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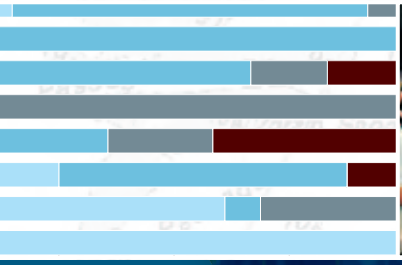
Great Barrier Reef Marine Park Authority

Ecological risk assessment of the

East Coast Otter Trawl Fishery

in the Great Barrier Reef Marine Park

Data report 3



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2012

Queensland Government

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Executive Summary

An ecological risk assessment of the East Coast Otter Trawl Fishery in the Great Barrier Reef Region was undertaken in 2010 and 2011. It assessed the risks posed by this fishery to achieving fishery-related and broader ecological objectives of both the Queensland and Australian governments, including risks to the values and integrity of the Great Barrier Reef World Heritage Area.

This was a comprehensive, robust and transparent assessment of the current fishery that used accepted standards and the latest scientific findings. The risks assessed included direct and indirect effects on the species caught in the Fishery as well as on the structure and functioning of the ecosystem. This ecosystem-based approach included an assessment of the impacts on harvested species, by-catch, species of conservation concern, marine habitats, species assemblages and ecosystem processes. In total, over 900 species, 10 habitat types, 16 assemblages and 14 ecosystem processes were considered in the assessment using a hierarchical process. The assessment also considered known external pressures (i.e. non-trawl fishery-related pressures such as modification of coastal ecosystems, degraded water quality and predicted climate change vulnerabilities), which may increase the susceptibility of an ecological component to the effects of trawling.

The assessment took into account current management arrangements and fishing practices at the time of the assessment. It also recognised that the ecosystem, which has been subject to multiple use for decades, is no longer pristine. The assessment was unusually well informed for an ecological risk assessment and captured a substantial range of published material as well as expert opinion from a diverse range of participants. This material included fishery-independent field studies, experimental manipulation of fishing activities to investigate impact and recovery of seabed species, modelling of the distributions of species, habitats and assemblages, and trophic interactions among the species groups affected by trawl fishing. Research and monitoring on harvested species, by-catch and protected species also informed the assessment. This broad body of knowledge provides a high degree of confidence that the findings about the remaining risk levels are robust.

The main findings of the assessment were:

- **Current risk levels from trawling activities are generally low.** Under current practices and 2009 effort levels the overall ecological risks from trawling in the Great Barrier Reef Region to harvested species and to the broader environmental values and integrity of the area are low, with most species, habitat types, species assemblages and ecosystem processes at low or intermediate-low risk from the Fishery (Figure 1). As trawl fishing effort has remained at similar levels over the period 2007 to 2011, the risk findings are still considered relevant in 2012 and it is unlikely overall ecological risks have changed from those reported here.

- **Some risks from trawling remain.** In particular, high risks were identified for 11 species of skates and rays and two species of sea snakes. The by-product species Balmain bugs (three species of lobsters in the genus *Ibacus*) were at intermediate-high risk. A poorly known upper continental slope habitat (90 to 300 m depth) in the southern Great Barrier Reef Region (that includes deepwater eastern king prawn fishing grounds) and the plant and animal communities occurring there were also assessed as at high risk.

  This particular upper continental slope habitat is not afforded the same levels of protection provided to other habitat types within the Region. In part, this level of protection is an artefact of the way the habitat boundary was defined for this assessment. About half of this area receives consistently high levels of trawl fishing effort. Additional ecological and biological information is required to more confidently assess the risks posed by the Fishery in this area.

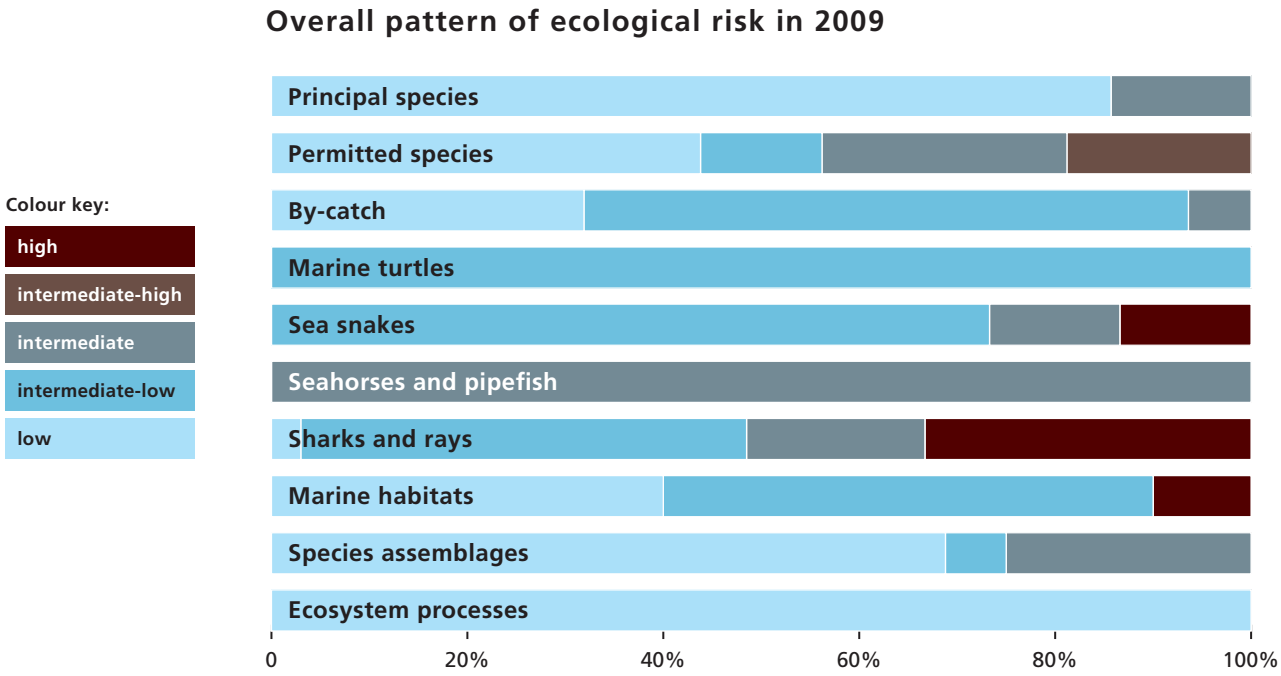

Figure 1. Overall ecological risk from activities of the East Coast Otter Trawl Fishery in the Great Barrier Reef Region.

The colour indicates the risk categories used (see colour key). Each bar is shaded to represent the proportion of species or types assigned to particular risk categories. The categories are explained in Section 3 and the contexts against which risk was assessed are defined in Section 4. The figure is based on trawl fishing effort data for 2009.

- **Risks from trawling have reduced in the Great Barrier Reef Region.** A comparison showed the overall ecological risk profile of the East Coast Otter Trawl Fishery was lower in 2009 compared to 2005 (Figure 2) as a result of a substantial reduction in trawl fishing effort over this period, principally in response to less favourable economic circumstances.
- **Trawl fishing effort is a key driver of ecological risk.** Risk may increase if fishing effort levels increase above those in 2009. Fishery management tools that actively manage effort within sustainable levels for each of the key trawl fishery sectors could provide a mechanism to control risks and impacts on harvested species and the environment.
- **Zoning has been important in reducing risks.** The protection afforded to the Great Barrier Reef Marine Park through zoning (particularly since rezoning in 2004) contributed to the relatively low ecological risks from the otter trawl fishery and is critical for protection of productive habitats, biodiversity conservation and maintaining ecosystem resilience.

  Trawling is allowed within 34 per cent, and currently occurs more than once per year in less than seven per cent, of the Great Barrier Reef Marine Park. Protection through zoning is an important measure which acts to limit spatial expansion of the Fishery and potential risk to the ecosystem.

Risk pattern for 2009 compared to 2005

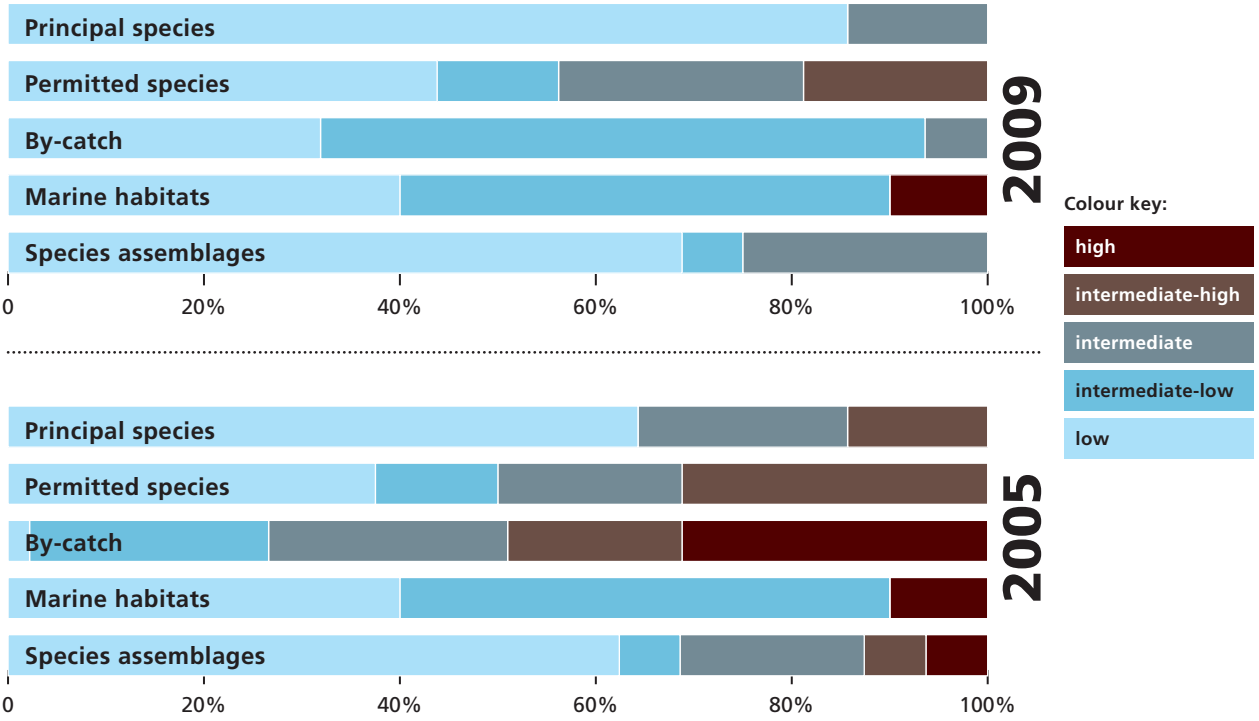

Figure 2. Comparison of overall ecological risk pattern at 2009 (top) and 2005 (bottom) trawl fishing effort levels, where data was available for both years.

The colour indicates the risk categories used (see colour key). Each bar is shaded to represent the proportion of species or habitat types assigned to particular risk categories.

The total annual trawl fishing effort in 2009 was over 40 per cent lower than in 2005, however 2005 levels were still allowable under management arrangements at the time of the assessment.

- **Reducing identified unacceptable risks requires a range of management responses.** Managers and industry will need to continue to work in partnership to prioritise and address the remaining risks. The assessment findings also validated other management actions implemented to address ecological sustainability concerns about trawling, and found that risks and impacts from trawling have been significantly reduced since the introduction of a management plan for the Fishery in 1999.
- **The commercial fishing industry is supportive and being proactive.** Positive steps have been, and are being, taken by trawl fishers to reduce the risks from trawling to the species, seabed communities and habitats of the Great Barrier Reef Region. For example, mandatory use of turtle excluder devices (TEDs) throughout the otter trawl fishery for the last decade has greatly reduced incidental catch of loggerhead turtles and other large animals such as sharks. The trawl industry is encouraged to continue to work with managers and researchers on further improvements and innovation in by-catch reduction devices (BRDs) and related efforts to further reduce the remaining risks for skates, rays and sea snakes in particular. Measures that improve the efficiency with which the catch is taken (such as better by-catch reduction measures) or reduce the Fishery's ecological impact also tend to have economic benefits for industry (e.g. improved product quality leading to higher market price or lower fuel usage).

- **Further reductions in trawl by-catch, high compliance with rules and accurate information from ongoing risk monitoring are important.** Risk monitoring would be assisted by improved reporting via logbooks, monitoring of discard levels and species composition through fishery observer programs and ongoing compliance programs. Measures to ensure adoption of best practice TEDs and BRDs throughout the Fishery and other related efforts to reduce remaining risks for species of conservation concern should be promoted.

  These are important for effective management of the Fishery, for any future re-evaluation of the ecological risks within the Great Barrier Reef Region and for public confidence in the sustainability of the Fishery.

- **Trawl fishing is just one of the sources of risk to the Great Barrier Reef.** Continuing to take positive actions to further improve trawl fishery management and practices is important for maintaining the resilience of the Great Barrier Reef, for which the overall outlook has recently been assessed as poor, in the light of serious threats, especially from climate change.

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Appendix 1. Resilience of principal species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Prawns	*Penaeidae*								
Brown tiger prawn	*Penaeus esculentus*	50% mature at 32mm CL with mean fecundity of 186 000 eggs	A	Good ability to maintain/ rebuild population. Continuous spawning with seasonal variation.	A	Widespread Indo-Pacific: Australia.(http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Penaeus)_esculentus)	A	Widespread. Occur over mud or sandy mud substrates in 8–20 m depth, juveniles occupy shallow waters in estuaries. Some reports indicate juveniles prefer seagrass along exposed coastlines.	A
Grooved tiger prawn	*Penaus semisulcatus*	50% mature at 39mm CL with mean fecundity of 365 000 eggs	A	Good ability to maintain/ rebuild population. Continuous spawning with seasonal variation.	A	Widespread Indo-West Pacific and the Mediterranean: southeast Africa to Japan, the Malay Archipelago and Australia. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Penaeus)_monodon)	A	Widespread. Occur over sand to mud substrates, juveniles found in shallow waters generally associated with seagrass beds, depth 2–130 m.	A
Black tiger prawn	*Penaeus monodon*	>800 000 eggs for large females	A	Good ability to maintain/ rebuild population. Continuous spawning with seasonal variation.	A	Widespread do-West Pacific and Atlantic Ocean: from southeast Africa and Pakistan to Japan, the Malay Archipelago and Australia. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Penaeus)_semisulcatus)	A	Widespread. Occur over mud to sand substrates, juveniles occasionally enter rivers, depths to 110 m.	A

Appendix 1. Resilience of principal species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Prawns										
Brown tiger prawn	Reach maturity in 5-6 months	A	Although tiger prawn species can live for several years the proportion of stock that survives longer than about 12 months due to natural and fishing mortality is very small. Evidence for this is the very small proportion of animals in the fishery that are larger than average size of 12 month old individuals. (CT, DEEDI)	A	There is potential for cumulative pressures but not known.	A	Concern about low prawn catches in Bowen area by industry	There are examples of decline due to high effort; Exmouth Gulf and the Northern Prawn Fishery	0	H
Grooved tiger prawn	Reach maturity in 5-6 months	A	Although tiger prawn species can live for several years the proportion of stock that survives longer than about 12 months due to natural and fishing mortality is very small. Evidence for this is the very small proportion of animals in the fishery that are larger than average size of 12 month old individuals. (C Turnbull, DEEDI)	A	None known	A	Concern about low prawn catches in Bowen area by industry	There are examples of decline due to high effort; Exmouth Gulf and the Northern Prawn Fishery	0	H
Black tiger prawn	Reach maturity in 5-6 months	A	Although tiger prawn species can live for several years the proportion of stock that survives longer than about 12 months due to natural and fishing mortality is very small. Evidence for this is the very small proportion of animals in the fishery that are larger than average size of 12 month old individuals. (C Turnbull, DEEDI)	A	None known	A	Concern about low prawn catches in Bowen area by industry	Collection of brood stock for aquaculture	0	H

Appendix 1. Resilience of principal species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Blue endeavour prawn	*Metapenaeus endeavouri*	296 000 eggs at 30 mm CL	A	High ability to recover, rapid turnover, probable multiple spawnings annually, winter, summer, all year at some level especially in north (C Turnbull, DEEDI)	A	Widespread Indo-West Pacific and Atlantic Ocean: India to Japan, Malay Archipelago and Wallis and Futuna Islands. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Metapenaeus_endeavouri)	A	Juveniles in shallow estuarine areas, seagrass meadows on reef tops in north; adults in deeper water to 50m +.	A
False endeavour prawn	*Metapenaeus ensis*	Highly fecund	A	High ability to recover, rapid turnover, continuous spawning with seasonal variation.	A	Widespread Indo-West Pacific: the Philippines and Australia and New Guinea. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Metapenaeus_ensis)	A	Juveniles in shallow estuarine areas, seagrass meadows on reef tops in north; adults in deeper water to 50m +.	A
Eastern king prawn	*Melicertus plebejus*	Log(10) ripe oocytes=0.0199xCL+4.7528. Works out to ~300 000 at 40 mm CL and ~800 000 at 60 mm CL (TC). 134637 at 33 mm CL (CT)	A	Eggs released externally into the water column. Benthic eggs, pelagic larvae. Benthic post-larvae and juveniles.	A	Widespread Indo-West Pacific: Australia. Victoria, NSW, north to about Swains Reefs (21 degrees) QLD. Migratory. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Melicertus)_plebejus)	A	Widespread. Juveniles: estuarine. Adults: marine. Found over sandy substrates, depth 2–350m and maybe deeper. Juvenile : bare & vegetated substrates in estuaries and oceanic embayment's. Adult : ocean. Highly migratory, generally northwards.	A
Red spot king prawn	*Melicertus longistylus*	high	A	Rapid turnover	A	Widespread Indo-West Pacific: Malaysia, Philippines and Australia (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Melicertus)_longistylus)	A	Trawled near coral reefs, shallow 10m to 50+m.	A

Appendix 1. Resilience of principal species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Blue endeavour prawn	Estimates of growth rates from tagging data for NT and Torres Strait. Size at maturity estimates. Less than 2 yrs	A	high natural maturity, rapid turnover	A	coastal development, water quality, but generalists / opportunists	A	Seasonality in spawning, possible regional populations all along coast,	Appear to have positive trawl effect (anecdotal information and Seabed Biodiversity Project). No indication of overfishing of endeavour prawn stocks in Torres Strait or on the Qld east coast.	0	H
False endeavour prawn	Less than 2 yrs	A	high natural maturity, rapid turnover	A	coastal development, water quality, but generalists / opportunists	A	Seasonality in spawning, possible regional populations all along coast,	Appear to have positive trawl effect (anecdotal information and Seabed Biodiversity Project). No indication of overfishing of endeavour prawn stocks in Torres Strait or on the Qld east coast.	0	H
Eastern king prawn	Less than 2 yrs. Male K=0.34 per month. Linf 41 mm CL. Female K=0.25 per month. Linf=53 mm CL Reaches Linf in < 2 years	A	M=0.2 per month	A	Experiences other trawl pressure outside the GBR - all part of the one stock hence included in scoring. No significant non-fishing pressures. Change in rain fall patterns (correlated with good season) in response to climate change?	P	There is one stock of this species on the east coast of Australia. The complementary ecological risk assessment project is considering the full stock, for which the fishery impact profile may vary.	This assessment has considered the component of the stock of eastern king prawns within the Great Barrier Reef Marine Park only.	1	H-I
Red spot king prawn	Adult size in less than 2 yrs. Growth rate estimates available from Townsville in the ~1985 & PCB in ~1990	A	Short lived, high mortality	A	None known	A			0	H

Appendix 1. Resilience of principal species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Blue legged king prawn	*Melicertus latisulcatus*	high	A	Rapid turnover	A	Widespread Indo-West Pacific: Southeast Africa to Japan, Malay Archipelago and Australia. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Melicertus)_latisulcatus)	A	Trawled over hard substrates, sand, sandy mud or gravel, depths of 0–90 m, Juveniles can occupy nursery areas in shallow waters of high salinity.	A
White banana prawn	*Fenneropenaeus merguiensis*	Number of ova = 19944.7xCL-441097. 100 000-450 000	A	Eggs released externally into the water column. Benthic eggs, pelagic larvae. Benthic post-larvae and juveniles.	A	Widespread. Indo-West Pacific, including northern Australian coastal waters. Persian Gulf, Thailand, Hong Kong, Philippines, Indonesia and New Caledonia. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Penaeus_(Fenneropenaeus)_merguiensis)	A	Trawled over muddy substrates 10-45m. Juveniles enter shallow rivers and estuaries as part of life cycle. Juveniles prefer mangroves. Sub adults in shallow estuaries. Adults in coastal waters to about 45m.	P

Appendix 1. Resilience of principal species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Blue legged king prawn	Adult size in less than 2 yrs. Growth rate estimates available from Townsville in the ~1985 & PCB in ~1990	A	Short lived, high mortality	A	None known	A			0	H
White banana prawn	Reaches Linf in < 2 years. Male K=0.136 per week. Linf 29.4 mm CL. Female K=0.116 per week. Linf=35.3 mm CL	A	M=0.2 per month	A	No significant non-fishing pressures	A	Population size is probably markedly affected by rainfall.		1	H-I

Appendix 1. Resilience of principal species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Other principal species (Moreton Bay bugs, squid, scallops)									
Moreton Bay bug (spotted legs/reef bug)	*Thenus australiensis*	Number of eggs=1273.2*CL - 67049 Works out to range from ~5 000 to 45 000 eggs	P	Eggs attached externally to endopods. Eggs hatch on mother. Phyllosoma larvae are part of plankton. Larval stages last about 40 days, then settle on bottom.	P	Northern Australian coastal waters north of Fraser Is. to about 70 m depth . This species, or very similar species may also occur through southeast Asia to India.	A	Sand bottom, sub littoral. Soft substrate sometimes with shells or gravel, depth 8 to 70 m, usually 10 to 50 m.	A
Moreton Bay bug (mud bug)	*Thenus parindicus*	Number of eggs=658.7*CL - 26 329 Works out to range from ~4 000 to 20 000 eggs	P	Eggs attached externally to endopods. Eggs hatch on mother. Phyllosoma larvae are part of plankton. Larval stages last about 40 days, then settle on bottom.	P	Widespread - 200 m bathymetric: Gulf of Carp., N coast, NE coast (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Thenus_indicus) Northern Australian coastal waters to about 40 m depth. This species, or very similar species may also occur through southeast Asia to India.	A	Benthic, sub tidal. Muddy-sand substrates. Shallow inshore muddy waters to a depth of about 40 m.	A
Squid spp (Pencil, Tiger & Arrow)	*Uroteuthis (Photololigo) spp & Sepioteuthis lessoniana*	A few thousand	P	Catastrophic spawners, short life span (< 12 months), population likely to spawn year round. Attached eggs, hatch at an advanced stage	A	Widespread northern Australia	A	Demersal during day, broad habitat use, probably prefer structured habitats	A
Tropical saucer scallop	*Amusium japonicum balloti*	These are a broadcast spawner with high fecundity	A	Broadcast spawners of eggs and sperm. External fertilization. Sexes usually separate. Eggs float. Planktonic oceanic larval stage of ~20 days. Limited or no abyssal stage. Juveniles settle on bare sand, rubble or soft sediments, unattached.	A	A. balloti are distributed throughout the GBRMP, south of the Park to NSW, across Northern Australia and down to Shark Bay in Western Australia. Also present in New Caledonia.	A	Juvenile and adults generally found on sandy, rubble or soft sediments in depths 10 to 70 m.	A
Asian moon (mud) scallop	*Anusium pleuronectes*	These are a broadcast spawner with high fecundity	A	Assume similar to saucer scallop	A	Widespread- tropical Indo-West Pacific (fishbase). (http://www.eol.org/pages/4739561)	A	Depth range 10 – 80 m	A

Appendix 1. Resilience of principal species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Other principal specie										
Moreton Bay bug (spotted legs/reef bug)	Male K=0.0014 per day, Linf = 77.45 mm CL. Female K=0.0016 per day and Linf = 89.04 mm CL. Approach Linf in 3-6 years.	A	Approach Linf in 3-6 years M=0.918 per year.	A	No significant non-fishing pressures	A			2	H-I
Moreton Bay bug (mud bug)	Male K=0.0026 per day, Linf = 61.23 mm CL. Female K=0.0023 per day and Linf = 72.44 mm CL. Approach Linf in 3-4 years.	A	Approach Linf in 3-4 years M Probably slightly higher than T. australiensis.	A	No significant non-fishing pressures	A		Previously called Thenus orientalis but that species is restricted to North Pacific	2	H-I
Squid spp (Pencil, Tiger & Arrow)	Rapid and variable	A	Few months lifespan	A	Very limited recreational fishing pressure	A			1	H-I
Tropical saucer scallop	Linf=104.31 and K=2.02 per year.	A	A. balloti reaches Linf in 1-2 years. Maximum age of 3-4 years. M=0.02 per week	A	No significant non-fishing pressures	A			0	H
Asian moon (mud) scallop	Assume similar to saucer scallop	A	Assume similar to saucer scallop	A	No significant non-fishing pressures	A			0	H

Appendix 2. Resilience of other permitted species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Threadfin bream (Pinkies)	Family Nemipteridae	Moderate fecundity	P	Protogynous, schooling (small groups), generation time < 15 moths	A	Western Pacific	A	Depending on species, occur on sand or mud bottoms in offshore waters, may also be found in inner bays, and feed on small crustaceans, molluscs and fishes etc	A
Mantis shrimp	*Family Squillidae, order Stomatopoda*	Fecundity likely to be moderate. Prolonged spawning season with at least two spawnings per season (Courtney et al 2007).One species found to be able to brood up to 5 clutches in 1 year.	P	Usually spawn, brood and hatch their eggs inside their burrows. Female cares for eggs. Incubation period is temperature dependent (shorter with increased temp.) Once larvae form they enter the water column as feeding plankton for 1 to 2.5 months before entering juvenile stage of rapid growth and high instantaneous mortality (for one species, at 2.5 years). Some pair for life. Disruption to breeding pair could reduce reproductively.	P	Widespread, and throughout GBRWHA	A	Benthic, and generally inhabit rock or coral crevices or in burrows in soft mud and sand substrates. Hunt at entrance to burrow, sea floor or swimming in water column. Feed on other crustaceans - mainly prawns, other mantis shrimps, and small fish.	A

Appendix 2. Resilience of other permitted species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Threadfin bream (Pinkies)	K= 1/0.47 or 1/1.04 Fishbase	A	(pinkies 5 yrs Nemipterus peronii. NW Shelf))	A	trawl only	A	unknown		1	H-I
Mantis shrimp	Fast growth (stephensonii) Courtney et al 2007)	A	High instantaneous mortality. For Erugosquilla woodmasoni 0.87 in Pitcher et al 2007. Oratosquilla stephensoni life span approximately 2.5 to 3 years (Courtney et al 2007).	A	Trawl only	A	Seasonality in catches reported for Moreton Bay, and in other places decreased catch rates may result from reduced female out-of-burrow activity when incubating their eggs and disappearance from the population of adults after spawning (in Courtney et al 2007).	About 400 species of mantis shrimp are known worldwide. Ahyong (2001) reported 146 species within 63 genera inhabit Australian waters, with 99 of these species being reported from Queensland (Haddy, 2000; Ahyong, 2001).	2	H-I

Appendix 2. Resilience of other permitted species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Blue swimmer crab	*Portunus pelagicus*	High fecundity: 2 million eggs / yr	A	Short life span, early maturing, guard eggs	A	Widespread (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Portunus_(Portunus)_pelagicus) Sealifebase: Tropical, Atlantic Ocean and throughout Indo-West Pacific.	A	Demersal soft substrates and in shallow sandbanks and estuaries. {Burrowing, estuarine, low intertidal, sand bottom, sub tidal. Sandy to muddy substrates, common in seagrass beds (Zostera), depths to 65 m. Sealifebase:Inhabits sandy to sandy-muddy substrates in areas near reefs, mangroves, and sea grass and algal beds. Juveniles tend to occur in shallow intertidal areas (Ref. 343).}	A
Three-spotted crab (Red-spotted crab)	*Portunus sanguinolentus*	Presumed slightly lower than Portunus pelagicus given smaller maximum body size in QLD waters	A	Similar to *Portunus pelagicus*	A	Widespread (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Portunus_(Portunus)_sanguinolentus_sanguinolentus) Sealifebase: Tropical, Indo-West Pacific.	A	Benthic, sub littoral. Sand to sandy-mud bottoms, to 40 m depth. Sealifebase: demersal; marine; depth range ? – 30 m. Occurs from the intertidal zone (especially juveniles) to depths of 30 m. Inhabits sandy to sandy-muddy substrates. Subtropical and tropical climates.	A

Appendix 2. Resilience of other permitted species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Blue swimmer crab	Rapid, mature at 12 months (females ~ 110 mm CW)	A	Max 3 yrs, high natural mortality	A	Trawl 60 out of 720t total commercial catch - crab (pot) fishery both commercial and recreational accounts for significant catch	P			1	H-I
Three-spotted crab (Red-spotted crab)	Rapid growth. Size at sexual maturity varies geographically	A	Unknown presumed similar to pelagicus	A	None known	A			0	H

Appendix 2. Resilience of other permitted species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Red champagne lobster (Barking crayfish)	*Linuparus trigonus*	Brood fecundity=0.1107*CL^2 .9241 Equates to ~20,000 eggs at CL=60 mm and 100,000 eggs for 100 mm CL.	A	Adults, sexes are separate. Eggs externally fertilise and held on endopods until hatching. Phyllosoma larvae hatch and disperse seaward for long oceanic phase prior to settling as post-larval puerulus and then juveniles. Move to shallower water as they grow and mature.	P	Indo-Pacific region, including Japan, Taiwan, Philippines, eastern and western Australia.	A	Deepwater species 81 to 313 m. Trawled mainly off Townsville in depths of 100-200 m. Benthic, continental shelf, continental slope, sub littoral. Bottom sandy-mud, sometimes with shells, depth 30–414 m. Sealifebase: demersal; marine; depth range 30 – 318 m	A
Slipper lobsters	*Scyllarus martensii, Scyllarus demani, Scyllarides squammosus, Scyllarides haanii*	Unknown - little known biological information. Assume moderate fecundity	P	Adults, sexes are separate. Eggs externally fertilise and held on endopods until hatching. Phyllosoma larvae hatch and disperse seaward for long oceanic phase prior to settling as post-larval puerulus and then juveniles.	P	Widely distributed throughout the GBR and more broadly	A	Non specific	A
Deepwater bug (Velvet balmain bug)	*Ibacus alticrenatus*	2000-15000	P	Adults, sexes are separate. Eggs externally fertilise and held on endopods until hatching. Phyllosoma larvae hatch and disperse seaward for pelagic phase prior to settling as post-larval puerulus and then juveniles.	P	Widespread southern GBRMP - (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Ibacus_alticrenatus) Sealifebase: subtropical, Indo-West Pacific: Australia and New Zealand. (Courtney et al. 2007) 118-258m	A	Benthic, burrowing, continental shelf, continental slope, sand bottom, sub littoral. Digs into substrate and covers itself with mud and sand, ovigerous females from May to October, depth 20 to 686 m. Sealifebase: demersal; marine; depth range 20 – 455 m	A

Appendix 2. Resilience of other permitted species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Red champagne lobster (Barking crayfish)	Smallest recorded in the fishery is 59.8mm CW and 50% maturity is reached between 80-85mm CW (Courtney et al 2007)	P	Unknown	P	No significant non-fishing pressures	A			3	I
Slipper lobsters	Unknown	P	Unknown	P	Unknown	A		Family Scyllaridae, subfamily Arctinae, genus *Scyllarides* , species *squammosus* and *haanii.* Family Scyllaridae, subfamily Scyllarinae, genus Scyllarus, species martensii and demani	4	I-L
Deepwater bug (Velvet balmain bug)		A	presumed <20	A	Trawl only	A	Ovigerous females are found from May to October		2	H-I

Appendix 2. Resilience of other permitted species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Shovel-nosed lobster (Honey balmain bug)	*Ibacus brucei*	2000-60000	P	Adults, sexes are separate. Eggs externally fertilise and held on endopods until hatching. Phyllosoma larvae hatch and disperse seaward for pelagic phase prior to settling as post-larval puerulus and then juveniles.	P	Widespread southern GBRMP: - Southern Qld, northern NSW; Kermadec Is., north of New Zealand. (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Ibacus_brucei) (Courtney et al. 2007) 117 - 230m	A	Benthic, continental shelf, continental slope, soft bottom. demersal; marine, Soft substrates with stones, depth 83–559 m.	A
Smooth bug (Garlic balmain bug)	*Ibacus chacei*	2 000 to 30 000 (size related)	P	Adults, sexes are separate. Eggs externally fertilise and held on endopods until hatching. Phyllosoma larvae hatch and disperse seaward for pelagic phase prior to settling as post-larval puerulus and then juveniles.	P	Widespread southern GBRMP (Courtney et al. 2007) - 58-238m:Central east Aust deep shelf slope widespread (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Ibacus_chacei)	A	Benthic, continental shelf, continental slope, sub tidal. From 22–330 m depth.	A
Cuttlefish	*Sepia spp.*	Moderate fecundity, but often very abundant	P	Generally females die after a single short spawning season (multiple egg layings). Attach grape-like eggs to hard structures. Eggs hatch as juveniles and start feeding immediately and grow to reproduce in the last 1/2 to 2/3 of the life cycle.	A	most widespread in Indo-West Pacific	A	Demersal from shallow inshore waters (inc bays but not liking freshwater) to the upper continental slope (to 600 m depth), all are ambush predators on macrocrustaceans and teleosts and perhaps other cephalopods smaller than themselves.	A

