Chapter 3
Coral Sea Fishery

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FIGURE 3.1 Area fished within the Coral Sea Fishery, 2011–12

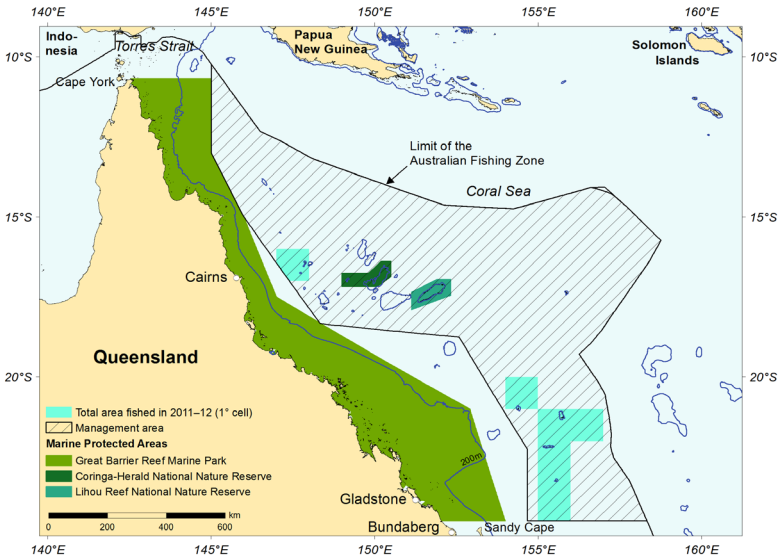


TABLE 3.1 Status of the Coral Sea Fishery

Status	2011		2012		Comments
Biological status	**Fishing mortality**	**Biomass**	**Fishing mortality**	**Biomass**	
Black teatfish (*Holothuria whitmaei*)					Minimal take in 2011–12; historical catch is less than plausible sustainable yield.
Prickly redfish (*Thelenota ananas*)					Minimal take in 2011–12; historical catch is less than plausible sustainable yield.
Surf redfish (*Actinopyga mauritiana*)					No take in 2011–12; historical catch is less than plausible sustainable yield in most years.
White teatfish (*Holothuria fuscogilva*)					No current assessment to determine fishing mortality or biomass status.
Other sea cucumber species (~11 species)					Minimal take in 2011–12; no current assessment to determine biomass status.
Aquarium Sector (>500 species)					Maximum potential effort under management constraints is likely to have minimal impact on stocks.
Tropical rock lobster (*Panulirus ornatus*)					No take in 2011–12; historical catch is less than plausible sustainable yield.
Line and Trap Sector (numerous finfish and shark species)					Fishing mortality levels are unlikely to constitute overfishing; no current assessment to determine biomass status.
Trawl and Trap Sector (numerous finfish, shark and crustaceans species)					Fishing mortality levels are unlikely to constitute overfishing; no current assessment to determine biomass status.
Economic status	Estimates of NER are not available. Aquarium Sector catch increased substantially in 2011–12, indicating an improvement in NER. For the remainder of the fishery, it is unclear how changes in gear used and reduced catch have affected NER.				

Notes: **NER** Net economic returns. **TAC** Total allowable catch.

Fishing mortality	Not subject to overfishing	Subject to overfishing	Uncertain
Biomass	Not overfished	Overfished	Uncertain

3.1 Description of the fishery

The Coral Sea Fishery (CSF) is a multispecies, multigear fishery, extending from Cape York to Sandy Cape, Queensland (Figure 3.1). It is bounded on the east by the Australian Fishing Zone and on the west by a boundary line 10–100 nautical miles east of the boundary of the Great Barrier Reef Marine Park (AFMA 2011). A number of individual fisheries existed in the Coral Sea before their integration into the CSF, including the East Coast Deepwater Finfish Fishery, the East Coast Deepwater Crustacean Trawl Fishery and the North Eastern Demersal Line Fishery.

