Chapter 8
Southern and Eastern Scalefish and Shark Fishery

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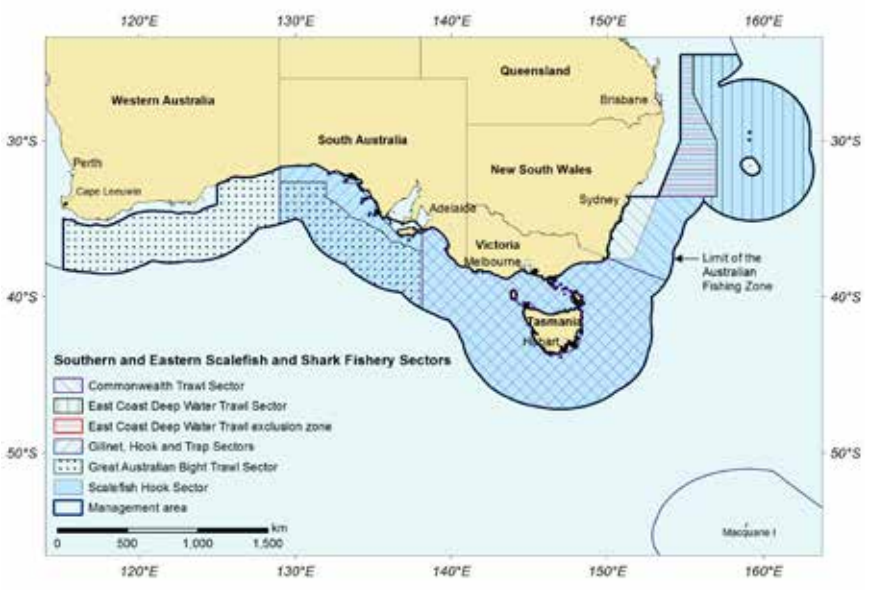
FIGURE 8.1 Area of the Southern and Eastern Scalefish and Shark Fishery



8.1 Description of the fishery

The Southern and Eastern Scalefish and Shark Fishery (SESSF) is a multisector, multigear and multispecies fishery, targeting a variety of fish, squid and shark stocks. The SESSF is the largest Commonwealth fishery in terms of volume produced, contributing around half of the total volume of Commonwealth landed catch. It is also the largest Commonwealth fishery in terms of production value, and accounted for 28 per cent of the gross value of production (GVP) of Commonwealth fisheries in 2012–13. The management area covers almost half the area of the Australian Fishing Zone (Figure 8.1), and spans both the Commonwealth waters and the waters of several Australian states under Offshore Constitutional Settlement arrangements. A number of the reserves within the Commonwealth marine reserve network established by the Australian Government fall within the SESSF management area (AFMA 2014).

The primary mechanism for controlling the harvest of stocks in the SESSF is through the allocation of annual total allowable catches (TACs). The TACs are determined for all key target species and several byproduct species. The TAC for each stock is distributed among fishers as individual transferable quotas for the fishing season. In addition to TACs, management arrangements in the SESSF include limited entry, gear restrictions (for example, restrictions on mesh size, net length, setting depth, hook limits and trap dimensions), spatial closures, prohibited species (for example, black cod—*Epinephelus daemelii*), trip limits for certain species (for example, snapper—*Pagrus auratus*), codes of conduct and requirements for observer/video coverage and vessel monitoring systems.

Mixed catch
Tamre Sarhan, AFMA

The SESSF was established in 2003 through the amalgamation of four fisheries—the South East Trawl, Great Australian Bight Trawl, Southern Shark Non-trawl and South East Non-trawl fisheries—under a common set of management objectives. The SESSF management plan 2003 came into operation on 1 January 2005 (amended in 2009). Originally, each of the four fisheries had its own management advisory committee; in 2009, the Australian Fisheries Management Authority (AFMA) created the South East Management Advisory Committee (SEMAC) to provide advice to the AFMA Commission on management measures for the entire SESSF. The Small Pelagic Fishery Management Advisory Committee (MAC) and SquidMAC became part of SEMAC in 2010, whereas the Great Australian Bight Trawl Sector MAC remains separate. Co-management trials were undertaken in the Great Australian Bight Trawl Sector (GABTS) with the Great Australian Bight Industry Association (GABIA), and in the Commonwealth Trawl Sector (CTS) with the Lakes Entrance Fishermen's Co-operative Society Limited (LEFCOL). The trials aimed to test approaches for AFMA and industry to work together to reduce regulatory burden and increase the efficiency of fisheries management, without sacrificing sustainability. The trials also focused on ways to streamline and simplify the day-to-day administration of the fishery. The trials have now concluded and GABIA continues to work with AFMA under co-management arrangements for the fishery. A report on the trials is expected to be published in late 2014.

