

URANOSCOPIDAE: STARGAZERS



The Uranoscopidae is a family of mostly marine-dwelling fishes, distributed in warm and temperate waters of the Atlantic, Indian, and Pacific oceans (Kishimoto, 2001; Froese and Pauly, 2012). Currently, there are about 53 named species in the family (Froese and Pauly, 2012), and at least 20 of these occur in Australian waters, plus several unnamed species (CSIRO, 2012).

Members of the family Uranoscopidae are bottom-dwelling, and many bury in the substrate with just their eyes exposed, particularly during daylight. Stargazers have a large head encased in sculptured bones; a cavernous, vertical mouth; a large (often venomous) spine above the pectoral fin base, and most species have eyes that are directed upward (Gomon, in Gomon et al., 1994; Kuitert, 1996a; Kishimoto, 2001). Stargazers are “ambush predators” that lie almost buried in seafloor sediments, and wait for passing food, which is grabbed using the large, protrusible jaws, and consumed whole. In southern Australia, Stargazer species eat mainly bony fish, but cephalopods and benthic crustaceans also form part of the diet. Predators of stargazers include Australian and Fur Seal and New Zealand Fur Seal (e.g. Page et al., 2005).

Although Stargazers are benthic species, they have a pelagic juvenile stage. Most stargazer species settle back to the bottom at a very small size; however the deep-water species *Pleuroscopus pseudodorsalis* (Scaled Stargazer or Purple Stargazer) is pelagic at a larger size, and settles to a benthic existence when about 28cm long. During the pelagic phase, *P. pseudodorsalis* is a square-shaped fish, with spiked scales and horn-like head ridges, and eyes on the side of the head. In southern Australia, the pelagic stage has been caught hundreds of metres above the sea floor, by long-line fishing. Upon settling, Scaled Stargazers become flabby adult animals with embedded scales, no spikes, and eyes on the top of the head (Kishimoto et al., 1988, and research by Gomon and Last, cited by National Oceans Office, 2003).

Stargazer genera in southern Australia include *Ichthyoscopus*, *Kathetostoma*, and *Pleuroscopus*. Within the genus *Kathetostoma*, the Common Stargazer is considered to have a broad distribution across southern Australia (pending further study of the species), whilst the Speckled or Western Stargazer *K. canaster* is found mainly in south-eastern Australia, and the Deepwater Stargazer *K. nigrofasciatum* occurs mainly in south-western Australia. South Australia represents the western and eastern edge of the respective distributions of *K. canaster* and *K. nigrofasciatum*.

Commercial Fishing

When taken outside of 3 nautical miles (NM) from the coast, catches of stargazers are managed by the Commonwealth. States manage catches taken inside 3 NM (AFMA, 2002a).

In south-eastern and southern Australia, species taken in fisheries bycatch include the variously named Scaled, Purple or Deep-sea Stargazer (*Pleuroscopus pseudodorsalis*); the Western or Speckled Stargazer *Kathetostoma canaster* (which are marketed as “monkfish”); the Bulldog Stargazer *Gnathagnus innotabilis* (caught in south-eastern Australia, with some retained and some discarded) and the smaller *K. nigrofasciatum* (Deepwater Stargazer) which is discarded (AFMA, 2002a; Brown and Knuckey, 2002; Wayte et al., 2004; C.H. Smith Marine, 2004).

In New Zealand, the Stargazer *Kathetostoma giganteum* is a commercial resource. During the past decade to 2004, the annual quota has ranged between 4,973t and 5,117t, and the catch ranged between 2,132t and 4,146t (New Zealand Ministry of Fisheries, 2005a). Concern has been expressed by a conservation organisation in New Zealand (Royal Forest and Bird Protection Society of New Zealand Inc.) that the fishery for *K. giganteum* is environmentally unsustainable, and this species has recently been listed in the “Red” category (i.e. to be avoided) in the *Best Fish Guide*, a consumer guide to environmentally responsible fish consumption. The main concerns expressed with regard to fishing *K. giganteum* were reported to be: “the unknown sustainability of some catch levels and limits; the habitat destruction caused by bottom trawling; the uncertainty over stock boundaries; the absence of quantitative stock assessments for any areas, and the lack of a management plan (Weeber and Szabo, 2004).

A number of species found in the continental shelf waters of South Australia are discussed below, due to their benthic existence, strong site association, possibly low resilience to exploitation, and potential vulnerability of populations to direct impacts (from fishing) or indirect impacts (e.g. benthic habitat damage).

Fringed Stargazer / Fringe Stargazer

Family Name:	Uranoscopidae
Scientific Name:	<i>Ichthyoscopus barbatus</i> Mees, 1960
Recommended Status in South Australia:	Data Deficient
Rationale:	<i>Although the Fringed Stargazer may have a broad geographic range, it is included here because the species (i) is a benthic, site-associated fish in sand habitats of the upper continental shelf; it may be susceptible to localised impacts, and may have a relatively low resilience to exploitation; (iii) is a bycatch (and minor by-product) species in some commercial fisheries, and is caught occasionally by recreational fishers, with no Commonwealth – or State-level controls over capture (other than voluntary restrictions by at least one fishing club in W.A.); (v) there are inadequate data on the geographic distribution, relative abundance (including the S.A. part of the range), biology (e.g. reproduction, and longevity), and population dynamics; (v) there are insufficient data on the commercial bycatch and recreational take, and inadequate information on the nature and extent of threatening processes, particularly potential population impacts of fishing.</i>

