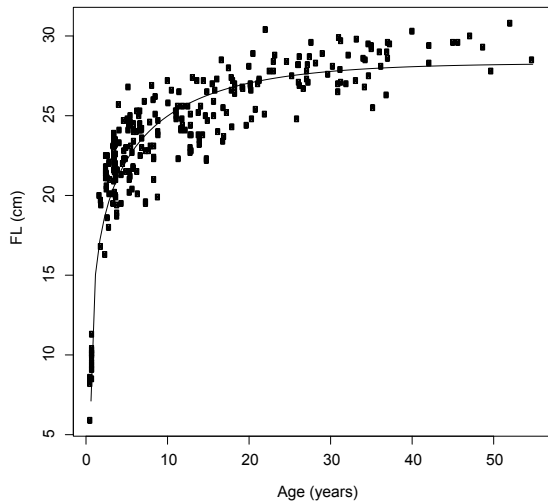
Reported landings of Silver Sweep by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Silver Sweep Harvested by Fish Trapping in NSW



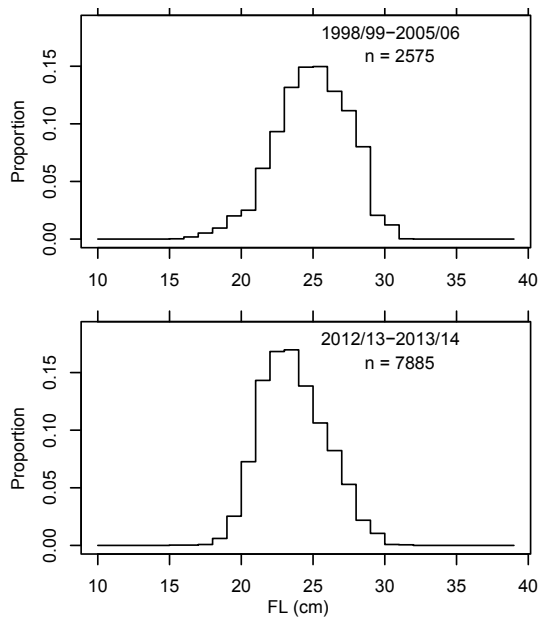
Catch rates of Silver Sweep harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Silver Sweep



Age-length data with fitted growth curve of Silver Sweep (Stewart and Hughes, 2005). Lengths are presented as fork length (FL).

Length Frequency of Silver Sweep



The length distributions of commercial landings of Silver Sweep show a decline in average size in recent years. There is no minimum legal length for sweep in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 361009, common name or scientific name to find further information.



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Silver Trevally

(*Pseudocaranx georgianus*)

Author John Stewart

EXPLOITATION STATUS **GROWTH OVERFISHED**

Yield per recruit analyses indicate that yield from the Silver Trevally stock would be increased by increasing the size at first capture and/or by reducing fishing mortality. There are concerns for this stock due to declines in landings, variable catch rates and few larger fish in landings.

SCIENTIFIC NAME

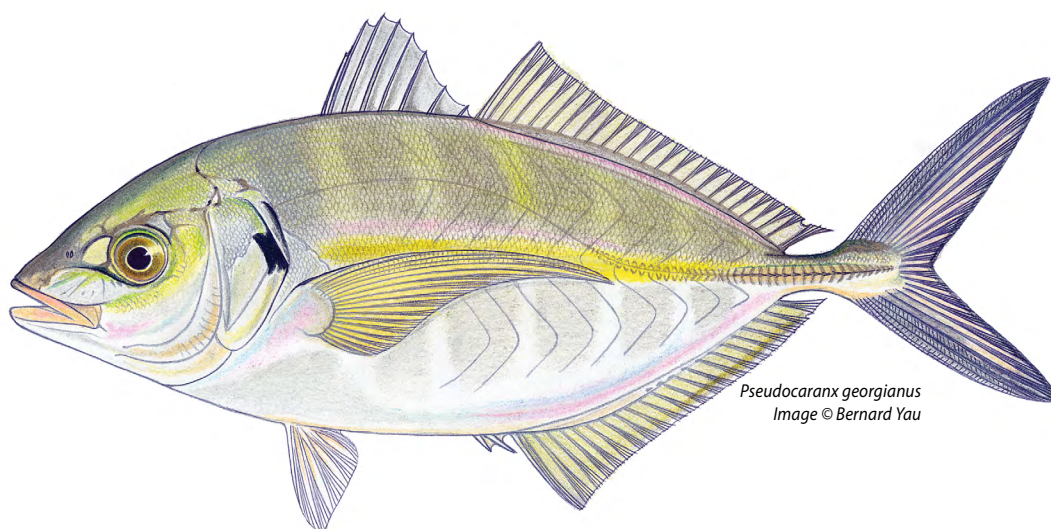
STANDARD NAME

COMMENT

Pseudocaranx georgianus

Silver Trevally

Previously *Pseudocaranx dentex*



Pseudocaranx georgianus
Image © Bernard Yau

Background

Silver Trevally occur in estuarine and coastal waters of southern Australian states ranging from about Coffs Harbour in NSW to about Perth in WA. Most of the Australian commercial catch is taken in NSW and eastern Victoria. Silver Trevally is a schooling species, inhabiting mainly sandy substrates and feeding on benthic invertebrates, including worms and molluscs, and also on benthic and planktonic crustaceans.

Silver Trevally mature between 18-24 cm fork length (FL) at 2-4 years of age. Females have moderate fecundity (50,000-200,000 eggs) and spawn during an extended period from spring to autumn. Larvae occur in coastal waters throughout this period, and may enter estuaries before settling out as juveniles. Fish less than 10 cm in length have been observed between December and August, however the life history of juvenile trevally is poorly known.

Silver Trevally is a relatively long lived, slow growing species, attaining a maximum age in excess of 25 years. In NSW coastal waters trevally reach a maximum size of about 65 cm FL and weight of about 4 kg. Since the 1980s, the average size of Silver Trevally in catches has declined considerably and in recent years, fish greater than about 35 cm in length (or 0.75 kg in weight) have been poorly represented in catches. Commercial catches are dominated by young fish, less than about five years of age.

Commercial landings of Silver Trevally increased significantly to more than 1,000 t per annum during the early 1980s. Annual landings then steadily declined to less than 500 t in the late 1990s. Commercial landings have been around 100 to 200 t in recent years. The bulk of the commercial catch of Silver Trevally is taken in ocean waters by otter trawling. Smaller quantities are taken by fish trapping. Commercial catches of Silver Trevally from estuarine waters have declined significantly following the declaration of a Recreational Fishing

Haven in Botany Bay in 2002. In recent years, buy-outs of trawling licences associated with the implementation of Marine Parks have resulted in a further decline in landings of Silver Trevally. Most trevally are sold fresh at the Sydney and Melbourne fish markets where the species receives moderate prices depending on the size grade and quality of handling after capture.

Significant catches of Silver Trevally are taken by recreational fishers in both estuarine and ocean waters. There has been a decline in the recreational harvest in parallel with the decline in the commercial harvest in NSW waters.

Additional Notes

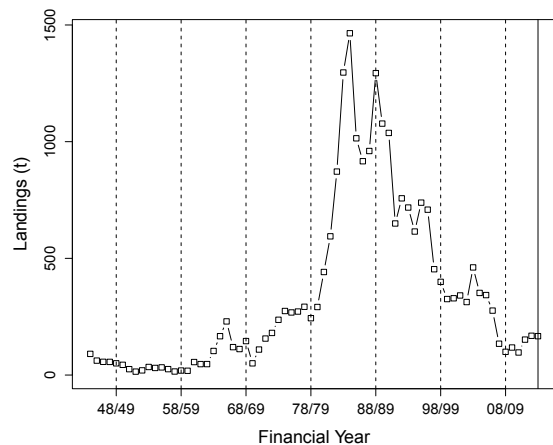
- A minimum legal length (MLL) of 30 cm total length was implemented in September 2007, however this regulation does not apply to fish caught under Commonwealth jurisdiction.
- The implementation of the zoning plan for the Batemans Marine Park off the NSW south coast in 2007 resulted in the closure to trawling of significant areas where Silver Trevally were previously targeted. A number of trawl licences were also bought out during the implementation of this Marine Park.
- Commonwealth assessments do not consider Silver Trevally to be overfished nor subject to overfishing (Georgeson *et al.*, 2014). The Commonwealth assessment does not consider the fact that Silver Trevally are 'Growth Overfished'.
- There is a MLL of 30 cm total length for Silver Trevally and a recreational bag limit of 10 and a possession limit of 20 for all trevallies.

Catch

Recreational Catch of Silver Trevally

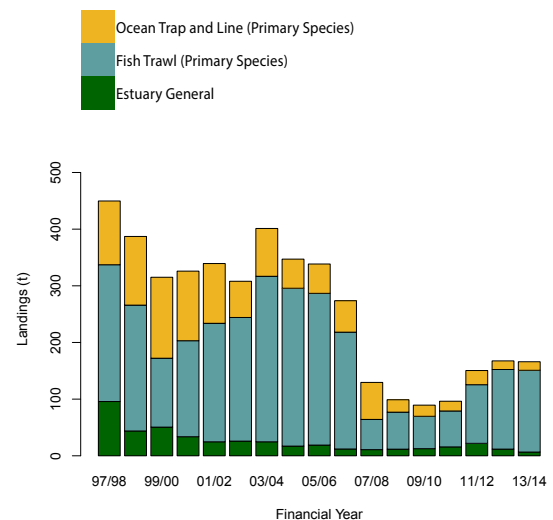
The most recent estimate of the recreational harvest of Silver Trevally in NSW was approximately 49,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 250,000 fish (in the order of 180 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Silver Trevally



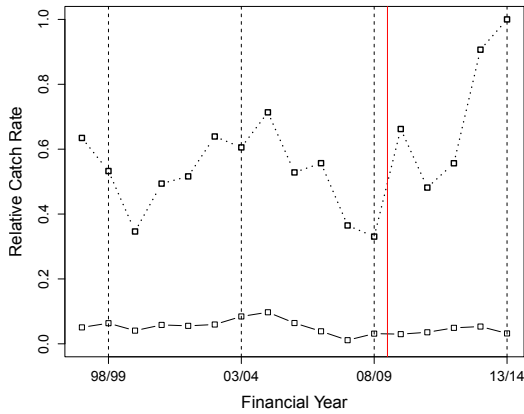
Commercial landings (including available historical records) of Silver Trevally for NSW from 1944/45 to 2013/14 for all fishing methods. Note that the decline in reported catch during the late 1990s was partly due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Silver Trevally



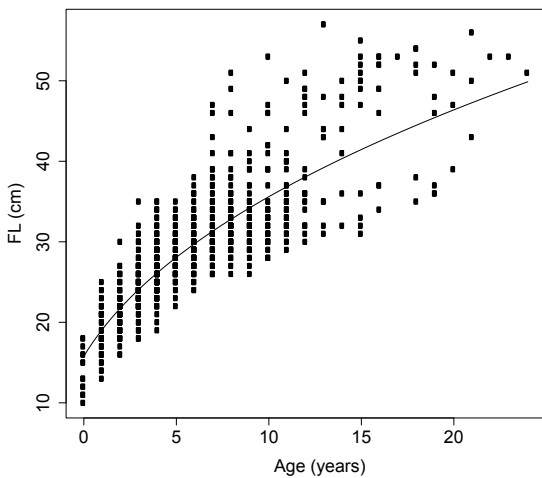
Reported landings of Silver Trevally by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Silver Trevally Harvested by Fish Trawling in NSW



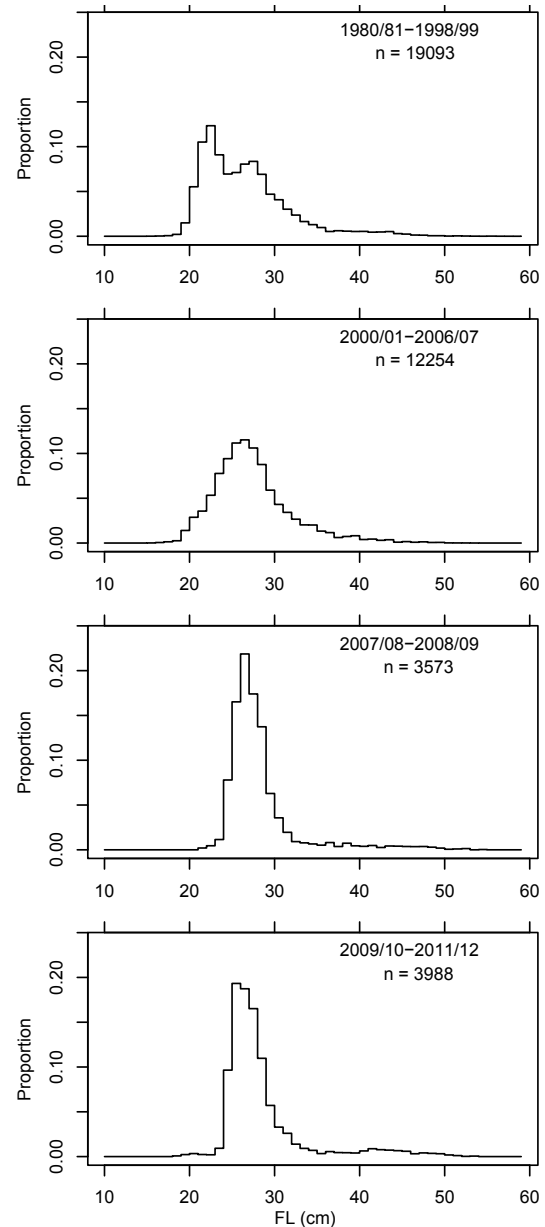
Catch rates of Silver Trevally harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Silver Trevally



Age-length data with fitted growth curve for Silver Trevally (Rowling and Raines, 2000). Lengths are presented as fork length (FL).

Length Frequency of Silver Trevally



The proportion of larger (> 30 cm fork length (FL)) Silver Trevally landed by NSW commercial fishers has declined substantially since 2006/07 and recent catches have comprised mainly fish between 25 and 30 cm FL. In September 2007 a minimum legal length of 30 cm total length (equivalent to 25 cm FL) was introduced for Silver Trevally in NSW.

Further Reading

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West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle (2015). Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series.

Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 337062, common name or scientific name to find further information.



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Snapper

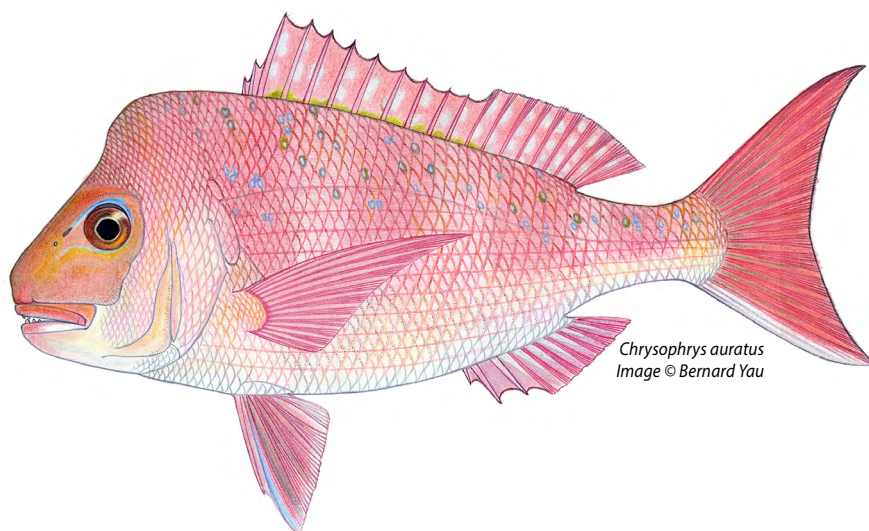
(*Chrysophrys auratus*)

Author John Stewart

EXPLOITATION STATUS **GROWTH OVERFISHED**

Yield per recruit analyses indicate that yield from the Snapper stock would be increased by increasing the size at first capture and/or by reducing fishing mortality. A decadal increase in commercial landings, catch rates and size and age compositions suggest improvement in the NSW snapper stock, however two recent years of declines in landings and catch rates are of some concern.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Chrysophrys auratus</i>	Snapper	Previously <i>Pagrus auratus</i>



Background

Snapper (*Chrysophrys auratus*) is distributed in the Indo-Pacific region from Japan and the Philippines to India and Indonesia, and New Zealand. In Australia, Snapper occur in waters south from Hinchinbrook Island in Queensland to Barrow Island in WA and are occasionally found off the north coast of Tasmania.

Juveniles can be found around inlets, bays and other shallow, sheltered marine waters, often over mud and seagrass. Adults can be found near reefs, over mud and sand substrates and offshore to the edge of the continental shelf, across a depth range of 5 to 200 m. Some level of genetic sub-structuring is thought to exist for Snapper in southern and western Australia, however Snapper on the east coast (NSW and Queensland) are thought to constitute one stock.

Snapper spawn repeatedly during the spawning season i.e. they are serial spawners, with the number of eggs increasing exponentially with length. The length at which 50% of female Snapper reach sexual maturity in NSW is approximately 25 cm fork length (FL) and 2-3 years of age. However

snapper mature at smaller sizes (approximately 22 cm FL or 26 cm total length (TL)) and age (approximately 1.7 years) in the north of the state and at larger sizes (27 cm FL or 32 cm TL) and age (approximately 3 years) in the south of the state.

Snapper are a relatively long lived species with a highly variable growth rate. In NSW, Snapper reach a maximum length of about 80 cm FL and weight of about 10 kg. They can live for up to 40 years, but the majority of fish in landings are less than 5 years of age. Growth rates of individual fish are highly variable.

More than 95% of Snapper harvested from the NSW commercial sector are taken by the Ocean Trap and Line Fishery. Since the mid-1980s, the commercial harvest of Snapper has decreased from around 750 t to around 200 to 300 t in recent years. The main harvest season for Snapper in the commercial sector is winter-spring. Significant quantities of Snapper are also taken by recreational fishers.

Additional Notes

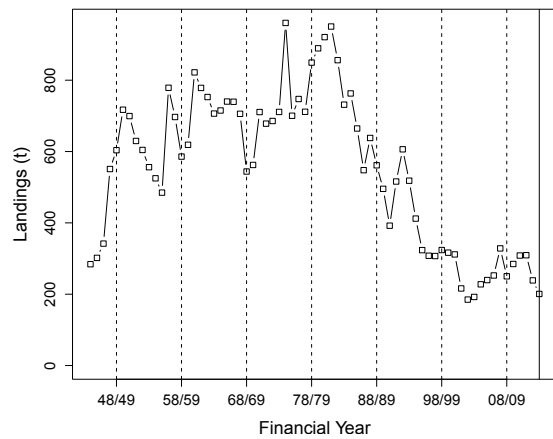
- The species name for Snapper has reverted to *Chrysophrys auratus*.
- NSW commercial landings increased steadily between 2002/03 and 2011/12, but have declined for 2 consecutive years since.
- Catch rates in the NSW trap fishery have tracked the trends in landings. The recent declines have been driven by the far northern NSW ports.
- Sampling since 2008/09 has shown a steady increase in the proportion of older (5 to 10 years) Snapper in commercial landings.
- The Queensland assessment for Snapper is Over-fished.
- The east coast biological stock of Snapper has been assessed as an Undefined Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal length of 30 cm TL for Snapper and a recreational bag limit of 10 in NSW.

Catch

Recreational Catch of Snapper

The most recent estimate of the recreational harvest of Snapper in NSW was approximately 186,000 fish weighing approximately 148 t during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 334,000 fish (in the order of 250 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

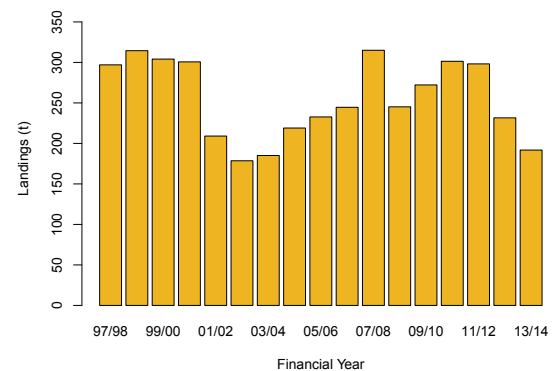
Historical Landings of Snapper



Commercial landings (including available historical records) of Snapper for NSW from 1944/45 to 2013/14 for all fishing methods.

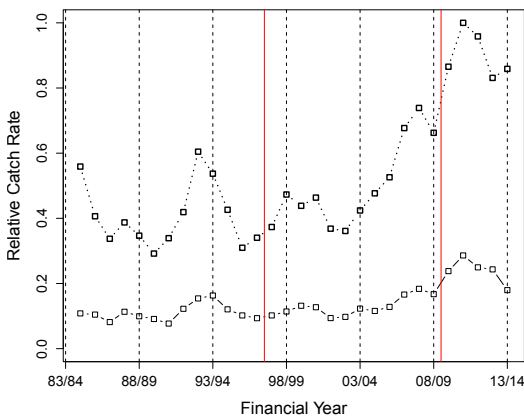
Landings by Commercial Fishery of Snapper

Ocean Trap and Line (Primary Species)



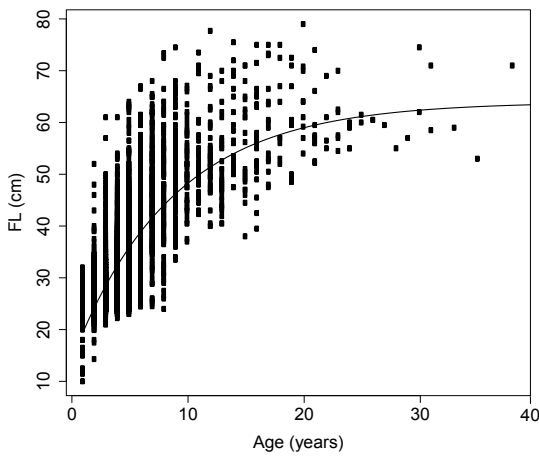
Reported landings of Snapper by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Snapper Harvested by Fish Trapping in NSW



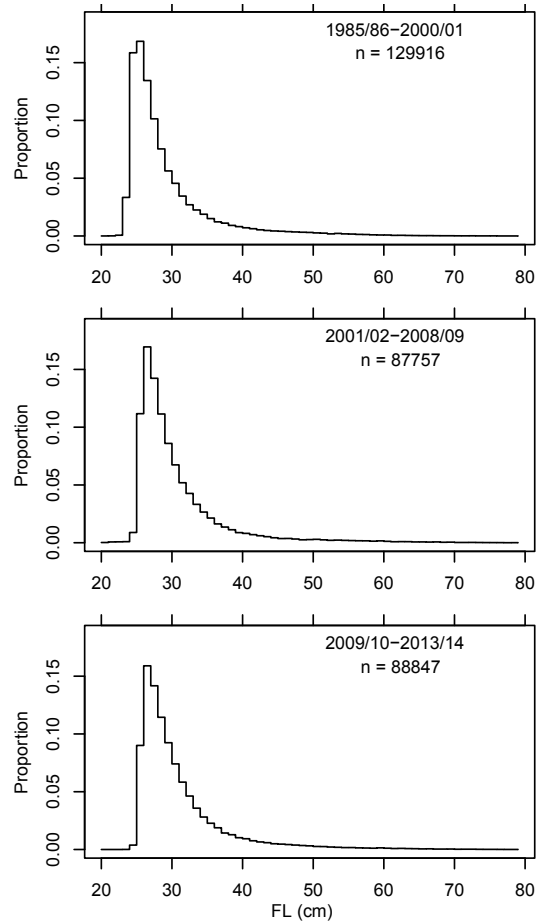
Catch rates of Snapper harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Snapper



Age-length data with fitted growth curve for Snapper in NSW (internal data). Lengths are presented as fork length (FL).

Length Frequency of Snapper



The length distribution of NSW commercial landings of Snapper is comprised mainly of fish between 25-40 cm fork length (FL). In 2001 the minimum legal length (MLL) of Snapper was increased from 28 to 30 cm total length, however the majority of fish in commercial landings in recent years are still within a few centimetres of the MLL, and the proportion of larger (>40 cm FL) Snapper in landings remains very low.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 353001, common name or scientific name to find further information.



Soles

(Soleidae and Cynoglossidae)

Author Karina Hall

EXPLOITATION STATUS UNDEFINED

Two species are significant in commercial catches, but little biological information and only limited size composition data are available. Catch data are compromised by poor species identification.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Paraplagusia bilineata</i>	Lemon Tongue Sole	Common in prawn trawl catches.
<i>Brachirus nigra</i>	Black Sole	Caught mostly by fish trawl.
<i>Zebrias scalaris</i>	Manyband Sole	Few landed.



Brachirus nigra
Image © Bernard Yau

Background

Soles marketed in NSW belong to the families Soleidae (true soles) and Cynoglossidae (tongue soles). The catch consists mainly of the Lemon Tongue Sole (*Paraplagusia bilineata*) and the Black Sole (*Brachirus nigra*) with very small quantities of the Manyband Sole (*Zebrias scalaris*).

The Lemon Tongue Sole is distributed throughout the Indo-West Pacific, across northeast Australia and down the eastern coast to about Sydney in NSW. It inhabits shallow estuaries, tidal rivers and inshore coastal waters to a maximum depth of about 30 m, and occurs on mud and sand substrates. The maximum size recorded is 33 cm total length (TL).

The Black Sole and Manyband Sole are both endemic to eastern Australia, ranging from southern Queensland to eastern Bass Strait and southern Victoria. They are primarily found inshore

in depths less than 50 m preferring muddy or sandy seabeds, particularly in estuaries and shallow coastal bays. Black Sole grows to about 35 cm while the Manyband Sole is a small species reaching only about 20 cm. Black Sole matures at about 16 cm TL for females and 19 cm TL for males at an estimated 1 year of age.

All three species spawn pelagic eggs during spring and summer. As for flounders, the pelagic larvae of soles are initially symmetrical like other fish but during development the body plan changes so that both eyes become located on the one side. For true soles (Soleidae) both eyes become located on the right side of the head, while the eyes of tongue soles (Cynoglossidae) are on the left side. The young soles then settle flat on the seabed with the eyed-side, which becomes pigmented and dark coloured, facing upwards. The under-side of soles is pale and unpigmented.

About 90% of the small commercial catch of soles in NSW is taken as by-product of fish and prawn trawls in the Ocean Trawl Fishery, and most of the remainder is taken from estuaries by haul and mesh nets of the Estuary General Fishery. Catches of around 10 t per annum were reported until a minimum legal length (MLL) of 25 cm TL was introduced in 2007, after which catches declined to less than 5 t per annum. Catches briefly returned to 13 t in 2011/12 after the MLL was removed, but have been less than 5 t for the last 2 years. Soles are not commonly caught by recreational fishers.

Additional Notes

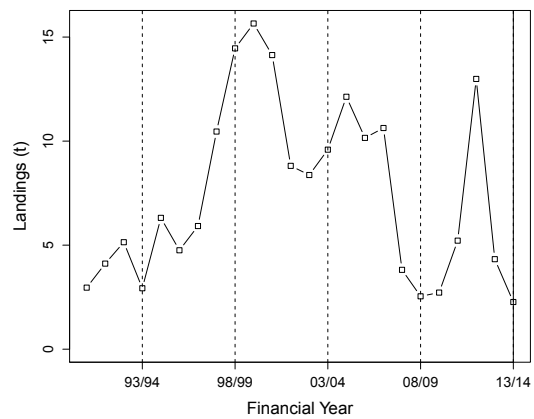
- Very little is known about the biology of soles in Australian waters.
- Black Sole and Lemon Tongue Sole are the most common species marketed in NSW and although catches have been reported by species since 1990 the data are compromised by poor species identification and are assessed as a species complex.
- These species are an incidental by-product of both fish and prawn trawling and are rarely taken by recreational fishers.
- There is a combined recreational bag limit of 20 for all flounders and soles. A MLL of 25 cm TL was introduced for soles in September 2007, but removed again in September 2010.

