11 Great Australian Bight Trawl Sector

A Moore and S Vieira

FIGURE 11.1 Relative fishing intensity in the Great Australian Bight Trawl Sector, 2009–11

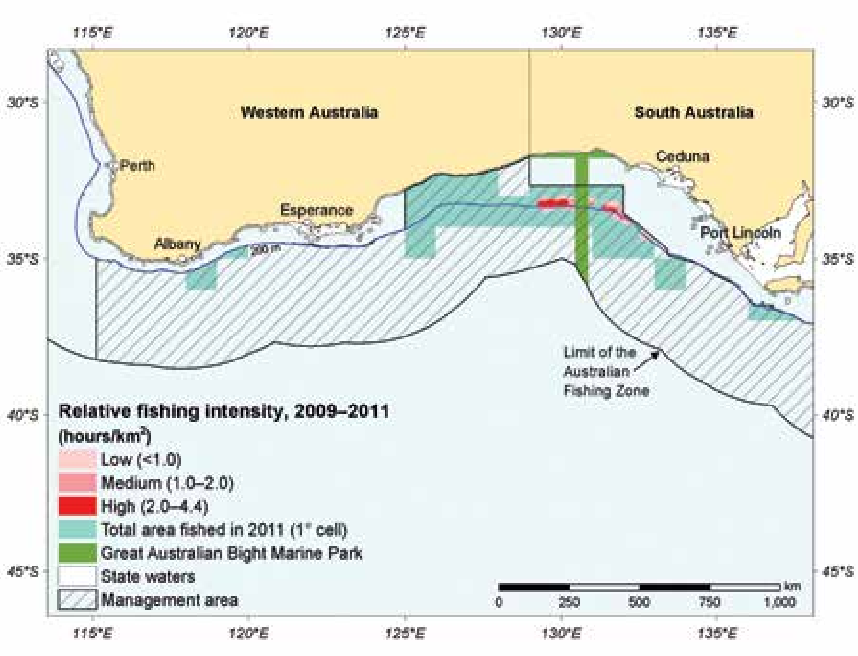


TABLE 11.1 Status of the Great Australian Bight Trawl Sector

Status	2010		2011		Comments
Biological status	**Fishing mortality**	**Biomass**	**Fishing mortality**	**Biomass**	
Bight redfish (*Centroberyx gerrardi*)					Estimate of current biomass is above target. Catches are below RBC.
Deepwater flathead (*Platycephalus conatus*)					Estimate of current biomass is above target. Catches are below RBC.
Ocean jacket, west (*Nelusetta ayraud*)					No formal assessment. Fishery-independent survey data indicate stock is not overfished. Catch appears stable in recent years and has not decreased.
Orange roughy (*Hoplostethus atlanticus*)					No formal assessment of biomass. Impact of historical catches uncertain. Only research catch in 2011.
Economic status	Estimates of NER are not available.				NER are likely to have become more positive in 2010–11. The two target stocks are above B_{MEY}, so there is potential for greater NER to be earned.

Notes: B_{MEY} Biomass producing maximum economic yield. **NER** Net economic returns. **RBC** Recommended biological catch.

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

11.1 Description of the fishery

The former Great Australian Bight Trawl Fishery was amalgamated with the Southern and Eastern Scalefish and Shark Fishery (SESSF) in 2003 to become the Great Australian Bight Trawl Sector (GABTS; Figure 11.1) of the SESSF. The GABTS can be divided into a continental-shelf fishery (in depths of less than 200 m), an upper continental-slope fishery (approximately 200–700 m), and a deepwater fishery (on the mid- to lower slope, 700–1000 m). In shelf waters, trawling is usually at 120–160 m, targeting mainly deepwater flathead and Bight redfish. The shelf fishery operates year round. Deepwater flathead catches and catch rates peak in October–December, while catches and catch rates of Bight redfish peak in February–April. For upper continental-slope trawling, other target species include blue grenadier (*Macruronus novaezelandiae*), western gemfish (*Rexea solandri*) and pink ling (*Genypterus blacodes*).

The deepwater fishery historically targeted orange roughy. In 1988, 68 per cent of the GABTS total effort was on the continental slope. However, there is now little effort at these depths, following the listing of orange roughy as conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999* and the 2007 closure of most of the historical orange roughy fishing grounds (>750 m depth).

Total fishing effort across all depths in 2011–12 was 6 259 trawl hours, about one-third the effort of the fishery peak in 2005 of 32 000 trawl hours (Figure 11.2). The continental shelf continues to be the focus of fishing effort, with 91–97 per cent of trawl hours between 2008 and 2011 recorded from this area. Effort on the continental shelf in 2011 was 5453 trawl hours; 806 trawl hours occurred on the continental slope (Figure 11.3). Reduced effort in the fishery has led to reduced catches over time. Deepwater flathead continues to dominate catches, with 1023 t landed in the 2011–12 fishing season, below the total allowable catch (TAC) of 1650 t. Bight redfish landings in 2011–12 were 352 t, well below the available TAC of 1716 t. Ocean jacket is an important byproduct species, with 220 t landed in 2011–12. Other key byproduct includes angel shark (*Squatina* spp.), yellow-spotted boarfish (*Paristiopterus gallipavo*), western gemfish (*Rexea solandri*) and jackass morwong (*Nemadactylus macropterus*). Substantial discarding is reported for some of these species.

