



MORETON BAY BUGS

Thenus parindicus, *Thenus australiensis*, *Thenus spp.*

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STOCK STATUS OVERVIEW

Stock status determination

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Queensland	East Coast Otter Trawl Fishery	ECOTF	Sustainable	Catch, CPUE
Commonwealth	Northern Prawn Fishery	NPF	Sustainable	Catch
Commonwealth	Torres Strait Prawn Fishery	TSPF	Sustainable	Catch
Western Australia	Western Australia	BPMF, OPMF, PFTIMF, EGPMF, KPMF, NBPMF, SBPMF, SBSCMF	Sustainable	Catch

BPMF, OPMF, PFTIMF

Broome Prawn Managed Fishery, Onslow Prawn Managed Fishery, Pilbara Fish Trawl (Interim) Managed Fishery (WA)

ECOTF East Coast Otter Trawl Fishery (QLD)

EGPMF Exmouth Gulf Prawn Managed Fishery (WA)

KPMF Kimberley Prawn Managed Fishery (WA)

NBPMF Nickol Bay Prawn Managed Fishery (WA)

NPF Northern Prawn Fishery (CTH)

SBPMF Shark Bay Prawn Managed Fishery (WA)

SBSCMF Shark Bay Scallop Managed Fishery (WA)

STOCK STRUCTURE

Reef Bug (*Thenus australiensis*) and Mud Bug (*T. parindicus*) are known collectively as 'Moreton Bay Bugs'. Moreton Bay Bugs are distributed along the tropical and subtropical coast of Australia from northern New South Wales to Shark Bay in Western Australia². No studies have been carried out on the biological stock structure of Australian Moreton Bay Bugs. The two species have overlapping distributions; may be trawled together; are undifferentiated in the catch; and are assessed together.

Given the uncertainty in biological stock structure, here assessment of stock status is presented at the management unit level—Queensland and Commonwealth; and the jurisdictional level—Western Australia.

STOCK STATUS

Northern Prawn Fishery

Northern Prawn Fishery (Commonwealth) trawl surveys were used to estimate the biomass of Moreton Bay Bugs in the Gulf of Carpentaria, from which an estimate of acceptable biological catch was derived³. This assessment estimated the annual acceptable biological catch for Moreton Bay Bugs in the fishery at 1887 tonnes (t) (95 per cent confidence interval 1716–2057 t). Annual commercial catches have remained well below this (catch peaked at 120 t in 1998). Catches were 59 t in 2014 and 77 t in 2015. The above evidence indicates the biomass of this stock is unlikely to be recruitment overfished.

Fishing mortality has been low in recent years, and ecological risk assessments⁴ have indicated that the risk of stock depletion of Moreton Bay Bugs is low. A trigger catch limit of 100 t is also in place. If this limit is reached then additional analysis will be conducted to ensure that there are no sustainability concerns with the harvest level. Fishing mortality of juveniles is also reduced by regulating the size at which Moreton Bay Bugs may be retained, and spawning potential is protected through prohibiting retention of egg bearing females. Given the low level of catch in recent years compared to estimates of acceptable biological catch, the stock is unlikely to become recruitment overfished.

On the basis of the evidence provided above, the Northern Prawn Fishery (Commonwealth) management unit is classified as a **sustainable stock**.

Torres Strait Prawn Fishery

No formal stock assessment exists for Moreton Bay Bugs in the Torres Strait Prawn Fishery (Commonwealth) (TSPF) management unit. Assessment of seabed and associated biodiversity in the Torres Strait ^{5,6} estimated the 2007 Moreton Bay (Reef) Bug biomass at 124 t, only 19 per cent of which was located within the area exposed to prawn trawling (based on the 2005 footprint of the fishery using vessel monitoring system data). The biomass of Mud Bugs was estimated to be 151 t. Only 18 per cent of biomass was located in areas exposed to prawn trawling. With the decline in fishing effort in recent years, fishing mortality is also likely to have declined. Fishing mortality of juveniles is also reduced by regulating the size at which Moreton Bay Bugs may be retained, and spawning potential is protected through prohibiting retention of egg bearing females. Research has found that Mud Bug egg production is maintained at the minimum size limit of 75 mm CW ⁷. The above evidence indicates the biomass of this stock is unlikely to be recruitment overfished.

