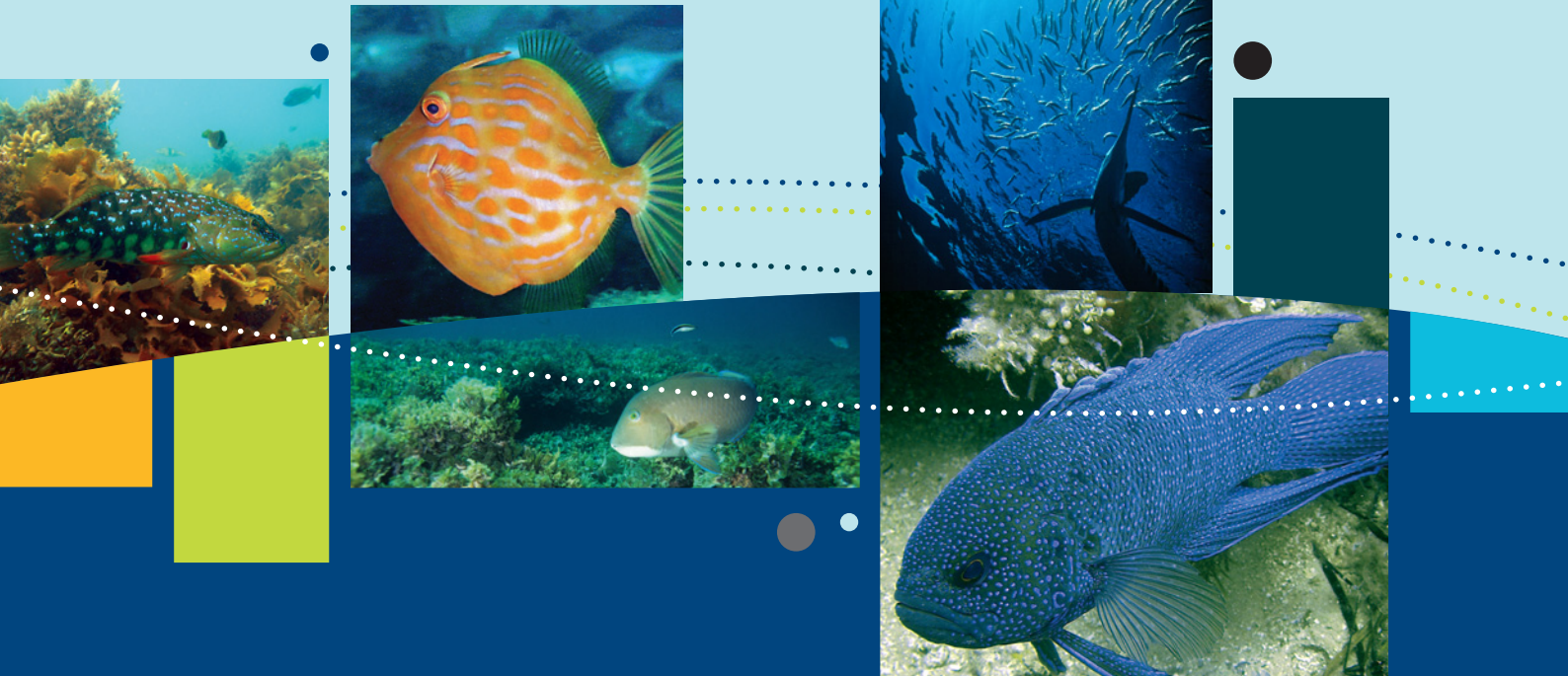




Australian Government

**Department of Sustainability, Environment,
Water, Population and Communities**



Species group report card —bony fishes

Supporting the marine bioregional plan
for the South-west Marine Region

prepared under the *Environment Protection and Biodiversity Conservation Act 1999*

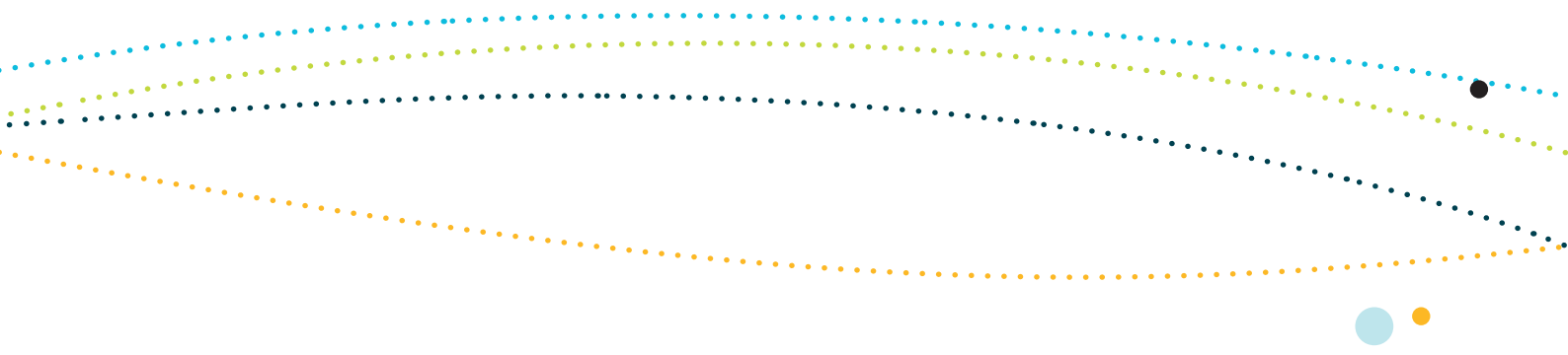
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Images:

Harlequin fish – James Brook, Mosaic leather jacket – Dennis Hutson, Baldchin Grouper – WA Fisheries, striped marlin and sardines – Bill Boyce, Southern Blue Devil – MLSSA/Anthony King, Swallow Tail Reef – Glen Cowan, Southern calamari squid – Anthony King, Blue whale – DSEWPaC, Sea lion – Glen Cowan, Tern common – Richard Freeman



CONTENTS

Species group report card—bony fishes	1
1. Bony fishes of the South-west Marine Region	3
2. Vulnerabilities and pressures	6
3. Relevant protection measures.....	13
References	14
Attachment 1: Bony fish species occurring in the South-west Marine Region	19



SPECIES GROUP REPORT CARD—BONY FISHES

Supporting the marine bioregional plan for the South-west Marine Region
prepared under the *Environment Protection and Biodiversity Conservation Act 1999*

Report cards

The primary objective of the report cards is to provide accessible information on the conservation values found in Commonwealth marine regions. This information is maintained by the Department of Sustainability, Environment, Water, Population and Communities and is available online through the department's website (www.environment.gov.au). A glossary of terms relevant to marine bioregional planning is located at www.environment.gov.au/marineplans.

Reflecting the categories of conservation values, there are three types of report cards:

- species group report cards
- marine environment report cards
- heritage places report cards.

While the focus of these report cards is the Commonwealth marine environment, in some instances pressures and ecological processes occurring in state waters are referred to where there is connectivity between pressures and ecological processes in state and Commonwealth waters.



Species group report cards

Species group report cards are prepared for large taxonomic groups that include species identified as conservation values in a region; that is, species that are listed under Part 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and live in the Commonwealth marine area for all or part of their lifecycle. All listed threatened, migratory and marine species and all cetaceans occurring in Commonwealth waters are protected under the EPBC Act and are identified in the relevant marine bioregional plans as conservation values.

Species group report cards focus on species for which the region is important from a conservation perspective; for example, species of which a significant proportion of the population or an important life stage occurs in the region's waters.

For these species, the report cards:

- outline the conservation status of the species and the current state of knowledge about its ecology in the region
- define biologically important areas; that is, areas where aggregations of individuals of a species display biologically important behaviours
- assess the level of concern in relation to different pressures.



1. Bony fishes of the South-west Marine Region

Conservation values in marine bioregional plans include species listed under Part 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that live in the Commonwealth marine area or for which the Commonwealth marine area is necessary for a part of the lifecycle. All listed threatened, migratory and marine species and all cetaceans occurring in the South-west Marine Region are identified as conservation values. Key ecological features have also been identified through the marine bioregional planning process, to more precisely define areas and features of importance in the Commonwealth marine environment. Two key ecological features identified in the South-west Marine Region are groups of bony fish. These are small pelagic fish and demersal slope fish communities in the Central Western Province. The report card on the Commonwealth marine environment discusses the key ecological features that have been identified in the South-west Marine Region.

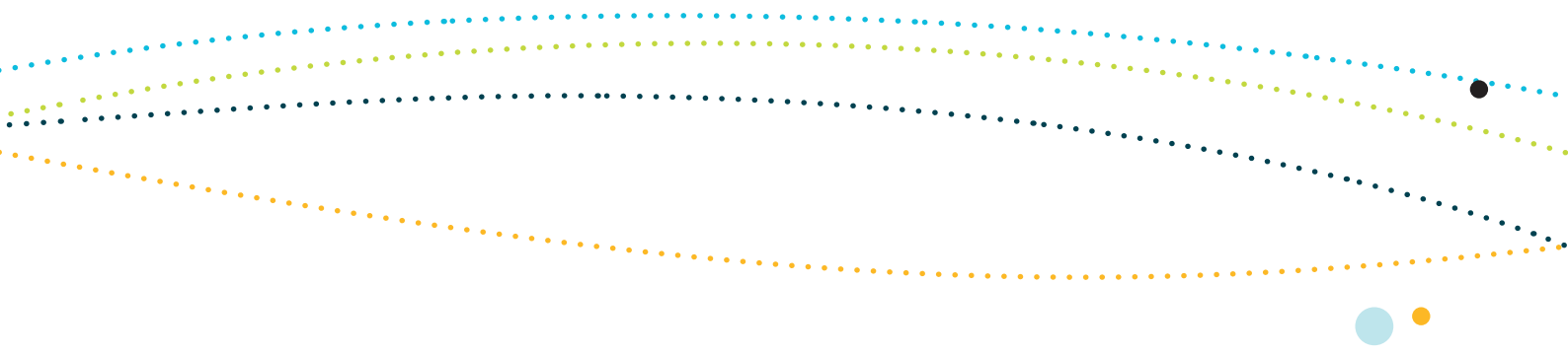
The fish fauna of the South-west Marine Region is diverse, with more than 900 species occupying a large variety of habitats. However, only three species of bony fish known to occur in the region are listed under the EPBC Act as threatened or marine species:

- Orange roughy, which is listed as a threatened species in the conservation dependent category
- Southern bluefin tuna, which is listed as a threatened species in the conservation dependent category and
- Gunther's pipehorse, which is a listed marine species.