Appendix 2. Resilience of other permitted species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Shovel-nosed lobster (Honey balmain bug)	Studies show that *Ibacus* spp. would require 3 months at sea in planktonic phase.	A	presumed <20	A	Trawl only	A			2	H-I
Smooth bug (Garlic balmain bug)	Mature at ~2 (Haddy), NSW 2-3 yrs. Female reaches sexual maturity at 54 mm carapace length. Rapid growth in first 4 years then slows. Both sexes Lmax 4-7 years	A	> 10 yrs NSW, presumed <20	A	Trawl only	A			2	H-I
Cuttlefish	Typically show fast growth rates and live for less than 2 years (most prob < 1)	A	high M and short life span	A	Trawl only	A	Potentially high seasonal and interannual variability in stock size, no known regional population boundaries		1	H-I

Appendix 2. Resilience of other permitted species

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Hammer octopus	*Octopus australis*	Large eggs	P	Parental care, night active on sand and mud substrates, shells or burrows during day	P	Restricted: New South Wales: Central E coast & Queensland: Central E coast (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Octopus_australis)	P	Benthic, continental shelf. demersal; marine	P
Red-spot night octopus	*Callistoctopus dierythraeus*	Large eggs	P	Parental care, night active with shell lairs	P	Widespread (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Octopus_dierythraeus) Sealifebase: Tropical, Western Central Pacific.	A	demersal; marine. Adult: benthic, continental shelf, nocturnal, predator. Juvenile: benthic, continental shelf.	P
Scribbled night octopus	*Callistoctopus graptus*	Large eggs	P	Parental care, night active	P	Northern Australia tropical shelf waters	A	Benthic, continental shelf, tropical.	A
Plain-spot octopus	*Amphioctopus exannulatus*	Small eggs	A	Broadcast spawners, intertidal mudflats to 80m+ muddy sandy and shelly substrates inc seagrass meadows	A	Widespread nth Aust inc Gulf (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Octopus_exannulatus)	A	Demersal interreefal species (sand and mud bottoms) intertidal to 80+m	A
Veined octopus	*Amphioctopus marginatus*	Small eggs	A	Broadcast spawners, mud and sand substrates	A	Widespread in the tropical western Pacific and coastal waters of the Indian Ocean	A	Demersal; marine	A
Southern star-eyed octopus	*Amphioctopus cf kagoshimensis*	Small eggs	A	Broadcast spawners, lairs in coral rubble, crepuscular	A	Central Queensland to central NSW	P	Intertidal to 100m+	A

Appendix 2. Resilience of other permitted species

Common Name	Growth rate	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Comments	Risk prone score	Resilience level
Hammer octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A		Many octopus have a short life cycle (< 2 years); species fit into two groups, large egg layers (maternal care) or small egg layers with pelagic dispersal. They are solitary animals with different species active during daylight or at night or in crepuscular periods.	4	I-L
Red-spot night octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A			3	I
Scribbled night octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A			2	H-I
Plain-spot octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A			0	H
Veined octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A			0	H
Southern star-eyed octopus	Fast growth	A	Short life span (<2 yrs)	A	None known	A			1	H-I

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Prawns											
Brown tiger prawn	*Penaeus esculentus*	7	A	47	P	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Grooved tiger prawn	*Penaus semisulcatus*	55	P	174	PP	Not triggered	A	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Black tiger prawn	*Penaeus monodon*	Not assessed in Seabed Biodiversity Project, however catch and effort are considered to be relatively low and there are likely to be substantial protected refugia.	A	Not assessed in Seabed Biodiversity Project, however catch and effort are considered to be relatively low and there are likely to be substantial protected refugia.	A	Not triggered	A	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Blue endeavour prawn	*Metapenaeus endeavouri*	10	A	46	P	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Low, less than 10%	A	None for NE coast specific, preliminary assessment for Torres Strait (effort issue)	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Prawns										
Brown tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Grooved tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Black tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Blue endeavour prawn	Not fully utilised	A	Adult stages only	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species identification problem	A or P	Market-ability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK
Prawns											
Brown tiger prawn	Don't separate and report on separately but fishers easily identify different species. Some monitoring at species level in some years in some areas.	P	High demand and moderate price	P	38	A	Seasonal fishery winter to September, not caught for 4-5 months of the year		7	I	INT
Grooved tiger prawn	Don't separate and report on separately but fishers easily identify different species. Some monitoring at species level in some years in some areas.	P	High demand and moderate price	P	26	A	Seasonal fishery winter to September, not caught for 4-5 months of the year		8	I	INT
Black tiger prawn	Separate code (brood stock) but sometimes reported in general	P	High demand and moderate price	P	Not assessed in Seabed Biodiversity Project, however there are likely to be substantial protected refugia.	A			5	I-L	LOW
Blue endeavour prawn	Don't separate and report on separately but fishers easily identify different species. Some DEEDI Long Term Monitoring Program monitoring at species level to 2009 in some areas. No marketing reason to separate	P	Can sell them all, but lowest value product among principal prawn species.	A	48	A		Daily revenue relatively good despite low prices as catch rates usually high	5	I-L	LOW

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
False endeavour prawn	*Metapenaeus ensis*	13	A	67	PP	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Low, less than 10%	A	None for NE coast specific, preliminary assessment for Torres Strait (effort issue)	P
Eastern king prawn	*Melicertus plebejus*	5 Around 990t are caught in the GBRMP annually (figure seemed too low to industry reps).	A	30	P	Not triggered	A	Around 2%	A	There is adequate information for stock assessment (2000) and a stock assessment is currently in progress.	A
Red spot king prawn	*Penaeus longistylus*	3 (Data provided by Pitcher in 2011)	A	17	A	not triggered	A	all adults kept (i.e. < 5%)	A	none	P
Blue legged king prawn	*Penaeus latisulcatus*	10	A	49	P	not triggered	A	all adults kept (i.e. < 5%)	A	none	P
White banana prawn	*Penaeus merguiensis/ Fenneropenaeus merguiensis*	Around 200 t are caught in the GBRMP annually. Targeted fishing is very seasonal and overall percent caught for the species in the GBR is likely to be below 25%.	A	Targeted fishing is very seasonal and overall percent effort exposed for the species in the GBR is likely to be below 25%.	A	Not triggered. See the stock assessment report by Tanimoto et al 2006	A	Around 2%	A	A stock assessment which included data from 1988-2004 was published in 2006.	A

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
False endeavour prawn	Not fully utilised	A	Adult stages only	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Eastern king prawn	Not overfished in GBR - only adult stock.	A	Only fished at adult stages in GBR	A	Spatial and temporal closures, and gear and effort restrictions	A	Not relevant for adults caught in the GBR	A	100% of prawns taken by ECTF	P
Red spot king prawn	uncertain	P	Minimal interaction with juveniles	A	Suite of measures appropriate for this species	A	No unwanted catch	A	~100%	P
Blue legged king prawn	uncertain	P	Minimal interaction with juveniles	A	Suite of measures appropriate for this species	A	No unwanted catch	A	~98%	P
White banana prawn	Sustainably fished - Biomass was generally found to be 50-70% of virgin biomass. Biomass levels fell below 40% virgin in the late 1990s around Townsville and Moreton.	A	Begins to experience fishing mortality at >=20 mm CL	A	Suite of measures appropriate for this coastal species	A	No unwanted catch	A	~80 of total in GBR, 60% of this is otter trawl	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species identification problem	A or P	Market-ability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK
False endeavour prawn	Don't separate and report on separately but fishers easily identify different species. Some DEEDI Long Term Monitoring Program monitoring at species level to 2009 in some areas. No marketing reason to separate	P	Can sell them all, but lowest value product among principal prawn species.	A	33	A			6	I-L	LOW
Eastern king prawn	While this species is very similar in appearance to other prawn species, its distribution is such that it can be readily identified from other species. Reported on at species level	A	Marketability is very high. It is a principal target species and the most commercially valuable fished species in QLD.	P	46 (from Pitcher et al. 2007)	A	There is one stock of this species on the east coast of Australia. The complementary ecological risk assessment project is considering the full stock, for which the fishery impact profile may vary.	It is likely to occur in locations where it cannot be trawled.	3	L	LOW
Red spot king prawn	Easily identified by fishers but fishery data not generally reported at species level.	P	High	P	62	A			5	I-L	LOW
Blue legged king prawn	Easily identified by fishers but fishery data not generally reported at species level.	P	High	P	41	A			6	I-L	LOW
White banana prawn	Readily identifiable. Reported commercial landings are unlikely to be confused with other prawn species.	A	Second lowest value - endeavours are lower	A	It is likely to occur in locations where it cannot be trawled.	A			1	L	LOW

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Other principal species (Moreton Bay bugs, squid, scallops)											
Moreton Bay bug (spotted legs/reef bug)	*Thenus australiensis*	7 (Data provided by Pitcher in 2011). Around 300 t are caught in the GBRMP annually.	A	23	A	Reef bugs are a principal species in QLD. In most cases, they are not targeted, but are commercially important by-product. They are targeted in some areas. PMS not triggered	A	Discard rate of sub-legal size classes is likely to vary seasonally and is likely to be high when small recruits enter the fished population. Discard rates used to be high when egg-bearing females were prohibited (< 2009). Now egg-bearing females can be retained and marketed.	A	There has not been a stock assessment undertaken on Moreton Bay bugs in QLD. Per-recruit analyses have been undertaken and used to provide advice on minimum legal size.	P
Moreton Bay bug (mud bug)	*Thenus parindicus*	28 Around 100-200 t are caught in the GBRMP annually.	P	57	PP	Mud bugs are a principal species in QLD. They are generally not targeted, but rather are a by-product of trawling for tiger and endeavour prawns. PMS not triggered	A	Under size (< 75 mm CW) are discarded, but probably have high post-release survival. The BRDs used by fishers probably have little effect in mud bug catch rates.	A	There has not been a stock assessment undertaken on Moreton Bay bugs in QLD. Per-recruit analyses have been undertaken and used to provide advice on size limits.	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Other principal s										
Moreton Bay bug (spotted legs/reef bug)	Uncertain status. Value per recruit analysis suggests that Thenus australiensis is likely to be growth overfished at a minimum legal size of 75 mm CW. Recruitment overfishing is unlikely if a high proportion of biomass is in area closed to trawling.	P	Sub-adults first recruit to the fishery at about 40 mm CL. Fished from around 40-85 mm CL (equates to around 60-120 mm CW).	A	The main form of direct management is via a minimum legal size of 75 mm CW. Benthic mapping project concluded a high proportion of biomass in areas closed to trawling.	A	100 mm square mesh codends (i.e. 50 mm x 50 mm) were shown to be highly effective in the scallop fishery at excluding sub-legal reef bugs. If these devices are made mandatory then they will significantly reduce incidental catch rates and mortality.	P	100%	P
Moreton Bay bug (mud bug)	Uncertain status. Value per recruit analysis suggests that the current minimum legal size of 75 mm CW results in maximising value for this species. Recruitment overfishing is unlikely if a high proportion of biomass is in area closed to trawling.	P	Sub-adults first recruit to the fishery at about 35 mm CL. Fished from around 40-70 mm CL (equates to 60-100 mm CW).	A	Main management measure is via a minimum legal size of 75 mm CW. Benthic mapping project concluded a significant proportion of biomass in areas closed to trawling.	A	Its unlikely that the BRDs currently used by trawler operators significantly lower the catch rates of sub-legal mud bugs	P	100%	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species identification problem	A or P	Market-ability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK
Other principal s											
Moreton Bay bug (spotted legs/reef bug)	This species is not directly differentiated by fishers or others from similar species, such as the mud bug, Thenus parindicus.	P	Marketability is very high. High value species of the QLD trawl fishery.	P	54	A			6	I-L	LOW
Moreton Bay bug (mud bug)	This species is not directly differentiated by fishers or others from similar species, such as the reef bug, Thenus australiensis.	P	Marketability is very high. High value species of the QLD trawl fishery.	P	45	A			9	H-I	INT-HIGH

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Squid spp (Pencil, Tiger & Arrow)	*Uroteuthis (Photololigo) spp & Sepioteuthis lessoniana*	Extremely low	A	Less than 10%	A	Not generally targeted (demersal during day, pelagic at night). PMS uncertain because of highly variable catch rates not providing a consistent trend.	A	Low: no intentional discard or required discard such as for a minimum legal size	A	Moderate: biological information adequacy	P
Tropical saucer scallop	*Amusium japonicum balloti*	18 Approximately 4000-8000 t (total body weight) are caught in the GBRMP annually. This equates to around 600-1300 t of scallop meat weight annually.	A	45	P	A. balloti is a principal species of the QLD trawl fishery. There is a specific fishery for it. CPUE is used regularly as an index of abundance. PMS not triggered	A	Relatively high rates of discarding occur. These can be affected by varying minimum legal sizes. Square mesh can be used to significantly reduce discarding, if square meshes of appropriate mesh size are made mandatory.	P	There have been two quantitative stock assessments undertaken on the QLD scallop fishery over the last 10 years. Currently biological reference points are being derived for the fishery.	A
Asian moon (mud) scallop	*Anusium pleuronectes*	38	P	52	PP	No trigger for this species rather a combined scallop measure which was not triggered	A	Relatively low discarding of scallops below marketable size as valuable product and no minimum size for this principal species.	A	There are no known or current stock assessments on this species in this fishery.	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Squid spp (Pencil, Tiger & Arrow)	Uncertain	P	Adult and potentially demersal egg capsules although no direct evidence of egg beds and spawning aggregations within the area of the ECTF for pencil squid but there is some evidence of egg beds for Tiger Squid adjacent to the trawl grounds.	A	No species specific measures but none required at this stage	A	Not applicable as all sizes and species permitted to be retained	A	99%	P
Tropical saucer scallop	FRDC 99/120 indicated the stock was overfished. Since then, effort has declined. No further assessment of stock status has currently been completed or published	P	Size classes caught in trawl nets in QLD range from about 45 mm SH to 125 mm SH. Use of square mesh codends will significantly lower catches of sub-legal size classes.	P	Large trawl mesh size (>3 inches). Scallop replenishment areas. minimum legal size = 90 mm SH all year round and annual seasonal closure	A	Large (> 3 inch) diamond mesh for use in this fishery reduces by catch of undersized scallop, could be further reduced through the use of SMC BRD's	A	The QLD scallop trawl fishery catches almost 100% of QLD scallops. There are some catches off Townsville and south of the GBRMP.	P
Asian moon (mud) scallop	Uncertain	P	Small and large scallops are interacted with by trawl gear much the same as with A. Balloti - by being retained in the gear and also be contact without capture.	P	Limited, this species often taken as by-product in prawn trawl gear. General fishery measures afford appropriate levels of protection to ensure sustainability.	A	Current BRD's not suitable for the exclusion of scallops below marketable size particularly if taken using prawn nets.	P	100%	P

Appendix 3. Fishery impact profile of principal species 2005

Common Name	Species identification problem	A or P	Market-ability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK
Squid spp (Pencil, Tiger & Arrow)	Yes identification issues do exist, but all species have similar life histories	A	High	P	>70%	A	High seasonally and potentially annually	Potentially spawn near structure (e.g. coral reefs, garden bottom); major commercial species are not typically found in muddy areas where prawn trawling principally occurs.	4	L	LOW
Tropical saucer scallop	This species is similar in appearance to Amusium pleuronectes	P	Marketability is very high. It is a principal target species and valuable fished species in QLD.	P	45	A			7	I	INT
Asian moon (mud) scallop	This species is similar in appearance to Amusium balloti	P	Marketability is very high. It is a principal target species and valuable fished species in QLD.	P	cf 40	A			10	H-I	INT-HIGH

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Prawns											
Brown tiger prawn	*Penaeus esculentus*	3	A	19	A	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Grooved tiger prawn	*Penaus semisulcatus*	20	A	63	PP	Not triggered	A	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Black tiger prawn	*Penaeus monodon*	Not assessed in Seabed Biodiversity Project, however catch and effort are considered to be relatively low and there are likely to be substantial protected refugia.	A	Not assessed in Seabed Biodiversity Project, however catch and effort are considered to be relatively low and there are likely to be substantial protected refugia.	A	Not triggered	A	Not applicable (less than 1%)	A	Currently lack stock assessment, but work in progress	P
Blue endeavour prawn	*Metapenaeus endeavouri*	4	A	18	A	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Low, less than 10%	A	None for NE coast specific, preliminary assessment for Torres Strait (effort issue)	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Prawns										
Brown tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Grooved tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Black tiger prawn	No assessment of exploitation status	P	Target as adults	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Blue endeavour prawn	Not fully utilised	A	Adult stages only	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species level data	A or P	Marketability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2009	RISK
Prawns											
Brown tiger prawn	Don't separate and report on separately but fishers easily identify different species. Some monitoring at species level in some years in some areas.	P	High demand and moderate price	P	38	A	Seasonal fishery winter to September, not caught for 4-5 months of the year		6	I-L	LOW
Grooved tiger prawn	Don't separate and report on separately but fishers easily identify different species. Some monitoring at species level in some years in some areas.	P	High demand and moderate price	P	26	A	Seasonal fishery winter to September, not caught for 4-5 months of the year		7	I	INT
Black tiger prawn	Separate code (broodstock) but sometimes reported in general	P	High demand and moderate price	P	Not assessed in Seabed Biodiversity Project, however there are likely to be substantial protected refugia.	A			5	I-L	LOW
Blue endeavour prawn	Don't separate and report on separately but fishers easily identify different species. Some DEEDI Long Term Monitoring Program monitoring at species level to 2009 in some areas. No marketing reason to separate	P	Can sell them all, but lowest value product among principal prawn species.	A	48	A		Daily revenue relatively good despite low prices as catch rates usually high	4	L	LOW

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
False endeavour prawn	*Metapenaeus ensis*	6	A	30	P	Triggered in the northern region in 2008 (for one month in that year - effort low may be part of explanation)	P	Low, less than 10%	A	None for NE coast specific, preliminary assessment for Torres Strait (effort issue)	P
Eastern king prawn	*Melicertus plebejus*	3	A	18	A	Not triggered	A	Around 2%	A	There is adequate information for stock assessment (2000) and a stock assessment is currently in progress.	A
Red spot king prawn	*Penaeus longistylus*	2	A	8	A	not triggered	A	all adults kept (i.e. < 5%)	A	none	P
Blue legged king prawn	*Penaeus latisulcatus*	5	A	25	A	not triggered	A	all adults kept (i.e. < 5%)	A	none	P
White banana prawn	*Penaeus merguiensis/ Fenneropenaeus merguiensis*	Around 200 t are caught in the GBRMP annually. Targeted fishing is very seasonal and overall percent caught for the species in the GBR is likely to be below 25%.	A	Targeted fishing is very seasonal and overall percent effort exposed for the species in the GBR is likely to be below 25%.	A	Not triggered. See the stock assessment report by Tanimoto et al 2006	A	Around 2%	A	A stock assessment which included data from 1988-2004 was published in 2006.	A

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
False endeavour prawn	Not fully utilised	A	Adult stages only	A	Range of measures in place (spatial and temporal) adequate. Juvenile stages live in shallow water. Spatial and seasonal closures and mesh selectively also to protect juvenile prawns from fishing.	A	No unwanted catch	A	ECTF is only fishery taking significant amount of prawns	P
Eastern king prawn	Not overfished in GBR - only adult stock.	A	Only fished at adult stages in GBR	A	Spatial and temporal closures, and gear and effort restrictions	A	Not relevant for adults caught in the GBR	A	100% of prawns taken by ECTF	P
Red spot king prawn	uncertain	P	Minimal interaction with juveniles	A	Suite of measures appropriate for this species	A	No unwanted catch	A	~100%	P
Blue legged king prawn	uncertain	P	Minimal interaction with juveniles	A	Suite of measures appropriate for this species	A	No unwanted catch	A	~98%	P
White banana prawn	Sustainably fished - Biomass was generally found to be 50-70% of virgin biomass. Biomass levels fell below 40% virgin in the late 1990s around Townsville and Moreton.	A	Begins to experience fishing mortality at >=20 mm CL	A	Suite of measures appropriate for this coastal species	A	No unwanted catch	A	~80 of total in GBR, 60% of this is otter trawl	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species level data	A or P	Marketability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2009	RISK
False endeavour prawn	Don't separate and report on separately but fishers easily identify different species. Some DEEDI Long Term Monitoring Program monitoring at species level to 2009 in some areas. No marketing reason to separate	P	Can sell them all, but lowest value product among principal prawn species.	A	33	A			5	I-L	LOW
Eastern king prawn	While this species is very similar in appearance to other prawn species, its distribution is such that it can be readily identified from other species. Reported on at species level	A	Marketability is very high. It is a principal target species and the most commercially valuable fished species in QLD.	P	46 (from Pitcher et al. 2007)	A	There is one stock of this species on the east coast of Australia. The complementary ecological risk assessment project is considering the full stock, for which the fishery impact profile may vary.	It is likely to occur in locations where it cannot be trawled.	2	L	LOW
Red spot king prawn	Easily identified by fishers but fishery data not generally reported at species level.	P	High	P	62	A			5	I-L	LOW
Blue legged king prawn	Easily identified by fishers but fishery data not generally reported at species level.	P	High	P	41	A			5	I-L	LOW
White banana prawn	Readily identifiable. Reported commercial landings are unlikely to be confused with other prawn species.	A	Second lowest value - endeavours are lower	A	It is likely to occur in locations where it cannot be trawled.	A			1	L	LOW

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Other principal species (Moreton Bay bugs, squid, scallops)											
Moreton Bay bug (spotted legs/reef bug)	*Thenus australiensis*	4	A	13	A	Reef bugs are a principal species in QLD. In most cases, they are not targeted, but are commercially important by-product. They are targeted in some areas. PMS not triggered	A	Discard rate of sub-legal size classes is likely to vary seasonally and is likely to be high when small recruits enter the fished population. Discard rates used to be high when egg-bearing females were prohibited (< 2009). Now egg-bearing females can be retained and marketed.	A	There has not been a stock assessment undertaken on Moreton Bay bugs in QLD. Per-recruit analyses have been undertaken and used to provide advice on minimum legal size.	P
Moreton Bay bug (mud bug)	*Thenus parindicus*	10	A	21	A	Mud bugs are a principal species in QLD. They are generally not targeted, but rather are a by-product of trawling for tiger and endeavour prawns. PMS not triggered	A	Under size (< 75 mm CW) are discarded, but probably have high post-release survival. The BRDs used by fishers probably have little effect in mud bug catch rates.	A	There has not been a stock assessment undertaken on Moreton Bay bugs in QLD. Per-recruit analyses have been undertaken and used to provide advice on size limits.	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Other principal s										
Moreton Bay bug (spotted legs/reef bug)	Uncertain status. Value per recruit analysis suggests that Thenus australiensis is likely to be growth overfished at a minimum legal size of 75 mm CW. Recruitment overfishing is unlikely if a high proportion of biomass is in area closed to trawling.	P	Sub-adults first recruit to the fishery at about 40 mm CL. Fished from around 40-85 mm CL (equates to around 60-120 mm CW).	A	The main form of direct management is via a minimum legal size of 75 mm CW. Benthic mapping project concluded a high proportion of biomass in areas closed to trawling.	A	100 mm square mesh codends (i.e. 50 mm x 50 mm) were shown to be highly effective in the scallop fishery at excluding sub-legal reef bugs. If these devices are made mandatory then they will significantly reduce incidental catch rates and mortality.	P	100%	P
Moreton Bay bug (mud bug)	Uncertain status. Value per recruit analysis suggests that the current minimum legal size of 75 mm CW results in maximising value for this species. Recruitment overfishing is unlikely if a high proportion of biomass is in area closed to trawling.	P	Sub-adults first recruit to the fishery at about 35 mm CL. Fished from around 40-70 mm CL (equates to 60-100 mm CW).	A	Main management measure is via a minimum legal size of 75 mm CW. Benthic mapping project concluded a significant proportion of biomass in areas closed to trawling.	A	Its unlikely that the BRDs currently used by trawler operators significantly lower the catch rates of sub-legal mud bugs	P	100%	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species level data	A or P	Marketability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2009	RISK
Other principal s											
Moreton Bay bug (spotted legs/reef bug)	This species is not directly differentiated by fishers or others from similar species, such as the mud bug, Thenus parindicus.	P	Marketability is very high. High value species of the QLD trawl fishery.	P	54	A			6	I-L	LOW
Moreton Bay bug (mud bug)	This species is not directly differentiated by fishers or others from similar species, such as the reef bug, Thenus australiensis.	P	Marketability is very high. High value species of the QLD trawl fishery.	P	45	A			6	I-L	LOW

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Nominal catch rate trends	A or P	Discard rate	A or P	Stock assessment adequacy	A or P
Squid spp (Pencil, Tiger & Arrow)	*Uroteuthis (Photololigo) spp & Sepiotheuthis lessoniana*	Extremely low	A	Less than 10%	A	Not generally targeted (demersal during day, pelagic at night). PMS uncertain because of highly variable catch rates not providing a consistent trend.	A	Low: no intentional discard or required discard such as for a minimum legal size	A	Moderate: biological information adequacy	P
Tropical saucer scallop	*Amusium japonicum balloti*	10	A	25	A	A. balloti is a principal species of the QLD trawl fishery. There is a specific fishery for it. CPUE is used regularly as an index of abundance. PMS not triggered	A	Relatively high rates of discarding occur. These can be affected by varying minimum legal sizes. Square mesh can be used to significantly reduce discarding, if square meshes of appropriate mesh size are made mandatory.	P	There have been two quantitative stock assessments undertaken on the QLD scallop fishery over the last 10 years. Currently biological reference points are being derived for the fishery.	A
Asian moon (mud) scallop	*Anusium pleuronectes*	15	A	20	A	No trigger for this species rather a combined scallop measure which was not triggered	A	Relatively low discarding of scallops below marketable size as valuable product and no minimum size for this principal species.	A	There are no known or current stock assessments on this species in this fishery.	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P
Squid spp (Pencil, Tiger & Arrow)	Uncertain	P	Adult and potentially demersal egg capsules although no direct evidence of egg beds and spawning aggregations within the area of the ECTF for pencil squid but there is some evidence of egg beds for Tiger Squid adjacent to the trawl grounds.	A	No species specific measures but none required at this stage	A	Not applicable as all sizes and species permitted to be retained	A	99%	P
Tropical saucer scallop	FRDC 99/120 indicated the stock was overfished. Since then, effort has declined. No further assessment of stock status has currently been completed or published	P	Size classes caught in trawl nets in QLD range from about 45 mm SH to 125 mm SH. Use of square mesh codends will significantly lower catches of sub-legal size classes.	P	Large trawl mesh size (>3 inches). Scallop replenishment areas. minimum legal size = 90 mm SH all year round and annual seasonal closure	A	Large (> 3 inch) diamond mesh for use in this fishery reduces by catch of undersized scallop, could be further reduced through the use of SMC BRD's	A	The QLD scallop trawl fishery catches almost 100% of QLD scallops. There are some catches off Townsville and south of the GBRMP.	P
Asian moon (mud) scallop	Uncertain	P	Small and large scallops are interacted with by trawl gear much the same as with A. Balloti - by being retained in the gear and also be contact without capture.	P	Limited, this species often taken as by-product in prawn trawl gear. General fishery measures afford appropriate levels of protection to ensure sustainability.	A	Current BRD's not suitable for the exclusion of scallops below marketable size particularly if taken using prawn nets.	P	100%	P

Appendix 4. Fishery impact profile of principal species 2009

Common Name	Species level data	A or P	Marketability	A or P	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2009	RISK
Squid spp (Pencil, Tiger & Arrow)	Yes identification issues do exist, but all species have similar life histories	A	High	P	>70%	A	High seasonally and potentially annually	Potentially spawn near structure (e.g. coral reefs, garden bottom); major commercial species are not typically found in muddy areas where prawn trawling principally occurs.	4	L	LOW
Tropical saucer scallop	This species is similar in appearance to Amusium pleuronectes	P	Marketability is very high. It is a principal target species and valuable fished species in QLD.	P	45	A			6	I-L	LOW
Asian moon (mud) scallop	This species is similar in appearance to Amusium balloti	P	Marketability is very high. It is a principal target species and valuable fished species in QLD.	P	cf 40	A			7	I	INT

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Species Name	Per cent caught 2005 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2005	A or P or PP	Can it be targeted/is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Threadfin bream (Pinkies)	Family Nemipteridae	22-54 % caught (Pitcher et al 2007)	P	14-54 % effort exposed (Pitcher et al 2007)	P	Incidental	A	High but variable	P	Moderate (some info for some species but not all that are caught) Courtney et al permitted spp FRDC	P
Mantis shrimp	*Family Squillidae, order Stomatopoda*	3-12 % caught (Pitcher et al 2007, 2011 data) Total reported annual landings of mantis shrimps from 2000 to 2005 were 2425, 651, 723, 1369, 1251 and 654 kg, respectively, with the great majority of the catch (i.e., 96%) reported from Moreton Bay (Courtney et al 2007).	A	29-65% effort exposed (Pitcher et al 2007, 2011 data)	P	No incidental only	A	Probably high	P	Inadequate	P
Blue swimmer crab	*Portunus pelagicus*	8	A	40	P	Yes they can be targeted by trawl however in possession limits restrict this activity. In the GBR its truly incidental catch.	A	~ 50%	P	High	A

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P
Threadfin bream (Pinkies)	No assessment made	P	Most stages probably	P	No but general management measures considered adequate (BRDs, demersal prawn trawl nets)	A	Unlikely to be effective	P	Probably close to 100%	P	Not reported by species, although can be readily identified (there is some biological data at the species level, but not fishery catch by species)	P
Mantis shrimp	No assessment made	P	Unknown, but likely most life stages interact since eggs are reared in burrows. Interactions with juveniles reported (Courtney et al 2007)	P	None but infrequently captured	P	Unlikely to be effective	P	100%	P	No data recorded at the species level	P
Blue swimmer crab	Sustainably fished (BSC FISHERY)	A	Sub adults - adults: anecdotal evidence from fishery independent trawl surveys indicates a prevalence of smaller BSc in northern waters compared with the same information from the southern GBR.	A	Yes, size limits 11.5 cm CW, catch limits (500 per 7 nights)	A	Being updated	P	Low	A	No	A

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Marketability	A or P	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2005	Fishery Impact Profile level 2005	RISK 2005
Threadfin bream (Pinkies)	Low	A	36-65 % protected (Pitcher et al 2007)	A			9	H-I	INT-HIGH
Mantis shrimp	Low. In 2000 the total reported catch of mantis shrimp was three tonnes with an estimated value of A$9000.	A	34-52 (Pitcher et al 2007)	A	While significant catches of mantis shrimp are caught incidentally throughout the East Coast Trawl Fishery (see Appendices in Courtney et al 2007 listing by catch by sector), their retention and marketing are largely limited to the Moreton Bay fleet, probably for socio-economic reasons.	PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	9	H-I	INT-HIGH
Blue swimmer crab	Relatively low value per kilo for other trawl caught species. General perception is trawl caught BSC is poorer quality than pot caught crab - moderate or low marketability.	A	40	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	3	L	LOW

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Species Name	Per cent caught 2005 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2005	A or P or PP	Can it be targeted/is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Three-spotted crab (Red-spotted crab)	*Portunus sanguinolentus*	7	A	34	P	Incidental	A	High	P	High	A
Red champagne lobster (Barking crayfish)	*Linuparus trigonus*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be relatively low. Relatively few boats target the species, and red champagne lobster not in habitats where prawns are found.	A	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be relatively low. Relatively few boats target the species, and red champagne lobster not in habitats where prawns are found.	A	Linuparus trigonus is a permitted species in the QLD trawl fishery. Legally, it is not permitted to be 'targeted', but before it was declared as a permitted species it was targeted. Since becoming a permitted species, logbook data suggest that it is no longer targeted and the reported catches indicate that the fishery for this species has declined markedly.	P	Discarding for this species is likely to be very low, because the smaller size classes are likely to be further offshore, in greater depths than the marketed larger/adults.	A	Poor although some reproductive and life history information is available, however information on growth and mortality rates is limited. No stock assessment has been undertaken for L. trigonus, and it is likely that none will ever be undertaken.	P
Slipper lobsters	*Scyllarus martensii, Scyllarus demani, Scyllarides squammosus, Scyllarides haanii*	3-5% caught (Pitcher et al 2007)	A	29-32 % effort exposed (Pitcher et al 2007)	P	Incidental, tends to be reef associated	A	Low	A	Very limited	P

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P
Three-spotted crab (Red-spotted crab)	No assessment made	P	Sub adults and adults	A	None - current mean size of captured crabs is below the optimum identified through yield per recruit analysis, although as they are incidentally captured in the trawl fishery it is not thought specific measures are required.	A	Being updated	P	High	P	No	A
Red champagne lobster (Barking crayfish)	No assessment made.	P	Size classes caught are from 30-125 mm CL. Females appear to dominate the smaller size classes 30-95 mm CL, while males dominate from 95-125 mm CL. Samples suggest small/younger age classes are in deeper waters, and that they move towards the coast as the grow and mature.	P	Egg bearing females prohibited. Minimum legal size of 75mm CL	A	The BRDs used by the fleet probably have no effect on this species and are not effective at excluding animals below the minimum legal size	P	The trawl fishery takes 100% of the catch for this species in the GBRWHA.	P	The taxonomy for this species is clear and straight forward. The likelihood of confusing it with other species is very low.	A
Slipper lobsters	No assessment made	P	Unknown	P	Yes; prohibition on egg bearing females and in possession limit of 20 per 7 days fishing	A	Presumed to be not very effective but captured in such low numbers and frequency that testing the BRD effect is extremely difficult.	P	100%	P	The species can be identified however catch data is reported as a slipper lobster species group.	P