Current Conservation Status

- (No listings known)

Distribution

Southern Australia

- Gomon (in Gomon et al., 1994, and pers. comm., 2006) reported a disjunct distribution, with two separate populations for the Fringed Stargazer *I. barbatus*: one in New South Wales, and the other from the gulfs region in South Australia through to southern Western Australia. According to M. Gomon (Museum of Victoria, pers. comm., 2006), the two populations may be the same species. Hutchins (in Hutchins and Thompson, 1983, 2001, and Hutchins and Swainston, 1986, 2001), excluded the N.S.W. population, and reported the distribution of this species to be Port Lincoln in S.A. through to Rottnest Island in Western Australia. B. Hutchins (W.A. Museum, pers. comm., 2006) considers that the eastern and western populations of *I. barbatus* might be separate species, but more work is required.
- It is noted that most records from southern Australian museums that are reported to be this species, are specimens from N.S.W. (Australian Museum records, Museum of Victoria record, cited in OZCAM database, 2007).

South Australia

- There are few published records from South Australia, and these are from the western part of the State. Examples include Port Lincoln area (Gomon, in Gomon et al., 1994; Hutchins and Swainston, 2001); Hardwicke Bay, other parts of south-eastern Spencer Gulf, and the central part of southern Spencer Gulf (Currie and Sorokin 2010); and the Great Australian Bight (CSIRO Marine Research data 1973, cited in CSIRO, 2007). There is also a museum record of a specimen collected in the Israelite Bay area of W.A., near the W.A. / S.A. border (CSIRO Marine Research record CA480, 1978).

Habitat

- The Fringed Stargazer is found on sandy bottom (including areas adjacent to reefs), often in shallow, protected waters (Hutchins and Swainston, 1986, 2001; Edgar, 2008).
- The species has a relatively narrow depth range on the continental shelf, from the shallow subtidal to about 50m deep (May and Maxwell, 1986, cited in Froese and Pauly, 2007; CSIRO Marine Research records and Australian Museum records, cited in OZCAM database, 2004 and CSIRO, 2007); however there is a museum record of a specimen, reported to be *I. barbatus*, collected from 60m – 64m, near the S.A. / W.A. border (CSIRO *Lira* survey data, 1973, cited in CSIRO, 2007).

Notes on Biology and Behaviour

- The Fringed Stargazer grows to about 41cm (May and Maxwell, 1986, cited in Froese and Pauly, 2007; Hutchins and Swainston, 1986, 2001; Gomon, in Gomon et al., 1994).
- The species grows to at least 1.54kg, which is one of the record sizes reported to date (Hutchins and Swainston, 1986), being a specimen taken in 1982 from Eagle Bay in W.A. (Australian Anglers Association – WA Division, 2002a).
- The species buries itself on the sea floor, in sandy habitats (Hutchins and Swainston, 1986).
- Stargazer species are ambush feeders that lie camouflaged in benthic sand and wait for prey.

Fisheries Information

Commercial

- The Fringed Stargazer is reported to be trawled in some parts of southern Australia (Hutchins and Swainston, 1986, 2001). The species is not targeted, but has been recorded as a component of the bycatch of fisheries, such as the Commonwealth-managed SESSF – Southern and Eastern Scalefish and Shark Fisheries, which includes the South East Trawl Fishery (SETF) (AFMA, 2002a). Stargazer bycatch is not recorded to species' level in fishers' logbooks in the SETF. Large quantities of unspecified stargazer species (which may include Fringed Stargazer, amongst others) are recorded in fishers' logbooks as bycatch. For example, in 2000/01, fishers' logbooks recorded about 86t of stargazers in the bycatch of the SETF (AFMA, 2002a); however it is probable that only a small proportion of the stargazer catch comprised *Ichthyoscopus barbatus*. It is noted that during an Integrated Scientific Monitoring Program, low quantities of *I. barbatus* were recorded in the otter trawl sub-fishery of the SETF (i.e. recorded only in 2 shots, with 1kg per shot retained, and 500g per shot discarded) (Wayte et al., 2004).

Recreational

- In some areas, such as southern W.A., the species is occasionally taken by hook and line on sandy bottoms adjacent to reefs, in shallow coastal waters (Hutchins and Swainston, 1986, 2001; Gomon, in Gomon et al., 1994).
- Some recreational fishing clubs and associations keep records of the maximum sizes caught (e.g. Australian Anglers Association – W.A. Division). One fishing club from W.A. has rules for its members regarding the minimum size (25cm) and number (i.e. 1 per day) of Fringed Stargazers that may be taken by recreational fishing (e.g. see Melville Amateur Angling Club, 2003). It is noted that Fringed Stargazer is an unlisted species in the State fishing regulations in W.A., and in 2006 the daily bag limit for any unlisted species was 16 fish.
- Species-specific data on the recreational catch of stargazers is not available for this report; however it is noted that the recent National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) reported that 1,782 Stargazer specimens were caught and kept by recreational fishers during the survey time period (May 2000 to April 2001), comprising 932 from Queensland, and 850 from New South Wales. The numbers discarded were not recorded, nor were statistics on catches from the southern Australian states.