This report card provides information on these three species of bony fish.

Fourteen species of the Family Syngnathidae (seahorses, sea dragons, pipefish and pipehorses) and one species of the Genus *Solenostomus* (ghost pipefish) that are listed marine species under s248 of the EPBC Act may occur in parts of the South-west Marine Region (see Attachment 1 for a complete list). However, due to uncertainty about their occurrence in the region, these species have not been considered in this report card.¹

¹ For additional information on bony fish in the region that are not addressed in this report card, see the report *South-west Marine Region: ecosystems and key species groups*, which contains separate reviews of the inshore, shelf and slope demersal fish species, syngnathids (seahorses, pipefish and sea dragons), and large pelagic, small pelagic and mesopelagic species. It is available online at www.environment.gov.au/coasts/mbp/south-west.



Orange roughy

Orange roughy (*Hoplostethus atlanticus*) live in cold, deep waters in the Atlantic, Pacific and Indian oceans. In Australia, orange roughy are found in the oceans bordering the southern half of the continent, from central New South Wales through to southern Western Australia, including Tasmania. They also occur on seamounts and ocean ridges south of Australia and on the South Tasman and Lord Howe rises. They are most common in Australian waters at depths of 700–1000 m (Kailola et al. 1993). Orange roughy are known to aggregate to spawn in areas in the South-west Marine Region.

Southern bluefin tuna

Southern bluefin tuna (*Thunnus maccoyii*) is a highly migratory species that occurs in southern hemisphere waters between 30° S and 50° S, but is primarily found in the Indian and south western Pacific Oceans (CCSBT 2010). It is generally accepted that there is a single population of southern bluefin tuna, with only one known spawning ground in the Indian Ocean between Java and northern Western Australia (Grewe et al. 1997; Farley and Davis 1998). The southernmost portion of the spawning ground lies within Australia's Exclusive Economic Zone (Nishikawa et al. 1985). They are carnivorous, feeding on a wide range of fish, squid, krill and salps and also benthic invertebrates in coastal waters (Itoh et al. 2011).

In Australian waters, southern bluefin tuna range from northern Western Australia, around the southern region of the continent, to northern New South Wales. Juveniles move south from the spawning ground to the south west of Australia in their first years of life. The warm Leeuwin Current, which begins near the spawning ground and is strongest in April, right after the spawning period, is likely to assist juveniles moving south along the Western Australian coast to the Great Australian Bight. Although surface-schooling juveniles are associated seasonally with the continental shelf region of the Great Australian Bight, it is not known what fraction of the juvenile stock is present (Farley and Basson 2010). Juveniles of southern bluefin tuna are found in coastal waters off south-western and southern Australia during the summer months (October to April) and spend winters in deeper, temperate waters (Bestley et al. 2008; CCSBT 2009). After reaching approximately five years of age, they are seldom found in near shore surface waters but are captured in deeper waters, generally by longline gear (Polackcheck et al. 2004).



Gunther's pipehorse

Some confusion surrounds the taxonomic status and geographic distribution of this syngnathid species. Most commonly cited as *Solegnathus lettiensis* (described by Bleeker in 1860 from Indonesia), Kuitert (2009) uses the name *S. guntheri* Duncker, 1915 for the Australian population, and *S. lettiensis* for Indonesian specimens. While the taxonomy needs further investigation, most authorities recognise a single species, *S. lettiensis* (e.g. Eschmeyer and Fricke 2011, Hoese et al. 2006).

From the limited scientific records of Gunther's pipehorse, it occurs in Western Australian temperate to tropical waters; from Albany in the south, northwards to the Northern Territory, extending to Indonesia (Pogonoski et al. 2002). The majority of these records are from south of North West Cape (ca. 22°S), possibly reflecting limited scientific sampling effort in far northern Western Australia and Northern Territory shelf waters (unpub. data², Pogonoski et al. 2002). The species occurs demersally from ca. 90–180 m depth (unpub. data², Dawson 1985) over the continental shelf, often in association with corals, sponges and soft substrates. A single record reported from 42 m depth requires confirmation. The southern limit of the known range extends into the South-west Marine Region, and it is likely to occur in the region throughout the year.

Biologically important areas

Biologically important areas are areas that are particularly important for the conservation of the protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration (the presence of the observed behaviour is assumed to indicate that the habitat required for the behaviour is also present). Biologically important areas have been identified for some EPBC Act listed species found in the South-west Marine Region, using expert scientific knowledge about species' distribution, abundance and behaviour in the region. The selection of species was informed by the availability of scientific information, the conservation status of listed species and the importance of the region for the species. The range of species for which biologically important areas are identified will continue to expand as reliable spatial and scientific information becomes available.

Biologically important areas have not yet been identified for any bony fish in the South-west Marine Region.