The gross value of production (GVP) in the GABTS was \$11.1 million in 2010–11 (real terms, 2010–11 dollars). Of this, deepwater flathead contributed \$6.7 million (60 per cent of total GVP), and Bight redfish contributed \$1.5 million (13 per cent). After the 2006–07 peak (\$20.2 million), GVP declined substantially to \$9.5 million in 2008–09 recovering only slightly in 2009–10 to \$21 million.

The Commonwealth Fisheries Harvest Strategy Policy (HSP; DAFF 2007) applies to the key species in the GABTS (see Chapter 8). Under this framework, recommended biological catches (RBCs) are based on achieving a default target reference point of 48 per cent of the unfished biomass ($0.48B_0$), as a proxy for the biomass producing maximum economic yield (B_{MEY}). A study has been conducted by the Australian National University and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) using a bioeconomic model to estimate B_{MEY} for Bight redfish and deepwater flathead in the GABTS (Kompas et al. 2012). Estimated target reference points for these species are $0.43B_0$ for deepwater flathead and $0.41B_0$ for Bight redfish. The estimated B_{MEY} target for Bight redfish was accepted by the Great Australian Bight Resource Assessment Group (GABRAG) (AFMA 2011) and used to set the TAC for the 2012–13 fishing season. The estimated target for deepwater flathead will be used to set the RBC in 2012.

In addition to applying the HSP, the GABTS has implemented multiyear TACs for Bight redfish and deepwater flathead. The TAC for Bight redfish is set for three years, and assessments are updated every second year. The TAC for deepwater flathead is currently set for two years, with assessments conducted every second year. Decision rules are based on the results of annual fishery-independent trawl surveys or, where these are not available, standardised catch-per-unit-effort (CPUE). These rules also set the conditions under which a full stock assessment would be required earlier than the predetermined interval (AFMA 2008a). The GABTS has implemented a development strategy for species not currently under a TAC, with increasingly stringent, tiered data collection and assessment processes occurring at specified catch triggers (AFMA 2008a). This strategy is designed to improve information and assessment as catch increases.

FIGURE 11.2 Catch and effort in the GABTS shelf, 1988 to 2011

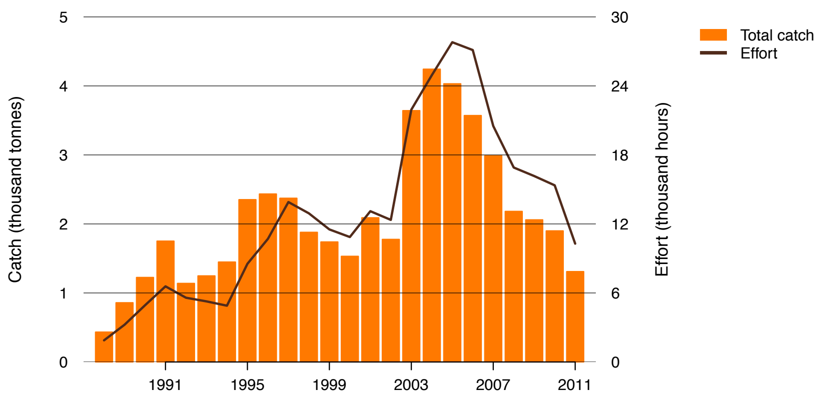


FIGURE 11.3 Catch and effort in the GABTS slope, 1988 to 2011

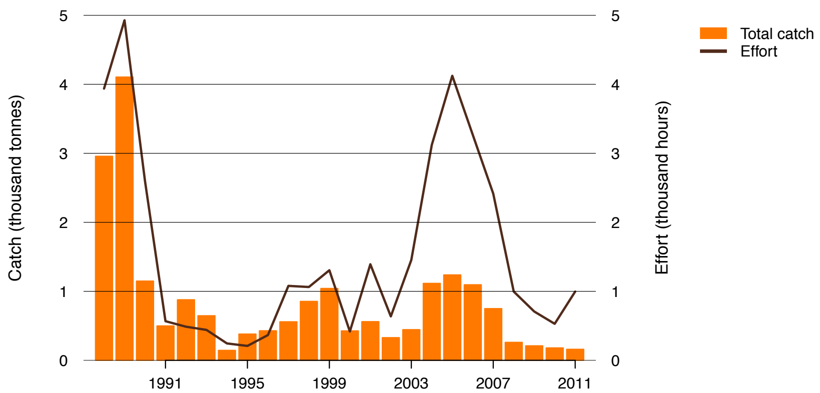


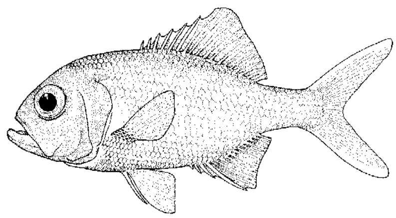
TABLE 11.2 Main features and statistics for the GABTS