Vulnerable Characteristics of the Species

- Fringed Stargazer is a member of the Uranoscopidae, a family of strongly site-associated, benthic fishes of limited mobility, and probably limited dispersal ability. The strong site association of Uranoscopidae fish makes them vulnerable to site-specific benthic impacts, such as trawling and dredging.
- Fringed Stargazer has a relatively narrow depth range, known to date from the shallow subtidal to about 50m deep.
- Previously, Froese and Pauly (2004) reported the Fringed Stargazer to have a low resilience to exploitation in terms of minimum population doubling time (based on preliminary age and growth estimates). The assumed level of resilience has since been changed to "medium" (Froese and Pauly, 2007); however the vulnerability of populations of fish in Uranoscopidae to over-exploitation is noted here.

- A draft ecological risk assessment of the South East Trawl and Danish Seine Fishery (Wayte et al., 2004), listed Fringed Stargazer as a “medium risk” species, i.e. one of the species that is susceptible to population impacts from trawling.

Threatening Processes

- Trawling is likely to be a threatening process (see above), but more information is required. No data are available about the change over time in the abundance of this species in the bycatch of trawl fisheries, nor are there any other indirect (or direct) measures of potential impact on populations.
- Localised benthic impacts, such as trawling, dredging and sand removal, may adversely affect populations of shallow-water stargazer species, but there are no specific data.

Research and Management Requirements

- More information is required on the geographic distribution (the entire range, and the distribution within S.A.), relative abundance, biology and population dynamics of this species.
- There is inadequate information on the nature and extent of threatening processes, particularly potential population impacts of fishing. In particular, more information is required on the bycatch in commercial fish and prawn trawl fisheries (both Commonwealth- and State-managed).
- Quantification of Stargazer bycatch (to species’ level) in fisheries over space and time is recommended, and measures to reduce the bycatch of benthic species such as Stargazers are required, where possible.
- Species-specific recreational catch statistics are lacking, and stargazer species are generally not targeted by recreational fishers. Nevertheless, given the potential for populations of Uranoscopid fishes to be affected by fishing, catch limits are required for recreational fishing of shallow water stargazer species.

Deepwater Stargazer / Blackbanded Stargazer

Family Name:	Uranoscopidae
Scientific Name:	<i>Kathetostoma nigrofasciatum</i> Waite and McCulloch, 1915
Recommended Status in S.A.:	<i>Data Deficient, possibly Near Threatened</i>
Rationale:	<i>although the Deepwater Stargazer has a broad depth range, it is included here because (i) it has a limited geographic distribution in southern Australia, being found in southern W.A. and western S.A., the latter of which may be the eastern edge of the range; (ii) it is a benthic, site-associated, and probably long-lived fish species, with limited mobility and possibly limited dispersal ability, and thus may be vulnerable to site-specific benthic impacts; (iii) it is a frequently recorded, discarded bycatch species in the Great Australian Bight Trawl Fishery, and might also be part of the discarded bycatch in other trawl fisheries, but there are no restrictions on capture, and little assessment of population impacts has been undertaken to date; (iv) there is little information on the nature and extent of threatening processes, but it is important to note that the species is considered to be at high risk of population impact from trawl capture in the GAB; and (v) it is one of the species in Uranoscopidae for which there is little information on the habitat requirements, relative abundance, biology (particularly reproduction, and longevity), or population dynamics.</i>

Current Conservation Status

- (No listings known)

Distribution

Southern Australia

- The Deepwater Stargazer is found in western S.A. and southern W.A., with the reported distribution ranging from the eastern end of the Great Australian Bight (GAB), through to Rottnest Island (Gomon, in Gomon et al., 1994).

- Williams et al. (2001) characterised *K. nigrofasciatum* as one of the indicator species in “a southern community of the well-defined (continental) shelf break community” in south-western Australia, which contains a number of Flindersian (warm temperate southern Australian) species that occur mainly between 200m and 400m depth, and extend northwards to about 28° S latitude.

South Australia

- In S.A., the species has been recorded mainly in the deeper mid and outer continental shelf waters across the GAB, from the western side of Eyre Peninsula, through to the W.A. border, and there is also a record from deeper waters off western Kangaroo Island (Brown and Knuckey, 2002; CSIRO Marine Research records, SA Museum records, Museum of Victoria records, cited in CSIRO, 2007 and OZCAM database, 2007). There are isolated and unverified museum records from other parts of S.A. reported to be *K. nigrofasciatum*, all in shallower waters, including one from 2 nautical miles off Outer Harbour in north-eastern Gulf St Vincent (1953), and two records from near Wallaroo in eastern Spencer Gulf, collected in 1894 and identified in 1932 (S.A. Museum records F02783, F01742 and F01743, cited in OZCAM database, 2007). There is also one unverified record from off Rapid Bay (Australian Anglers Association, 2005).

Habitat

- The Deepwater Stargazer is a benthic species in deeper waters, on the mid to outer continental shelf, and upper slope. The depth range commonly cited in publications is 130m – 260m (or 270m) deep, presumably based on trawl records (May and Maxwell, 1986, cited in Froese and Pauly, 2006; Gomon, in Gomon et al., 1994). However, there are records reported to be this species, from waters shallower than 130m. Examples include a specimen collected at 20 fathoms (36.6m) (Waite and McCulloch, 1915, cited by Eschmeyer, 2003); records from 42m (CSIRO *Soela* trawl survey record, 1981, and *Courageous* trawl survey record, 1978); 70m (CSIRO Marine Research - Ichthyology record CA 3683, and S.A. Museum record F08073), and less than 40m (S.A. Museum records F02783, F01742 and F01743, unverified). There are also records from deeper than 270m (e.g. CSIRO Marine Research - Ichthyology record T 1393-2).