SESSF landings declined from a peak of almost 37 000 t in 2002 to 10 673 t in 2013–14 as a result of reductions in TACs and fishing effort. The GVP was $91.8 million in the 2012–13 financial year, an increase from $83.4 million in 2011–12. The SESSF was one of the target fisheries of the Securing our Fishing Future structural adjustment package (2006–07), which substantially reduced the number of fishing vessels through the purchase of fishing endorsements. Although this package contributed to lower landings and GVP, net economic returns (NER) improved for the remaining participants in the fishery (Vieira et al. 2010).

8.2 Sectors of the fishery

Current management arrangements are structured around the four primary sectors of the fishery: the CTS; the East Coast Deepwater Trawl Sector (ECDTS); the GABTS; and the Gillnet, Hook and Trap Sector (GHaTS).

The status of stocks taken in these sectors is discussed in Chapters 9, 10, 11 and 12. The GHaTS includes the Scalefish Hook Sector (ScHS), the Shark Gillnet and Shark Hook sectors (SGSHS), and the Trap Sector. In this report, the ScHS is reported with the CTS (Chapter 9) because most of their target species are shared. The SGSHS is reported separately (Chapter 12). The trap sector is not reported in detail because of its low fishing effort and landings. Chapters 10 and 11 focus on stocks taken in the ECDTS and GABTS, respectively.

8.3 Harvest strategy performance

A tiered harvest strategy framework (HSF) has been applied in the SESSF since 2005. The framework has evolved since its introduction, particularly after the release of the Commonwealth Fisheries Harvest Strategy Policy (HSP; DAFF 2007). The current SESSF HSF is described in AFMA (2009), and applies to all sectors and all species under quota. The HSF currently uses three tiers (1, 3 and 4; Tier 2 has been phased out), which have been developed to accommodate different levels of data quality or knowledge about stocks (AFMA 2009). Tier 1 assessments are quantitative, model-based stock assessments that are conducted for stocks with the highest quality of data or information. The Tier 3 assessment methodology primarily involves catch-curve analyses of age (or size) composition data, together with information on size-at-maturity and selectivity, to provide estimates of fishing mortality rates. Tier 4 involves an assessment of trends in standardised catch rates, and is undertaken for stocks for which only catch-and-effort data are available.

The target and limit reference points for each tier reflect those prescribed in the HSP. All tier levels generate a recommended biological catch (RBC) through associated harvest control rules (AFMA 2009) that are intended to move stock biomass towards the target reference point. RBCs are translated into TACs through a set of predetermined rules, which include deductions for discarding, recreational catches and state catches. The level of precaution applied in RBCs is intended to increase from Tier 1 to Tier 4, reflecting the increasing level of uncertainty in assessments. To this end, TACs are reduced using discount factors of 5 per cent and 15 per cent for species assessed using the Tier 3 and Tier 4 harvest control rules, respectively, unless other management arrangements are considered to have introduced an equivalent level of precaution. The SESSF Resource Assessment Group (SESSFRAG) has also produced guidelines on the implementation of various post-assessment 'meta-rules' (recent catch-rate modifiers, minimum and maximum change rules, and discount factors). Since 2012, there has also been a move towards greater recommendation and implementation of multiyear TACs in the SESSF, whereby a safe RBC (incorporating appropriate precaution) is estimated for a period longer than one year—typically three or five years. This provides a basis for setting TACs for longer periods, which provides greater catch stability for industry, and reduces the number of annual assessments and therefore the assessment cost.

The SESSF contains several stocks that are classified as overfished (that is, the current biomass is estimated to be below the limit reference point). These overfished stocks are blue warehou (*Seriolella brama*), eastern gemfish (*Rexea solandri*), gulper sharks (*Centrophorus harrissoni*, *C. moluccensis*, *C. zeehaani*), school shark (*Galeorhinus galeus*), and orange roughy (*Hoplostethus atlanticus*) in two zones (southern and western). There are various reasons for these stocks remaining below the limit reference point despite management under rebuilding plans. Reasons might include ongoing catches exceeding levels that will facilitate rebuilding, changes in stock productivity, or slow recovery because of the biology of the species (Ward et al. 2013).

For overfished stocks, the harvest control rules in the SESSF HSF, in line with the HSP, recommend a zero RBC. AFMA typically allocates minimum incidental catch allowances to cover catches when fishers are targeting other species. Although the SESSF HSF does not provide guidelines for setting these catch allowances, the SESSFRAG-agreed process uses companion species analysis to estimate the quantities of species taken as bycatch when fishing for other species, and these data feed into advice on appropriate setting of bycatch TACs. In some cases, catch allowances may have been set above levels required to allow recovery of the stock within stipulated rebuilding timeframes. In other cases, even with zero catch, stocks may not rebuild within stipulated rebuilding timeframes because of their low natural productivity at low stock size. The SESSF HSF is currently being reviewed to provide guidelines for setting catch allowances for overfished species.