Management of the CSF involves both input (effort) and output (catch) controls, including limited entry, total allowable catches (TACs), spatial closures, move-on provisions, size limits and catch-and-effort triggers that are used to initiate further analysis and assessment. Approximately 42 t of finfish and echinoderms were taken in the CSF during 2011–12, a decrease from the 78 t in the 2010–11 season (Table 3.2). In 2011–12, there were five active vessels in the fishery: two in the Line and Trap Sector, two in the Aquarium Sector and one in the Sea Cucumber Sector.

The harvest strategies for this fishery recognise the developmental nature of the fishery, and this is taken into account in assessing their performance. ABARES (2011a, 2011b, 2012, 2013) analysed harvest levels within the Sea Cucumber, Lobster and Trochus, Aquarium, and Line and Trap sectors of the fishery. This work, part of the Reducing Uncertainty in Stock Status (RUSS) project, looked at current and historical catches and indicators of population size to evaluate status. Although it did not explicitly consider the design of harvest strategies, the work may inform revision of harvest strategies in the coming years. The Australian Fisheries Management Authority recently began redrafting the individual sector harvest strategies into a single document. It is expected that the updated harvest strategies will identify the key commercial species for each sector, which was not done previously.

Trap hauling
AFMA

TABLE 3.2 Main features and statistics for the CSF

Fishery statistics a	2010–11 fishing season			2011–12 fishing season		
Stock	**TAC (t) or catch trigger**	**Catch (t)**	**Real value (2010–11)**	**TAC (t) or catch trigger**	**Catch (t)**	**Real value (2011–12)**
Aquarium Sector	40 000 individuals b	27 583 individuals	Confidential	40 000 individuals b	39 819 individuals	Confidential
Black teatfish	1	0.08	Confidential	1	0.38	Confidential
Greenfish and lollyfish	10	0	0	10	0	0
Other sea cucumber	10	0.1	Confidential	10	0.05	Confidential
Prickly redfish	20	1.1	Confidential	20	0.8	Confidential
Sandfish	1	0	0	1	0	0
Surf redfish	10	0	0	10	0	0
White teatfish	4	3.1	Confidential	4	1.6	Confidential
Total sea cucumber	150	4.4	Confidential	150	2.8	Confidential
Tropical rock lobster	30 b	0	0	30 b	0	0
Trochus	30 b	0	0	30 b	0	0
Line, trap and trawl operations (numerous finfish and shark species)	–	73.6	Confidential	–	39.6	Confidential
Total fishery c		**78.0**	**Confidential**		**42.4**	**Confidential**