Catch

Recreational Catch of Soles

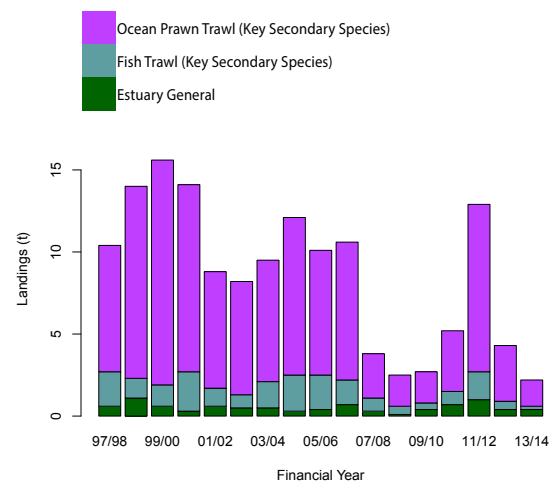
The most recent estimate of the recreational harvest of flatfish (flounders and soles combined) in NSW was approximately 22,000 during 2013/14 (West *et al.*, 2015). Annual recreational harvest was previously estimated to be minor. Historical onsite surveys indicate that most flatfish harvested by recreational fishers in NSW are flounders.

Historical Landings of Soles



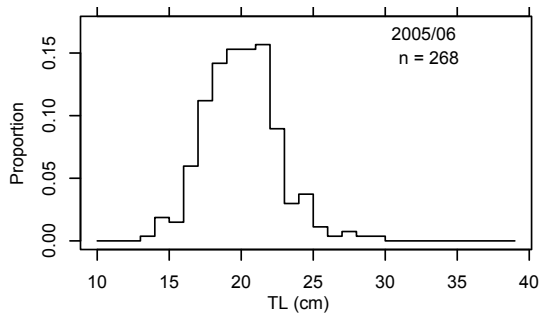
Commercial landings (including available historical records) of soles for NSW from 1990/91 to 2013/14 for all fishing methods. Note that a minimum legal length of 25 cm TL was introduced in NSW in September 2007, and revoked in September 2010.

Landings by Commercial Fishery of Soles



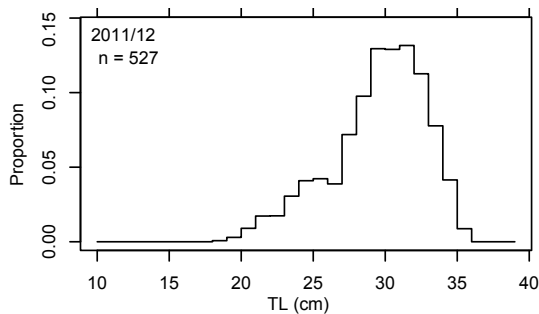
Reported landings of soles by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Black Sole



The length distribution of Black Sole landed by NSW commercial fishers during 2005/06 was comprised mainly of fish between 15-30 cm total length (TL). A minimum legal length of 25 cm TL was introduced in NSW for all flounder and sole species in September 2007 and revoked in September 2010.

Length Frequency of Lemon Tongue Sole



The length distribution of Lemon Tongue Sole landed by NSW commercial fishers during 2005/06 was comprised mainly of fish between 20-35 cm total length (TL). A minimum legal length of 25 cm TL was introduced in NSW for all flounder and sole species in September 2007 and revoked in September 2010.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 463001, 37 462017 and 37 462010, common name or scientific name to find further information.



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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Southern Calamari

(*Sepioteuthis australis*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

A short-lived squid species that is very important in commercial and recreational catches of NSW. Relatively stable landings and catch rates over the last 8 years suggest that the stock status is Fully Fished.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Sepioteuthis australis</i>	Southern Calamari	



Background

The Southern Calamari (*Sepioteuthis australis*) are found in estuarine and inshore coastal waters around southern Australia from Brisbane in Queensland to Perth in WA, and including Tasmania. It also occurs off northern New Zealand. Across this broad species distribution the stock structure is apparently quite complex, with reports of two main genetic types and hybrids, evidence of localised structuring in Tasmanian waters and a possible division between northern NSW populations and more widely distributed southern populations. Therefore, the species is currently assessed at the jurisdictional level.

Although only size data are available for Southern Calamari in NSW waters, the species biology has been extensively studied off southern Australia, where large targeted jig fisheries operate. It is a fast growing, short-lived squid, with a maximum

age of less than 1 year. In SA waters, males reach a maximum size of 50 cm mantle length (ML) and females 40 cm ML. Large squid measuring around 30-35 cm ML and weighing about 1 kg have also been reported from NSW waters.

In southern states, Southern Calamari attain maturity at about 7-8 months of age and 15-20 cm ML. Females mate with multiple males and store sperm before spawning in relatively shallow (3-5 m) depths mainly during the spring and summer. They produce multiple batches of eggs (numbering up to several hundred), which are laid in long coated strings attached to seagrass, macro-algae, hard reef and even sandy substrates.

In NSW, Southern Calamari is taken primarily as by-product in commercial ocean trawl fisheries, particularly off the central and southern coasts. Landings of Southern Calamari have been recorded

separately from other squid species since 1990. Catches remained relatively stable at greater than 50 t per annum until the mid-2000s, with a distinct peak of over 100 t in the late 1990s. For the last 8 years, catches have been slightly lower, but stable around a new average of about 30 t per annum and catch rates have been consistent over many years, with recent averages greater than historical rates.

The main fisheries for Southern Calamari occur in the large shallow gulfs of SA, where commercial catches usually exceed 400 t per year and recreational landings are estimated to be similar. Stable catch rates in SA jig and hauling net sectors suggest that the biomass is unlikely to be overfished or subject to overfishing, and the stock was classified as sustainable in the most recent assessment, as was the Victorian stock for similar reasons. The Tasmanian stock was classified as undefined because of some conflicting trends and evidence of possible localised depletions, and the Commonwealth stock, which supports only minor catches and has limited information, was also classified as undefined.

Significant amounts of Southern Calamari are also taken by recreational anglers and charter boat fishers from NSW estuaries, bays and inshore oceanic waters, where they are quite often targeted for bait rather than consumption. Given their short and rapid life histories, the wealth of biological information available from other jurisdictions, relatively small commercial and recreational fisheries in NSW and stable catch rates over many years, Southern Calamari were changed from an Undefined status in NSW in 2012/13 to Fully Fished in 2013/14.

Additional Notes

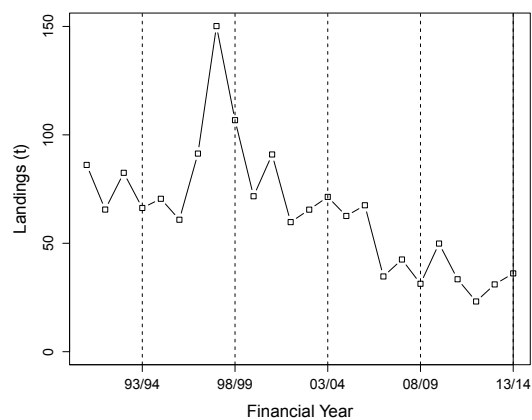
- The biological stocks of Southern Calamari were assessed as Sustainable stocks in SA and Victoria and as Undefined stocks in NSW, Tasmania and Commonwealth waters in the *Status of Key Australian Fish Stocks Reports 2014*.
- Commercial landings and catch rates have been reasonably stable, but do fluctuate (probably as a result of recruitment variability).
- Trawl gears can retain small sizes (<10 cm mantle length) but the majority of the catch is comprised of Southern Calamari that are larger than 10 cm ML.
- Local biological information, particularly for squid from northern NSW waters that may be part of a separate stock, would assist assessments.
- There is a combined recreational bag limit of 20 for all squid and cuttlefish in NSW.

Catch

Recreational Catch of Southern Calamari

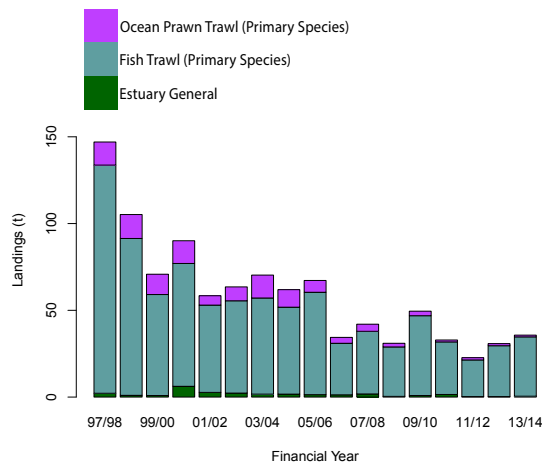
The most recent estimate of the recreational harvest of Southern Calamari in NSW was approximately 7,000 squid during 2013/14 (West *et al.*, 2015). The annual recreational harvest of Southern Calamari in NSW was previously estimated to lie between 10 and 40 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Southern Calamari



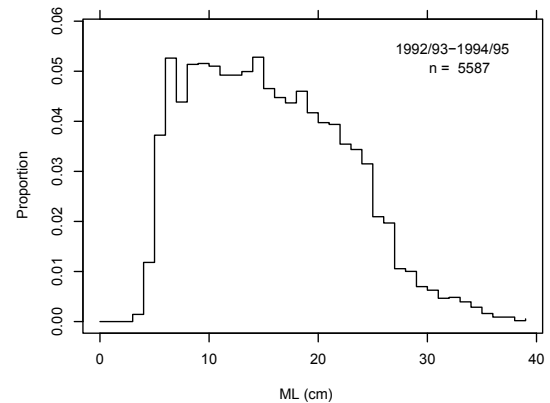
Commercial Landings (including available historical records) of Southern Calamari for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Southern Calamari



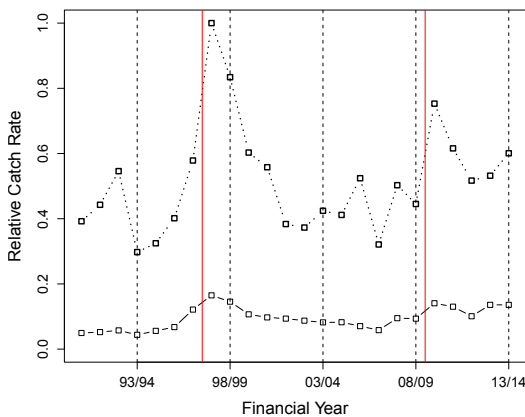
Reported landings of Southern Calamari by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Southern Calamari



The length distribution of Southern Calamari caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mostly of squid between 5-25 cm mantle length (ML). There is no minimum legal length for Southern Calamari in NSW.

Catch Per Unit Effort Information of Southern Calamari Harvested by Fish Trawling in NSW



Catch rates of Southern Calamari harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 23 617005, common name or scientific name to find further information.



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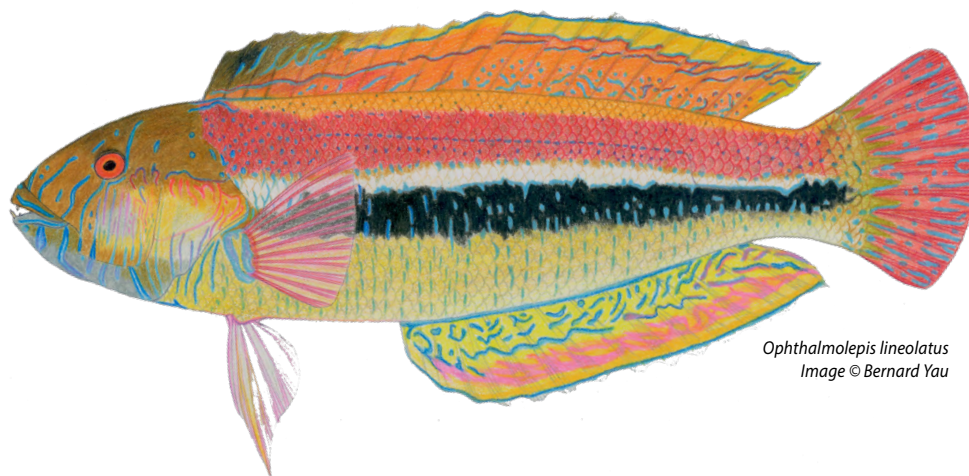
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Southern Maori Wrasse

(*Ophthalmolepis lineolatus*)

Author Julian Hughes

EXPLOITATION STATUS	UNDEFINED	
Mainly a recreational species, but there is a small targeted commercial fishery. There is little current biological or fishery information for Southern Maori Wrasse resulting in a status of Undefined.		
SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Ophthalmolepis lineolatus</i>	Southern Maori Wrasse	



Ophthalmolepis lineolatus
Image © Bernard Yau

Background

The Southern Maori Wrasse (*Ophthalmolepis lineolatus*) is a small endemic labrid commonly found on the temperate coastal rocky reefs of southern Australia from southern Queensland to southern Western Australia. Southern Maori Wrasse are carnivorous and are more frequently found in reef habitats dominated by sponges than in kelp forest or urchin-grazed barrens. Adult Southern Maori Wrasse are also more abundant with increasing depth down to 20 m where they may form loose aggregations, but can be found to depths of 60 m.

Like other members of the family Labridae, Southern Maori Wrasse are protogynous hermaphrodites. They are sexually dimorphic with males and females differing in size and colour. Juveniles mature as females at approximately 18 cm total length (TL) and 2 years of age. Females

change to terminal phase males at a length of approximately 30 cm TL and 5 years of age. The peak reproductive season in NSW is from January to March.

Southern Maori Wrasse grow quickly, attaining approximately 28 cm TL after 5 years, with growth slowing thereafter. They can reach 45 cm TL in length and can attain 14 years of age.

Southern Maori Wrasse are important to the recreational fishery in NSW and were ranked within the top 10 species by number retained during both years of a survey of offshore trailerboat fishers (Steffe *et al.*, 1996). They are not considered an important commercial species with reported landings averaging around 2.5 t annually from line fishing methods.

Additional Notes

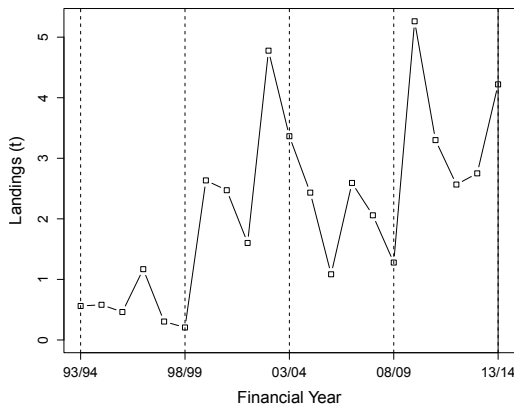
- There is no minimum legal length or bag limit for Southern Maori Wrasse in NSW waters.

Catch

Recreational Catch of Southern Maori Wrasse

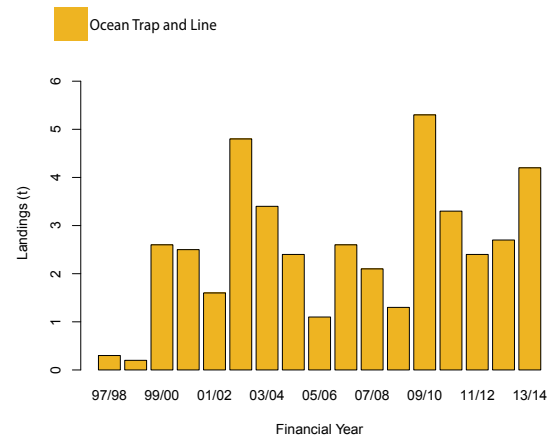
The most recent estimate of the recreational harvest of Southern Maori Wrasse in NSW was approximately 4,000 fish during 2013/14 (West *et al.*, 2015). The annual recreational harvest was previously estimated to lie between 20 and 30 t based upon the results of the offshore trailer boat recreational survey (Steffe *et al.*, 1996) undertaken by NSW DPI.

Historical Landings of Southern Maori Wrasse



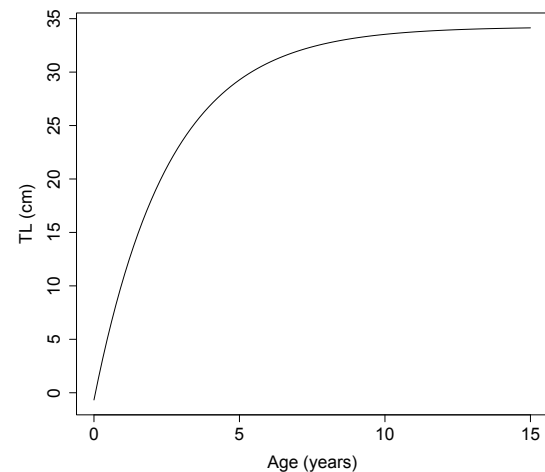
Commercial landings (including available historical records) of Southern Maori Wrasse for NSW from 1993/94 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Southern Maori Wrasse



Reported landings of Southern Maori Wrasse by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Southern Maori Wrasse



Growth curve of Southern Maori Wrasse using parameters from Stewart and Hughes (2008). Lengths are presented as total length (TL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 384040, common name or scientific name to find further information.



Spanish Mackerel

(*Scomberomorus commerson*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

The majority of the harvest occurs in Queensland waters where the east coast biological stock is considered sustainable. The Queensland assessment is consistent with a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Scomberomorus commerson</i>	Spanish Mackerel	



Background

Spanish Mackerel are distributed in the waters of the Indo-Pacific from the Red Sea and South Africa to southeast Asia, north to China and Japan, and south to Australia. They are also found in the eastern Mediterranean Sea. In Australian waters, they are generally distributed from Geographe Bay in WA around northern and eastern Australia to the northern half of NSW. Within this geographical distribution, Spanish Mackerel can be found from the edge of the continental shelf to shallow coastal waters. Adults are associated with coral reefs, rocky shoals and current lines on outer reef areas and offshore. Small juveniles up to 10 cm fork length (FL) occur in creeks, estuaries and sheltered mud flats during the early wet season in north Queensland.

Migrations of Spanish Mackerel extend along the entire east coast of Queensland although permanently resident populations also seem to exist. Resident fish disperse from reefs after spawning whilst migrating fish can move up to 1,000 nautical miles to the south (into NSW waters). The use of parasites to distinguish between stocks suggested that there may be six separate stocks of Spanish Mackerel across northern Australia,

however, the use of isozyme, allozyme and mitochondrial DNA genetic analysis failed to find any significant differences. The diet of Spanish Mackerel consists of small fish like anchovies, clupeids and carangids, as well as squid and prawns.

Spanish Mackerel reach sexual maturity at around 80 cm FL and 2 years of age. They are serial or partial spawners with fish showing a peak in reproductive activity during the spring/summer months in Queensland. They are highly fecund with large females producing more than 1 million eggs. In Queensland waters, Spanish Mackerel can reach 240 cm FL and a maximum weight of 70 kg with females growing to a larger size than males. Initial growth is rapid with fish reaching 100 cm in the first few years of life.

Spanish Mackerel are an important target of commercial and recreational fishers in NSW, mainly during the summer and autumn months and in the northern half of the state. The NSW commercial fishery is mainly reported as being taken by line fishing methods such as handline and trolling. Relatively minor and inconsistent catches are also taken in the Ocean Hauling Fishery.

Additional Notes

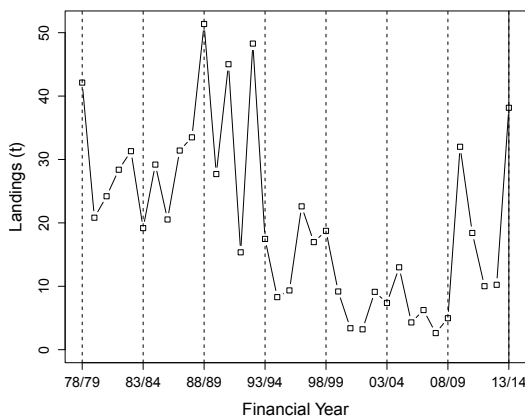
- NSW annual commercial landings are generally small (10-40 t) compared with Queensland (200-600 t).
- There are significant recreational landings of Spanish Mackerel, especially in Queensland.
- A length-based stock assessment conducted in 2008 by Queensland Fisheries concluded that the stock was at about maximum sustainable yield level, with exploitable biomass estimated to be between 35-60% of the unfished level.
- The east coast biological stock of Spanish Mackerel has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- In NSW there is a minimum legal length of 75 cm total length for Spanish Mackerel and a combined recreational bag limit of 5 for all Spanish and Spotted Mackerel.

Catch

Recreational Catch of Spanish Mackerel

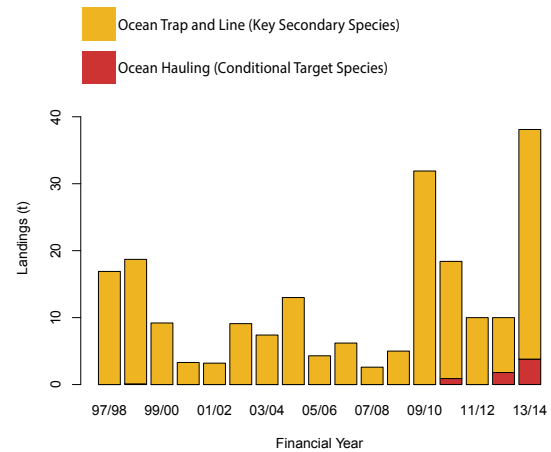
The most recent estimate of the recreational harvest of Spanish Mackerel in NSW was approximately 5,000 fish during 2013/14 (West *et al.*, 2015). This estimate is consistent with the previous estimate of between 20 and 110 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Spanish Mackerel



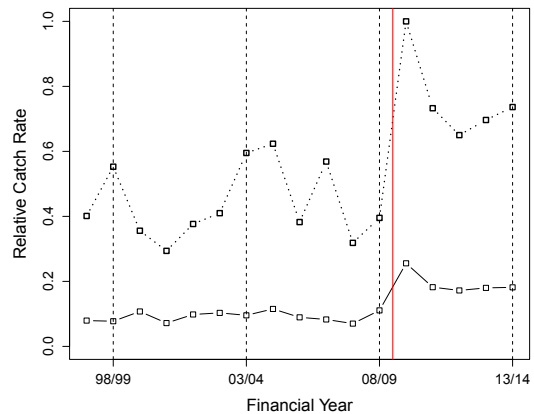
Commercial landings (including available historical records) of Spanish Mackerel for NSW from 1978/79 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Spanish Mackerel



Reported landings of Spanish Mackerel by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Spanish Mackerel Harvested by All Line Methods in NSW



Catch rates of Spanish Mackerel harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441007, common name or scientific name to find further information.



Spanner Crab

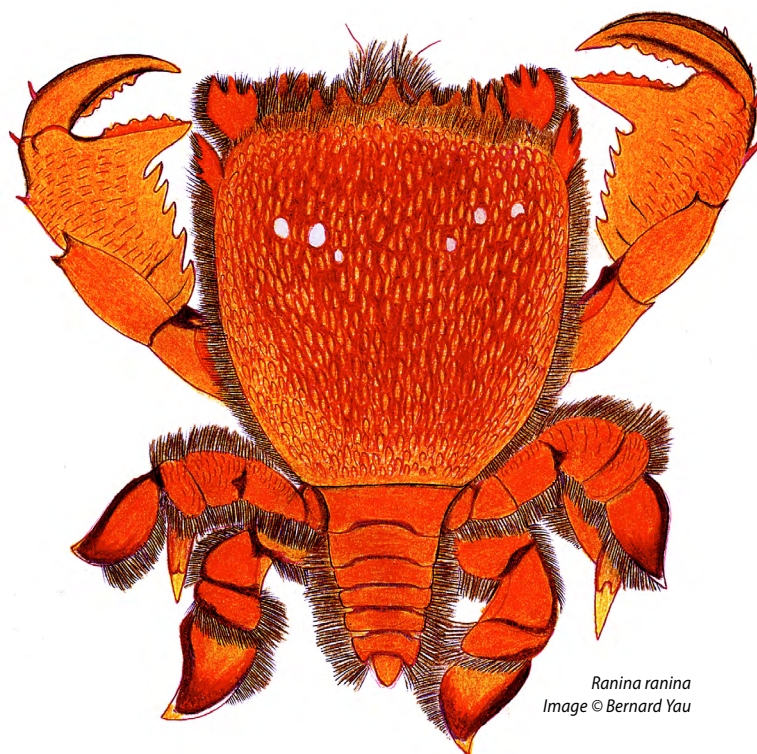
(*Ranina ranina*)

Author Daniel Johnson

EXPLOITATION STATUS FULLY FISHED

Joint fishery-independent monitoring between NSW and Queensland occurs for this shared stock, and the status has been determined from the Queensland assessment.

SCIENTIFIC NAME	COMMON NAME	COMMENT
<i>Ranina ranina</i>	Spanner Crab	



Ranina ranina
Image © Bernard Yau

Background

Spanner Crabs (*Ranina ranina*) are distributed throughout the Indo-Pacific region in coastal waters, to a depth of 70 m, on sandy substrates in which they bury. On the east coast of Australia, Spanner Crabs are distributed from Yeppoon in Queensland to Nowra in NSW and on the west coast, from Quinns Rocks (north of Perth) to the Houtman Abrolhos and Geraldton in WA.

Spanner Crabs mature and spawn between October and February, and large females are able to produce two batches of eggs each season with each batch averaging around 120,000 eggs. Female crabs mature at about 2 years of age which is equivalent to 7-7.5 cm carapace length (CL), or about 150 g in weight.

Spanner Crabs are opportunistic feeders with their diet consisting of urchins, bivalve molluscs, crustaceans, polychaete worms, and fish. Growth estimates for Spanner Crabs sampled in NSW suggest that males reach a maximum size of 14 cm CL and females reach a maximum size of 11 cm CL. Growth to these maximum lengths is thought to take approximately 10 years. Sampling of Spanner Crabs in both NSW and Queensland has indicated that the commercial catch consists predominantly of males.

Virtually all spanner crabs are caught in the Ocean Trap and Line Fishery by specifically endorsed fishers using spanner crab nets (also known as dillies).

Additional Notes

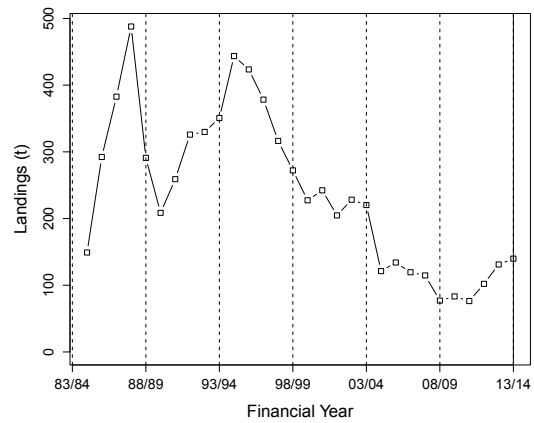
- Shared stock with Queensland, where the majority of the fishery (~90%) exists.
- The standardised catch rate of Spanner Crabs from annual fishery independent surveys (from 2000-2013 in Queensland, and 2006-2013 in NSW) has increased since 2000.
- The survey also observed consistent numbers of sub-legal sized crabs, indicating continued recruitment to the fishery.
- There are no concerning trends evident in catch rates of legal-sized crabs from Queensland, but the fishery dependant catch rates from NSW have declined since 2003/04.
- Both jurisdictions have regulations that prohibit the harvesting of berried crabs (females carrying maturing ova) and seasonal closures that prohibit the taking of females (NSW: 21 October to 20 January) and males (NSW: 21 November to 20 December).
- Spanner Crab northern zone (Yamba to NSW/ Queensland border) has moved to an interim total catch limit (ITCAL) of 164,124 kg, with quota allocations based on current shareholdings, effective 1 July 2015.
- In NSW there is a minimum legal length of 9.3 cm carapace length and a recreational bag limit of 10 spanner crabs.