The performance of the SESSF HSF against the economic objective of maximising NER has improved. Indications are that NER increased in the CTS and GHaTS in the years immediately following the implementation of the SESSF HSF (George & New 2013). However, the impacts of the HSF are difficult to separate from other factors, such as the influence of the Securing our Fishing Future structural adjustment package (Ward et al. 2013). Up to half the available TACs, established at levels designed to achieve maximum economic yield (MEY), have remained uncaught in recent years, and there is scope for further improvement in NER from fully catching these TACs.

Quota species caught in the CTS and GHaTS are currently managed towards a B_{MEY} (biomass at maximum economic yield) target, although these targets are not estimated using a bioeconomic model because of the complexity and high data requirements of these models. For species that have had a maximum sustainable yield (MSY) estimated, a $1.2B_{MSY}$ proxy for B_{MEY} is used as the target. For other species, a target that is equivalent to the proxy $0.48B_0$ (48 per cent of the unfished biomass) is applied. There may be potential to improve economic performance of the fishery by developing estimated B_{MEY} targets for multiple species for some of the more valuable quota species, rather than the default proxy applied to individual species. Consideration is also being given to alternative approaches to setting targets for secondary species (that is, those that are not targeted and contribute a small proportion of the NER). Following guidance from SESSFRAG, the smaller, ecosystem focused assessment groups, the Slope Resource Assessment Group (which is responsible for the monitoring, assessment and reporting for upper continental slope and deepwater species) and the Shelf Resource Assessment Group (which is responsible for the monitoring, assessment and reporting of species associated with the shallow areas of the continental shelf), have recommended targets at B_{MSY} levels, below the B_{MEY} proxy, for a small number of secondary species, and AFMA has agreed to adopt these alternative targets (SEMAC 2014).

The multispecies nature of the CTS and GHaTS, and the multiple gears used to harvest many quota species complicate the optimisation of harvests to obtain MEY, because of differences in the profitability of the various methods and species that are caught together in the fishery. Augmenting current stock assessments with available economic survey data may provide a cost-effective means of estimating MEY targets for a broader range of species. For example, current work (under a Fisheries Research and Development Corporation project) on setting harvest reference points in multispecies fisheries may provide guidance on how to better target MEY. The results of work aimed at developing target reference points for data-poor fisheries (Pascoe et al. 2011) may present other options.

For the GABTS, the development of a bioeconomic model for the sector's two key target species (Kompas et al. 2012) has allowed TACs to be set in line with achieving estimated B_{MEY} targets.

8.4 Biological status

Of the 37 stocks (34 under quota) assessed across the SESSF in 2013, 31 were not subject to overfishing and 26 were not overfished, none were subject to overfishing and 6 were overfished, 6 were uncertain with regard to the level of fishing mortality, and 5 were uncertain with regard to the level of biomass (Figures 8.2 and 8.3).

The number of stocks assessed for status in the SESSF increased from 24 in 2004 to 37 in 2013. As a result, the percentage of stocks classified in each status may be more informative than the number. The percentage of stocks classified as not subject to overfishing in the SESSF increased to 84 per cent in 2013, from 4 per cent in 2004. The percentage of stocks classified as not overfished increased to 70 per cent in 2013, up from 24 per cent in 2004.

The percentage of stocks that were uncertain with regard to the level of fishing mortality and/or biomass has decreased substantially in recent years. In 2004, 72 per cent of stocks in the SESSF were classified as uncertain with regard to the level of fishing mortality, and 56 per cent were classified as uncertain with regard to the level of biomass. These figures declined to 14 per cent of stocks uncertain with regard to the level of fishing mortality in 2013 and 16 per cent uncertain with regard to the level of biomass in 2013.

The percentage of stocks in the SESSF classified as subject to overfishing decreased from 24 per cent in 2004 to zero in 2013; this is the first time that no stocks have been classified as subject to overfishing since 2006. The percentage of stocks classified as overfished decreased from 20 per cent in 2004 to 16 per cent in 2013. Eastern gemfish was classified as overfished and uncertain if subject to overfishing in 2013. Ocean perch (*Helicolenus barathri*, *H. percoides*) was classified as not overfished and not subject to overfishing in 2013, which is a change from uncertain for fishing mortality and biomass in 2012. Gulper sharks remain classified as overfished, but were classified as uncertain with regard to the level of fishing mortality as a result of implementation of various measures to reduce targeting and catches. Blue warehou remains classified as overfished because there are still no signs of recovery under current catch levels. School shark remains classified as overfished in 2013. AFMA continues to work with stakeholders to control the level of fishing mortality for these stocks and to facilitate rebuilding. Elephantfish (*Callorhinchus milii*) and sawshark (*Pristiophorus cirratus*, *P. nudipinnis*) both changed from uncertain with respect to fishing mortality and biomass in 2012 to not subject to overfishing and not overfished in 2013. Orange roughy (southern and western zone) remains classified as overfished, but current management arrangements are seeing recovery towards the limit reference point.

