Chapter 24
Western Tuna and Billfish Fishery
A Williams, H Patterson and D Mobsby

FIGURE 24.1 Area of the Western Tuna and Billfish Fishery, 2019
### Table 24.1 Status of the Western Tuna and Billfish Fishery

#### Biological status $^a$

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Striped marlin ($Kajikia$ audax)</td>
<td>Not subject to overfishing</td>
<td>Subject to overfishing</td>
<td>Not overfished</td>
<td>Overfished</td>
<td>Most recent estimates of biomass (2018) indicate that the stock is below the default Commonwealth limit reference point. Current fishing mortality rate exceeds that required to produce MSY.</td>
</tr>
<tr>
<td>Swordfish ($Xiphias$ gladius)</td>
<td>Not subject to overfishing</td>
<td>Uncertain</td>
<td>Not overfished</td>
<td>Overfished</td>
<td>Most recent estimate of spawning biomass (2017) is above the default Commonwealth limit reference point. Current fishing mortality rate is below that required to produce MSY.</td>
</tr>
<tr>
<td>Albacore ($Thunnus$ alalunga)</td>
<td>Not subject to overfishing</td>
<td>Uncertain</td>
<td>Not overfished</td>
<td>Overfished</td>
<td>Most recent estimate of spawning biomass (2019) is above the default Commonwealth limit reference point. Current fishing mortality rate is above that required to produce MSY.</td>
</tr>
<tr>
<td>Bigeye tuna ($Thunnus$ obesus)</td>
<td>Not subject to overfishing</td>
<td>Uncertain</td>
<td>Not overfished</td>
<td>Overfished</td>
<td>Most recent estimate of spawning biomass (2019) is above the default Commonwealth limit reference point. Current fishing mortality rate is above that required to produce MSY.</td>
</tr>
<tr>
<td>Yellowfin tuna ($Thunnus$ albacares)</td>
<td>Not subject to overfishing</td>
<td>Uncertain</td>
<td>Not overfished</td>
<td>Overfished</td>
<td>Most recent estimate of spawning biomass (2018) is above the default Commonwealth limit reference point. Current fishing mortality rate is above that required to produce MSY.</td>
</tr>
</tbody>
</table>

#### Economic status

Participation rate was low and latency remained high in 2019, suggesting little economic incentive to fish and relatively low net economic returns.

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$^a$ Ocean-wide assessments and the default limit reference points from the Commonwealth Fisheries Harvest Strategy Policy (Department of Agriculture and Water Resources 2018) are used as the basis for determining stock status.

Note: MSY Maximum sustainable yield.
24.1 Description of the fishery

Area fished

The Western Tuna and Billfish Fishery (WTBF) operates in Australia’s Exclusive Economic Zone and high seas of the Indian Ocean (Figure 24.1). In recent years, fishing effort has concentrated off south-west Western Australia, with occasional activity off South Australia. Domestic management arrangements for the WTBF reflect Australia’s commitment to the Indian Ocean Tuna Commission (IOTC; see Chapter 20).

Fishing methods and key species

Key species in the WTBF are bigeye tuna (*Thunnus obesus*), yellowfin tuna (*T. albacares*), striped marlin (*Kajikia audax*) and swordfish (*Xiphias gladius*). Some albacore (*T. alalunga*) is also taken. The main fishing gear in the WTBF is pelagic longline, with low levels of minor-line fishing (Table 24.2).

### TABLE 24.2 Main features and statistics for the WTBF

<table>
<thead>
<tr>
<th>Stock</th>
<th>TACC (t)</th>
<th>Catch (t)</th>
<th>GVP</th>
<th>TACC (t)</th>
<th>Catch (t)</th>
<th>GVP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018</td>
<td>2019</td>
<td></td>
<td>2018</td>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>Striped marlin</td>
<td>125</td>
<td>1</td>
<td>Confidential</td>
<td>125</td>
<td>1</td>
<td>Confidential</td>
</tr>
<tr>
<td>Swordfish</td>
<td>3,000</td>
<td>174</td>
<td>Confidential</td>
<td>3,000</td>
<td>117</td>
<td>Confidential</td>
</tr>
<tr>
<td>Albacore</td>
<td>–</td>
<td>12</td>
<td>Confidential</td>
<td>–</td>
<td>16</td>
<td>Confidential</td>
</tr>
<tr>
<td>Bigeye tuna</td>
<td>2,000</td>
<td>49</td>
<td>Confidential</td>
<td>2,000</td>
<td>38</td>
<td>Confidential</td>
</tr>
<tr>
<td>Yellowfin tuna</td>
<td>5,000</td>
<td>42</td>
<td>Confidential</td>
<td>5,000</td>
<td>46</td>
<td>Confidential</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,125</strong></td>
<td><strong>278</strong></td>
<td><strong>Confidential</strong></td>
<td><strong>10,125</strong></td>
<td><strong>218</strong></td>
<td><strong>Confidential</strong></td>
</tr>
</tbody>
</table>