Notes on Biology and Behaviour

Growth

- Deepwater Stargazer grows to at least 28cm (May and Maxwell, 1986, cited in Froese and Pauly, 2007; Gomon, in Gomon et al., 1994). One of the maximum sizes (reported to be this species) is 0.285kg, a specimen taken off Rapid Bay in S.A., in 1976 (Australian Anglers Association, 2005).

Diet

- Stargazer species are ambush feeders that lie camouflaged in benthic sand and wait for prey.

Fisheries Information

Commercial

- The Deepwater Stargazer is not targeted, but has been recorded as a component of the bycatch of fisheries, such as the Commonwealth-managed SESSF (AFMA, 2002a). Bromhead and Bolton (2005) reported that *K. nigrofasciatum* is a discarded bycatch species in both the South East Trawl Fishery and the Great Australian Bight Trawl Fishery (GABTF).
- In terms of *frequency of capture*, Deepwater Stargazer is a significant bycatch species in the GABTF. Bycatch sampling in 2000 - 2001 (Brown and Knuckey, 2002) showed that during that period, Deepwater Stargazers were observed in 85 of the 209 trawl shots, none were retained, and the average quantity discarded was 4.2kg per trawl shot (Brown and Knuckey, 2002).

Recreational

- The species occurs in waters deeper than the most recreational fishers operate; however it is noted that the Australian Anglers Association (AAA) has a fishing record, reportedly *Kathetostoma nigrofasciatum*, taken from Rapid Bay (Gulf St Vincent), in 1976. It is noted that the species mostly occurs in deeper continental shelf and upper slope waters; hence the GSV record is unusual. The validity of the GSV record could not be determined for this report.

Vulnerable Characteristics of the Species

- The Deepwater Stargazer has a limited geographic distribution in southern Australia, being found only in western S.A. and southern W.A.
- Deepwater Stargazer is a member of the Uranoscopidae, a family of strongly site-associated, benthic fishes of limited mobility, and probably limited dispersal ability. The strong site association of Uranoscopidae fish makes them vulnerable to site-specific benthic impacts, such as trawling and dredging.
- As is the case with other members of the family, populations of the Deepwater Stargazer are likely to have a fairly low level of resilience to exploitation. This species may be relatively long-lived (as is a related species in New Zealand, *Kathetostoma giganteum*).

Threatening Processes

- Bycatch monitoring has shown that Deepwater Stargazer is frequently recorded in bycatch of the GAB Trawl Fishery. Trawling may be a threatening process, both directly (mortality of stargazers caught in the by-catch) and indirectly (due to benthic habitat damage), but more information is required. No data are available about the change over time in abundance of this species in the bycatch, nor are there other indirect (or direct) measures of potential impact on populations, but it is noted that in 2006, an Ecological Risk Assessment (ERA) for species in the Great Australian Bight Trawl Fishery (Daley et al., 2006), ranked *K. nigrofasciatum* as a “high risk” species, in terms of population impacts from capture in the GAB trawl fishery.

Research Requirements

- There is some discrepancy between the depth range cited in fish identification texts, and the recorded depths at which various museum specimens of *Kathetostoma nigrofasciatum* were captured. The presence or absence of this species in shallow waters should be determined, including an expert check of the species identity of SA Museum specimens F02783, F01742 and F01743.
- There is little information on the habitat requirements, biology (particularly reproduction, and longevity), relative abundance or population dynamics of this species.

Management Requirements

- Quantification of stargazer bycatch (to species' level) in the SET and GAB trawl fisheries over space and time is recommended, and measures to reduce the bycatch of benthic species such as stargazers are required, where possible.

Speckled Stargazer / Western Stargazer

Family Name:	Uranoscopidae
Scientific Name:	<i>Kathetostoma canaster</i> Gomon and Last, 1987
Recommended Status in S.A.:	Data Deficient in South Australia; Near Threatened or possibly VU A2(d) in south-eastern Australia
Rationale:	<i>Although the Speckled Stargazer has a wide geographic distribution across southern Australia, and broad depth range, it is included here because (i) the species is a benthic, site-associated, and probably long-lived fish, with limited mobility and possibly limited dispersal ability; (ii) it may be vulnerable to site-specific benthic impacts, and may have a relatively low resilience to exploitation; (iii) it is taken in seemingly very large quantities in Commonwealth-managed fisheries in southern Australia, particularly the South East Trawl Fishery, with no controls over the numbers taken, and no assessment of the sustainability of the catch over space and time; (iv) the species has been categorised as one at high risk of population impacts from trawl fishing in the SETF; (v) there has been inadequate assessment of population impacts of fishing, despite large quantities having been taken commercially (as by-product) every year since at least the early 1990s; and (iv) Speckled Stargazer is one of the species in Uranoscopidae for which there is little information on the habitat requirements, relative abundance, biology (particularly the reproduction, and longevity) or population dynamics.</i>

Current Conservation Status

- (No listings known)

Distribution

Southern Australia

- The Speckled Stargazer ranges from the Sydney area in N.S.W., through to the western Great Australian Bight / south-western W.A., and Tasmania is part of the distribution (Gomon and Last, 1987; Gomon, in Gomon et al., 1994, Hutchins and Swainston, 2001).
- The species is considered common in the South East Marine Region, and has been listed as an indicator species for that region (CSIRO et al., 2001).