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Marketability	A or P	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2005	Fishery Impact Profile level 2005	RISK 2005
Three-spotted crab (Red-spotted crab)	Low	A	35	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	5	I-L	LOW
Red champagne lobster (Barking crayfish)	Marketability for this species is very good. Matbe some marketing problems associated with removing its long antennae.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, and per cent protected has not been formally estimated, however it is likely that substantial protected refugia exist.	A		Logbook reports between 10-100 t annually. Trawled in rel deep water and far from the coast. Declaring as a permitted species, which cannot be targeted, has probably reduced level of trawl fishing effort on populations in QLD. Targeting is illegal, although it is unclear how targeting is defined and legally pursued. This has probably deterred some fishers from trawling for it. Likely to have large and significant untrawled refuge areas	7	I	INT
Slipper lobsters	High	P	45-50% protection (Pitcher et al 2007)	A		2009 reported commercial catch of Slipper lobsters in the whole ECTF was 4kg (data quality unknown). It was only recently added to the list in 2009 along with the corresponding amendment to logbook reporting instructions for the reporting of slipper lobster catch.	8	I	INT

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Species Name	Per cent caught 2005 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2005	A or P or PP	Can it be targeted/is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Deepwater bug (Velvet balmain bug)	*Ibacus alticrenatus*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A
Shovel-nosed lobster (Honey balmain bug)	*Ibacus brucei*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A
Smooth bug (Garlic balmain bug)	*Ibacus chacei*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P
Deepwater bug (Velvet balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes 75mm cw minimum legal size; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P
Shovel-nosed lobster (Honey balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes 75mm cw minimum legal size; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P
Smooth bug (Garlic balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes, 105 mm CW allows reproduction before retention; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Marketability	A or P	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2005	Fishery Impact Profile level 2005	RISK 2005
Deepwater bug (Velvet balmain bug)	High	P	No data (deepwater but unknown)	P		2065 individuals; 118-258m (Courtney etal 2007)	10	H-I	INT-HIGH
Shovel-nosed lobster (Honey balmain bug)	High	P	No data (deepwater but unknown)	P		760 individuals; 117-230m (Courtney etal 2007)	10	H-I	INT-HIGH
Smooth bug (Garlic balmain bug)	High	P	No data (deepwater but unknown)	P		10,396 individuals; 58-238m (Courtney etal 2007)	10	H-I	INT-HIGH

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Species Name	Per cent caught 2005 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2005	A or P or PP	Can it be targeted/is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Cuttlefish	*Sepia spp.*	19-48 % caught	P	19-48% effort exposed	P	Incidental	A	Unknown but all caught die from impacts of trawling, most probably kept for bait or marketed	A	Adequate general life history knowledge	A
Hammer octopus	*Octopus australis*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Red-spot night octopus	*Callistoctopus dierythraeus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Scribbled night octopus	*Callistoctopus graptus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Plain-spot octopus	*Amphioctopus exannulatus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Veined octopus	*Amphioctopus marginatus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Southern star-eyed octopus	*Amphioctopus cf kagoshimensis*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P
Cuttlefish	underexploited	A	Sub adults to adults	P	None	P	Unknown	P	~100%	A	Data generally not available at species level, fishers don't differentiate species and could not be expected to do so	P
Hammer octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P
Red-spot night octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P
Scribbled night octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P
Plain-spot octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P
Veined octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P
Southern star-eyed octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P

Appendix 5. Fishery impact profile for other permitted species 2005

Common Name	Marketability	A or P	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2005	Fishery Impact Profile level 2005	RISK 2005
Cuttlefish	High for larger animals	P	49-60 (Pitcher et al 2007)	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	7	I	INT
Hammer octopus	High	P	High	A			5	I-L	INT-LOW
Red-spot night octopus	High	P	High	A			5	I-L	INT-LOW
Scribbled night octopus	High	P	High	A			5	I-L	LOW
Plain-spot octopus	High	P	High	A			5	I-L	LOW
Veined octopus	High	P	High	A			5	I-L	LOW
Southern star-eyed octopus	High	P	High	A			5	I-L	LOW

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Species Name	Per cent caught 2009 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Can it be targeted/ is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Threadfin bream (Pinkies)	Family Nemipteridae	5-20% (data from Pitcher in 2011 after removing BRD effect)	A	6-20% (data from Pitcher in 2011)	A	Incidental	A	High but variable	P	Moderate (some info for some species but not all that are caught) Courtney et al permitted spp FRDC	P
Mantis shrimp	*Family Squillidae, order Stomatopoda*	Assumed considerably less than 25% caught based on effort trends and available analyses by Pitcher in 2011	A	Uncertain but unlikely to be above 25% based on effort trends and available analyses by Pitcher in 2011	A	No incidental only	A	Probably high	P	Inadequate	P
Blue swimmer crab	*Portunus pelagicus*	4 (data from Pitcher in 2011)	A	21 (data from Pitcher in 2011)	A	Yes they can be targeted by trawl however in possession limits restrict this activity. In the GBR its truly incidental catch.	A	~ 50%	P	High	A

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P	Marketability	A or P
Threadfin bream (Pinkies)	No assessment made	P	Most stages probably	P	No but general management measures considered adequate (BRDs, demersal prawn trawl nets)	A	Unlikely to be effective	P	Probably close to 100%	P	Not reported by species, although can be readily identified (there is some biological data at the species level, but not fishery catch by species)	P	Low	A
Mantis shrimp	No assessment made	P	Unknown, but likely most life stages interact since eggs are reared in burrows. Interactions with juveniles reported (Courtney et al 2007)	P	None but infrequently captured	P	Unlikely to be effective	P	100%	P	No data recorded at the species level	P	Low. In 2000 the total reported catch of mantis shrimp was three tonnes with an estimated value of A$9000.	A
Blue swimmer crab	Sustainably fished (BSC FISHERY)	A	Sub adults - adults: anecdotal evidence from fishery independent trawl surveys indicates a prevalence of smaller BSc in northern waters compared with the same information from the southern GBR.	A	Yes, size limits 11.5 cm CW, catch limits (500 per 7 nights)	A	Being updated	P	Low	A	No	A	Relatively low value per kilo for other trawl caught species. General perception is trawl caught BSC is poorer quality than pot caught crab - moderate or low marketability.	A

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Threadfin bream (Pinkies)	36-65 % protected (Pitcher et al 2007)	A			7	I	INT
Mantis shrimp	34-52 (Pitcher et al 2007)	A	While significant catches of mantis shrimp are caught incidentally throughout the East Coast Trawl Fishery (see Appendices in Courtney et al 2007 listing by catch by sector), their retention and marketing are largely limited to the Moreton Bay fleet, probably for socio-economic reasons.	PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	8	I	INT
Blue swimmer crab	40	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	2	L	LOW

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Species Name	Per cent caught 2009 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Can it be targeted/ is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Three-spotted crab (Red-spotted crab)	*Portunus sanguinolentus*	4 (data from Pitcher in 2011)	A	21 (data from Pitcher in 2011)	A	Incidental	A	High	P	High	A
Red champagne lobster (Barking crayfish)	*Linuparus trigonus*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be relatively low. Relatively few boats target the species, and red champagne lobster not in habitats where prawns are found.	A	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be relatively low. Relatively few boats target the species, and red champagne lobster not in habitats where prawns are found.	A	Linuparus trigonus is a permitted species in the QLD trawl fishery. Legally, it is not permitted to be 'targeted', but before it was declared as a permitted species it was targeted. Since becoming a permitted species, logbook data suggest that it is no longer targeted and the reported catches indicate that the fishery for this species has declined markedly.	P	Discarding for this species is likely to be very low, because the smaller size classes are likely to be further offshore, in greater depths than the marketed larger/adults.	A	Poor although some reproductive and life history information is available, however information on growth and mortality rates is limited. No stock assessment has been undertaken for L. trigonus, and it is likely that none will ever be undertaken.	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P	Marketability	A or P
Three-spotted crab (Red-spotted crab)	No assessment made	P	Sub adults and adults	A	None - current mean size of captured crabs is below the optimum identified through yield per recruit analysis, although as they are incidentally captured in the trawl fishery it is not thought specific measures are required.	A	Being updated	P	High	P	No	A	Low	A
Red champagne lobster (Barking crayfish)	No assessment made.	P	Size classes caught are from 30-125 mm CL. Females appear to dominate the smaller size classes 30-95 mm CL, while males dominate from 95-125 mm CL. Samples suggest small/younger age classes are in deeper waters, and that they move towards the coast as the grow and mature.	P	Egg bearing females prohibited. Minimum legal size of 75mm CL	A	The BRDs used by the fleet probably have no effect on this species and are not effective at excluding animals below the minimum legal size	P	The trawl fishery takes 100% of the catch for this species in the GBRWHA.	P	The taxonomy for this species is clear and straight forward. The likelihood of confusing it with other species is very low.	A	Marketability for this species is very good. Matbe some marketing problems associated with removing its long antennae.	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Three-spotted crab (Red-spotted crab)	35	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	4	L	LOW
Red champagne lobster (Barking crayfish)	Largely outside the depth range studied by the Seabed Biodiversity Project, and per cent protected has not been formally estimated, however it is likely that substantial protected refugia exist.	A		Logbook reports between 10-100 t annually. It is trawled in rel. deep water and far from the coast. Declaring it as a permitted species, which cannot be targeted, has probably reduced the level of trawl fishing effort on populations in QLD. Targeting is illegal although it is unclear how targeting is defined and legally pursued. This has probably deterred some fishers from trawling for it. Likely to have large and significant untrawled refuge areas	7	I	INT

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Species Name	Per cent caught 2009 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Can it be targeted/ is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Slipper lobsters	*Scyllarus martensii, Scyllarus demani, Scyllarides squammosus, Scyllarides haanii*	2% caught (Pitcher data 2011)	A	16% effort exposed (Pitcher data 2011)	A	Incidental, tends to be reef associated	A	Low	A	Very limited	P
Deepwater bug (Velvet balmain bug)	*Ibacus alticrenatus*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A
Shovel-nosed lobster (Honey balmain bug)	*Ibacus brucei*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P	Marketability	A or P
Slipper lobsters	No assessment made	P	Unknown	P	Yes; prohibition on egg bearing females and in possession limit of 20 per 7 days fishing	A	Presumed to be not very effective but captured in such low numbers and frequency that testing the BRD effect is extremely difficult.	P	100%	P	The species can be identified however catch data is reported as a slipper lobster species group.	P	High	P
Deepwater bug (Velvet balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes 75mm cw minimum legal size; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P	High	P
Shovel-nosed lobster (Honey balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes 75mm cw minimum legal size; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P	High	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Slipper lobsters	45-50% protection (Pitcher et al 2007)	A		2009 reported commercial catch of Slipper lobsters in the whole ECTF was 4kg (data quality unknown). It was only recently added to the list in 2009 along with the corresponding amendment to logbook reporting instructions for the reporting of slipper lobster catch.	7	I	INT
Deepwater bug (Velvet balmain bug)	No data (deepwater but unknown)	P		2065 individuals; 118-258m (Courtney etal 2007)	10	H-I	INT-HIGH
Shovel-nosed lobster (Honey balmain bug)	No data (deepwater but unknown)	P		760 individuals; 117-230m (Courtney etal 2007)	10	H-I	INT-HIGH

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Species Name	Per cent caught 2009 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Can it be targeted/ is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Smooth bug (Garlic balmain bug)	*Ibacus chacei*	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Largely outside the depth range studied by the Seabed Biodiversity Project, however the proportion of the population exposed and the proportion caught are expected to be moderately high. Occur on trawl grounds in deeper water within southern GBR.	P	Incidental	A	Discard rates of undersize likely > 10%	P	Moderate	A
Cuttlefish	*Sepia spp.*	Likely to be less than 25% caught based on effort trends and available analyses by Pitcher in 2011	A	Likely to be less than 25% effort exposed based on effort trends and available analyses by Pitcher in 2011	A	Incidental	A	Unknown but all caught die from impacts of trawling, most probably kept for bait or marketed	A	Adequate general life history knowledge	A
Hammer octopus	*Octopus australis*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Red-spot night octopus	*Callistoctopus dierythraeus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Scribbled night octopus	*Callistoctopus graptus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Plain-spot octopus	*Amphioctopus exannulatus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P	Marketability	A or P
Smooth bug (Garlic balmain bug)	Uncertain: insufficient data	P	Probably (see Courtney et al 2007)	P	Yes, 105 mm CW allows reproduction before retention; prohibition on egg bearing females; southern closure may have some benefit for egg bearing females	A	No information	P	100%	P	Species can be identified, but data currently recorded as species group	P	High	P
Cuttlefish	underexploited	A	Sub adults to adults	P	None	P	Unknown	P	~100%	A	Data generally not available at species level, fishers don't differentiate species and could not be expected to do so	P	High for larger animals	P
Hammer octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P
Red-spot night octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P
Scribbled night octopus	No assessment made. No evidence of overfishing	P	Eggs probably laid among structure not trawled	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P
Plain-spot octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Smooth bug (Garlic balmain bug)	No data (deepwater but unknown)	P		10,396 individuals; 58-238m (Courtney etal 2007)	10	H-I	INT-HIGH
Cuttlefish	49-60 (Pitcher et al 2007)	A		PMS triggered with harvest being 10% less in 2008 than the lowest annual harvest from 2001 -2006. Because they are incidentally harvested total catch is not indicative of biomass. (DEEDI 2009)	5	I-L	LOW
Hammer octopus	High	A			5	I-L	INT-LOW
Red-spot night octopus	High	A			5	I-L	INT-LOW
Scribbled night octopus	High	A			5	I-L	LOW
Plain-spot octopus	High	A			5	I-L	LOW

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Species Name	Per cent caught 2009 (excluding BRD effect)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Can it be targeted/ is it truly incidental catch?	A or P	Discard rate	A or P	Biological information adequacy	A or P
Veined octopus	*Amphioctopus marginatus*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P
Southern star-eyed octopus	*Amphioctopus cf kagoshimensis*	low	A	low	A	Incidental	A	Probably most survive discarding	A	Limited	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Exploitation status	A or P or PP	Interaction throughout life cycle	A or P	Species specific measures	A or P	BRD effectiveness	A or P	Proportion this fishery takes of total catch in GBRWHA	A or P	Species identification problem	A or P	Marketability	A or P
Veined octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P
Southern star-eyed octopus	No assessment made. No evidence of overfishing	P	Broadcast spawner	A	None	A	Easily escapes through meshes	A	Unknown, no other fishery impact	P	Data in logbooks not to species level	P	High	P

Appendix 6. Fishery impact profile for other permitted species 2009

Common Name	Refuge availability in GBRMP	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Veined octopus	High	A			5	I-L	LOW
Southern star-eyed octopus	High	A			5	I-L	LOW

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Ray-finned fish								
Pearly-finned cardinal fish	Actinopterygii	*Apogon poecilopterus*	High turnover, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) (Vulnerability data from Fishbase, source Cheung et al 2005) Mouthbrooders (Fishbase Ref. 240). Distinct pairing during courtship and spawning (Fishbase Ref. 205). Main ref Thresher, R.E., 1984	P	Demersal Nocturnal species, so more vulnerable to trawl at night.	P	Inshore, soft bottom. EOL: Occurs inshore over soft bottom (Fishbase Ref. 7300). Lives in holes in the mud during the day. Usually trawled near river mouths (Fishbase Ref. 48635).	A
Pigmy leatherjacket	Actinopterygii	*Brachaluteres taylori*	High turnover, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) (Vulnerability data from Fishbase, source Cheung et al 2005) grows to ~ 5 cm	A	Demersal	P	Coral reef, inshore, seagrass and algal beds (seabed midshelf gravel areas Cairns to Swains).	A
Tufted sole	Actinopterygii	*Brachirus muelleri* / *Dexillichthys muelleri*	Resilience (Fishbase Ref. 69278) - High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.)	A	Demersal . When this species is present it is vulnerable to fishing pressure.	P	EOL: Found over sand bottoms.	P
Longnose stinkfish	Actinopterygii	*Calliurichthys grossi* / *Callionymus grossi*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.)	A	Demersal	P	Benthic, continental shelf, coral reef, inshore.	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Ray-finned fish	From Pitcher et al. 2007								
Pearly-finned cardinal fish	1.73	A	Widespread http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Apogon_poecilopterus EOL: Western Pacific: Papua New Guinea, Australia (including Lord Howe Island), and the Marshall Islands. Reported from the Chesterfield Islands (Fishbase Ref. 11897) and New Zealand (Fishbase Ref. 5755).	A	None known	A		2	I
Pigmy leatherjacket	2.33 (family level estimate from Stobutski et al)	A	Widespread (http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Brachaluteres_taylori) EOL: Western Pacific: Papua New Guinea, Australia (including Lord Howe Island), and the Marshall Islands. Reported from the Chesterfield Islands (Fishbase Ref. 11897) and New Zealand (Fishbase Ref. 5755).	A	None known	A		1	H-I
Tufted sole	0.98	P	Widespread, but not common. EOL: Indo-West Pacific: Sri Lanka to Samoa and Tonga, north to the Philippines, south to northern Australia.	A	None known	A		3	I-L
Longnose stinkfish	1.11	A	Widespread: Northern half of Australia from Moreton Bay to Shark Bay	A	None known	A		2	I

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Prickly leatherjacket	Actinopterygii	*Chaetodermis penicilligera*	Max length : 31.0 cm TL male/unsexed (Fishbase). Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.)	P	EOL: Reef-associated. Often found in weedy areas of coastal reefs (Fishbase: Ref. 9710) and trawling grounds.	P	Coastal, inshore, sub littoral, weed beds.	P
Spotted-fin tongue-sole	Actinopterygii	*Cynoglossus maculipinnis*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.)	A	EOL: demersal; marine; depth range ? - 132 m (Fishbase: Ref. 5297)	P	Benthic, continental shelf, soft bottom.	P
Naked-headed catfish	Actinopterygii	*Euristhmus nudiceps*	Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.) . Max length : 33.0 cm TL male/unsexed (Fishbase)	P	Demersal; freshwater; brackish; marine	P	Benthic, estuarine, inshore, soft bottom. EOL: demersal; freshwater; brackish; marine. Occurs inshore over soft bottoms (Fishbase Ref. 7300). Found along coastlines and in estuaries, including freshwater reaches.	P
Rough flutemouth	Actinopterygii	*Fistularia petimba*	Relatively long-lived species that grows to about 1.8M, and is caught to about 0.5m length.	PP	Occurs near the seabed	A	Coastal, estuarine, inshore, pelagic. EOL: Inhabits coral reefs (Fishbase Ref. 58534). Found in the sub littoral zone (Fishbase Ref. 11230); inhabits coastal areas over soft bottoms, usually at depths greater than 10 m (Fishbase Ref. 30573). Feeds on small fishes and shrimps (Fishbase Ref. 3401). Found in coral reefs swimming over coral, sandy bottoms, or seagrass. When not hunting, can be found floating/resting near the bottom of the reef.	A

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Prickly leatherjacket	2.53	A	Widespread EOL: Indo-West Pacific: Indo-Malayan region to Australia, north to Japan. Only in SGBR in Seabed Biodiversity Project report	A	None known	A		3	I-L
Spotted-fin tongue-sole	0.59	P	Widespread EOL; Western Pacific: northern Australia, from Western Australia to Queensland (Fishbase: Ref. 5297) and Papua New Guinea (Fishbase: Ref. 6771).	A	None known	A		3	I-L
Naked-headed catfish	0.89	P	Widespread EOL; Indo-West Pacific: north-western Australia, the Arafura Sea (Fishbase Ref. 9819) and Papua New Guinea. Known from the freshwater reaches of the Mekong estuary (Fishbase Ref. 12693).	A	None known	A		4	I-L
Rough flutemouth	0.26	P	Widespread globally EOL: western Atlantic and indo-pacific.	A	None known	A	Habitat association: Juvenile habitat association is to trawled areas, whereas adult habitat association is more reef-associated, the species also has some refuge in deeper areas - overall risk averse.	3	I-L

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Orangefin ponyfish	Actinopterygii	*Leiognathus bindus / Photopectoralis bindus*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (K=0.88-2.63; tm=1.2) Mode -dioecism Fertilization -external Reproductive guild –nonguarders - open water/substratum egg scatterers	A	EOL: demersal; amphidromous (Fishbase Ref. 51243); brackish; marine; depth range 10 - 160 m (Fishbase Ref. 47581). Day - night: prone	P	Found on the continental shelf, soft bottom. (Fishbase Ref. 75154). Feeds mainly on copepods and diatoms (Fishbase Ref. 26908). Found over muddy sand bottoms of coastal inshore waters (Fishbase Ref. 47581). Often enters estuaries (Fishbase Ref. 4833). Forms schools.	A
Whipfin ponyfish	Actinopterygii	*Leiognathus leuciscus / Equulites leuciscus*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (K=0.93-1.80) Highly productive, broadcast spawners.	A	EOL: demersal; marine; depth range 10 - 70 m (Fishbase Ref. 12260) . Day -night: equal day night Stobutzki et al	P	Found in coastal waters, about 5 to 15 m depth. Stays near the substrate and feeds on small shrimps, other crustaceans, and polychaetes (Fishbase Ref. 5213).	P
Splendid ponyfish	Actinopterygii	*Leiognathus splendens /Eubleekeria splendens*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (K=0.33-1.60; tm=1; tmax=2.3) Mode -dioecism Fertilization -external Reproductive guild –nonguarders - open water/substratum egg scatterers	A	Demersal; amphidromous (Fishbase: Ref. 51243); brackish; marine; depth range 10 - 100 m (Fishbase: Ref. 12260) Day - night: on seabed at night time so prone to capture	P	This schooling species inhabits coastal waters and generally lives in turbid waters. It feeds on fish, crustaceans, foraminiferans, and bivalves (Fishbase: Ref. 5213).	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Orangefin ponyfish	1.72	A	Widespread EOL:Indo-West Pacific: Port Sudan in the Red Sea and the Persian Gulf to Japan, the Arafura Sea (Fishbase Ref. 9819), and Australia.	A	None known, not taken in other fisheries, and assume little or no water quality issues as not coastal	A	Extremely common in trawl by catch, most common pony fish in by catch. In Seabed Biodiversity Project, trawl effort coefficient was positive but not very large, which suggests the species has some association with trawled areas.	1	H-I
Whipfin ponyfish	2.41	A	Widespread EOL: Indo-West Pacific: East Africa to northern Australia and New Caledonia. Only in northern GBR in Seabed Biodiversity Project report, north of Whitsundays at least.	A	Not taken in other fisheries, but concern about possible water quality issues for the species as coastal	P	In Seabed Biodiversity Project, trawl effort coefficient was highly important in modelling, which suggests the species tends to occur more in trawled areas.	3	I-L
Splendid ponyfish	2.03	A	Widespread.EOL: Indo-West Pacific: from India to Papua New Guinea; north to Japan; south to Australia,	A	Not taken in other fisheries, but concern about possible water quality issues for the species as coastal	P		3	I-L

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Fourlined terapon	Actinopterygii	*Pelates quadrilineatus*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.) Mode -dioecism Fertilization -external, one clear seasonal peak per year Stobutzi et al life history characteristics: risk averse	A	Reef-associated; brackish; marine; depth range 0 - ? M. Occurs relatively high in water column, no difference between day - night	A	A coastal species often found in brackish waters; common in estuaries. Croaks when taken from the water. Usually forming schools. Present in seagrass beds at all life stages. Juveniles in seagrass beds and in mangrove bays (Fishbase Ref. 48635). Feeds on small fishes and invertebrates. Omnivore (Fishbase Ref. 41878). Occurs in places other than trawl grounds	A
Longfin silverbiddy	Actinopterygii	*Pentaprion longimanus*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (K=0.70-1.80)	A	Demersal; brackish; marine; depth range 15 - 220 m (Fishbase Ref. 12260)	P	EOL: Inhabits coastal waters. Forms large schools. Probably feeds on small benthic animals. Continental shelf, schooling, soft bottom. Trawled to depths of 70 m. Mostly caught in daytime trawl or around full moon.	P
Australian threadfin	Actinopterygii	*Polydactylus multiradiatus*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) Nonguarders, Open water/substratum egg scatterers, Sex change occurs between 12-14 cm SL (Fishbase: Ref. 45356).	A	Demersal; brackish; marine; depth range 10 - 56 m (Ref. 45356), usually 10 - 56 m (Ref. 45356)	P	Occur in inshore waters of the continental shelf. Fishbase: Inhabits coastal waters over sand or mud bottoms. Feeds on prawns. Often taken in association with Penaeus prawns in the Gulf of Carpentaria. Max length : 21.0 cm FL male/unsexed; (Ref. 1844); 24.5 cm FL (female) Fishbase.	P
Blotched javelin	Actinopterygii	*Pomadasys maculatus*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (K=0.16)	P	Reef-associated; amphidromous (Fishbase Ref. 51243); brackish; marine; depth range 20 - 110 m (Fishbase Ref. 12260)	P	Found in coastal waters over sand near reefs. Feeds on crustaceans and fishes (Fishbase Ref. 5213).	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Fourlined terapon	1.11	A	Widespread Fishbase: Indo-West Pacific: Red Sea and East Africa to southern Japan, New Guinea and Arafura Sea (Fishbase Ref. 9819). Reported from Vanuatu (Fishbase Ref. 13300). Migrated to the Mediterranean from the Red Sea via the Suez Canal (Fishbase Ref. 5385). GBR from Curtis Island to top of GBR	A	Unknown, however some (limited) recreational catch likely	A		0	H
Longfin silverbiddy	1.79	P	Widespread EOL: Indo-West Pacific: western and southern coasts of India and off Sri Lanka to Indonesia, the Philippines and Ryukyu Islands, and south to the northern part of Australia (Fishbase Ref. 3131).	A	Unknown. Not captured in other fisheries and not aquarium trade.	A		3	I-L
Australian threadfin	Assume high	A	Widespread	A	Unknown, incidental recreational species	A		2	I
Blotched javelin	0.34	P	Widespread Fishbase: Indo-West Pacific: throughout the Indian Ocean (Fishbase Ref. 11441) and the western Pacific, north to China, south to Australia.	A	None known	A		4	I-L

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Damselfish sp	Actinopterygii	*Pristotis obtusirostris*	attached eggs, parental care ? L inf 17 cm, K 0.8	P	demersal	P	sand carbonate sediments (not mud)	A
Australian halibut	Actinopterygii	*Psettodes erumei*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (K=0.26-0.38; tm=3-4; Fec=300,000) Mode -dioecism Fertilization -external Reproductive guild –nonguarders - open water/substratum egg scatterers	P	Demersal; marine; depth range 1 - 100 m (Fishbase Ref. 9792), usually 20 - 50 m (Fishbase Ref. 9792)	P	Found on sand and mud bottoms (Fishbase Ref. 9796, 48637). Usually deeply buried in the substrate during the day, but out and hunting at night (Fishbase Ref. 48637). Often swims in an upright position (Fishbase Ref. 9796). Mainly piscivorous (Fishbase Ref. 5986).	P
Flathead dragonet	Actinopterygii	*Repomucenus belcheri / Callionymus belcheri*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (K=0.41-0.48; tmax=3)	A	Demersal; marine; depth range 18 - 36 m (Fishbase: Ref. 75992)	P	Benthic, continental shelf, inshore, sand bottom-marine.	P
Shortfin saury (Short-finned lizardfish)	Actinopterygii	*Saurida argentea/tumbil*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.)	A	Demersal; marine; depth range 1 - 70 m (Fishbase Ref. 38189)	P	Found in coastal waters, on sand and mud bottoms.	P
Largescale saury (Brushtooth lizardfish)	Actinopterygii	*Saurida grandisquamis/ undosquamis*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (K=0.3-0.9; tm=1-2; tmax=8) Mode -dioecism Fertilization -external Reproductive guild –nonguarders - open water/substratum egg scatterers	P	Sandy bottom species. Found in 76% tiger/endeavour prawn fishery by catch, 34% scallop fishery by catch, 19% deepwater eastern king prawn by catch. Average size in deepwater king prawn fishery area 387mm, average size in north QLD 181mm. May move seaward as they grow, based on size distributions in catches.	P	Found on the sub littoral zone above 100 m over sand or mud bottoms of coastal waters (Fishbase Ref. 11228, 11230). Feeds on fishes (anchovy and red mullet Mullus surmuletus), crustaceans, and other invertebrates (Fishbase Ref. 5213). Spawns from April to May off Japan	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Damselfish sp	0.46	P	WA (Dampier B. Hutchins checklist of D. Archipelago) and Qld	A	None known	A		3	I-L
Australian halibut	0.69	P	Widespread Fishbase: tropical, Indo-West Pacific: Red Sea and East Africa to Japan and Australia.	A	None known	A		4	I-L
Flathead dragonet	1.11	A	Widespread: Fishbase: Western Central Pacific: north-western Australia and Papua New Guinea (Fishbase: Ref. 6192).	A	None known	A		2	I
Shortfin saury (Short-finned lizardfish)	1.1	A	Widespread Fishbase: Tropical, Western Pacific: widespread from the Gulf of Thailand to north-eastern Australia.	A	None known	A		2	I
Largescale saury (Brushtooth lizardfish)	1.1 GENUS LEVEL ESTIMATE	A	Widespread Fishbase: Subtropical; 45°N - 40°S Distribution - Eastern Indian Ocean, Malay Peninsula, southern Philippines, northern Java, Arafura Sea, Louisiade Archipelago, and northern half and south-western Australia. Distribution needs revision due to questionable (unconfirmed) occurrences as reported by major references (see Inoue & Nakabo 2006, Ref. 57869:385-6).	A	None known	A	Biomass is likely to be naturally very high, predator. Some question regarding taxonomy?	3	I-L

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Trumpeter whiting	Actinopterygii	*Sillago maculata*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) Oviparous (Fishbase Ref. 205). Spawn throughout the year with peaks in Dec.-Feb. (Fishbase Ref. 6390). Mode -dioecism Fertilization -external Reproductive guild –nonguarders - open water/substratum egg scatterers	A	Demersal; non-migratory; brackish; marine; depth range 0 - 50 m (Fishbase Ref. 6205)	P	Occur on silty and muddy substrates in the deeper water of bays, but also frequenting the mouths of rivers, estuaries, and mangrove creeks. Juveniles abound in estuaries and shallow water during summer, moving deeper as they mature. Diet of juveniles consist largely of small crustaceans and that of the adult fish consist mainly of polychaete worms and bivalve molluscs.	P
Spinycheek grunter	Actinopterygii	*Terapon puta*	High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) Mode -dioecism Fertilization -external, one clear seasonal peak throughout the year.	A	Benthopelagic; amphidromous (Fishbase Ref. 51243); freshwater; brackish; marine; depth range ? - 30 m (Fishbase Ref. 43448)	P	Inhabit coastal waters, entering brackish estuaries (Fishbase Ref. 3132) and mangrove areas (Fishbase Ref. 7300). Also in fresh waters (Fishbase Ref. 30573). Feed on fishes and invertebrates.	A
Largescale grunter (Banded grunter)	Actinopterygii	*Terapon theraps*	Resilience (Fishbase: Ref. 69278) High, minimum population doubling time less than 15 months (K=0.6-0.8)	A	Reef-associated; freshwater; brackish; marine . Often found under floating algae. Omnivorous	A	Inhabits coastal waters (Fishbase: Ref. 5213). Often found in brackish waters (Fishbase: Ref. 4833). Juveniles with floating weeds, often far offshore (Fishbase: Ref. 48635).	P
Yellowfin tripodfish	Actinopterygii	*Tripodichthys angustifrons*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.)	P	Demersal; marine; depth range ? - 15 m (Fishbase Ref. 9804)	P	Inhabits sandy and muddy flats in coastal areas. Feeds on benthic invertebrates.	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Trumpeter whiting	0.57	P	Restricted: Fishbase: Western Pacific: endemic to Australia. Records of this species from western Australia or northern Australia refer to *Sillago burrus* .	P	Commonly caught by recreational fishers	P	Frequently confused with Sillago burrus which occurs in WA & NT	5	L
Spinycheek grunter	1.11	A	Widespread: Fishbase: Tropical, Indo-West Pacific: northern Indian Ocean and the Indo-Australian Archipelago. A lessepsian migrant, now prevalent in the Mediterranean (Fishbase Ref. 43448). Only in NGBR in Seabed Biodiversity Project report	A	Coastal development, water quality issues and bait fishery.	P		2	I
Largescale grunter (Banded grunter)	1.11	A	Widespread: Fishbase; Tropical Indo-West Pacific: East Africa, Madagascar, Seychelles, Red Sea, Arabian Peninsula, Persian Gulf to India and Andaman Islands; and southeast Asia. Reaches south to the Arafura Sea (Fishbase: Ref. 9819) and northern Australia (Fishbase: Ref. 3131).	A	None known	A		1	H-I
Yellowfin tripodfish	0.86	P	Widespread: Fishbase; Tropical Western Central Pacific: known only from Australia (including north-western Australia) and Indonesia.	A	None known	A		4	I-L

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Blacktip tripodfish (Long-nosed tripodfish)	Actinopterygii	*Trixiphichthys weberi*	Resilience (Fishbase Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.)	P	Demersal; marine; depth range ? - 65 m (Fishbase Ref. 9804)	P	Inhabits sandy and muddy flats of coastal waters. Feeds on benthic invertebrates.	P
Sunrise goatfish (Sulphur goatfish)	Actinopterygii	*Upeneus sulphureus*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (K=0.5-1.3) , mature at 130 mm, ~4 yrs	A	Demersal; oceanodromous (Fishbase Ref. 51243); brackish; marine; depth range 10 - 90 m (Fishbase Ref. 12260)	P	Found in coastal waters, entering estuaries (Fishbase Ref. 30573). Forms schools (Fishbase Ref. 5213). Has appearance of sillaginids when schooling (Fishbase Ref. 48636).	A
Ochreband goatfish	Actinopterygii	*Upeneus sundaicus*	Resilience (Fishbase Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.)	A	Demersal; brackish; marine; depth range 20 - 60 m (Fishbase Ref. 83903)	P	Inhabits coastal waters down to 100 m. Usually occurs in schools. Feeds on benthic animals (Fishbase Ref. 2110).	P
Hairfin goby	Actinopterygii	*Yongeichthys nebulosus*	Guard eggs, good to moderate ability to recover populations	P	Closely associated with seafloor	P	Found over silty (Fishbase Ref. 58652) and muddy bottoms around inner reefs. Common in mangroves and enter estuaries and rivers (Fishbase Ref. 4343).	A