Catch

Recreational Catch of Spanner Crab

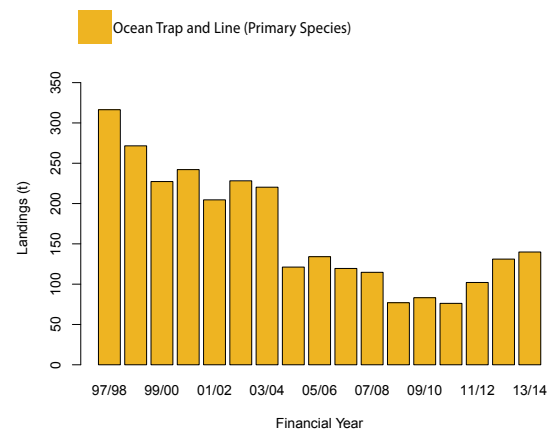
The annual recreational harvest of Spanner Crab in NSW is considered to be minor.

Historical Landings of Spanner Crab



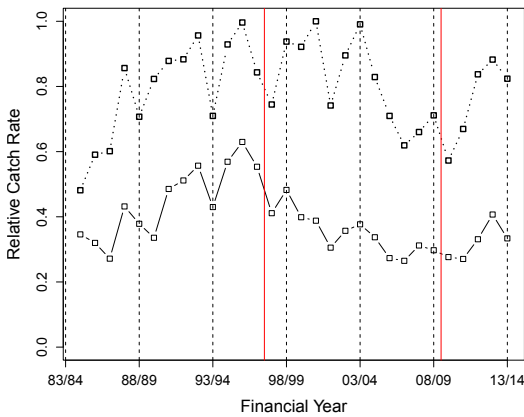
Commercial landings (including available historical records) of Spanner Crab for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Spanner Crab



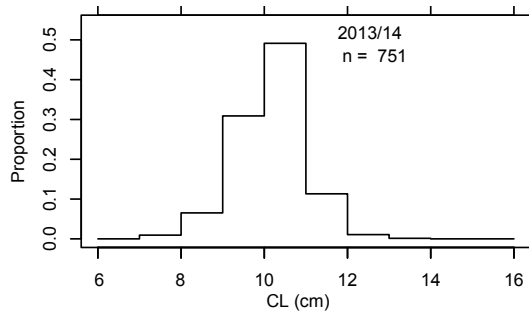
Reported landings of Spanner Crab by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Spanner Crab Harvested by Spanner Crab Trapping in NSW

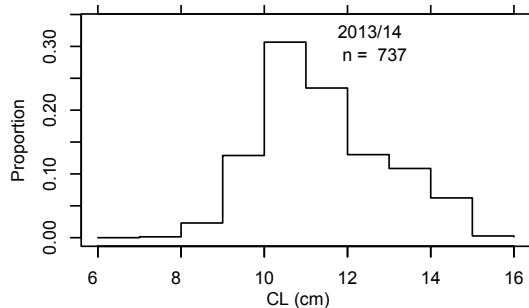


Catch rates of Spanner Crab harvested using Spanner Crab trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Spanner Crab



The length distribution of female Spanner Crabs from independent surveys conducted during 2013/14.



The length distribution of male Spanner Crabs from independent surveys conducted during 2013/14.

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Please visit the CSIRO website,
<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 28 865001, common name or scientific name to find further information.

Spotted Mackerel

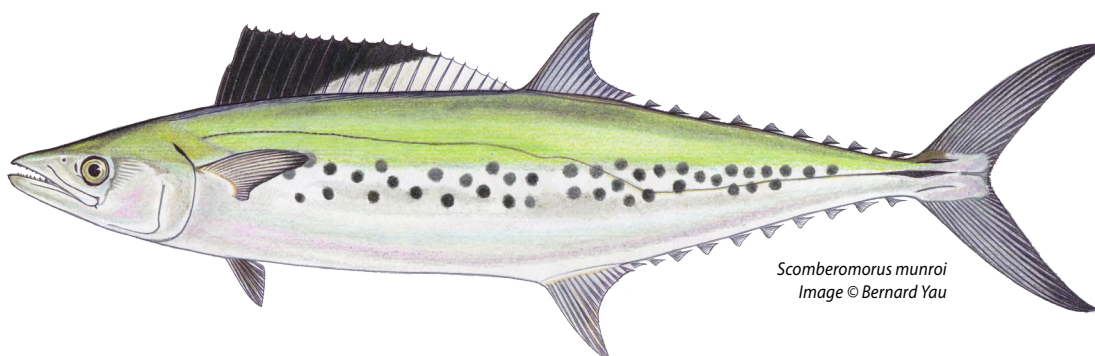
(*Scomberomorus munroi*)

Author John Stewart

EXPLOITATION STATUS FULLY FISHED

The majority of the harvest occurs in Queensland waters where the stock is considered sustainable. The Queensland assessment is consistent with a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Scomberomorus munroi</i>	Spotted Mackerel	



Background

Spotted Mackerel (*Scomberomorus munroi*) are endemic to the Australasian region and are distributed around northern Australia from Wollongong in NSW to Rottnest Island in WA. They comprise a single stock in Australian east coast waters that is genetically isolated from a northern Arafura Sea stock. Spotted Mackerel undertake seasonal movements, generally northwards during winter and early spring and southwards towards southern Queensland and northern NSW during summer. Spotted Mackerel feed almost exclusively on pelagic species such as anchovies, pilchards and herring.

Spotted Mackerel spawn in northern Queensland waters from late winter to early spring prior to their southerly migration. Spawning occurs in offshore waters in an area believed to be between Mackay

and waters south of Townsville. The size at sexual maturity is approximately 60 cm total length (TL) for females and 52 cm TL for males and occurs at 1-2 years of age. After spawning, pelagic eggs and larvae may then be dispersed southward by the East Australian Current. Spotted Mackerel grow rapidly during their first 3 years, with females growing faster and to larger sizes than males. Spotted Mackerel may live for 8 years and attain 118 cm TL and 11 kg in weight.

Spotted Mackerel are an important target of commercial and recreational fishers in NSW, mainly during the summer and autumn months and in the northern half of the state. NSW commercial landings are entirely taken in the Ocean Trap and Line Fishery.

Additional Notes

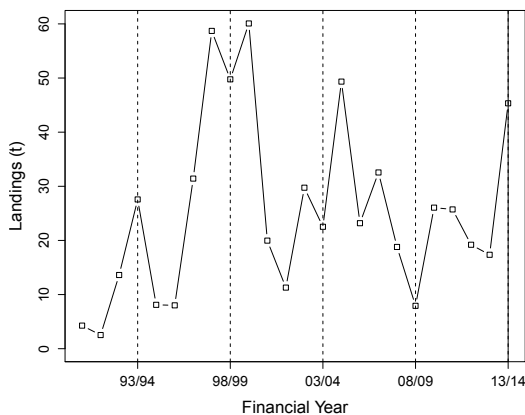
- NSW commercial landings are typically 20-50 t per annum.
- Catch rates (all line fishing methods) vary annually but show no overall trend.
- The Eastern Australian biological stock of Spotted Mackerel is assessed as a Sustainable Stock in Queensland.
- The NSW recreational fishery is opportunistic, but the species is highly sought after when the fish are available in NSW waters.
- In NSW there is a minimum legal length of 60 cm total length for Spotted Mackerel and a combined recreational bag limit of 5 for all Spanish and Spotted Mackerel.

Catch

Recreational Catch of Spotted Mackerel

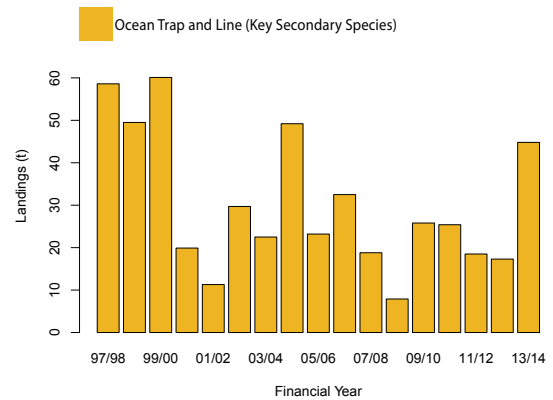
The most recent estimate of the recreational harvest of Spotted Mackerel in NSW was approximately 13,000 fish during 2013/14 (West *et al.*, 2015). This estimate is consistent with the previous estimate of between 25 and 120 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Spotted Mackerel



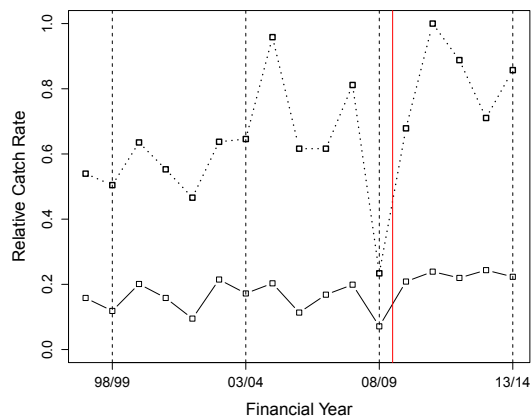
Commercial landings (including available historical records) of Spotted Mackerel for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Spotted Mackerel



Reported landings of Spotted Mackerel by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Spotted Mackerel Harvested by All Line Methods in NSW



Catch rates of Spotted Mackerel harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441015, common name or scientific name to find further information.



Stout Whiting

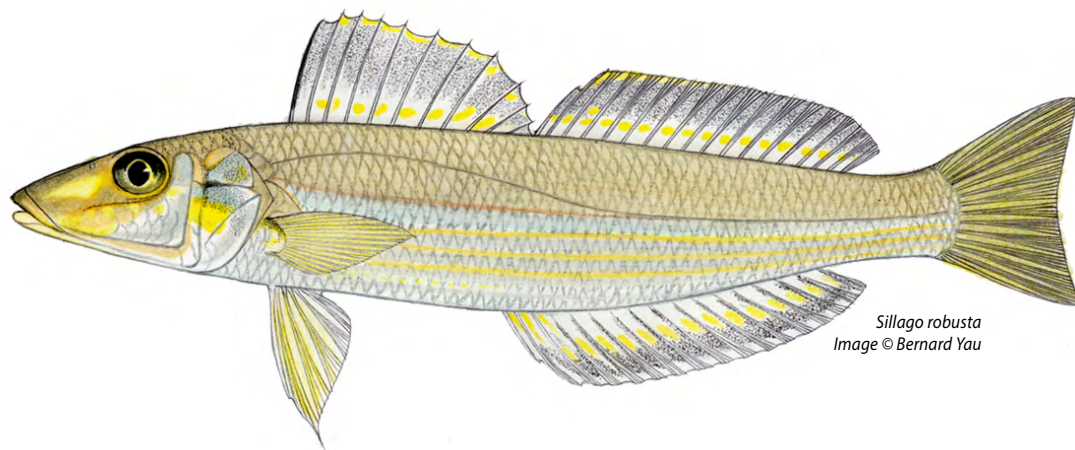
(*Sillago robusta*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

A small, fast growing species caught by trawling in northern NSW inshore waters. The stock is shared with Queensland and a status of Fully Fished is consistent with outcomes of the most recent Queensland quantitative stock assessment.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sillago robusta</i>	Stout Whiting	



Background

Stout Whiting (*Sillago robusta*) is a sub-tropical species that occurs in ocean waters around northern Australia from WA to central NSW. Stout Whiting occurring off southern Queensland and northern NSW are considered a single 'eastern' Australian stock for assessment purposes.

There has been considerable research into the biology of Stout Whiting off southern Queensland. Adult Stout Whiting form schools over sandy substrates. The species is relatively short lived and fast growing, with a maximum age of 8 years and length of 25 cm fork length (FL); although the bulk of catches is comprised of fish from 1-2 years of age and 14-18 cm FL. Sexual maturity is reached at about 2 years of age and 15 cm FL. Peak spawning occurs during spring and summer, but sexually mature fish can be present for more than 8 months each year.

The southeastern extremity of the Stout Whiting distribution overlaps with the northern end of the Eastern School Whiting (*S. flindersi*) distribution, and mixtures of the two species commonly occur in

ocean prawn trawl catches from inshore waters off northern NSW. Fishery independent surveys suggest that the two species are partially segregated by water depth, with Stout Whiting more common in inshore waters to about 30 m depth and Eastern School Whiting are more abundant further offshore to about 60 m depth.

Stout Whiting in northern NSW was historically reported by fishers as mixed 'school whiting' (combined with Eastern School Whiting) and catches of each species were estimated according to the latitude of capture. Since July 2009, fishers have been required to report the two species separately, but considerable quantities of Stout Whiting are still misreported as Eastern School Whiting in northern zones and recent catches continue to be estimated according to latitude, creating considerable uncertainty in the catch data.

NSW trawlers traditionally discarded Stout Whiting until an export market was developed in the 1970s. Estimated NSW landings of Stout Whiting increased to around 300 t in the mid-late 1980s, declined to very low levels in the early 1990s, and rose again to around 500 t in the late 1990s. The decline in land-

ings around 2000 coincided with the introduction of bycatch reduction devices into trawl nets, but catches again rapidly increased to around 500 t before undergoing a steady decline until present. In 2013/14, the estimated commercial catch of Stout Whiting in NSW was only 140 t.

Stout Whiting are not taken in significant quantities by any other commercial or recreational fisheries in NSW. A targeted trawl fishery for Stout Whiting off southern Queensland also declined in effort and catch around the mid-1990s, but then stabilised with 2 to 5 vessels taking combined annual catches of 500 to 1,000 t over the last 15 years. Catch rates have also remained stable. The Queensland fishery is managed by a Total Allowable Commercial Catch (TACC) that is reassessed each year and was set at 1,150 t in 2014 and 2015. The State also undertakes a full quantitative stock assessment of the shared stock every 5 years, with the most recent occurring in 2014.

Significant quantities of Stout Whiting are also taken as a by-catch by inshore prawn trawling off Queensland, but these are discarded and not reported to comply with regulations. Preliminary estimates of these discards were around 4,000 t during the 1990s and then between 1,000 t and 2,000 t more recently in line with effort declines.

Additional Notes

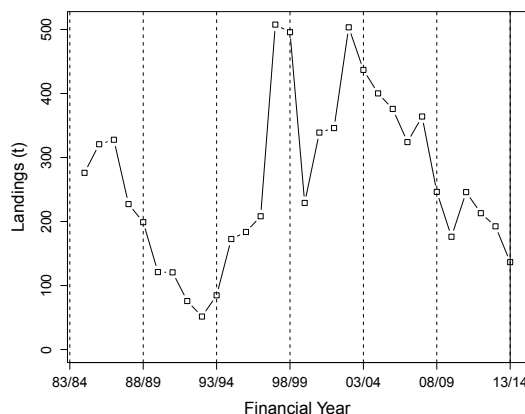
- The biological stock of Stout Whiting was assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- The stock is shared with Queensland, where the bulk (approximately 80 %) of the commercial catch is landed by 2-5 operators, who are managed by a catch quota.
- The size and age structure of the Queensland commercial catch is monitored annually and a full quantitative stock assessment of the shared stock was completed in 2014, which included catch data from NSW.
- Some local information on size structure and size at maturity are available from northern NSW waters and more recent data are being collected through ongoing port monitoring. This will include a more accurate description of the species composition of mixed whiting catches taken from northern NSW waters.
- There is no minimum legal length for Stout Whiting in NSW, but it is included in a combined recreational bag limit of 20 for all whiting.

Catch

Recreational Catch of Stout Whiting

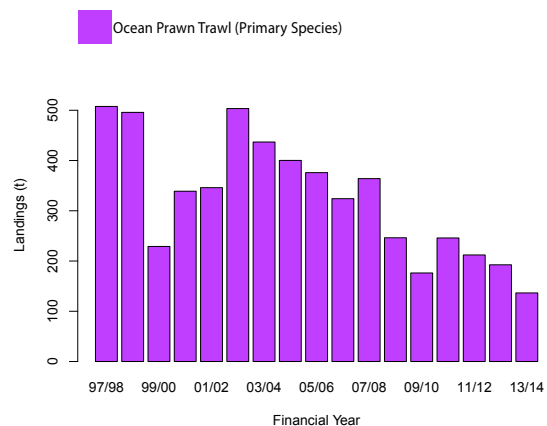
The annual recreational harvest of Stout Whiting in NSW is considered to be minor.

Historical Landings of Stout Whiting



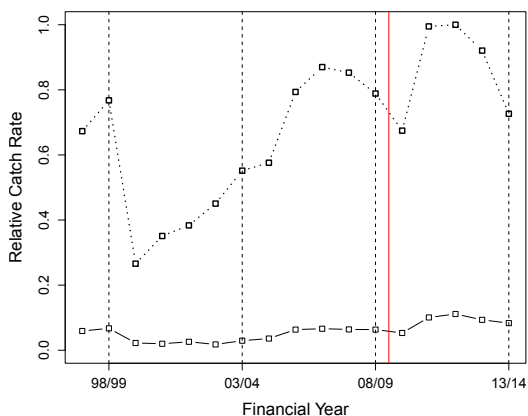
Commercial landings (including available historical records) of Stout Whiting for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Stout Whiting



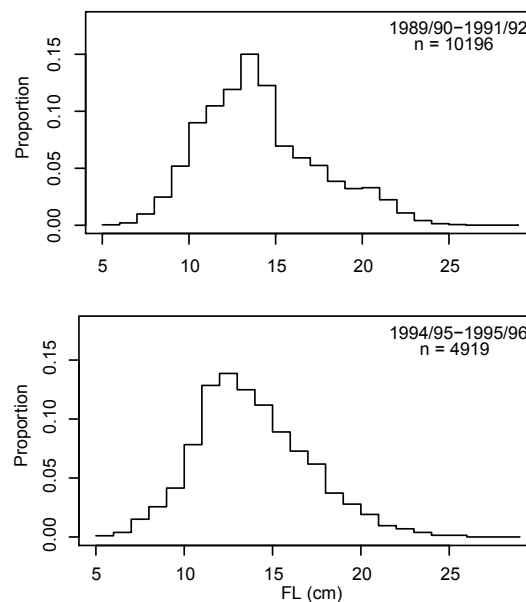
Reported landings of Stout Whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Stout Whiting Harvested by Ocean Prawn Trawling in NSW



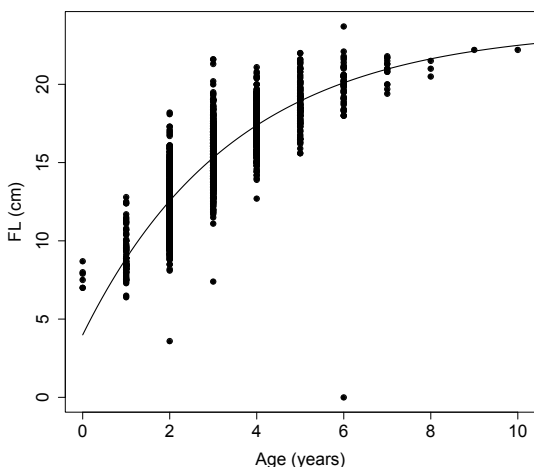
Catch rates of Stout Whiting harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Stout Whiting

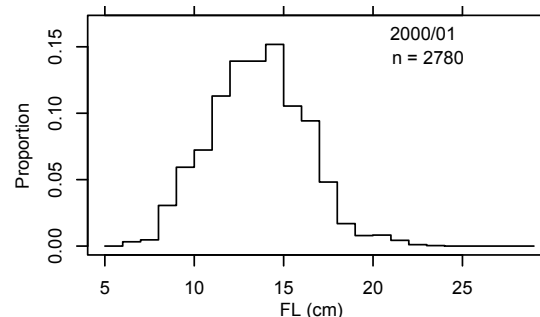


The length distribution of Stout Whiting caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mainly of Stout Whiting between 10-20 cm FL.

Growth Curve of Stout Whiting



Age-length data with fitted growth curve of Stout Whiting (internal data). Lengths are presented as fork length (FL).



The length distribution of Stout Whiting from NSW commercial landings in 2000/01 was comprised mainly of fish between 10-20 cm fork length (FL). There is no minimum legal length for Stout Whiting in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 330005, common name or scientific name to find further information.



Department of
Primary Industries

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Striped Marlin

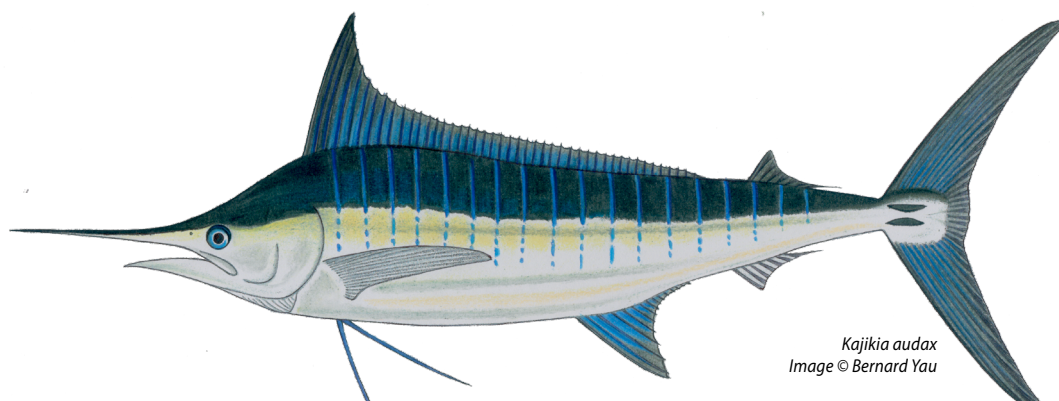
(*Kajikia audax*)

Author Caitlin Young

EXPLOITATION STATUS FULLY FISHED

The NSW exploitation status for Striped Marlin was adapted from the Commonwealth assessment of not overfished and not subject to overfishing.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Kajikia audax</i>	Striped Marlin	Previously <i>Tetrapturus audax</i> .



Background

Striped Marlin (*Kajikia audax*) is a highly migratory pelagic species distributed throughout warm-temperate to tropical waters of the Indian and Pacific Oceans. The stock structure of Striped Marlin is uncertain although there are thought to be separate stocks in the south-west, north-west, east and south-central regions of the Pacific Ocean, as indicated by genetic research, tagging studies and the locations of identified spawning grounds. The south-west Pacific Ocean (SWPO) stock of Striped Marlin spawn predominately during November and December each year in waters warmer than 24°C between 15-30°S from the east coast of Australia to Fiji and as far east as French Polynesia. Mature Striped Marlin move south during summer months to feed in cooler temperate waters off the NSW coast and northern New Zealand. Striped Marlin are opportunistic carnivores that predominately consume small pelagic finfish and squid.

Striped Marlin grow rapidly during their first two years of life, with about 70-75% of their maximum body length reached during this time. Male and female Striped Marlin grow at similar rates although females tend to grow slightly larger

than males. Striped Marlin can reach ages of at least 10 years and grow to lengths greater than 250cm (lower jaw-to-fork length) and can attain a maximum weight of about 240 kg. Females mature between 1.5-2.5 years of age whilst males mature between 1-2 years of age. Striped Marlin are multiple batch spawners with females shedding eggs every 1-2 days during 4-41 events per spawning season. An average sized female of about 100 kg is able to produce up to about 120 million eggs annually.

Striped Marlin spend most of their time in surface waters above the thermocline, making them vulnerable to surface fisheries. They are caught mostly by commercial longline and recreational fisheries throughout their range. Commercial longline catches from the south-west Pacific Ocean have varied between 2,000 and 4,000 t since the 1960s, with large catches prior to that time peaking at about 12,000 t. Since 2010/11 the Commonwealth catch of Striped Marlin in the Eastern Tuna and Billfish Fishery (ETBF) has been managed by quota. The total allowable commercial catch (TACC) limits were originally set at 390 t and are reassessed by fisheries managers, industry members, scientists and researchers each year. In recent years the TACC has decreased to 351 t.

Striped Marlin is a popular gamefish and is caught commonly during NSW recreational gamefish competitions. Harvest of Striped Marlin by NSW recreational fisheries is estimated to be less than 10% of the ETBF catch. Additionally, more than 1,000 Striped Marlin are tagged and released annually by recreational fisheries on the east coast of Australia, with the majority of these from NSW offshore waters. Over 80% of Striped Marlin caught by competition-based recreational fisheries in NSW are tagged and released. Post-release mortality of recreationally-tagged billfish range from 0-35% as estimated from tagging studies with post-release survival found to be higher when circle hooks were used. Competition-based recreational fisheries have altered their fishing rules to reflect this research with a mandatory rule in place within gamefishing clubs that enforces the use of circle hooks when using natural baits to target marlin.

Additional Notes

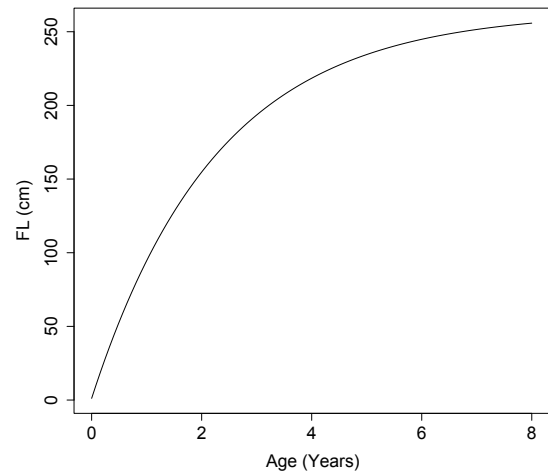
- Commercial exploitation off eastern Australia since 2006 has ranged from 10-14% of the total commercial catch of Striped Marlin in the Western and Central Pacific Fisheries Commission Statistical Area.
- Exploitation by NSW-based fisheries is small compared to the much larger Commonwealth and International fisheries that operate in the south-west Pacific.
- Commercial catches are greater than recreational catches off eastern Australia although this is a primary recreational gamefish species in NSW.
- Local catch and catch rate information is available (Murphy *et al.*, 2002; Lowry & Murphy, 2003; Park, 2007).
- A bag limit of 1 for each marlin species (striped, black and blue) applies to NSW recreational fishers.

Catch

Recreational Catch of Striped Marlin

Recreational fishers in NSW view Striped Marlin as a premium sportfish and most of the catch is released. There is no robust estimate of the current recreational harvest of Striped Marlin in NSW. The annual recreational harvest of Striped Marlin in NSW was previously estimated to lie between 5 and 45 t based upon the results of onsite surveys undertaken by NSW DPI.

Growth Curve of Striped Marlin



Growth curve for Striped Marlin using parameters from Kopf (2010). Lengths are presented as fork length (FL).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 444002, common name or scientific name to find further information.



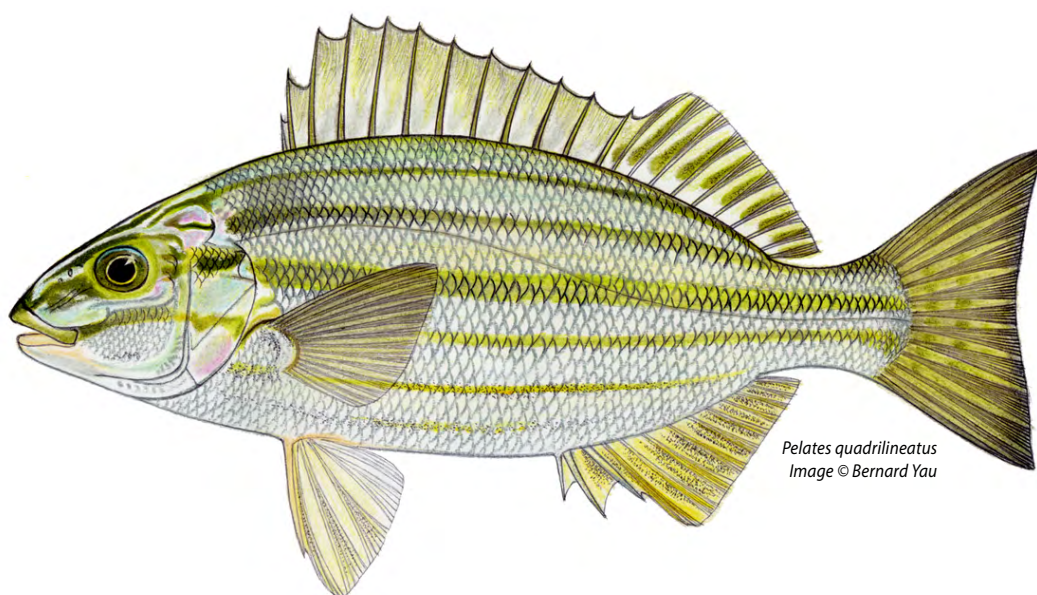
Striped Perch (Terapontidae)

Author Karina Hall

EXPLOITATION STATUS **UNDEFINED**

A group of at least four small estuary/inshore fish taken in small amounts as by-product by commercial hauling nets and trawls. Little biological information is available to inform stock assessments, so their status remains Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Pelates sexlineatus</i>	Eastern Striped Perch	Also formerly known as Striped Trumpeter.
<i>Pelates quadrilineatus</i>	Fourline Striped Perch	Also known as Striped Trumpeter.
<i>Terapon jarbua</i>	Crescent Grunter	Also known as Crescent Perch.
<i>Terapon theraps</i>	Largescale Grunter	Also known as Banded Grunter.