FIGURE 8.2 Fishing mortality status for all stocks in the SESSF, 2004 to 2013

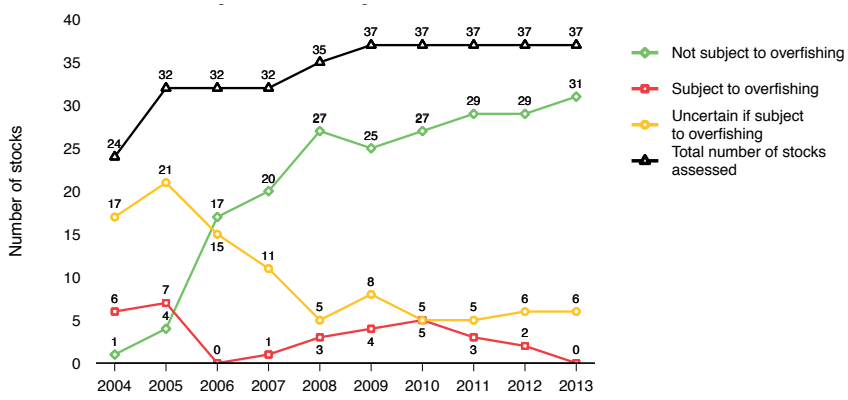
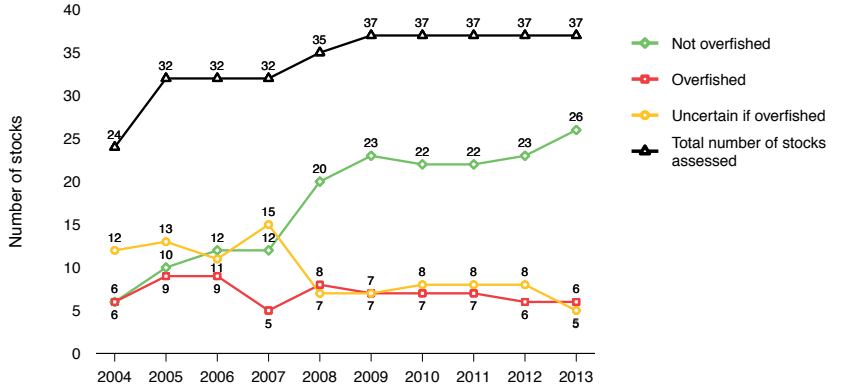


FIGURE 8.3 Biomass status for all stocks in the SESSF, 2004 to 2013



Blue grenadier
Heesham Garroun, AFMA

8.5 Economic status

The SESSF HSF provides a framework to assess the economic status of the fishery. Indicators of stock biomass are used to assess the current biomass of species relative to their B_{MEY} target (or its proxy, $0.48B_0$). When this information is combined with indicators of profitability and efficiency, the economic status of SESSF sectors can be assessed in terms of whether they are moving towards or away from MEY.

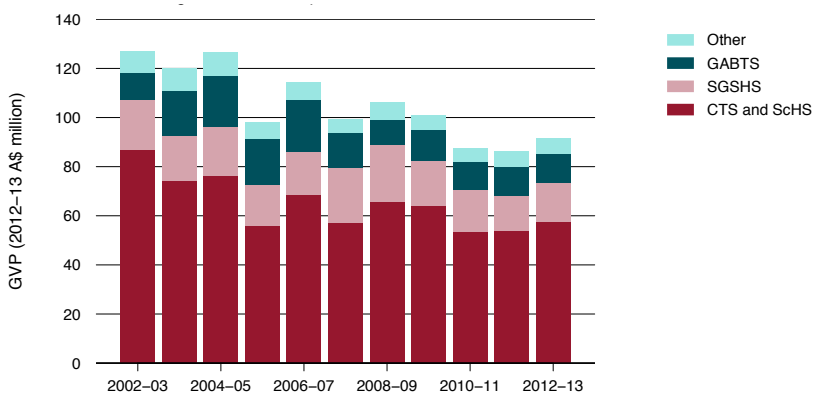
Scalefish catches in the CTS and ScHS accounted for 66 per cent of SESSF GVP in 2012–13 (Figure 8.4). These sectors are therefore key drivers of economic performance in the SESSF. Of these two sectors, only the CTS is surveyed as an individual sector by ABARES as part of its fishery economic surveys program; the ScHS is surveyed as part of the GHaTS. The NER for the CTS have followed a positive trend since 2004–05. As well, the estimated biomass of three of the sector's four most valuable species (blue grenadier, silver warehou and tiger flathead—*Neoplatycephalus richardsoni*) are close to their B_{MEY} targets (Chapter 9). This indicates that the economic status of the CTS is positive and has substantially improved since 2004–05. However, it could be further improved if catches approached TACs for other species, and proxy target reference points were replaced with more appropriate, cost-effective estimates of B_{MEY} for some of the more valuable species in the sector.