Fishery-level statistics

- **Effort**
  - Pelagic longline: 404,880 hooks
  - Minor line: na
- **Fishing permits**
  - 94 boat SFRs
- **Active vessels**
  - Pelagic longline: 2
  - Minor line: 1
- **Observer coverage**
  - 13.0% c
  - 12.8% c
- **Fishing methods**
  - Pelagic longline (monofilament mainline), minor line (handline, rod and reel, troll and poling), purse seine
- **Primary landing ports**
  - Fremantle and Geraldton (Western Australia)
- **Management methods**
  - Input controls: limited entry, gear and area restrictions
  - Output controls: TACCs, ITQs, byproduct restrictions
- **Primary markets**
  - International: Japan, United States—fresh, frozen
  - Domestic: fresh, frozen
- **Management plan**
  - Western Tuna and Billfish Management Plan 2005 (amended 2016); SFRs issued 2010

Notes:
- GVP Gross value of production.
- ITQ Individual transferable quota.
- na Not available.
- SFR Statutory fishing right.
- TACC Total allowable commercial catch.
- – Not applicable.

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a Fishery statistics are provided by calendar year to align with international reporting requirements. Value statistics are by financial year. b The TACC for each stock was first set in 2010, then revised in 2012, and was based on an approximation of the proportion of the total potential yield for the Indian Ocean that is available to the WTBF. c From 1 July 2015, e-monitoring became mandatory for all full-time pelagic longline vessels in the WTBF. At least 10% of video footage of all hauls is reviewed to verify the accuracy of logbooks, which are required to be completed for 100% of shots.
Management methods

The management plan for the fishery began in 2005, although the Australian Fisheries Management Authority (AFMA) first granted statutory fishing rights in 2010. Under the management plan, output controls have been implemented in the fishery through individual transferable quotas (ITQs) for the 4 key commercial species (excluding striped marlin) (Table 24.2). Determinations of total allowable commercial catch (TACC) are made in accordance with Australia’s domestic policies, and apply to the Australian Fishing Zone and the high-seas area of the IOTC area of competence. A harvest strategy framework has been developed for the WTBF (Davies et al. 2008), with the intention that it be implemented if fishing effort increases significantly in the fishery and sufficient data are available for use in the strategy. The framework includes a decision tree that defines rules and subsequent adjustments to the recommended biological catch (or level of fishing mortality) in response to standardised size-based catch rates.

The default limit reference points in the Commonwealth Fisheries Harvest Strategy Policy (Department of Agriculture and Water Resources 2018) are used to determine stock status in the WTBF. The limit reference point for biomass is 20% of the unfished biomass (0.2B0). For fishing mortality, the limit reference point is the fishing mortality that would achieve maximum sustainable yield (FMSY). The IOTC determines stock status relative to target reference points, not limit reference points, resulting in a different stock status reported by the IOTC for some stocks.

Electronic monitoring (e-monitoring) became mandatory for all pelagic longline vessels that fished for more than 30 days in the previous or current season in the Eastern Tuna and Billfish Fishery and the WTBF from 1 July 2015. At least 10% of video footage of all longline sets is reviewed to verify the accuracy of logbooks, which are required to be completed for 100% of shots.

Fishing effort

Effort in the WTBF was relatively low (<20 vessels) from the mid 1980s to the mid 1990s (Figure 24.2). Effort increased in the late 1990s, peaking at 50 active vessels in 2000, but then declined rapidly. Since 2005, fewer than 5 vessels have been active in the fishery each year.
Catch

Swordfish is the main target species in the WTBF, with annual catches peaking at more than 2,000 t in 2001 (Figure 24.3) and declining to a few hundred tonnes in recent years. Bigeye and yellowfin tuna are also valuable target species, although catches of these species have never been as high as for swordfish and have been more variable.
24.2 Biological status

Striped marlin (Kajikia audax)

Stock structure

Mamoozadeh, McDowell & Graves (2018) evaluated genetic variation in striped marlin populations sampled from the eastern and western Indian Ocean, and across the Pacific Ocean. Their results suggest that there could be genetically distinct east and west stocks of striped marlin in the Indian Ocean. However, the sample size from the eastern Indian Ocean was small (8 fish) and no samples were collected from the central Indian Ocean, making it difficult to delineate a border between potential stocks. Therefore, striped marlin is currently considered to be a single biological stock for assessments in the Indian Ocean.