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Blacktip tripodfish (Long-nosed tripodfish)	0.33	P	Widespread: Fishbase; Tropical, Western Pacific: Philippines through Indonesia to northern Australia. Indian Ocean: both sides of Bay of Bengal.	A	None known	A		4	I-L
Sunrise goatfish (Sulphur goatfish)	2.23	A	Widespread: Fishbase; Tropical, Indo-West Pacific: East Africa to southeast Asia, north to China, south to northern Australia and Fiji (Fishbase Ref. 12743).	A	None known	A		1	H-I
Ochreband goatfish	2.23	A	Widespread: Fishbase; Tropical, Indo-West Pacific: Pakistan, India and Sri Lanka, extending eastward to Indonesia. Recorded from the Gulf (Fishbase Ref. 37588); also from north-western Australia northward to Japan. Only in NGBR in Seabed Biodiversity Project report	A	None known	A		2	I
Hairfin goby	3 or more? (high)	A	Widespread: Fishbase; Tropical, Indo-West Pacific: East Africa through Indonesia to Micronesia, north to China and the Ryukyu Islands (Fishbase Ref. 559), south to northern Australia. Only in northern GBR in Seabed Biodiversity Project report	A	None known	A		2	I

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Seapens								
Sea pen	Anthozoa	*Sea pen (Pteroides?) sp1*	Assume good ability to maintain population as likely to be highly fecund. Wikipedia: Sea pens reproduce by co-ordinating a release of sperm and eggs into the water column; this may occur seasonally or throughout the year.	A	Benthic	P	Benthic	P
Bivalves								
Bivalve sp	Bivalvia	*Enisiculus cultellus*	Assume good ability to maintain population as likely to be highly fecund.	A	Benthic	P	Benthic	P
Glycymerididae	Bivalvia	*Melaxinaea vitrea*	Shallow burrowing infaunal bivalve that inhabits soft substrates, with little information available on biology	A	Benthic	P	Most areas of GBR except high current areas, Courtney et al 2007 1% north QLD trawls. In the Dampier area, Melaxinaea vitrea is associated with more inshore silts and muds, and is common in that area (Taylor & Glover 2004)	A
Bivalve sp	Bivalvia	*Placamen tiara*	Shallow burrowing infaunal bivalve that inhabits soft substrates, with little information available on biology	A	benthic; marine; depth range 10 – 50 m,	P	Benthic: endofauna (infauna); Soft Bottom, Seabed mud, caught in research sled rather than trawl	A
Crustaceans								
Blunt-toothed crab	Crustacea	*Charybdis truncata*	small abundant portunid crab, short lived (cf *P. pelagicus*),	A	demersal; marine; depth range 10 – 100 m	P	88% trawl samples north QLD Courtney et al 2007	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Seapens	From Pitcher et al. 2007								
Sea pen	Unknown	P	Unknown	P	None known	A	Wikipedia: Analysis of rachis growth rings indicates sea pens may live for 100 years or more, if the rings are indeed annual in nature	4	I-L
Bivalves	From Pitcher et al. 2007								
Bivalve sp	Unknown	P	Widespread Sealife base: Tropical, Indo-West Pacific: from East Africa, to Melanesia; north to Japan and south to South Australia.	A	None known	A		3	I-L
Glycymerididae	unknown	P	Widespread Sealife base: Tropical, Eastern Indian Ocean: Australia.	A	None known	A		2	I
Bivalve sp	unknown	P	Widespread Sealife base: Tropical, Indo-West Pacific: from East Africa, to Melanesia; north to Japan and south to South Australia.	A	None known	A		2	I
Crustaceans	From Pitcher et al. 2007								
Blunt-toothed crab	high (for *P. sanguinolentus* , 0.5-1.0)	A	Widespread Sealife base: Tropical, Indo-West Pacific, reaching Japan and Australia.	A	None known	A		2	I

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Pilumnidae (Hairy crabs)	Crustacea	*Cryptolutea arafurensis*	No information available, but assume moderate ability to maintain population	P	Benthic. Depths to 59 m.	P	Benthic, low intertidal, mangrove, soft bottom, sub tidal. Common on muddy seabeds, and had the largest predicted positive trawl effect change (+19%) (Pitcher et al 2007)	P
(Hermit crab)	Crustacea	*Diogenidae sp356-1*	No information available, but assume moderate ability to maintain population	P	Benthic	P	Unknown	P
Leucosiidae (Purse crabs)	Crustacea	*Myra tumidospina*	No information available, but assume moderate ability to maintain population	P	Benthic; marine	P	Unknown	P
Portunidae (Swimming crabs)	Crustacea	*Portunus gracilimanus*	Good to moderate ability to maintain population. Small species Carry eggs, which hatch live and become planktonic.	A	demersal; marine	P	Mud and sand, negatively correlated with gravel. Occurrence is positively correlated with trawl in Seabed Biodiversity Project.	A
Portunidae (Swimming crabs)	Crustacea	*Portunus tuberculosus*	No information available, but assume good ability to maintain population as for other species in genus	A	Pelagic; marine; depth range 12 – 52 m	A	ABRS: Benthic, continental shelf, sub littoral. Soft substrates, to 140 m depth.	P
Hardback shrimp (Penaeid shrimps)	Crustacea	*Trachypenaeus anchoralis*	FAO guide: Maximum body length 10.4 cm(females) and 7 cm(males). Found on bottoms of mud to coral debris, from depths of 12.5 to 60 m. Assumed to have good ability to maintain population.	A	demersal	P	Inshore muddy sandy areas whole GBR. Occurs at depths from 12.5 to 52 m.	P

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Pilumnidae (Hairy crabs)	Unknown	P	Pitcher et al 2007 species distribution map indicates widespread. ABRS: Northern Territory: Gulf of Carpentaria, N coast & Queensland: Gulf of Carpentaria	A	None known	A		4	I-L
(Hermit crab)	Unknown	P	Pitcher et al 2007 species distribution map indicates widespread.	A	None known	A		4	I-L
Leucosiidae (Purse crabs)	Unknown	P	Widespread Sealife base: Tropical, Western Central Pacific: Indonesia, Philippines, New Caledonia, Fiji and Vanuatu.	A	None known	A		4	I-L
Portunidae (Swimming crabs)	1.73	A	Widespread Sealife base: Subtropical, Indo-West Pacific: China and Taiwan Widely distributed inner half of GBR shelf.	A	No other fishery pressures likely	A	More catchable in north Qld prawn trawl, also caught in lower quantities in scallop fishery.	1	H-I
Portunidae (Swimming crabs)	Unknown	P	Widespread ABRS: Tropical NT and QLD Mostly in northern GBR in Seabed Biodiversity Project report	A	None known	A		2	I
Hardback shrimp (Penaeid shrimps)	2.35	A	Widespread Sealife base: Tropical, Indo-West Pacific: Taiwan and Australia. FAO Guide: Generally believed to be restricted to northern Australia from Shark Bay (western Australia) and Keppel Bay (Queensland), but probably also occurs in southern Taiwan Province of China.	A	FAO Guide: Taken mainly by trawls. Caught incidentally in the northern prawn fishery of Australia, but without much economic importance, due to its relatively small size.	A	? Offshore in trawl catches	2	I

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Gastropods								
Sea snail	Gastropoda	*Aplysia sp1_QMS*	Possibly have demersal eggs, pelagic larvae (A dactylomela), reproduce from 2 moths til about 9 moths, many million eggs	A	benthic	P	Similar species: A dactylomela: from Wikipedia: commonly found in shallow waters, tide pools and rocky and sandy substrates, during day mostly hide. Usually stay in relatively shallow water, but they have been found as deep as 40m. Often considered reef associated.	A
Small sea snail	Gastropoda	*Lamellaria sp1*	No information available, but assume moderate ability to maintain population	P	benthic	P	Unknown	P
Sea snail	Gastropoda	*Nassarius cremmatus cf*	Mud whelk, pelagic veliger larvae	A	Benthic, very low catchability, Seabed Biodiversity Project research sled caught > 20 times trawl gear, likely to go under trawl net and very robust shelled animal	A	Shallow muddy areas, widely distributed not only in trawl grounds	A

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Gastropods	From Pitcher et al. 2007								
Sea snail	Unknown but probably high, short lived (< 1 yr), veliger larvae	A	Capricorn Bunker group to Mackay and offshore Cape Bedford, Pitcher et al 2007	A	None known	A	Genus includes medium sized to extremely large sea slugs, specifically sea hares. Courtney et al 2007: a few caught in scallop fishery by catch Aplysia dactylomela, 2% of samples in scallop fishery. Other species have short life spans (< 1 yr)	1	H-I
Small sea snail	Unknown	P	Swains , Pompeys, inshore and offshore. Wide distribution but not very abundant (Pitcher et al 2007)	A	None known	A	Probably relative catch rate (to sled) is ~3-4%, as at the order level, Seabed Biodiversity Project showed that trawl typically captures 3.5% relative to research sled.	4	I-L
Sea snail	? Warm temperate northern hemisphere species have moderate growth and mortality, tropical shorter lived, higher mortality ? cf prawns	A	Widespread Sealife base: Tropical	A	None known	A	lifespan 3-5 yrs temperate, Hong Kong sp 1-2 yrs	0	H

Appendix 7. Resilience of by-catch species

Common Name	Class	Species Name	Life history strategy	A or P or PP	Mode of life - pelagic or demersal	A or P	Habitat association	A or P
Ray-finned fish								
Razorfish	Actinopterygii	*Aeoliscus strigatus*	Resilience (Ref. 69278) High, minimum population doubling time less than 15 months (Preliminary K or Fecundity.) Schoolers.	A	Demersal; depth range 1 - 20 m	P	Benthic, continental shelf, coral reef, inshore, schooling. EOL: Form schools among the spines of Diadema or staghorn corals, and feed on minute crustaceans in the zooplankton.	A
Pineapple fish	Actinopterygii	*Cleidopus gloriamaris*	Resilience (Ref. 69278) Very Low, minimum population doubling time more than 14 years (Preliminary K or Fecundity.) Reproduction unknown assumed to be non-guarders.	PP	Demersal; depth range 6 - 200 m	P	Benthic, continental shelf, coral reef, inshore, nocturnal, rock reef. EOL: Found in caves and under ledges of rocky, occasionally coral-reef habitats (Ref. 9710). Also in muddy substrates (Ref. 9563).	A
Personifer angelfish	Actinopterygii	*Chaetodontoplus meredithi*	Resilience (Ref. 69278) Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity). Broadcast spawners. Solitary or in pairs.	P	Demersal; depth range 10 - 50 m	P	Coral reef, inshore, rock reef, silt bottom–marine. Inhabits soft or rubble bottoms and open flat bottom areas with rock, coral, sponge, and sea whip outcrops. Flat bottoms with rocky coral patches in 6 - 45m. Harbours and coastal to inner reefs, usually in sponge areas and often under deep jetties where sponges are prolific on pylons. Small juveniles in rocky ledges with sea urchins.	A

Appendix 7. Resilience of by-catch species

Common Name	Natural mortality	A or P	Geographic distribution	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Ray-finned fish									
Razorfish	Unknown	P	Widespread EOL: Indo-West Pacific: Tanzania (Ref. 51015) and Seychelles (Ref. 1623); then from southern Japan to New South Wales, Australia.	A	Collected for Marine Aquarium Fish trade, but collections localised and relatively low fishing effort	A	This species identified as interacting with trawl in the ecological risk assessment of Marine Aquarium Fish Fishery	2	I
Pineapple fish	Unknown	P	Widespread EOL: Eastern Indian Ocean to Western Pacific: Australia.	A	Collected for Marine Aquarium Fish trade, but collections localised and relatively low fishing effort	A	This species identified as interacting with trawl in the ecological risk assessment of Marine Aquarium Fish Fishery	4	I-L
Personifer angelfish	Unknown	P	Widespread EOL: Western Pacific: Queensland, Australia. Reported to range south to New South Wales and Lord Howe Island (Ref. 9710).	A	Collected for Marine Aquarium Fish trade, but collections localised and relatively low fishing effort	A	This species identified as interacting with trawl in the ecological risk assessment of Marine Aquarium Fish Fishery	3	I-L

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Ray-finned fish			R 14-58 Table 3-57 Seabed Biodiversity excluding BRD effect		R 14-58 Table 3-57 Seabed Biodiversity					
Pearly-finned cardinal fish	Actinopterygii	*Apogon poecilopterus*	48	P	51	PP	Assume 100% mortality based on expert opinion	P	No effect of BRD (Courtney et al 2007)	P
Pigmy leatherjacket	Actinopterygii	*Brachaluteres taylori*	9	A	72	PP	Assume high survival based on expert opinion	A	No effect of BRD (Courtney et al 2007)	P
Tufted sole	Actinopterygii	*Brachirus muelleri* / *Dexillichthys muelleri*	119	PP	119	PP	Seem to survive OK - assume at least moderate survival	A	Could not analyse for effect of BRD (Courtney et al 2007)	P
Longnose stinkfish	Actinopterygii	*Calliurichthys grossi* / *Callionymus grossi*	25	A	59	PP	Unknown	P	Unknown	P
Prickly leatherjacket	Actinopterygii	*Chaetodermis penicilligera*	31	P	31	PP	Assume similar to pigmy leatherjacket	A	Unlikely to be effective	P
Spotted-fin tongue-sole	Actinopterygii	*Cynoglossus maculipinnis*	7	A	52	PP	Assume similar to turfted sole: at least moderate survival	A	Unknown	P
Naked-headed catfish	Actinopterygii	*Euristhmus nudiceps*	51	PP	51	PP	Pretty hardy post-capture, from FRDC project 96/257	A	Good reduction in trials (Courtney et al 2007); but current BRD's not particularly effective	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Ray-finned fish	R 14-58 Table 3-57 Seabed Biodiversity						
Pearly-finned cardinal fish	50	A	More of a north QLD species, so main interaction will be with trawl sectors operating in north QLD.	Mean size of 4.8mm	5	H	HIGH
Pigmy leatherjacket	29	A			3	I	INT
Tufted sole	31	A		Mean size of 162mm	5	H	HIGH
Longnose stinkfish	46	A			4	H-I	INT-HIGH
Prickly leatherjacket	41	A			4	H-I	HIGH
Spotted-fin tongue-sole	40	A			3	I	INT
Naked-headed catfish	44	A		Very common in tiger prawn trawl by catch	5	H	HIGH

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Rough flutemouth	Actinopterygii	*Fistularia petimba*	32	P	32	P	Low survival. Elongated fish tend to have poor survival in trawl as even individuals that go through the net may not survive well	P	In 41% of north QLD samples from Courtney et al 2007; 1% of samples from the scallop fishery. Benefit from large-mesh net; current BRD's probably not having much of an effect, but other models could be effective.	P
Orangefin ponyfish	Actinopterygii	*Leiognathus bindus / Photopectoralis bindus*	1	A	63	PP	Low survival	P	Not effective	P
Whipfin ponyfish	Actinopterygii	*Leiognathus leuciscus / Equulites leuciscus*	41	P	95	PP	Low survival	P	Not effective	P
Splendid ponyfish	Actinopterygii	*Leiognathus splendens /Eubleekeria splendens*	4	A	54	PP	moderate - Stobutzki et al FRDC 1996/257	A	not effective	P
Fourlined terapon	Actinopterygii	*Pelates quadrilineatus*	15	A	103	PP	Moderate survival - Stobutzki et al FRDC 1996/257	A	Quite good swimmers, but lack data on effectiveness of BRDs. Assume about 8%. Expect quite high escapement from trawl gear in general because quite small species.	P
Longfin silverbiddy	Actinopterygii	*Pentaprion longimanus*	13	A	117	PP	Low survival - dead in net	P	No data: assume ineffective	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Rough flutemouth	56	A		Catching small animals (average between 400 and 600mm) in prawn and scallop trawl grounds, but adults gets much bigger at greater than 1.2m.	4	H-I	HIGH
Orangefin ponyfish	58	A			4	H-I	INT-HIGH
Whipfin ponyfish	41	A		Extremely common in trawl by catch in north Queensland. Seen early evening and probably also in the daytime. Captured at sizes less than maturity	5	H	HIGH
Splendid ponyfish	46	A		Quite common in trawl by catch.	3	I	INT
Fourlined terapon	31	A		Trawl catch average size 102mm, in 14% of catch, Courtney et al 2007. Few caught below 20m depth, more common around 10m. Tend to see at about 100mm in catch.	3	I	INT
Longfin silverbiddy	38	A		More likely to be caught by daytime banana prawn fishery, as this is not a nocturnal species.	4	H-I	HIGH

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Australian threadfin	Actinopterygii	*Polydactylus multiradiatus*	Assume about 22 (check data)	A	22	A	Unknown	P	Unknown	P
Blotched javelin	Actinopterygii	*Pomadasys maculatus*	35	P	35	P	Low survival	P	No data from Courtney et al 2007: assume ineffective	P
Damselfish sp	Actinopterygii	*Pristotis obtusirostris*	17	A	21	A	Low survival	P	Unknown	P
Australian halibut	Actinopterygii	*Psettodes erumei*	56	PP	56	PP	Assumed to be relatively high survival as appear quite hardy on sorting tray	A	No effect of BRD (Courtney et al 2007)	P
Flathead dragonet	Actinopterygii	*Repomucenus belcheri / Callionymus belcheri*	22	A	53	PP	Unknown	P	No effect of BRD (Courtney et al 2007)	P
Shortfin saury (Short-finned lizardfish)	Actinopterygii	*Saurida argentea/tumbil*	63	PP	63	PP	Low survival as soft bodied and usually die quite quickly once captured. Predation also an issue.	P	No effect of BRD (Courtney et al 2007)	P
Largescale saury (Brushtooth lizardfish)	Actinopterygii	*Saurida grandisquamis/ undosquamis*	46	P	46	P	Low survival as soft bodied and usually die quite quickly once captured.	P	No effect of BRD currently used in QLD, but significant effect (80%) Square Mesh Codend in scallop fishery (Courtney et al 2007)	P
Trumpeter whiting	Actinopterygii	*Sillago maculata*	37	P	37	P	Moderate survival	P	Tested radial escape section but not significant for this species.	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Australian threadfin	70	A			2	I-L	INT-LOW
Blotched javelin	35	A		Can grow to 600mm and 3.2kgs. Reef associated. Courtney et al report common in by catch, probably catching juveniles.	4	H-I	HIGH
Damselfish sp	57	A			2	I-L	INT-LOW
Australian halibut	39	A		Range of sizes caught (industry/expert opinion)	5	H	HIGH
Flathead dragonet	36	A			4	H-I	INT-HIGH
Shortfin saury (Short-finned lizardfish)	42	A			6	H	HIGH
Largescale saury (Brushtooth lizardfish)	41	A		Catching smallest individuals in shallow sectors, then in scallop mid sized, and in deepwater king getting large ones. Possibly latitudinal variation in growth/size? In by catch from all trawl sectors.	4	H-I	HIGH
Trumpeter whiting	54	A		Was in 27% of samples from nth old tiger/endeavour trawl fishery - Courtney et al 2007. Average size 160mm se 1.48mm trawl by catch.	4	H-I	HIGH

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Spinycheek grunter	Actinopterygii	*Terapon puta*	64	PP	78	PP	Assume good survival as considered very hardy species	A	No data from Courtney et al 2007; may be good swimmers and should be able to escape from BRD's, but likely to get meshed; considered to be more of a daytime fish than night time	P
Largescale grunter (Banded grunter)	Actinopterygii	*Terapon theraps*	6	A	62	PP	Assume at least moderate survival, as high survival (97%) after 30 min trawls in Hill and Wassenberg 1990.	A	No data from Courtney et al 2007, assume similar to Spinycheek Grunter (was assessed as Prone)	P
Yellowfin tripodfish	Actinopterygii	*Tripodichthys angustifrons*	50	P	50	P	Assume good survival as considered very hardy species	A	Rare in samples Courtney et al 2007; unlikely to be excluded by BRD's.	P
Blacktip tripodfish (Long-nosed tripodfish)	Actinopterygii	*Trixiphichthys weberi*	40	P	40	P	Medium 1/3 to 2/3 survival ilona's report. Mostly daytime species.	A	Bit more common 12% north QLD; 11% samples from scallop fishery. 107mm average size north QLD; 139mm TL average size scallop fishery	P
Sunrise goatfish (Sulphur goatfish)	Actinopterygii	*Upeneus sulphureus*	26	P	58	PP	Fairly soft fleshed and easily injured. Ilona report 1/3 to 2/3 survive.	A	There was a sign effect of BRD's in Courtney et al 2007. Radial escape section. Could benefit from other BRD's.	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Spinycheek grunter	44	A	Expect greater interaction with banana prawn fishery and other daytime or very early evening trawling activities. Note: catchability may be lower than estimated by research, given more of a daytime species, and this would tend to reduce exposure to trawl.		5	H	HIGH
Largescale grunter (Banded grunter)	37	A		Occurred in 12.9% of by catch samples in tiger/endeavour prawn trawl fishery (Courtney et al 2007).	3	I	INT
Yellowfin tripodfish	55	A			3	I	INT
Blacktip tripodfish (Long-nosed tripodfish)	44	A			3	I	INT
Sunrise goatfish (Sulphur goatfish)	30	A			4	H-I	INT-HIGH

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Ochreband goatfish	Actinopterygii	*Upeneus sundaicus*	42	P	93	PP	Fairly soft fleshed and easily injured. Ilona report 1/3 to 2/3 survive.	A	There was a sign effect of BRD's in Courtney et al 2007. Radial escape section. Could benefit from other BRD's.	P
Hairfin goby	Actinopterygii	*Yongeichthys nebulosus*	51	PP	51	PP	Low survival	P	Unknown	P
Seapens										
Sea pen	Anthozoa	*Sea pen (Pteroides?) sp1*	8	A	50	P	Assume depletion and recovery similar to gorgonian gardens (assessed as habitat element): medium depletion rate and low recovery, giving relatively poor survival	P	Unlikely to be effective	P
Razorfish	Actinopterygii	*Aeoliscus strigatus*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P
Pineapple fish	Actinopterygii	*Cleidopus gloriamaris*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P
Personifer angelfish	Actinopterygii	*Chaetodontoplus meredithi*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Ochreband goatfish	37	A			4	H-I	INT-HIGH
Hairfin goby	58	A			6	H	HIGH
Seapens	R 14-58 Table 3-57 Seabed Biodiversity						INT-LOW
Sea pen	43	A		The exposure of sea pens in the genus Pteroides was 16%, and sea pens appear to have a low catchability (~0.06) with narrow uncertainty (~0.05), so would appear to be at low risk [from discarding] (Pitcher et al 2007), [however some risk from contact without capture].	3	I	INT-LOW
Razorfish		A			2	I-L	INT-LOW
Pineapple fish		A			2	I-L	
Personifer angelfish		A		Although small juveniles reported to be in crevices and may be inaccessible to trawlers, anecdotal reports of interaction of juveniles with trawlers	2	I-L	INT

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Bivalves										
Bivalve sp	Bivalvia	*Enisiculus cultellus*	5	A	75	PP	Good survival post-capture	A	Trawl catchability negligible, so not applicable	A
Glycymerididae	Bivalvia	*Melaxinaea vitrea*	4	A	63	PP	High survival	A	Trawl catchability negligible so not applicable	A
Bivalve sp	Bivalvia	*Placamen tiara*	2	A	55	PP	High survival	A	Trawl catchability negligible so not applicable	A
Crustaceans										
Blunt-toothed crab	Crustacea	*Charybdis truncata*	18	A	46	P	High survival	A	no effect	P
Pilumnidae (Hairy crabs)	Crustacea	*Cryptolutea arafurensis*	4	A	128	PP	Good survival post-capture	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
(Hermit crab)	Crustacea	*Diogenidae sp356-1*	3	A	36	P	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Bivalves	R 14-58 Table 3-57 Seabed Biodiversity						
Bivalve sp	39	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	2	I-L	INT-LOW
Glycymerididae	41	A		Mostly research sled captures, 7% trawl catchability in Seabed Biodiversity Project	2	I-L	INT-LOW
Bivalve sp	45	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	2	I-L	INT-LOW
Crustaceans	R 14-58 Table 3-57 Seabed Biodiversity						
Blunt-toothed crab	52	A			2	I-L	INT-LOW
Pilumnidae (Hairy crabs)	43	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	3	I	INT
(Hermit crab)	55	A			2	I-L	INT-LOW

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Class	Species Name	Per cent caught (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Leucosiidae (Purse crabs)	Crustacea	*Myra tumidospina*	8	A	60	PP	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Portunidae (Swimming crabs)	Crustacea	*Portunus gracilimanus*	34	P	86	PP	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Portunidae (Swimming crabs)	Crustacea	*Portunus tuberculosus*	3	A	46	P	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Hardback shrimp (Penaeid shrimps)	Crustacea	*Trachypenaeus anchoralis*	17	A	67	PP	Moderate survival	A	no effect	P
Gastropods										
Sea snail	Gastropoda	*Aplysia sp1_QMS*	38	P	38	P	Low - moderate survival (poor quality info)	P	Unknown but probably not effective	P
Small sea snail	Gastropoda	*Lamellaria sp1*	37	P	37	P	Unknown	P	Unlikely to be effective	P
Sea snail	Gastropoda	*Nassarius cremmatus cf*	2	A	57	P	High survival	A	Ineffective but not applicable	A

Appendix 8. Fishery impact profile of by-catch species 2005

Common Name	Refuge availability	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Leucosiidae (Purse crabs)	43	A			3	I	INT
Portunidae (Swimming crabs)	41	A		Caught at 36mm in north QLD, in 35% of samples Courtney et al 2007. Sub adult to adult stages likely to be caught.	4	H-I	INT-HIGH
Portunidae (Swimming crabs)	53	A			2	I-L	INT-LOW
Hardback shrimp (Penaeid shrimps)	36	A		Trawled over varying bottom types from mud to coral debris, depths to 60m.	3	I	INT
Gastropods	R 14-58 Table 3-57 Seabed Biodiversity						
Sea snail	49	A		Probably capture all life stages once settled.	4	H-I	INT-HIGH
Small sea snail	54	A			4	H-I	HIGH
Sea snail	45	A		Only catch large specimens	1	L	LOW

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Ray-finned fish										
Pearly-finned cardinal fish	Actinopterygii	*Apogon poecilopterus*	19	A	20	A	Assume 100% mortality based on expert opinion	P	No effect of BRD (Courtney et al 2007)	P
Pigmy leatherjacket	Actinopterygii	*Brachaluteres taylori*	6	A	50	P	Assume high survival based on expert opinion	A	No effect of BRD (Courtney et al 2007)	P
Tufted sole	Actinopterygii	*Brachirus muelleri / Dexillichthys muelleri*	37	P	37	P	Seem to survive OK - assume at least moderate survival	A	Could not analyse for effect of BRD (Courtney et al 2007)	P
Longnose stinkfish	Actinopterygii	*Calliurichthys grossi / Callionymus grossi*	9	A	22	A	Unknown	P	Unknown	P
Prickly leatherjacket	Actinopterygii	*Chaetodermis penicilligera*	18	A	18	A	Assume similar to pigmy leatherjacket	A	Unlikely to be effective	P
Spotted-fin tongue-sole	Actinopterygii	*Cynoglossus maculipinnis*	3 (data from Pitcher in 2011)	A	21 (data from Pitcher in 2011)	A	Assume similar to turfted sole: at least moderate survival	A	Unknown	P
Naked-headed catfish	Actinopterygii	*Euristhmus nudiceps*	19	A	19	A	Pretty hardy post-capture, from FRDC project 96/257	A	Good reduction in trials (Courtney et al 2007); but current BRD's not particularly effective	P
Rough flutemouth	Actinopterygii	*Fistularia petimba*	13	A	13	A	Low survival. Elongated fish tend to have poor survival in trawl as even individuals that go through the net may not survive well	P	In 41% of north QLD samples from Courtney et al 2007; 1% of samples from the scallop fishery. Benefit from large-mesh net; current BRD's probably not having much of an effect, but other models could be effective.	P

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Ray-finned fish	R 14-58 Table 3-57 Seabed Biodiversity						
Pearly-finned cardinal fish	50	A	More of a north QLD species, so main interaction will be with trawl sectors operating in north QLD.	Mean size of 4.8mm	2	I-L	INT-LOW
Pigmy leatherjacket	29	A			2	I-L	LOW
Tufted sole	31	A		Mean size of 162mm	3	I	INT
Longnose stinkfish	46	A			2	I-L	INT-LOW
Prickly leatherjacket	41	A			1	L	INT-LOW
Spotted-fin tongue-sole	40	A			1	L	INT-LOW
Naked-headed catfish	44	A		Very common in tiger prawn trawl by catch	1	L	INT-LOW
Rough flutemouth	56	A		Catching small animals (average between 400 and 600mm) in prawn and scallop trawl grounds, but adults gets much bigger at greater than 1.2m.	2	I-L	INT-LOW

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Orangefin ponyfish	Actinopterygii	*Leiognathus bindus / Photopectoralis bindus*	0	A	23	A	Low survival	P	Not effective	P
Whipfin ponyfish	Actinopterygii	*Leiognathus leuciscus / Equulites leuciscus*	14	A	32	P	Low survival	P	Not effective	P
Splendid ponyfish	Actinopterygii	*Leiognathus splendens /Eubleekeria splendens*	2 (data from Pitcher in 2011)	A	23 (data from Pitcher in 2011)	A	moderate - Stobutzki et al FRDC 1996/257	A	not effective	P
Fourlined terapon	Actinopterygii	*Pelates quadrilineatus*	6	A	38	P	Moderate survival - Stobutzki et al FRDC 1996/257	A	Quite good swimmers, but lack data on effectiveness of BRDs. Assume about 8%. Expect quite high escapement from trawl gear in general because quite small species.	P
Longfin silverbiddy	Actinopterygii	*Pentaprion longimanus*	5	A	44	P	Low survival - dead in net	P	No data: assume ineffective	P
Australian threadfin	Actinopterygii	*Polydactylus multiradiatus*	8	A	8	A	Unknown	P	Unknown	P
Blotched javelin	Actinopterygii	*Pomadasys maculatus*	13	A	13	A	Low survival	P	No data from Courtney et al 2007: assume ineffective	P
Damselfish sp	Actinopterygii	*Pristotis obtusirostris*	10	A	12	A	Low survival	P	Unknown	P
Australian halibut	Actinopterygii	*Psettodes erumei*	21	A	21	A	Assumed to be relatively high survival as appear	A	No effect of BRD (Courtney et al 2007)	P
Flathead dragonet	Actinopterygii	*Repomucenus belcheri / Callionymus belcheri*	10 (data from Pitcher in 2011)	A	22 (data from Pitcher in 2011)	A	Unknown	P	No effect of BRD (Courtney et al 2007)	P

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Orangefin ponyfish	58	A			2	I-L	LOW
Whipfin ponyfish	41	A		Extremely common in trawl by catch in north Queensland. Seen early evening and probably also in the daytime. Captured at sizes less than maturity	3	I	INT
Splendid ponyfish	46	A		Quite common in trawl by catch.	1	L	INT-LOW
Fourlined terapon	31	A		Trawl catch average size 102mm, in 14% of catch, Courtney et al 2007. Few caught below 20m depth, more common around 10m. Tend to see at about 100mm in catch.	2	I-L	LOW
Longfin silverbiddy	38	A		More likely to be caught by daytime banana prawn fishery, as this is not a nocturnal species.	3	I	INT
Australian threadfin	70	A			2	I-L	INT-LOW
Blotched javelin	35	A		Can grow to 600mm and 3.2kgs. Reef associated. Courtney et al report common in by catch, probably catching juveniles.	2	I-L	INT-LOW
Damselfish sp	57	A			2	I-L	INT-LOW
Australian halibut	39	A		Range of sizes caught (industry/expert opinion)	1	L	INT-LOW
Flathead dragonet	36	A			2	I-L	INT-LOW

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Shortfin saury (Short-finned lizardfish)	Actinopterygii	*Saurida argentea/tumbil*	25	A	25	A	Low survival as soft bodied and usually die quite quickly once captured. Predation also an issue.	P	No effect of BRD (Courtney et al 2007)	P
Largescale saury (Brushtooth lizardfish)	Actinopterygii	*Saurida grandisquamis/ undosquamis*	23	A	23	A	Low survival as soft bodied and usually die quite quickly once captured.	P	No effect of BRD currently used in QLD, but significant effect (80%) Square Mesh Codend in scallop fishery (Courtney et al 2007)	P
Trumpeter whiting	Actinopterygii	*Sillago maculata*	16	A	16	A	Moderate survival	P	Tested radial escape section but not significant for this species.	P
Spinycheek grunter	Actinopterygii	*Terapon puta*	20	A	25	A	Assume good survival as considered very hardy species	A	No data from Courtney et al 2007; may be good swimmers and should be able to escape from BRD's, but likely to get meshed; considered to be more of a daytime fish than night time	P
Largescale grunter (Banded grunter)	Actinopterygii	*Terapon theraps*	3	A	26	P	Assume at least moderate survival, as high survival (97%) after 30 min trawls in Hill and Wassenberg 1990.	A	No data from Courtney et al 2007, assume similar to Spinycheek Grunter (was assessed as Prone)	P
Yellowfin tripodfish	Actinopterygii	*Tripodichthys angustifrons*	17	A	17	A	Assume good survival as considered very hardy species	A	Rare in samples Courtney et al 2007; unlikely to be excluded by BRD's.	P