Pelates quadrilineatus
Image © Bernard Yau

Background

Striped Perch are relatively small shallow water fishes belonging to the family Terapontidae. This family includes 30 Australian species which mostly inhabit freshwater or estuaries; only nine species are marine. Striped Perch are often confused with the larger, commercially important southern trumpeters (e.g. the Tasmanian Striped Trumpeter, *Latris lineata*), which are unrelated and belong to the family Latridae.

The main species taken by commercial fisheries in NSW is the estuarine Eastern Striped Perch (*Pelates sexlineatus*) which has a wide tropical distribution

from Japan through the northwest Pacific to Jervis Bay on the NSW south coast. It is a small schooling species that inhabits large estuaries, bays and inshore coastal waters to about 30 m depth. It also frequents large reef areas, but is common over seagrasses and smooth trawling and hauling grounds.

At least three other members of the family are also known from northern NSW: the Fourline Striped Perch (*P. quadrilineatus*), Crescent Grunter (*Terapon jarbua*) and Largescale Grunter (*T. theraps*). These species are similar in size and appearance to the Eastern Striped Grunter and may occur in small

quantities in catches from northern NSW. These all have similar tropical species distributions.

Little is known about the biology of Eastern Striped Grunter. It has a maximum size of 32 cm total length (TL), but is more commonly between 18-24 cm TL. A recent study on the similarly sized Western Striped Grunter, *P. octolineatus*, determined that it has a maximum age of 10 years and reaches maturity within 2 years of age at about 14-17 cm TL. It spawns in estuaries during spring and summer.

The annual NSW commercial catch of Striped Perch averaged about 4.5 t between 1990/91 and 2004/05, but then steadily declined to just 0.5 t in 2013/14. Most of the historical landings were from estuaries taken by haul nets in the Estuary General Fishery. Small amounts were also reported from the Estuary Prawn Trawl Fishery and the Ocean Trawl Fishery in some years. Bycatch studies have indicated that much larger quantities are caught and discarded than are retained, because of their small size. Likewise, most of the Striped Perch caught by recreational fishers is discarded.

Additional Notes

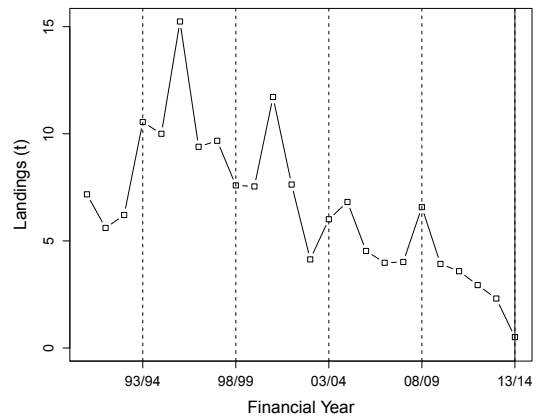
- Ongoing species complex and identification issues, but the estuarine catch mostly comprises the single species of Eastern Striped Perch. The species composition of the oceanic catch is unknown.
- At times confused with the much larger and commercially important Tasmanian Striped Trumpeter or Bastard Trumpeter (Latridae), which are occasionally taken in commercial trawls along the NSW south coast.
- Historically included in assessments as a permitted by-product species in the Hawkesbury River and now closed Port Jackson Estuary Prawn Trawl Fisheries.
- Recent declines in landings are possibly related to low market prices.
- There are no size restrictions or recreational bag limits for Striped Perch in NSW.

Catch

Recreational Catch of Striped Perch

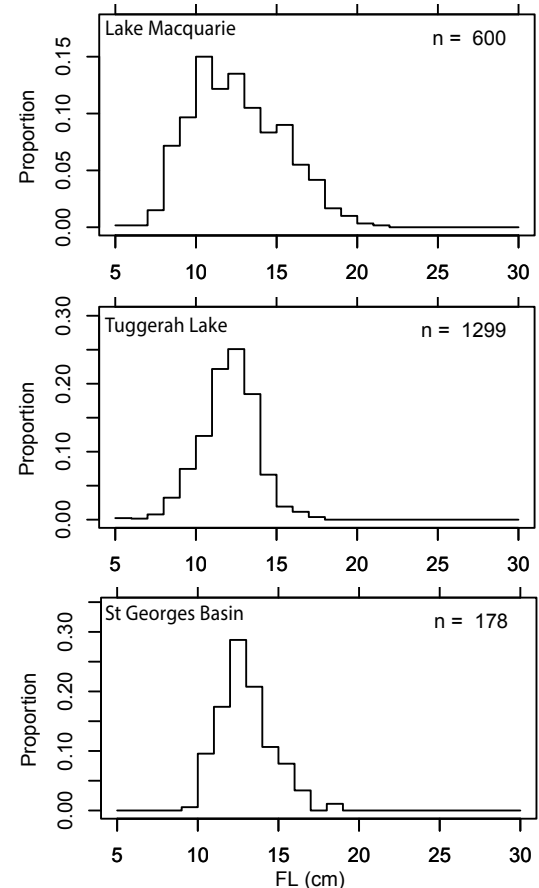
There is no robust estimate of the recreational harvest of Striped Perch in NSW. The annual recreational harvest of Striped Perch in NSW was previously considered to be minor based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Striped Perch



Commercial landings (including available historical records) of Striped Perch for NSW from 1990/91 to 2013/14 for all fishing methods.

Length Frequency of Striped Perch



The length distribution of Striped Perch caught in fishery independent surveys from Lake Macquarie, Tuggerah Lakes and St Georges Basin during 2008 -11.

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Please visit the CSIRO website,

<http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 321005, 37 321001, 37 321002 and 37 321003, common name or scientific name to find further information.



Tailor

(*Pomatomus saltatrix*)

Author John Stewart

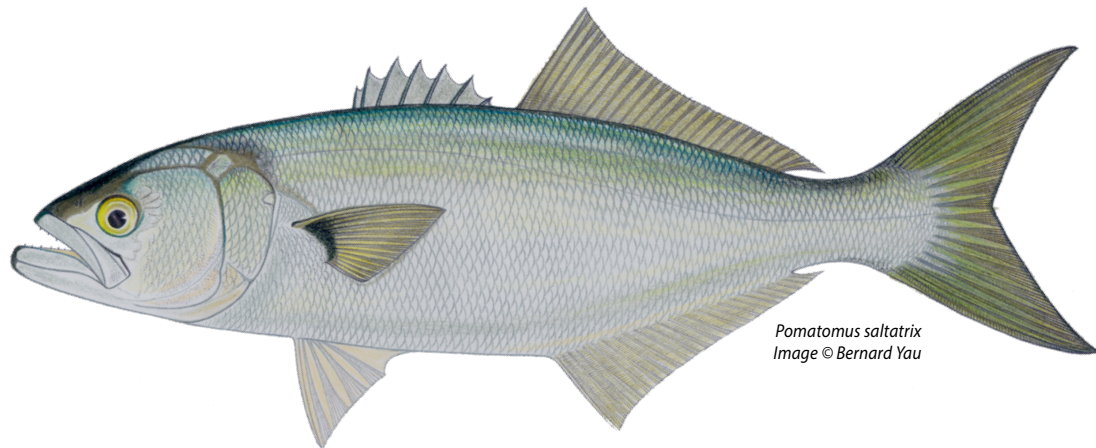
EXPLOITATION STATUS FULLY FISHED

Significant recreational and commercial harvests are taken in Queensland and NSW. The most recent Queensland assessment indicated that the stock was close to the biomass at maximum sustainable yield (Bmsy), consistent with a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Pomatomus saltatrix

Tailor



Background

Tailor (*Pomatomus saltatrix*) occur in estuarine and close inshore waters along the Atlantic coasts of North and South America (where they are known as 'bluefish'), western and southern Africa (where they are known as 'elf'), and throughout the Mediterranean. In Australia, Tailor occur from southern Queensland to eastern Bass Strait, and in southern Western Australia. Tailor form large schools in surface waters close to shore and are voracious predators. They are a very popular species with recreational fishers, and the catch by recreational fishers is estimated to be larger than the catch by commercial fishers.

In NSW, juvenile Tailor occur in estuaries and large coastal bays, and older fish are commonly found in surf zones of beaches and around rocky headlands. Mature fish migrate north along the coast to spawn during late winter and spring off northern NSW and southern Queensland. The regular seasonal occurrence of large schools of pre-spawning fish in the surf zone has led to significant targeted recreational fisheries on the islands off southern Queensland (such as Stradbroke and Fraser Islands).

Although reported to live for greater than 10 years and weigh more than 10 kg, the majority of Tailor landed by both recreational and commercial fishers off south-eastern Australia are 2-4 years of age, between 30-50 cm in length and 0.5-1.5 kg in weight. The growth of Tailor has been the subject of many studies throughout the species' world wide range, and there is considerable variation between the different stocks. Tailor in South Africa and North America grow faster and to a greater size than in Australia.

Because of their inshore schooling behaviour and predatory nature, Tailor are susceptible to very high exploitation rates, and some stocks have been overfished and are subject to stringent management regulations to promote recovery of the stock. In NSW, the minimum legal size (30 cm total length (TL)) corresponds approximately to the size at maturity. The recreational fishery is subject to the minimum legal length and a possession limit of 20 fish per person, which may do little to constrain harvest in this fishery sector. Landings in the NSW commercial net fisheries are constrained through daily trip limits of 100 kg per day (ocean

haul nets) or 50 kg per day (other netting methods). The majority of the NSW commercial catch is taken using line fishing methods.

Additional Notes

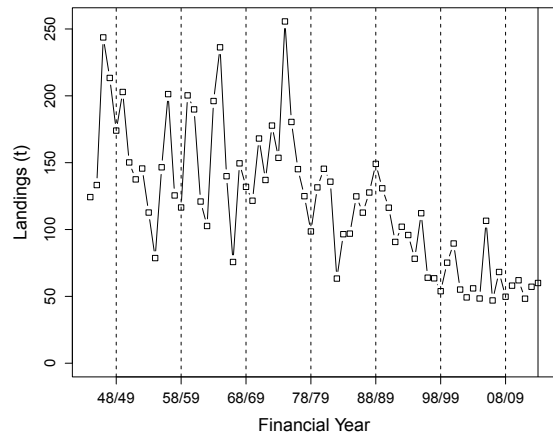
- Tailor is an important recreational species along the east coast (and also in WA).
- Queensland had an estimated recreational catch of approximately 140 t in 2011.
- Commercial catch rates (line fishing) in NSW have been steadily increasing.
- Catches mostly contain 2-4 year old fish (30-50 cm in length), but the species is reported to attain a maximum size of 15 kg and length of about 1 m.
- The Eastern Australian biological stock of Tailor has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- The minimum legal length for Tailor in NSW is 30 cm TL and there is a bag limit of 10 and a possession limit of 20.

Catch

Recreational Catch of Tailor

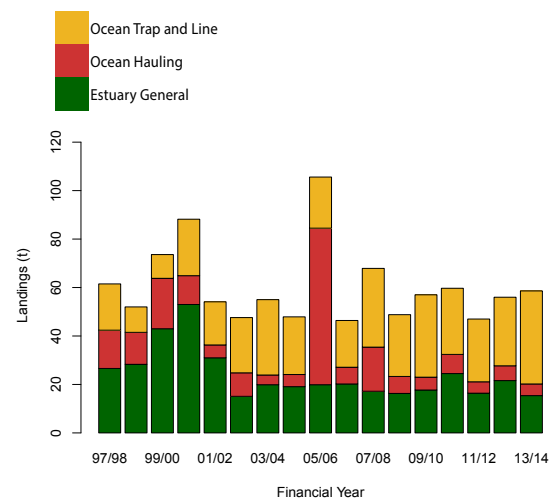
The most recent estimate of the recreational harvest of Tailor in NSW is approximately 190,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 880,000 fish (in the order of 150 to 300 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Tailor



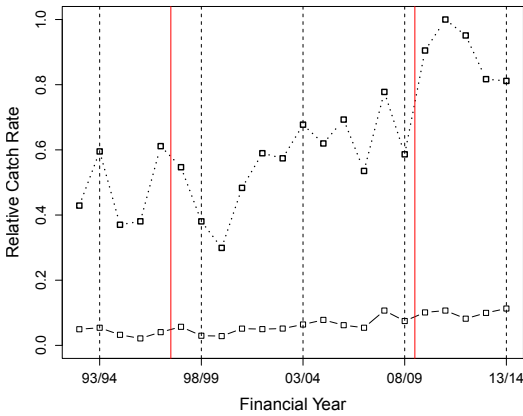
Commercial landings (including available historical records) of Tailor for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Tailor



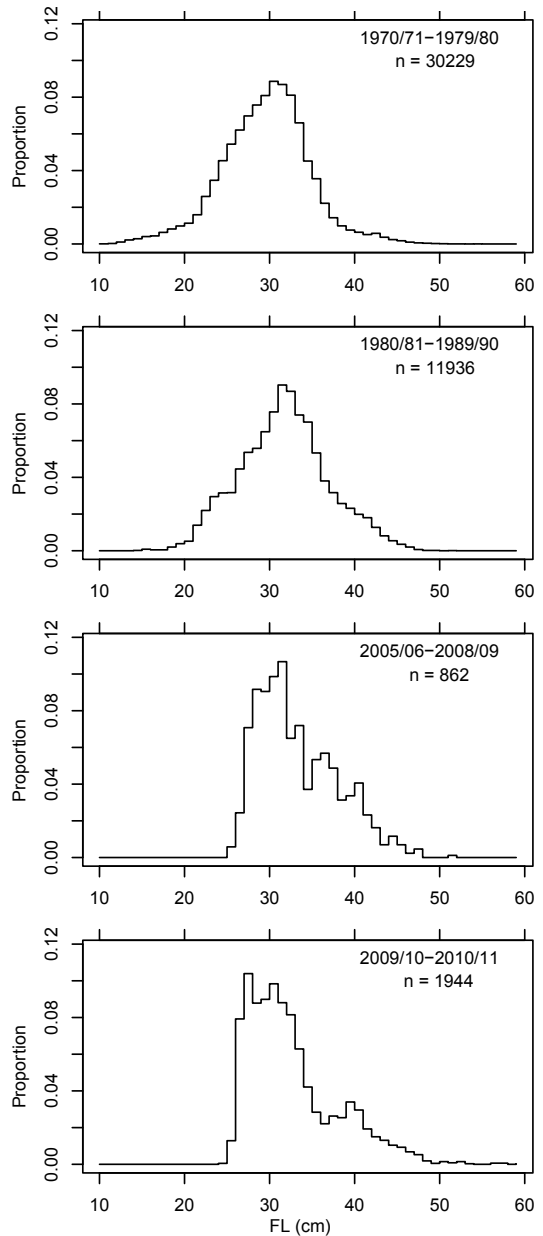
Reported landings of Tailor by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Tailor Harvested by all Lining Methods in NSW



Catch rates of Tailor harvested using line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Tailor - Commercial Fishery



The length distribution of Tailor landed by NSW commercial fishers is comprised mainly of fish between 27-50 cm fork length (FL). Recent years have been characterized by visible modes within the length distribution. The minimum legal length for Tailor in NSW is 30 cm total length (which equates to about 27 cm FL). Note that prior to 1993 Tailor were not subject to a minimum legal length in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 334002, common name or scientific name to find further information.



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Tarwhine

(*Rhabdosargus sarba*)

Author John Stewart

EXPLOITATION STATUS **UNCERTAIN**

A large decline in commercial landings to the lowest levels in 24 years in 2013/14, declines in fish trap landings to almost zero, a lack of data from the recreational fishery in association with a lack of recent data on sizes, ages and mortality rates have resulted in a status of Uncertain.

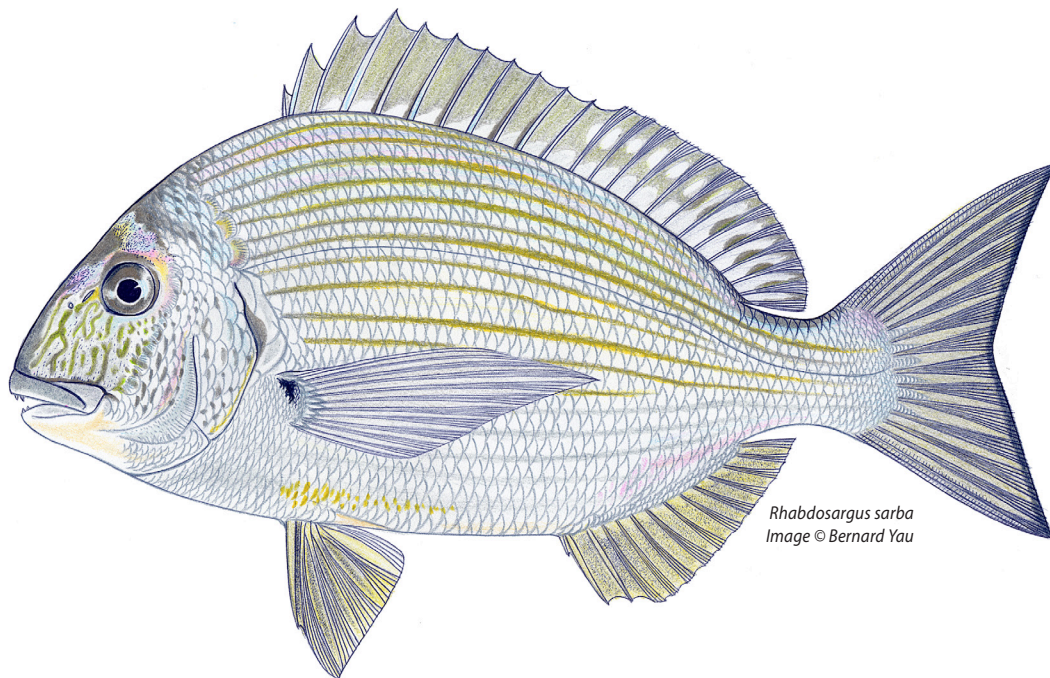
SCIENTIFIC NAME

STANDARD NAME

COMMENT

Rhabdosargus sarba

Tarwhine



Rhabdosargus sarba
Image © Bernard Yau

Background

The Tarwhine (*Rhabdosargus sarba*) belongs to the family Sparidae, which also includes Snapper (*Pagrus auratus*) and Yellowfin Bream (*Acanthopagrus australis*). It was originally described (named) from the Red Sea, but it is now believed that the Indian Ocean form (including WA) differs from the West Pacific form and therefore may need to be re-named. The Tarwhine found off eastern Australia ranges from southern NSW, through the tropical West Pacific, to Japan. It is an inshore species found in estuaries and on coastal reefs out to depths of about 70 m.

The Tarwhine is similar in appearance to the Yellowfin and Black Bream. Distinguishing features of the Tarwhine include obvious yellow or gold lines on a silver body and a more rounded head shape. A yellow marking is found above the pelvic

base and on each scale. Also, above the lateral line on the Tarwhine are 6-7 scale rows whereas on bream there are only four.

In NSW, Tarwhine attain a maximum size of about 40 cm fork length (FL), or 45 cm total length, and weigh up to 1.4 kg. In commercial catches, Tarwhine are typically 17-25 cm FL but recreational catches generally comprise larger fish in the 20-30 cm range (0.2-0.5 kg). They mature between 16-21 cm FL at 2-3 years of age, but after reaching about 24 cm at age 5 years, their growth rate slows. Spawning takes place in coastal reef areas, sheltered bays and lower estuaries in winter with the peak activity in July. Main food sources for Tarwhine include molluscs and other bottom dwelling invertebrates such as crustaceans and worms.

Annual NSW commercial landings have fluctuated between 30-80 t during the past decade. The bulk of the landings have historically come from the Estuary General Fishery, caught mainly by hauling net and mesh net; however this sector has declined in recent years and the Ocean Trawl, Ocean Hauling, and Ocean Trap and Line Fisheries now contribute in greater proportions to the total catch.

Additional Notes

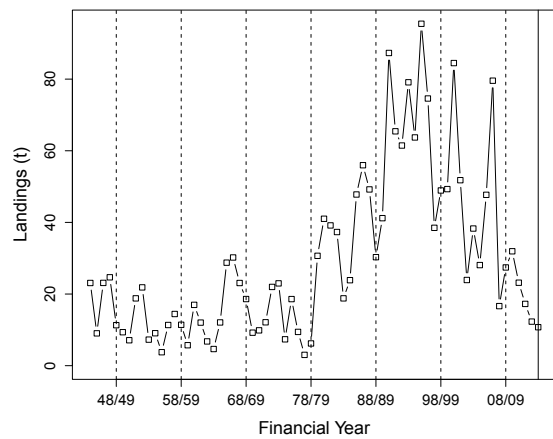
- Tarwhine comprise a significant incidental catch of commercial and recreational fisheries in estuarine and near-shore ocean waters.
- Total landings of Tarwhine have declined markedly in both the NSW commercial and recreational fisheries.
- Fish mature at about 19 cm FL (23 cm TL), slightly larger than the minimum legal length of 20 cm total length.
- Median catch rates (mesh-netting) have been stable.
- There is a minimum legal length of 20 cm total length for Tarwhine and a combined recreational bag limit of 10 for all bream and Tarwhine.

Catch

Recreational Catch of Tarwhine

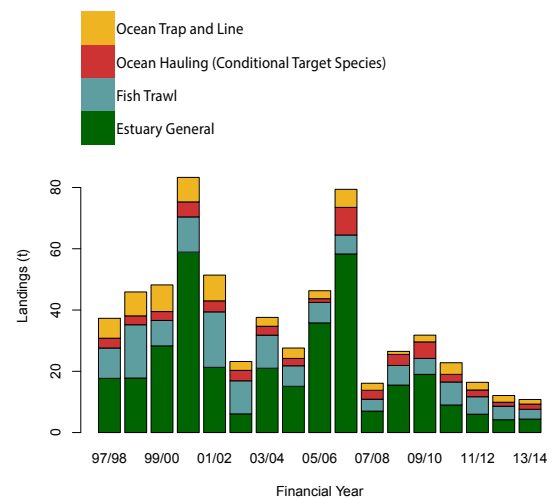
The most recent estimate of the recreational harvest of Tarwhine in NSW was approximately 19,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 36,000 fish (in the order of 14 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Tarwhine



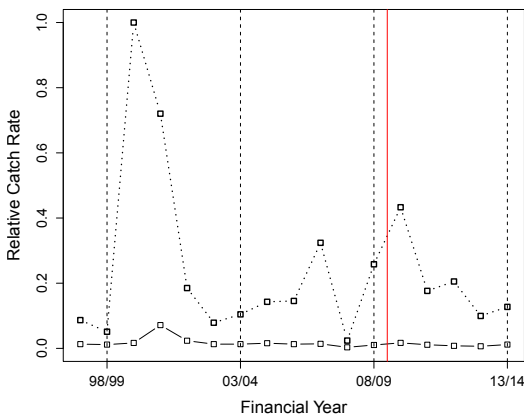
Commercial landings (including available historical records) of Tarwhine for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Tarwhine



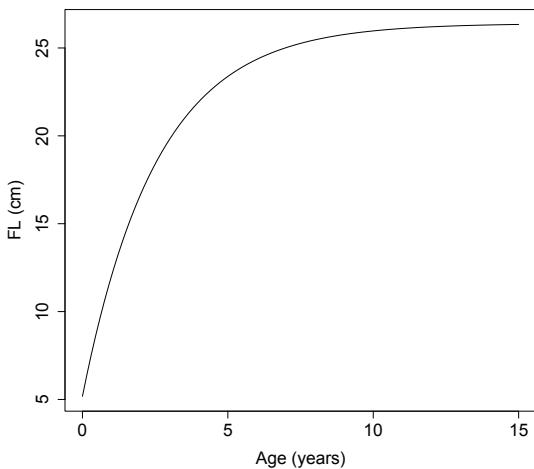
Reported landings of Tarwhine by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Tarwhine Harvested by Mesh-Netting in NSW



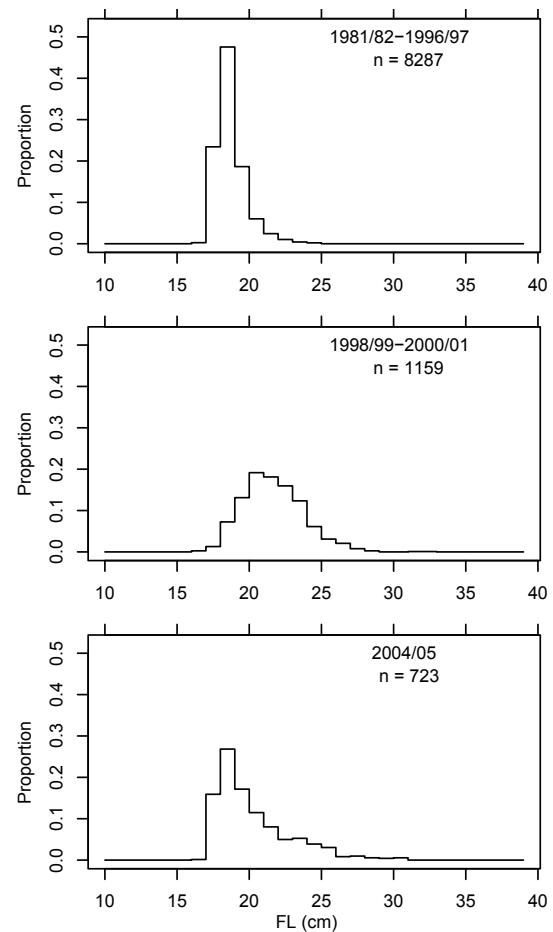
Catch rates of Tarwhine harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Tarwhine



Growth curve of Tarwhine using parameters from Hughes *et al.*, (2008). Lengths are presented as fork length (FL).

Length Frequency of Tarwhine



Tarwhine landed by NSW estuarine commercial fisheries (1981/82 – 1996/97) tend to be smaller than those landed by the Ocean Trap and Line Fishery (1998 to 2004/05). There was a decline in the average size of Tarwhine landed by the Ocean Trap and Line Fishery in 2004/05, but no length-based monitoring has been done since that time. The minimum legal length for Tarwhine in NSW is 20 cm total length (which equates to approximately 17 cm fork length (FL)).

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 353013, common name or scientific name to find further information.