Fishery statistics a	2010–11 fishing season			2011–12 fishing season		
Stock name	**TAC**	**Catch (t)**	**Real value (2009–10)**	**TAC**	**Catch (t)**	**Real value (2010–11)**
Bight redfish	1 653	310	$2.5 million	1716	352	$1.5 million
Deepwater flathead	1 100	961	$6.1 million	1650	1022	$6.7 million
Ocean jacket, west	–	166	$0.2 million	–	220	$0.3 million
Orange roughy **b**	0 (200, 50)	0 (133)	$0.5 million **c**	0 (200, 50)	0 (34)	$0.4 million **c**
Total fishery	**2 753 (250)**	**1 998**	**$12.1 million**	**3 366 (250)**	**2 280**	**$11.1 million**
Fishery-level statistics						
Effort	14 450 trawl hours, 0 seine shots			6 259 trawl hours, 525 seine shots		
Fishing permits	10 SFRs			10 SFRs		
Active vessels	5			4		
Observer coverage	721 trawl hours (4.5% of total trawl effort)			14 450 trawl hours (2.2%)		
Fishing methods	Trawl, Danish-seine					
Primary landing ports	Port Lincoln, Thevenard					
Management methods	Input controls: limited entry, area closures, gear restrictions Output controls: ITQs, TACs, trigger limits					
Primary markets	Melbourne, Perth					
Management plan	*Southern and Eastern Scalefish and Shark Fishery management plan* (DAFF 2003; amended 2009)					

a Fishery statistics are provided by fishing season, unless otherwise indicated. Fishing season is 1 May to 30 April. Real value statistics provided by financial year. **b** 200 t research quota and 50 t bycatch TAC in Albany and Esperance zones. **c** GVP for orange roughy includes value attributed to research catch.
Notes: ITQ Individual transferable quota. **SFR** Statutory fishing right. **TAC** Total allowable catch. – Not applicable.

11.2 Biological status

11.2.1 Bight redfish



Line drawing: FAO

Stock assessment

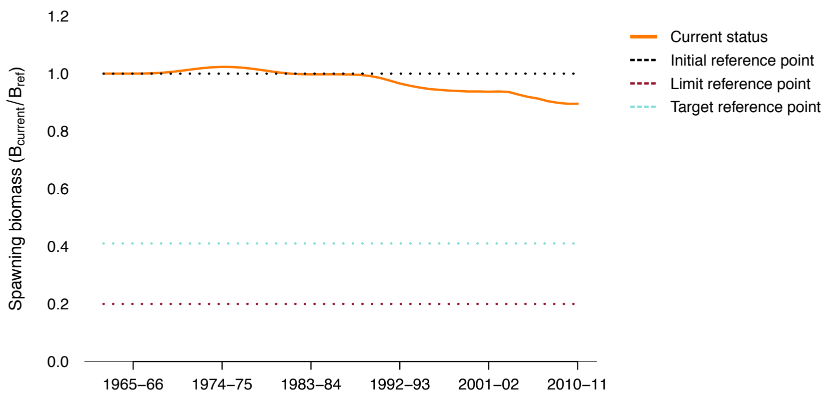
The most recent integrated stock assessment for Bight redfish in the GABTS (Klaer 2011) estimated spawning biomass to be above the target reference point in 2010–11 (Figure 11.4). The base-case model forecast Bight redfish spawning stock biomass (SB) at the start of 2012–13 to be 23 593 t—90 per cent of the unfished spawning biomass ($0.9SB_0$; Figure 11.4).

Fishery-independent trawl surveys have been undertaken annually since 2006 (except for 2010) to estimate relative abundance of the main target species on the shelf (Knuckey & Hudson 2007; Knuckey et al. 2008, 2009, 2011). The estimated relative biomass of Bight redfish for 2011 (13 189 t; CV 0.13) was 44 per cent lower than the 2009 estimate (23 410 t; CV 0.13) but similar to the 2008 estimate (14 591 t, CV 0.11). These variations in estimated relative biomass are likely to be due to availability of fish, rather than actual changes in abundance.

The RBC for the 2011–12 fishing season was 1556 t (AFMA 2011). The 2011–12 TAC set by the Australian Fisheries Management Authority (AFMA) Commission was 1556 t, and the actual TAC was 1716 t after carryover of uncaught quota from 2010–11. Landed catch in the 2011–12 season was 352 t, up from the catch reported in 2010–11 of 310 t (Figure 11.5).