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Shortfin saury (Short-finned lizardfish)	42	A			2	I-L	INT-LOW
Largescale saury (Brushtooth lizardfish)	41	A		Catching smallest individuals in shallow sectors, then in scallop mid sized, and in deepwater king getting large ones. Possibly latitudinal variation in growth/size? In by catch from all trawl sectors.	2	I-L	INT-LOW
Trumpeter whiting	54	A		Was in 27% of samples from nth old tiger/endeavour trawl fishery - Courtney et al 2007. Average size 160mm se 1.48mm trawl by catch.	2	I-L	INT-LOW
Spinycheek grunter	44	A	Expect greater interaction with banana prawn fishery and other daytime or very early evening trawling activities. Note: catchability may be lower than estimated by research, given more of a daytime species, and this would tend to reduce exposure to trawl.		1	L	LOW
Largescale grunter (Banded grunter)	37	A		Occurred in 12.9% of by catch samples in tiger/endeavour prawn trawl fishery (Courtney et al 2007).	2	I-L	LOW
Yellowfin tripodfish	55	A			1	L	INT-LOW

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Blacktip tripodfish (Long-nosed tripodfish)	Actinopterygii	*Trixiphichthys weberi*	17	A	17	A	Medium 1/3 to 2/3 survival ilona's report. Mostly daytime species.	A	Bit more common 12% north QLD; 11% samples from scallop fishery. 107mm average size north QLD; 139mm TL average size scallop fishery	P
Sunrise goatfish (Sulphur goatfish)	Actinopterygii	*Upeneus sulphureus*	11 (data from Pitcher in 2011)	A	24 (data from Pitcher in 2011)	A	Fairly soft fleshed and easily injured. Ilona report 1/3 to 2/3 survive.	A	There was a sign effect of BRD's in Courtney et al 2007. Radial escape section. Could benefit from other BRD's.	P
Ochreband goatfish	Actinopterygii	*Upeneus sundaicus*	14	A	32	P	Fairly soft fleshed and easily injured. Ilona report 1/3 to 2/3 survive.	A	There was a sign effect of BRD's in Courtney et al 2007. Radial escape section. Could benefit from other BRD's.	P
Hairfin goby	Actinopterygii	*Yongeichthys nebulosus*	16	A	16	A	Low survival	P	Unknown	P
Razorfish	Actinopterygii	*Aeoliscus strigatus*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P
Pineapple fish	Actinopterygii	*Cleidopus gloriamaris*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P
Personifer angelfish	Actinopterygii	*Chaetodontoplus meredithi*	Uncertain, but considered to be less than 25%	A	Uncertain, but considered to be less than 25%	A	Uncertain, but may be low	P	Unlikely to be effective	P
Seapens										

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Blacktip tripodfish (Long-nosed tripodfish)	44	A			1	L	INT-LOW
Sunrise goatfish (Sulphur goatfish)	30	A			1	L	LOW
Ochreband goatfish	37	A			2	I-L	INT-LOW
Hairfin goby	58	A			2	I-L	INT-LOW
Razorfish		A			2	I-L	INT-LOW
Pineapple fish		A			2	I-L	INT-LOW
Personifer angelfish		A		Although small juveniles reported to be in crevices and may be inaccessible to trawlers, anecdotal reports of interaction of juveniles with trawlers	2	I-L	INT-LOW
Seapens	R 14-58 Table 3-57 Seabed Biodiversity						

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
Sea pen	Anthozoa	*Sea pen (Pteroides?) sp1*	3	A	20	A	Assume depletion and recovery similar to gorgonian gardens (assessed as habitat element): medium depletion rate and low recovery, giving relatively poor survival	P	Unlikely to be effective	P
Bivalves										
Bivalve sp	Bivalvia	*Enisiculus cultellus*	2	A	31	P	Good survival post-capture	A	Trawl catchability negligible, so not applicable	A
Glycymerididae	Bivalvia	*Melaxinaea vitrea*	2	A	25	A	High survival	A	Trawl catchability negligible so not applicable	A
Bivalve sp	Bivalvia	*Placamen tiara*	1	A	22	A	High survival	A	Trawl catchability negligible so not applicable	A
Crustaceans										
Blunt-toothed crab	Crustacea	*Charybdis truncata*	7	A	17	A	High survival	A	no effect	P
Pilumnidae (Hairy crabs)	Crustacea	*Cryptolutea arafurensis*	1	A	42	P	Good survival post-capture	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Sea pen	43	A		The exposure of sea pens in the genus Pteroides was 16%, and sea pens appear to have a low catchability (~0.06) with narrow uncertainty (~0.05), so would appear to be at low risk [from discarding] (Pitcher et al 2007), [however some risk from contact without capture].	2	I-L	INT-LOW
Bivalves	R 14-58 Table 3-57 Seabed Biodiversity						
Bivalve sp	39	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	1	L	INT-LOW
Glycymerididae	41	A		Mostly research sled captures, 7% trawl catchability in Seabed Biodiversity Project	0	L	LOW
Bivalve sp	45	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	0	L	LOW
Crustaceans	R 14-58 Table 3-57 Seabed Biodiversity						
Blunt-toothed crab	52	A			1	L	LOW
Pilumnidae (Hairy crabs)	43	A		This species is associated with Assemblage 12, which had 108% exposure in 2005, and was distributed in patches along the coastal/inner-shelf from the Whitsundays to Cape Upstart and from Cairns north.	2	I-L	INT-LOW

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Class	Species Name	Per cent caught 2009 (W/O BRD EFFECT)	A or P or PP	Per cent effort exposed 2009	A or P or PP	Survival after capture	A or P	Effectiveness of TEDs/BRDs	A or P
(Hermit crab)	Crustacea	*Diogenidae sp356-1*	1	A	15	A	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Leucosiidae (Purse crabs)	Crustacea	*Myra tumidospina*	3	A	23	A	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Portunidae (Swimming crabs)	Crustacea	*Portunus gracilimanus*	12	A	31	P	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Portunidae (Swimming crabs)	Crustacea	*Portunus tuberculosus*	1	A	19	A	Likely to have relatively good survival	A	TEDs/BRDs not effective for small crabs, even with best designs tend not to be excluded.	P
Hardback shrimp (Penaeid shrimps)	Crustacea	*Trachypenaeus anchoralis*	7	A	26	P	Moderate survival	A	no effect	P
Gastropods										
Sea snail	Gastropoda	*Aplysia sp1_QMS*	17	A	17	A	Low - moderate survival (poor quality info)	P	Unknown but probably not effective	P
Small sea snail	Gastropoda	*Lamellaria sp1*	15	A	15	A	Unknown	P	Unlikely to be effective	P
Sea snail	Gastropoda	*Nassarius cremmatus cf*	1	A	22	A	High survival	A	Ineffective but not applicable	A

Appendix 9. Fishery impact profile of by-catch species 2009

Common Name	Refuge availa-bility	A or P	Variance	Comments	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
(Hermit crab)	55	A			1	L	INT-LOW
Leucosiidae (Purse crabs)	43	A			1	L	INT-LOW
Portunidae (Swimming crabs)	41	A		Caught at 36mm in north QLD, in 35% of samples Courtney et al 2007. Sub adult to adult stages likely to be caught.	2	I-L	LOW
Portunidae (Swimming crabs)	53	A			1	L	LOW
Hardback shrimp (Penaeid shrimps)	36	A		Trawled over varying bottom types from mud to coral debris, depths to 60m.	2	I-L	INT-LOW
Gastropods	R 14-58 Table 3-57 Seabed Biodiversity						
Sea snail	49	A		Probably capture all life stages once settled.	2	I-L	LOW
Small sea snail	54	A			2	I-L	INT-LOW
Sea snail	45	A		Only catch large specimens	0	L	LOW

Appendix 10. Resilience of marine turtles

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P
Flatback turtle	*Natator depressus*	Av 50 to 54 eggs/clutch depending on year and location, with 2.8 clutches/season (reviewed in Limpus 2007).	P	Remigration interval of 2.2 yr for females at Peak Is. Nest in sand on beach, no parental care.	PP	Endemic to the Australian continental shelf, with nesting restricted to tropical and subtropical Australia (reviewed in Limpus 2007). There is one management unit for Eastern Australia centred around rookeries in on Peak, Wild Duck and Avoid Is.)	A
Green turtle	*Chelonia mydas*	Av 115 eggs/clutch x 5 clutches/season for Heron Is. (reviewed in Limpus 2008).	P	Remigration interval of 5.8 yr for females at Heron Is. Nest in sand on beach, no parental care.	PP	Worldwide tropical and subtropical distribution (Hirth 1997) with 7 identified genetic stocks for Australia, including southern GBR and northern GBR (Bowen et al 1992 and others, reviewed in Limpus 2008). Major rookery for southern Great Barrier Reef on Capricorn Bunker Group, and for northern Great Barrier Reef on Raine Is.	A
Hawksbill turtle	*Eretmochelys imbricata*	Av 121 to 142 eggs/clutch depending on year and location, with 3 clutches/season (reviewed in Limpus 2009).	P	Remigration interval of 5 yr for females at Milman Is. Nest in sand on beach, no parental care.	PP	Worldwide circumtropical and subtropical distribution (Witzell 1983) with discrete genetic stocks globally. One Australian stock in northern GBR/Torres Strait/Arnhem Land, and another in north-western shelf of Western Australia (Broderick et al 1994, reviewed in Limpus 2009). 72 rookeries identified within north-eastern QLD.	A

Appendix 10. Resilience of marine turtles

Common Name	Habitat specificity or ecological niche	A or P	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P
Flatback turtle	Post hatchlings feed on macro zooplankton over the continental shelf inside the GBR lagoon. Juveniles and adults inhabit sub-tidal soft bottomed habitats inshore of the outer GBR. Generalist carnivore, feeding on soft-bodied invertebrates (soft corals, sea pens, holothurians, and jellyfish).	A	Unknown population size, nesting data indicates population stable on East Coast, no previous exploitation	P	Age at maturity about 20 years. Turtles returned to Mon Repos at 21 years for first breeding (reviewed in Limpus 2007). Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P
Green turtle	Post-hatchlings rare in GBR, follows an oceanic surface-water dwelling planktonic life, feeding on macro zooplankton. Recruits to a benthic foraging phase and is a generalist herbivore. Juvenile and adults feed in tidal and sub tidal habitats including coral and rocky reefs, seagrass meadows and algal turns on sand and mud flats. In coastal waters feeds primarily on seagrass, a wide range of algae and mangrove fruits. Occasionally feeds on jellyfish, bluebottles, dead fish and small crustaceans.	A	Large population, but trends stock dependent. southern Great Barrier Reef is increasing at 3.8%/yr and is probably A; data on northern Great Barrier Reef stock not as good and there are several indications that this stock is under pressures. northern Great Barrier Reef stock is probably prone. southern Great Barrier Reef stock stable with a total nesting population of 8,000 females in an average breeding season. southern Great Barrier Reef stock (and to a lesser degree the northern Great Barrier Reef stock) commercially harvested in the early to mid 1900's. Commercial harvesting ended 1954. northern Great Barrier Reef stock considered declining. >75,000 females at Raine Is. in 1999/2000 season, but significant decline in proportion of females successfully laying eggs over last 3 decades.	P	30-40 years age to maturity (reviewed in Limpus 2008). Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P
Hawksbill turtle	Narrow habitat requirements. Post-hatchling rarely encountered within GBR waters. Follow an oceanic, surface-water dwelling planktonic life, feeding on macro zooplankton. Foraging juvenile and adults encountered in tidal and sub-tidal coral and rocky reef habitats. Omnivorous, feeding on sponges, algae and seagrass.	A	Total nesting population for QLD is expected to be about 4,000 females annually. Population declining 3% pa primarily from pressures outside Australian waters. At this rate, Torres Strait-northern Great Barrier Reef stock can be expected to decline by >90% by 2020. Harvest of larger individuals for "tortoise shell".	P	Probably more than 30 years when commence breeding (reviewed in Limpus 2009). Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P

Appendix 10. Resilience of marine turtles

Common Name	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Risk prone score	Resilience level
Flatback turtle	30-50+ years. 1:1000 reaches maturity. Most mortality in hatching and juvenile stage.	P	Egg depredation by feral pigs (minimal on east coast) and Indigenous communities. Captured in ghost nets (minimal on east coast). Ingestion of marine debris. Climate change affecting incubation (temp) and can lead to feminisation of the hatchlings.	P	Nesting on 3 main sites on the East Coast but minor rookeries at many island and mainland sites.	7	L
Green turtle	30-50+ years. 1:1000 reaches maturity. Most mortality in hatching and juvenile stage.	P	Egg depredation by feral pigs (minimal on east coast) and Indigenous communities. Captured in ghost nets (minimal on east coast). Ingestion of marine debris. Climate change affecting incubation (temp) and can lead to feminisation of the hatchlings. Boat strike. GTFP disease. Coastal habitat loss and declines in WQ affecting seagrass meadows. Indigenous harvest is contributing stress. Beam Trawl impacts within estuaries unsure but likely.	P	Yes more Indigenous pressure in the north and more cumulative anthropogenic pressures in the south.	7	L
Hawksbill turtle	30-50+ years. 1:1000 reaches maturity. Most mortality in hatching and juvenile stage.	P	Egg depredation by feral pigs (minimal on East Coast) and Indigenous communities. Captured in ghost nets (minimal on East Coast). Ingestion of marine debris. Climate change affecting incubation (temp) and could lead to feminisation of hatchlings. Harvest of adults for "tortoise shell" occurring outside Australian waters and targeting larger size classes.	P	? Most pressures from outside GBR.	7	L

Appendix 10. Resilience of marine turtles

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P
Leatherback turtle	*Dermochelys coriacea*	Av 86 eggs/clutch for QLD, with up to 4 clutches/season (reviewed in Limpus 2009).	P	Remigration interval unknown for the Australian population	PP	Worldwide distribution in tropical and temperate oceans (Behler et al 1996) with discrete genetic stocks globally (Dutton et al 1999). Regionally isolated eastern Australian and northwest Arnhem Land nesting populations are managed as separate small breeding stocks. In eastern Australia nesting did occur around Wreck Rock beaches and Rules Beach in southern Queensland (reviewed in Limpus 2009). There has been no recorded nesting by leatherbacks in Queensland since 1996 and data of capture of adults on drum-lines from the QSCP indicate that the population that migrates along the East Coast has declined significantly over the last three decades (Hamann et al.).	A
Loggerhead turtle	*Caretta caretta*	Av 127 eggs/clutch x 3.4 clutches/season for Mon Repos (reviewed in Limpus 2008).	P	Remigration interval of 3.8 yr for females at Mon Repos Nest in sand on beach, no parental care.	PP	Worldwide circumtropical and subtropical distribution (Dodd 1988; Bolten and Witherington 2003) with 5 identified genetic stocks globally, including and Eastern Australian stock (Bowen et al 1993, reviewed in Limpus 2008). Major rookeries around Mon Repos and islands of the Capricorn-Bunker Group in the southern GBR.	A
Olive ridley turtle	*Lepidochelys olivacea*	Av 109 eggs/clutch x 2 clutches/season for Crab Is. QLD (reviewed in Limpus 2008).	P	Breeding cycles have not been described from the Australian nesting population. For overseas populations, remigration interval is given as 1-3 years.	PP	Worldwide circumtropical distribution (Marquez 1990) with discrete genetic stocks globally, including a stock in northern Australia (reviewed in Limpus 2008). No nesting on east coast, but limited data indicate some forage in GBR.	A

Appendix 10. Resilience of marine turtles

Common Name	Habitat specificity or ecological niche	A or P	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P
Leatherback turtle	Totally pelagic life history, and carnivorous. Post-hatchling diet is unknown. Juvenile and adults are specialists, feeding on jellyfish (Catostylus spp.) and salps (barrel-shaped, free-floating tunicate of the family Salpidae) and colonial tunicates such as *Pyrosoma* that live usually in the upper layers of the open ocean in warm seas. Will feed at all levels of the water column from benthos to surface (Limpus 1984, reviewed in Limpus 2009)	A	Severely depleted and internationally declining. No recorded nesting on the East Coast since 1996.	PP	Possibly reach maturity at about 13-14 years (Zug and Parham 1996). Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P
Loggerhead turtle	Post-hatchling follow an oceanic planktonic life in surface waters. Juvenile and adults feed in tidal and sub tidal habitats including coral and rocky reefs, seagrass meadows soft bottomed sand and mud flats. Generalist carnivore which feeds principally on gastropod and bivalve molluscs, portunid crabs and hermit crabs and other invertebrates (jellyfish, anemones, holothurians, sea urchins) and fish.	A	Management intervention has resulted in recovery of population. East Coast nesting population severely declined by 86% between mid- 1970s and 1999. East Coast nesting population estimated at less than 500 females in 1999-2000 (Limpus and Limpus 2003, reviewed in Limpus 2008). Still concerns for impacts on life history stages in pelagic Post-phase outside GBR.	P	Age at maturity about 30 years. Turtles returned to Mon Repos at 30 years for first breeding (reviewed in Limpus 2008). Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P
Olive ridley turtle	Generalist carnivore. Usually a pelagic foraging species, but substantial part of Australian population forages over shallow benthic habitats and remain within continental shelf waters. Species was most frequently captured at 6-35 m depth within the QLD East Coast TF. Data from NT indicates animals feeding at depth (<50m). Carnivorous, feeding on gastropod molluscs and small crabs.	A	Australian population appears to be an isolated moderately sized population when compared with the global populations. Nesting density in the NT has not be quantified, but is expected to be in the order of a few thousand females annually. No census has been made of the nesting population in QLD. Low density nesting occurs along the NW coast of Cape York Peninsula. No recorded nesting on East Coast.	A	Age at maturity probably between 20-50 years. Turtles are slow growing and take decades to grow from hatchlings to breeding adults.	P

Appendix 10. Resilience of marine turtles

Common Name	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Variance	Risk prone score	Resilience level
Leatherback turtle	30-50+ years. 1:1000 reaches maturity. Most mortality in hatching and juvenile stage.	P	Ingestion of marine debris. Capture on QLD Shark Control program drum lines. Long-line fleets outside the GBRMP. Boat strike. Entanglement in crab pot lines.	P	Some pressures on East Coast such as boat strike in summer during migration and capture on drum lines.	8	L
Loggerhead turtle		P	Egg depredation by foxes (impact minimised since 1990's). Ingestion of marine debris. Climate change affecting incubation (temp). Boat strike. Entanglement in crab pots. Beam Trawl? Coastal development and lighting impacts on mainland rookeries. Impacts of pelagic post-hatchlings outside Australian waters (Pacific long-line and purse seine fisheries) and artisanal fisheries of western coast of South and Central America.	P	More pressures around areas of high human habitation. Pressures on mainland nesting beaches vs. islands.	7	L
Olive ridley turtle	30-50+ years. 1:1000 reaches maturity. Most mortality in hatching and juvenile stage.	P	Egg depredation by feral pigs and Indigenous communities. Captured in ghost nets in Gulf of Carpentaria. Ingestion of marine debris. Climate change affecting incubation (temp) and could lead to feminisation of hatchlings. Scarce within GBRMP.	P		6	L

Appendix 11. Fishery impact profile of marine turtles

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD gear used effectively minimises catch rates	A or P	Risk prone score 2009	Fishery Impact Profile level 2009	RISK 2009
Flatback turtle	*Natator depressus*	Interaction with trawl gear in the east coast trawl fleet likely to be high but consequences of the interaction low. Number of animals actually landed on deck very low.	P	Flatback turtles have better breath-hold ability than other species of cheloniid turtles. Better able to withstand capture in trawl. Likely to pass through ted largely unharmed.	A	Juveniles and adult stage	P	Y	A	2	I-L	INT-LOW
Green turtle	*Chelonia mydas*	Interaction with trawl gear in the east coast trawl fleet likely to be high but consequences of the interaction low. Number of animals actually landed on deck very low.	P	Likely to pass through ted largely unharmed.	A	Juveniles, sub adult and adult stage	P	Y	A	2	I-L	INT-LOW
Hawksbill turtle	*Eretmochelys imbricata*	Interaction with trawl gear in the east coast trawl fleet likely to be lower than for other marine turtle species because of association with reefal habitats. consequences of the interaction low. Number of animals actually landed on deck very low.	P	Likely to pass through ted largely unharmed.	A	Juveniles, sub adult and adult stage	P	Y	A	2	I-L	INT-LOW
Leatherback turtle	*Dermochelys coriacea*	Extremely rare. Numbers of animals along the East Coast of Queensland very low, hence probably of interacting with the fishery very low.	A	Likely to pass through ted largely unharmed unless very large.	A	Sub adult and adult stage	P	Y but maybe not so effective for adults (if too big to fit through the TED)	P	2	I-L	INT-LOW
Loggerhead turtle	*Caretta caretta*	Interaction with trawl gear in the east coast trawl fleet likely to be high but consequences of the interaction low. Number of animals actually landed on deck very low.	P	Likely to pass through ted largely unharmed.	A	Juveniles, sub adult and adult stage	P	Y	A	2	I-L	INT-LOW
Olive ridley turtle	*Lepidochelys olivacea*	Relatively infrequent	A	Probably better than greens and loggerheads.	A	Sub adult and adult stage	P	Y	A	1	L	INT-LOW

Appendix 12. Resilience of sea snakes

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P
Horned sea snake	*Acalyptophis peronii*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 88,824 ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Dubois' sea snake	*Aipysurus duboisii*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 0 ha (Pitcher et al. 2007, Courtney et al. 2010). Modelled distribution data appears to be inconsistent with observed data.	A
Spine-tailed sea snake	*Aipysurus eydouxii*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 1,757 ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Olive sea snake	*Aipysurus laevis*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Reproduce every 2-3 years	PP	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 166,693 ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Stokes' sea snake	*Astrotia stokesii*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 1,368 ha (Pitcher et al. 2007, Courtney et al. 2010)	P
Spectacled sea snake	*Hydrophis/ Disteira kingii*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 863 ha (Pitcher et al. 2007, Courtney et al. 2010)	P

Appendix 12. Resilience of sea snakes

Common Name	Habitat specificity or ecological niche	A or P	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Risk prone score	Resilience level
Horned sea snake	Often seen on the surface of reefs at medium depths. Feeds on eels and gobies and possibly other fish (Heatwole 1999).	A	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A	K=0.421, M=0.356	P	No known concerns in GBR	A	4	I-L
Dubois' sea snake	Specialised diet (Stobutzki et al. 2000).	P	Unknown, probably large	A	Assume similar to A. laevis	A	K=0.47, M=.393	P	No known concerns in GBR	A	5	I-L
Spine-tailed sea snake	Specialised - feeds almost exclusively on fish eggs (Heatwole 1999). Does not inhabit clear reef waters (Rasmussen). Turbid waters 30 - 50m	P	Unknown, probably large	A	Assume similar to A. Laevis	A	K=0.631, M=0.517	P	No known concerns in GBR	A	5	I-L
Olive sea snake	Found in shallow water and in deep water. One of the most common sea snakes on coral reefs throughout its range. An opportunistic, generally benthic feeding carnivore.	A	Unknown, probably large	A	Reproductive 4-5 years for females and 3 years for males (Burns and Heatwole 2000).	A	K=0.178, M=0.193	P	No known concerns in GBR	A	5	I-L
Stokes' sea snake	A benthic-feeding piscivore, mostly feeds on Batrachoididae (toadfishes). Species is relatively reef associated	P	Unknown, but relatively uncommon	P	By 12 months most species of sea snakes are close to adult size.	A	K=0.294, M=0.28	P	No known concerns in GBR	A	7	L
Spectacled sea snake	Most species caught in trawls between depths of 30 and 40m. Feeds on eel like fishes.	P	Unknown, but relatively uncommon	P	By 12 months most species of sea snakes are close to adult size.	A	K=0.446, M=0.373	P	No known concerns in GBR	A	7	L

Appendix 12. Resilience of sea snakes

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P
Olive-headed sea snake	*Hydrophis/ Disteira major*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 7,345 ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Beaked sea snake	*Enhydrina schistosa*	Numerous smaller young (p. 12 Courtney et al. 2010)	P	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Modelled distribution (App. 5, T1) in GBR is 140,741 ha (Pitcher et al. 2007, Courtney et al. 2010) Note: consider modelled distribution of this species appears inconsistent with observed data. This is a small, inshore and estuarine species; extremely limited captures in the GBR.	A
Elegant sea snake	*Hydrophis elegans*	13 young per clutch but a lower reproductive frequency (Fry 2001, Ward 2001).	P	Reproduce every 2-3 years	PP	Widespread in northern Australia (SRRAT Database). Modelled distribution (App. 5, T1) in GBR is 131 ha (Pitcher et al. 2007, Courtney et al. 2010). Note: consider modelled distribution of this species appears inconsistent with observed data.	A
Small-headed sea snake	*Hydrophis macdowelli*	Ovoviviparous - < 10 live young. Clutch sizes determined for sea snakes in Northern Prawn Fishery (Stobutski et al. 2000).	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 189 ha (Pitcher et al. 2007, Courtney et al. 2010). Modelled distribution seems low versus observed distribution.	A
Ornate reef sea snake	*Hydrophis ornatus*	Ovoviviparous - < 10 live young	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 51,960 ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Large-headed sea snake	*Hydrophis pacificus*	Ovoviviparous - < 10 live young	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia but only in northern GBR (SRRAT Database) Distribution in GBR not modelled. Not captured in trawl by catch study (Courtney et al. 2010)	A

Appendix 12. Resilience of sea snakes

Common Name	Habitat specificity or ecological niche	A or P	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Risk prone score	Resilience level
Olive-headed sea snake	Feeds on fish. Found in deeper more turbid waters.	A	Unknown, but relatively uncommon	P	By 12 months most species of sea snakes are close to adult size.	A	K=0.537, M=0.434	P	No known concerns in GBR	A	5	I-L
Beaked sea snake	Very abundant on mud flats along coastal areas and in river mouths. Feeds mostly on catfish, other fish and prawns (Heatwole, 1999)	A	Unknown, probably large	A	18 months (Voris and Jayne 1979)	A	NO K; M=0.434	P	Cumulative inshore pressures; capture in crab-pots	P	4	I-L
Elegant sea snake	Most specimens trawled in depths more than 30m. Specialised diet (Stobutzki et al. 2000). Feeds on eels, and inhabits turbid deepwater areas between reefs (Heatwole 1999)	P	Unknown, probably large	A	Females mature at approx 24 months (Ward 2001).	A	K=0.25, M=0.219	P	Cumulative inshore pressures; capture in crab-pots	P	6	L
Small-headed sea snake	Specialised diet (Stobutzki et al. 2000). Turbid estuaries and inshore waters (Heatwole 1999)	P	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A	K=0.5, M=0.37	P	No known concerns in GBR	A	5	I-L
Ornate reef sea snake	One of few generalist feeders - diet includes squid, crustaceans and fish (Stobutzki et al. 2000, reviewed in Courtney et al. 2010). Coral reefs to turbid inshore waters and estuaries (Heatwole 1999)	A	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A	K=0.578, M=0.445	P	No known concerns in GBR	A	4	I-L
Large-headed sea snake	Unknown	P	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A	K=0.383, M=0.299	P	No known concerns in GBR	A	5	I-L

Appendix 12. Resilience of sea snakes

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P
Spine-bellied sea snake	*Lapemis curtus (Lapemis hardwickii)*	Ovoviviparous - < 10 live young	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread in northern Australia (SRRAT Database). Caught throughout GBR (Courtney et al. 2010). Modelled distribution (App. 5, T1) in GBR is 161,846ha (Pitcher et al. 2007, Courtney et al. 2010)	A
Turtle-headed sea snake	*Emydocephalus annulatus*	Ovoviviparous - < 10 live young	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Widespread	A
Yellow-bellied sea snake	*Pelamis platura*	Ovoviviparous - < 10 live young	PP	Live bearing, breed annually, with moderate ability to maintain or rebuild population	P	Not captured in trawl by catch study in the Great Barrier Reef (Courtney et al. 2010). Widespread, pelagic, oceanic.	A

Appendix 12. Resilience of sea snakes

Common Name	Habitat specificity or ecological niche	A or P	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Risk prone score	Resilience level
Spine-bellied sea snake	One of few generalist feeders - diet includes squid, crustaceans and fish (Stobutzki et al. 2000, reviewed in Courtney et al. 2010). Coral reefs to turbid estuaries (Heatwole 1999)	A	Unknown, probably large. Common	A	Females mature at 23 months and males at 20 months (Ward 2001).	A	K=0.423, M=0.374	P	Cumulative inshore pressures; capture in crab-pots	P	5	I-L
Turtle-headed sea snake	Strong reef association (V Luchosheck). Extremely low risk from trawling. Feeds on fish eggs, and inhabits shallow water on coral reefs (Heatwole 1999)	A	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A	M=0.434	P	No known concerns in GBR	A	4	I-L
Yellow-bellied sea snake	Feeds on pelagic fish associated with flotsam and jetsam along convergence lines. Broad range of fish species identified from diet. Pg 194 The Biology of Sea Snakes.	A	Unknown, probably large	A	By 12 months most species of sea snakes are close to adult size.	A		P	No known concerns in GBR	A	4	I-L

Appendix 13. Fishery impact profile of sea snakes

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Horned sea snake	*Acalyptophis peronii*	Proportion of the population caught estimated to be 23% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 10.6% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010).	P	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	2	I-L	INT-LOW
Dubois' sea snake	*Aipysurus duboisii*	Proportion of the population caught estimated to be 0% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 3.0% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010)	A	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	1	L	INT-LOW
Spine-tailed sea snake	*Aipysurus eydouxii*	Proportion of the population caught estimated to be 18% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 4.7% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010)	A	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	1	L	INT-LOW
Olive sea snake	*Aipysurus laevis*	Proportion of the population caught estimated to be 20% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 5.9% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010)	A	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	1	L	INT-LOW

Appendix 13. Fishery impact profile of sea snakes

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Stokes' sea snake	*Astrotia stokesii*	Proportion of the population caught estimated to be 12% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 10.5% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010).	P	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	2	I-L	INT-LOW
Spectacled sea snake	*Hydrophis/ Disteira kingii*	Proportion of the population caught estimated to be 26% (excluding BRD effect) (Courtney et al. 2010).	P	QLD has 17.5% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010) Northern Prawn Fishery, has lower in-trawl survival rate than most other species (50% even with best practice BRDs (Brewer et al. 2009).	P	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	3	I	INT
Olive-headed sea snake	*Hydrophis/ Disteira major*	Proportion of the population caught estimated to be 7% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 14.9% within-trawl mortality (Table 6.4.9 in Courtney et al. 2010)	P	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	2	I-L	INT-LOW

Appendix 13. Fishery impact profile of sea snakes

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Beaked sea snake	*Enhydrina schistosa*	Proportion of the population caught estimated to be 17% (excluding BRD effect) (Courtney et al. 2010).	A	In QLD has 1.2% within-trawl mortality (p. 28 in Courtney et al. 2010). All 80 individuals survived capture in the shallow water beam trawl and black tiger prawn broodstock collection fisheries, where trawl durations are typically very short, whereas an individual caught in the red spot king prawn sector died. (Courtney et al 20010, p46)	A	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	1	L	INT-LOW
Elegant sea snake	*Hydrophis elegans*	Proportion of the population caught estimated to be 35% (excluding BRD effect) (Courtney et al. 2010).	P	QLD has 11.4% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010). Larger ones low survival, hence double prone.	PP	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	4	H-I	HIGH

Appendix 13. Fishery impact profile of sea snakes

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Small-headed sea snake	*Hydrophis macdowelli*	Proportion of the population caught estimated to be 0% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 22.2% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010). Had highest within-trawl mortality rate (unadjusted) of 33.3%, and mainly caught in red-spot king prawn fishery (Courtney et al. 2010, p28, p45)	PP	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	3	I	INT
Ornate reef sea snake	*Hydrophis ornatus*	Proportion of the population caught estimated to be 38% (excluding BRD effect) (Courtney et al. 2010).	P	QLD has 19.1% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010) Northern Prawn Fishery, has low in-trawl survival rate (79% even with best practice BRDs (Brewer et al. 2009). Had second highest within-trawl mortality rate (unadjusted) of 27.2% (Courtney et al. 2010, p28)	PP	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	4	H-I	HIGH
Large-headed sea snake	*Hydrophis pacificus*	Proportion of the population caught unknown. Not captured in trawl by catch study, so assume relatively low interaction rate.	A	Northern Prawn Fishery, has lower in-trawl survival rate than most other species (66% even with best practice BRDs (Milton et al. 2009).	P	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	2	I-L	INT-LOW

Appendix 13. Fishery impact profile of sea snakes

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Spine-bellied sea snake	*Lapemis curtus (Lapemis hardwickii)*	Proportion of the population caught estimated to be 20% (excluding BRD effect) (Courtney et al. 2010).	A	QLD has 7.5% adjusted within-trawl mortality (Table 6.4.9 in Courtney et al. 2010).	A	It is rare to see juveniles of any sea snake species in the trawl fishery by catch, and research projects have also seen few juveniles.	A	Current styles of BRDs being used by fishermen in the trawl fishery are highly variable for excluding sea snakes. Research has shown that when effective BRDs are used and installed in appropriate distances from the drawstring they are highly effective at excluding sea snakes.	P	1	L	INT-LOW
Turtle-headed sea snake	*Emydocephalus annulatus*	Not caught in research trawl work done by Courtney et al. 2010. Species is strongly reef associated, so not surprising it is not sampled.	A	N/A	A	Limited or none	A	Not applicable as interaction rate negligible	A	0	L	INT-LOW
Yellow-bellied sea snake	*Pelamis platura*	Proportion of the population caught unknown. Not captured in trawl by catch study, so assume relatively low interaction rate.	A	N/A	A	Limited or none	A	Not applicable as interaction rate negligible	A	0	L	INT-LOW