South Australia

- In S.A., examples of locations where the species has been recorded include Cape Jervis, near Investigator Strait (national angling record from 1997, cited by Australian Anglers Association, 2005); deeper waters (i.e. edge of continental shelf) off central and western Great Australian Bight (CSIRO Marine Research records 1965 and 1966, cited in CSIRO, 2007), and continental slope waters off the lower South East (e.g. south-west of Beachport, and further south-east, near the S.A. / Victorian border) (Museum of Victoria records, cited in OZCAM database, 2007).

Habitat

- Speckled Stargazer is a benthic species found in sandy habitats (Hutchins and Swainston, 2001) over a broad depth range, from ~ 30m deep to more than 700m (Gomon, in Gomon et al., 1994); however the species is mostly found within the depth range 40m – 450m (CSIRO et al., 2001).

Notes on Biology and Behaviour

Growth

- The Speckled Stargazer grows to between 65cm (Gomon, in Gomon et al., 1994) and 75cm (Hutchins and Swainston, 2001). One of the maximum sizes recorded is 2.81kg, being a specimen taken off Cape Jervis in S.A., in 1997 (Australian Anglers Association, 2005).
- There is no information on the age of the species, but it is noted that a related species in New Zealand, *K. giganteum*, which grows to a similar size, reportedly reaches a maximum age of about 23 years (Sutton, 1999, 2004; Manning and Sutton, 2004).

Other Information

- Stargazer species are ambush feeders, which lie camouflaged in benthic sediments, and wait for prey.

Fisheries Information

Commercial

- The Speckled Stargazer is considered to have “better than average quality” flesh, and is marketed in small quantities (Gomon, in Gomon et al., 1994). In southern Australia, several species of stargazer from deeper waters, are usually taken as a bycatch of deepwater trawling operations, and are marketed either as whole fish or fillets of “monkfish” (Sea-Ex Australia, 2004).
- The Speckled Stargazer is part of the bycatch of fisheries such as the Commonwealth-managed SESSF (Southern and Eastern Scalefish and Shark Fisheries), which includes the South East Trawl Fishery (AFMA, 2002a). Bromhead and Bolton (2005) reported that *K. canaster* is a retained byproduct species in the Gillnet, Hook and Trap Fishery; the South East Trawl fishery, and the Great Australian Bight Trawl Fishery. In the Commonwealth-managed Gillnet, Hook and Trap fishery, Speckled Stargazer is a by-product species of the Scalefish Demersal Long-line sub-fishery and the Scalefish Automatic Long-line sub-fishery (Webb et al., 2004).
- In an assessment of bycatch in the Southern Shark Fishery, Walker et al. (2003) showed that the species is vulnerable to capture in small mesh gill nets, and also by 10 / OSS shark hooks.
- A scientific monitoring program in 2001 recorded **5.15 tonnes** of Speckled Stargazer in the bycatch of the South East Trawl Fishery (SETF), 95% of which was retained (AFMA, 2002a). In the otter trawl sub-fishery of the SETF, an Integrated Scientific Monitoring Program (ISMP) reported that in 652 trawl shots, about **20.3 tonnes** of Speckled Stargazer were retained (equivalent to 31kg per trawl shot retained), and about 963kg were discarded (Wayte et al., 2004). Large quantities of unspecified stargazer species (which may include Speckled Stargazer, amongst others) are recorded in fishers’ logbooks as bycatch. For example, in 2000/01, fishers’ logbooks recorded about **86 tonnes** of stargazers in the bycatch of the SETF (AFMA, 2002a); however it is not known what proportion of the catch comprised *K. canaster*. In the Danish seine sub-fishery of the SETF, the ISMP recorded that in 11 shots, 4kg were retained, and 8.2kg were discarded (Wayte et al., 2004).
- The species might also be taken in the so-called High Seas Trawl Fishery, but it is uncertain whether the species is retained (Bromhead and Bolton, 2005).
- There are museum records of the Speckled Stargazer being taken by commercial fishing in the Port Phillip Bay / Bass Strait area (Anon., 2002b), and the species is also taken in New South Wales (Andrew et al., 1997).
- During the past decade, *K. canaster* has been sold in large quantities in some fish markets in southern Australia. An example is shown in the table below. During the 1990s, the largest annual quantity sold through the Melbourne Wholesale Fish Market was approximately 133t, in 1997. An average of 75t per year of Speckled Stargazer was sold in this market over a 8 year period during the mid 1990s to early 2000s (see table below). The species is also marketed in New South Wales (e.g. Andrew et al., 1997, Table 2.4).