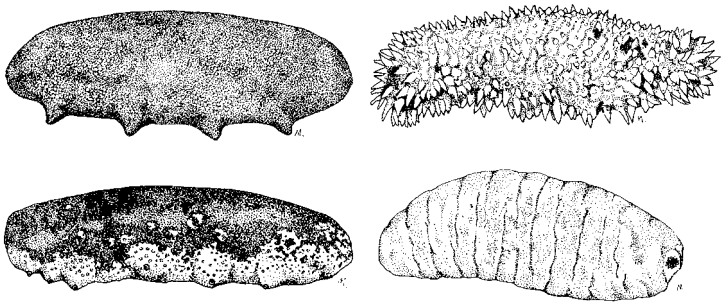
Fishery-level statistics

Effort	Sea Cucumber: 116 dive hours Lobster: 0 dive hours Aquarium: 3 240 dive hours Line and Trap, and Trawl and Trap: 555 hooks, 11 081 trap lifts, 0 trawl hours	Sea Cucumber: 92 dive hours Lobster: 0 dive hours Aquarium: 3 647 dive hours Line and Trap, and Trawl and Trap: 244 964 hooks, 0 trap lifts, 0 trawl hours
Fishing permits	16 fishing permits across the Line and Trap (8), Trawl and Trap (2), Sea Cucumber (2), Aquarium (2), and Lobster and Trochus (2) sectors	16 fishing permits across the Line and Trap (8), Trawl and Trap (2), Sea Cucumber (2), Aquarium (2), and Lobster and Trochus (2) sectors
Active vessels	4	5
Observer coverage	Sea Cucumber: 0 Lobster: 0 Trochus: 0 Aquarium: 0 Line and Trap, and Trawl and Trap: 5 days of dropline fishing	Sea Cucumber: 0 Lobster: 0 Trochus: 0 Aquarium: 0 Line and Trap, and Trawl and Trap: 1 day of auto-longline fishing
Fishing methods	Hand collection (includes barbless hooks and line, scoop, cast and seine nets), with or without the use of breathing apparatus; line (demersal longline, dropline and trotline); traps and trawl (finfish and crustacean)	
Primary landing ports	Cairns, Bundaberg	
Management methods	Input controls: limited entry, spatial closures Output controls: catch triggers, size restrictions, TACs for sea cucumbers Other: prescribed observer coverage levels, move-on provisions	
Primary markets	Domestic: fish products—fresh, frozen; aquarium species—live International: South-East Asia—dried sea cucumber (bêche-de-mer); worldwide—live aquarium species	
Management plan	*Management arrangements booklet 2011—Coral Sea Fishery* (AFMA 2011)	

a Fishery statistics are provided by fishing season, unless otherwise indicated. Season is consistent with financial year (1 July to 30 June). Real-value statistics are by financial year; however, these data are confidential because of the low number of operators. **b** Trigger limits. **c** Total catch weight excludes Aquarium Sector catch.
Notes: **TAC** Total allowable catch. – Not applicable.

3.2 Biological status

3.2.1 Sea Cucumber Sector



Line drawing: FAO

Stock assessment

Thirteen species or species groups have been reported in the Sea Cucumber Sector's historical catches. There have been no formal quantitative stock assessments for sea cucumber species within this sector. Research by ABARES (2013) was used to determine status for black teatfish, white teatfish, surf redfish and prickly redfish in 2012.

The ABARES research predicts biomass for these species using a habitat-based approach. This approach uses survey data and estimates of habitat area to derive estimates of population size. Average animal weights from commercial catch data were used to estimate biomass, from which estimates of maximum sustainable yield (MSY) and surplus production models were derived. Estimates of habitat area were derived from a geomorphological classification undertaken as part of the Millenium Coral Reef Mapping Project (Andréfouët et al. 2005), and population densities were derived from survey data collected within Lihou and Coringa–Herald national nature reserves (Ceccarelli et al. 2008; Oxley et al. 2003, 2004).

Stock status determination

Stock status is evaluated using the outputs of the surplus production models, which provide an estimate of biomass in 2010 as a proportion of biomass at the start of the assessment period (1997). For black teatfish and prickly redfish, using an estimate of median biomass, total biomass in 2010 exceeded 99 per cent of that at the start of the assessment period. In the years since this estimate of biomass, catches have remained low, not exceeding the estimate of MSY. As a result, black teatfish and prickly redfish are classified as **not overfished** and **not subject to overfishing**.

There was no catch of surf redfish in 2011–12, and so this stock is classified as **not subject to overfishing**. Since surf redfish catch was less than the median estimate of MSY for 11 of the 14 seasons since 1997–98 (including the 2011–12 season), this stock is also classified as **not overfished**. Because of data limitations, a plausible initial biomass estimate could not be established for white teatfish, and the stock remains **uncertain** with respect to both biomass and fishing mortality. Since stock status classification is undertaken at the fishery-wide level, caution is required when considering status at the level of an individual reef. Historical catch at some reefs has been high, and impacts of this reef-level catch should be considered further.