2 Unpublished fish collection records from CSIRO and Australian Museums.



2. Vulnerabilities and pressures

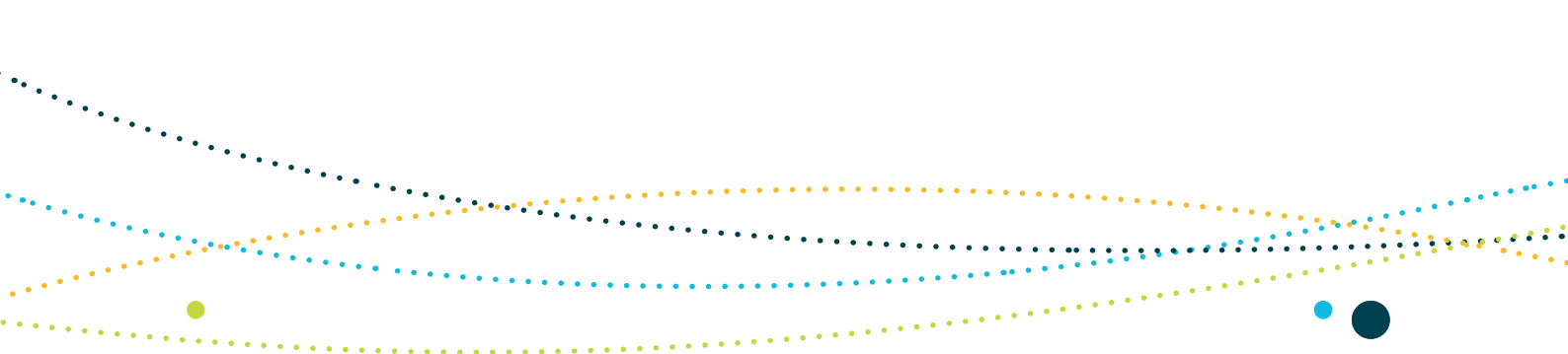
Vulnerabilities

Orange roughy is believed to be one of the longest lived fish species; examination of their otoliths (ear bones) suggests a maximum age of greater than 100 years. This longevity means that the species is very slow growing and does not reach sexual maturity until 25–35 years. Orange roughy also have relatively low fecundity. As a result of these life history characteristics, and the fact that they form dense aggregations, the species has high susceptibility to overfishing (Branch 2001).

The life history characteristics of southern bluefin tuna make it also vulnerable to overfishing. It is a slow growing, long lived (up to 40+ years) and late maturing (approximately 10–12 years) species, which is highly migratory with only one known spawning ground and forms a single population (Gunn et al. 2008; Farley and Davis 1998; Grewe et al. 1997). Commercial fishing of juveniles for aquaculture farming (in South Australia) means that these fish are caught before they have been able to reproduce. Also, due to the highly migratory nature of the species, juveniles through to adults are targeted by fishing fleets from a number of nations, both on the high seas and in the Exclusive Economic Zones of Australia, New Zealand, Indonesia and South Africa. The stock is likely to be slow to recover from depletion, relative to other tunas that mature at a younger age such as yellowfin and skipjack tuna (Preece et al. 2011; Phillips and Findlay 2008).

There is very little known of the basic biology and population dynamics (e.g. sex ratios, size at maturity, fecundity), or ecological preferences, core geographic distribution and depth-range data from which to identify critical habitats for Gunther's pipehorse (DSEWPac 2010, Pogonoski et al. 2002). From the limited available records, the species is known to occur from at least Albany in the south of Western Australia and northwards to the Northern Territory in 90–180 m depth range (unpublished fish collection records from CSIRO and Australian Museums). However, it is known that some syngnathids have particular microhabitat preferences, mainly occupying the edges of specific habitat types (e.g. seagrass, sand or reef interfaces). Syngnathids feed in the water column, on or near the substrate. Most eat small invertebrates, such as planktonic crustaceans, including mysids and small amphipods. A few species are known to feed on larval fishes (Baker 2007).

Most syngnathids have low population densities, with relatively low reproductive potential (Baker 2007). Based on their habitat preferences, population dynamics and limiting life history characteristics, syngnathid populations can be vulnerable to site-specific impacts. Such naturally high vulnerability can be exacerbated by anthropogenic pressures; for example, most *Solegnathus* species are known to have low survival following trawl capture, particularly from deeper continental shelf and slope waters.



Analysis of pressures

On the basis of current information, pressures have been analysed for three bony fish discussed in this report card. A summary of the pressure analysis for bony fish is provided in Table 1. Only those pressures identified as of concern or of potential concern are discussed in further detail below. An explanation of the pressure analysis process, including the definition of substantial impact used in this analysis, is provided in Part 3 and Section S1.1 in Schedule 1 of the plan.



Table 1: Outputs of the bony fish species pressure analysis for the South-west Marine Region

Note: To maintain uniformity among all bioregions, this table has been added subsequently to the review by independent experts.