Annual Quantities of K. canaster Sold, & Maximum & Minimum Quantities Sold per Month, at Melbourne Wholesale Fish Market, 1993-2001

(Adapted from C.H. Smith Marine, 2004)

Year	Minimum monthly quantity sold	Maximum monthly Quantity sold	Total quantity sold per annum (t)
1993	0kg (Jan - May)	19,200kg (Sep)	68.1t
1994	0kg (Jul, Aug, Dec)	16,890kg (Sep)	69.4t
1995	0kg (Jan – Mar; May – Nov)	11,070kg (Dec)	14.25t
1996	0kg (Feb, Oct)	13,410kg (Aug)	86.1t
1997	4,980kg (Aug)	21,810kg (Sep)	132.8t
1998	3,150kg (Jun)	13,770kg (Apr)	74.5t
1999	0kg (Sep)	7,530kg (Mar)	57.9t
2000	3,270kg (Jan)	17,970kg (Nov)	93.9t
2001	3,000kg (Jul)	13,920kg (Feb)	49t *

*(N.B. data in 2001 for January - July only)

Recreational

- The species is not targeted, but is incidentally taken by recreational fishers in some areas. Some clubs and associations keep records of the maximum sizes recorded (e.g. Australian Anglers Association, 2005).
- Species-specific data on the recreational catch of stargazers is not available for this report; however it is noted that the recent National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) reported that 1,782 Stargazer specimens were caught and kept by recreational fishers during the survey time period (May 2000 to April 2001), comprising 932 from Queensland, and 850 from New South Wales. The number discarded was not recorded, nor were statistics from the southern Australian States.

Vulnerable Characteristics of the Species

- Speckled Stargazer is reported to have a low resilience to exploitation, in terms of minimum population doubling time (based on preliminary age and growth estimates) (Froese and Pauly, 2007). This species may be relatively long-lived (as is a related species in New Zealand, *Kathetostoma giganteum*).
- Speckled Stargazer is a member of the Uranoscopidae, a family of strongly site-associated, benthic fishes of limited mobility, and probably limited dispersal ability. The strong site association of Uranoscopidae fish makes them vulnerable to site-specific benthic impacts, such as trawling and dredging.

Threatening Processes

- Fishing is likely to be the main threatening process. It is possible that ongoing commercial exploitation of this species at the current level may have a negative impact on populations. Based on estimates of likely maximum age and growth rate, the species is reported to have a low resilience to exploitation. There appears to be no information on population sizes or population dynamics of Speckled Stargazer, yet this benthic species continues to be taken in seemingly large quantities by trawls (see above), with no quota on the number taken.
- A recent draft ecological risk assessment of the South East Trawl and Danish Seine Fishery (Wayte et al., 2004), listed Speckled Stargazer as a “high risk” species, i.e. one of the species that is highly susceptible to population impacts from trawling. The species has also been listed as being at moderate risk from trawl impacts in the Great Australian Bight Trawl Fishery (Daley et al., 2006).

Research and Management Recommendations

- Population and fishery assessments should be undertaken as a priority for commercial species such as Speckled Stargazer. This species has been taken in large quantities for more than a decade, with no knowledge of population impacts, or the sustainability of the catch over space and time. As a precautionary measure, controls are required (where possible) over the numbers of Speckled Stargazer taken as by-product in trawl fisheries, pending population assessments.
- In addition to the trawl fisheries in which Speckled stargazer is taken as by-product, quantification of Stargazer bycatch (to species’ level) is required in other fisheries in which this species might be caught.
- There is little information on the habitat requirements, biology (particularly reproduction, and longevity), relative abundance or population dynamics of this species.
- Species-specific recreational catch statistics are lacking, and stargazer species are generally not targeted by recreational fishers. Nevertheless, given the potential for populations of Uranoscopid fishes to be affected by fishing, catch limits are required for recreational fishing of stargazer species, even deepwater species such as Speckled Stargazer, for which there are recreational catch records in the shallow part of the range.

Other Information

- Thomson (1985) reported the mercury concentrations of a sample of Speckled Stargazers in Tasmanian waters.

Common Stargazer / Eastern Stargazer

Family Name:	Uranoscopidae
Scientific Name:	<i>Kathetostoma laeve</i> (Bloch and Schneider, 1801)
Recommended Status in S.A.:	Data Deficient
Rationale:	<i>Although the Common Stargazer may have a broad geographic range, it is included here because the species (i) is a benthic, site-associated fish in sand habitats of the upper continental shelf; it may be susceptible to localised impacts, and may have a relatively low resilience to exploitation; (ii) is a retained by-product in some Commonwealth fisheries; is a discarded bycatch in a variety of State-based fisheries, and is caught occasionally by recreational fishers, with no Commonwealth- or State-level controls over capture in any fishery; (iii) there are inadequate data on the relative abundance (including the S.A. part of the range), biology (particularly reproduction and longevity), and population dynamics; and (iv) there are insufficient data on the commercial catch (retained by-product and discarded by-catch) and recreational take over space and time, and inadequate assessment of the potential population impacts of fishing.</i>

Current Conservation Status

- (No listings known)

Distribution

Southern Australia

- The Common Stargazer is reportedly found across southern Australia, from mid-northern N.S.W., through to southern W.A., and Tasmania is part of the distribution (Hutchins and Swainston, 1986; Gomon, in Gomon et al., 1994; Edgar, 1991, 2000).
- The specimens from western South Australia and south-western Australia may represent a distinct species (Gomon, in Gomon et al., 1994; Kuitert, 2000; Australian Museum, 2004k). Populations from south-eastern and south-western Australia are distinct at least at sub-species level, and although the taxonomic status is still uncertain, they are likely to be separate species (M. Gomon, Museum of Victoria, pers. comm., 2006).