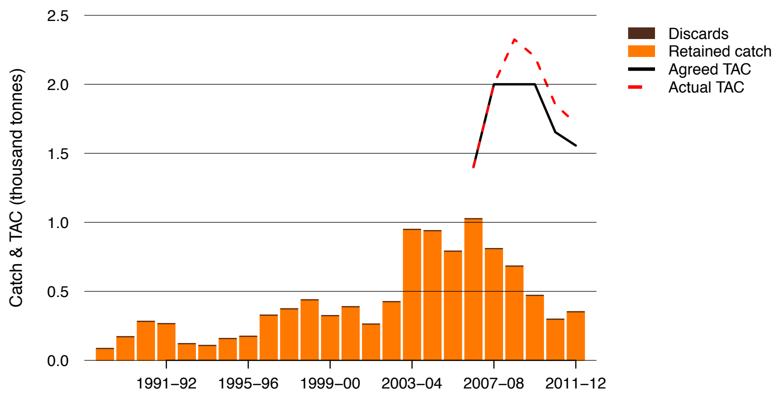
The target reference point for Bight redfish has been determined using bioeconomic modelling to be $0.41B_0$ (41 per cent of SB_0; Kompas et al. 2012). This was accepted by the RAG in 2011 (AFMA 2011). The RBC under the 20:40:41 harvest control rules was estimated at 5823 t for the 2012–13 fishing season.

FIGURE 11.4 Biomass estimate for Bight redfish in the GABTS, 1962–63 to 2010–11



Source: Klaer 2011

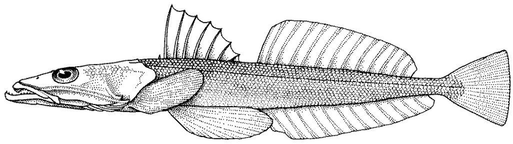
FIGURE 11.5 Catch of Bight redfish in the GABTS, 1988–89 to 2011–12



Stock status determination

The integrated stock assessment forecast biomass at the start of 2012–13 to be approximately 90 per cent of unfished spawning stock biomass, and catch continues to be well below the RBC. On this basis, Bight redfish is classified as **not overfished** and **not subject to overfishing**.

11.2.2 Deepwater flathead



Line drawing: Karina Hansen

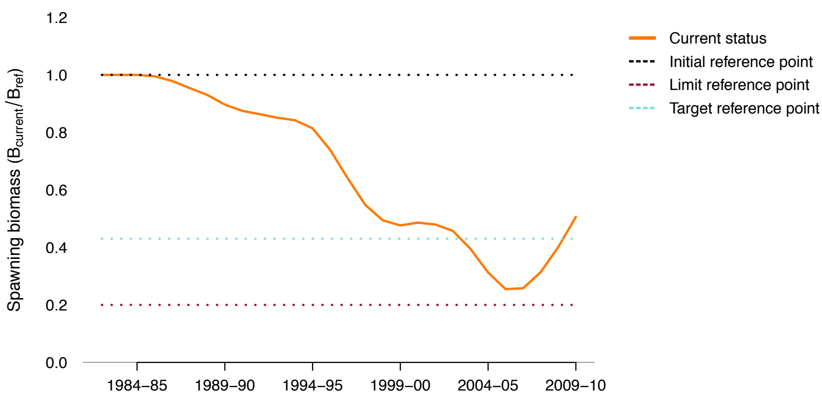
Stock assessment

The most recent integrated stock assessment for deepwater flathead in the GABTS (Figure 11.6; Klaer 2010) estimated that spawning biomass was above the target reference point in 2009–10. The base-case model forecast deepwater flathead spawning stock biomass at the start of 2012–13 to be 6414 t—62 per cent of unfished spawning stock biomass (0.62SB_0; Figure 11.6).

The relative biomass estimated from the results of the fishery-independent trawl survey for 2011 (9227 t; CV 0.05) is 7 per cent lower than the 2009 survey estimate (9942 t; CV 0.05) (Knuckey et al. 2009, 2011). Relative biomass estimates have remained similar from 2006 to 2011.

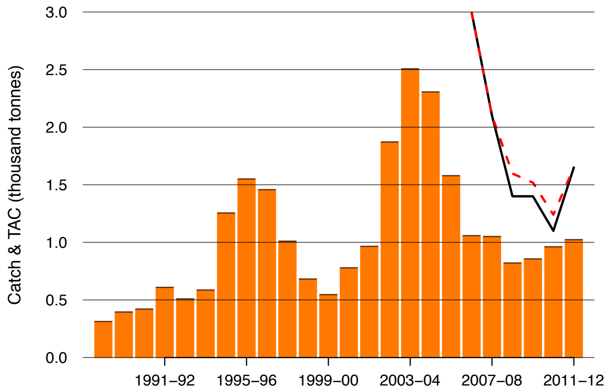
The RBC for the 2011–12 fishing season was 1500 t. The 2011–12 TAC was set by the AFMA Commission at 1650 t, with no carryover of uncaught quota. Landed catch in the 2011–12 season was 1023 t, up from the catch of 961 t in 2010–11 and 855 t in 2009–10 (Figure 11.7).