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Teraglin

(*Atractoscion aequidens*)

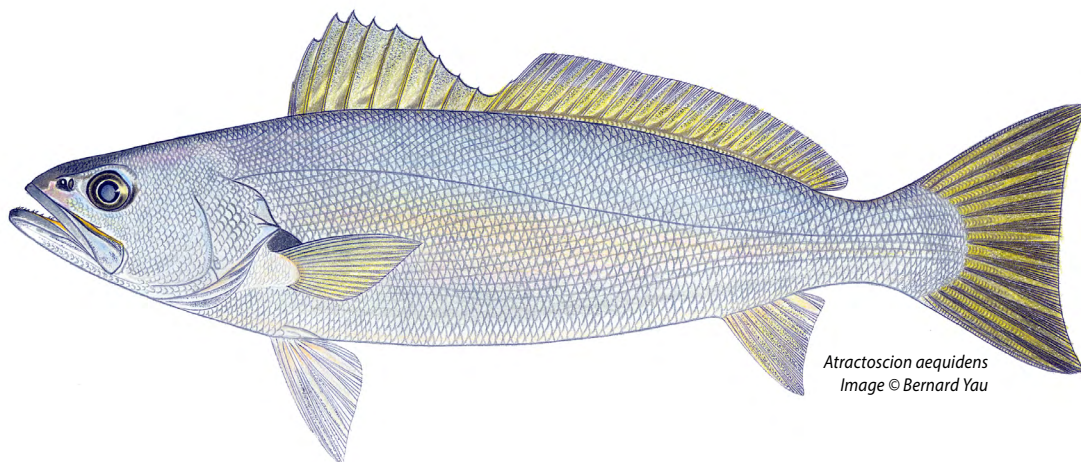
Authors John Stewart and Anne-Marie Hegarty

EXPLOITATION STATUS **UNCERTAIN**

Commercial catch data suggest a long-term decline in this stock. Current commercial landings are based on relatively small, young fish with the population showing large variations in recruitment strength. Teraglin are thought to grow quickly and mature at a relatively small size; however there is insufficient biological and fishery data on which to assess the status of the stock, which is therefore classified as Uncertain.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Atractoscion aequidens</i>	Teraglin	
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Atractoscion aequidens
Image © Bernard Yau

Background

Teraglin (*Atractoscion aequidens*) occur around southern Africa from Angola to South Africa and, in Australia from southern Queensland to Montague Island in NSW. Preliminary genetic analysis suggests that Teraglin in Australia may be a different species to that fished in South Africa although further work is needed to clarify this. Juvenile fish can be found in inshore waters, including deeper estuaries, while schools of adult fish can be found at depths of 20-80 m over gravel or broken reef substrates.

Relatively little is known about the life-history of Teraglin in NSW waters. In Queensland, sexual maturity occurs at around 2-3 years of age and at approximately 35 cm fork length (FL). Teraglin appear to spawn year-round in southern Queensland and this is supported by work currently being done in NSW. Teraglin have been aged to 14 years and can attain more than 100 cm in length and 10 kg in weight. Most fish landed are 40-70 cm FL and 1-3 kg in weight.

The majority of commercial landings of Teraglin are made by line fishers in the Ocean Trap and Line Fishery, and significant numbers are taken by recreational fishers. The largest catches are made off northern and central NSW and they are, in general, quite sporadic.

Additional Notes

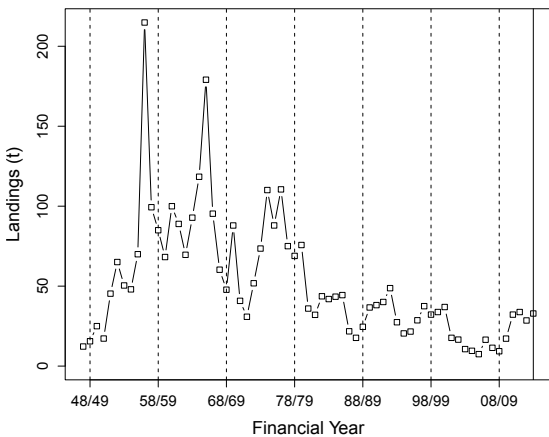
- Teraglin is a schooling species, which is very susceptible to line fishing methods.
- The relatively high fecundity, extended spawning period, and early onset of maturity are features that may provide some resilience to fishing.
- There is evidence that older and larger Teraglin occur in deeper waters.
- Recent annual commercial landings have been less than 35 t, compared with 100-200 t prior to the 1970s.
- Commercial landings show a long history of decline overlaying a strong cyclical pattern.
- Long-term declines in landings and average sizes have resulted in concerns for the status of the stock.
- There is a minimum legal length of 38 cm total length and a recreational bag limit of 5 Teraglin.

Catch

Recreational Catch of Teraglin

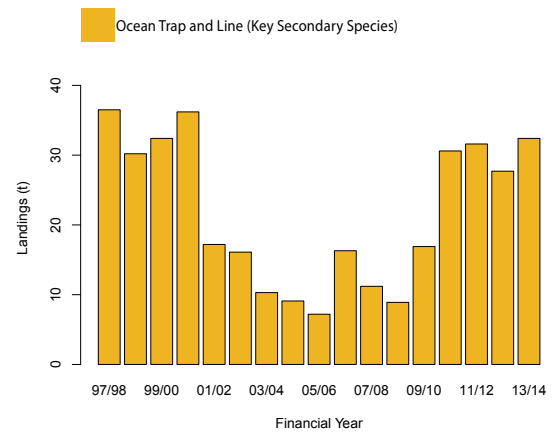
The most recent estimate of the recreational harvest of Teraglin in NSW was approximately 33,000 fish during 2013/14 (West *et al.*, 2015). This estimate is similar to the previous estimate of approximately 38,000 fish (in the order of 37 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Teraglin



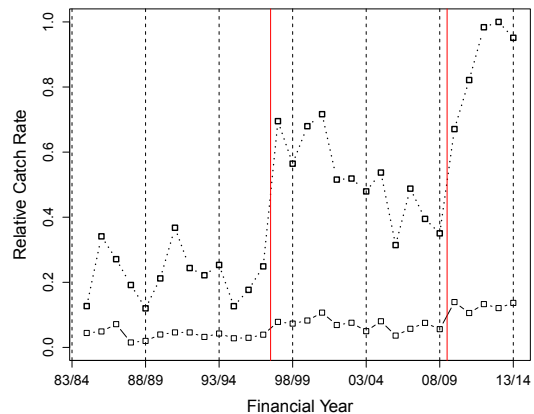
Commercial landings (including available historical records) of Teraglin for NSW from 1947/48 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Teraglin



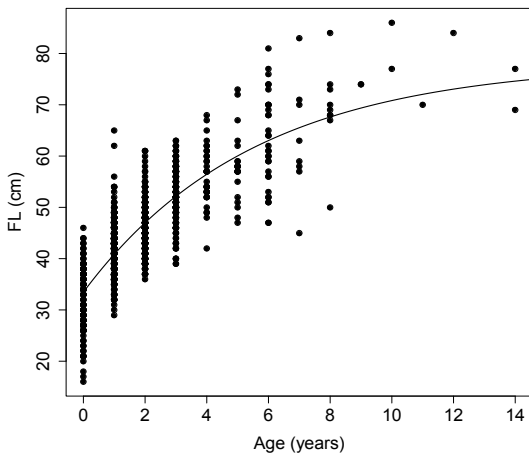
Reported landings of Teraglin by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Teraglin Harvested by Handlining in NSW



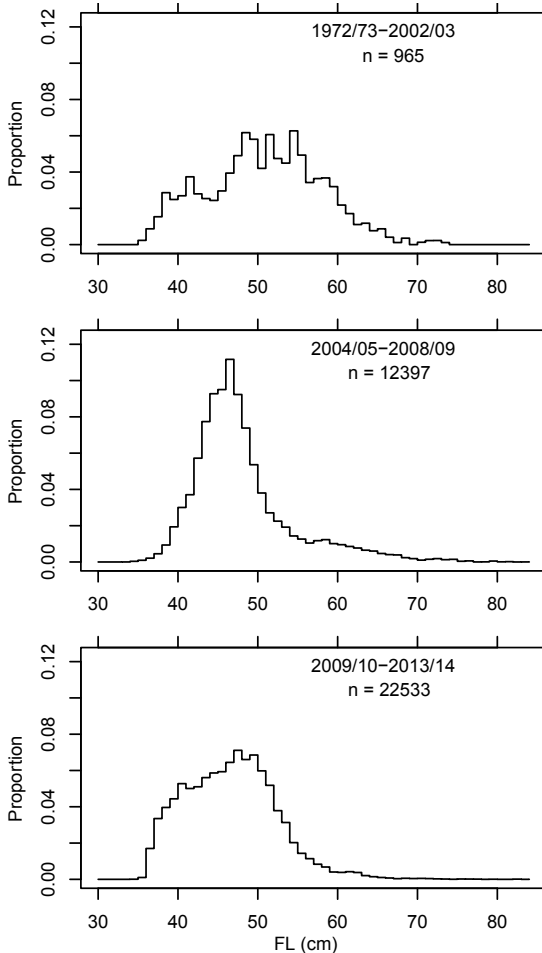
Catch rates of Teraglin harvested using handlining for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Teraglin



Age-length data with fitted growth curve for Teraglin in NSW (internal data). Lengths are presented as fork length (FL).

Length Frequency of Teraglin



The length distribution of Teraglin landed since the 1970s by NSW commercial fishers has comprised fish generally between 40 and 70 cm fork length (FL). Commercial landings since 2002/03 have shown a decline in average size, with a greater proportion of fish in the 40 to 50 cm FL size classes. The minimum legal length for Teraglin in NSW is currently 38 cm total length (TL).

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Tiger Flathead

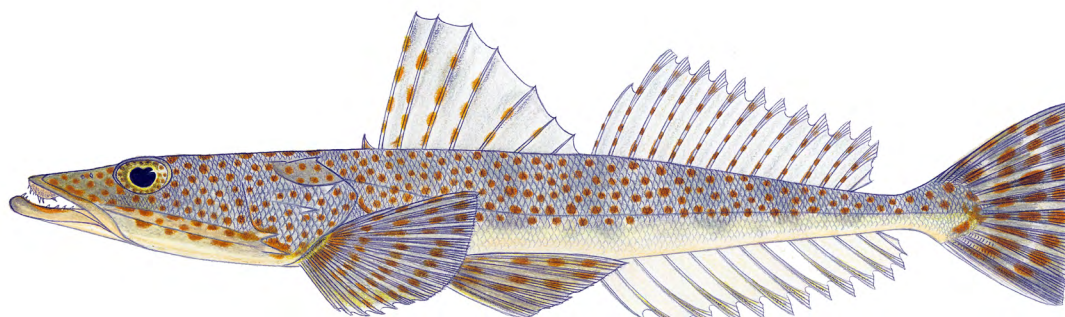
(*Platycephalus richardsoni*)

Author Karina Hall

EXPLOITATION STATUS FULLY FISHED

Predominantly a Commonwealth fishery, although significant landings are made by NSW trawlers north of Sydney. Results of the most recent Commonwealth stock assessment in 2013 indicated the stock is not overfished or being overfished and were consistent with a Fully Fished status in NSW.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Platycephalus richardsoni</i>	Tiger Flathead	



Platycephalus richardsoni
Image © Bernard Yau

Background

The Tiger Flathead (*Platycephalus richardsoni*) occurs in ocean waters from northern NSW to western Victoria, including Tasmania. It is found on sandy and muddy habitats in depths of 10-400 m. It can be easily confused with a similar species, the Toothy Flathead (*P. aurimaculatus*), which is common in the southern part of the range. Although regional variations in form, growth and reproduction have been documented, the stock structure of Tiger Flathead remains unknown and a single continuous stock is assumed for management and assessment purposes.

The general biology and population dynamics of Tiger Flathead have been studied in detail since the species was first commercially fished in NSW around 100 years ago. Tiger Flathead is a moderately long-lived species reaching a maximum age of 28 years in Tasmanian waters, but most fish landed in NSW are less than 7 years of age and have a maximum age of 18 years.

Females grow larger (to 60 cm fork length, FL) and mature later (at 3 years of age and about 30 cm FL) than males, which reach only 50 cm FL and may mature at 1-2 years of age. The spawning period extends from spring to autumn, during which individual females may produce up to 2.5 million eggs. Little is known about the early life history of Tiger Flathead, but recent Commonwealth stock assessments suggest that recruitment has been above average for the past 15 years.

Tiger Flathead was the original focus of commercial trawling in NSW waters and despite being overfished in the 1950s and 1960s it remains significant in recent ocean trawl landings. Annual catches in NSW have been relatively stable at around 200 t since 1997/98 (192 t in 2013/14). Much larger catches are taken by the trawl and Danish seine sectors in the Commonwealth Southern and Eastern Scalefish and Shark Fishery, which has annually landed around 3,000 t of combined flathead over the last decade (2,317 t in 2013/14).

Tiger Flathead is not taken in significant quantities by any other commercial fisheries in NSW, but recreational fishers are estimated to take approximately 39,000 fish (or over 20 t) each year.

Commercial catches of combined flathead species in Commonwealth waters are managed by a Total Allowable Catch (set at 2,878 t in 2014/15) and trip limits of 200 kg whole weight for NSW fishers. Length and age structures are monitored annually in Victorian waters and occasionally in NSW, and the entire stock is assessed periodically by the Commonwealth through an integrated, model-based (Tier 1) approach. The most recent assessment in 2013 estimated the 2014 spawning biomass to be 50 per cent of the unfished spawning biomass and well above the target reference point of 40 per cent. On this basis, the stock was classified as not overfished and not subject to overfishing by the Commonwealth, and Fully Fished in NSW.

Additional Notes

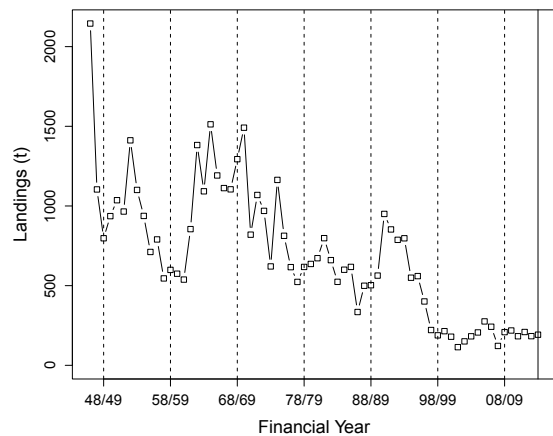
- The biological stock of Tiger Flathead was also assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- The Commonwealth undertakes a robust assessment that indicated that (in 2013/14) Tiger Flathead was not overfished and was not subject to overfishing, with current catches below the long term sustainable yield.
- Monitoring of the size and age structure and bycatch of NSW commercial landings was recommenced in 2014 through an onboard fish trawl observer program.
- Some historical local biological data on growth, reproduction and mortality are also available for commercial catches in the Sydney/Newcastle area.
- There is a minimum legal length of 33 cm total length for Tiger Flathead and a combined recreational bag limit of 20 for all flathead (including only 10 Dusky Flathead).

Catch

Recreational Catch of Tiger Flathead

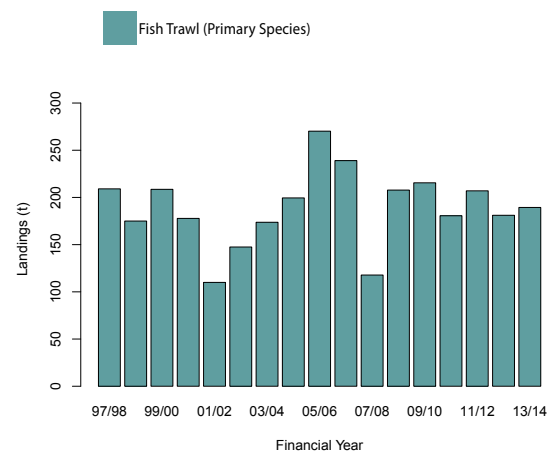
The most recent estimate of the recreational harvest of Tiger Flathead in NSW was approximately 39,000 fish during 2013/14 (West *et al.*, 2015). This was substantially lower than the previous estimate of approximately 88,000 fish (or between 20 and 60 t) based on the results of the offsite National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Tiger Flathead



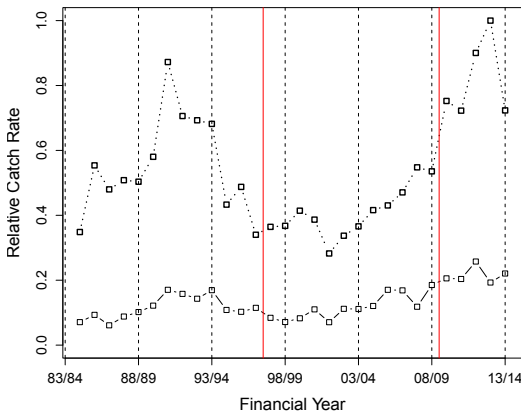
Commercial landings (including available historical records) of Tiger Flathead for NSW from 1946/47 to 2013/14 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Tiger Flathead



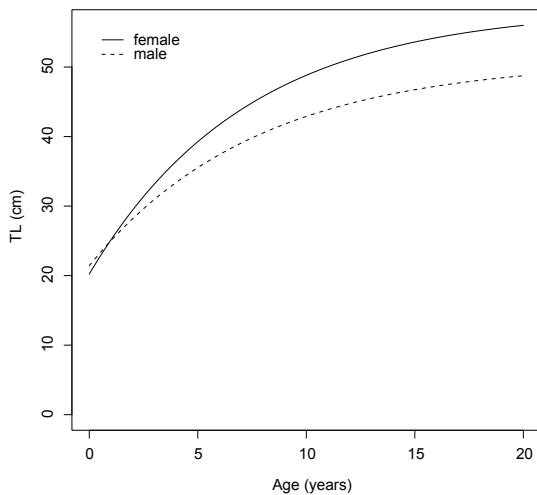
Reported landings of Tiger Flathead by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Tiger Flathead Harvested by Fish Trawling in NSW



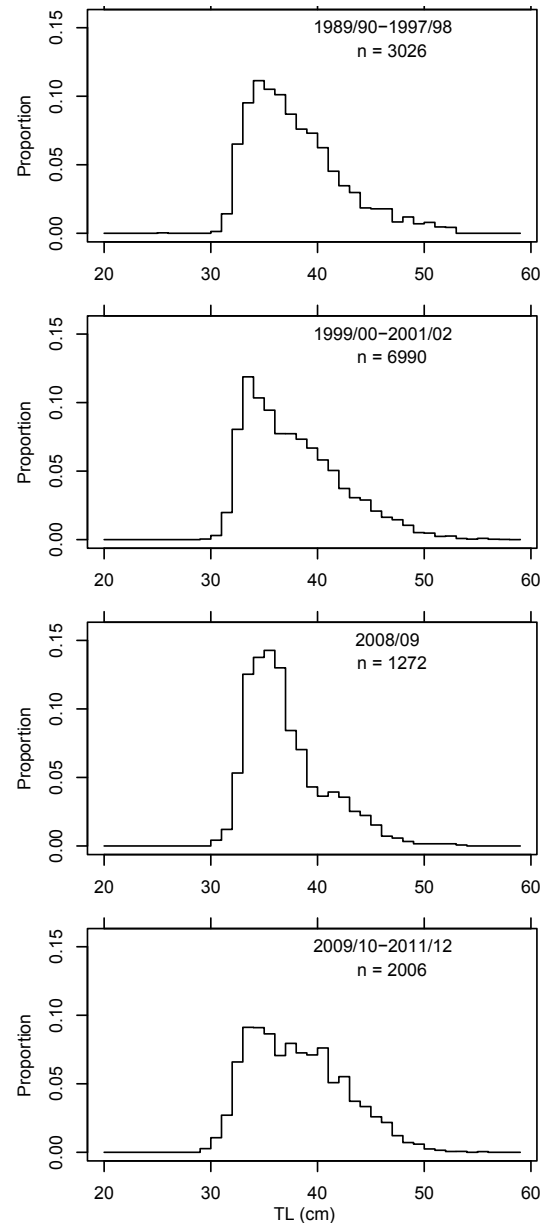
Catch rates of Tiger Flathead harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curves of Tiger Flathead



Growth curve of Tiger Flathead using parameters from Cui *et al.*, (2005). Lengths are presented as total length (TL).

Length Frequency of Tiger Flathead



The length distribution of Tiger Flathead landed by NSW commercial fishers has been very stable since the 1990s, and comprises mainly fish between 33-50 cm fork length (FL). The minimum legal length of Tiger Flathead in NSW is 33 cm total length (approximately 32 cm FL).

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Tiger Shark

(*Galeocerdo cuvier*)

Author Vic Peddemors

EXPLOITATION STATUS **UNDEFINED**

Tiger sharks are an important target species in the recreational club-based gamefish fishery. Commercial catches off NSW are likely to be smaller than recreational catches. There is little local fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.

SCIENTIFIC NAME

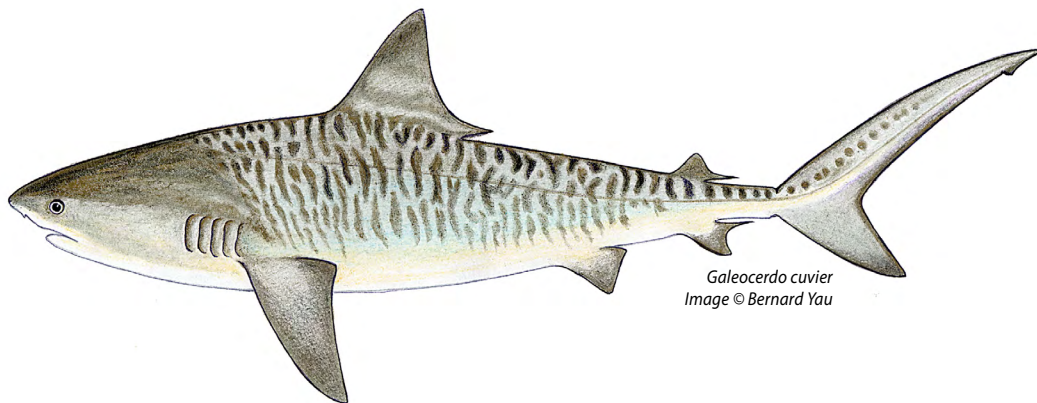
STANDARD NAME

COMMENT

Galeocerdo cuvier

Tiger Shark

Found along the NSW coast, mainly in summer.



Background

The Tiger Shark (*Galeocerdo cuvier*) is found in tropical and warmer temperate waters of all the world's oceans. Its Australian distribution includes all northern Australia, extending south to Perth in the west and Bass Strait in the east. Tiger Sharks are found from close inshore to well off the continental shelf, with a depth distribution ranging from the surface to 850 m. Satellite telemetry work has found individual Tiger Sharks are capable of undertaking long migrations. One individual was found to swim from an Australian coral reef directly to Papua New Guinea, then into the Gulf of Carpentaria before being caught in a net 3 months later.

At birth, Tiger Sharks are 50-75 cm in length. Males mature at about 300 cm and females between 287 and 330 cm. Both males and females grow at similar rates, and may reach a total length of 600 cm, and a weight of about 1,000 kg. Tiger sharks are lecithotrophic viviparous where the young develop internally from eggs. Litter sizes of tiger sharks vary from 10-80, with an average litter size of 35.

Breeding and pupping both occur every two years, usually in summer.

A huge variety of dietary items can be found in the stomachs of Tiger Sharks. Fishes and reptiles (turtles and sea snakes) dominate, with mammals (primarily cetaceans) and dugongs also commonly found.

NSW commercial fisheries land small numbers of Tiger Sharks, with annual catches ranging between 1 and 6 t. Catches come mostly from the Ocean Trap and Line Fishery, with the Ocean Trawl Fishery contributing only a minor proportion of the catch. Tiger Sharks are often released alive due to poor market demand.

The catch of Tiger Shark by recreational fishers is probably greater than the commercial catch. Tiger Sharks are a favoured target species for some gamefishers, with an estimated 10 t being landed annually. Catches of Tiger Sharks are correlated with water temperature, as the species moves south with warmer waters.

Additional Notes

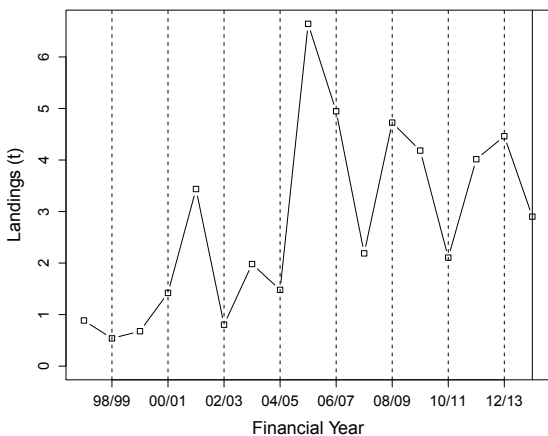
- Tiger Shark is an important target species in the recreational gamefish fishery and a key secondary species in the Ocean Trap and Line Fishery.
- Poor eating qualities result in low commercial landings (recently less than 5 t per annum). The fins are also apparently of comparatively low value.
- Historical NSW recreational gamefish catch information and biological data are available (Chan, 2001).
- There is a recreational bag limit of one Tiger Shark.

Catch

Recreational Catch of Tiger Shark

There is no robust estimate of the current recreational harvest of Tiger Shark in NSW. The annual recreational harvest of Tiger Shark in NSW was previously estimated to be approximately 10 t based upon data collected by Chan (2001).

Historical Landings of Tiger Shark



Commercial landings (including available historical records) of Tiger Shark for NSW from 1997/98 to 2013/14 for all fishing methods.

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- Simpfendorfer, C. (1992). Biology of tiger sharks (*Galeocerdo cuvier*) caught by the Queensland Shark Meshing Program off Townsville, Australia. *Australian Journal of Marine and Freshwater Research* 43(1): 33-43.
- Simpfendorfer C.A., A.B. Goodreid and R.B. McAuley (2001). Size, sex and geographic variation in the diet of the tiger shark, *Galeocerdo cuvier*, from Western Australian waters. *Environmental Biology of Fishes* 61:37-46

Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 018022, common name or scientific name to find further information.



Tilefish

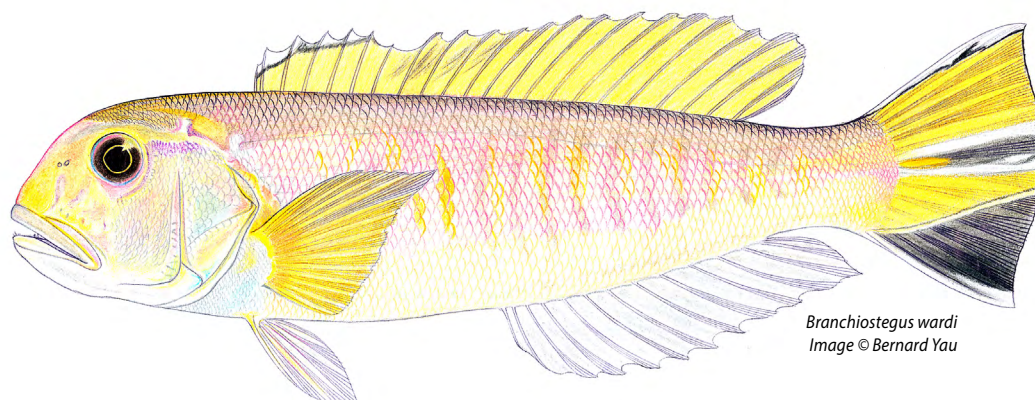
(*Branchiostegus* spp.)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

The distribution of this two species complex is essentially limited to the temperate east Australian coast. Commercial catches are relatively low (<2 t p.a. since 2004/05). There is little fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Branchiostegus wardi</i>	Pink Tilefish	The major component of tilefish landings.
<i>Branchiostegus serratus</i>	Australian Barred Tilefish	Small quantities landed.



Background

Two species of Tilefish inhabit NSW waters - the Pink Tilefish, (*Branchiostegus wardi*) and the less commonly caught Barred Tilefish (*B. serratus*). These species mainly inhabit depths between about 50-200 m although the Barred Tilefish has been caught as deep as 350 m. Both have a relatively restricted distribution along the east coast of Australia, between Noosa Heads in southern Queensland and eastern Bass Strait. The Pink Tilefish has also been reported from New Caledonia.

