Chapter 21
Eastern Tuna and Billfish Fishery

FIGURE 21.1 Fishing intensity in the Eastern Tuna and Billfish Fishery, 2019
### TABLE 21.1 Status of the Eastern Tuna and Billfish Fishery

#### Biological status

<table>
<thead>
<tr>
<th>Stock</th>
<th>2018</th>
<th>2019</th>
<th>Comments a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fishing mortality</td>
<td>Biomass</td>
<td>Fishing mortality</td>
</tr>
<tr>
<td>Striped marlin (Kajikia audax), south-west Pacific</td>
<td></td>
<td></td>
<td>Most recent estimate of spawning biomass (2019) is below the default limit reference point of 0.2SB0. Current fishing mortality rate is below FMSY.</td>
</tr>
<tr>
<td>Swordfish (Xiphias gladius), south-west Pacific</td>
<td></td>
<td></td>
<td>Most recent estimate of biomass (2017) is likely above the default limit reference point. Recent fishing mortality is likely below FMSY.</td>
</tr>
<tr>
<td>Albacore (Thunnus alalunga), south Pacific</td>
<td></td>
<td></td>
<td>Most recent estimate of spawning biomass (2018) is well above the default limit reference point. Recent estimate of fishing mortality is below FMSY.</td>
</tr>
<tr>
<td>Bigeye tuna (Thunnus obesus), western and central Pacific</td>
<td></td>
<td></td>
<td>Most recent estimate of spawning biomass (2017) is likely above the limit reference point. Recent fishing mortality is likely below FMSY.</td>
</tr>
<tr>
<td>Yellowfin tuna (Thunnus albacares), western and central Pacific</td>
<td></td>
<td></td>
<td>Most recent estimate of biomass (2017) is highly likely above the limit reference point. Ocean-wide estimates of fishing mortality are highly likely below FMSY.</td>
</tr>
</tbody>
</table>

#### Economic status

NER followed an increasing trend over the decade to 2016–17 and became positive in 2010–11. Non-survey-based estimates of NER for 2017–18 show an increase to $5.7 million, largely as a result of a 10% increase in fishing income. For 2018–19 non-survey-based estimates indicate a 34% reduction in NER to $3.7 million, largely reflecting income falling more than fishing costs. A decline in total number of fishing days is expected to have contributed to lower overall fishing costs in 2018–19.

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**Notes:**
- 0.2SB0, Spawning biomass at 20% of unfished biomass.
- FMSY, Fishing mortality at maximum sustainable yield.
- NER, Net economic returns.

**Fishing mortality**
- Not subject to overfishing
- Subject to overfishing
- Uncertain

**Biomass**
- Not overfished
- Overfished
- Uncertain
21.1 Description of the fishery

Area fished

The Eastern Tuna and Billfish Fishery (ETBF) operates in the Exclusive Economic Zone and adjacent high seas, from Cape York to the Victoria – South Australia border, including waters around Tasmania and the high seas of the Pacific Ocean (Figure 21.1). Domestic management arrangements for the ETBF are consistent with Australia’s commitments to the Western and Central Pacific Fisheries Commission (WCPFC; see Chapter 20).

Fishing methods and key species

Key species in the ETBF are shown in Table 21.1. Most of the catch in the fishery is taken with pelagic longlines, although a small quantity is taken using minor-line methods (Table 21.2). Some ETBF longliners catch southern bluefin tuna (Thunnus maccouyi) off New South Wales during winter, after fishing for tropical tunas and billfish earlier in the year, while others take them incidentally when targeting other tunas. All southern bluefin tuna taken must be covered by quota and landed in accordance with the Southern Bluefin Tuna Fishery Management Plan 1995. Recreational anglers and game fishers also target tuna and marlin in the ETBF. Many game fishers tag and release their catch, especially marlins. The retention of blue marlin (Makaira mazara) and black marlin (M. indica) has been banned in commercial fisheries since 1998, and catch limits have been introduced on longtail tuna (T. tonggol), in recognition of the importance of these species to recreational anglers.