Catch history

Catches of striped marlin in the WTBF have been relatively low (<50 t) since the mid 1980s and very low (<5 t) since 2000, with less than 1 t taken in 2019 (Figure 24.4). Total international catches in the IOTC area of competence declined from around 6,000 t in 1995 to around 2,000 t in 2009 (Figure 24.5). Annual catches in 2018 were 2,612 t, which is below the estimated maximum sustainable yield (MSY) (4,730 t).

FIGURE 24.4 Striped marlin catch and TACC in the WTBF, 1983 to 2019

Note: TACC Total allowable commercial catch; initial TACC for 19 months.
Source: AFMA
FIGURE 24.5 Striped marlin catch in the IOTC area, 1970 to 2018

Source: IOTC

Stock assessment

A stock assessment in 2018 for the Indian Ocean–wide stock used 2 assessment models: JABBA, a Bayesian state-space production model, and Stock Synthesis 3 (SS3) (IOTC 2019). The 2017 spawning biomass for the Indian Ocean–wide stock was estimated to be 13% of unfished (1950) biomass (SS3: \( SB_{2017}/SB_{1950} = 0.13 \); range 0.09–0.14) and below the level that supports MSY (JABBA: \( SB_{2017}/SB_{MSY} = 0.33 \); no range available) (IOTC 2019). Fishing mortality for the Indian Ocean–wide stock was estimated to be above \( F_{MSY} \) (JABBA: \( F_{2017}/F_{MSY} = 1.99 \); 95% confidence interval [CI] 1.21–3.62). Retrospective analysis for both the JABBA and SS3 models produced consistent stock status estimates, thus providing a degree of confidence in the predictive capabilities of the assessments.

Stock status determination

Both stock assessment models indicate that the Indian Ocean–wide stock has been heavily depleted and is below the Commonwealth’s biomass limit reference point (0.2\( B_0 \)). The stock is therefore classified as overfished. Despite relatively small domestic catches of striped marlin in the WTBF, fishing mortality for the Indian Ocean–wide stock was estimated to be well above \( F_{MSY} \), so the stock is classified as subject to overfishing.
Swordfish (Xiphias gladius)

Stock structure
The possibility of a separate south-west Indian Ocean stock was examined in the Indian Ocean Swordfish Stock Structure project—a genetic study focused on the links between the south-west and other regions (Muths et al. 2013). The study found that genetic markers were consistent with a single stock in the Indian Ocean. Similarly, preliminary genetics and otolith microchemistry analysis from a more recent study of a relatively large sample across the Indian Ocean also suggests a single stock (Davies et al. 2019). Swordfish in the Indian Ocean is therefore considered to be a single biological stock.

Catch history
Annual swordfish catch in the WTBF peaked at around 2,000 t in the early 2000s but has declined to below 350 t since 2005. In 2019, the annual catch was 117 t, a slight decrease from the 2018 catch of 174 t (Figure 24.6). Total international catches of swordfish in the IOTC area of competence peaked in 2004 at more than 40,000 t, but declined to around 22,000 t in 2011 (Figure 24.7), likely as a result of the effects of piracy in the western Indian Ocean. Annual catches in the IOTC area of competence have increased since 2011, reaching 30,936 t in 2018, which is just below the 2017 estimate of MSY (31,590 t).

FIGURE 24.6 Swordfish catch and TACC in the WTBF, 1983 to 2019

Note: TACC Total allowable commercial catch; initial TACC for 19 months.
Source: AFMA
FIGURE 24.7 Swordfish catch in the IOTC area, 1970 to 2018

Source: IOTC

Stock assessment

In 2017, the Indian Ocean swordfish assessment was updated using SS3 with data up to 2015 (IOTC 2017). The SS3 model was spatially disaggregated, sex explicit and age structured. The 2015 spawning biomass for the Indian Ocean–wide stock was estimated to be 31% of unfished (1950) biomass (SB$_{2015}$/SB$_{1950}$ = 0.31; 80% CI 0.26–0.43) and above the level that supports MSY (SB$_{2015}$/SB$_{MSY}$ = 1.50; 80% CI 1.05–2.45) (IOTC 2017). Fishing mortality for the Indian Ocean–wide stock was estimated to be below F$_{MSY}$ (F$_{2015}$/F$_{MSY}$ = 0.76; 80% CI 0.41–1.04).