FIGURE 11.6 Biomass estimate for deepwater flathead in the GABTS, 1982–83 to 2009–10



Source: Klaer 2010

FIGURE 11.7 Catch of deepwater flathead in the GABTS, 1988–89 to 2011–12



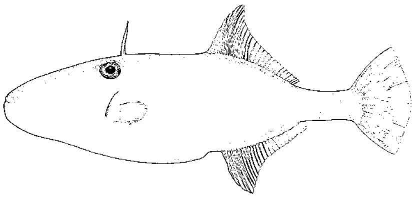
Note: TAC Total allowable catch

Stock status determination

The integrated stock assessment forecast biomass at the start of 2012–13 to be approximately 62 per cent of unfished spawning stock biomass, and catch continues to be well below the RBC. On this basis, deepwater flathead is classified as **not overfished** and **not subject to overfishing**.

Sorting GABTS catch
Tamre Sarhan AFMA

11.2.3 Ocean jacket, west



Line drawing: FAO

Stock assessment

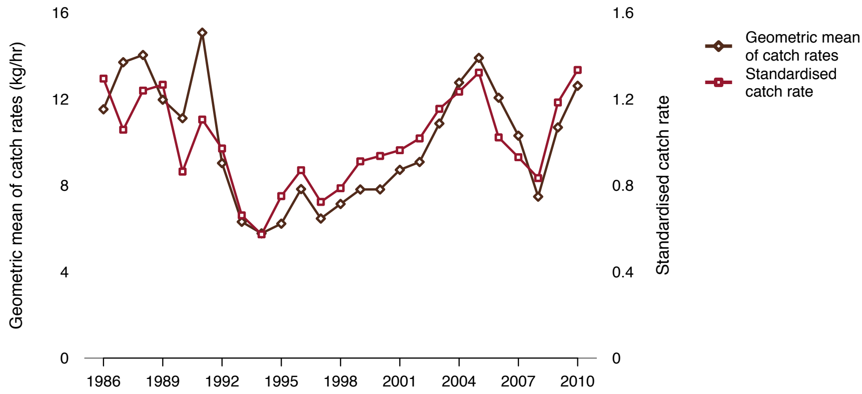
There is no formal stock assessment of ocean jacket in the GABTS. Standardised catch rates for ocean jacket in the GABTS are variable; with the most recent catch rates similar to the start of the series (1986) (Figure 11.8; Haddon 2012), suggesting that there has been no decline over this period.

In the fishery-independent trawl surveys (in 2006, 2008, 2009 and 2011), ocean jacket represented 16–35 per cent of survey catch by weight, with an increase in relative abundance between 2009 and 2011 (Knuckey & Hudson 2007; Knuckey et al. 2008, 2009, 2011). The bycatch survey of the GABTS in 2002 suggested that ocean jacket is often discarded (Knuckey & Brown 2002), raising concerns about use of CPUE as an index of abundance for this species. Based on integrated scientific monitoring, it is estimated that around four times the total landed catch was discarded in 2010 (Upston & Klaer 2011). If discard rates have changed over time, this would degrade the value of CPUE as an indicator of abundance, unless these changes can be accounted for.

Landed catch of ocean jacket peaked in 2005 at 526 t, and then decreased to 168 t in 2010 (Figure 11.9). Catch for the 2011–12 fishing season was 220 t, which is below the 10-year average of 296 t.

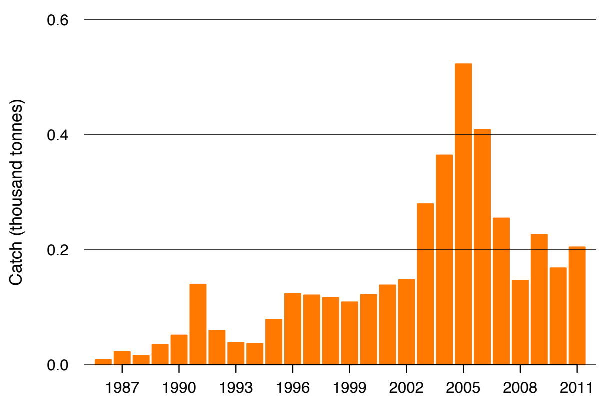
Historical catch data suggest that ocean jacket was fished down off the east coast of Australia in the 1920s and 1950s (Klaer 2001). Ocean jacket is a relatively short-lived species (~6 years), reaching maturity within 2–3 years, with large cyclical changes in abundance off eastern Australia (Miller & Stewart 2009). There are no age data for ocean jacket from the GABTS, and available length-frequency data are too dated to be used as an index of abundance.