Management methods

The primary ETBF tuna and billfish species are managed through total allowable catches allocated as individual transferable quotas (ITQs). The Commonwealth Fisheries Harvest Strategy Policy (HSP; Department of Agriculture and Water Resources 2018) is not prescribed for fisheries managed under international agreements. However, a harvest strategy framework was developed for the ETBF (Campbell 2012) to set the total allowable commercial catch (TACC) for the 5 main species. For reasons set out below, this harvest strategy framework has been discontinued for the 3 tuna species, and is being redeveloped for swordfish (Xiphias gladius) and striped marlin (Kajikia audax).

Australia’s annual catch of bigeye tuna (T. obesus), yellowfin tuna (T. albacares) and albacore (T. alalunga) in the ETBF represents only a small percentage of the total catch from all nations in the Coral and Tasman seas (averaging 16%, 27% and 6%, respectively, since 2006) (Campbell 2019a). As a consequence, in 2013, the Tropical Tuna and Billfish Fisheries Resource Assessment Group (TTRAG) concluded that the ETBF harvest strategy was not likely to achieve its objectives (including achieving the target catch rate) according to the requirements of the HSP for these species. Changes to Australia’s catch of these tuna species could not be expected to result in a change in the stock status (because of a lack of feedback to the stock as a whole). The Australian Fisheries Management Authority (AFMA) Commission subsequently directed TTRAG to cease using the harvest strategy to calculate recommended biological commercial catch levels for bigeye tuna, yellowfin tuna and albacore tuna, and to instead prepare information on the stock status of these tunas (Campbell 2019b). In the absence of an accepted domestic harvest strategy, and noting that WCPFC harvest strategies for these species are still under development and the WCPFC has not yet allocated tuna catches, AFMA considered a range of other factors in applying TACCs. These include
stock status, local catch indices, historical catch levels in the fishery, and limits determined by the WCPFC (through conservation and management measures) or agreed through regional arrangements.

Unlike the 3 tuna species, Australia's annual catch of swordfish and striped marlin in the ETBF represents more than half the total catch from all nations in the Coral and Tasman seas (averaging 67% and 56%, respectively, since 2006) (Campbell 2019a). Changes in Australia’s catch of these species could therefore be expected to result in a change in stock status. Nevertheless, the harvest strategies for swordfish and striped marlin were reviewed in 2017–18, including a management strategy evaluation. The review determined that the harvest strategies were not likely to achieve HSP objectives (including achieving the set target and appropriate responsiveness of the harvest rate to stock biomass conditions) and so required redevelopment. The AFMA Commission agreed and requested that TTRAG provide the best available scientific indicators to provide catch limit advice while a new harvest strategy is developed (Campbell 2019b).

The status of ETBF tuna and billfish is derived from regional assessments undertaken for the WCPFC. Assessment results over the relevant geographic area modelled are used to determine stock status, but supplementary management advice may also be derived from the region most relevant to Australia. The WCPFC has agreed limit reference points for some stocks, but, where agreed limit reference points are absent, status determination was informed by the proxies specified in the HSP.

In 2017, the WCPFC Scientific Committee adopted key changes to the way it treats uncertainty in the stock assessments and communicates that uncertainty. Management statistics and stock status are based on a structural uncertainty grid that incorporates all plausible models across all combinations of key uncertainty axes (for example, steepness, natural mortality, growth, tagging parameters). The structural uncertainty grid may comprise a large number of separate models (generally up to 72) that may be weighted when some axis settings are less plausible than others. The various management quantities are then expressed as the median of the grid, with a range of uncertainty around that median. There will also be a probability (or a proxy of the probability) associated with breaching each of the key reference points (for example, percentage of the grid models where recent spawning biomass was below the limit reference point). The status information in this chapter reflects this change.