Pressure	Source	Species		
		Gunther's pipehorse	Orange roughy	Southern bluefin tuna
Sea level rise	Climate change	Blue	Blue	Blue
Changes in sea temperature	Climate change	Yellow	Yellow	Yellow
Changes in oceanography	Climate change	Yellow	Yellow	Yellow
Ocean acidification	Climate change	Yellow	Yellow	Blue
Chemical pollution/contaminants		Blue	Blue	Blue
Nutrient pollution		Blue	Blue	Blue
Changes in turbidity		Blue	Blue	Blue
Marine debris		Blue	Blue	Blue
Noise pollution	Aquaculture infrastructure Defence/surveillance activities Onshore and offshore construction Onshore and offshore mining operations Renewable energy infrastructure Seismic exploration Shipping Urban development Vessels (other)	Blue	Blue	Yellow
Light pollution		Blue	Blue	Blue
Physical habitat modification		Blue	Blue	Blue
Human presence at sensitive sites		Blue	Blue	Blue
Nuisance species		Blue	Blue	Blue
Extraction of living resources	Commercial fishing (domestic or non-domestic) IUU fishing (domestic or non-domestic)	Blue	Yellow	Red
Bycatch	Commercial fishing	Yellow	Blue	Blue
Oil pollution		Blue	Blue	Blue
Collision with vessels		Blue	Blue	Blue
Collision/entanglement with infrastructure		Blue	Blue	Blue
Disease		Blue	Blue	Blue
Invasive species		Blue	Blue	Blue

Legend of concern of potential concern of less concern or not of concern



Changes in sea temperature—climate change

Future changes in sea temperature are assessed as being *of potential concern* for orange roughy, southern bluefin tuna and Gunther's pipehorse. Sea temperatures have warmed by 0.7 °C between 1910–1929 and 1989–2008, and current projections estimate ocean temperatures will be 1 °C warmer by 2030 (Lough 2009).

In Australian waters, orange roughy most commonly occur at depths of 700–1000 m (Kailola et al. 1993). Seawater warming at depth is expected to have significant implications for benthic and demersal fish (such as orange roughy). While orange roughy in the South-west Marine Region have not experienced stock decline and collapse as in the South-east Marine Region, this pressure is *of potential concern* for this species, given its conservation dependent status and vulnerability inherent in its life history traits.

Due to the very low stock of southern bluefin tuna it is considered highly susceptible to environmental variability. Temperature of the ocean strongly influences the distribution of pelagic fish species, including southern bluefin tuna (Reddy et al. 1995). Hence changes in sea temperature have been assessed as *of potential concern*. High sea temperatures at the spawning grounds of southern bluefin tuna in the north-east Indian Ocean may be of particular concern as further increases in temperatures are predicted in these waters over the next 50 years.

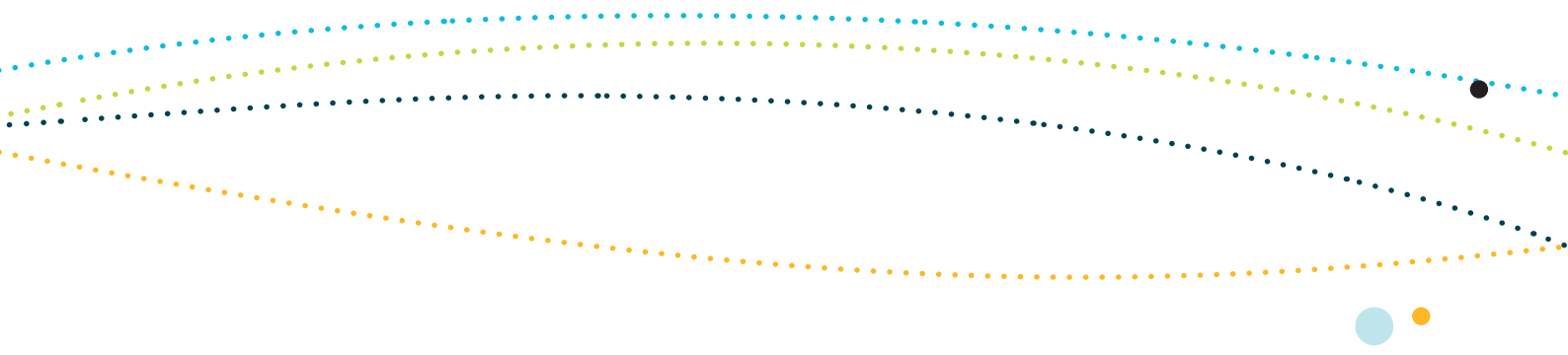
Gunther's pipehorse, like other syngnathids, tend to have specific habitat preferences within small home ranges (McClatchie et al. 2006). Populations can be vulnerable to site-specific impacts, and the existence of suitable habitat may determine their abundance within their geographic range. Given predicted impacts resulting from climate change, syngnathids are susceptible as they have low mobility, which may limit their ability to find and adapt to suitable new habitat.

Changes in oceanography—climate change

Changes in oceanography are assessed as *of potential concern* for orange roughy, Gunther's pipehorse and southern bluefin tuna.

The strength of the Leeuwin Current has decreased slightly since the 1970s. Weakening of the Leeuwin Current is likely to have implications for the productivity of the region, with uncertain but potentially significant effects on a broad range of species (Feng et al. 2009).

Gunther's pipehorse is likely to have a diet of small crustaceans, and possibly larval fishes; the species might be affected by climate-related changes to the region's productivity and trophic processes, but its distribution and its use of the region's habitats are poorly known. Orange roughy might also be affected by the climate-related effects on the region's productivity and trophic dynamics. Changes in productivity are likely also to affect the



pelagic ecosystems and the harvested species at the top of the food chain. The impact of climate change on the winter southern bluefin tuna feeding grounds in the Southern Ocean may be significant (Sarmiento et al. 2004 cited in Hobday et al. 2008).