Given the lack of stock assessments for this multi-species stock, this stock is classified as **uncertain** with regard to the level of biomass. Since the catch from the stock was low (only 53 kg) in 2011–12, the stock is classified as **not subject to overfishing**.

3.2.2 Aquarium Sector

Stock assessment

There are no formal stock assessments for the Aquarium Sector. ABARES (2011a) indicates that the sector is unlikely to be having an adverse impact on the stock. Under current permit conditions, operators can only fish about 7 per cent of suitable habitat within the CSF in any given year. Around 35 per cent of the suitable habitat in the fishery is fully protected within the Coringa–Herald and Lihou national nature reserves (Figure 3.1).

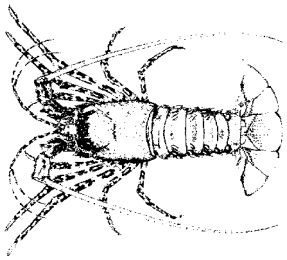
Investigation of annual extraction rates by ABARES (2011a) for key commercial fish families suggests that historical extraction rates have been very low. Furthermore, a species-specific risk assessment suggests low or very low risk to the species harvested in the fishery.

Stock status determination

Based on the results of ABARES analyses, the Aquarium Sector stock is classified as **not overfished** and **not subject to overfishing**.

Flame snapper
AFMA

3.2.3 Tropical rock lobster



Line drawing: FAO

Stock assessment

No quantitative stock assessment has been carried out for this stock. ABARES (2011b) indicates that current fishing activity in the sector is unlikely to be having an adverse impact on the stock. Because there has been limited targeting of lobster in the Coral Sea, insufficient information is available from logbook data to estimate stock size or sustainable yields. However, consideration of the number of reefs, the potential reef area in the CSF, and the pattern of catch and effort recorded in fisher logbooks indicates that none of the major reefs in the CSF have ever been extensively fished.

Estimates of lobster density on Coral Sea reefs, inferred from catch rates, suggest that extrapolated lobster abundance is likely to be many times higher than would be required to support the total historical catch of less than 10 t (ABARES 2011b).

Stock status determination

Given the number of reefs, potential reef area and low levels of fishing effort, the tropical rock lobster stock is classified as **not overfished**. Since there was no harvest of lobster in the 2011–12 season, the stock is classified as **not subject to overfishing**.

3.2.4 Line and Trap, and Trawl and Trap sectors

Stock assessment

The Line and Trap, and Trawl and Trap sectors take a large suite of finfish, as well as sharks and, historically, crustaceans (using trawl gear). There are no formal stock assessments for any of the species taken in these sectors. In 2012, ABARES used a multispecies approach that considered historical catch levels and conservative yield estimates to evaluate stock status (ABARES 2012). The work provides summaries of catch and effort across sectors, and species taken by line-and-trap operations. Three separate species assemblages were considered: a deep assemblage, a reef assemblage and a shark assemblage. Although results varied at the reef level, recent harvest from these assemblages was considered unlikely to constitute overfishing when the fishery is considered as a whole.

The total landed catch across these sectors was 39.6 t in 2011–12, down from 73.6 t in 2010–11. There was also a substantial change in the primary gears used to take this catch. There was no recorded trap effort in 2011–12, whereas trap lifts in 2010–11 was far greater than the number of hooks deployed (Table 3.2). The majority of the 2011–12 catch (39.3 t) was taken by auto-longline operations, with the balance taken with dropline gear.

When considered at the fishery level, the total line catch in 2011–12 was less than conservative estimates of all-species sustainable yield (ABARES 2012). However, approximately 75 per cent of the catch from the deep assemblage in 2011–12 was made up of only four species: north-west rubyfish (*Etelis carbunculus*), bar rockcod (*Epinephelus* spp.), blue-eye trevalla (*Hyperoglyphe antarctica*) and flame snapper (*Etelis coruscans*). Catch in 2011–12 exceeded species-specific sustainable yield estimates for northwest rubyfish and blue-eye trevalla under some scenarios in the analysis. Both these species are characterised by slow growth and low estimates of natural mortality (implying low productivity), and catches at the levels taken in 2011–12 could constitute overfishing if they were to continue.