Appendix 14. Resilience of seahorses and pipefish

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Seahorses									
Queensland seahorse	*Hippocampus queenslandicus*	Seahorses of the size of *H. queenslandicus* (height to 13 cm) have broods that are normally in the range of 100-300 young. Males of all seahorses studied go through more than one pregnancy in a breeding season.	P	Seahorse males brood young in pouches on the underside of their tail. Young are born live after a gestation of 20-28 days (for similar species). Pair bonding may not apply to all syngnathid species. Faithful pair bonding means that breeding of widowed individual may be disrupted.	P	Certainty in distribution is between Southport, Qld to Papua New Guinea.	A	Patchy distribution within range. Syngnathids are strictly benthic animals. Found mostly within 3 dimensional sessile benthic biota. Seahorses also require holdfasts in their habitats and prefer areas with currents. Known from trawls near reefs to 63 m but rarely seen in waters less than 20 m depth. This species is also found in estuaries (P. Groves pers. Obs)	A
Highcrown seahorse	*Hippocampus proceros*	Based on *H. queenslandicus*	P	Based on *H. queenslandicus*	P	Coastal Queensland - Moreton bay to the Gulf (Kuiter, 2009)	A	Occurs on mixed algae reef to depths of about 20m (Kuiter 2001)	A
Pipefish									
Bentstick pipefish	*Trachyrhamphus bicoarctatus*	Very little is known of the biology of pipefish. Biological consideration can be given on membership to the Syngnathids family. Using sea dragons as an example, these larger pipefish produce approx 100 - 200 young that hatch from the eggs over a week or so (to aid with dispersal), and have 2-4 clutches per year (P. Groves, pers. comm.).	P	Pipefish males carry their young on brood patches (or sometimes brood pouches) on the underside of their tail. Young are unlikely to have a planktonic phase and will remain near the benthos.	P	Possibly widespread Indo-West Pacific distribution. Taxonomic uncertainty - all populations need further investigation. 3 specimens recorded during DPI survey work in the QECTF scallop sector (Dunning et al. 2001) .	A	Deep water species mainly known from deep trawls over muddy substrates.	P
Straightstick pipefish	*Trachyrhamphus longirostris*	Very little is known of the biology of pipefish. Biological consideration can be given on membership to the Syngnathids family.	P	As above	P	Reported from thought the tropical Indo-West Pacific but various populations may represent additional species.	A	Inshore species. Often in shallow depths along the edges of seagrass beds to at least 30 m depth. May have relatively high habitat specificity	P

Appendix 14. Resilience of seahorses and pipefish

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Seahorses											
Queensland seahorse	Studies indicate that population densities of Syngnathids are commonly low, though knowledge gap exists (Connolly et al. 2001, Lourie et al. 2004). Low adult mobility and small home ranges in many species may restrict the decolonisation of depleted areas. Juveniles may be the primary dispersers though are susceptible to predation. As the young are well developed, dispersal is generally limited to a small area.	P	Medium-sized seahorses, for which data is available, show these species maturing during the first reproductive season after birth, thus at age 6 to 12 months.	A	Medium sized seahorses live for around 4 -5 years. Lourie et. al. 2004 state that natural mortality of adult Hippocampus appears to be low (minimal predation on adults, neonates most vulnerable), highlighting that unnatural forms of mortality presents real pressure.	P	May exist. Syngnathids thought to be affected by flood/storm events. Poor swimming ability means they often wash onto beaches after storms. Connolly et al. 2001 cites a pers. comm. of reports of greater numbers of pipehorses being caught following storms or unusual tidal patterns as a result of pipehorses being forced off reefs and onto adjacent sand areas.	P		5	I-L
Highcrown seahorse	Unknown. Syngnathids are generally sparsely distributed and not highly abundant.	P	As above. Height to more than 110mm.	A	As above	P	As above	P		5	I-L
Pipefish											
Bentstick pipefish	Unknown. Syngnathids are generally sparsely distributed and not highly abundant.	P	Growth rate likely to be similar to other Syngnathids of similar size.	A	Similar to other Syngnathids. May be similar to seahorses, where there is thought to be low adult mortality. (refer *H. queenslandicus* above)	P	Unknown	A		5	I-L
Straightstick pipefish	Unknown. Syngnathids are generally sparsely distributed and not highly abundant. Thought to be less common than *T. bicoarctatus* .	P	Growth rate likely to be similar to other Syngnathids of similar size.	A	Similar to other Syngnathids. May be similar to seahorses, where there is thought to be low adult mortality. (refer *H. queenslandicus* above)	P	Likely to be prone to threats from coastal zone process and increased human population and development which increased with climate change pressures.	P		6	L

Appendix 14. Resilience of seahorses and pipefish

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Tiger pipefish	*Filicampus tigris*	Very little is known of the biology of pipefish. Biological consideration can be given on membership to the Syngnathids family.	P	As above	P	Sub-tropical waters on the east and west coast of Australia. Population once in existence in Spencer Gulf, SA now thought to be extirpated. Three specimens recorded in tiger/endeavour prawn sector in Dunning et al. 2003. 1 specimen recorded in the scallop sector in DPI survey work (Dunning et al. 2001)	A	Inshore species. Often in shallow depths along the edges of seagrass beds to at least 30 m depth.	P
Pipehorse									
Pallid/Hardwick(e)'s pipehorse	*Solegnathus cf. hardwickii*	Brood sizes comparatively smaller than those for seahorses and pipefish. Peak breeding season July to September and lowest in June. 20-40% males have egg scars throughout remainder of year. Brood size 19-207 (mean 117). Year round breeding increases fecundity of this species	P	Young born live at about 34 mm length. Male bares young - removal during pregnancy reduces recruitment. Faithful pair bonding and sparse distribution which may mean consequent reduced production from widowed individual.	P	Form of same species distributed through China Sea to southern Japan. By catch records indicate the east Australian coast distribution to extend between Innisfail, Qld and Mooloolaba, Qld.	A	Syngnathids are strictly benthic animals. Shows preference for deeper water beyond 25 m. Lack of caudal fin indicates high site fidelity and small home range. Preference for structured habitat in high current regimes.	P

Appendix 14. Resilience of seahorses and pipefish

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	A or P	Comments	Risk prone score	Resilience level
Tiger pipefish	Unknown. Syngnathids are generally sparsely distributed and not highly abundant.	P	Growth rate likely to be similar to other Syngnathids of similar size.	A	Similar to other Syngnathids. May be similar to seahorses, where there is thought to be low adult mortality. (refer *H. queenslandicus* above)	P	Spencer Gulf, SA, population thought to be extirpated as a result of heavy industry pollution and loss of habitat. Likely to be prone to threats from coastal zone process and increased human population and development which increased with climate change pressures.	P		6	L
Pipehorse											
Pallid/Hardwick(e)'s pipehorse	Studies indicate that population densities of Syngnathids are commonly low, though knowledge gap exists (Connolly et al. 2001; Lourie et al. 2004). Low adult mobility and small home ranges in many species may restrict the recolonisation of depleted areas. Juveniles may be the primary dispersers though are susceptible to predation. Most common pipehorse in trawl catch.	A	1.2mm.d-1 hatchlings to juvenile. 0.3 mm.d-1 juv. to adult. In Connolly et al. 2001, it was stated that many pipehorses had most likely reproduced many times prior to capture.	A	*Solegnathus cf. hardwickii* lives for 3 - 5 years. M may be similar to seahorses, where there is thought to be low adult mortality. (refer *H. queenslandicus* above)	P	May exist. Syngnathids thought to be affected by flood/storm events. Connolly et al. 2001 cites a pers. comm. of reports of greater numbers of pipehorses being caught following storms or unusual tidal patterns as a result of pipehorses being forced off reefs and onto adjacent sand areas. Dried specimens are highly sought after in the traditional Chinese medicine trade.	P	Found in communities in 30 to 40m depth in the scallop fishery and outside the GBRMP (?) they occur in depths to 80m in east coast king prawn fishery	5	I-L

Appendix 15. Fishery impact profile of seahorses and pipefish

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Seahorses					
Queensland seahorse	*Hippocampus queenslandicus*	Known to interact with the northern tiger/endeavour and eastern king prawn sectors. No reports of interactions with Syngnathids in banana prawn sector (Stobutzki et al. 2000), and no mention of Syngnathids in other QECTF reports on by catch (Jones & Derbyshire 1998, Watson et al. 1990, Poiner et al. 1998). 17% effort exposed (Pitcher et al. 2007). Less than 1% of the biomass are captured; very low catchability and distributed outside the GBRMP (Pitcher et al 2007)	A	Studies of Syngnathids by catch shows that survival following interaction with trawl gear is almost nil (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	PP
Highcrown seahorse	*Hippocampus proceros*	Occurs on mixed algae reef to depths of about 20m (Kuiter 2001)	A	As above	PP
Pipefish					
Bentstick pipefish	*Trachyrhamphus bicoarctatus*	Habitat known to somewhat overlap with scallop sector. May interact with red spot and other shallow water tropical to sub-tropical sectors to 25 m. 3 specimens trawled in the scallop sector in by catch survey work. Commercial log book data does not describe to species level. Courtney did 368 trawls in by-catch study in the scallop sector and caught none, 204 trawls in the shallow water king prawn fishery and none caught, 418 trawls in the north QLD tiger/endeavour and none caught. 2007 FRDC report 2000/170.	A	Studies of Syngnathids by catch shows that survival following interaction with trawl gear is almost nil (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	PP
Straightstick pipefish	*Trachyrhamphus longirostris*	Habitat overlaps most QECTF sectors. Limited record in by catch studies. May indicate species' rarity or patchy distribution, or lack of species-specific information from logbooks. 1 specimen trawled in the scallop sector in by catch survey work. Commercial log book data does not describe to species level.	A	Studies of Syngnathids by catch shows that survival following interaction with trawl gear is almost nil (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	PP
Tiger pipefish	*Filicampus tigris*	Habitat known to somewhat overlap with tiger/endeavour prawn and scallop sectors. May also interact with red spot and other shallow water tropical to sub-tropical sectors to 30 m. 3 adult specimens trawled in the tiger/endeavour prawn sector and 1 specimen in the scallop sector in by catch survey work. Commercial log book data does not describe to species level.	A	Studies of Syngnathids by catch shows that survival following interaction with trawl gear is almost nil (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	PP

Appendix 15. Fishery impact profile of seahorses and pipefish

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level	RISK
Seahorses									
Queensland seahorse	Studies of some seahorses (and Syngnathids) show high site-fidelity and small home ranges (likely due to small caudal fin) and dispersal may only occur passively in juvenile stage. *H. queenslandicus* prone due to its preferred habitat overlapping with trawl grounds. Usually trawled in depths over 20m and as deep as 63m (Kuiter 2001).	A	By catch studies of BRD and TEDS indicate their ineffectiveness in reducing the accidental capture of Syngnathids (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	P	Syngnathids by catch rates greater in the EKP sector.		3	I	INT
Highcrown seahorse	Probably minimal due to habitat niche and level of interaction.	A	As above	P			3	I	INT
Pipefish									
Bentstick pipefish	Studies of Syngnathids show high site-fidelity and small home ranges (likely due to small caudal fin) and dispersal may only occur passively in juvenile stage. *T. bicoarctatus* may not be overly exposed to QECTF as thought to be mostly an inshore species.	A	By catch studies of BRD and TEDS indicate their ineffectiveness in reducing the accidental capture of Syngnathids (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	P		Recorded during DPI surveys during October 1999 and 2000. Dunning et al. 2001.	3	I	INT
Straightstick pipefish	Studies of Syngnathids show high site-fidelity and small home ranges (likely due to small caudal fin) and dispersal may only occur passively in juvenile stage. *T. longirostris* may have a greater capacity for accidental capture due to its high habitat specificity overlapping with sectors of QECTF .	A	By catch studies of BRD and TEDS indicate their ineffectiveness in reducing the accidental capture of Syngnathids (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	P			3	I	INT
Tiger pipefish	Studies of Syngnathids show high site-fidelity and small home ranges (likely due to small caudal fin) and dispersal may only occur passively in juvenile stage. *F. tigris* may not be overly exposed to QECTF as thought to be mostly an inshore species.	A	By catch studies of BRD and TEDS indicate their ineffectiveness in reducing the accidental capture of Syngnathids (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	P			3	I	INT

Appendix 15. Fishery impact profile of seahorses and pipefish

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Pipehorse					
Pallid/Hardwick(e)'s pipehorse	*Solegnathus cf. hardwickii*	**Permitted species in fishery with trip limit of 50 individual pipefish in total.** Pipefish are reported as number of individuals retained, and in 2009 5640 were reported in ECOTF catches for the East Coast (DEEDI 2010). Highest frequency of accidental capture of S. cf. hardwickii in the Eastern King Prawn sectors, mostly in the deepwater sector. Log book records of interaction from between Innisfail and Mooloolaba. No reports of interactions with Syngnathids in banana prawn sector (Stobutzki et al. 2000), and no mention of Syngnathids in other QECTF reports on by catch (Jones & Derbyshire 1998; Watson et al. 1990; Poiner et al. 1998) ; anecdotal information (from industry) suggests not captured north of Cairns.	A	Studies of Syngnathids by catch shows that survival following interaction with trawl gear is almost nil (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	PP

Appendix 15. Fishery impact profile of seahorses and pipefish

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Variance	Comments	Risk prone score	Fishery Impact Profile level	RISK
Pipehorse									
Pallid/Hardwick(e)'s pipehorse	Studies of Syngnathids show high site-fidelity and small home ranges (likely due to small caudal fin) and dispersal may only occur passively in juvenile stage. S. cf. hardwickii prone due to its preferred habitat overlapping with trawl grounds.	A	By catch studies of BRD and TEDS indicate their ineffectiveness in reducing the incidental capture of Syngnathids (Dunning et al. 2001; Dunning et al. 2003; Connolly et al. 2001).	P	More captures in the scallop and East coast king prawn fishery.	It is possible that switching to square-mesh cod-ends in the scallop fishery would reduce incidental capture of pipefishes.	3	I	INT

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Blind sharks (Family Brachaeluridae)									
Blue-grey carpet shark	*Brachaelurus colcloughi*	Viviparous. Litter size range 6-7 pups (Kyne et al. in press).	PP	Live bearing, low fecundity.	PP	IUCN - Vulnerable. Endemic to eastern Australia. Distributed between Hardline Reefs (20degS) and Julian Rocks NSW (Kyne et al. in press)	P	Moderate habitat specificity (and limited distribution). Mainly inshore in less than 4 m depth but one only below 100m (specimen from 217 m), NSW trawl 11 records 54-71 m, Courtney et al. down to ~90m (all but 1 specimen south of GBR) (total specs 48) uses cover (rocky reef, etc to rest in the day, moves over sand etc at night	A
Wobbegongs (Family Orectolobidae)									
Tasselled wobbegong	*Eucrossorhinus dasypogon*	Viviparous. Litter size low. Considered to have similar biology to Orectolobus maculatus with litter size of 21 (up to 37) pups.	P	Live bearing, low fecundity. Considered to have similar biology to *O. maculatus* with a 10 - 11 month gestation period, breeding periodicity every 2-3 years.	PP	Distributed through New Guinea and northern Australia from Ningaloo Reef, WA to Bundaberg, QLD.	A	Moderate habitat specificity and large area of available habitat within its distribution range. Inhabits shallow areas of the continental shelf and offshore reefs, to about 50 m depth. Coral reef specialist. (Last &Stevens 2009)	A
Spotted wobbegong	*Orectolobus maculatus*	Viviparous. Litter size of 21 (up to 37) pups.	P	Live bearing, low fecundity. 10 - 11 month gestation period, breeding periodicity less than annually.	PP	Distributed from north of the Swain Reefs, QLD south around to Fremantle, WA and possibly further north to North West Cape, WA.	A	Moderate habitat specificity and large area of available habitat within its distribution range. Most common inshore but has been trawled to 218 m. (Last &Stevens 2009)	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Blind sharks (									
Blue-grey carpet shark	Unknown.	P	Total length sizes: Size at birth 170-180 mm Size at maturity (females) 650 mm Maximum size 750 mm	P	Unknown - but comparing with other like sharks <20 y/o, and natural mortality <1. 'A' is a fairly reasonable estimate for this species.	A	NSW trawl, QLD inshore net. Habitat loss & alteration cause for concern (particularly in the southeast Moreton Bay). Climate change vulnerability is low (Chin et al. 2010)	8	L
Wobbegongs									
Tasselled wobbegong	Relatively common	A	Total length sizes: Size at birth 200 mm Size at maturity (both sexes) unknown Maximum size 1250 mm	P	Indicator species *O. hlorie* reaches sexual maturity at 16 yrs, suggests longevity of this species is > 20 (I. Jacobsen)	P	Low in climate change vulnerability assessment (Chin et al. 2010). Reef associated so no inshore net. Potentially marine aquarium collection - will be low numbers.	5	I-L
Spotted wobbegong	Relatively common in the south. No information for the GBR.	A	Total length sizes: Size at birth 200 - 250 mm Size at maturity (both sexes) ~ 1150-1200 mm Maximum size 1700 - 3200 mm	P	Indicator species *O. hlorie* reaches sexual maturity at 16 yrs, suggests longevity of this species is > 20 (I. Jacobsen)	P	Low in climate change vulnerability assessment (Chin et al. 2010). Caught in multi species fisheries - NSW line and trap, Vic and WA. No information about connectivity between different regions. Aware of fishing pressures - but not thought to be very significant within GBR area.	5	I-L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Longtailed carpetshark (Family Hemiscylliidae)									
Grey carpetshark	*Chiloscyllium punctatum*	Oviparous. In captivity in QLD, 2 females laid 115 eggs each over 2 seasons of which about 40 were viable. Eggs hatched in 153 days.	P	Egg laying. Moderate fecundity. Breeds once annually.	P	Wide Indo-West Pacific distribution from India to Japan and south to Australia where it occurs in tropical waters from Shark Bay, WA to Sandon River, NSW.	A	Low habitat specificity and large area of available habitat within its distribution range. Inshore shelf to at least 85m deep. (Last and Stevens 2009)	A
Catsharks (Family Scyliorhinidaeae)									
Eastern banded catshark	*Atelomycterus marnkalha (previously sp.A / grouped with fasciatus)*	Presumably' oviparous. Further reference Jacobsen & Bennett 2007	P	Egg-laying. Periodicity greater than annually.	P	Distributed through the northern and north eastern coast of Australia and across to New Guinea. Locally, between the Coburg Peninsula, NT and Gladstone, Qld. Associated with rubbly bottoms.	A	Moderate habitat specificity and large area of available habitat within its distribution range. Mainly inhabits inshore habitats between depths of 10 to 75 m.	A
Weasel shark (Family Hemigalidae)									
Australian weasel shark	*Hemigaleus australiensis*	Viviparous. Litter size range 1-19 pups. Birthing mainly in February and September after a gestation of about 6 months.	P	Live bearing, low fecundity. Breeds bi-annually.	PP	Endemic to northern Australia from Geraldton, WA to Brunswick Heads, NSW	A	Low habitat specificity and large area of available habitat within its distribution range. On or near bottom on continental and insular shelves to depths of 170m. (Last and Stevens 2009)	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Longtailed ca									
Grey carpetshark	Relatively common. Comprised 1.46% of chondrichthyan by catch in QECTF scallop sector and 37.5% / 15.79% in the tiger/endeavour sector sampling in Kyne 2008, Tables 3.10 and 3.12 / 3.14 respectively.	A	Total length sizes: Size at birth 130-180 mm Size at maturity (both sexes) ~ 700-870mm Maximum size 1180-1320mm. * L & S, 2009 - reaches sexual maturity in captivity at around 1 yr.	A	Unknown - but comparing with other like sharks <20 y/o, and natural mortality <1. 'A' is a fairly reasonable estimate for this species.	A	Other pressures that have little impact on the species. Still a common species.	2	H-I
Catsharks (Fa									
Eastern banded catshark	Not a common species.	P	Total length sizes: Size at birth unknown Size at maturity (both sexes) ~350 mm Maximum size 484 mm	P	Unknown.	P	Limited cumulative pressures.	5	I-L
Weasel shark									
Australian weasel shark	Relatively commonly found. Comprised 11.84% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling in Kyne 2008, Table 3.14.	A	Total length sizes: Size at birth 300mm Size at maturity (both sexes) ~ 600-700mm Max size 1100 mm Don't reach adulthood within 2 years?	P	Unknown.	P	Taken in low numbers in gill net and line fishing in GBR. Significant number taken in fish trawls in WA. Likely catch in GOC fisheries. However readily abundant still.	5	I-L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Whaler shark (Family Carcharhinidae)									
Sliteye shark	*Loxodon macrorhinus*	Viviparous. Litter sizes average 1-2	PP	Live bearing, low fecundity. Breeds annually from about 2 - 3 years.	PP	Wide Indo-West Pacific distribution from east Africa to Japan and south to Australia where it occurs in waters from Geraldton WA to Moreton Bay QLD	A	Low habitat specificity and large area of available habitat within its distribution range. Found in continental and insular shelves, near shore to at least 75 m depth. Last &Stevens 2009.	A
Milk shark	*Rhizoprionodon acutus*	Little published data in Australia. In northern Australia, mean little size was 3, with a range of 1-6 (Stevens and McLoughlin 1991).	PP	Live bearing, with small litters and sexual maturity (2-3 years) suggests low or moderate ability to maintain populations. Little information on periodicity of the reproductive cycle in Australia. R. acutus in south-western Indian ocean and eastern Atlantic has a seasonal reproductive cycle, mating occurs in summer with parturition occurring 12 months later (Stevens and McLoughlin 1991).	PP	Tropical east Atlantic and Indo-West Pacific. Throughout northern Australia from the Brisbane area to the North West shelf of Western Australia (Stevens and McGloughlin 1991).	A	One of the most common sharks caught by trawl in the GOC in Stevens and McCloughlin's study (1991). Common in Cleveland Bay, Hervey Bay and Moreton Bay. Probably no quantifiable data on habitat specificity.	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Whaler shark									
Sliteye shark	Unknown for GBR but relatively common in Hervey Bay (A. Gutteridge pers. com).	A	Age at maturity unknown but provisionally estimated to be between 2 and 3 years. Size at birth 400 -450 mm. Size at maturity ~600 mm , Max size 880 -990 mm Based on criteria assessed as P	P	Unknown but preliminary estimate is that it is less than 10 yrs (A. Gutteridge).	A	None known but may be impacted on by water quality. Off north-western Australia taken by trawl.	5	I-L
Milk shark	Abundant inshore species	A	Completes much of its growth in first year (Harry et al 2010) therefore risk averse. *Age at when 50% of females and males were mature reported at 1.8 and 1.1 years respectively indicating maturity likely to be reached at between 1 and 3 years of age (Last & Stevens, 2009; Harry et al., 2010; IUCN red list assessment, Simpfendorfer); *Born at 22 - 26 cm and attains 67 cm. Males mature at around 40 cm and females around 45cm. Although regional differences in maturation does exist in this species (Last & Stevens, 2009).	A	Age and growth estimates indicates this species grows to at least 8 years. No indication it lives in excess of 20 years (Harry et al., 2010).	A	Taken as by-product in the ECIFF and comprise about 8% by number of all sharks caught in the fishery, but only about 1% by weight of total shark harvest in ECIFF. Harry et al 2011 reported that by virtue of their small size relative to the net mesh size, milk sharks are almost exclusively susceptible to capture as adults in the ECIFF.	5	I-L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Spinner shark	*Carcharhinus brevipinna*	Viviparous. Litter sizes average 9 (range 3 to 15) pups.	P	Live bearing, low fecundity. 10 - 12 month gestation period, with a 2 year breeding periodicity.	PP	Distributed widely in warm temperate and tropical waters of Indo-West Pacific and Atlantic Ocean. Tropical throughout northern Australia and migrating south to Walpole, WA and Jervis Bay, NSW.	A	Low habitat specificity and large area of available habitat within its distribution range. Found in continental and insular shelves, near shore to at least 75 m depth. Last & Stevens 2009.	A
Whitecheek shark	*Carcharhinus coatesi*	Viviparous. Usual litter size 2 (range 1 - 4).	PP	Live bearing, low fecundity. Breeds annually without determinable seasonality.	PP	Widely distributed through the Indo-West Pacific from the Persian Gulf to Japan and south to Australia where it occurs in tropical waters from Dirk Hartog Island, WA to Fraser Island, QLD.	A	Low habitat specificity and large area of available habitat within its distribution range. Inhabits inshore areas of continental and insular shelves down to about 170 m depth, usually near the bottom. Last & Stevens 2009.	A
Sawfish (Family Pristidae)									
Narrow sawfish	*Anoxypristis cuspidata*	Litter size up to 15 pups (Last & Stevens, 2009)	P	Viviparous - born live; no parental care; K-selected life traits - poor ability to rebuild population	PP	Indo-Pacific from the Red Sea to Australia. Most common in the GOC but found from Broad Sound (QLD) to Pilbara coast (WA).	A	Found in inshore area to 40m; juveniles tend to occur in inshore depths of less than 10 m.	P
Green sawfish	*Pristis zijsron*	litter size - 12. (Last & Stevens 2009)	P	Viviparous - born live; no parental care; K-selected life traits - poor ability to rebuild population	PP	Contraction of Australian range by 30% from previously known. (Stevens et.al. 2005)	P	Specialist. Current extent of knowledge suggests it exists in northern part of its former range. (Peverell et.al. 2004; Stevens et.al. 2005; Last 7 Stevens 2009)	P

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Spinner shark	Relatively common.	A	Age at maturity 8 - 10 years Total length sizes: Size at birth 600 - 800 mm Size at maturity (both sexes) varies geographically 1500 - 2100 mm Maximum size 2780 - 3000 mm	P	Unknown.	P	Other fishing pressures within and beyond QLD and GBR, incl. rec catch. QSCP catch - QLD and NSW. Could be retained by illegal fishers in the GOC.	6	L
Whitecheek shark	Considered to be common in northern Australia but population size / trend unknown.	P	Total length sizes: Size at birth 350 - 400 mm Size at maturity (both sexes) ~ 700 mm Maximum size 900 mm	P	Unknown.	P	Other fishing pressures within and beyond QLD and GBR, incl. rec catch. Could be retained by illegal fishers in GOC.	8	L
Sawfish (Fam									
Narrow sawfish	Unknown, but more common than other sawfish species in the GBRMP	P	Age at maturity is 4 yrs for males and 5 years for females (in Last & Stevens, 2009. Peverell 2005, 2008 places Age at maturity at ~3 yrs. Must be a P based on criteria	P	Unknown.	P	Coastal development/habitat loss, ECIFF, climate change, catchment runoff. Peverell 2005; Stevens et.al. 2005; Chin et al. 2008. High cumulative risk from northern Australian fisheries (Salini et al 2007)	8	L
Green sawfish	Unknown, though various data suggest EC population is small and in decline. Qld shark control program data; (Thornburn et.al 2003; Peverell et.al. 2004; Last & Stevens; Stevens et.al. 2005; Peverell 2005; IUCN Red List)	PP	Age at maturity ~ 9 years. Last and Stevens.	P	Unknown. One example of maximum length reached at approximately 24 years. Stevens et.al. 2005.	P	Coastal development/habitat loss, East Coast Inshore Finfish Fishery, climate change, catchment runoff. Peverell 2005; Stevens et.al. 2005; Chin and Kyne 2008	10	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Wedgefishes (Family Rhynchobatidae)									
Whitespotted guitarfish (Eyebrow wedgefish)	*Rhynchobatus australiae / Rhynchobatus palpebratus* Species not separated in Kyne 2008.	Viviparous. Litter size low (15 laevis).	P	Live bearing, low fecundity. Thought to breed once annually.	PP	IUCN - Vulnerable. Patchy distribution in the Indo-West Pacific including northern Australia from the Gulf of Carpentaria to NSW.	A	Moderate habitat specificity but large area of available habitat within its distribution range. Mainly an inshore species probably to depth of 60 m or more. (Last & Stevens 2009)	A
Shovelnose rays (Family Rhinobatidae)									
Eastern shovelnose ray	*Aptychotrema rostrata*	Viviparous. Litter size range 9-20 pups, gestation 3-5 months giving birth mainly November - December. (Kyne 2008, p. 151)	P	K-selected life traits. Viviparous. Moderate ability to maintain / rebuild population. Breeds once annually.	P	Endemic to EC Australia between Halifax Bay to Merimbula, NSW. More abundant southern GBR and south (bulk south of 24° S in Courtney et al 2007)	A	Moderate habitat specificity but large area of available habitat within its distribution range.	A
Coffin rays (Family Hypnidae)									
Coffin ray	*Hypnos monopterygius*	Viviparous. Litter sizes 4 - 8.	PP	Live bearing, low fecundity.	PP	Endemic to Australia's west and west south coast between Broome, WA and St. Vincents Gulf, SA , and the east coast from Heron Island, Qld to Eden, NSW.	A	Moderate habitat specificity and large area of available habitat within its distribution range. Mainly inhabits inshore habitats to a depth of about 80 m, but has been collected to 220 m.	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Wedgefishes									
Whitespotted guitarfish (Eyebrow wedgefish)	Probably relatively common as a species group; (+JCU sampling)	A	Total length sizes: Size at birth 460-500 mm Size at maturity (females) 1550 mm Maximum size 2820 mm	P	Unknown.	P	Net fishery pressure, illegal fin market, low climate change vulnerability in Chin & Kyne 2008	6	L
Shovelnose r									
Eastern shovelnose ray	Unknown. Comprised 52.20% (107 animals) of chondrichthyan by catch in QECTF scallop sector sampling in Kyne 2008, Table 3.10. Kyne 2008 brings into question abundance of the species in the northern part of its range. p. 287. Ninety-one percent of samples caught in southern extremity of the GBRMP between 24° 06' and 24° 55' S for similar effort and depths as for the other 9% caught north of that region.	A	Total length sizes: Size at birth ~ 170mm Size at maturity (female) 640mm Maximum size 1200mm	P	Unknown.	P	East Coast Inshore Finfish Fishery: net fishery, tunnel nets, recreational fishing. Retained in trawl fishery in NSW; and water quality issues	5	I-L
Coffin rays (F									
Coffin ray	Unknown	P	Total length sizes: Size at birth 80 - 110 mm Size at maturity (both sexes) 395 - 480mm Maximum size 625 - 630 mm	P	Unknown.	P	Taken as by catch species in NSW trawl fisheries.	7	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Stingrays (Family Dasyatidae)									
Estuary stingray	*Dasyatis fluviorum*	Viviparous. Litter size unknown but estimated to be less than <5 (Ian Jacobsen pers. comm. 2010).	PP	Live bearing, low fecundity, reproductive cycle probably annual.	PP	Geographical range extends along the eastern coast of Australia	A	Prefers estuarine and inshore coastal environments particularly over mangrove-fringed sand / mud intertidal depths down to ~35 m depth	P
Blackspotted whipray	*Himantura astra*	Viviparous. Litter size range 1-3 pups.	PP	Live bearing, low fecundity, annual.	PP	Endemic to southern West Papua and northern Australia from Shark Bay, WA to Moreton Bay, Qld	A	Moderate habitat specificity but large area of available habitat within its distribution range. Mainly inshore, but also in depths to 140m. (Last & Stevens 2009)	A
Pink whipray	*Himantura fai*	Viviparous. Litter size unknown. Biological characteristics likely to be within the same vicinity as H. astra.	PP	Live bearing, with low fecundity. Reproductive cycle remains unknown.	PP	Has a wide, but poorly defined distribution that extends throughout northern Australia and the Indo-Pacific.	A	Found over soft substrates on the inner continental shelf, from the intertidal to at least 200 m depth (Manjaji et al., 2004; IUCN red list assessment).	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Stingrays (Fa									
Estuary stingray	Pierce and Bennett (2010) indicate D. fluviorum life history traits place it at high to very high risk of population decline. Anecdotal evidence also suggest population has retracted over time.	P	Size: males to at least 651 mm disc width, females 762 mm disc width. Age at maturity reported at 13.4 yrs for females and 7.0 years for males. Reaches sexual maturity at 630 mm disc width (females) and 412 mm disc width (males) (Pierce and Bennett, 2010)	P	Pierce and Bennett (2010) record maximum age estimates of 21 years for females and 16 years for males	P	Habitat reduction through urban development, by catch may not be as prominent (commercial trawl and recreation) (Kyne et al. 2003, IUCN assessment). More than likely effected more in the beam trawl sector.	9	L
Blackspotted whipray	Unknown. Comprised 12.50% / 26.32% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling in Kyne 2008, Tables 3.12 / 3.14. Not small pop or declining	A	*Males to at least 660 mm and females 770 mm (max disc width likely to be <1m) *Size at birth 170 - 190 mm *Age at 50% sexual maturity: 7.32 (males and 8.67 (females) (Jacobsen & Bennett, 2011).	P	Females grow to at least 29 years of age and males at least 18 years of age (Jacobsen & Bennett, 2011).	P	Net fisheries as well as other prawn trawl fisheries (previously misidentified as *H. toshi* which has now been confirmed as H. sp A). Not regularly taken for commercial sale though.	6	L
Pink whipray	Population trends unknown but considered to be common but not abundant	A	Disc Width (Max) - to at least 184 cm. Estimated size at birth - 30 - 55 cm Size at maturity - males 108 - 115 cm. (White et al. 2006; Manjaji 2004) No age and growth data available.	P	Unknown	P	Caught as by catch in ancillary prawn trawl fisheries including the Northern Prawn Fishery in the Gulf of Carpentaria (Stobutzki et al., 2002; Zouh & Griffiths, 2008)	6	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Reticulate whipray	*Himantura uarnak*	Viviparous. Litter size ~4 (Last & Stevens, 2009).	PP	Live bearing, with low fecundity. Reproductive cycle remains unknown.	PP	Widespread in Indo-West Pacific region including entire GBR and northern Australia (White et al., 2006).	A	Demersal on soft substrates, commonly in intertidal regions, but also to depths of at least 50 m (White et al., 2006).	A
Bleeker's variegated whipray	*Himantura undulata*	Viviparous. Litter size unknown. Likely to be similar to *H. uarnak.*	PP	Live bearing, with low fecundity. Reproductive cycle remains unknown.	PP	Eastern Indian and western Pacific Oceans: widespread from India to southern Japan and south to northern Australia (White et al. 2006). Two reports of H. undulata inhabiting waters of the GBR still to be verified (Ian Jacobsen, pers. comm.).	A	Demersal on soft substrates (White et al., 2006).	A
Leopard whipray	*Himantura leoparda*	Unknown. Expert opinion suggests biological data can be based on species with similar life history traits (congeners). Oviparous, small litter size. (Kyne 2008, p. 256,257).	PP	Live bearing, low fecundity. Of all species assessed by Kyne 2008, *H. leoparda* is ranked 2nd lowest in its ability to recovery from interaction with the QECTF (although ranked low in its susceptibility to the fishery).	PP	Widely distributed through the Indo-West Pacific including Australia where it occurs from Ningaloo Reef to about Yeppoon, Qld.(only 2 records south of Cape York) Kyne 2008 study first to extend distribution down the east coast of Qld.	A	Moderate habitat specificity and large area of available habitat within its distribution range. Found on the inner continental shelf to about 70 m depth. (Last & Stevens 2009)	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Reticulate whipray	IUCN red list (Manjaji & White, 2004) indicates broader population trends for the species is decreasing. This however does not necessarily represent the situation in Australia.	A	Disc Width (Max) - to at least 160 cm. Estimated size at birth - 21-28 cm Size at maturity - males 82 - 84 cm. No age and growth data available. (Last & Stevcns, 2009)	P	Unknown	P	Caught as by catch in ancillary prawn trawl fisheries including the Northern Prawn Fishery in the Gulf of Carpentaria (Stobutzki et al., 2002; Zouh & Griffiths, 2008)	6	L
Bleeker's variegated whipray	IUCN red list (Manjaji & White, 2004) indicates broader population trends for the species is decreasing; principally relates to Indonesia.	A	Disc Width (Max) - to at least 140 cm. Estimated size at birth ~ 20 cm (White et al., 2006). Size at maturity - males ~85 - 90 cm. No age and growth data available. (Last & Stevcns, 2009)	P	Unknown	P	Caught as by catch in ancillary prawn trawl fisheries including the Northern Prawn Fishery in the Gulf of Carpentaria (Stobutzki et al., 2002; Zouh & Griffiths, 2008)	6	L
Leopard whipray	Unknown. Caught 1 in QECTF by catch samples. Population likely to be small.	P	Disc width sizes: Size at birth 200 mm Size at maturity (female) 890 mm Maximum size 1400 mm	P	Unknown.	P	Probably caught where *H. astra* is caught, but in low numbers. Moderate climate change assessment ranking (Chin & Kyne 2008). Net fishery	7	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Brown whipray	*Himantura toshi* (=sp A of Last & Stevens 1994, Stobutzki et al 1999)	Viviparous. Litter size <=3 (Jacobsen, pers. comm. 2010)	PP	Live bearing, low fecundity. Of all species assessed by Kyne 2008, *H. toshi* ranked 3rd lowest in its ability to recover from interaction with the QECTF (ranked moderately in its susceptibility to the fishery).	PP	Endemic to northern Australia from Darwin, NT to the Clarence River, NSW. Possibly extends to north western coast, WA.	A	Last & Stevens (2009) indicates species is common near the coast over muddy bottoms and on mangrove flats. Preference is for shallow, inshore environments but has a large area of available habitat within its distribution range. In Kyne 2008, deepest collection was 41 m but likely to extend further. Recorded by Courtney et al. 2007 in the scallop fishery by catch (Yeppoon - Hervey Bay).	A
Mangrove whipray	*Himantura granulata*	Viviparous. Litter size unknown. Likely to be similar to *H.uarnak.*	PP	Live bearing, with low fecundity. Reproductive cycle remains unknown.	PP	Western Central Pacific: throughout Indonesia (except southern Sumatra), Malaysia (Borneo and Sabah), Papua New Guinea, Vanikoro, Pohnpei, Melanesia, and the Philippines. The range also extends through some Pacific Islands, including Guam and Fiji and alon	A	Demersal in shallow waters, including mangroves and estuaries	P