The Torres Strait assessment of seabed and associated biodiversity ⁵ indicated that Moreton Bay Bugs are unlikely to have been exposed to high levels of fishing pressure in the Torres Strait Protected Zone. In 2013–15 annual catch of Moreton Bay Bugs averaged 23 t, which is estimated to be less than 10 per cent of available biomass, most of which inhabits extensive areas outside of fished areas. Trawl operations in the TSPF cover only a small proportion—approximately 20 per cent ⁶—of the Torres Strait Protected Zone. Lower fishing effort has resulted in reduced spatial coverage of the fishery in recent years. The above evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, the Torres Strait Prawn Fishery (Commonwealth) management unit is classified as a **sustainable stock**.

Western Australia

No formal stock assessment exists for Moreton Bay Bugs in Western Australia. At 10 t in 2015, the combined Western Australian fisheries landings of Moreton Bay Bugs are at a low level, but within historical limits. Combined fishery landings have been at or below 10 t five out of nine years since 2007. The spatial coverage of Western Australian fisheries that retain Moreton Bay Bugs are limited in extent by comparison with the large area across which Moreton Bay Bugs are distributed in north-western Western Australia. Biomass is protected within the extensive network of fishery closures in place from Shark Bay to Napier Broome Bay ⁸. Moreton Bay Bugs are not targeted in Western Australia, but are landed as occasional byproduct species of prawn and scallop trawl fisheries, thus fishing effort directed at them is very low. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished, and that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, Moreton Bay Bugs in Western Australia is classified as a **sustainable stock**.

East Coast Otter Trawl Fishery

Moreton Bay Bugs are targeted in the East Coast Otter Trawl Fishery (Queensland) (Qld ECOTF) management unit. While no formal stock assessment has been conducted, the 2009 ecological risk assessment reported a low risk of the species being recruitment overfished in the Great Barrier

Reef Marine Park (GBRMP)⁹, where harvesting pressure is greatest and which produces 90 per cent of the Qld ECOTF Moreton Bay Bug catch. A risk assessment for the Qld ECOTF reported an intermediate risk of recruitment overfished exists south of the GBRMP¹⁰, where about 10 per cent of the Moreton Bay Bugs catch is taken. Since 2009, average nominal fishing effort has declined by 15 per cent in the GBRMP and by two per cent in the Qld ECOTF south of the GBRMP, indicating that the risk of the stock being recruitment overfished has not increased. Despite decreasing effort, catch and nominal catch rate has been increasing since 2011 and is near the historically high level of 2013¹¹. The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished.

Permanent closures in the GBRMP protect significant portions of the biomass in eastern Queensland. Research estimated that closures included 54 per cent of the estimated GBRMP biomass of Reef Bug and 45 per cent of the estimated GBRMP biomass of Mud Bug in 2005¹². In addition, a minimum legal size limit of 75 mm carapace width (CW) based on yield-per-recruit analysis, allows Mud Bug the opportunity to spawn before entering the fishery⁷. Individuals below this size are discarded from the retained catch. Research has found that: post-capture survival is high among Moreton Bay Bugs¹³; turtle excluder devices (TEDs) lower catch rates of legal sized Moreton Bay Bugs (greater than 75 mm CW)¹⁴; and 100 mm square-mesh codend bycatch reduction devices (BRDs) greatly lower incidental capture of undersize Reef Bug¹⁴ in the Qld ECOTF management unit where about one-third of vessels use square-mesh codends¹⁵. Retention of berried female bugs since 2010 is likely a factor in maintaining generally higher catches. However, the risk of overfishing^{9,10} is unlikely to be increasing under the current scenario of significant biomass protection within permanent GBRMP closures, size selectivity of TEDs and BRDs and a likely decline in fishing related mortality associated with declining fishing effort. The above evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, the East Coast Otter Trawl Fishery (Queensland) management unit is classified as a **sustainable stock**.