FIGURE 11.8 Geometric mean catch rate for ocean jacket in the GABTS, 1986 to 2010



Source: Haddon 2012

FIGURE 11.9 Ocean jacket catch in the GABTS, 1986 to 2011 (Source Haddon 2012)

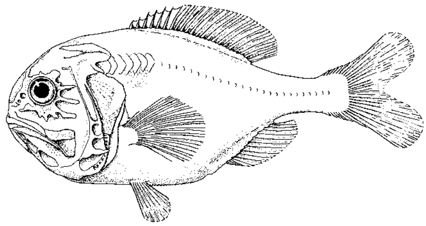


Source: Haddon 2012

Stock status determination

There is no formal stock assessment for ocean jacket in the GABTS. However, life history characteristics, results of the fishery-independent surveys and catch rates suggest that it is unlikely that the stock is overfished. Furthermore, the level of catch in 2011 is unlikely to constitute overfishing. On this basis, ocean jacket in the GABTS is classified as **not overfished** and **not subject to overfishing**.

11.2.4 Orange roughy



Line drawing: Rosalind Murray

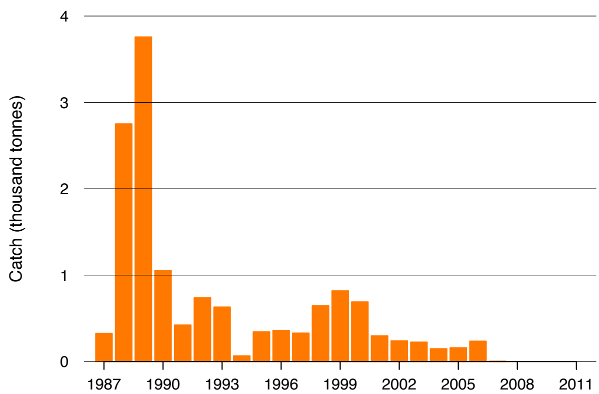
Stock assessment

No quantitative stock assessment has been conducted for orange roughy in the GABTS because the available data are sporadic and spatially scattered (Knuckey et al. 2010). The most recent review of data for orange roughy in this fishery was completed in 2004 (Wayte 2004). The review summarised spatial catch history from 1987 to 2003 across the Great Australian Bight. Catches of orange roughy were taken from 1987 onwards, with the largest catches being recorded between 1988 and 1989 (Figure 11.10). These early catches were reported as coming from temporary feeding aggregations associated with cold-water upwelling off Kangaroo Island and Port Lincoln. Catches from these aggregations ranged from 2500 t to 3784 t (Newton 1989). Aggregations have not since been found in the same locations (Wayte 2004). A spawning aggregation was discovered in 1990 on a ridge 30 nautical miles from the Port Lincoln grounds (Newton & Tuner 1990). This aggregation, which has also not been observed since, initially supported high trawl catches (40 t/shot), typical of lightly exploited orange roughy fisheries, but only yielded a total catch of 800 t.

Since 1990, most of the catch has come from grounds off Albany and Esperance in the western part of the GABTS. Catches off Albany peaked in 1993 at approximately 425 t and have fluctuated since then. Catches off Esperance peaked in 1999 at approximately 650 t and have decreased since. Early fishery-independent trawl surveys on the continental slope in the Great Australian Bight reported that orange roughy had the highest maximum catch rate (1820 kg/hour) of any slope species at that time (Newton & Klaer 1991). The highest catch rates came from the locations of the original aggregations off Kangaroo Island and Port Lincoln, although the survey found no large aggregations. It seems likely that orange roughy across the Great Australian Bight has been depleted, with no large aggregation being seen since 1990.

Orange roughy was listed as conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999* in 2006. A deepwater management strategy has therefore been implemented to address the requirements of the Orange Roughy Conservation Programme (AFMA 2006), under which fishing was closed in several research zones in the Great Australian Bight. The strategy identifies orange roughy 'research zones' that include the areas of the Great Australian Bight from which more than 96 per cent of the catch has historically been taken (1988 to 2005) and from which more than 99 per cent of the more recent catch was taken (2001 to 2005). Until sustainable harvest levels can be determined, fishing will be allowed in these zones only under a research program that has been approved by AFMA. The research quota for 2011–12 was 200 t, with 34 t taken. The 'bycatch TAC' for the Albany and Esperance zones remained at 50 t for the 2010–11 fishing season, with zero reported catch.

FIGURE 11.10 Orange roughy catch in the GABTS, 1987 to 2011



Stock status determination

There are no recent surveys or representative catch-trend data to determine the abundance of orange roughy in the Great Australian Bight. As a result, this stock is classified as **uncertain** with regard to the level of biomass. Given the zero reported commercial catch and the large spatial closures, orange roughy is classified as **not subject to overfishing**.