The Pink Tilefish is predominantly plain pink on the body, grading to pink/white on the belly and has a colourful caudal fin bearing two broad yellow stripes in the centre, a dark triangular patch on the lower part of the fin and yellow and grey on the upper part of the fin. The Barred Tilefish is more silver/white in body colour and has about 15-16 dark vertical bands prominent on the upper body.

Pink Tilefish is commonly associated with mud or sandy substrates, and are reported to live in

burrows. Tilefish feed on molluscs, worms, squid, crabs and small fish. Tilefish larvae are pelagic with distinct patterns of spines along the head and on their scales. These spines are shed when the larvae develop into benthic juveniles. Pink Tilefish grow to about 50 cm maximum length. The majority of small fish (< 40 cm) are female while male fish dominate the larger size classes.

Almost all the NSW Tilefish catch is landed by fish and prawn trawlers working off Newcastle-Port Stephens and is comprised mostly of Pink Tilefish. An annual catch of 11 t was recorded in 1994/95. However, annual catches since then have averaged about 2 t and since 2009/10 average annual catch has been < 1 t. In 2013/14, 800 kg of tilefish were reported. Little has been published in relation to the biology of the species.

There is little fishery or biological information enabling a reliable assessment of exploitation status, resulting in a status of Undefined.

Additional Notes

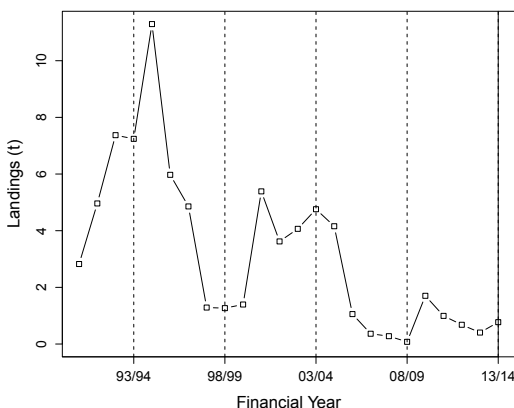
- Pink Tilefish *Branchiostegus wardi* is the main species taken - distribution is from southern Queensland to eastern Bass Strait, but significant landings only occur in the Newcastle/Nelson Bay area off central NSW.
- The environmental assessment for the Ocean Trawl Fishery assigned a moderately high risk for Pink Tilefish.
- Tilefish are bottom dwelling fish that eat crustaceans and small fish species. Growth and reproductive biology are not well known.
- Tilefish have been traditionally reported as 'moonfish', and there has been confusion in the catch records with the oceanic moonfish (opah) *Lampris guttatus*. Recent reported landings of Tilefish have apparently been less than the amount marketed through the Sydney Fish Markets.
- Taken only by trawling - commercial catch is low (recently less than 2 t) and fluctuates between years. Landings during recent years have been very low, possibly reflecting changes in fishing activity.

Catch

Recreational Catch of Tilefish

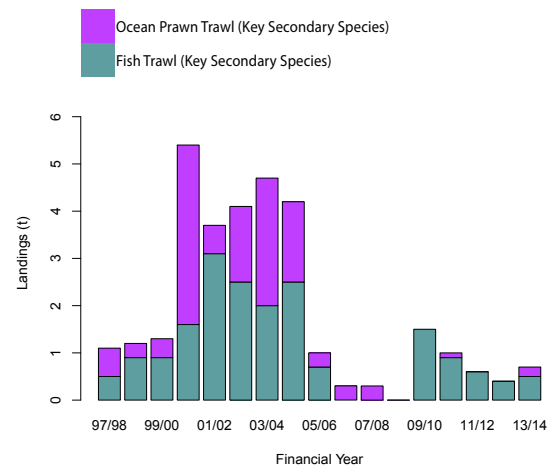
The annual recreational harvest of Tilefish in NSW is considered to be minor.

Historical Landings of Tilefish



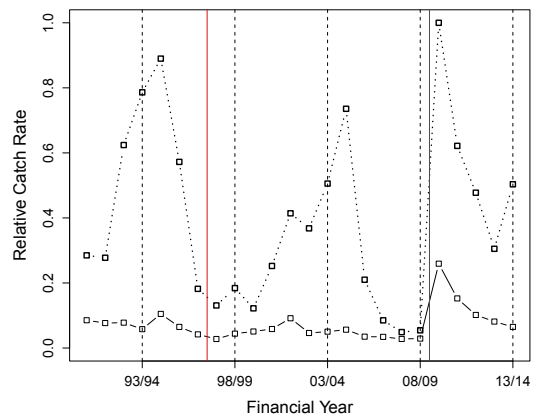
Commercial landings (including available historical records) of Tilefish for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Tilefish



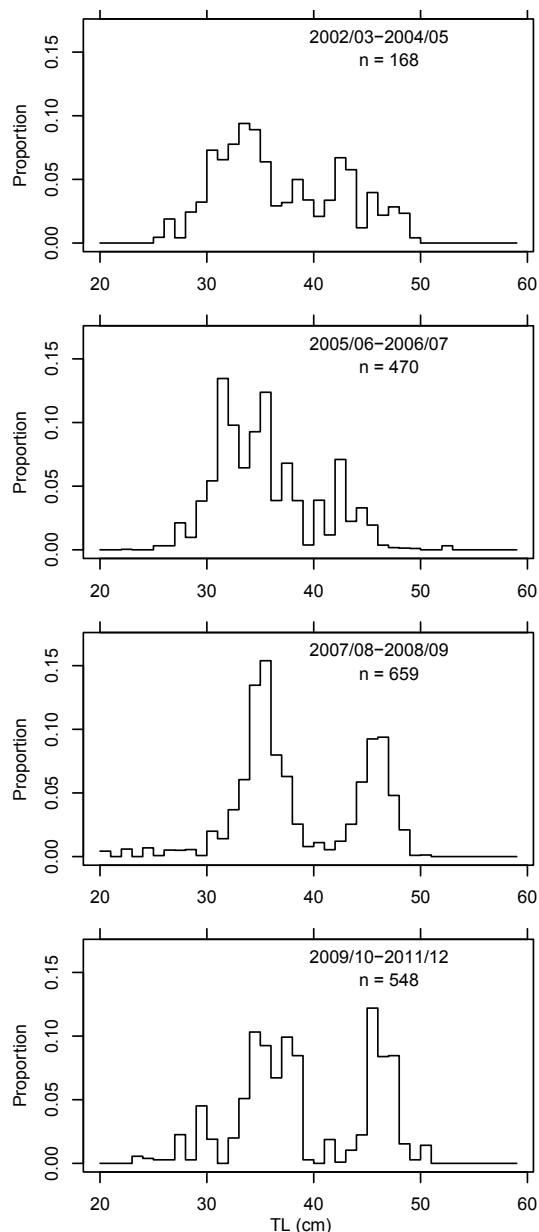
Reported landings of Tilefish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Tilefish Harvested by Fish Trawling in NSW



Catch rates of Tilefish harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Pink Tilefish



The length distribution of Pink Tilefish landed by NSW commercial fishers is comprised mainly of fish between 25-50 cm total length (TL). There is no minimum legal length for Pink Tilefish in NSW.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 331006 and 37 331005, common name or scientific name to find further information.



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Trumpeter Whiting

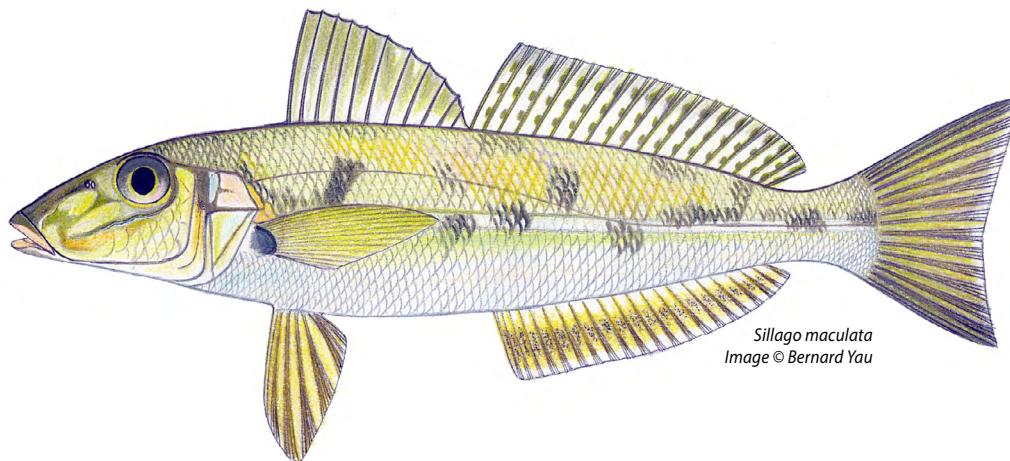
(*Sillago maculata*)

Author Karina Hall

EXPLOITATION STATUS **UNCERTAIN**

Small commercial and recreational landings, mainly from a few estuaries. Large unexplained declines in the commercial landings and catch rates over the last 2 years have resulted in an Uncertain status.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Sillago maculata</i>	Trumpeter Whiting	Also known as Winter Whiting.



Background

The Trumpeter Whiting (*Sillago maculata*) is distributed along the east coast of Australia from Cape York Peninsula in Queensland to Gippsland Lakes in Victoria. It favours silty or muddy substrates in estuaries and coastal embayments. Juveniles are found in estuarine seagrasses and shallow habitats, while adults are common in deeper estuarine waters down to depths of 30 m.

Trumpeter Whiting grows to about 30 cm fork length (FL) and a weight of 260 g. In NSW, it reaches a maximum age of about 9.5 years for males and 12 years for females, although in commercial catches most are aged 2-4 years of age. Juveniles grow rapidly during their first two years and mature at 1-3 years of age and about 15 cm FL. Spawning typically occurs in estuaries during spring and summer, with multiple batches of eggs possible for each female.

Trumpeter Whiting forages for burrowing or benthic animals and eats mainly polychaete worms, crustaceans (amphipods, shrimps, crabs), bivalve molluscs and a variety of small fish.

Trumpeter Whiting is harvested by commercial and recreational fisheries throughout its species distribution. In NSW, it is taken commercially in shallow estuarine waters by hauling and seine nets of the Estuary General Fishery and slightly deeper waters by otter trawls of the Estuary Prawn Trawl Fishery (Hawkesbury River only).

The recreational catch of Trumpeter Whiting is significant and is probably around the same order of magnitude as commercial landings.

Additional Notes

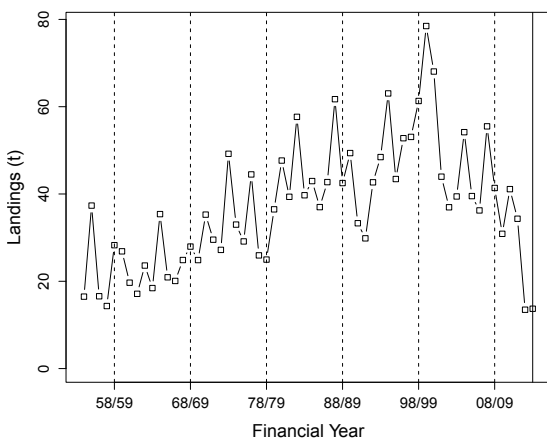
- NSW commercial landings peaked in 1999/00 at 78 t and until recently averaged 40 t per year.
- In 2012/13 landings declined by 70 % across all three sectors to a total of only 14 t and remained at that level in 2013/14.
- Catch rates in the hauling sector similarly declined, but increased in the meshing sector.
- The species is subject to variable recruitment, so these declines may be related to environmental variation.
- There is a combined recreational bag limit of 20 for all whiting.

Catch

Recreational Catch of Trumpeter Whiting

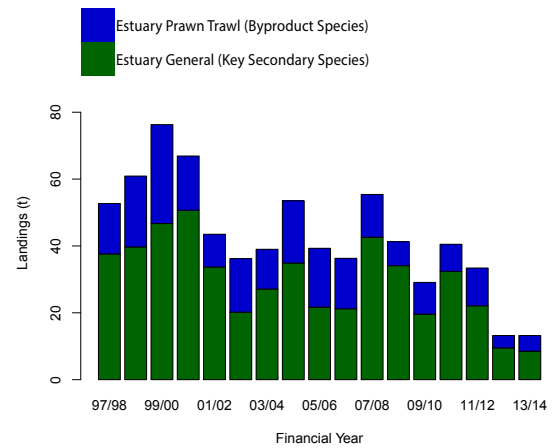
The most recent estimate of the recreational harvest of Trumpeter Whiting in NSW was approximately 124,000 fish during 2013/14 (West *et al.*, 2015). This was lower than the previous estimate of approximately 220,000 fish (or between 10 and 30 t) based on the results of the offsite National Recreational and Indigenous Fishing Survey during 2000/01 (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Trumpeter Whiting



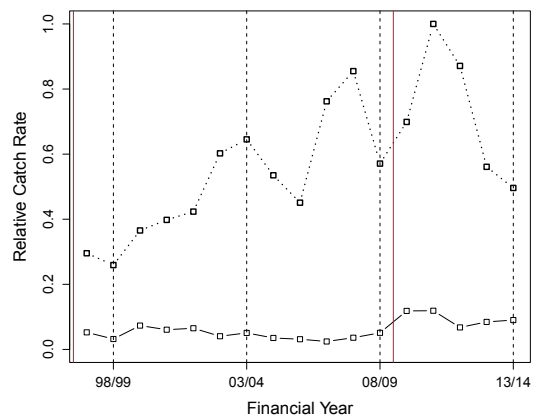
Commercial landings (including available historical records) of Trumpeter Whiting for NSW from 1954/55 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Trumpeter Whiting



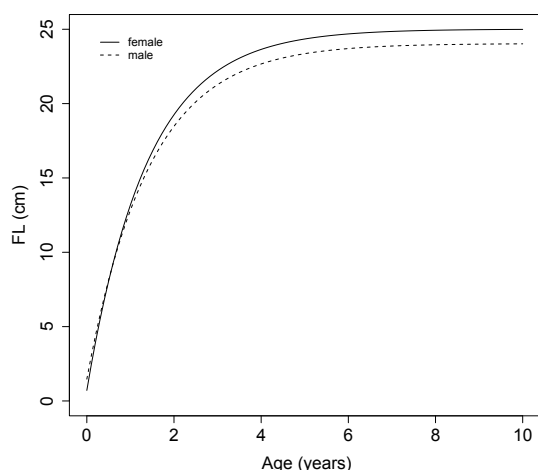
Reported landings of Trumpeter Whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Trumpeter Whiting Harvested by Hauling in NSW



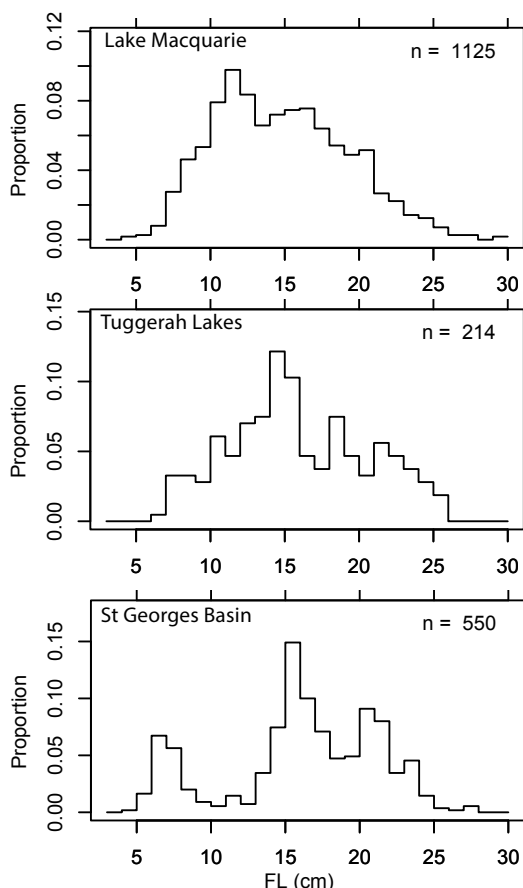
Catch rates of Trumpeter Whiting harvested using hauling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Trumpeter Whiting



Growth curves of Trumpeter Whiting using parameters from Kendall and Gray (2009). Lengths are presented as fork length (FL).

Length Frequency of Trumpeter Whiting



The length distribution of Trumpeter Whiting from Fishery Independent Surveys in Lake Macquarie, Tuggerah Lakes and St Georges Basin during 2008-11. The length distribution in NSW commercial landings between the 1970s and 1990s were comprised mainly of fish between 18-25 cm fork length (FL). There is no legal length for Trumpeter Whiting in NSW.

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West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle (2015). Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series.

Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 330015, common name or scientific name to find further information.



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Turban Shells

(*Turbo* spp.)

Author Rowan Chick

EXPLOITATION STATUS UNDEFINED

The NSW Turban Shell fishery consists of a complex of three species. Historical and current reporting and recording of catch information does allow individual species catch histories to be generated. Biological information for individual species is available. Determination of a reliable exploitation status is currently not possible, and as such remains Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Turbo torquatus</i>	Sydney Turban Shell	
<i>Turbo militaris</i>	Military Turban Shell	Also known as <i>Turbo imperialis</i> .
<i>Turbo undulatus</i>	Green Turban Shell	

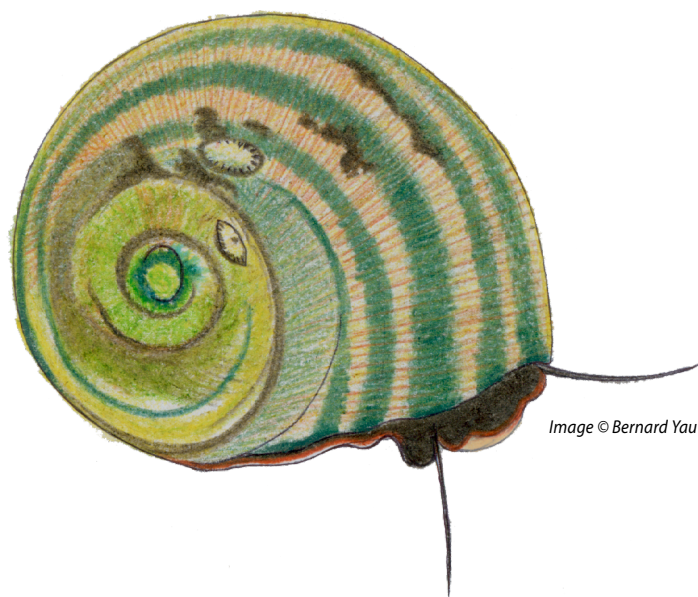


Image © Bernard Yau

Background

Turban Shells are large marine gastropods (snails) that occur in intertidal and shallow subtidal rocky shores of NSW ocean waters. They are opportunistic feeders, eating a variety of foliose and encrusting algae. Turban Shells have been found to spawn twice a year, although spawning may be asynchronous among individual females and between localities. Growth and mortality rates have not been subject to detailed study, although for the Sydney Turban Shell (*Turbo torquatus*) the available data suggest that females may live longer and grow larger than males.

The two larger Turban Shell species, the Sydney Turban Shell and the Military Turban Shell (*T. militaris*) grow to a maximum size of about 10-

11 cm shell width, and are harvested mainly by licensed commercial divers. Sydney Turban Shells occur in suitable habitats along the length of the NSW coast and have a relatively rounded apex on the shell, while Military Turban Shells occur north of about Wollongong and have a distinctly pointed apex on the shell. A smaller species, the Green Turban Shell (*T. undulatus*) grows to a maximum size of about 6 cm shell width, and occurs in intertidal zones on rocky shores, south from southern Queensland to Western Australia, including Tasmania. It is likely that this species is more commonly harvested by recreational fishers.

Since 2009/10, commercial landings of Turban Shells have averaged about 5 t p.a., and during the early 1990's annual catches were <1.5 t (Andrew *et al.*, 1996). In conjunction with the Sea Urchin

Fishery, the commercial fishery for Turban Shells is subject to a significant number of area closures, designed to provide areas of refugia against which the effects of fishing in the open areas can be evaluated and both the Sydney and Military Turban Shell are subject to a 75 mm minimum legal length (shell width).

Additional Notes

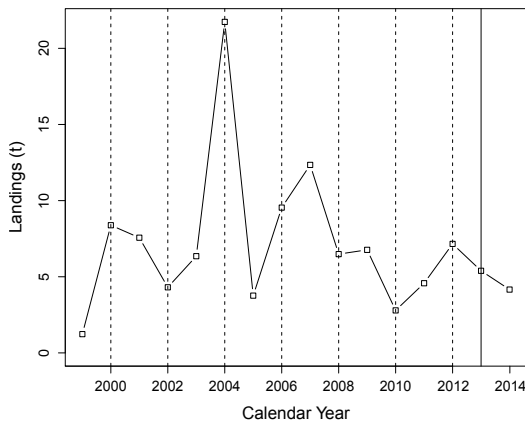
- Two species provide the majority of the harvest (*Turbo torquatus* and *T. militaris*) – both are subject to a 75 mm minimum legal length (shell width).
- A third species, *T. undulatus*, is smaller and less commonly harvested.
- The Recreational Fishery has not been estimated.
- There is a recreational bag limit of 20 individual Turban Shells per fisher per day (all species combined).

Catch

Recreational Catch of Turban Shells

The annual recreational harvest of Turban Shells in NSW is considered to be minor.

Historical Landings of Turban Shells



Commercial landings (including available historical records) of Turban Shells for NSW from 1999 to 2014 for all fishing methods.

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 24 045003, 24 045002, and 24 045004, common name or scientific name to find further information.



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Whaler Sharks

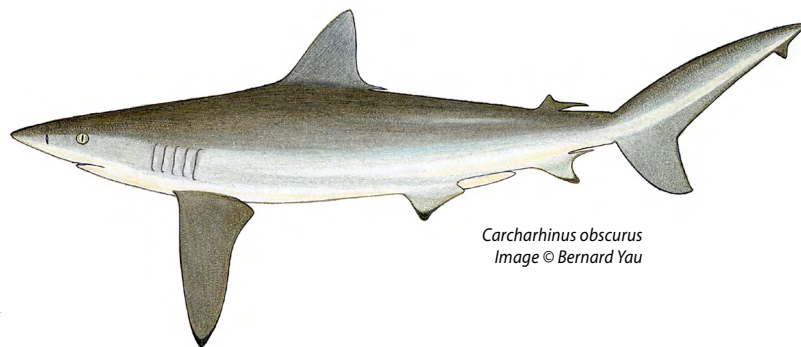
(*Carcharhinus* spp.)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

A complex of species that are very difficult to identify (particularly as juveniles). Insufficient information is available to determine status for any of the whaler shark species.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Carcharhinus brachyurus</i>	Bronze Whaler	Generally south of Coffs Harbour.
<i>Carcharhinus brevipinna</i>	Spinner Shark	Generally north of Jervis Bay.
<i>Carcharhinus falciformis</i>	Silky Shark	Generally north of Sydney.
<i>Carcharhinus leucas</i>	Bull Shark	Nearshore, estuaries and rivers from Sydney north, more common on North Coast.
<i>Carcharhinus limbatus</i>	Common Blacktip	Caught north of Bermagui.
<i>Carcharhinus obscurus</i>	Dusky Whaler	Mainly caught inshore.
<i>Carcharhinus plumbeus</i>	Sandbar Shark	Generally from Coffs Harbour north in water warmer than 23°C.



Background

Seven species of Whaler Sharks have been recorded in catches off NSW. The Bronze Whaler (*Carcharhinus brachyurus*) is found on the inshore continental shelf, usually in depths shallower than 100 m. Its Australian distribution extends southward from Coffs Harbour in NSW to southern WA. Bronze Whalers reach a length of 300 cm, with males maturing at 235 cm, and females at 245 cm. Litter sizes of Bronze Whalers range from 7-20 pups.

Both the Spinner Shark (*C. brevipinna*) and Common Blacktip Shark (*C. limbatus*) occur on the continental shelf from nearshore to depths of 75 m, although the Common Blacktip occasionally may be caught far offshore. These two species are found from southern NSW northward around northern

Australia to WA. In tropical waters, the Common Blacktip is externally indistinguishable from the Australian blacktip Shark (*C. tilstoni*), however this species is infrequently found in NSW. Maximum length of the Spinner Shark is 280 cm, while the blacktip Shark reaches 250 cm. For the Spinner Shark both sexes mature at 190-200 cm, while maturity in the blacktip Shark varies with location. Males can mature at 135-180 cm and females between 120-190 cm. Litter sizes vary from 3-15 pups in the Spinner Shark, and 1-10 (usually 4-7) pups in the Common Blacktip Shark. For both species, gestation period is 10-12 months and females breed every 2 years. There is a late summer fishery on juvenile Spinner Sharks in Stockton Bight off Newcastle, NSW.

The Silky Shark (*C. falciiformis*) is oceanic but most abundant along the edge of the continental shelf, and can be found from the surface down to depths of 500 m. Silky Sharks occur in waters north from Sydney, across northern Australia, and south to Lancelin in WA. Maximum length is 330 cm, with both sexes mature between 200-210 cm. The Silky Shark produces litter sizes between 2-15 pups after an unknown gestation.

The Bull Shark (*C. leucas*) is a coastal, estuarine and riverine shark. In the marine environment it occurs near the bottom, from the surf zone to depths of at least 150 m. It is found in tropical and warm temperate seas around northern Australia between Sydney and Perth. Bull Sharks reach a length of 340 cm, and both sexes mature at 220-230cm. Litter sizes range from 1-13 pups. Females normally give birth in the lower reaches of estuaries, and the juvenile Sharks may remain in the river for up to 5 years.

The Dusky Whaler (*C. obscurus*) is a widespread species, distributed around the entire Australian coast (although rare off southern Tasmania). It is found on the continental shelf, from the surf zone to adjacent oceanic waters. The Dusky Whaler inhabits depths ranging from the surface down to at least 400 m. Maximum length is 365 cm, with males maturing at 265-280 cm and females at 295-310 cm. Litter sizes range from 3-14 pups (average 10). Adults and adolescent Dusky Whalers appear to move inshore during summer in WA waters, however the occurrence of similar movement patterns has not been examined on the east coast.

The Sandbar Shark (*C. plumbeus*) prefers water warmer than 23°C. Its distribution extends around northern Australia from Coffs Harbour in NSW to Esperance in WA. The Sandbar Shark is found on the continental shelf and adjacent deep water from the intertidal region to depths of 280 m. This species is normally found closely associated with the substrate. It grows to a maximum length of 240 cm. Males mature at 130-180cm and females mature at 145-185 cm. Only 3-8 pups are produced every second year, with multiple males fathering a single litter.

Accurate statistics are not currently available for each of these species from NSW catch records. The Ocean Trap and Line Fishery lands the majority of the annual catch of Whaler Sharks, with Estuary General and Ocean Trawl Fisheries also contributing catches. Whaler Sharks are the largest NSW commercial Shark catch. Specific management rules for commercial shark fishing apply in NSW, requiring fishers to more accurately report catches by species for the 'Whaler Shark' group. Many of the species

landed in the NSW commercial fishery are also landed by fisheries in adjoining jurisdictions, and by recreational fisheries in NSW.

Additional Notes

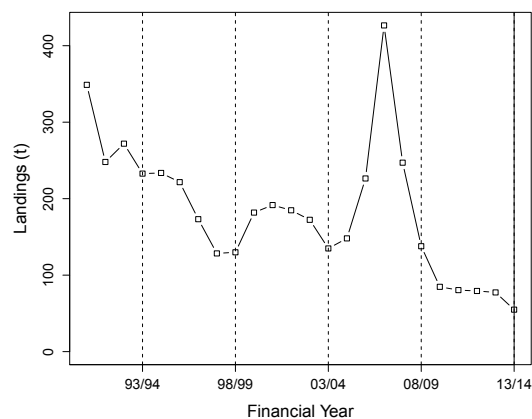
- Onboard observer studies suggest five species make up the majority of the catch by commercial line fishers.
- NSW recreational gamefish catch information is available, including identification of landed Sharks to species level (Chan, 2001).
- There is a recreational bag limit of one Whaler Shark.