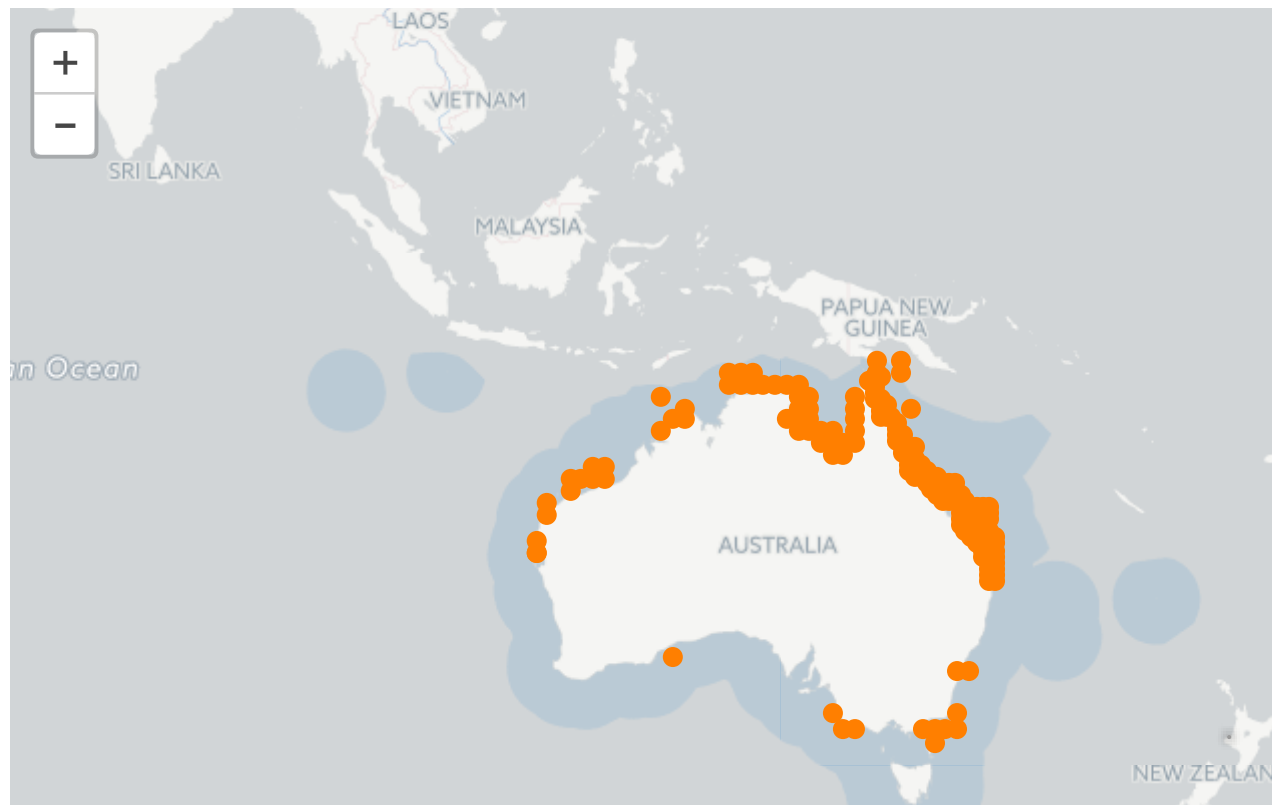
BIOLOGY

Moreton Bay Bug biology^{16,17}

Biology

Species	Longevity / Maximum Size	Maturity (50 per cent)
MORETON BAY BUGS	~7 years T. australiensis: Males 106 mm <u>CW</u> , Females 124 mm <u>CW</u> T. parindicus: Males 87 mm <u>CW</u> , Females 103 mm <u>CW</u>	T. australiensis (Female): 82 mm <u>CW</u> T. parindicus (Female): 75 mm <u>CW</u>

DISTRIBUTIONS



Distribution of reported commercial catch of Moreton Bay Bugs

TABLES

Fishing methods

	Commonwealth	Western Australia	Queensland
Commercial			
Otter Trawl	✓		✓
Various		✓	
Recreational			
Diving			✓
Pots and Traps			✓

Management methods

Method	Commonwealth	Western Australia	Queensland
Commercial			
Effort limits	✓	✓	✓
Limited entry	✓	✓	✓
Retention of females with eggs prohibited	✓		
Size limit	✓		✓
Spatial closures	✓	✓	✓
Vessel restrictions	✓	✓	✓
Indigenous			
Gear restrictions			✓
Recreational			
Size limit			✓

Active vessels

	Commonwealth	Western Australia	Queensland
	51 in NPF, 23 in TSPF	0 in BPFM, 6 in EGPMF, 11 in KPMF, 5 in NBPMF, 3 in OPMF, 18 in SBPMF, 22 in SBSCMF	222 in ECOTF

BPMF Broome Prawn Managed Fishery (WA)

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TSPF Torres Strait Prawn Fishery (CTH)

Catch

	Commonwealth	Western Australia	Queensland
Commercial	77.63t in NPF, 27.88t in TSPF	1.46t in BPMF, OPMF, PFTIMF, 2.98t in EGPMF, 50.30kg in KPMF, 42.00kg in NBPMF, 4.87t in SBPMF, 281.00kg in SBSCMF	541.05t in ECOTF
Indigenous	No catch	No catch	No catch
Recreational	No catch	No catch	No catch