Historically, orange roughy has contributed substantially to the CTS GVP. The rebuilding of orange roughy stocks over the longer term should also improve the sector's economic status, although sustainable harvests of this species are likely to be lower than peak historical levels.

Economic indicators for the GHaTS were used to assess the economic status of the SGSHS, which accounted for 71 per cent of GVP in the GHaTS in 2012–13. For the decade preceding 2009–10, estimates of NER in the GHaTS had been positive. In 2009–10, estimates became negative (–$0.4 million) and remained at similar levels in the following two financial years. This is despite biomass levels of gummy shark (*Mustelus antarcticus*), the sector's main target species being close to or above the stock's target reference point (Chapter 12). Recent spatial closures aimed at reducing marine mammal interactions in the sector may have contributed to this change, as well as the school shark controls and their impacts on gummy shark catches. A key challenge for the sector is the rebuilding of the school shark stock; this could lead to increases in NER in the future but is likely to be associated with adjustment costs.

The development of a bioeconomic model for the two key species targeted in the GABTS (deepwater flathead—*Platycephalus conatus*, and bight redfish—*Centroberyx gerrardi*) has improved the ability of fishery managers to target B_{MEY} (Kompas et al. 2012). The most recent stock assessments for bight redfish projected biomass levels at the start of 2013–14 to be above the B_{MEY} target (Klaer 2010, 2011, 2012), potentially allowing increased profits from the species as it is fished down to its MEY target reference point. However, the most recent stock assessment for deepwater flathead suggests that biomass levels need to be rebuilt towards the B_{MEY} target (Chapter 11). Nonetheless, fishery profitability is unlikely to be constrained by stock status, with biomass forecast to increase to $0.39B_0$ in 2013–14, just below the MEY target reference point of $0.43B_0$.

FIGURE 8.4 Real GVP in the SESSF by sector, 2002–03 to 2012–13



Notes: **CTS** Commonwealth Trawl Sector. **GABTS** Great Australian Bight Trawl Sector. **GVP** Gross value of production. **ScHS** Scalefish Hook Sector. **SGSHS** Shark Gillnet and Shark Hook sectors. GVP for the SGSHS only includes gummy, school and sawsharks, and elephantfish, caught in the gillnet and hook sectors. GVP for other sectors includes non-scalefish product caught in the CTS and ScHS, non-shark product caught in the SGSHS, and product caught in the Victorian Inshore Trawl and East Coast Deepwater Trawl sectors of the SESSF.

In the ECDTS, low levels of fishing effort have prevailed in recent years. Low expected profit in the sector appears to have discouraged activity in the fishery. As a result, the sector has generated minimal NER.

Overall, the current economic status of the SESSF is mixed. The negative change in economic performance in the GHaTS has occurred at the same time as continued NER improvements in the CTS, while the GABTS now pursues estimated B_{MEY} targets for its key species. The deterioration in economic performance in the GHaTS demonstrates that management of bycatch and other environmental issues (for example, interactions with threatened, endangered and protected [TEP] species) can have significant implications for a fishery's economic performance, and such factors should be taken into account when attempting to meet bycatch management objectives. The SESSF HSF will continue to make an important contribution to the fishery's economic performance by guiding management decisions that explicitly aim to maximise NER.

8.6 Environmental status

General bycatch and discards

Bycatch is defined in the HSP as 'species taken incidentally in a fishery where other species are the target, and which are always discarded' (DAFF 2007). Tuck et al. (2013) evaluated bycatch and discards (including target and byproduct species) in a number of Commonwealth fisheries, including the SESSF, and concluded that trawling in the South East Trawl (SET) fishery and GABTS, and Danish-seining account for the greatest volume of unintended bycatch in the Commonwealth fisheries examined. This largely reflects the high level of fishing activity in these sectors and fisheries. Bycatch and discards largely comprise small fish species with little or no commercial value, but can also include crustaceans, sharks, molluscs, marine mammals, reptiles and birds.

Twenty years of monitoring by the Integrated Scientific Monitoring Program (ISMP) have shown a reduction in the volume of trawl discards since the mid-2000s. Trawling effort in the SESSF declined by about one-third over this time. In conjunction with changes in mesh types and increased mesh sizes used in trawl net codends, this probably explains much of the reduction in discards. Tuck et al. (2013) found that discard rates for quota species have been variable and dependent on market prices, availability of quota and the influx of small fish, particularly blue grenadier. However, data for catch, bycatch and discards for rarer or non-target species are often lacking, as economic reasons can mean that observer coverage is focused on key commercial species.

In the context of discarding in the SET and GABT sectors of the SESSF, a distinction can be made between highly targeted shots at single-species aggregations (such as orange roughy or blue grenadier) and general shots for multiple species. The latter is often referred to as 'market fishing' and is associated with higher levels of byproduct and discarding (target and non-target species) (Tuck et al. 2013). The ISMP has revealed that up to 50 per cent of catch weight is caught and discarded in the 'market fishery' of the SET fishery and 40 to 60 per cent in the GABTS (Tuck et al. 2013). Commercial species are discarded for various reasons, but the majority of discards are small fish species with little or no commercial value. In comparison, studies of more targeted fishing have shown that bycatch can be minimal; less than 1 per cent for orange roughy in the GABTS, and less than 2 per cent in the South East Trawl fishery.