Spilling the net
Tristan New AFMA

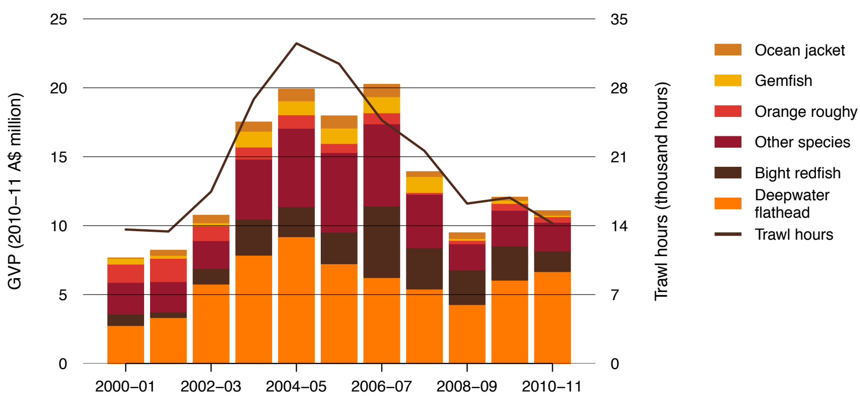
11.3 Economic status

11.3.1 Key economic trends

Estimates of net economic returns (NER) for the GABTS are not available. Analysis of the sector's real GVP shows that the sector's total value increased from $7.6 million in 2000–01 to $20.2 million in 2006–07 (2010–11 dollars; Figure 11.11). With declines in the sector's catch, substantial declines in GVP occurred in the two years after 2006–07. GVP in 2010–11 recovered slightly, to $11.1 million. Deepwater flathead accounted for the majority of the sector's GVP in 2010–11, valued at $6.7 million (60 per cent of total GVP), while Bight redfish accounted for $1.5 million (13 per cent).

Recent declines in catch are consistent with reductions in effort, which would have resulted in reduced sector costs. Changes in hours trawled have been closely correlated with changes in GVP over the past decade (Figure 11.11). Hours trawled increased rapidly from 2001–02, to 32 511 hours in 2004–05, and then declined steadily to 14 227 hours in 2010–11. Effort levels were 12 per cent lower in 2010–11 than in 2008–09. Coupled with a 17 per cent increase in GVP, this indicates an improvement in profitability in 2010–11.

FIGURE 11.11 GVP in the GABTS in real terms by key species, and trawl hours, 2000–01 to 2010–11



Although lower catches have driven the decrease in GVP, this has been partially offset by increasing prices received for key species caught in the sector (Figure 11.12). Prices in 2010–11 were $6.90 per kilogram for deepwater flathead and $5.00 per kilogram for Bight redfish (2010–11 dollars), up from $3.53 per kilogram for deepwater flathead and $2.07 per kilogram for Bight redfish in 2000–01. The higher prices in 2009–10 and 2010–11, which are considered to reflect improvements in product quality (GABMAC 2009, 2010), drove the increase in GVP between 2008–09 and 2010–11.

Trawling is the main method used in the sector, and this method is typically fuel intensive. Fluctuations in fuel prices are also likely to be a key driver of sector profitability. Like fish prices, the Australian average off-road diesel price followed an increasing trend for most of the decade (Figure 11.12). It peaked in 2007–08 at $1.07 per litre, before declining to $0.83 per litre in 2010–11. While rising fuel prices have negatively affected profitability, increases in fish prices since 2000–01 have reduced this impact. When combined with relatively lower effort and higher GVP, this suggests that NER are likely to have improved in 2009–10 and 2010–11.

FIGURE 11.12 Average prices for deepwater flathead and Bight redfish, and average off-road diesel price, 2000–01 to 2010–11

Note: The off-road diesel price is the price per litre paid by farmers (excludes goods and services tax and includes subsidies and rebates received by farmers).

Anecdotal reports indicate that prices received for deepwater flathead and Bight redfish decreased in the latter part of 2011–12, while the cost of fuel was relatively higher. In addition, there was reduced availability of both target stocks (Great Australian Bight Fishing Industry Association, pers. comm., 2012). These factors are likely to have reduced the profitability of the GABTS in the 2011–12 financial year.

11.3.2 Management arrangements

Like other SESSF sectors, the GABTS is a limited-entry fishery and is managed under TACs for key species, which are allocated as individual transferable quotas (ITQs). This is the Australian Government's preferred management approach, since ITQs typically promote greater economic efficiency. For the 2010–11 fishing season, most (961 t; 87 per cent) of the 1100 t TAC for deepwater flathead was caught. For Bight redfish, only 310 t (19 per cent) of the 1653 t TAC was caught. Market prices for Bight redfish are sensitive to supply (Kompas et al. 2012), so this high level of latency may indicate that fishers expected that taking a higher catch would reduce prices and would not have been profitable.