BPMF, OPMF, PFTIMF

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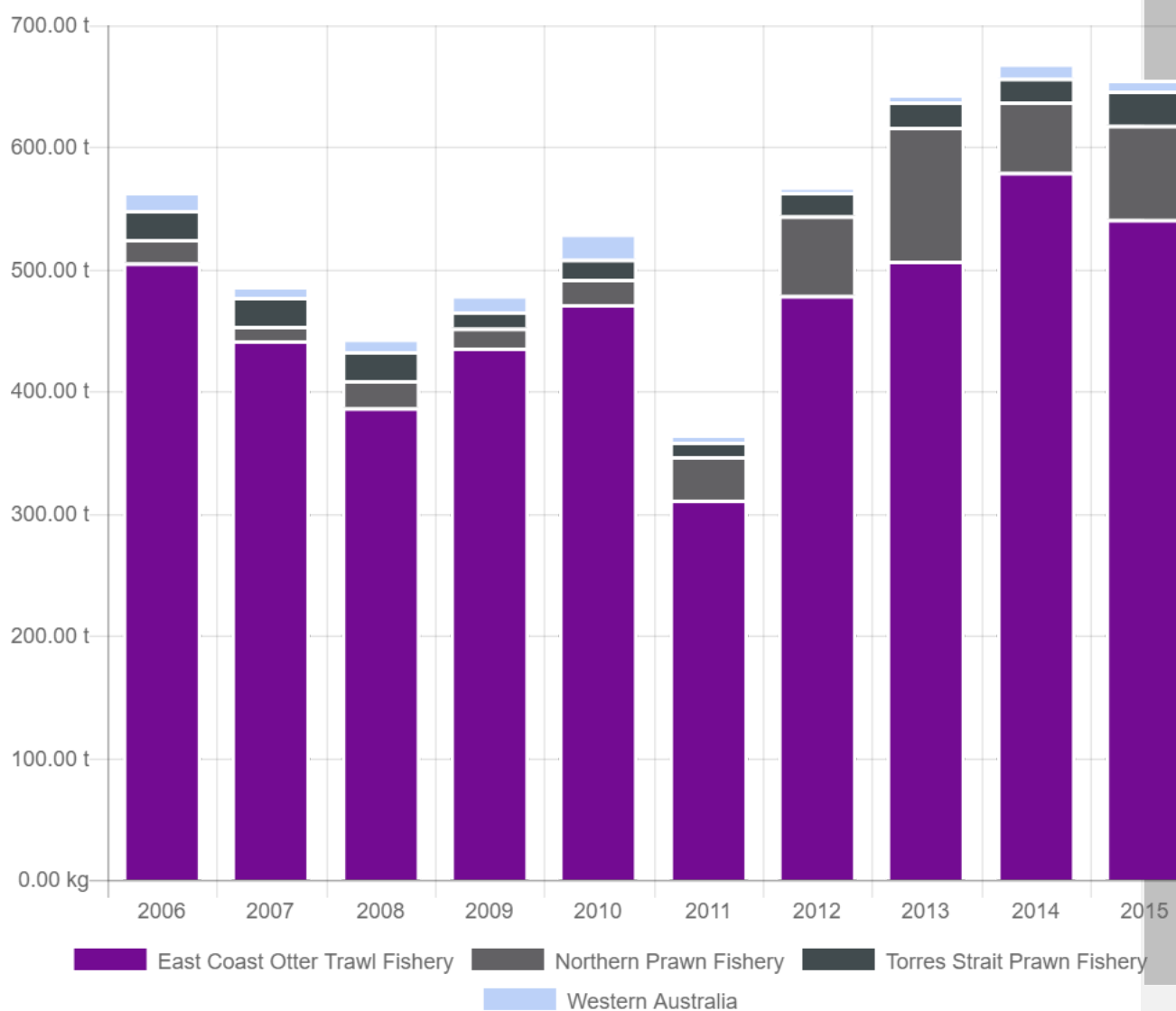
a Commonwealth – Recreational The Commonwealth Government does not manage recreational fishing. Recreational fishing in Commonwealth waters is managed by the states or territory immediately adjacent to those waters, under their management regulations.

b Commonwealth – Indigenous The Commonwealth Government does not manage non-commercial

Indigenous fishing (with the exception of the Torres Strait). In general, non-commercial Indigenous fishing in Commonwealth waters is managed by the states or territory immediately adjacent to those waters. In the Torres Strait, both commercial and non-commercial Indigenous fishing is managed by the Torres Strait Protected Zone Joint Authority (PZJA) through the Australian Fisheries Management Authority (Commonwealth), Department of Agriculture Fisheries and Forestry (Queensland) and the Torres Strait Regional Authority. The PZJA also manages non-Indigenous commercial fishing in the Torres Strait.

c Queensland – Indigenous In Queensland, under the Fisheries Act 1994, Indigenous fishers are able to use prescribed traditional and non-commercial fishing apparatus in waters open to fishing. Size and possession limits and seasonal closures do not apply to Indigenous fishers. Further exemptions to fishery regulations can be obtained through permits.