Since 1 July 2015, electronic monitoring has been mandatory for all full-time pelagic longline vessels in the ETBF and the Western Tuna and Billfish Fishery. At least 10% of video footage of all hauls is reviewed to verify the accuracy of logbooks, which must be completed for 100% of shots.

**Fishing effort**

The number of active vessels in the fishery (Figure 21.2) has decreased substantially in the past 2 decades (from around 152 in 1999 to 37 in 2019), probably as a result of a decline in economic conditions in the fishery and the removal of vessels through the Securing Our Fishing Future structural adjustment package in 2006–07 (Vieira et al. 2010). Similarly, the effort in hooks set has declined (though to a lesser extent) from a peak of over 12 million in 2003 to around 8 million per annum in recent years (Figure 21.2).
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FIGURE 21.2 Longline fishing effort, number of boat SFRs and active vessels in the ETBF, 1985 to 2019

Note: SFR Statutory fishing right.
Source: AFMA

Catch

Following a decrease in effort from 2003, the total retained catch of all species in the ETBF declined from a high of more than 8,000 t in 2002 to around 4,200 t in 2013. Catch increased from 4,046 t in 2018 to 4,341 t in 2019 (Figure 21.3). Swordfish, yellowfin tuna and bigeye tuna continue to be the main target species.

FIGURE 21.3 Total catch (from logbook data) for all methods, by species, in the ETBF, 1987 to 2019

Source: AFMA
## TABLE 21.2 Main features and statistics for the ETBF

<table>
<thead>
<tr>
<th>Stock</th>
<th>TACC (t)</th>
<th>Catch (t)</th>
<th>GVP (2017–18)</th>
<th>TACC (t)</th>
<th>Catch (t)</th>
<th>GVP (2018–19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Striped marlin</td>
<td>311</td>
<td>246</td>
<td>$1.6 million</td>
<td>351</td>
<td>251</td>
<td>$0.9 million</td>
</tr>
<tr>
<td>Swordfish</td>
<td>960</td>
<td>1,027</td>
<td>$9.2 million</td>
<td>1,250</td>
<td>793</td>
<td>$7.3 million</td>
</tr>
<tr>
<td>Albacore</td>
<td>2,351</td>
<td>889</td>
<td>$2.7 million</td>
<td>2,500</td>
<td>924</td>
<td>$2.7 million</td>
</tr>
<tr>
<td>Bigeye tuna</td>
<td>957</td>
<td>367</td>
<td>$4.3 million</td>
<td>1,056</td>
<td>284</td>
<td>$4.6 million</td>
</tr>
<tr>
<td>Yellowfin tuna</td>
<td>2,054</td>
<td>1,517</td>
<td>$18.8 million</td>
<td>2,400</td>
<td>2,089</td>
<td>$14.7 million</td>
</tr>
<tr>
<td><strong>Total fishery</strong></td>
<td><strong>6,633</strong></td>
<td><strong>4,046</strong></td>
<td><strong>$38.4 million</strong></td>
<td><strong>7,557</strong></td>
<td><strong>4,341</strong></td>
<td><strong>$32.1 million</strong></td>
</tr>
</tbody>
</table>