A key change in the SET fishery has been the setting of the minimum codend mesh size at 90 mm; this was introduced in 1965 to reduce the catch of small tiger flathead (Tuck et al. 2013). Studies have shown an escapement rate of around 70 per cent of all species swept into the codend that are able to fit through the mesh, equating to around 30 per cent of the catch weight (Tuck et al. 2013). Individuals passing through were mainly small finfish. Other changes that have helped reduce bycatch in both the SET fishery and GABTS include the use of 'T-90 panels' or 'T-90 lengtheners'. Trials of mesh size and type led to mandatory requirements for bycatch reduction in the SET fishery in 2006 and the GABTS in 2007. Tuck et al (2013) state that, as yet, there has been no formal testing of the level of bycatch reduction achieved through these measures.

Changes in the Danish-seine component of the fishery have been limited, despite trials showing that a change from 75 mm mesh to T-90 in codends did not affect catch weight of targeted species but reduced the catch weight of non-commercial species by around 27 per cent (across the study). Reasons for the lack of change include limited spatial and temporal coverage of the trials and concern from industry about the use of the T-90 codend at various times of the year (Tuck et al. 2013).

In the GHaTS, which includes the SGSHS, discarding of target species is minimal, with 2 per cent of teleosts and 3 per cent of chondricthyans discarded (Walker et al. 2005). However, reports of increased school shark abundance in recent years may have led to an increase in discarding of this species under the incidental catch TAC. Trials to estimate discards for non-target species have found that discards can account for more than 30 per cent of catch weight in commercial nets (six-inch mesh) (Tuck et al. 2013); the most commonly discarded species were draughtboard shark *Cephaloscyllium laticeps*), Port Jackson shark (*Heterodontus portusjacksoni*) and spikey dogfish (*Squalus megalops*). Discards increase to average 40 per cent and almost 80 per cent for 5-inch and 4-inch mesh sizes, respectively, across the study (Braccini et al. 2009).

Protected species bycatch

The SESSF sectors interact with a number of species listed as protected or conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Five previous target species in the SESSF are listed as conservation dependent: orange roughy, eastern gemfish, Harrisson's dogfish (*Centrophorus harrissoni*), southern dogfish (*C. zeehaani*) and school shark. Blue warehou has been nominated for listing under the EPBC Act. These species, discussed in Chapters 9 and 12, are under rebuilding or recovery strategies. They are currently managed under incidental catch allowances, closed areas and trip limits, to allow for incidental catch while targeting other species.

Recent reductions in bycatch of TEP species have been observed, to varying degrees. However, the reductions are difficult to attribute to recent measures to protect TAC species because of a lack of data. These measures have included fishery closures to protect Australian sea lions and gulper sharks; seabird mitigation measures for longline and trawl fisheries; seal, turtle and other bycatch excluder devices; and gear changes (Tuck et al. 2013). Trends in TEP species interactions are also difficult to interpret with confidence because the ISMP was originally designed only to provide estimates of the retained and discarded proportions of fish catch in the SESSF. A review of the ISMP in 2009 sought to facilitate better estimates of bycatch for TEP (and major non-quota) species.

Fishers are required to take all reasonable steps to avoid interactions with protected species (other than those listed as 'conservation dependent') and report all interactions in their logbooks. An interaction is defined as any physical contact that a person, boat or gear has with a protected species, including catching and colliding with any of these species. AFMA reports all interactions with protected species recorded in logbooks to the Australian Government Department of the Environment on a quarterly basis. These reports (which are published on the AFMA website) provide the basis for reports of the number of interactions with protected species within the SESSF in 2013. Interactions are known to occur with species groups protected under the EPBC Act, including marine mammals (cetaceans and pinnipeds), seabirds, sharks (white shark—*Carcharodon carcharias*, grey nurse shark—*Carcharias taurus*, shortfin mako shark—*Isurus oxyrinchus*, porbeagle shark—*Lamna nasus*) and syngnathids (seahorses and pipefish). Although these interactions are rare, they can have a significant impact on some species with small populations. However, it is difficult to obtain robust estimates of interaction rates at low levels of observer coverage or monitoring, especially when such interactions are rare.