The GABTS began a trial of fishery co-management in July 2009 (AFMA 2012). Fisheries co-management can be defined as 'an arrangement in which responsibilities and obligations for sustainable fisheries management are negotiated, shared and delegated between government, fishers, and other interest groups and stakeholders' (FRDC 2008). Such an approach should be associated with improvements in the cost, efficiency and adaptability of management (FRDC 2008). For the GABTS, co-management has seen the Great Australian Bight Fishing Industry Association (GABIA) taking a greater role in management decisions, including making direct operational recommendations to AFMA, improving fisheries data collection, developing a chain-of-custody process to improve product traceability and developing a boat operating procedures manual. The trial of co-management arrangements received positive feedback from GABTS operators (GABMAC 2010), and these arrangements have been maintained in the fishery.

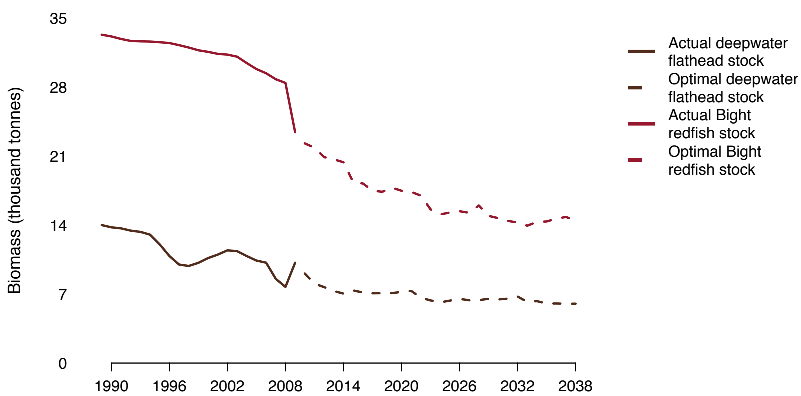
Industry recently applied to use pair trawling in the sector (AFMA 2011). This method involves the use of two vessels to tow a single net and can improve fuel efficiency and increase catch rates (Tietze et al. 2005). The introduction of pair trawling would be consistent with AFMA's objective of promoting efficiency and could allow operators to reduce the negative impact on profitability of rising fuel prices.

11.3.3 Performance against economic objective

A bioeconomic model has been used to estimate economic target reference points for the sector's two key target species, deepwater flathead and Bight redfish (Kompas et al. 2012). For deepwater flathead, the relevant target reference point has been determined as $0.43B_0$. For Bight redfish, the target reference point has been determined as $0.41B_0$. The most recent stock assessments for both species indicate that biomass levels are above these targets (Klaer 2010, 2011). This suggests that the economic performance of the fishery may not be constrained by low stock biomass and that, depending on the sensitivity of prices to supply, there is potential for increased profits. Kompas et al. (2012) predicted that increased profits will occur as the two key stocks are fished down to the MEY target reference points over a 10–20-year period (baseline case) (Figure 11.13).

The estimation of target reference points for the two key species has improved the information available to support targeting of stock levels that maximise NER. However, as noted by Kompas et al. (2012), the accuracy of the target for each species could potentially be improved with information on how prices for each species are influenced by catch levels. Taking these factors into account in the setting of target reference points for each target species would allow an improved assessment of economic performance.

FIGURE 11.13 Estimated and forecast optimal stock size for deepwater flathead and Bight redfish in the GABTS, 1989 to 2038



Source: Adapted from Kompas et al. 2012; data provided by Long Chu (pers. comm.)

11.4 Environmental status

Chapter 9 discusses strategic assessment processes for the SESSF. The GABTS ecological risk management report (AFMA 2008b) indicated that two byproduct invertebrate species groups—cuttlefish (various species) and octopods (various species)—were at high risk (Level 2 Residual Risk Assessment); this risk determination primarily reflected a lack of data. The Level 3 Sustainability Assessment for Fishing Effects (SAFE) excluded invertebrates and indicated that fishing mortality did not exceed the reference point for any of the 204 vertebrate species assessed (Zhou et al. 2007). Impacts on bycatch species are likely to have been reduced by a reduction in effort and closures in the fishery.

AFMA publishes quarterly reports of logbook interactions with threatened, endangered and protected species on its website. One seal was entangled in trawl gear in the GABTS in 2011. The seal was reported as dead, and anecdotal reports suggest that it was a decayed carcase at the time of capture.

Most shelf trawls are on regularly trawled, soft, sandy substrates with little sessile fauna or flora, but some exploratory trawls near the established grounds reported substantial benthic bycatch. The Fisheries Research and Development Corporation project 'Supporting sustainable fishery development in the GAB with interpreted multi-scale seabed maps based on fishing industry knowledge and scientific survey data' (project 2006/036) is expected to provide useful information and tools to better understand benthic habitats and sustainable management of the GABTS.

The codend
Tristan New AFMA

11.5 Literature cited

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