**Fishery-level statistics**

<table>
<thead>
<tr>
<th>Effort</th>
<th>Longline: 7.90 million hooks</th>
<th>Longline: 8.57 million hooks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minor line: na</td>
<td>Minor line: 0</td>
</tr>
<tr>
<td>Fishing permits</td>
<td>Longline boat SFRs: 82</td>
<td>Longline boat SFRs: 81</td>
</tr>
<tr>
<td></td>
<td>Minor-line boat SFRs: 84</td>
<td>Minor-line boat SFRs: 84</td>
</tr>
<tr>
<td>Active vessels</td>
<td>Longline: 40</td>
<td>Longline: 37</td>
</tr>
<tr>
<td></td>
<td>Minor line: 0</td>
<td>Minor line: 0</td>
</tr>
<tr>
<td>Observer coverage</td>
<td>Longline: 10.8% b</td>
<td>Longline: 11.7% b</td>
</tr>
<tr>
<td></td>
<td>Minor line: zero</td>
<td>Minor line: zero</td>
</tr>
<tr>
<td>Fishing methods</td>
<td>Pelagic longline, minor line (trolling, rod and reel, handline)</td>
<td></td>
</tr>
<tr>
<td>Primary landing ports</td>
<td>Bermagui, Coffs Harbour and Ulladulla (New South Wales); Cairns, Mooloolaba and Southport (Queensland)</td>
<td></td>
</tr>
<tr>
<td>Management methods</td>
<td>Output controls: TACCs and ITQs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Input controls: limited entry, gear restrictions</td>
<td></td>
</tr>
<tr>
<td>Primary markets</td>
<td>Domestic: fresh</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International: Japan, United States—mainly fresh; Europe—frozen; American Samoa, Indonesia, Thailand—albacore mainly for canning</td>
<td></td>
</tr>
<tr>
<td>Management plan</td>
<td>Eastern Tuna and Billfish Fishery Management Plan 2010</td>
<td></td>
</tr>
</tbody>
</table>

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*a Fishery statistics are provided by calendar year to align with international reporting requirements. The 2018 season ran for 10 months because the fishing season transitioned to a calendar year, as of 2019, season and calendar year will be the same. Value statistics are by financial year. Total value includes value from non-quota species caught in the ETBF. 
*b From 1 July 2015, electronic monitoring became mandatory for all full-time pelagic longline vessels in the ETBF. At least 10% of video footage of all hauls is reviewed to verify the accuracy of logbooks, which must be completed for 100% of shots. The percentage of hooks observed is provided. 
*Notes: GVP Gross value of production. ITQ Individual transferable quota. na Not available. SFR Statutory fishing right. TACC Total allowable commercial catch.*
21.2 Biological status

Striped marlin (*Kajikia audax*)

Stock structure

Genetic studies have identified multiple stocks of striped marlin in the Pacific Ocean (for example, McDowell & Graves 2008; Purcell & Edmands 2011). As a result, the north Pacific Ocean and south-west Pacific Ocean (SWPO) stocks are assessed separately (WCPFC 2013). Information for the SWPO stock is reported here.

Catch history

Catch for the ETBF increased slightly in 2019 to 251 t (Figure 21.4), while catch in the WCPFC area south of the equator decreased slightly from 1,074 t in 2017 to 1,029 t in 2018. (Figure 21.5).

FIGURE 21.4 Striped marlin catch and TACC in the ETBF, 1984 to 2019

[Graph showing striped marlin catch and TACC from 1984 to 2019]

Note: TACC Total allowable commercial catch. TACC in 2018 was adjusted for a 10-month season. Source: AFMA
**FIGURE 21.5** Striped marlin catch in the WCPFC area south of the equator, 1970 to 2018

![Graph showing striped marlin catch from 1970 to 2018](image_url)

Source: WCPFC

**Stock assessment**

The last stock assessment for striped marlin in the SWPO (0–40°S, 140°E–130°W) was in 2019 (Ducharme, Pilling & Hampton 2019). Influential changes from the previous (2012) assessment included use of standardised catch-per-unit-effort for the Japanese and Chinese Taipei fisheries calculated using a geostatistical model, and updating the biological information on maturity and defining maturation as a function of length rather than age. The full stock assessment comprises a grid of 300 individual assessment models covering 6 axes of uncertainty, all with equal weighting.

The grid median recent spawning stock biomass was 19.8% of the levels predicted to occur in the absence of fishing ($SB_{\text{recent}}/SB_{\text{BF}} = 0.198; 80\%$ confidence interval [CI] 0.09–0.46). There was a 50.3% probability that the recent spawning stock biomass had breached the Commonwealth default limit reference point ($0.2SB_0$). This was more pessimistic than the previous (2012) assessment where spawning biomass was estimated to be 34% of the levels predicted to occur in the absence of fishing ($SB_{2006-2009}/SB_{\text{BF}} = 0.34$).