Stock status determination

Assessments of the Indian Ocean–wide stock indicate that swordfish biomass is above the Commonwealth's biomass limit reference point (0.2B$_0$) and that fishing mortality is below F$_{MSY}$. As a result, the stock is classified as not overfished and not subject to overfishing.
Albacore (*Thunnus alalunga*)

**Stock structure**

A global genetic study of albacore found that the Atlantic Ocean and Indian Ocean populations were not genetically distinguishable, and found no evidence of genetic heterogeneity within the Indian Ocean (Montes et al. 2012). Similarly, a preliminary analysis from a recent genetics and otolith microchemistry study of a relatively large sample suggests a single stock within the Indian Ocean (Davies et al. 2019). Therefore, albacore is assumed to be a single biological stock in the Indian Ocean for assessments.

**Catch history**

Historically, albacore catches in the WTBF have been low, peaking at 115 t in 1994 and again at 94 t in 2001 (Figure 24.8). Since 2004, annual catches have been below 30 t, and were approximately 16 t in 2019. Total international catches in the IOTC area of competence peaked at more than 43,000 t in 2010, and have fluctuated between 30,000 t and 42,000 t since 2011 (Figure 24.9). The average annual catch during the past 5 years (2014–2018) was approximately 38,030 t, which is higher than the 2019 estimate of MSY (35,700 t) (IOTC 2019).

**Figure 24.8 Albacore catch in the WTBF, 1983 to 2019**

Source: AFMA
**FIGURE 24.9 Albacore catch in the IOTC area, 1970 to 2018**

Source: IOTC

**Stock assessment**

In 2019, 5 assessment models were used to assess the Indian Ocean albacore stock: SS3, ASPIC, a statistical catch-at-age model (SCAA) and a Bayesian state-space production model. The results from the SS3 model were used to determine the current status of albacore and provide management advice (IOTC 2019), although the results from all the models were generally consistent. Considerable uncertainty remains in the SS3 model results because of conflicts in key data inputs (IOTC 2019).

The result of the SS3 model indicated that the current (2017) biomass for the Indian Ocean–wide stock was above the limit reference point (SB2017/SB1950 = 0.26; CI not available) and above the level that supports MSY (SB2017/SBMSY = 1.28; 95% CI 0.57–2.07). Fishing mortality for the Indian Ocean–wide stock was estimated to be above the level that supports MSY (F2017/FMSY = 1.35; 95% CI 0.59–2.17) (IOTC 2019), which is an increase since the last assessment in 2016 due an increase in catches by several countries since 2015 across the Indian Ocean.

**Stock status determination**

The assessment indicates that the spawning biomass is above the Commonwealth’s biomass limit reference point (0.2B0), and so the stock is classified as **not overfished**. Despite relatively small domestic catches of albacore in the WTBF, fishing mortality for the Indian Ocean–wide stock is above FMSY and so the stock is classified as **subject to overfishing**.
Bigeye tuna (*Thunnus obesus*)

Line drawing: FAO

**Stock structure**

The stock structure of bigeye tuna in the Indian Ocean is uncertain, but the species is considered to be a single biological stock for assessments. The assumption of a single stock is based on a genetic study (Chiang et al. 2008) that indicated no genetic differentiation within the Indian Ocean, and tagging studies that have demonstrated large-scale movements of bigeye tuna within the Indian Ocean (IOTC 2014).

**Catch history**

Annual catches of bigeye tuna in the WTBF varied widely between 1983 and 2004, with the highest catch of more than 900 t in 1987 and the lowest catch of less than 22 t in 1991 (Figure 24.10). Catches have been more stable since 2004, and have not exceeded 200 t; catches over the past 4 years are below 100 t. Total international catches in the IOTC area of competence have declined from a peak of more than 160,000 t in 1999 to less than 100,000 t in recent years (Figure 24.11). Bigeye catch was 93,493 t in 2018 and averaged 92,108 t over the past 5 years, both of which are above the 2019 MSY estimate of 87,000 t.