Ocean acidification—climate change

Ocean acidification has been assessed as *of potential concern* for orange roughy and Gunther's pipehorse. Driven by increasing levels of atmospheric carbon dioxide and subsequent chemical changes in the ocean, acidification is already underway and detectible. Since pre-industrial times, acidification has lowered ocean pH by 0.1 units (Howard et al. 2009). Furthermore, climate models predict this trend will continue, with a further 0.2–0.3 unit decline by 2100 (Howard et al. 2009).

The potential effects of increased ocean acidity on fish species are poorly understood. It is believed that for some invertebrates and fish, accumulation of carbon dioxide in the body may result in morphological changes, and impact metabolic state, physical activity and reproduction (Orr et al. 2009). Effects on phytoplankton and zooplankton are also likely to disrupt trophic dynamics and affect fish species and communities (Hobday et al. 2006), which are important food resources for fish. While evidence is absent, increasing acidification of the oceans is likely to be less of an issue for temperate fish species, and a direct impact only during the larval life stages (Hobday et al. 2009).

Noise Pollution

Noise pollution has been assessed as being *of potential concern* for southern bluefin tuna. Research on the effects of noise disturbance on fish is limited and mostly confined to physiological impacts. Behavioural responses observed to date range from no overt response to substantial avoidance movements that may displace fish from their normal location (Popper & Hastings 2009; Popper et al. 2002). Two to four year old southern bluefin tuna are known to feed regularly during spring and summer in the waters of the Great Australian Bight; during this time, they grow at a faster rate than in winter, presumably due to a combination of warmer waters and abundant food. Sustained noise disturbance off the waters of the Great Australian Bight during their feeding season has the potential to impact on growth and, indirectly, survivorship on those year classes exposed to the disturbance (C Davies, CSIRO, pers. comm., 28 March 2011). There are currently no management measures specifically aimed at assessing and mitigating effects of noise on fish.



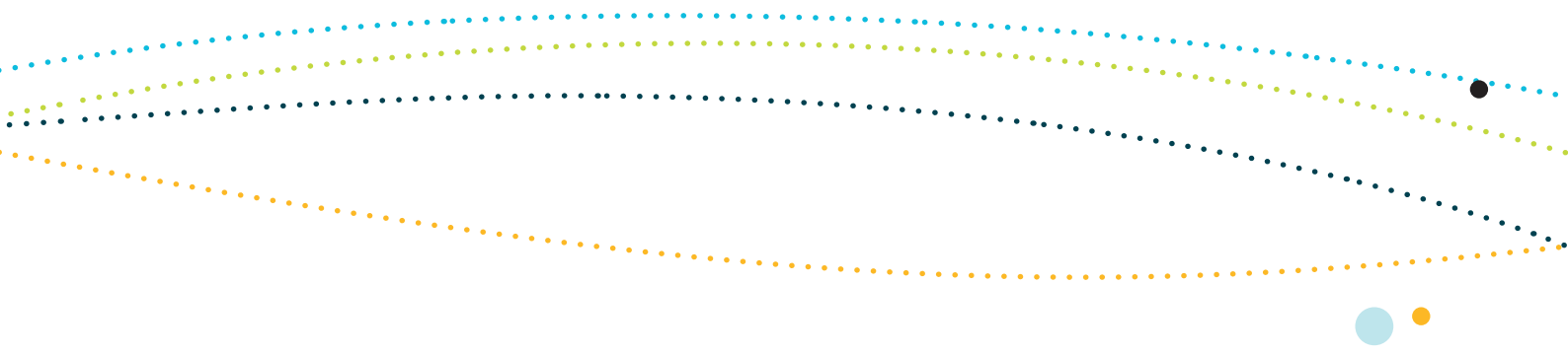
Extraction of living resources

Extraction of living resources has been assessed as a pressure *of concern* for southern bluefin tuna. The decline in southern bluefin tuna is estimated to have occurred from the late 1950s to the late 1970s, with a short period of stabilisation followed by a further decline from the early 1980s to mid 1990s to a very low level. The 2009 stock assessment indicated further decline in the spawning stock biomass from 2002 (CCSBT 2009).

Juvenile southern bluefin tuna are harvested in the Great Australian Bight by Australian purse seine fishing vessels. Juveniles through to adults are targeted by fishing fleets from a number of nations, both on the high seas and in the Exclusive Economic Zones of Australia, New Zealand, Indonesia and South Africa. The fishery is managed globally by the international Commission for the Conservation of Southern Bluefin Tuna (CCSBT), which has taken management decisions in recent years to reduce the risk of further decline and increase the likelihood of stock rebuilding. At its 2011 meeting, the CCSBT adopted a formal management procedure for setting global catch levels that has a high probability of rebuilding the stock.