CATCH CHART



EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

- The impact of trawling on habitats is managed in the Queensland and Western Australian fisheries which harvest Moreton Bay Bugs. In Queensland, the Great Barrier Reef Marine Park (GBRMP) occupies 63 per cent of the East Coast Otter Trawl Fishery¹⁸, 34 per cent of which is open to trawling⁵, but effort is highly aggregated, occurring within only a small fraction (six per cent) of the open area⁹. South of the GBRMP, the fishery operates in only 10 per cent of the area open to trawling¹⁹. In Western Australia, extensive permanent and temporary closures result in the fleet operating in only seven per cent of the Shark Bay region, less than 30 per cent of the Exmouth Gulf, and less than three per cent of the north coast region. Fishing operations are restricted to areas of sand and mud, where trawling has minimal long-term physical impact²⁰⁻²³. The Northern Prawn Fishery (Commonwealth) (NPF) also uses a system of closures (spatial and seasonal) to manage the fishery, as well as other input controls (for example limited entry, gear restrictions). A total of 2.1 per cent of the total managed area of the fishery is subject to permanent closures, while 8.3 per cent is subject to seasonal closures²⁴. The Torres Strait Prawn Fishery (Commonwealth) (TSPF) also employs spatial and temporal closures which are used to protect small prawns, but also important habitat areas like breeding populations of turtles²⁵.
- Although the incidental capture of byproduct and bycatch species by trawling can lead to a range of indirect ecosystem effects²⁶, studies in Queensland and Western Australia, found no significant difference in biodiversity or overall distribution patterns of seabed biota between trawled and non-trawled areas^{12,22}. An assessment of trawl-related risk in the GBRMP found that the East Coast Otter Trawl Fishery (Queensland) (Qld ECOTF), posed no more than an intermediate risk of overfishing species assemblages exposed to trawling⁹. The spatial contraction and/or temporal reduction in effort in these jurisdictions (see above) are likely to have mitigated somewhat the ecosystem impacts of trawling. Similarly, the Commonwealth fisheries have undergone varying levels of ecological risk assessment. In the NPF, the ecological risk management report identifies priority species at high risk. However, no target or protected species have been assessed as high risk because of the fishery²⁷. An ecological risk assessment has also been conducted for the TSPF and identified nine species where trawling has had a negative impact on their biomass²⁸.
- The use of bycatch reduction devices (BRDs) in trawling can significantly reduce bycatch—by more than 50 per cent by weight in some fisheries²⁹. In the Qld ECOTF the mandatory use of BRDs from 1999 and of turtle excluder devices (TEDs) from 2001, largely eliminated capture of most large bycatch species, including turtles, sharks and rays³⁰. BRDs and TEDs became mandatory in NPF in 2001. Use of TEDs in the NPF reduced turtle bycatch from 5 700 individuals per year (before 2001) to approximately 30 per year (after 2001)⁴. The introduction of TEDs in the Western Australian trawl fisheries in 2003 reduced turtle bycatch by at least 95 per cent³¹. BRDs and TEDs have been mandatory in the Shark Bay and Exmouth Gulf prawn fisheries since 2003 and in all northern Western Australian prawn fisheries since 2005. All prawn trawlers operating in Western Australia now must use BRDs, including TEDs, secondary fish exclusion devices and hoppers to increase survival of returned fish. Commitment to continuous improvement in bycatch mitigation has facilitated increased use of best practice TEDs and BRDs in the Qld ECOTF since 2008. Reduced

impact of trawling and a general absence of high risk of overfishing bycatch species has been acknowledged in recent ecological risk assessments of the fishery ^{9,10}.

ENVIRONMENTAL EFFECTS ON MORETON BAY BUGS

- There are suggestions that ocean acidification, changes in ocean current patterns (for example, strengthening of the East Australian Current), and increased intensity of tropical storms associated with climate change may affect food availability, larval survival, dispersion and settlement patterns, abundance of Moreton Bay Bugs, and the distribution and level of catches in the East Coast Otter Trawl Fishery (Queensland) ³². Increased rainfall and sea level rise have been identified³³ as key impacts of climate change in the region of the Northern Prawn Fishery (Commonwealth). These impacts have the potential to modify the geographical distribution of Moreton Bay Bug stocks.

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