Sorting the catch
Gavin Kewan, AFMA

Pinnipeds (seals and sea lions)

The areas fished by the SESSF overlap with the distributions of the Australian fur seal (*Arctocephalus pusillus doriferus*), New Zealand fur seal (*A. forsteri*) and Australian sea lion (*Neophoca cinerea*). Fur seal populations have recovered substantially following heavy harvesting in the 18th and 19th centuries, but sea lions are currently listed under the EPBC Act as vulnerable. The CTS and Shark Gillnet Sector, in particular, are known to interact with these species, whereas interactions with the hook sectors are much rarer. Between 1993 and 2000, data collected by the ISMP and its precursor (the Scientific Monitoring Program) indicated that an average of 720 fur seals might be caught incidentally by small trawlers operating in the CTS each year (Knuckey et al. 2002). Because of their smaller vessels and net sizes, wet-boat trawlers have reduced ability to apply mitigation methods such as seal excluder devices (SEDs), which are designed for larger nets. Trials of a flexible SED design suitable for use in smaller nets have been reasonably successful (Knuckey 2009), but reliably estimating and reducing the level of interactions between seals and wet-boats remains difficult. A trial using a shortened codend to reduce seal bycatch is currently under way.

Minimising seal interactions has been a focus for the winter trawl fishery for blue grenadier off western Tasmania. SEDs have been compulsory for freezer boats in this component of the SESSF since 2005, and modifications to fishing practices appear to have substantially reduced the incidence of seal bycatch in the midwater nets of factory vessels. Observers have been deployed on factory trawlers to verify interaction rates. In 2007, the South East Trawl Fishing Industry Association (SETFIA) released an updated trawl industry code of conduct for responsible fishing. It also released an industry code of practice that aims to minimise interactions with fur seals, as well as addressing the environmental impacts of the fishery generally.

Concern has been increasing about the mortality of Australian sea lions caught as bycatch in shark gillnets. The Australian sea lion is endemic and listed as vulnerable under the EPBC Act. Sea lion populations were reduced substantially by sealing between the 18th and early 20th centuries, and recovery has been slow (DEWHA 2010). Australian sea lions show high genetic differentiation due to high fidelity of female sea lions to their natal sites, indicating that animals lost from a colony are unlikely to be replaced by immigrants from other colonies (DEWHA 2010). The small size of some colonies suggests that the loss of a few breeding females from a population can significantly reduce the long-term prospects for recovery of that population (Goldsworthy et al. 2010).

Closures were introduced in 2003 around the Pages Islands (the largest sea lion colony) and around Kangaroo Island. In December 2009, interim voluntary closures of four nautical miles around all colonies were introduced. The current declaration of the SESSF as an approved Wildlife Trade Operation under the EPBC Act includes a requirement to implement long-term management measures, including formal fisheries closures, which should significantly reduce the impact of fishing on Australian sea lions and facilitate the recovery of subpopulations. AFMA implemented an Australian sea lion management strategy during 2010 that included spatial closures around colonies, increased observer coverage and trigger limits, with observed levels of bycatch above the trigger limits resulting in the closure of larger areas (AFMA 2010).

Increased onboard observer coverage or camera monitoring is important for obtaining reliable data on interaction rates. In the first six months of the sea lion management strategy, the prescribed level of observer coverage was not achieved. The Australian Government funded a trial of onboard cameras to monitor Australian sea lion bycatch in 2010–11. In 2011, in light of an expert review of the management strategy, AFMA introduced a temporary order (six months, effective 1 May) that increased the size of closed areas around 31 colonies and required 100 per cent observer coverage on gillnet vessels off South Australia in the Australian sea lion management area. This area consists of several zones, each with an interaction trigger limit, which triggers closure if the limit is reached. Onboard cameras have already been deployed in the fishery and are used instead of a scientific observer. The temporary order was replaced by a Closure Direction, which extended protection to 50 known Australian sea lion colonies. The Closure Direction expired on 1 May 2013. However, after consultation with stakeholders, it has been extended to 1 May 2015, with the addition of two newly identified Australian sea lion colonies. Observer requirements in the Australian sea lion management area off South Australia, including 100 per cent onboard observers or electronic monitoring, have been continued under conditions attached to permits and statutory fishing rights. AFMA lowered the trigger limit for sea lion mortalities in December 2011, following advice from marine mammal experts regarding risks to some sea lion subcolonies. The trigger limit was reduced from 52 animals to 15 animals across seven management zones in the Australian sea lion management area (AFMA 2011a). There has only been one Australian sea lion mortality since March 2012.

Logbook reporting of pinniped interactions has improved markedly over the past three years, but comparison with observer data suggests that there is still some level of under-reporting. In 2013, 259 pinniped interactions were reported in CTS and GHaTS logbooks: 1 with a sea lion, 6 with New Zealand fur seals, 121 with Australian fur seals and 131 with seals of unknown species. This is an increase from the 203 interactions reported in 2012. Of the 259 pinniped interactions, the sea lion, 58 of the 121 Australian fur seals, all (6) of the New Zealand fur seals and 107 of the 131 unspecified seals were reported to be dead. The interaction with the Australian sea lion (dead) was reported from gillnet operations in the GHaTS.