Southern bluefin tuna was listed as conservation dependent under the EPBC Act in 2010 on the advice of the Threatened Species Scientific Committee (TSSC) because of the decline in the size of the spawning stock since the 1950s (TSSC 2010). The TSSC's complete conservation assessment is available at: www.environment.gov.au/biodiversity/threatened/species/pubs/69402-listing-advice.pdf

Extraction of living resources has been assessed as being *of potential concern* for orange roughy. Due to the orange roughy's long life, slow growth rate and low fecundity, extraction of living resources is a pressure *of potential concern* for the species due to uncertainty about the effectiveness of management. In 2009, the total allowable catch for orange roughy remained at bycatch levels (50 t) for the Albany/Esperance zone in the Great Australian Bight Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery, and a zero commercial catch was reported (Moore et al. 2010). A deepwater management strategy has been implemented to address the requirements for the Orange Roughy Conservation Program. Given the low catch levels and the deepwater management strategy, orange roughy in this area remain assessed as not subject to overfishing. There has been no targeting of orange roughy in the Western Deepwater Trawl Fishery since 2005–06. The status of the stock is uncertain as there are no current estimates of biomass (Rodgers, Sampaklis and Pham 2010). Bycatch mitigation measures are part of the Orange Roughy Conservation Program, but some level of bycatch remains unavoidable through the operation of the fisheries (AFMA 2006).



Bycatch

Bycatch is assessed as *of potential concern* for Gunther's pipehorse. Little is known about the biology, ecology, behaviour, population dynamics, critical habitats, full distribution (geographical and depth range) and relative abundance of southern Australian pipehorses. Information on the level of bycatch is limited, particularly at the species level, for pipehorses and other syngnathids. However, syngnathids are likely to be susceptible to effects from fishing due to their life history characteristics (Baker 2007). Gunther's pipehorse is caught incidentally in trawl nets. Due to the lack of data, as discussed above, it is not possible to assess the effects of trawling on Gunther's pipehorse, but trawl-fishing interactions need further investigation as most *Solegnathus* species are known to have low survival following trawl capture.



3. Relevant protection measures

Orange roughy and southern bluefin tuna are listed as threatened marine species in the conservation dependent category under section 179 of the EPBC Act. Gunther's pipehorse is listed as a marine species under section 248 of the EPBC Act.

Alongside the EPBC Act, a broad range of sector-specific management measures to address environmental issues and mitigate impacts applies to activities that take place in Commonwealth marine areas. These measures give effect to regulatory and administrative requirements under Commonwealth and state legislation for activities, such as commercial and recreational fishing, oil and gas exploration and production, port activities and maritime transport. In some instances, as in the case of shipping, these measures also fulfil Australia's obligations under a number of international conventions for the protection of the marine environment from pollution and environmental harm.

EPBC Act conservation plans and action plans

Section 179 of the EPBC Act specifies that species of fish listed in the conservation dependent category must be the focus of a plan of management in force under a law of the Commonwealth, or of a State or Territory, that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised. In the case of orange roughy and southern bluefin tuna the plans in force to stop the decline of, and support the recovery of, these species are:

- Orange Roughy Conservation Program (AFMA 2006)
- Southern Bluefin Tuna Fishery Management Plan 1995 (Commonwealth of Australia 2010)

International measures

Australia is a signatory to the following international agreement for the conservation of southern bluefin tuna:

- Convention for the Conservation of Southern Bluefin Tuna 1994
www.ccsbt.org/docs/pdf/about_the_commission/convention.pdf

For more information on conservation listings under the EPBC Act and related management objectives and protection measures, visit the following sites:

- www.environment.gov.au/coasts/species/marine-species-list.html
(listed marine species)
- www.environment.gov.au/epbc/protect/species-communities.html
(listed threatened species)
- www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
(species profile and threats database).