Catch

Recreational Catch of Whaler Sharks

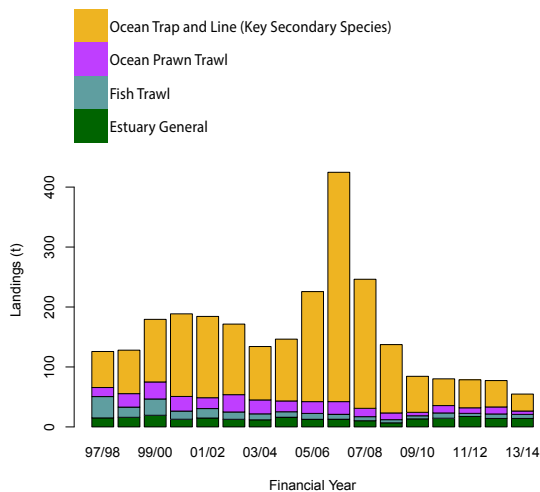
There is no robust estimate of the recreational harvest of Whaler Sharks in NSW. The annual recreational harvest of Whaler Sharks in NSW was previously estimated to lie between 40 and 160 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Whaler Sharks



Commercial landings (including available historical records) of Whaler Sharks for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Whaler Sharks



Reported landings of Whaler Sharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 018001, 37 018023, 37 018008, 37 018021, 37 018039, 37 018003 and 37 018007, common name or scientific name to find further information.



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Whitebait - Sandy Sprat

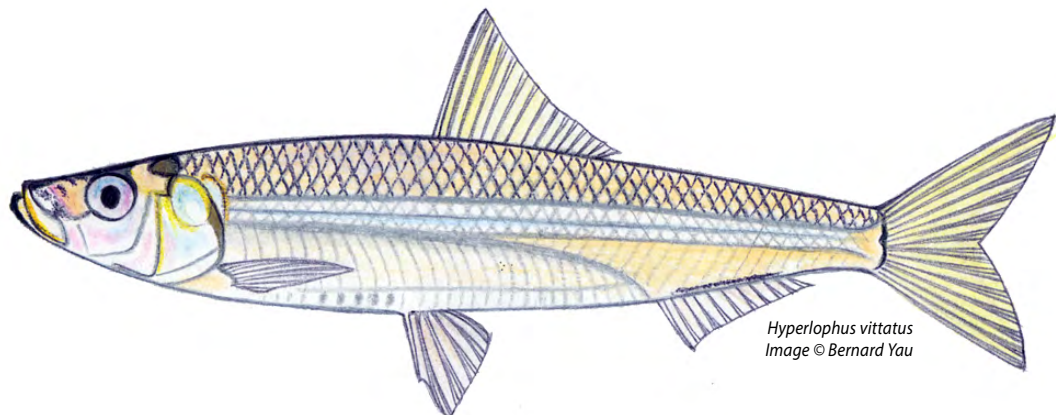
(*Hyperlophus vittatus*)

Author John Stewart

EXPLOITATION STATUS UNDEFINED

Very little local biological information is available for whitebait. This lack of information and the variable commercial fishery for this species has resulted in a status of Undefined.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Hyperlophus vittatus</i>	Sandy Sprat	Constitutes the majority of the catch.
<i>Engraulis australis</i>	Australian Anchovy	Small quantities landed.
<i>Sardinops sagax</i>	Australian Sardine	Small quantities landed.
<i>Spratelloides robustus</i>	Blue Sprat	Small quantities landed.



Background

In NSW, catches reported as 'Whitebait' by commercial fishers can include a number of species; however the vast majority (> 95%) of the catch is comprised of Sandy Sprat (*Hyperlophus vittatus*). Other species sometimes included in catches of Whitebait are Australian Anchovy (*Engraulis australis*), Australian Sardine (*Sardinops sagax*) and Blue Sprat (*Spratelloides robustus*). Sandy Sprat occurs in estuarine and inshore waters around southern Australia, from southern Queensland to southern WA, and significant fisheries exist in some areas, however little is known of the stock structure of Sandy Sprat throughout this range.

Sandy Sprat is a multiple batch spawner, but estimated batch fecundity is low to medium (743-5,600 hydrated oocytes per batch). In South Australia female Sandy Sprat mature at 5.8-7.5 cm fork length, when they are 1-2 years of age, and spawning occurs in spring and summer. In NSW

spawning may occur later as larvae have been caught in April/May. Sandy Sprat is a small, short lived species, reaching a maximum size of about 10 cm and 4 years of age. However, the majority of fish in NSW commercial catches are 5-8 cm in length and inferred to be 1-3 years of age.

The majority of the Whitebait catch in NSW is taken from ocean waters, however in some years significant landings of Whitebait are reported from estuarine waters. Most of the commercial catch of Whitebait is taken with small-meshed hauling nets.

Additional Notes

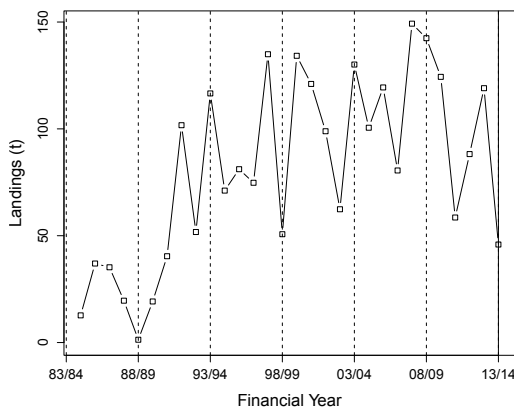
- Sandy Sprat constitutes the majority (> 95%) of the NSW commercial catch, so the assessment is based on this species.
- Commercial landings fluctuate but are regularly in excess of 100 t per annum. Average prices are often \$6 to \$8 per kilo, making this a valuable fishery.
- There is a lack of biological, life-history and fishery information for Sandy Sprat in NSW.
- Research in South Australia indicates Sandy Sprat is a fast growing, relatively short-lived species that is likely to be resilient to fishing.
- There is a recreational bag limit of 100 for Whitebait/Sandy Sprat in NSW.

Catch

Recreational Catch of Whitebait - Sandy Sprat

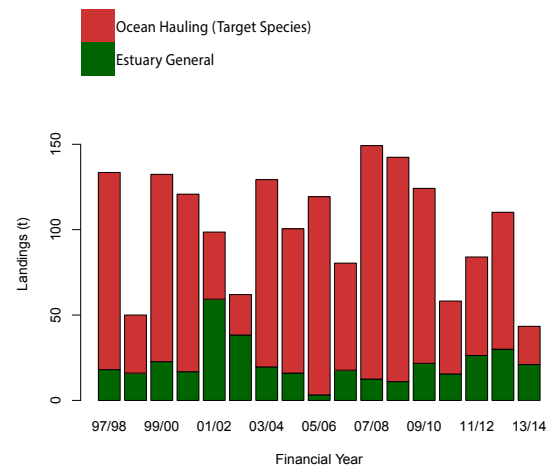
The annual recreational harvest of 'Whitebait' in NSW is considered to be minor.

Historical Landings of Whitebait - Sandy Sprat



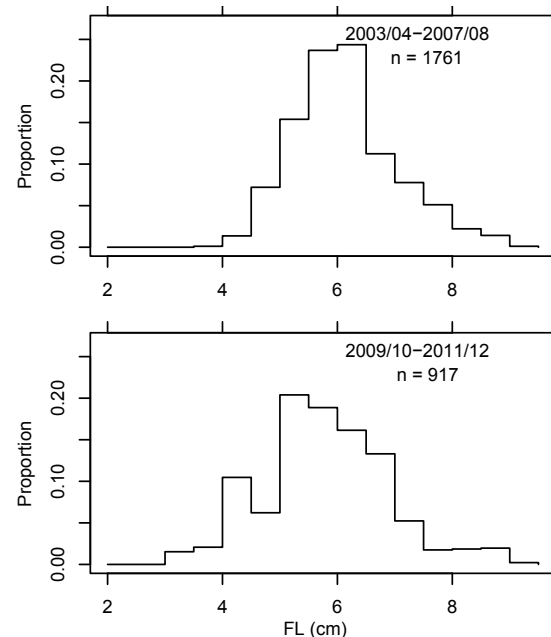
Landings (including available historical records) of Whitebait - Sandy Sprat for NSW from 1984/85 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Whitebait - Sandy Sprat



Reported landings of Whitebait - Sandy Sprat by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Length Frequency of Whitebait - Sandy Sprat



The length distribution of Whitebait (Sandy Sprat) sampled from NSW commercial catches generally comprise fish of between 4-8 cm fork length (FL). There is no minimum legal length for Whitebait (Sandy Sprat) in NSW.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 085005, 37 086001, 37 085002 and 37 085003, common name or scientific name to find further information.



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Wobbegong Sharks

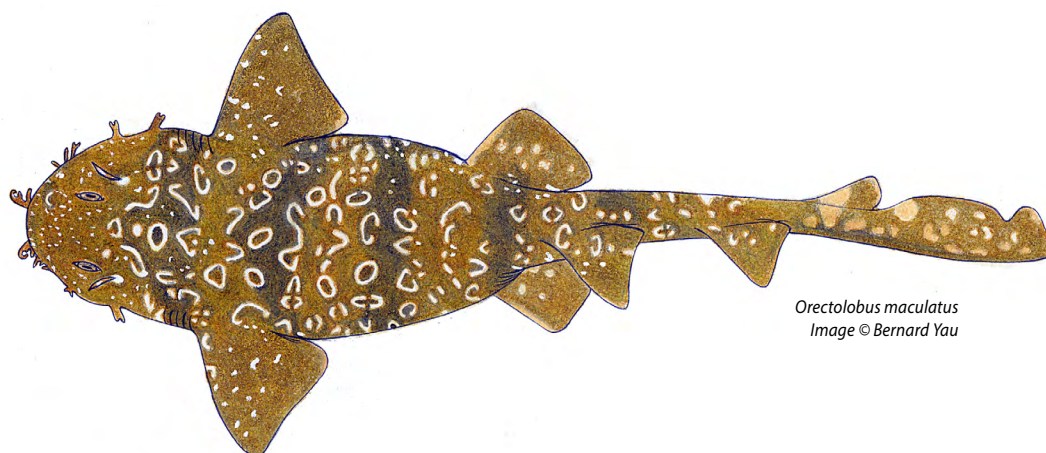
(*Orectolobus* spp.)

Author Vic Peddemors

EXPLOITATION STATUS UNDEFINED

The available catch data are not sufficiently accurate to use for determining stock status for any of the three species which occur off NSW.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
<i>Orectolobus ornatus</i>	Ornate Wobbegong	
<i>Orectolobus maculatus</i>	Spotted Wobbegong	
<i>Orectolobus halei</i>	Gulf Wobbegong	



Orectolobus maculatus
Image © Bernard Yau

Background

At least ten species of wobbegongs are known from Australian waters with three species occurring along the NSW coast. The Ornate Wobbegong (*Orectolobus ornatus*) is distributed from Port Douglas in North Queensland to Sydney in the south. The Spotted Wobbegong (*O. maculatus*) is found from about Gladstone in central Queensland to Lakes Entrance in Victoria, and may also occur west of Bass Strait, but these records are uncertain. The third species is the Gulf Wobbegong (*O. halei*), which ranges around the south of the continent from southern Queensland to southern WA.

The three species are typically found in shallow inshore waters on coral and rocky reefs along the coast and around offshore islands. They usually inhabit depths less than 50 m although have been recorded to 220 m. Occasional captures, mainly

of Spotted Wobbegongs, are made on sandy trawl grounds to depths of 100 m. The diet of wobbegongs comprises various fishes including small sharks and rays, octopus and occasionally invertebrates.

The Ornate Wobbegong is a small species, maturing at about 80 cm and attaining a maximum length of about 110 cm. The Spotted Wobbegong is reported to reach about 300 cm in length, but seldom exceeds 160 cm in NSW with a size at maturity of around 115-120 cm. Gulf Wobbegong reaches at least 210 cm in NSW, and reportedly grows to almost 300 cm. The size at maturity for Gulf Wobbegong is between 161-187 cm. Wobbegongs are lecithotrophic viviparous, where the young develop in the uterus from eggs before being born at about 20 cm in length. The number of young varies with the size of the sharks with Ornate

Wobbegongs having up to 18 pups, (averaging 9), Spotted Wobbegongs up to 37 pups, and Gulf Wobbegong as many as 53 pups. Although gestation for all species is 10-11 months, they breed only once every three years making their apparent high fecundity (for sharks) much lower in practice.

The Ocean Trap and Line Fishery accounts for 80% of the commercial harvest of wobbegong sharks in NSW with most caught by various line-fishing methods. In the 15 years after 1990, annual NSW wobbegong landings declined from about 120 t to about 60 t. Recent management in the form of trip limits has seen a further decline in commercial landings.

Additional Notes

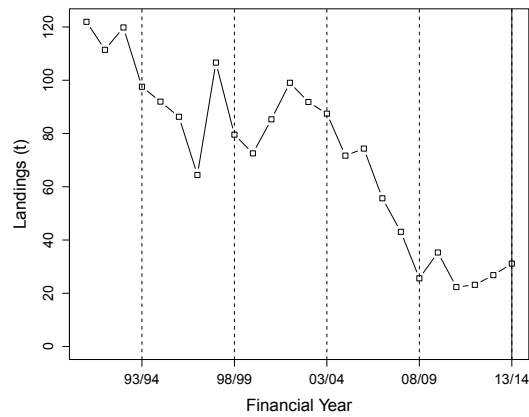
- Three species of wobbegong now recognised in the NSW catch but better information is required on the proportion of the three species in catches.
- There are important biodiversity and conservation issues associated with this group of species.
- Additional management measures have been introduced for wobbegong sharks taken in the Ocean Trap and Line Fishery - a trip limit of 6 carcasses applies.
- Wobbegong sharks are no longer permitted to be retained by recreational fishers.
- Changes to the structure of the industry are probably responsible for some of the patterns in the catches (decreasing) and catch rates (increasing).

Catch

Recreational Catch of Wobbegong Sharks

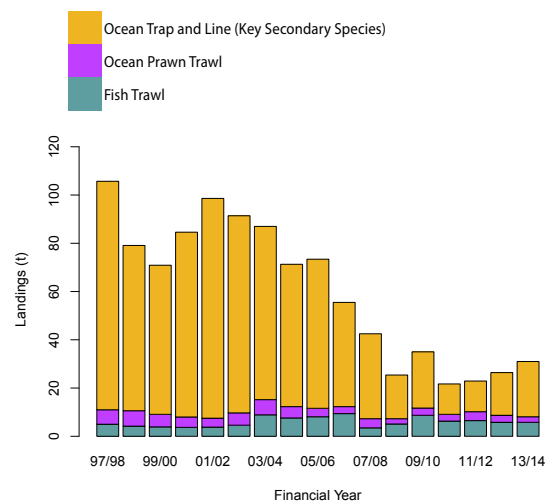
Prior to 2007, the annual recreational harvest of wobbegong sharks in NSW was likely to lie between 10 and 50 t. This estimate was based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI. Note that a recreational bag limit of zero was introduced for wobbegong sharks in September 2007 and they are no longer permitted to be retained by recreational fishers.

Historical Landings of Wobbegong Sharks



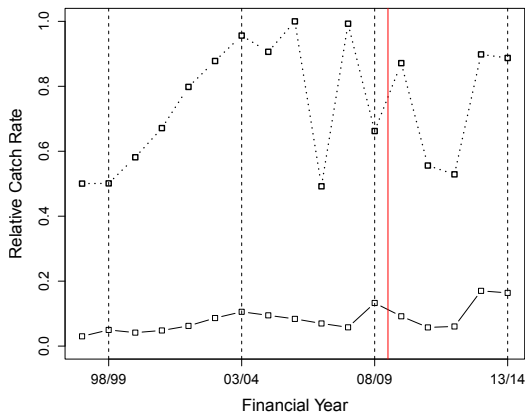
Commercial landings (including available historical records) of wobbegong sharks for NSW from 1990/91 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Wobbegong Sharks



Reported landings of wobbegong sharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Wobbegong Sharks Harvested by All Line Fishing Methods in NSW



Catch rates of wobbegong sharks harvested using all line fishing methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

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Walker, T.I. (1998). Can shark resources be harvested sustainably? A question revisited with a review, of shark fisheries. *Marine and Freshwater Research* 49 (7): 553-572.

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Yellowfin Bream

(*Acanthopagrus australis*)

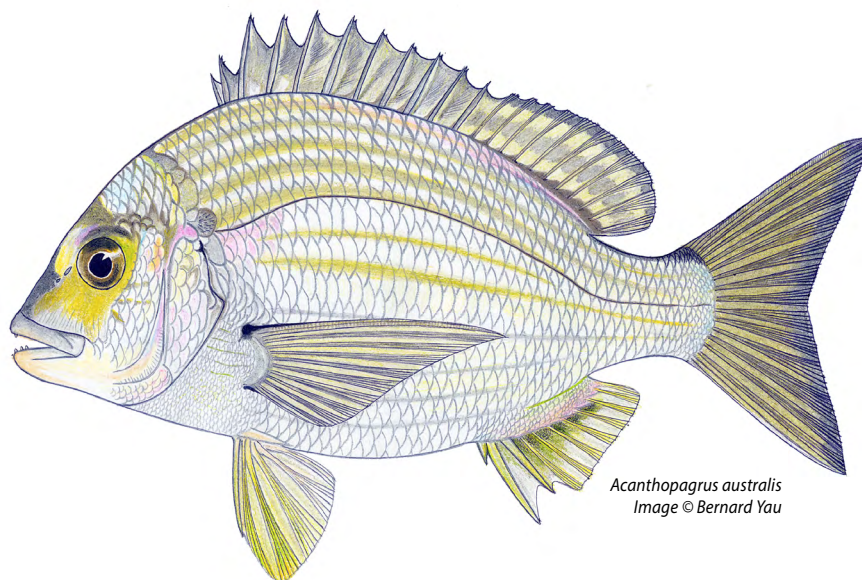
Author John Stewart

EXPLOITATION STATUS FULLY FISHED

A long history of stable commercial catch rates in both the estuarine and oceanic fisheries, consistent size compositions through time and recent age compositions indicating that fishing mortality is similar to natural mortality has resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Acanthopagrus australis</i>	Yellowfin Bream	
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Background

Yellowfin Bream (*Acanthopagrus australis*) are endemic to Australia and occur from Townsville in Queensland to the Gippsland lakes Victoria. In NSW waters, Yellowfin Bream are found primarily within estuaries and along nearshore beaches and rocky reefs, although they also occur within the lower freshwater reaches of coastal rivers. Within estuaries, Yellowfin Bream are found in association with all types of habitat, including seagrass beds, mangroves, bare substrates and rocky reefs. They eat a wide variety of foods, including small fish, molluscs, crustaceans and worms.

The timing of spawning of Yellowfin Bream varies along the east coast of Australia. They have been reported to spawn from winter to summer in southern NSW and mainly during winter in southern Queensland (Pollock, 1982). There is a pre-spawning run of fish from estuaries to the ocean in NSW usually between April and July. Spawning occurs in inshore waters near estuary entrances. The larvae enter estuaries and the small juveniles

subsequently live in sheltered shallow water habitats (particularly seagrass beds and mangrove channels). Larger juveniles occur in slightly deeper waters, and are particularly common around estuarine and near shore coastal reefs. Yellowfin Bream grow slowly, taking about 5 years to reach 23 cm fork length (FL). They mature at around 22 cm and appear to undertake extensive pre-spawning migrations. Maximum length is about 55 cm FL and maximum weight about 3.7 kg. Adults may return to estuarine waters after spawning.

The majority of bream taken in the Estuary General Fishery are caught in mesh and hauling nets with a smaller number taken in fish traps. The highest commercial catches of bream occur in autumn and winter. Reported commercial landings of bream declined substantially during the 1990s; however this was due to declines in effort and the phasing out of the pound (figure six) nets in Port Stephens and adjoining coastal waters. Yellowfin Bream are also taken in very large quantities by recreational fishers.

Black Bream (*Acanthopagrus butcheri*) is a similar species to Yellowfin Bream and is found in estuarine waters on the NSW coast south of Myall Lakes. They are almost exclusively found in estuarine waters, and generally only enter ocean waters after periods of flood. Black Bream are often reported as Yellowfin Bream during catch reporting, as distinguishing the species by visual examination can be very difficult. The differentiation between the species is made more difficult through a significant percentage of hybrids that exist as a result of the two species interbreeding.

Additional Notes

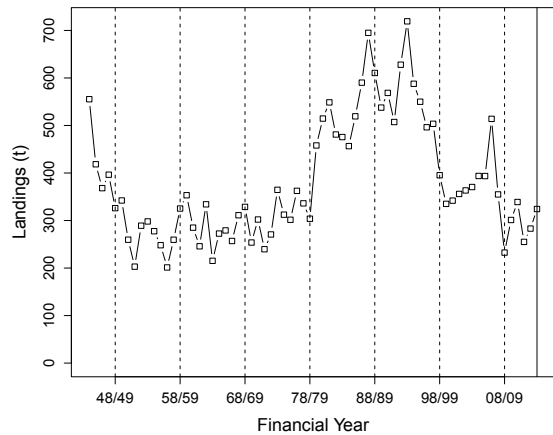
- Estuarine and ocean catch rates of Yellowfin Bream have remained relatively stable.
- The sizes of Yellowfin Bream in commercial landings have been stable since the 1950s.
- Surveys of recreational fishing showed no changes in the sizes of Yellowfin Bream retained in Lake Macquarie through time.
- The most recent age composition data for Yellowfin Bream (2009/10) indicated that natural mortality was similar to fishing mortality.
- The Eastern Australian biological stock of Yellowfin Bream has been assessed as a Sustainable Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal length of 25 cm total length (approximately 22.5 cm FL) for bream in NSW and a combined recreational bag limit of 10 for all bream and tarwhine combined.

Catch

Recreational Catch of Yellowfin Bream

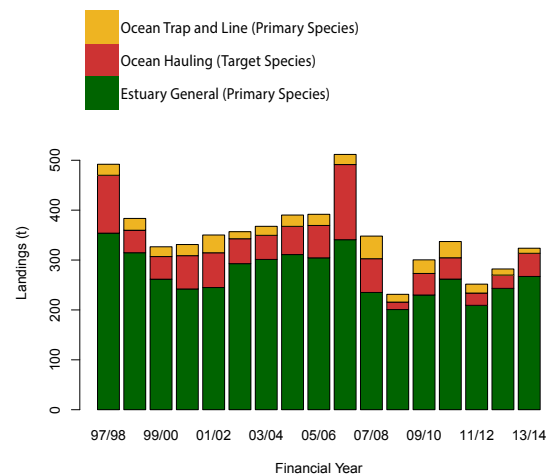
The most recent estimate of the recreational harvest of bream (all species combined) in NSW was approximately 614,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 1.5 million fish (in the order of 940 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Yellowfin Bream



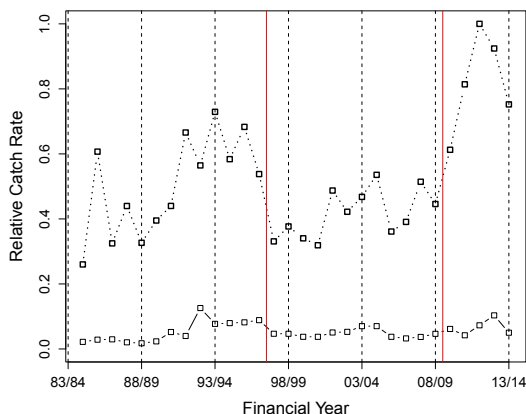
Commercial landings (including available historical records) of Yellowfin/Black Bream for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Yellowfin Bream



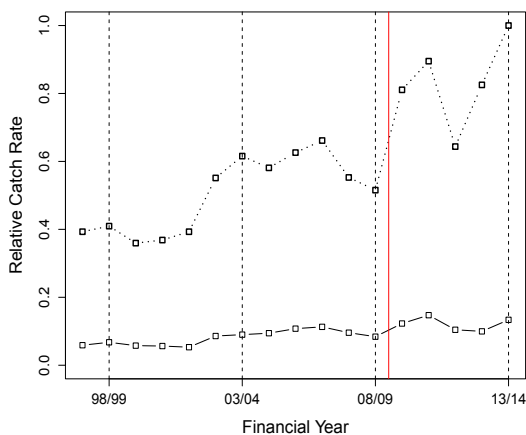
Reported landings of Yellowfin Bream by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Yellowfin Bream Harvested by Fish Trapping in NSW



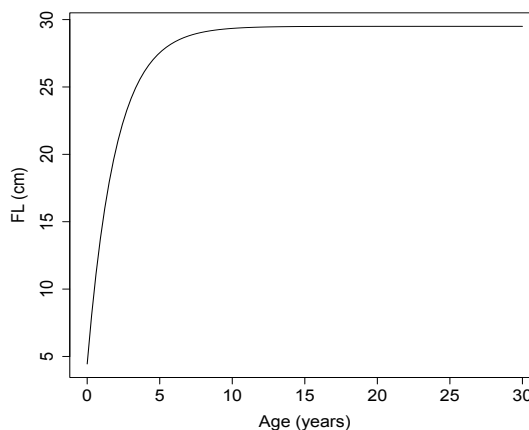
Catch rates of Yellowfin Bream harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Catch Per Unit Effort Information of Yellowfin Bream Harvested by Mesh-Netting in NSW



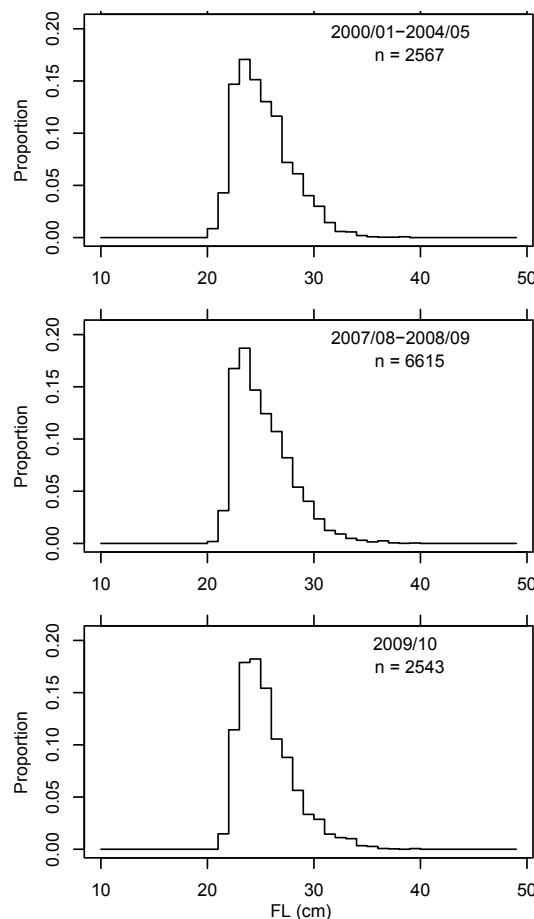
Catch rates of Yellowfin Bream harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Growth Curve of Yellowfin Bream



Growth curve for Yellowfin Bream using parameters from Pollock (1982). Lengths are presented as fork length (FL).

Length Frequency of Yellowfin Bream



The length distribution of NSW commercial landings of Yellowfin Bream has been stable and comprises fish mainly between 22-35 cm fork length (FL). The minimum legal length for bream in NSW is 25 cm total length (TL), approximately 22.5 cm FL.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/>, and search for the species code (CAAB) 37 353004 and 37 353003, common name or scientific name to find further information about the species.