In the CTS, 93 per cent of all pinniped interactions in 2013 were reported from bottom trawling operations, and the remainder of interactions were reported from midwater trawl (eight) or Danish-seine (nine) operations. Of the eight pinniped interactions reported in logbooks or by observers in the GHaTS in 2013, seven were reported from gillnet operations and one from longline operations.

Ocean perch
AFMA

Dolphins

All cetaceans are protected species under the EPBC Act. Increased observer coverage in the SGSHS in 2011 highlighted interactions with dolphins and potential under-reporting in logbooks (AFMA 2011a). Two dolphin mortalities were reported in logbooks between January and September 2010 (AFMA 2011b), and 52 interactions with dolphins were reported from September 2010 to September 2011 (AFMA 2011b). In response, AFMA introduced an additional temporary order (AFMA 2011b) that included the Dolphin Gillnet Closure, an area of about 27 239 km^2 south-west of Kangaroo Island, where most of the interactions were reported. Observer coverage was increased to 100 per cent (onboard observer or camera) in the area adjacent to the gillnet closure. The lack of historical independent monitoring in the fishery means that the significance of the interactions with dolphins, and how they might have changed over time, cannot be assessed. The increase to 10 per cent observer coverage across the broader area of the SGSHS is providing more information on interactions. In 2013, 10 dolphin interactions were reported: 9 in the GHaTS fishery, 8 of which were dead, and 1 in the CTS, which was also dead.

Seabirds

In 1998, in accordance with EPBC Act requirements, the Australian Government developed a threat abatement plan for the incidental bycatch of seabirds during oceanic longline fishing operations. The plan, which was revised in 2006 (DEWR 2006) and reviewed in 2011, applies to longline operations in the SESSF (and longline operations in other Commonwealth fisheries) and is the main guide to mitigating seabird bycatch in this sector. The levels of seabird bycatch recorded by auto-longline, demersal longline, dropline and trotline operators in the SESSF are low, compared with those in other pelagic longline fisheries that target tuna and billfish (Brothers 1991; Brothers et al. 2010; CCAMLR 2002).

Seabirds also interact with trawling activities—they are vulnerable to injury as a result of striking the trawl warps during fishing operations, predominantly when catches are being processed. Analysis of observer data suggests that there may be significant levels of interaction, but further work is needed to understand the scale and significance of interactions (Phillips et al. 2010). Given the difficulty of documenting these interactions (birds suffering warp strike are not landed and are not easily observed by skippers or crew), obtaining reliable estimates of seabird mortalities is difficult, even with onboard observers. The issue was investigated by a research project between AFMA and the Tasmanian Department of Primary Industries, Parks, Water and Environment. Mitigation measures, such as offal management and bird-scaring devices, have been effective in reducing seabird bycatch elsewhere. During 2011, AFMA worked with SETFIA to develop tailored seabird management plans for individual vessels to address this issue. Vessels are required to use effective seabird mitigation devices, and AFMA is conducting a trial using observers to test the effect of these devices on seabird interactions with otter trawlers. SETFIA has also introduced a code of conduct and training program to improve seabird avoidance measures and has received funding to trial a range of bird mitigation devices.

During 2013, 90 seabird interactions were reported in logbooks or by observers in the SESSF: 47 in the GHaTS fishery and 43 in the CTS. Most interactions (55) were with various species of petrels, prions and shearwaters, 51 of which were reported to be dead. Thirty-four interactions with various albatross species were reported, including 18 shy albatross (the remainder were unclassified); of these 34 birds, 30 died. One Pacific gull was reported dead after a collision with warp wires in the CTS.

Sharks

In 2013, 135 interactions with non-target sharks were reported in GHaTS logbooks (96 of which were dead) and 8 in the CTS (6 of which were dead). The most prevalent bycatch shark was shortfin mako, with 128 interactions reported. Of these, 91 were dead, 1 was alive and 36 had an unknown life status. Seven porbeagle sharks were reported, all of which were dead. Eight white sharks were also reported—six in the GHaTS and two in the CTS; four of these were released alive and four were dead. The EPBC Act requires all white sharks and grey nurse sharks to be released alive, if possible.

During 2012, in view of their overfished status, a proposal was made for the listing of Harrisson's dogfish and southern dogfish as threatened species under the EPBC Act. On 30 May 2013, the then Minister for Sustainability, Environment, Water, Population and Communities decided to list Harrisson's dogfish and southern dogfish in the conservation-dependent category, noting that both these species have experienced severe historical declines following overfishing. These species are subject to recovery plans that provide for management actions to stop their decline and support their recovery.

Syngnathids (seahorses and pipefish)

Syngnathids are taken as bycatch in the CTS in otter-trawl and Danish-seine nets but they are generally small and difficult to observe among large catches of fish. In contrast with 2011, when the greatest number of syngnathids was reported in Danish-seine logbooks, the largest number of syngnathids in 2012 and 2013 was reported in trawl logbooks. In 2013, 81 syngnathids were reported in trawl logbooks, all of which were dead.

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