South Australia

- In South Australia, the species has a broad distribution, and has been regularly observed in the two gulfs. Examples of locations where Common Stargazer has been recorded include the eastern, central and western Great Australian Bight (CSIRO Marine Research trawl survey records, reported to be this species, from deeper continental shelf waters); Ceduna area; Nuyts Archipelago area; northern Anxious Bay / Venus Bay area off western Eyre Peninsula; Elliston / Waterloo Bay area; south-western Eyre Peninsula / Coffin Bay area; parts of Spencer Gulf (e.g. Port Broughton, Tiparra, Moonta Bay, Port Hughes, Tumby Bay, Point Bolingbroke); parts of southern Yorke Peninsula (e.g. Stenhouse Bay, Sturt Bay area, Troubridge Island, Edithburgh); western Gulf St Vincent (e.g. Port Giles); metropolitan Gulf St Vincent (e.g. Brighton area, Glenelg area, including Glenelg Dredge); southern Fleurieu (e.g. Yankalilla Bay, Carrickalinga area, Parsons / Waitpinga area); mouth of Gulf St Vincent / eastern Investigator Strait; and the north-eastern Kangaroo Island bays region (records from divers and diving clubs in S.A., cited by Baker, 2004; CSIRO Marine Research data 1979, cited in CSIRO, 2005; J. Brook, Reef Watch, pers. comm., 2002; Fairhead et al., 2002a; photograph by F. Bavendam, undated; photographs by J. Lewis, May and September, 2004; K. Smith, pers. comm., 2005; S.A. Museum records, Museum of Victoria record, cited in OZCAM database, 2007).

Habitat

- The Common Stargazer is a benthic species found in sandy habitats in shallow water, between 0m and about 60m deep (Gomon et al., 1994; Edgar, 2000). It is noted there are records, reported to be this species, from deeper waters (e.g. CSIRO Marine Research trawl survey data, 1979, cited in CSIRO, 2007); however deeper water records from the GAB may represent a separate species.

- The Common Stargazer occurs in shallow, sheltered to moderately exposed bays, estuaries and other quiet coastal waters, and other nearshore habitats, with sandy, silty or shelly bottoms (Gomon et al., 1994; Edgar, 2000; Museum of Victoria, 2005a).
- In eastern Victoria, the Common Stargazer has been reported from sandy plains near reefs (DSE Victoria, 2002), *Heterozostera tasmanica* seagrass beds (Hindell et al., 2000), and also from under jetties (Evatt, 2003). Similarly in S.A., the species has been recorded buried in sand, adjacent to reef patches (J. Brook, unpubl. data, 2002), and jetties. In Tasmania, Common Stargazer has been recorded in estuaries (e.g. Edgar et al., 1999), and from reef and sand habitats in various coastal bays and channels (Lyle et al., 2000), the latter including very shallow waters off beaches (e.g. Jordan et al., 1998).

Notes on Biology and Behaviour

Growth

- The Common Stargazer grows to about 75cm (Gomon, in Gomon et al., 1994; Edgar, 2000).
- The species grows to at least 5.6kg. For example, the Australian Underwater Federation reported that the record size of *K. laeve* taken by spearfishing was 5.67kg, being a specimen taken in 1964, at Woolami Beach in Victoria (Australian Underwater Federation, Inc., 2003). The national angling record is 4.933kg, being a specimen taken in N.S.W. in 1972 (Australian Anglers Association, 2005). The Victorian angling record is a specimen of 4.19kg (Australian Anglers Association (AAA), Victorian Division, 2003).
- There is no information on the age of the species, but it is noted that a related species in New Zealand, *K. giganteum*, which grows to a similar size, reportedly reaches a maximum age of about 23 years (Sutton, 1999, 2004; Manning and Sutton, 2004).

Diet and Feeding Behaviour

- A study of juvenile Common Stargazers in Victoria showed that the diet comprises mainly bony fish (80%, in the sample), with a lesser percentage of benthic crustaceans (Hindell et al., 2000). Stargazers lie almost buried and motionless, with the eyes and mouth protruding from the sand. The Common Stargazer can rapidly lunge upward, using its large, cavernous mouth to consume prey in one gulp.

Other Information

- Stargazers in southern Australia form a small part of the diet of New Zealand Fur Seal and Australian Fur Seal (Page et al., 2005).

Fisheries Information

Commercial – Commonwealth

- The Common Stargazer is part of the bycatch of fisheries such as the Commonwealth-managed SESSF (Southern and Eastern Scalefish and Shark Fisheries), which includes the South East Trawl Fishery (SETF) (AFMA, 2002a). In the SETF, Stargazer bycatch is not recorded to species level in fishers' logbooks; however large quantities of unspecified stargazer species are recorded as bycatch. It is likely that the Common Stargazer does not form a substantial proportion of that catch, due to the shallow depths at which it occurs. A scientific monitoring program in 2001 recorded 671kg of Common Stargazer in the bycatch of the SETF, about 82% of which was retained (AFMA, 2002a). In the otter trawl sub-fishery of the South East Trawl Fishery, an Integrated Scientific Monitoring Program (ISMP) reported that in 452 trawl shots, about 1.86t of *K. laeve* was retained and 557kg discarded (Wayte et al., 2004), which is an average of 4kg per trawl shot retained, and 1.2kg per trawl shot discarded. The ISMP also recorded 4kg in a single shot in the Danish seine sub-fishery of the SETF, but the species was reported only in one shot (compared with 452, in the otter trawl sub-fishery sampling) (Wayte et al., 2004).
- Bromhead and Bolton (2005) reported that *K. laeve* is a retained byproduct species in the Commonwealth-managed Gillnet, Hook and Trap fishery.

Commercial – Tasmania

- The species is vulnerable to by-capture in large mesh gillnets, as used in finfish fisheries in Tasmania (e.g. Murphy and Lyle, 1999).