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Brown whipray	Unknown. Not rare but not as abundant as *H. astra* , common in Moreton Bay shallows	A	*To at least 74 cm disc width. Expected to have similar growth rates to H. astra. Size at birth 200 mm . Size at maturity (female) 660 mm and greater >2yrs	P	Unknown, but *H. astra* appears to be a reasonable indicator species.	P	Net fisheries as well as other prawn trawl fisheries. Possible water quality impacts, moderate climate change assessment ranking (Chin & Kyne 2008)	6	L
Mangrove whipray	Unknown	P	Disc Width (Max) - to at least 141 cm.	P	Unknown	P	None known but may be impacted on by urban development and water quality issues	8	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Bluespotted maskray	*Neotrygon kuhlii*	Viviparous. Litter size range 1-3 pups, birthing Feb/March after 4-6 month gestation.	PP	Live bearing, low fecundity. Breeds once annually.	PP	Considered to be common and widely distributed across Indian and Western Pacific Oceans, including Melanesia and Micronesia. In Aust. from Shark Bay, WA to Port Stephens, NSW	A	Broad shelf intereefal (lagoonal) distribution in GBR to depths of 90m. Last and Stevens 2009.	A
Speckled maskray	*Neotrygon picta*	Viviparous. Litter size range 1-3 pups.	PP	Live bearing, low fecundity. Breeds once annually.	PP	Endemic to north-eastern Australia (possibly including southern New Guinea) from the Wessel Islands, NT, to Hervey Bay, Qld but patchy distribution	A	large area of available habitat within its distribution range. Shallow to inshore waters in depths > 5m to 100m. Last and Stevens 2009.	A
Cowtail Stingray	*Pastinachus astrus*	Viviparous. Litter size 2.	PP	Live bearing, low fecundity. Kyne 2008 ranked *P. astrus* 5th lowest in ability to recover from interaction with the QECTF.	PP	Wide Indo-West Pacific distribution from southern Africa east to China and Micronesia, and south to Australia where it occurs in tropical waters from Shark Bay, WA to Clarence River, NSW.	A	Moderate habitat specificity but large area of available habitat within its distribution range. Inhabits inshore continental shelf habitats to 60 m depth.	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Bluespotted maskray	Unknown. But considered to be relatively common with no indication population trends in decline. Comprised 12.50% / 6.58% of chondrichthyan by catch in QECTF tiger/endeavour sector and 23.41% in the scallop sector sampling in Kyne 2008, Tables 3.12 / 3.14 and 3.10 respectively.	A	Disc width sizes: Size at birth 120-170mm Size at maturity (female) ~ 249mm-300mm 5-7 yrs Maximum size 400-470mm	P	Reaches at least 15 years of age, other Neotrygon species attain 18 years. Species may very well reach 20 years but has yet to be shown. No indications of natural mortality	A	? Aquarium collection, net fishery, some in other northern Australian trawl fisheries (not as abundant in catches as GBR), low climate change vulnerability	5	I-L
Speckled maskray	Relatively common Comprised 12.50% / 6.58% of chondrichthyan by catch in QECTF tiger/endeavour sector and 15.61% in the scallop sector sampling in Kyne 2008, Tables 3.12 / 3.14 and 3.10 respectively.	A	Disc width sizes: Size at birth 100mm Size at maturity (females and males) 160-190mm (2)-3 yrs Maximum size 280-322mm males 11 yrs, fem. 15yrs	P	Disc width sizes: Size at birth 100mm Size at maturity (females and males) 160-190mm (2)-3 yrs Maximum size 280-322mm males 11 yrs, fem. 18yrs	A	? Aquarium collection, net fishery, some in other northern Australian trawl fisheries, low climate change vulnerability	5	I-L
Cowtail Stingray	Unknown but species generally considered to be moderately prominent.	A	Disc width sizes: Size at birth 180 mm, Size at maturity (female) unknown maximum size 1800 mm. Age at maturity unknown.	P	Unknown.	P	Not expected to be significant. Likely to be affected by water quality issues, may interact with inshore / shallow water net fisheries.	6	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Stingarees (Urolophidae									
Common stingaree	*Trygonoptera testacea*	Viviparous. Likely to be similar to the Western Australian species *T. personata* and *T mucosa* (White et al., 2002) which averaged <3 pups.	PP	Live bearing, low fecundity, reproductive cycle probably annual.	PP	Temperate eastern Australia from Caloundra (Qld) to Cape Howe (NSW)	A	Habitat specify considered to be reasonably low (I. Jacobsen). Inhabits estuaries and shallow coastal waters to 60 m depth. Recorded by Courtney et al. (2007) in the shallow water (<91 m) EKP fishery by catch (Mooloolaba to Southport) & deepwater (>91 m) EKP fishery by catch (Noosa to Jumpinpin) . .	A
Patchwork stingaree	*Urolophus flavomosaicus*	Viviparous. Fecundity levels unknown but expected to be less than 10 (I. Jacobsen).	PP	Viviparous species with low fecundity. Reproductive cycle likely to be at most annual.	PP	On the east coast from Caloundra to Townsville and from Abrolhos Islands to Cape Leveque in WA. Based on known geographical distribution and criteria, requires a conservative estimate.	A	Found in waters of depths between 60 - 320 m. Habitat specificity considered to be comparatively low (I. Jacobsen).	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Stingarees (U									
Common stingaree	Unknown	P	SIZE: Attains at least 52 cm and possibly up to 61 cm. Males mature at about 35 cm and females at 40cm. Born at 12cm(Last & Stevens, 2009). *Age and growth analysis has not been undertaken for this species. Growth rates for other Urolophid species tends to be low. Ages at maturity for west Australian Urolophidae 2 - 3 yrs (White et al. 2002. Considered to be a reasonable estimate.	P	Unknown, but best available data indicates Urolophidae species can grow to 17 and 18 years respectively (White et al, 2001, 2002).	A	None known	6	L
Patchwork stingaree	Unknown	P	*Reaches at least 59 cm with smallest mature male reported at 38cm. Unknown size of birth. *Age and growth analysis has not been undertaken for this species. Growth rates for other Urolophid species tends to be low. Ages at maturity for west Australian Urolophidae 2 - 3 yrs (White et al. 2002. Considered to be a reasonable estimate.	P	Unknown, but best available data indicates Urolophidae species can grow to 17 and 18 years respectively (White et al, 2001, 2002).	A	None known	6	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Skates (Rajidae)									
Pale tropical skate	*Dipturus apricus*	Unknown. Expert opinion suggests biological data can be based on species with similar life history traits (congeners). Oviparous. Kyne 2008, p. 256,257.	P	Unknown. Expert opinion suggests biological data can be based on species with similar life history traits. Oviparous, k-selected life traits, moderate ability to maintain population	P	Occurs in Swains, Saumarez Plateau and to the north. Possible endemic.	A	Upper slope, with moderate area of available habitat.	A
Argus skate	*Dipturus polyommata*	Fecundity higher than *D. endeavouri*	P	Moderate ability to maintain population, reproduce annually	P	Endemic to the East Coast of Australia between Cairns and Byron Bay (although northern range extension needs to be established). May have refugia from the EC trawl fishery in continental slope habitat. Known from depths of 153 - 500 m.	A	Moderate habitat specificity but large area of available habitat within its distribution range. Outer continental shelf and shelf slope between 140-310 metres.	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Skates (Rajid									
Pale tropical skate	Unknown	P	Reaches about 80cm. Probably reaches adult size in a few years. Age at maturity unknown but indicator species suggest skates reach sexual maturity >2 year with some species living in excess of 20 years. 'P' a reasonable estimate i.e. MacFarlane and King (2006) Raja spp.	P	Unknown. MacFarlane and King (2006) demonstrated some Raja spp. Can live to 25 yrs.	P	None known	5	I-L
Argus skate	Unknown. Comprised 35.38% (23 animals) of chondrichthyan by catch in QECTF eastern king prawn deepwater sampling in Kyne 2008, Table 3.6.	P	Total length sizes: Size at birth 110mm Size at maturity (female) 321mm Age at maturity unknown but indicator species suggest skates reach sexual maturity >2 year with some species living in excess of 20 years. 'P' a reasonable estimate i.e. MacFarlane and King (2006) Raja spp.	P	Unknown. MacFarlane and King (2006) demonstrated some Raja spp. Can live to 25 yrs.	P	None known	5	I-L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Endeavour skate	*Dipturus endeavouri*	Oviparous. Kyne 2008b, 2 eggs found in females in winter samples	P	Size at birth, 100-110mm, maturity 321 mm females, 2 egg cases, feed on crustaceans and teleosts	P	Endemic to the east coast of Australia south of ~ 25degS to about Newcastle, NSW. May have refugia from the EC trawl fishery in continental slope habitat. Known from depths of 153 - 500 m.	A	Moderate habitat specificity but large area of available habitat within its distribution range. Outer continental shelf and shelf slope.	A
Butterfly rays (Family Gynmuridae)									
Australian butterfly ray	*Gymnura australis*	Viviparous. Litter size range 1-6 pups. (Typically 3 -4 pups)	PP	Live bearing, low fecundity. Breeds once annually.	PP	Endemic to southern New Guinea and northern Australia from Shark Bay, WA to Broken Bay, NSW.	A	Moderate habitat specificity but large area of available habitat within its distribution range. Mainly inshore, but known in depths to 250m. Last and Stevens 2009. Sampled 9 to 54m Courtney et al 2007.	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Endeavour skate	Unknown. Comprised 35.38% (23 animals) of chondrichthyan by catch in QECTF eastern king prawn deepwater sampling in Kyne 2008, Table 3.6.(incorrectly assigned to *D. polyommata*)	P	Total length sizes: Size at birth 110mm Size at maturity (female) 321mm Maximum size 360-380mm Males mature between 240 - 315 mm TL. Age at maturity unknown but indicator species suggest skates reach sexual maturity >2 year with some species living in excess of 20 years. 'P' a reasonable estimate i.e. MacFarlane and King (2006) Raja spp.	P	Unknown. MacFarlane and King (2006) demonstrated some Raja spp. Can live to 25 yrs.	P	None known	5	I-L
Butterfly rays									
Australian butterfly ray	Unknown. Comprised 13.16% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling in Kyne 2008, Table 3.14. Range used to extend to Sydney, may have contracted historically in NSW.	A	Disc width sizes: Size at birth 220-250mm Size at maturity (both sexes) ~ 450mm Maximum size 940mm	P	Unknown.	P	Net fishery; Northern Prawn Fishery fisheries. Moderate climate change vulnerability (Chin & Kyne 2008)	6	L

Appendix 16. Resilience of sharks and rays

Common Name	Species Name	Fecundity	A or P or PP	Life history strategy	A or P or PP	Geographic distribution	A or P	Habitat specificity or ecological niche	A or P
Eagle rays (Family Myliobatidae)									
Banded eagle ray	*Aetomylaeus nichofii*	Viviparous. Litter size range 1-4 pups.	PP	Live bearing, low fecundity.	PP	Widely distributed though listed by IUCN as vulnerable. An Indo-West Pacific distribution from India east to Japan and south to Australia in tropical waters between the Bonaparte archipelago, WA to Harvey Bay, Qld.	A	Narrow habitat requirements but large area of available habitat within its distribution range. In Australia, demersal on the tropical continental shelf to depths of at least 115 m. (Last & Stevens 2009)	A

Appendix 16. Resilience of sharks and rays

Common Name	Population size or trend	A or P or PP	Growth rate / Age at maturity	A or P	Longevity / Natural mortality	A or P	Cumulative pressures	Score	Resilience level
Eagle rays (Fa									
Banded eagle ray	Unknown population size, but relatively rare species in Australian waters.	P	Disc width sizes: Size at birth 170 mm Size at maturity (female) ~ 390 mm Maximum size 640 - 720 mm	P	Unknown.	P	Moderate climate change vulnerability (Chin & Kyne 2008). Fishing pressure has reduced populations in SE Asia. Some non-trawl fishing impacts on species, but relatively low catchability in other gears too.	7	L

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Blind sharks (Family Brachaeluridae)					
Blue-grey carpet shark	*Brachaelurus colcloughi*	In Kyne 2008, 6 specimens caught in the eastern King Prawn (shallow and deepwater) sectors.	P	Kyne 2008 used information inferred from similar species to determine the post-capture mortality rank in order to calculate the susceptibility rank for *H. colcloughi* . Not thought to be prone to high mortality risk from trawl interaction. Considered a hardy species.	A
Wobbegongs (Family Orectolobidae)					
Tasselled wobbegong	*Eucrossorhinus dasypogon*	In Kyne 2008, 1 specimen caught in the northern tiger/endeavour sector.	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available. Not thought to be prone to high mortality risk from trawl interaction.	A
Spotted wobbegong	*Orectolobus maculatus*	In Kyne 2008, 4 specimens caught in the King Prawn (shallow water) sector south of GBR.	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available. Not thought to be prone to high mortality risk from trawl interaction.	A
Longtailed carpetshark (Family Hemiscylliidae)					
Grey carpetshark	*Chiloscyllium punctatum*	Comprised 1.46% of chondrichthyan by catch in QECTF scallop sector and 37.5% / 15.79% in the tiger/endeavour sector sampling in Kyne 2008, Tables 3.10 and 3.12 / 3.14 respectively.	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available.	A

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Blind sharks (Fan							
Blue-grey carpet shark	Most life stages found to interact with the fishery. Kyne 2008 sampled juveniles through to mature females and juvenile males in the EKP (shallow and deepwater) sectors.	P	No significant differences in probability of capture between different gear types, though lowest probability was found with a radial escape section BRD with TED fitted. Juveniles get through easily, maybe some benefit for larger animals, but some do still get caught.	P	3	I	INT
Wobbegongs (Fa							
Tasselled wobbegong	Unsure. In Kyne 2008 1 specimen captured. 1 immature male.	P	For sharks in tiger/endeavour prawn sector, no sig. diff. of capture existed between codend types. Lowest probability of capture was for a codend fitted with a fisheye BRD. Juveniles get through easily, maybe some benefit for larger animals, but some do still get caught.	P	2	I-L	HIGH
Spotted wobbegong	Most life stages likely to interact with the fishery In Kyne 2008 4 specimens captured in EKP (shallow water) sector south of the GBR. 1 mature female and 3 young juveniles (male and female).	P	No significant differences in probability of capture between different gear types, though lowest probability was found with a radial escape section BRD with TED fitted.	P	2	I-L	HIGH
Longtailed carpet							
Grey carpetshark	All life stages found to interact with the fishery. Kyne 2008 sampled young juv. through to mature males and females.	P	The sea snake study (Kyne 2008 thesis) found that for elasmobranchs combined, nets fitted with a fisheye BRD showed a statistically significant difference of capture (lower) than nets fitted with a standard codend only.	P	2	I-L	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Catsharks (Family Scyliorhinidaeae)					
Eastern banded catshark	*Atelomycterus marnkalha (previously sp.A / grouped with fasciatus)*	In Kyne 2008, 3 specimens caught in the scallop sector. In Kyne 2008, susceptibility ranking of 2.73 - high. 2nd highest ranking for chondrichthyans in Kyne 2008. Low, infrequent.	A	Catsharks on deck mortality - moderately robust. Kyne 2008	P
Weasel shark (Family Hemigalidae)					
Australian weasel shark	*Hemigaleus australiensis*	Comprised 11.84% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling in Kyne 2008, Table 3.14. Juveniles likely to be retained in cod end (plus some adults up to 90cm). Some may still escape through fish eye. Probably strong swimmers.	A	50% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available.	P
Whaler shark (Family Carcharhinidae)					
Sliteye shark	*Loxodon macrorhinus*	In Kyne 2008, 1 specimen caught in the scallop sector and had a susceptibility rating of medium to high. Interactions expected to be low.	A	Individual caught by Kyne (2008) was dead, but probably not indicative - 'P' would be appropriately conservative	P
Milk shark	*Rhizoprionodon acutus*	Interaction with the ECTF likely to be relatively low but common. Expected to be one of the more common whaler species to be caught with respect to elasmobranch by catch.	A	Kyne (2008) reported 3 specimens, all of which were returned alive. Survival rates for this species with respect to trawl fisheries is expected to be moderate to good.	A
Spinner shark	*Carcharhinus brevipinna*	In Kyne 2008, 1 specimen caught in the northern tiger/endeavour sector. In Kyne 2008, susceptibility ranking of 1.45 - low. Fast swimming, rarely caught - can escape through TEDs.	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available. Not thought to be prone to high mortality risk from trawl interaction.	A

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Catsharks (Family							
Eastern banded catshark	Some life stages found to interact with the fishery. With limited data (n=3), 1 mature female and 2 immature males were recorded in the scallop sector in Kyne 2008.	P	For sharks in the scallop sector there was significant statistical difference of capture between codends fitted with TED/BRD combinations and every other codend configuration without a TED. Also a sig. difference between TED only and BRD only. Therefore showed good TED/BRD effectiveness	P	3	I	INT
Weasel shark (Fa							
Australian weasel shark	All life stages interact with the fishery. Kyne 2008 sampled individuals neonatal through to adults.	P	Nets fitted with a fisheye BRD showed a statistically significant difference of capture than nets fitted with a standard codend only.	P	3	I	INT
Whaler shark (Fa							
Sliteye shark	Limited data but expect juveniles and adults would have possible interactions (A. Gutteridge pers comm).	P	For sharks in the scallop sector there was significant statistical difference of capture between codends fitted with TED/BRD combinations and every other codend configuration without a TED. Also a sig. difference between TED only and BRD only. Therefore showed good TED/BRD effectiveness	A	2	I-L	HIGH
Milk shark	Interactions likely to occur with juveniles and adults.	P	TED/BRD's not considered to be overtly effective for this species.	P	2	I-L	HIGH
Spinner shark	Limited given its size - smaller sizes may interact more frequently. In Kyne 2008, 1 specimen captured. 1 immature male.	A	For sharks in tiger/endeavour prawn sector, no sig. diff. of capture existed between codend types. Lowest probability of capture was for a codend fitted with a fisheye BRD.	A	0	L	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Whitecheek shark	*Carcharhinus coatesi*	In Kyne 2008, 2 specimens caught in the northern tiger/endeavour sector. Regularly observed interacting with deepwater EKP sector.	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available. Not thought to be prone to high mortality risk from trawl interaction.	A
Sawfish (Family Pristidae)					
Narrow sawfish	*Anoxypristis cuspidata*	Some interactions with ECTF reported via SOCI and FOP data. Most common sawfish encountered in offshore fisheries in Qld.	P	Placed as a P. NB: Likely to be relatively poor as this species is not considered to be very robust to fishing interactions. SOCI data for 2008 and 2009 indicated that 37% of narrow sawfish reported in SOCI logbooks were injured but survival could be reasonable if handled to sawfish guidelines.	P
Green sawfish	*Pristis zijsron*	Mostly an estuarine and near shore species, so interactions may occur with banana and tiger/endeavour fishery sectors. Kyne et.al. 2007; Stobuzki et.al. 2001	P	Survival likely to be reasonable if handled to sawfish guidelines.	A
Wedgefishes (Family Rhynchobatidae)					
Whitespotted guitarfish (Eyebrow wedgefish)	*Rhynchobatus australiae / Rhynchobatus palpebratus* Species not separated in Kyne 2008.	In Kyne 2008, 12 specimens caught in the scallop sector and 6 in the northern tiger/endeavour sector.	P	100% alive on deck, Kyne 2008 Table 8.2 p. 246.	A

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Whitecheek shark	Unsure. In Kyne 2008 2 specimens captured. 1 immature female and 1 mature male. Scoring based on smaller size of species.	P	For sharks in tiger/endeavour prawn sector, no sig. diff. of capture existed between codend types. Lowest probability of capture was for a codend fitted with a fisheye BRD. Scoring based on smaller size of species.	P	2	I-L	HIGH
Sawfish (Family P							
Narrow sawfish	Adults likely to be caught. Not sure of level of interaction with juveniles and immature.	A	BRD's are known to be ineffective for species such as sawfish	P	3	I	INT
Green sawfish	Studies show that sawfish generally inhabit shallow and estuarine waters as juveniles (3-5 years) then migrate between these waters and deeper waters as adults. Thornborn et.al. 2003; Stevens et.al. 2005	P	BRD's are known to be ineffective for species such as sawfish. TED not problem, but net causes entanglement.	P	3	I	INT
Wedgefishes (Far							
Whitespotted guitarfish (Eyebrow wedgefish)	Most life stages found to interact with the fishery. In Kyne 2008, 18 Rhynchobatus spp. captured. All males immature. Females not assessed but possibly immature and mature. Max size varies by species and so will benefits of TEDs. Robust animal which most likely is excluded at most sizes by TEDs.	P	Robust animal which most likely is excluded at most sizes by TEDs.	A	2	I-L	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Shovelnose rays (Family Rhinobatidae)					
Eastern shovelnose ray	*Aptychotrema rostrata*	Comprised 52.20% of chondrichthyan by catch in QECTF scallop sector sampling in Kyne 2008, Table 3.10; most abundant in SW EKP.	PP	26.2% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available.	P
Coffin rays (Family Hypnidae)					
Coffin ray	*Hypnos monopterygius*	In Kyne 2008, 21 specimens caught in the eastern king prawn (shallow and deep) sectors. This represented 3.08% of chondrichthyan by catch in the EKP (deepwater) sector. In Kyne 2008, susceptibility ranking of 2.73 - high.	P	50% of individuals (n = 21) recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available; although other information indicates survival rates are reasonable (pers com. Ann-Marie Frost). ' P' reasonable estimate given available information.	P
Stingrays (Family Dasyatidae)					
Estuary stingray	*Dasyatis fluviorum*	Interactions within the GBR most likely to occur in shallow inshore environments. Interactions would be higher outside the GBR i.e. in RIBTF.	A	Survival appears fairly good from FOP data which indicates that all are released alive.	A
Blackspotted whipray	*Himantura astra*	Comprised 12.50% and 26.32% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling charters (by catch and sea snake) in Kyne 2008 , Table 3.12 / 3.14.	P	*13.0% of individuals recorded as dead on deck in Kyne 2008 (research trawls) Table 8.2 p. 246. *No post-mortality data available. *Mortality rates in NPF = 53% (Stobutzki et al. 2002)	P
Pink whipray	*Himantura fai*	Interaction with the fishery likely to be low with capture rates even lower given this species maximum disc width.	A	Unknown but expected to be reasonably good considering the estimated size of birth is reasonably large (Ian Jacobsen, pers. Comm)	A

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Shovelnose rays							
Eastern shovelnose ray	All sizes interact with the fishery. Kyne 2008 sampled neonatal through to adults.	P	For this species, nets fitted with a TED showed a statistically significant difference of capture than nets fitted with a BRD codend only. There was no significant difference of capture between BRD codend types when a TED was fitted. Good TED effectiveness for this species (demonstrated in the scallop sector).	A	4	H-I	HIGH
Coffin rays (Famil							
Coffin ray	Most life stages found to interact with the fishery. 21 specimens recorded in the eastern king prawn sectors (shallow and deepwater) outside the GBR. Records of immature and mature males and females in Kyne 2008.	P	No significant differences in probability of capture between different gear types for batoids in the EKP sectors, though lowest probability was found with a radial escape section BRD with TED fitted in the shallow water section. In addition this ray is slow moving and has a soft body which means TEDs are likely to be fairly ineffective on this species.	P	4	H-I	HIGH
Stingrays (Family							
Estuary stingray	While this species is likely to be caught infrequently within the ECTF, it has the potential to interact with the fishery at all stages of its life history.	P	Some of the larger rays will get out via BRD. But overall TED/BRD effectiveness is considered to be less than that observed in other species.	P	2	I-L	HIGH
Blackspotted whipray	Most life stages found to interact with the fishery. Kyne 2008 sampled immature and mature males and females.	P	Northern Prawn Fishery and ECOTF TEDs positive effect for larger rays; fisheyes have potential to reduce retention of small rays	P	4	H-I	HIGH
Pink whipray	The introduction of TEDs has dramatically reduce the likelihood of large *H. fai* being caught. As such, interactions with this species is more than likely to be with smaller, immature specimens.	A	Given the size of this species, the use of TEDs are likely to be fairly effective.	A	0	L	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Reticulate whipray	*Himantura uarnak*	Interaction with the fishery likely to be low with capture rates even lower given this species maximum disc width.	A	Unknown but expected to be reasonably good considering the estimated size of birth is reasonably large (Ian Jacobsen, pers. Comm)	A
Bleeker's variegated whipray	*Himantura undulata*	Interaction with the fishery likely to be low with capture rates even lower given this species maximum disc width.	A	Unknown but expected to be reasonably good considering the estimated size of birth is reasonably large (Ian Jacobsen, pers. Comm)	A
Leopard whipray	*Himantura leoparda*	In Kyne 2008, 1 specimen caught in the scallop sector outside GBR. Two records near Yeppoon In Kyne 2008, susceptibility ranking of 1.55 - low	A	0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available. Limited data (n=1) more robust than *H. toshi* and *H. astra*	A
Brown whipray	*Himantura toshi* (=sp A of Last & Stevens 1994, Stobutzki et al 1999)	*Interactions with this species likely to be low and below that of *H. astra* . Last & Stevens (2009) indicates this species has been reported infrequently in the southern reaches of its range which has been supported by projects originating out of UQ (I. Jacobsen). *In Kyne 2008, 3 specimens caught in the Hervey Bay sector outside GBR, 1 in scallop, and 2 in northern tiger/endeavour prawn sectors. *In Kyne 2008, susceptibility ranking of 1.82 - medium.	A	Unknown but likely to be similar to *H. astra* . (Stobuzki et al 2002 indicated)	P
Mangrove whipray	*Himantura granulata*	Interactions with the fishery expected to be limited. Likely encounters with juveniles, with mature animals captured less frequently.	A	Unknown	A

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Reticulate whipray	The introduction of TEDs has dramatically reduce the likelihood of large *H. uarnak* being caught. As such, interactions with this species is more than likely to be with smaller, immature specimens.	A	Given the size of this species, the use of TEDs are likely to be fairly effective.	A	0	L	HIGH
Bleeker's variegated whipray	Unknown, but expected to be similar to *H. uarnak* if found in QLD waters.	A	Given the size of this species, the use of TEDs are likely to be fairly effective.	A	0	L	HIGH
Leopard whipray	Unsure. In Kyne 2008, 1 specimen captured. 1 mature male.	A	No significant statistical differences of capture between codend types for batoids in the scallop sector. However, lowest probability of capture was for a codend with TED and BRD fitted.	P	1	L	HIGH
Brown whipray	Most life stages found to interact with the fishery. In Kyne 2008, 6 specimens captured. 1 mature female and 5 immature juvenile and adult male and female specimens.	P	Northern Prawn Fishery and ECOTF TEDs positive effect for larger rays; fisheyes have potential to reduce retention of small rays	P	3	I	INT
Mangrove whipray	Information from *H. uarnak* indicates that the likelihood of large animals being caught has been dramatically reduced with the introduction of TEDs.	A	Reasonable success for larger (sub-adult & adult) specimens	A	0	L	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Bluespotted maskray	*Neotrygon kuhlii*	Comprised 12.50% / 6.58% of hondrichthyan by catch in QECTF tiger/endeavour sector and 23.41% in the scallop sector sampling in Kyne 2008, Tables 3.12 / 3.14 and 3.10 respectively.	P	*73.5% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. *Stobutski et al 2002 indicates that mortality rates of *N. picta* were 59% (proxy) *No post-mortality data available.	PP
Speckled maskray	*Neotrygon picta*	Comprised 12.50% / 6.58% of chondrichthyan by catch in QECTF tiger/endeavour sector and 15.61% in the scallop sector sampling in Kyne 2008, Tables 3.12 / 3.14 and 3.10 respectively.	P	57.6% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available.*Stobutski et al 2002 indicates that mortality rates of N. picta were 59% *No post-mortality data available.	PP
Cowtail Stingray	*Pastinachus astrus*	*Overall interactions likely to be fairly low for this species. *In Kyne 2008, 1 specimen caught in the northern tiger/endeavour prawn sector. Caught very close inshore. *In Kyne 2008, susceptibility ranking of 1.82 - medium.	A	0% of individuals (n=1) recorded as dead on deck in Kyne 2008 Table 8.2 p. 246. No post-mortality data available.	A
Stingarees (Urolophidae					
Common stingaree	*Trygonoptera testacea*	Kyne (2008; PhD thesis) indicated Chondrichthyan by catch in the eastern king prawn (shallow water) sector was dominated by the three batoids A*ptychotrema rostrata, Trygonoptera testacea* and *Urolophus kapalensis* which comprised ~92% of Chondricthyan by catch.	P	12 of the 13 specimens collected by Kyne (2008) or 92% were dead on deck. Research from the Gulf also indicates smaller species have increased mortality rates in trawl species when compared to larger batoids.	PP
Patchwork stingaree	*Urolophus flavomosaicus*	*Observer data indicates that species has been encountered up in the Swains Reefs region. M. Dunning indicates this species is regularly encountered in deepwater EKP sector south of Swains.	P	*92% of T. testacea were recorded as dead for T. testacea, others around 30%. 'P' considered to be an appropriate proxy for this species. Research from the Gulf also indicates smaller species have increased mortality rates in trawl species when compared to larger batoids.	P