**FIGURE 24.10** Bigeye tuna catch and TACC in the WTBF, 1983 to 2019

Note: TACC Total allowable commercial catch; initial TACC for 19 months.
Source: AFMA
FIGURE 24.11 Bigeye tuna catch in the IOTC area, 1970 to 2018

Source: IOTC

Stock assessment

In 2019, the 2016 Indian Ocean–wide stock assessment for bigeye tuna was updated using SS3 and JABBA (IOTC 2019). The SS3 assessment was used to provide management advice, and consisted of 18 model configurations that were designed to account for the uncertainty in the stock–recruitment relationship, the influence of the tagging data, and selectivity of longline fleets (IOTC 2019). Current (2018) spawning stock biomass in the Indian Ocean was estimated to be above the level that would produce MSY ($SB_{2018}/SB_{MSY} = 1.22; 80\% \text{ CI } 0.82–1.81$). Similarly, the assessment indicated that Indian Ocean spawning biomass was above 20% of the initial unfished level ($SB_{2018}/SB_0 = 0.31; 80\% \text{ CI } 0.21–0.34$). Fishing mortality for the Indian Ocean–wide stock was above the level associated with MSY ($F_{2015}/F_{MSY} = 1.20; 80\% \text{ CI } 0.70–2.05$), which is an increase since the last assessment in 2016 due to a significant increase in estimated purse seine catches in 2018 in the Indian Ocean.

Stock status determination

The SS3 assessment indicates that bigeye tuna spawning stock biomass is above the Commonwealth’s biomass limit reference point (0.2$B_0$). As a result, the Indian Ocean bigeye tuna stock is classified as not overfished. Despite relatively small domestic catches of bigeye tuna in the WTBF, fishing mortality for the Indian Ocean–wide stock is above the level that would produce $F_{MSY}$, so the stock is classified as subject to overfishing.
Yellowfin tuna (*Thunnus albacares*)

**Stock structure**

Preliminary analysis from a recent genetics and otolith microchemistry study found evidence for 2 distinct groupings of yellowfin tuna in the Indian Ocean, but the spatial delineation of these groups remains unclear (Davies et al. 2019). The stock structure of yellowfin tuna in the Indian Ocean remains uncertain, and the species is considered to be a single biological stock for assessments until the stock structure can be resolved.

**Catch history**

Historical catches of yellowfin tuna in the WTBF have varied widely from peaks of around 800 t in 1984 and 1995 to less than 15 t in 1991 and 1992 (Figure 24.12). Since the early 2000s, declining effort in the WTBF has resulted in reduced catches of yellowfin tuna. Catches have not exceeded 100 t since 2004 (Figure 24.12).

Total international catches in the IOTC area of competence peaked at more than 500,000 t in 2004, then declined for several years (2007 to 2011) because of the effects of piracy in the north-west Indian Ocean. Average catches from 2014 to 2018 were 416,026 t, which is above the level of MSY (approximately 403,000 t). Catches in 2018 were approximately 432,401 t.

**FIGURE 24.12** Yellowfin tuna catch and TACC in the WTBF, 1983 to 2019

Note: TACC Total allowable commercial catch; initial TACC for 19 months.
Source: AFMA
Stock assessment
In 2018, the 2016 Indian Ocean–wide yellowfin tuna assessment was updated using SS3 and incorporating catch data, size frequency data, tagging data and longline catch-per-unit-effort series (IOTC 2019). The results were largely similar to previous assessments, and indicate that 2017 levels of fishing mortality for the Indian Ocean–wide stock were above the level that would achieve MSY ($F_{2017}/F_{MSY} = 1.20; 80\% \text{ CI} 1.00–1.71$). Current spawning biomass for the Indian Ocean–wide stock was estimated to be below the level associated with MSY ($SB_{2017}/SB_{MSY} = 0.83; 80\% \text{ CI} 0.74–0.97$) but above the Commonwealth’s biomass limit reference point ($SB_{2017}/SB_0 = 0.30; 80\% \text{ CI} 0.27–0.33$).