Department of
Primary Industries

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2015). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Yellowfin Tuna

(*Thunnus albacares*)

Author Ashley Fowler

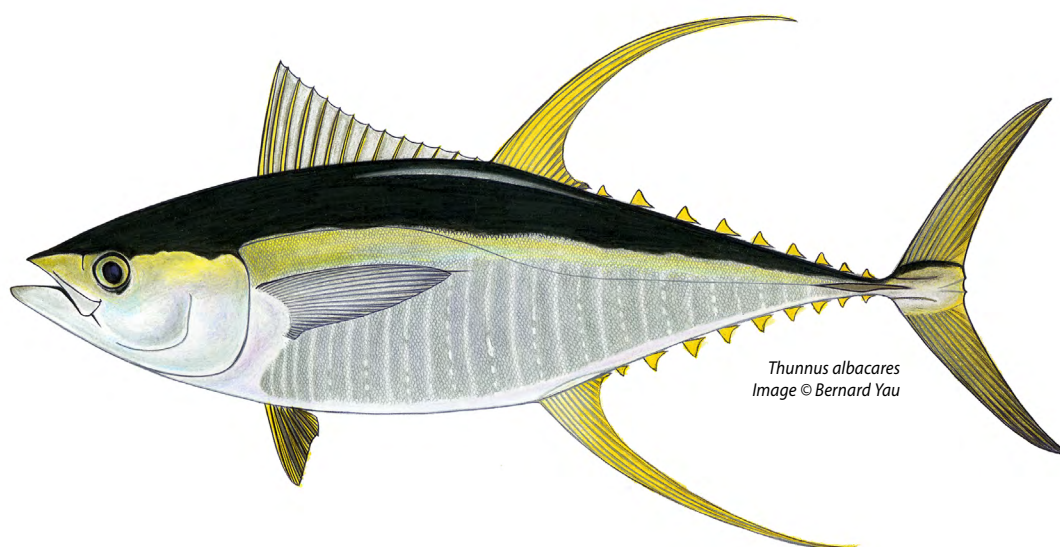
EXPLOITATION STATUS FULLY FISHED

Mainly a Commonwealth fishery off eastern Australia, with some uncertainty about the degree of overlap with the much larger western and central Pacific stock. The NSW exploitation status has been adapted from the Commonwealth assessment of not overfished and overfishing not occurring but there is some concern about high rates of fishing in the western and central Pacific.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Thunnus albacares

Yellowfin Tuna



Background

Yellowfin Tuna (*Thunnus albacares*) are distributed throughout the warm-temperate and tropical waters of all oceans living in temperatures between 15-31°C. They are a highly migratory, pelagic species that prefer open oceanic waters although they are occasionally caught in deep bays and harbours. Yellowfin Tuna form large schools, primarily by size, which are often associated with floating debris such as logs. In the central Pacific, the larger fish frequently school with dolphins and it was this behaviour that led to high dolphin mortality during the early years of the purse seine fishery for Yellowfin Tuna; subsequent changes in fishing procedures have greatly reduced the dolphin mortality. It is a highly migratory species that regularly travels long distances and genetic studies have found that Yellowfin Tuna from all oceans share a common gene pool.

Yellowfin Tuna are fast growing fish, with females reaching 5 kg by the end of their first year and

maturity after about 2 years at 25 kg. Maximum size is in excess of 200 cm (fork length, FL) and 175 kg, but on the east coast of Australia, Yellowfin Tuna are commonly 50-190 cm in length and 4-100 kg in weight. Spawning occurs through most of the year in water temperatures greater than 26°C, with females shedding eggs every 1-2 days over a period of several months; during a single spawning season, an individual can produce up to 1,500,000 eggs. Yellowfin Tuna are opportunistic carnivores, feeding on small fish, crustaceans and squids.

Worldwide, about one million tonnes of Yellowfin Tuna are harvested annually making it one of the most important fishery resources of the world. The total Australian catch is comparatively small (~ 2000 t per annum) and although Yellowfin Tuna are found around the whole Australian coast, most of the catch is taken off NSW and Queensland in

the Commonwealth managed East Coast Tuna and Billfish Fishery. Yellowfin Tuna is an excellent eating fish that is sold frozen, canned, fresh, and smoked, and is highly valued for sashimi.

In recent years, the NSW Yellowfin Tuna catch has been less than 10 t per year, with almost all taken by line-fishing methods in the Ocean Trap and Line Fishery. The species is also a popular gamefish and it is likely that the recreational fishery lands far more Yellowfin Tuna than the commercial fishery.

Additional Notes

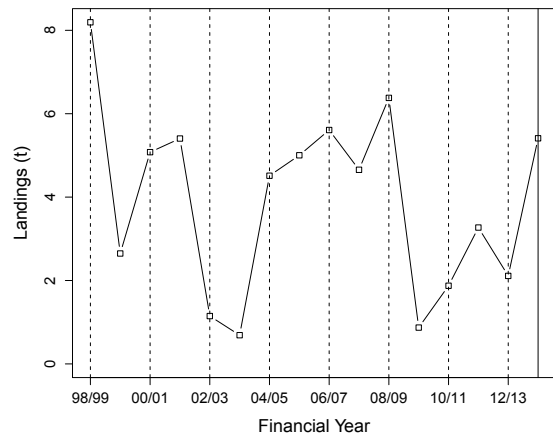
- NSW commercial landings are very small (< 10 t) compared with Commonwealth Eastern Tuna and Billfish Fishery (approximately 2,000 t per annum).
- Recreational landings off NSW are significant.
- Commonwealth assessment processes for the Eastern Tuna and Billfish Fishery consider this species to be not overfished (40-50% of unfished biomass) and not subject to overfishing.
- There is a combined recreational bag limit of 5 fish under 90 cm total length (TL) and 2 fish over 90 cm TL for all tuna species.

Catch

Recreational Catch of Yellowfin Tuna

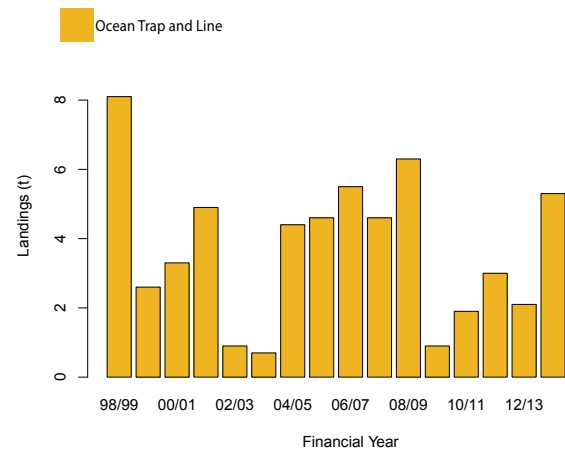
There is no robust estimate of the recreational harvest of Yellowfin Tuna in NSW. The annual recreational harvest of Yellowfin Tuna in NSW was previously estimated to lie between 50 and 350 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Yellowfin Tuna



Commercial landings (including available historical records) of Yellowfin Tuna for NSW from 1998/99 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Yellowfin Tuna



Landings of Yellowfin Tuna by NSW commercial fisheries from 1998/99. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 441002, common name or scientific name to find further information.



Yellowtail Kingfish

(*Seriola lalandi*)

Author John Stewart

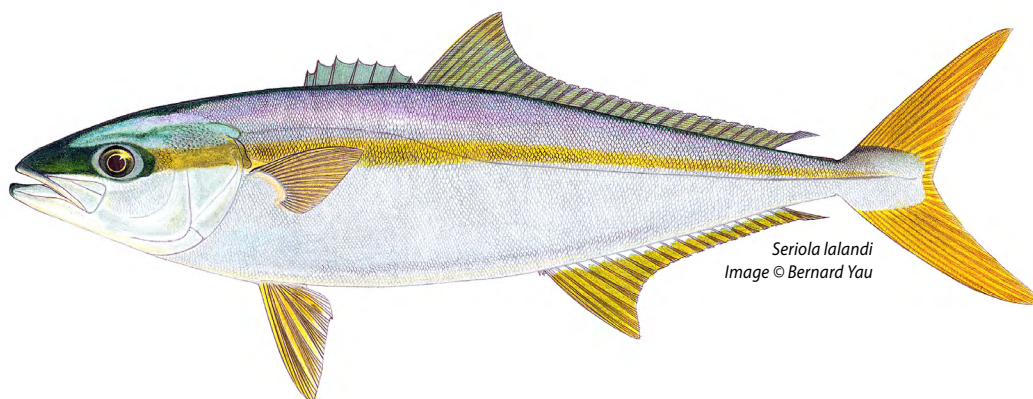
EXPLOITATION STATUS **GROWTH OVERFISHED**

There are some concerns for this stock due to declines in total landings across sectors, variable catch rates and few larger fish in landings. A lack of recent age composition and fishing mortality estimates is limiting assessment of the Yellowtail Kingfish stock. Yield per recruit analyses indicate that yield from the Yellowtail Kingfish stock would be increased by increasing the size at first capture and/or by reducing fishing mortality and has resulted in a status of Growth Overfished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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Seriola lalandi

Yellowtail Kingfish



Background

Yellowtail Kingfish (*Seriola lalandi*) are distributed throughout temperate waters of the Pacific and Indian Oceans. In Australian waters they are distributed from southern Queensland to central WA, including the east coast of Tasmania, and around Lord Howe and Norfolk islands. Recaptured tagged Yellowtail Kingfish have shown extensive movements along the northeast coast of Australia and between Australia and New Zealand, suggesting that the east coast population is well mixed. The most recent genetic evaluation of stock structure indicated separate east and west coast Australian populations. Kingfish are opportunistic daytime feeders with fish, squid and crustaceans forming a large part of their diet.

Kingfish are spring-summer spawners with pelagic eggs that are about 1.4 mm in diameter. The estimated size at which 50% of females and males are sexually mature is around 83 cm and 47 cm FL respectively. For males, this size at maturity occurs at an age of less than 1 year old.

Larval kingfish hatch within 2-3 days at 4 mm in length. Schools of juvenile kingfish can be found in offshore waters around the continental shelf and solitary or small groups of adults can be found near rocky shores, reefs and islands. Growth is rapid, being nearly linear between 1 and 11 years old, with fish reaching the 65 cm minimum legal length (MLL) at around 2-3 years of age. Yellowtail Kingfish can attain about 190 cm in total length (TL) and can weigh up to 70 kg. The maximum age is thought to be in excess of 21 years.

Kingfish is an important commercial and recreational target. The Ocean Trap and Line Fishery (utilizing line fishing methods) reports about 99% of the total catch in the commercial sector. The commercial harvest of kingfish decreased from around 600 t in the mid-late 1980s to around 100 t in the late 1990s. A 60 cm MLL was imposed for Kingfish in NSW waters in 1990, and kingfish traps were banned in 1996. In September 2007 the MLL for Yellowtail Kingfish in NSW was increased further from 60 cm to 65 cm TL.

Additional Notes

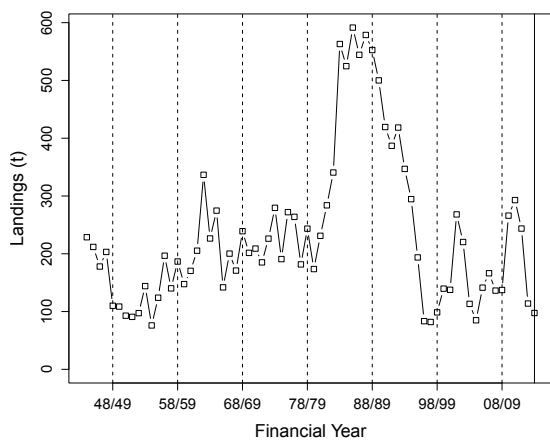
- Monitoring of commercial catches shows little change in the size range of fish being landed, with the majority of the catch being of immature sizes.
- High rates of recaptures of tagged fish suggest ongoing high levels of exploitation.
- Commercial landings have fluctuated substantially between years during recent times.
- Commercial catch rates have varied through time, partly due to changes in reporting requirements, however the 2 most recent years show a substantial decline.
- The Eastern Australian biological stock of Yellowtail Kingfish has been assessed as an Undefined Stock in the *Status of Key Australian Fish Stocks Reports 2014*.
- There is a minimum legal length of 65 cm total length and a recreational bag limit of 5 Yellowtail Kingfish in NSW.

Catch

Recreational Catch of Yellowtail Kingfish

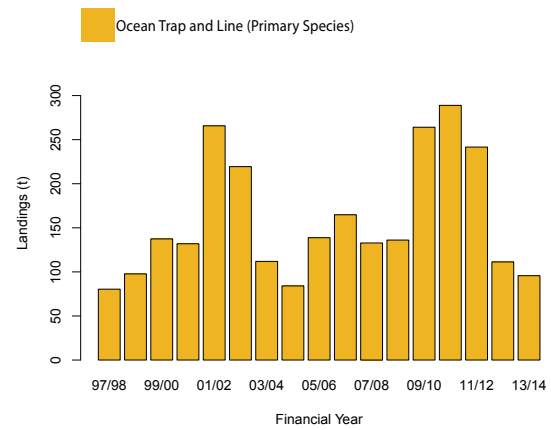
The most recent estimate of the recreational harvest of Yellowtail Kingfish in NSW was approximately 35,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 58,000 fish (in the order of 170 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Yellowtail Kingfish



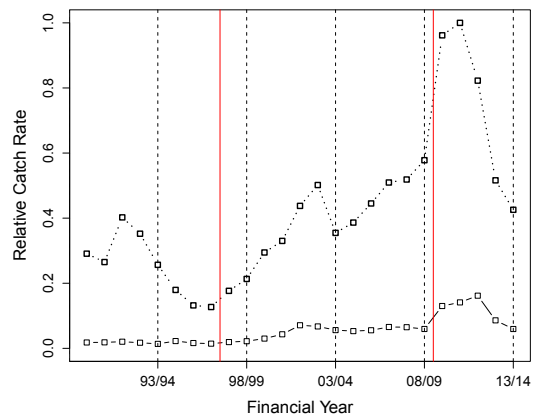
Commercial landings (including available historical records) of Yellowtail Kingfish for NSW from 1944/45 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Yellowtail Kingfish



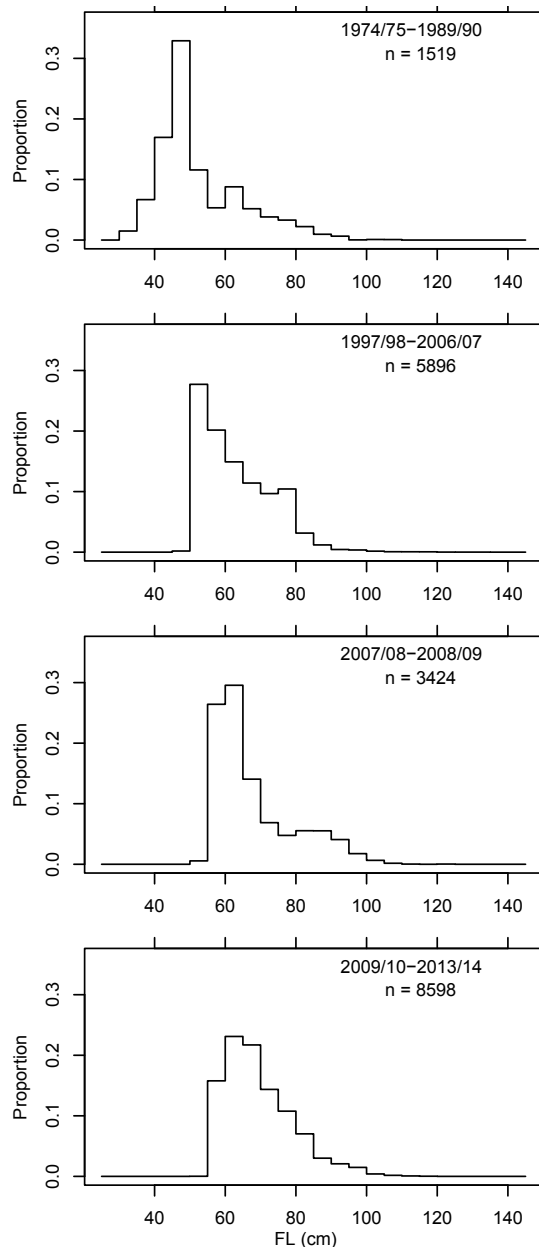
Reported landings of Yellowtail Kingfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Yellowtail Kingfish Harvested by all Lining Methods in NSW



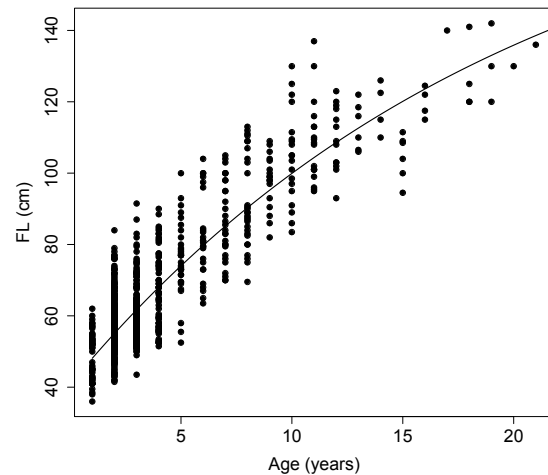
Catch rates of Yellowtail Kingfish harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). The red lines indicate years when reporting requirements changed. In 2009/10 fishing effort reporting requirements changed substantially and relative catch rates before and after this time may not be directly comparable. Relative catch rates may not be robust indicators of abundance and caution should be applied when interpreting these results.

Length Frequency of Yellowtail Kingfish



The length distribution of NSW commercial landings of Yellowtail Kingfish mainly comprises fish between 50-100 cm fork length (FL). The range of sizes has remained relatively consistent however the shapes of the distributions have varied between years. A minimum legal length (MLL) of 60 cm total length (TL) (approximately 52 cm FL) was introduced in 1990 and increased to 65 cm TL (approximately 57 cm FL) in September 2007.

Growth Curve of Yellowtail Kingfish



Growth curve for Yellowtail Kingfish using parameters from Stewart *et al.*, (2004). Lengths are presented as fork length (FL).

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- Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 337006, common name or scientific name to find further information.



Yellowtail Scad

(*Trachurus novaezelandiae*)

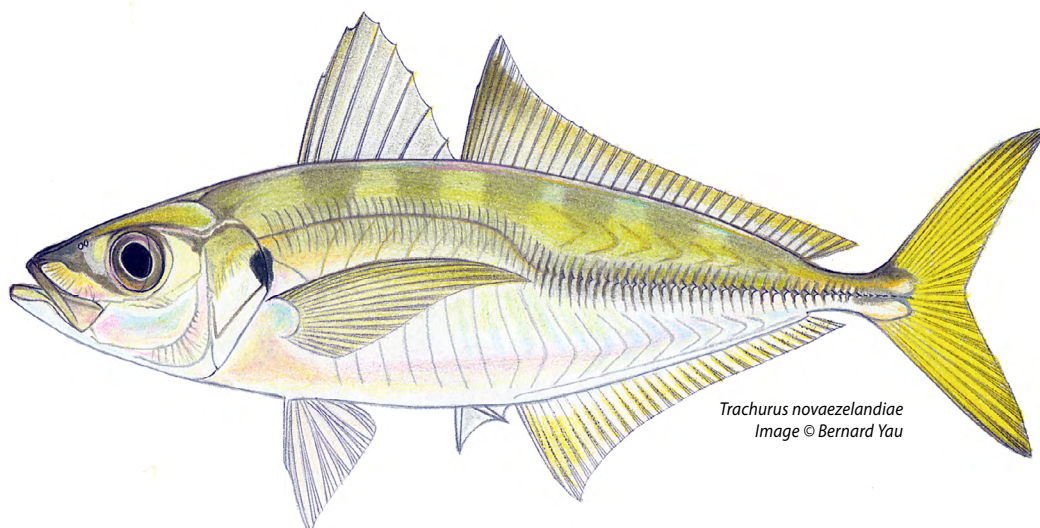
Author John Stewart

EXPLOITATION STATUS FULLY FISHED

A relatively long-lived small pelagic species which is fished throughout its distribution. Recent declines in average sizes landed have caused some concerns for the stock, however age composition data indicating that fishing mortality was similar to natural mortality have resulted in a status of Fully Fished.

SCIENTIFIC NAME	STANDARD NAME	COMMENT
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<i>Trachurus novaezelandiae</i>	Yellowtail Scad	
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Trachurus novaezelandiae
Image © Bernard Yau

Background

Yellowtail Scad (*Trachurus novaezelandiae*) occur around southern Australia from Queensland to Western Australia, and off New Zealand. The species inhabits coastal waters and the lower reaches of estuaries. Little is known of the stock structure of Yellowtail Scad. Adults are frequently associated with rocky reefs, while juveniles commonly occur over shallow, soft substrate and around structures such as wharves.

In NSW waters, Yellowtail Scad grow to a maximum length of about 35 cm and age of 22 years, while in New Zealand, the species reaches 40 cm and an age of 28 years. NSW Yellowtail Scad mature at approximately three years old and 20-22 cm fork length, and spawning occurs in summer and autumn.

In NSW, Yellowtail Scad are mainly caught by the Ocean Hauling Fishery in purse seine nets. Smaller quantities are also taken in bait nets (which are modified hauling nets) and general purpose hauling nets. Small quantities are also landed by trawlers but much of the trawl-caught Yellowtail Scad is discarded. Catches are taken throughout the year, with slightly higher catches in summer and autumn. Yellowtail Scad is a very significant species in recreational catches, and is often caught for use as bait by both recreational and commercial fishers. They are also an important bait species taken under permit for the Commonwealth longline fleet.

Additional Notes

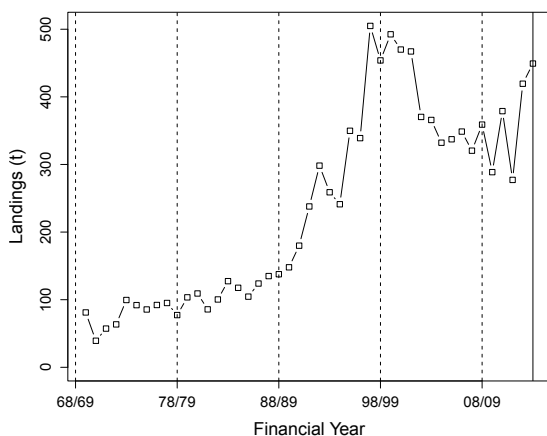
- Slight declines in average sizes landed in recent years are of some concern.
- Yellowtail Scad are relatively long-lived for a small pelagic species and have been aged to 22 years old in NSW.
- Age-based monitoring of the purse-seine sector shows that the fishery generally exploits fish between 3-15 years old.
- Strong and weak year classes are evident within the age compositions.
- Age compositions indicate that fishing mortality is similar to natural mortality.
- Yellowtail Scad are a permitted by-catch species under the Commonwealth Small Pelagic Fishery, however landings are minor.

Catch

Recreational Catch of Yellowtail Scad

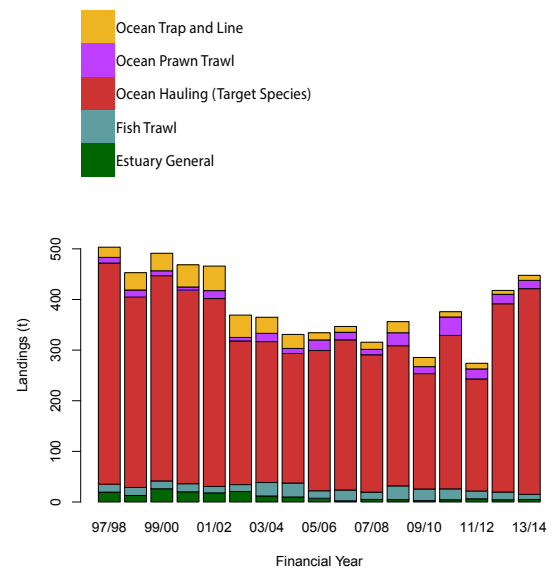
The most recent estimate of the recreational harvest of Yellowtail Scad in NSW was approximately 90,000 fish during 2013/14 (West *et al.*, 2015). This estimate is substantially lower than the previous estimate of approximately 160,000 fish (in the order of 32 t) based upon the results of the offsite National Recreational and Indigenous Fishing Survey in 2000/01 (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI.

Historical Landings of Yellowtail Scad



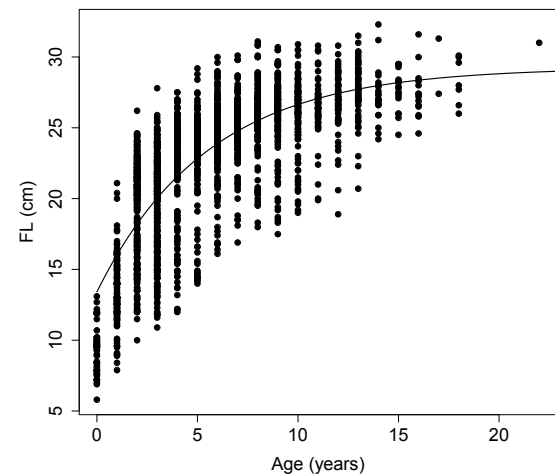
Commercial landings (including available historical records) of Yellowtail Scad for NSW from 1969/70 to 2013/14 for all fishing methods.

Landings by Commercial Fishery of Yellowtail Scad



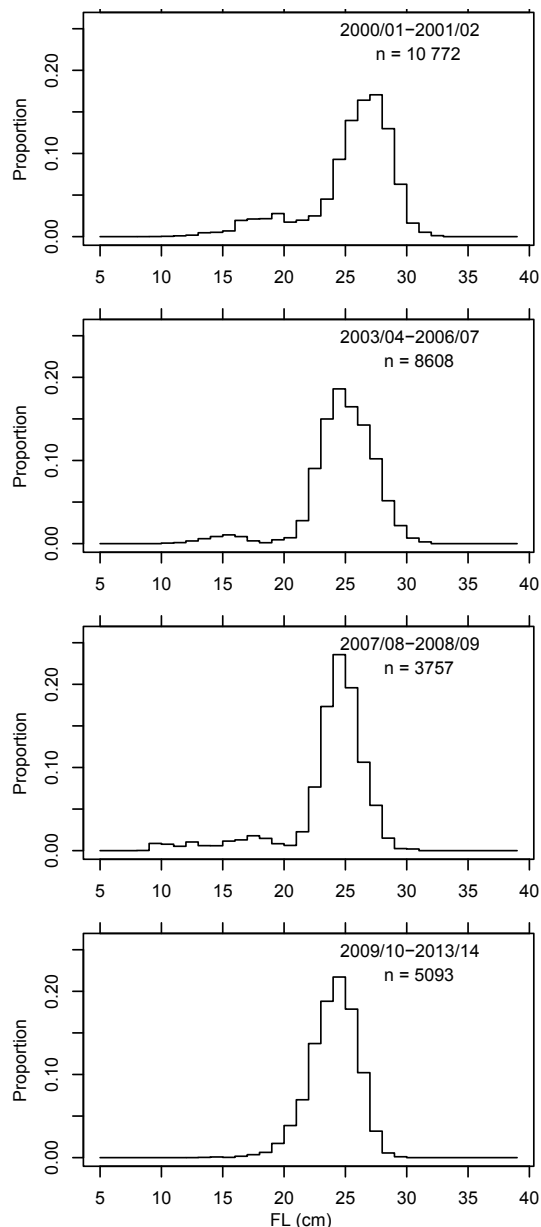
Reported landings of Yellowtail Scad by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Growth Curve of Yellowtail Scad



Age-length data with fitted growth curve for Yellowtail Scad (internal data). Lengths are presented as fork length (FL).

Length Frequency of Yellowtail Scad



The length distribution of Yellowtail Scad landed by NSW commercial purse seine fishers generally consists of fish between 20-30 cm fork length (FL). There has been a slight decline in average size since 2006/07 from approximately 25 cm to 24 cm FL. There is no minimum legal length for Yellowtail Scad in NSW.

Further Reading

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Please visit the CSIRO website, <http://www.marine.csiro.au/caab/> and search for the species code (CAAB) 37 337003, common name or scientific name to find further information.



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