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Bluespotted maskray	Most life stages found to interact with the fishery. Kyne 2008 sampled immature and mature males and females.	P	As above; small size makes TEDs BRDs ineffective	P	5	H	HIGH
Speckled maskray	Most life stages found to interact with the fishery. Kyne 2008 sampled immature and mature males and females.	P	As above; small size makes TEDs BRDs ineffective	P	5	H	HIGH
Cowtail Stingray	Given the size of adults expected to interact with mostly immature specimens as larger rays would be excluded through the TED.	A	For batoids, in tiger/end sector, nets fitted with a fisheye BRD showed a statistically significant difference of capture than nets fitted with a standard codend only (position of device and length of trawl was significant - more research required). Benefits for large ones	A	0	L	HIGH
Stingarees (Urolo							
Common stingaree	Likely to interact with juvenile and adult specimens.	P	Effectiveness likely to be low due to the small size of adults.	P	5	H	HIGH
Patchwork stingaree	Likely to interact with juvenile and adult specimens.	P	Effectiveness likely to be low due to the small size of adults.	P	4	H-I	HIGH

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Species Name	Level of interaction	A or P or PP	Survival after interaction	A or P or PP
Skates (Rajidae)					
Pale tropical skate	*Dipturus apricus*	Regularly caught in deepwater EKP fishery south of Swains (up to a few individuals per shot). Distribution only partially overlaps with fishing effort so species has refugia outside fished areas (M. Dunning)	P	Deepwater species and unlikely to be robust to fishing/handling as skin relatively soft, so survival expected to be low.	PP
Argus skate	*Dipturus polyommata*	Confusion in identifications has restricted amount of available information (M. Dunning). In some areas of deepwater EKP grounds it appears some are caught quite regularly.	P	Deepwater species and unlikely to be robust to fishing/handling as skin relatively soft, so survival expected to be low.	PP
Endeavour skate	*Dipturus endeavouri*	Eighteen individuals from 130 shots in the QECTF EKP deepwater sector sampling (Kyne 2008). Sampling took place outside the GBRMP but its distribution extends through the GBRMP	P	79% of individuals recorded as dead on deck by Kyne (2008)	PP
Butterfly rays (Family Gynmuridae)					
Australian butterfly ray	*Gymnura australis*	Comprised 13.6% of chondrichthyan by catch in QECTF tiger/endeavour sector sampling in Kyne 2008, Table 3.14. Ambush prey items and wait in sandy areas until last moment, unlikely to flee in advance of trawl.	P	Stobutxki et al 2002 indicates mortality rates for this species are >40% in the NPF *FOP data indicates that of the 8 caught in the TEP and Bay prawn sectors 7 were dead. *0% of individuals recorded as dead on deck in Kyne 2008 Table 8.2 p. 246 (n = 12) *No post-mortality data available.	P
Eagle rays (Family Myliobatidae)					
Banded eagle ray	*Aetomylaeus nichofii*	1 specimen caught in the Hervey Bay sector in Kyne's 2008 study. Unknown whether this displays a depleted population or limited interaction with the fishery. Swim higher in water column and have good swimming ability, so reduced likelihood of interaction with prawn trawl	A	Kyne 2008 used information inferred from similar species to determine the post-capture mortality rank in order to calculate the susceptibility rank for *A. nichofii* . Not thought to be prone to high mortality risk from trawl interaction.	P

Appendix 17. Fishery impact profile of sharks and rays

Common Name	Interaction throughout life cycle	A or P	TED/BRD effectiveness	A or P	Risk prone score	Fishery Impact Profile level	RISK
Skates (Rajidae)							
Pale tropical skate	A deepwater skate that spends all of its life stages within areas that include the QECTF king prawn deepwater fishery.	P	Unlikely to be effective.	P	5	H	HIGH
Argus skate	A deepwater skate that spends all of its life stages within areas that include the QECTF king prawn deepwater fishery.	P	Unlikely to be effective.	P	5	H	HIGH
Endeavour skate	A deepwater skate that spends all of its life stages within areas that include the QECTF king prawn deepwater fishery.	P	No significant differences in probability of capture between different gear types although lowest probability was found with SMC and TED attached.	P	5	H	HIGH
Butterfly rays (Fa							
Australian butterfly ray	All life stages found to interact with the fishery. Kyne 2008 sampled young juveniles through to mature males and females.	P	TEDs less effective than for other species of rays because of morphology (flatness etc).	P	4	H-I	HIGH
Eagle rays (Famil							
Banded eagle ray	Unknown. Ecology of species largely unknown.	A	No data for *A. nichofii.* Not applicable as interaction rate low.	A	1	L	HIGH

Appendix 18. Impact and recovery of the main living habitat elements

Structural element	Impact of trawling (proportion depleted/removed by trawling) (Guidance: L = <5 per cent per trawl; M = 5-20 per cent per trawl), H=>20 per cent per trawl)		Ability to recover after being trawled (recovery period) (Guidance: H = 1-2 yrs; M = 3-8 yrs; L > 8 yrs)		Comments
Whip gardens		L		L	
Tube polychaete beds		N/A		N/A	Not recorded in seabed biodiversity report in Great Barrier Reef
Squid eggs		N/A		N/A	Not recorded in seabed biodiversity report in Great Barrier Reef
Sponge garden	10-40 per cent; average 20 per cent depleted	H	3-10 yrs for recovery	M	
Seagrass	Trawl effects mostly above ground biomass, rather than roots	L	From trawl, probably high 1-2 yrs based on Rob Coles work. Trawl effects mostly above ground biomass, rather than roots, so 1-2 yrs to recover for Spinulosa	H	Recovery within decade from widespread destruction if not a few seasons - 5-6 yrs. Cyclone Sandy in the 80s - evidence of depletion/recovery timeframes.
Live reef corals	Untrawled. Impact low, gear would stop.	L	Recovery rate expected to be similar to hard corals	M	
Hard coral garden	Impact 40 per cent per trawl or higher. Avoided by trawling if/after first pass now	H	Flower pot corals grow back quickly, others slower	M	
Flora		M		H	Seagrass, alga or ? Couldn't define from video
Caulerpa	Impact gear slips over it. Damages it (above ground biomass) but then once cutter bar (steel bar on research sled) is covered, it slides over it. Sled catches hardly any, so trawl gear would catch even less.	L		H	40 spp.
Halimeda	Higher impact rate than other algae - chokes the net - certainly M if not higher	M	Recovery rate is probably M	M	Bank integrity can be destroyed too.
Gorgonian garden	5-15 per cent, average 10 per cent impact rate	M	Most have M recovery rate but seawhips slow (L)	L	
Bivalve shell beds		N/A		N/A	Did not find them very much in Great Barrier Reef. On top of reefs at 20m, found in Torres Strait
Bioturbated	Probably not effected, protected by living down in the sediment	L	Expected to take days to years for the mound to come back	H	
Algae	Depletion rate likely to be L as lie flat. Trawl damages some with flowerpot corals, not much, L.	L		L	Coraline habitat type in Habitat 8.
Algae		L	Fleshy- like Caulerpas, recovery high, probably ephemeral. Medium for anchored things, but these unlikely to be trawled. Mostly on chain only.	H	
Alcyonarians/ soft corals		H		H	
No biohabitat		N/A		N/A	N/A

Appendix 19. Resilience of marine habitats

Habitat	Habitats from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Impact of trawling on key structural elements (proportion depleted/ removed by trawling)	A or P or PP	Ability of key structural elements to recover after being trawled (recovery period)	A or P or PP	Cumulative pressures	A or P	Resilience level
				Major elements (as %), **bold ≥ 3%**		Major elements (as %), **bold ≥ 3%**				
Habitat 1	Habitat 1 represents the most barren seabed type, almost entirely bare (~20%) and bioturbated (>70%) with very little observed biogenic habitat. It is distributed in muddy areas of the inshore and midshelf, as well as the deep end of the Capricorn Channel.	15,244 sq km Wide Pitcher et al 2007	A	**bioturbated (>70%) = L** [<1%=H or M]	A	**bioturbated (>70%) = H** [<1%=L or M]	A	Nature of habitat means little risk	A	H
Habitat 2	Habitat 2 is also very barren, with some bioturbation (~20%), 60-70% bare seabed and very little epibenthos or algae (<1%). It is distributed in muddy-sandy areas of the southern midshelf and far north.	33,670 sq km Wide Pitcher et al. 2007	A	**bioturbated (~20%) = L** epibenthos or algae (<1%) = L to H [<1%=H or M]	A	**bioturbated (~20%) = H** epibenthos or algae (<1%) = H to L [<1%=L]	A	Nature of habitat means little risk	A	H
Habitat 3	Habitat 3 had significant patches of whip gardens (~4%), sponge gardens (~6%), gorgonian gardens (~5%), alcyonarians (~6%), and algae (~4%) separated by tracts of bare seabed (~70%). This habitat may also include very small (<1%) amounts of hard coral gardens, Halimeda and Caulerpa. It is distributed in low mud, higher current areas, primarily in the southern Great Barrier Reef.	30,213 sq km Wide Pitcher et al. 2007	A	**whip gardens (~4%) = L** **sponge gardens (~6%) = H** **gorgonian gardens (~5%) = M** **algae (~4%) = L** **alcyonarians (~6%) = H** [12%=H, 5%=M]	PP	**whip gardens (~4%) = L** **sponge gardens (~6%) = M** **gorgonian gardens (~5%) = L** **algae (~4%) = H** **alcyonarians (~6%) = H** [9%=L, 6%=M]	PP	Unknown	A	L

Appendix 19. Resilience of marine habitats

Habitat	Habitats from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Impact of trawling on key structural elements (proportion depleted/ removed by trawling)	A or P or PP	Ability of key structural elements to recover after being trawled (recovery period)	A or P or PP	Cumulative pressures	A or P	Resilience level
Habitat 4	Habitat 4 is similar to Habitat 3, but with more algae (~16%). It also had <5% Halimeda and seagrass. This habitat may also include very small (<1%) amounts of live reef corals, hard coral gardens, alcyonarians and Caulerpa. Habitat 4 is distributed in low mud, high current areas with higher benthic irradiance, in both the southern and far northern Great Barrier Reef.	31,089 sq km Wide Pitcher et al. 2007	A	whip gardens (~2%) = L sponge gardens (~2%) = H seagrass (~2%) = L **halimeda (~4%) = M** **gorgonian gardens (~3%) = M** bioturbated (~2%) = L **algae (~16%) = L** alcyonarians (~1%) = H [3%=H, 7%=M]	P	whip gardens (~2%) = L sponge gardens (~2%) = M seagrass (~2%) = H **halimeda (~4%) = M** **gorgonian gardens (~3%) = L** bioturbated (~2%) = H **algae (~16%) = H** alcyonarians (~1%) = H [5%=L, 6%=M]	A	Unknown	A	H-I
Habitat 5	Habitat 5 represented mostly bioturbated (~40%) and bare seabed (~40%) with a little algae (~6%) and seagrass algal (~5%) habitat with <1-2% each of whip, sponge and gorgonian gardens, live reef corals, hard coral gardens, Halimeda, alcyonarians and Caulerpa. It is distributed over much of the shelf in central and northern sections of the Great Barrier Reef.	54,714 sq km Wide Pitcher et al. 2007	A	**seagrass (~5%) = L** **halimeda (~4%) = M** **bioturbated (~40%) = L** **algae (~6%) = L** [4%=M]	A	**seagrass (~5%) = H** halimeda (~4%) = M **bioturbated (~40%) = H** **algae (~6%) = H** [4%=M]	A	Unknown	A	H
Habitat 6	Habitat 6 represented seagrass (~30%) and algal (~10%) habitats with ~10% bioturbated and ~35% bare seabed. May also include very small amounts of whip, sponge, and gorgonian gardens, alcyonarians, and Halimeda. It is distributed along much of the inner half of the shelf in the southern Capricorn section of the Great Barrier Reef.	13,360 sq km Restricted Pitcher et al. 2007	P	**seagrass (~30%) = L** **bioturbated (~10%) = L** **algae (~10%) = L** [<1%=H or M]	A	**seagrass (~30%) = H** **bioturbated (~10%) = H** **algae (~10%) = H** [<1%=L or M]	A	Water quality-industrial pollution from port - probably not getting significantly worse in 20 yrs. Potential high vulnerability to climate change e.g.- upwelling reduction	P	I

Appendix 19. Resilience of marine habitats

Habitat	Habitats from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Impact of trawling on key structural elements (proportion depleted/ removed by trawling)	A or P or PP	Ability of key structural elements to recover after being trawled (recovery period)	A or P or PP	Cumulative pressures	A or P	Resilience level
Habitat 7	Habitat 7 represents patchy seagrass (~30%) and algal (~15%) habitat with ~40% bare seabed. It is distributed along the mid-shelf from Cape Upstart to Innisfail. This habitat also has very small amounts of whip, sponge and gorgonian gardens, Halimeda, flora, and caulerpa.	6,175 sq km WIDE Pitcher et al. 2007	P	**seagrass (~30%) = L** **halimeda (~3%) = M** **bioturbated (~7%) = L** **algae (~15%) = L** [3%=M]	A	**seagrass (~30%) = H** **halimeda (~3%) = M** **bioturbated (~7%) = H** **algae (~15%) = H** [3%=M]	A	Water quality- more of a consideration than for Habitat 6. Potential high vulnerability to climate change e.g.- upwelling reduction for 7 (likely impact not known)	P	I
Habitat 8	Habitat 8 represents much of the Halimeda (>40%) habitat, as well as some other algae (~20%) and ~12% bare seabed. Other characteristics include ~2% whip gardens, ~3% sponge gardens, ~6% seagrass, ~4% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~1% flora, ~4% Caulerpa, and ~4% bioturbation.	6,414 sq km Wide Pitcher et al. 2007	P	whip gardens (~2%) = L **sponge gardens (~3%) = H** **seagrass (~6%) = L** **live reef corals (~4%) = L** **halimeda (~40%) = M** **caulerpa (~4%) = L** **bioturbated (~4%) = L** **algae (~20%) = L** [3%=H, 40%=M]	P	whip gardens (~2%) = L **sponge gardens (~3%) = M** **seagrass (~6%) = H** **live reef corals (~4%) = M** **halimeda (~40%) = M** **caulerpa (~4%) = H** **bioturbated (~4%) = H** **algae (~20%) = H** [2%=L, 47%=M]	P	Potential high vulnerability to climate change e.g.- upwelling reduction as for Habitat 7 (likely impact not known)	P	L

Appendix 19. Resilience of marine habitats

Habitat	Habitats from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Impact of trawling on key structural elements (proportion depleted/ removed by trawling)	A or P or PP	Ability of key structural elements to recover after being trawled (recovery period)	A or P or PP	Cumulative pressures	A or P	Resilience level
Habitat 9	Habitat 9 represents ~35% patchy algae (including some Halimeda) with ~15% bioturbation and ~35% bare seabed. Other characteristics include ~1% whip gardens, ~2% sponge gardens, ~2% seagrass, ~2% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~2% Caulerpa, and ~1% alcyonarians. Habitat 9 is distributed primarily in the outer-shelf offshore from Townsville.	8,761 sq km WIDE Pitcher et al. 2007	P	sponge gardens (~2%) = H seagrass (~2%) = L live reef corals (~2%) = L **halimeda (~7%) = M** caulerpa (~2%) = L **bioturbated (~15%) = L** **algae (~28%) = L** [2%=H, 7%=M]	P	sponge gardens (~2%) = M seagrass (~2%) = H live reef corals (~2%) = M **halimeda (~7%) = M** caulerpa (~2%) = H **bioturbated (~15%) = H** **algae (~28%) = H** [11%=M]	P	Overall considered not to be under cumulative pressures, as although upwelling comments apply, there is only sparse coverage of algae, and consequences of loss is lower than for the above habitats.	A	I-L
Habitat 10	Habitat 10 is an additional habitat type to those above from the Seabed Biodiversity Project, and occurs in the southern GBRMP between about 90 and 300m depths and includes X8 Southern Embayment bioregion (within that depth range) and the southern part of the NU Terraces bioregion.	14,056 sq km, large area restricted distribution.	P	Key structural elements are unknown as lack biological data for habitat, so precautionary assessment. Some deepwater benthos is known to be easily depleted by trawling, however fishery not using heavy impact gear.	P	Key structural elements are unknown as lack biological data for habitat, so precautionary assessment. Some deepwater benthos is known to recover slowly after depletion	PP	Potential high vulnerability to climate change e.g.- upwelling reduction (likely impact not known)	P	L

Appendix 20. Fishery impact profile of marine habitats 2005

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Habitat 1	Habitat 1 represents the most barren seabed type, almost entirely bare (~20%) and bioturbated (>70%) with very little observed biogenic habitat. It is distributed in muddy areas of the inshore and midshelf, as well as the deep end of the Capricorn Channel.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	26 % Pitcher et al. 2007	P	56% Pitcher et al. 2007	A	Gear overall used in this fishery is not considered high impact gear compared to other fisheries. Industry tending to even lighter gear.	A	1	I-L	LOW
Habitat 2	Habitat 2 is also very barren, with some bioturbation (~20%), 60-70% bare seabed and very little epibenthos or algae (<1%). It is distributed in muddy-sandy areas of the southern midshelf and far north.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	4% Pitcher et al. 2007	A	55% Pitcher et al. 2007	A	As above	A	0	L	LOW
Habitat 3	Habitat 3 had significant patches of whip gardens (~4%), sponge gardens (~6%), gorgonian gardens (~5%), alcyonarians (~6%), and algae (~4%) separated by tracts of bare seabed (~70%). This habitat may also include very small (<1%) amounts of hard coral gardens, Halimeda and Caulerpa. It is distributed in low mud, higher current areas, primarily in the southern Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	10% Pitcher et al. 2007	A	68% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW
Habitat 4	Habitat 4 is similar to Habitat 3, but with more algae (~16%). It also had <5% Halimeda and seagrass. This habitat may also include very small (<1%) amounts of live reef corals, hard coral gardens, alcyonarians and Caulerpa. Habitat 4 is distributed in low mud, high current areas with higher benthic irradiance, in both the southern and far northern Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	7% Pitcher et al. 2007	A	66% Pitcher et al. 2007	A	As above	A	0	L	LOW

Appendix 20. Fishery impact profile of marine habitats 2005

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Habitat 5	Habitat 5 represented mostly bioturbated (~40%) and bare seabed (~40%) with a little algae (~6%) and seagrass algal (~5%) habitat with <1-2% each of whip, sponge and gorgonian gardens, live reef corals, hard coral gardens, Halimeda, alcyonarians and Caulerpa. It is distributed over much of the shelf in central and northern sections of the Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	34% Pitcher et al. 2007	P	53% Pitcher et al. 2007	A	As above	A	1	I-L	LOW
Habitat 6	Habitat 6 represented seagrass (~30%) and algal (~10%) habitats with ~10% bioturbated and ~35% bare seabed. May also include very small amounts of whip, sponge, and gorgonian gardens, alcyonarians, and Halimeda. It is distributed along much of the inner half of the shelf in the southern Capricorn section of the Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	34% Pitcher et al. 2007	P	20% Pitcher et al. 2007	A	As above	A	1	I-L	INT-LOW
Habitat 7	Habitat 7 represents patchy seagrass (~30%) and algal (~15%) habitat with ~40% bare seabed. It is distributed along the mid-shelf from Cape Upstart to Innisfail. This habitat also has very small amounts of whip, sponge and gorgonian gardens, Halimeda, flora, and Caulerpa.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	39% Pitcher et al. 2007	P	26% Pitcher et al. 2007	A	As above	A	1	I-L	INT-LOW
Habitat 8	Habitat 8 represents much of the Halimeda (>40%) habitat, as well as some other algae (~20%) and ~12% bare seabed. Other characteristics include ~2% whip gardens, ~3% sponge gardens, ~6% seagrass, ~4% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~1% flora, ~4% Caulerpa, and ~4% bioturbation.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	3% Pitcher et al. 2007	A	88% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW
Habitat 9	Habitat 9 represents ~35% patchy algae (including some Halimeda) with ~15% bioturbation and ~35% bare seabed. Other characteristics include ~1% whip gardens, ~2% sponge gardens, ~2% seagrass, ~2% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~2% Caulerpa, and ~1% alcyonarians. Habitat 9 is distributed primarily in the outer-shelf offshore from Townsville.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	25% Pitcher et al. 2007	A	64% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW

Appendix 20. Fishery impact profile of marine habitats 2005

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
Habitat 10	Habitat 10 is an additional habitat type to those above from the Seabed Biodiversity Project, and occurs in the southern GBRMP between about 90 and 300m depths and includes X8 Southern Embayment bioregion (within that depth range) and the southern part of the NU Terraces bioregion.	Until further information is gained it is unknown if the area is heterogeneous, hence spatial knowledge of habitat is poor	P	Yes, detailed VMS data analysed	A	113% calculation by DEEDI using methods of Pitcher et al 2007, but assuming a full coverage of each 1 minute lat long cell takes 8.5 hrs with deepwater EKP nets (headrope average 75m) rather than 8hrs.	PP	13.8	P	Gear overall used in this fishery is not considered high impact gear compared to other fisheries. Industry tending to even lighter gear.	A	4	H	HIGH

Appendix 21. Fishery impact profile of marine habitats 2009

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2009	RISK 2009
Habitat 1	Habitat 1 represents the most barren seabed type, almost entirely bare (~20%) and bioturbated (>70%) with very little observed biogenic habitat. It is distributed in muddy areas of the inshore and midshelf, as well as the deep end of the Capricorn Channel.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	12 % Pitcher et al. 2009	A	56% Pitcher et al. 2007	A	Gear overall used in this fishery is not considered high impact gear compared to other fisheries. Industry tending to even lighter gear.	A	0	L	LOW
Habitat 2	Habitat 2 is also very barren, with some bioturbation (~20%), 60-70% bare seabed and very little epibenthos or algae (<1%). It is distributed in muddy-sandy areas of the southern midshelf and far north.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	1% Pitcher et al. 2009	A	55% Pitcher et al. 2007	A	As above	A	0	L	LOW
Habitat 3	Habitat 3 had significant patches of whip gardens (~4%), sponge gardens (~6%), gorgonian gardens (~5%), alcyonarians (~6%), and algae (~4%) separated by tracts of bare seabed (~70%). This habitat may also include very small (<1%) amounts of hard coral gardens, Halimeda and Caulerpa. It is distributed in low mud, higher current areas, primarily in the southern Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	4% Pitcher et al. 2009	A	68% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW

Appendix 21. Fishery impact profile of marine habitats 2009

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2009	RISK 2009
Habitat 4	Habitat 4 is similar to Habitat 3, but with more algae (~16%). It also had <5% Halimeda and seagrass. This habitat may also include very small (<1%) amounts of live reef corals, hard coral gardens, alcyonarians and Caulerpa. Habitat 4 is distributed in low mud, high current areas with higher benthic irradiance, in both the southern and far northern Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	5% Pitcher et al. 2009	A	66% Pitcher et al. 2007	A	As above	A	0	L	LOW
Habitat 5	Habitat 5 represented mostly bioturbated (~40%) and bare seabed (~40%) with a little algae (~6%) and seagrass algal (~5%) habitat with <1-2% each of whip, sponge and gorgonian gardens, live reef corals, hard coral gardens, Halimeda, alcyonarians and Caulerpa. It is distributed over much of the shelf in central and northern sections of the Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	15% Pitcher et al. 2009	A	53% Pitcher et al. 2007	A	As above	A	0	L	LOW
Habitat 6	Habitat 6 represented seagrass (~30%) and algal (~10%) habitats with ~10% bioturbated and ~35% bare seabed. May also include very small amounts of whip, sponge, and gorgonian gardens, alcyonarians, and Halimeda. It is distributed along much of the inner half of the shelf in the southern Capricorn section of the Great Barrier Reef.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	34% Pitcher et al. 2009	P	20% Pitcher et al. 2007	A	As above	A	1	I-L	INT-LOW

Appendix 21. Fishery impact profile of marine habitats 2009

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2009	RISK 2009
Habitat 7	Habitat 7 represents patchy seagrass (~30%) and algal (~15%) habitat with ~40% bare seabed. It is distributed along the mid-shelf from Cape Upstart to Innisfail. This habitat also has very small amounts of whip, sponge and gorgonian gardens, Halimeda, flora, and caulerpa.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	30% Pitcher et al. 2009	P	26% Pitcher et al. 2007	A	As above	A	1	I-L	INT-LOW
Habitat 8	Habitat 8 represents much of the Halimeda (>40%) habitat, as well as some other algae (~20%) and ~12% bare seabed. Other characteristics include ~2% whip gardens, ~3% sponge gardens, ~6% seagrass, ~4% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~1% flora, ~4% Caulerpa, and ~4% bioturbation.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	3% Pitcher et al. 2009	A	88% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW
Habitat 9	Habitat 9 represents ~35% patchy algae (including some Halimeda) with ~15% bioturbation and ~35% bare seabed. Other characteristics include ~1% whip gardens, ~2% sponge gardens, ~2% seagrass, ~2% live reef corals, ~1% hard coral gardens, ~1% gorgonian gardens, ~2% Caulerpa, and ~1% alcyonarians. Habitat 9 is distributed primarily in the outer-shelf offshore from Townsville.	Yes, modelled in Pitcher et al 2007	A	Yes, detailed VMS data analysed	A	20% Pitcher et al. 2009	A	64% Pitcher et al. 2007	A	As above	A	0	L	INT-LOW

Appendix 21. Fishery impact profile of marine habitats 2009

Habitat	Habitats from Seabed Biodiversity Report	Knowledge of spatial distribution of habitat types	A or P	Knowledge of spatial distribution of fishing effort	A or P	Proportion of available habitat impacted by fishing gear (%effort exposed)	A or P or PP	Proportion of total habitat which is permanently protected from fishery activity	A or P	Impacts caused by different gear types used in the fishery	A or P	Risk prone score	Fishery Impact Profile level 2009	RISK 2009
Habitat 10	Habitat 10 is an additional habitat type to those above from the Seabed Biodiversity Project, and occurs in the southern GBRMP between about 90 and 300m depths and includes X8 Southern Embayment bioregion (within that depth range) and the southern part of the NU Terraces bioregion.	Until further information is gained it is unknown if the area is heterogeneous, hence spatial knowledge of habitat is poor	P	Yes, detailed VMS data analysed	A	112% calculation by DEEDI using methods of Pitcher et al 2007, but assuming a full coverage of each 1 minute lat long cell takes 8.5 hrs with deepwater EKP nets (headrope average 75m) rather than 8hrs.	PP	13.8	P	Gear overall used in this fishery is not considered high impact gear compared to other fisheries. Industry tending to even lighter gear.	A	4	H	HIGH

Appendix 22. Resilience of species assemblages

Assemblages from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Risk to species with high affinity and fidelity	A or P	Cumulative pressures	A or P	Risk prone score	Resilience level
Assemblage 1	14,709 km sq Wide (north of Cairns to southern boundary) Pitcher et al. 2007, p3-241	A	None	A	Offshore, no known risks	A	0	H
Assemblage 2	28,565 km sq Wide (Cardwell to southern boundary) Pitcher et al. 2007	A	None	A	Offshore, no known risks	A	0	H
Assemblage 3	14,374 km sq Wide (north of Rockhampton) Pitcher et al. 2007	A	None	A	Offshore, no known risks	A	0	H
Assemblage 4	9,506 km sq Wide (Bowen to southern boundary) Pitcher et al. 2007	A	*Orthoscuticells spp* p Effort Exp 26%, *Ambiserrula jugosa* p Effort Exp 43%, *Xenospongia patelliformis* p Effort Exp 33%	P	Offshore, no known risks	A	1	H-I
Assemblage 5	5,310 km sq Localised (south of Mackay to north of Rockhampton) Pitcher et al. 2007	P	Presume no high affinity species	A	Proportion inshore	P	2	I
Assemblage 6	16,545 km sq Wide Pitcher et al. 2007	A	Presume no high affinity species	A	Proportion inshore	P	1	H-I
Assemblage 7	12,940 km sq Localised in sGBR Pitcher et al. 2007	P	*Portunus sanguinolentus* p EffortExp >34%	P	Mostly inshore and shallow (reef)	P	3	I-L
Assemblage 8	14,172 km sq Wide (Northern boundary to approx Cairns) Pitcher et al. 2007	A	None	A	Offshore, no known risks	A	0	H

Appendix 22. Resilience of species assemblages

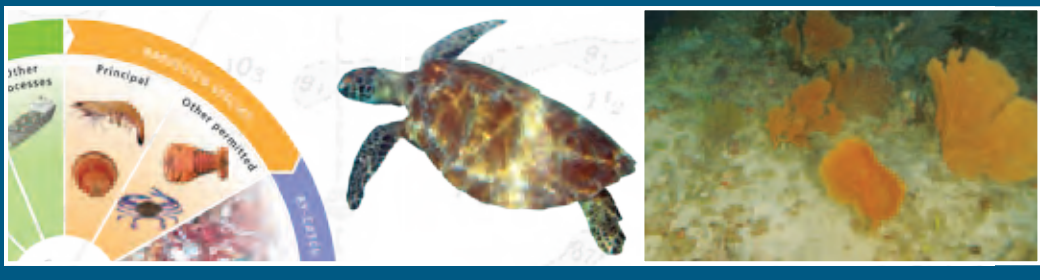
Assemblages from Seabed Biodiversity Report	Geographic distribution in GBRMP	A or P or PP	Risk to species with high affinity and fidelity	A or P	Cumulative pressures	A or P	Risk prone score	Resilience level
Assemblage 9	9,576 km sq Wide (northern boundary to southern boundary) Pitcher et al. 2007	A	*Paradorippe australiensis* p Effort Exp 33%	P	Mostly inshore and shallow (reef), with water quality thought to be an issue for Anthozoa spp.	P	2	I
Assemblage 10	21,537 km sq Wide (northern boundary to south of Mackay) Pitcher et al. 2007	A	Presume no high affinity species	A	Hard to call, mixed but inshore near Bowen	P	1	H-I
Assemblage 11	24,367 km sq Wide (whole of GBR) Pitcher et al. 2007	A	*Scolopsis taeniopterus* p Effort Exp 54%, p Caught 50%	P	Inshore	P	2	I
Assemblage 12	4,706 km sq Wide (north of Bowen) Pitcher et al. 2007	P	*Cryptolutea arafurensis* p Effort Exp 128%	P	Inshore	P	3	I-L
Assemblage 13	3,851 km sq Wide Pitcher et al. 2007	P	*Leiognathus splendens* p Effort Exp 54%, *Leiognathus moretoniensis* p Effort Exp 41%, *Gerres filamentous* p Effort Exp 50%	P	Inshore	P	3	I-L
Assemblage 14	2,110 km sq Wide (north of Cardwell) Pitcher et al. 2007	P	Presume no high affinity species	A	Offshore	A	1	H-I
Assemblage 15	13,690 km sq Localised (south of Mackay, north of Rockhampton) Pitcher et al. 2007	A	None	A	Right across the shelf, with some inshore.	A	0	H
Assemblage 16	3,684 km sq Localised (south of Mackay, north of Rockhampton) Pitcher et al. 2007	PP	None	A	Offshore	A	2	I

Appendix 23. Fishery impact profile for species assemblages 2005

Assemblages from Seabed Biodiversity Report	Proportion of available assemblage impacted by fishing gear	A or P or PP	Proportion of total assemblage which is permanently protected from fishery activity	A or P	Risk prone score	Fishery Impact Profile level 2005	RISK 2005
	Pitcher et al. 2007		Pitcher et al. 2007				
Assemblage 1	32%	P	49%	A	1	I	INT
Assemblage 2	8%	A	62%	A	0	L	LOW
Assemblage 3	2%	A	84%	A	0	L	LOW
Assemblage 4	41%	P	30%	A	1	I	INT
Assemblage 5	10%	A	45%	A	0	L	LOW
Assemblage 6	13%	A	49%	A	0	L	LOW
Assemblage 7	21%	A	31%	A	0	L	INT-LOW
Assemblage 8	3%	A	71%	A	0	L	LOW
Assemblage 9	0%	A	84%	A	0	L	LOW
Assemblage 10	2%	A	44%	A	0	L	LOW
Assemblage 11	58%	PP	43%	A	2	H-I	INT-HIGH
Assemblage 12	108%	PP	43%	A	2	H-I	HIGH
Assemblage 13	41%	P	27%	A	1	I	INT
Assemblage 14	0%	A	90%	A	0	L	LOW
Assemblage 15	0%	A	84%	A	0	L	LOW
Assemblage 16	0%	A	95%	A	0	L	LOW

Appendix 24. Fishery impact profile for species assemblages 2009

Assemblages from Seabed Biodiversity Report	Proportion of available assemblage impacted by fishing gear	A or P or PP	Proportion of total assemblage which is permanently protected from fishery activity	A or P	Risk prone score	Fishery Impact Profile level 2009	RISK 2009
	Pitcher (PERS COMM. 2009)		Pitcher et al. 2007				
Assemblage 1	28%	P	49%	A	1	I	INT
Assemblage 2	3%	A	62%	A	0	L	LOW
Assemblage 3	2%	A	84%	A	0	L	LOW
Assemblage 4	27%	P	30%	A	1	I	INT
Assemblage 5	2%	A	45%	A	0	L	LOW
Assemblage 6	8%	A	49%	A	0	L	LOW
Assemblage 7	24%	A	31%	A	0	L	INT-LOW
Assemblage 8	2%	A	71%	A	0	L	LOW
Assemblage 9	0%	A	84%	A	0	L	LOW
Assemblage 10	1%	A	44%	A	0	L	LOW
Assemblage 11	23%	A	43%	A	0	L	LOW
Assemblage 12	46%	P	43%	A	1	I	INT
Assemblage 13	26%	P	27%	A	1	I	INT
Assemblage 14	0%	A	90%	A	0	L	LOW
Assemblage 15	0%	A	84%	A	0	L	LOW
Assemblage 16	0%	A	95%	A	0	L	LOW



This ecological risk assessment is available at www.gbrmpa.gov.au