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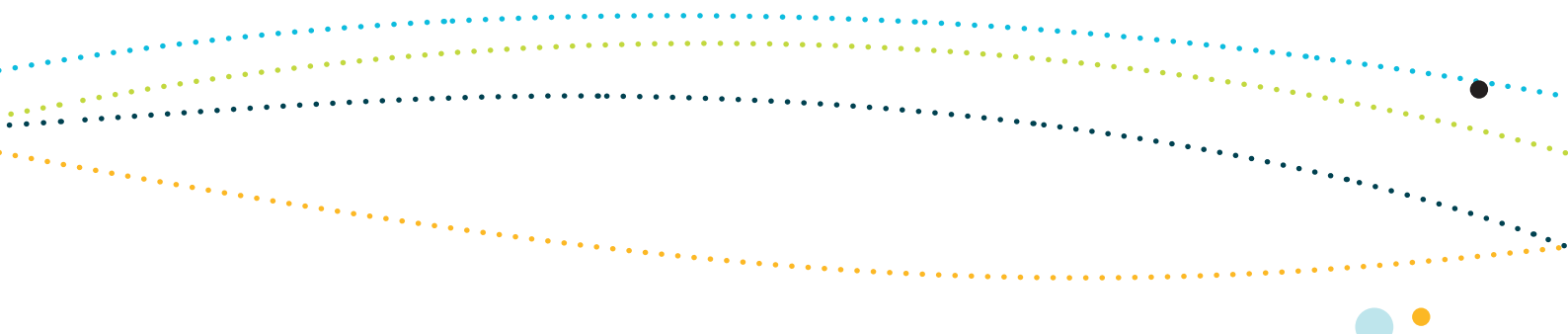
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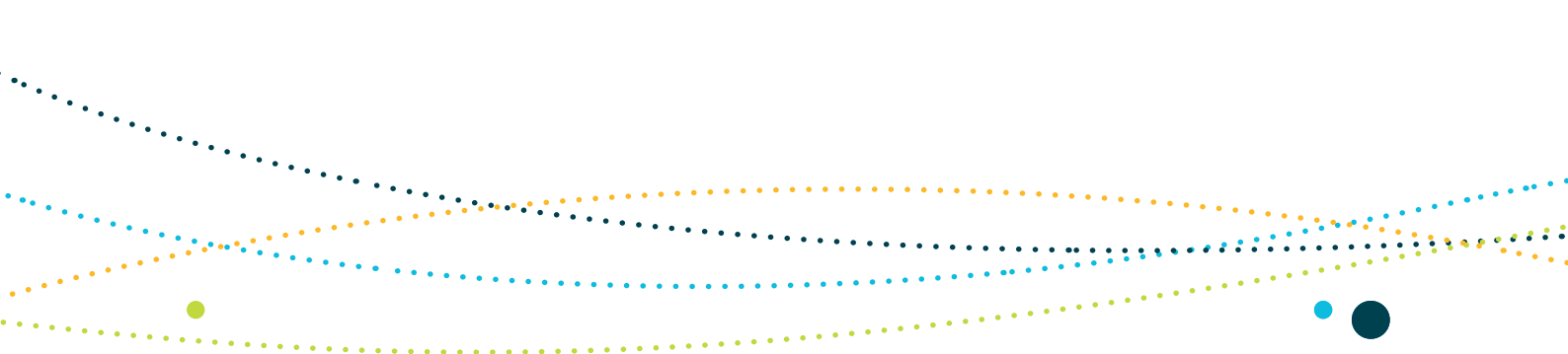
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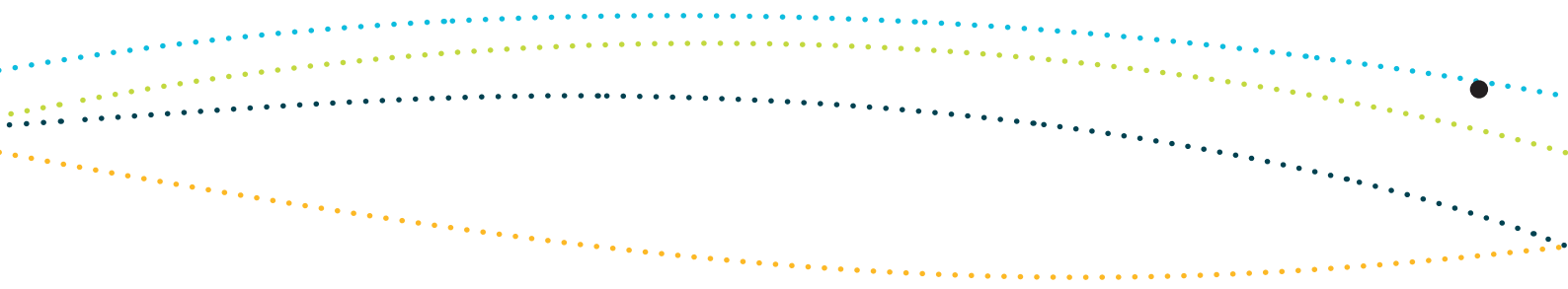
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ATTACHMENT 1: BONY FISH SPECIES OCCURRING IN THE SOUTH-WEST MARINE REGION

Table A1: Listed bony fish species known to occur in the South-west Marine Region

Species (common name/ scientific name)	Conservation status
Orange Roughy (<i>Hoplostethus atlanticus</i>)	Conservation dependent
Southern Bluefin Tuna (<i>Thunnus maccoyii</i>)	Conservation dependent
Gunther's Pipehorse (<i>Solegnathus lettiensis</i>)	Marine

Other species of syngnathid that may occur in parts of the South-west Marine Region include:

- Robust Pipehorse (*Solegnathus robustus*). Also known as *robust spiny pipehorse*
- shaggy pipefish (*Hypselognathus horridus*). Also known as prickly pipefish
- leafy sea dragon (*Phycodurus eques*)
- weedy sea dragon (*Phyllopteryx taeniolatus*). Also known as common sea dragon
- Gale's pipefish (*Campichthys galei*)
- Brock's pipefish (*Halicampus brocki*)
- bentstick pipefish (*Trachyrhamphus bicoarctatus*). Also known as bendstick pipefish, short-tailed pipefish
- Port Phillip pipefish (*Vanacampus phillipi*)
- wide-body pipefish (*Stigmatopora nigra*)
- bony-headed pipefish (*Nannocampus subosseus*)
- West Australian seahorse (*Hippocampus subelongatus*)
- western spiny seahorse (*Hippocampus angustus*). Also known as narrow-bellied seahorse
- short-headed seahorse (*Hippocampus breviceps*). Also known as short-snouted seahorse
- southern potbelly seahorse (southern form of *Hippocampus abdominalis* = '*Hippocampus bleekeri*'). Also known as potbelly seahorse, pot-bellied seahorse.

There is only one species of the family Solenostomidae (ghost pipefish) that may occur in the region. This is the Robust Ghost pipefish (*Solenostomus cyanopterus*).