Preliminary analyses were conducted for the shark assemblage (ABARES 2012). However, no yield estimates were produced because of a lack of published information on shark densities and the prevalence of some wide-ranging species in the catch (such as tiger shark—*Galeocerdo cuvier*). Although catch of shark was minimal in 2011–12, sharks have comprised a large component of the total catch by these sectors in some years (blacktip sharks were greater than 50 per cent of the total line catch in 2005–06). There are currently no data to evaluate the impact of that historical harvest on shark populations in the CSF, or the impact on these species throughout their distribution. As a result, it is difficult to draw conclusions about the biomass status of these components of the stocks. However, only a small proportion (~1 t) of the line catch in 2011–12 comprised shark, and it is unlikely that this low catch would constitute overfishing.

Although trawl operations have contributed a considerable proportion of the total catch from the fishery in some years, there have been no trawl operations in the CSF since the 2006–07 season. Trawl operations in the CSF have historically targeted finfish and crustaceans. ABARES (2012) did not consider any finfish or crustaceans taken by trawl operations and there is limited information on the sustainability of harvest of these species groups within the fishery.

Stock status determination

The ABARES analyses indicates that the line catch in 2011–12 was unlikely to constitute overfishing, and there were no trawl or trap operations. As a result, the Line and Trap, and Trawl and Trap sectors are classified as **not subject to overfishing**.

Although it is unlikely that the finfish that make up the catch of line-and-trap operations are overfished, uncertainty remains about the impact of historical fishing on a few of the low-productivity finfish species, and on sharks and species that supported trawl operations. As a result, the Line and Trap, and Trawl and Trap sectors are classified as **uncertain** with regard to their biomass status.

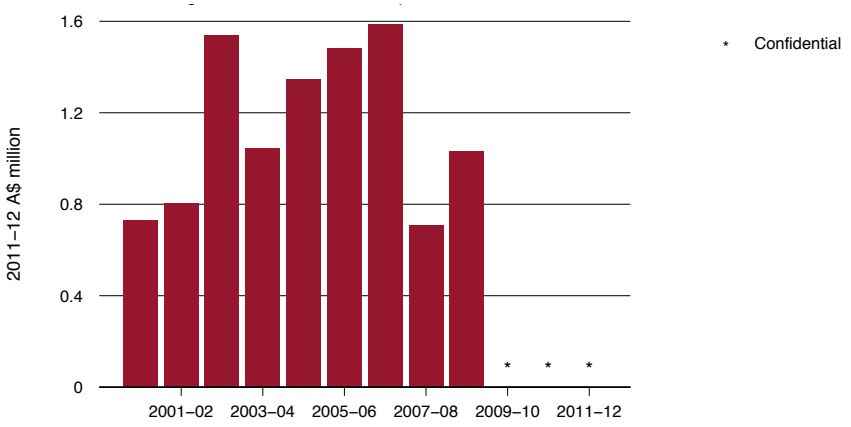
3.3 Economic status

3.3.1 Key economic trends

The Aquarium Sector is likely to have contributed most of the value of the CSF in recent years. The sector's gross value of production (GVP) is difficult to estimate because catch is reported as the number of fish rather than the weight of fish, and prices of individual fish vary with sex, colour, size and age. A large proportion of the species taken are exported and traded in US dollars. Therefore, the value of production is influenced by movements in the exchange rate. The Australian Bureau of Statistics records the exports of live Australian species of ornamental fish (with no distinction made between marine and non-marine species). In 2011–12, these exports were valued at $2.3 million (compared with $2.2 million in 2010–11), of which exports from Queensland accounted for 87 per cent. It is not possible to determine the CSF's contribution to this total. The Queensland Marine Aquarium Fish Fishery is larger than the CSF in terms of vessel numbers (DEEDI 2010) and is likely to make a larger contribution to total exports.