Stock status determination
Despite relatively small domestic catches of yellowfin tuna in the WTBF, the assessments indicate that fishing mortality for the Indian Ocean–wide stock is above the level associated with MSY. As a result, the Indian Ocean yellowfin tuna stock is classified as subject to overfishing. The biomass is above the default limit reference point ($0.2B_0$), and, as a result, the stock is classified as not overfished.
24.3 Economic status

Key economic trends

Economic surveys have not been conducted in the WTBF since 2001–02 because of the low level of fishing activity. During 2018 and 2019, 94 fishing permits were issued in the fishery although only a small number of vessels operated in the fishery in those years (Table 24.2): 3 vessels (2 pelagic longline and 1 minor line) in 2018 and 4 vessels (2 pelagic longline and 2 minor line) in 2019. Pelagic longline vessels account for around 97% of catch volume, so the entry of 1 minor line vessel in 2019 was insignificant for the fishery. Total effort in the fishery decreased by 9%, from 404,880 hooks in 2018 to 366,821 hooks in 2019—the lowest number of hooks since 2016. Total catch in the WTBF fell in the same proportion as the number of hooks, declining 9% to 218 t (Table 24.2).

As in previous years, landed catch in the fishery was a small proportion of the TACC during 2019. This high level of latent quota (the extent to which the TACC is not fully caught) and a relatively low participation rate indicate that permit holders expect low profitability from operating in the fishery, and relatively low net economic returns are achieved from the fishery.

Performance against economic objective

Although a harvest strategy has not been implemented because of low levels of effort in the fishery, the current management arrangements are unlikely to be constraining fishers’ ability to operate profitably. The high levels of latency experienced in the fishery are more likely to arise from market factors that affect business input costs and international tuna prices. Furthermore, since the WTBF accesses a relatively small component of broader, internationally managed ocean-wide stocks, domestic management actions to control catch are likely to have limited impact on the biomass of these stocks and, therefore, on fishers’ ability to access the resource for profitable operations. Constraints to further fishing appear to be market-related rather than arising from management arrangements. Hence, the economic objective of maximising net economic returns is likely being met for the fishery.

24.4 Environmental status

The WTBF has been granted continued export approval under the Environment Protection and Biodiversity Conservation Act 1999, expiring on 11 November 2022. Conditions of export approval include a requirement to determine the impact of fishing on shark species and to make demonstrable progress in improving the status of shark bycatch in the WTBF, as well as working with the IOTC to improve the understanding of the status of stocks currently classified as overfished or uncertain.

AFMA’s ecological risk assessment conducted in 2009 examined 187 fish species in the WTBF (38 chondrichthyans and 149 teleosts), all of which were classified as being at low risk of potential overfishing, based on the level 3 sustainability assessment for fishing effects analysis (Zhou, Smith & Fuller 2009). Although no shark species were identified as high risk, an increase in effort could move some species to a higher-risk category. A priority action identified in the WTBF ecological risk management report (AFMA 2010) is to monitor the catch of, and level of interaction with, sharks. Management of shark interactions in this fishery will be reviewed if the landed amount of any 1 shark species exceeds 50 t within a year. Trip limits on sharks apply, depending on species.
In accordance with accreditation under the *EPBC Act 1999* (see Chapter 1, ‘Protected species interactions’) AFMA publishes and reports quarterly on interactions with protected species on behalf of Commonwealth fishing operators to the Department of Agriculture, Water and the Environment (DAWE) and these are summarised below.

In 2019, 127 shortfin mako sharks (*Isurus oxyrinchus*) were hooked in the WTBF; all were released in an unknown condition. Eight porbeagles (*Lamna nasus*) were also released in unknown condition. Eight leatherback turtles (*Dermochelys coriacea*) were also hooked and released alive, as were 6 olive ridley turtles (*Lepidochelys olivacea*), 1 flatback turtle (*Natator depressus*), 4 hawksbill turtles (*Eretmochelys imbricata*) and 2 green turtles (*Chelonia mydas*). Four loggerhead turtles (*Caretta caretta*) were captured, with 3 released alive and 1 injured. Two flesh-footed shearwaters (*Ardeona carneipes*) were released alive and 1 unidentified shearwater was released in an unknown condition. One unidentified albatross was dead. Finally, 1 short-finned pilot whale (*Globicephaela macrorrhynchus*) was released alive.

These reported interactions with protected species form a part of the ongoing monitoring by DAWE of the performance of fisheries within their accreditation under the EPBC Act.

### 24.5 References


Chapter 24: Western Tuna and Billfish Fishery


Zhou, S, Smith, T & Fuller, M 2009, Rapid quantitative risk assessment for fish species in major Commonwealth fisheries, report to the Australian Fisheries Management Authority, Canberra.