- *Kathetostoma laeve* is a minor (and discarded) part of the bycatch in the Bass Strait Scallop Fishery (Haddon and Semmens, 2001, 2002; Bromhead and Bolton, 2005).
- According to BRS (2004), commercial catch figures from Tasmania include the following: 15t in 1990/91, and 1t - 4t per annum between 1991/92 – 1994/94. No specimens were recorded between 1994/95 and 1998/99, and no data are available for the early 2000s.
- *K. laeve* is sold in the aquarium market, and collected in Tasmania for that purpose. The permitted total annual catch limit is 60 individuals, with a fishing block limit (6 x 6 nautical miles) of 10 individuals (DPIWE Tasmania, 2005b; Australian Government DEH, 2005b).

Commercial – South Australia

- In South Australia, the species has been recorded as a minor component of bycatch in the Spencer Gulf prawn trawl fishery. For example, 7 Common Stargazer were recorded from 32 trawl tows, in a sampling program during the mid 1990s (Carrick, 1997). It is noted that the species was also recorded in a trawl survey in the snapper grounds of upper Spencer Gulf (P. Jennings, SARDI, unpublished survey data, 2003).

Commercial – New South Wales

- Stargazers form a small part of the bycatch in the Estuary General Fishery in New South Wales (New South Wales Fisheries, 2001).

Recreational

- Common Stargazers are occasionally taken by hook and line (Museum of Victoria, 2005).
- Common Stargazers are part of the recreational gillnet bycatch in Tasmania. Experiments have shown that the survival rate is high for specimens caught in gillnets in the recreational fishery (Lyle et al., 2000).
- There are records of the species being taken accidentally by recreational line fishers in South Australia (e.g. SA Museum record F 04533, cited in OZCAM database, 2004).
- There are records of the species being taken by spearfishing (e.g. Australian Underwater Federation, Inc., 2003). Common Stargazer is also caught irregularly (sometimes accidentally) by recreational fishers. For example, Wilson (2003) reported a ~4kg specimen taken by squid jig at a beach near Geelong. Some clubs and associations keep records of the maximum sizes of specimens caught by anglers (e.g. AAA, Victorian Division, 2003; AAA, 2005).
- Species-specific data on the recreational catch of stargazers is not available for this report; however it is noted that the recent National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) reported that 1,782 Stargazer specimens were caught and kept by recreational fishers during the survey time period (May 2000 - April 2001), comprising 932 from Queensland, and 850 from N.S.W.. The number discarded was not recorded, nor were statistics from the southern Australian states.

Vulnerable Characteristics of the Species

- Common Stargazer is a member of the Uranoscopidae, a family of strongly site-associated, benthic fishes of limited mobility, and probably limited dispersal ability. The strong site association of these fish makes them vulnerable to site-specific benthic impacts, such as trawling and dredging.
- Common Stargazer has a relatively narrow depth range, known to date from the shallow subtidal to about 60m deep.
- The species may have a low resilience to exploitation, in terms of minimum population doubling time (based on preliminary age and growth estimates) (Froese and Pauly, 2007).

Threatening Processes

- Due to the benthic association and limited mobility of this species, localised benthic impacts, such as trawling, dredging and sand removal, may adversely affect populations of shallow-water Stargazer species, but there are no specific data.
- In some areas, the combined effects of fishing by different methods (e.g. a combination of trawls, scallop dredges, gill-nets, hooks-and-lines, hand collecting, and/or spears) are likely to threaten some populations, but more information is required.

- It is noted that a draft ecological risk assessment of the South East Trawl and Danish Seine Fishery (Wayte et al., 2004), listed Common Stargazer as a “medium risk” species in that fishery, i.e. one of the species that is susceptible to population impacts from trawling.

Research and Management Requirements

- The species identity of specimens from eastern and western Australia needs to be ascertained, and if two species are present, then the ranges of each (and the degree of overlap) need to be defined.
- There is little information on the biology (particularly the reproduction and longevity) or population dynamics of this species.
- No population or fisheries assessments have been undertaken, even in those fisheries in which Common Stargazer is a retained by-product. No data are available about the change over time in the abundance of this species in the bycatch of any fishery, nor are there any other indirect (or direct) measures of potential impact on populations. In particular, more information is required on the bycatch in commercial fish and prawn trawl fisheries (both Commonwealth- and State-managed), and gill-net fisheries (e.g. in Tasmania).
- Quantification of Stargazer bycatch (to species’ level) in fisheries over space and time is recommended, and measures to reduce the bycatch of benthic species such as Stargazers are required, where possible.
- In Tasmania, an assessment is required of the sustainability and/or potential population impacts of the commercial take for the aquarium industry.
- Species specific recreational catch statistics are lacking, and stargazer species are generally not targeted by recreational fishers. Nevertheless, given the potential for populations of Uranoscopid fishes to be affected by fishing, catch limits are required for recreational fishing of shallow water stargazer species.

Other Notes

- Common Stargazer is the only stargazer species in south-eastern Australia that is regularly seen by divers, although it is considered to be uncommon (Edgar, 2000). Night divers have been bitten by this species (Australian Museum, 2003k).
- The Common Stargazer occurs in a number of the marine national parks and sanctuaries in Victoria, such as Popes Eye, Port Phillip Heads, and Ninety Mile Beach (DSE Victoria, 2002; Plummer et al., 2003).