In 2011–12, the composition of fishing effort in other sectors of the fishery changed substantially compared with 2010–11. The number of hooks used increased from 555 in 2010–11 to 244 964 in 2011–12 (Table 3.2). At the same time, the number of trap lifts declined from 11 081 in 2010–11 to zero in 2011–12. The change in gear used is understood to have been caused by a change in the vessels operating and the markets accessed (AFMA, pers. comm., 2013). Total line and trap catch declined from 73.6 t in 2010–11 to 39.6 t in 2011–12. The GVP from these sectors also declined, but cannot be reported because of the small number of operators (Figure 3.2).

FIGURE 3.2 Real GVP in the CSF (excluding the Aquarium Sector), 2000–01 to 2011–12



Notes: **GVP** Gross value of production.

The Sea Cucumber Sector had a decline in catch and effort in 2011–12 compared with 2010–11. The substantial decline in catch (from 4.4 t in 2010–11 to 2.8 t in 2011–12), compared with the relatively steady decline in dive hours (116 in 2010–11 to 92 in 2011–12), suggests that net economic returns (NER) are likely to have declined in the sector (Table 3.2). Although GVP is confidential for this sector, a large proportion (57 per cent) of the 2011–12 catch was made up of white teatfish, a relatively highly valued sea cucumber species. Catch of this species declined from 3.1 t in 2010–11 to 1.6 t in 2011–12. This is likely to have had a negative influence on GVP.

There was no lobster catch in 2010–11 or 2011–12 and no trawl effort, and therefore these sectors did not generate any NER.

3.3.2 Management arrangements

The CSF is managed using a range of input controls and output controls. Given the relatively low value of the fishery, these arrangements are probably appropriate for keeping the cost of managing the fishery low.

3.3.3 Performance against economic objective

Low NER in this fishery are indicated by the existence of latent available effort units in some CSF sectors. For example, the Line and Trap Sector has had only a small number of active vessels in recent years (two vessels in 2011–12), despite eight permits being available. This suggests that fishers have had a low incentive to participate in the fishery, reflecting expectations of low profits. For the Aquarium Sector, on the other hand, the substantial increase in catch (27 583 individuals in 2010–11 to 39 819 individuals in 2011–12) relative to the increase in dive hours (3240 in 2010–11 to 3647 in 2011–12) suggests that NER are likely to have improved in that sector.

The CSF is a relatively data-poor fishery, and its performance against Harvest Strategy Policy objectives is difficult to assess. It is unclear whether the management settings (TACs and trigger levels) are in accordance with the economic objective of maximising NER.

3.4 Environmental status

The Australian Government Department of the Environment strategically assessed the CSF under Part 13 and Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* on 19 November 2010. Conditions placed on the 2010 approval relate to the management of threatened and endangered species, including school shark (*Galeorhinus galeus*), eastern gemfish (*Rexea solandri*) and humphead maori wrasse (*Cheilinus undulatus*). The catch of humphead maori wrasse, which is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, is subject to strict trade regulations. An annual take of 50 humphead maori wrasse was approved by DSEWPaC under the non-detriment finding process.

Eight Level 1 (Scale, Intensity, Consequence Analysis) ecological risk assessments have been completed for the CSF, covering a broad suite of species and associated habitats. A subsequent qualitative risk assessment was undertaken in 2009 for threatened, endangered and protected (TEP) species and chondrichthyans (AFMA 2009). A Level 2 ecological risk assessment for all TEP and chondrichthyan species was submitted to AFMA in 2012, and harvest strategy trigger limits may be updated in 2013.

AFMA publishes quarterly reports of logbook interactions with TEP species on its website, there were no reported interactions in the CSF in 2012.

3.5 Literature cited

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