In terms of maximum sustainable yield (MSY), the median recent spawning biomass was clearly below the level associated with MSY ($SB_{\text{recent}}/SB_{\text{MSY}} = 0.74; 80\%$ CI 0.33–1.63). There was a 68.6% probability that the recent spawning biomass depletion was below the spawning biomass associated with MSY.

The median recent fishing mortality was 91% of the level associated with MSY ($F_{\text{recent}}/F_{\text{MSY}} = 0.91; 80\%$ CI 0.31–1.89). There was a 44.3% probability that the recent fishing mortality was above $F_{\text{MSY}}$. This is slightly more pessimistic than the previous (2012) assessment where fishing mortality was at 81% of the level associated with MSY.
**Stock status determination**

The most recent median estimate of the SWPO spawning biomass of striped marlin is estimated to be very close to, but just below, the 0.2SB₀ limit reference point adopted in the HSP and in the WCPFC for tunas (specifically, 20% of the levels predicted to occur in the absence of fishing: 0.2SB₀). The most recent median estimate of fishing mortality (and a majority of the grid outcomes) were below the level associated with MSY (F<sub>MSY</sub>). As a result, the striped marlin stock in the SWPO (including the ETBF) is classified as **overfished** but is not subject to **overfishing**. The WCPFC Scientific Committee recommended measures to control overall catch, through expansion of the geographical scope of CMM 2006-04 to cover the distribution of the stock; the WCPFC has not yet adopted this recommendation.
Swordfish (Xiphias gladius)

**Stock structure**

Although studies of swordfish have generally indicated a low level of genetic variation in the Pacific Ocean (Kasapidis et al. 2008), the WCPFC assesses 2 stocks separately: a north Pacific stock and an SWPO stock. The information reported here is for the SWPO stock (0–50°S, 140°E–130°W).

**Catch history**

Swordfish catch in the ETBF decreased in 2019 to 792 t (Figure 21.6). Catch in the WCPFC area south of the equator declined from 7,415 t in 2017 to 7,239 t in 2018. (Figure 21.7).

**FIGURE 21.6 Swordfish catch and TACC in the ETBF, 1984 to 2019**

Note: TACC Total allowable commercial catch. TACC in 2018 was adjusted for a 10-month season.
Source: AFMA
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FIGURE 21.7 Swordfish catch in the WCPFC area south of the equator, 1970 to 2018

Source: WCPFC

**Stock assessment**

The SWPO stock of swordfish was most recently assessed in 2017 using the assessment package MULTIFAN-CL (Takeuchi, Pilling & Hampton 2017). The stock assessment was based on a structural uncertainty grid that included steepness, size data weighting, diffusion rate and natural mortality as the main uncertainties. The uncertainty grid using this approach contained 72 related models. The WCPFC Scientific Committee agreed to use the full grid, with equal weighting for all axes of uncertainty. Note that the primary uncertainty in the 2013 assessment (Davies et al. 2013), relating to growth and maturity schedules, has been resolved based on new research (Farley et al. 2016).

Across all models in the uncertainty grid, the spawning biomass declined steeply between the late 1990s and 2010, but the rate of decline has been less since then. These declines are greater in eastern region 2 (0–50°S, 165°E–130°W), where fishing mortality is also greater, compared to western region 1 where the Australian fishery operates.

The median recent spawning stock biomass was 35% of the levels predicted to occur in the absence of fishing ($SB_{\text{rec}}/SB_{\text{BF}} = 0.35$; 80% CI 0.29–0.43). The probability that the recent spawning stock biomass has breached the limit reference point was very low. The median recent fishing mortality was 86% of the fishing mortality associated with MSY ($F_{\text{rec}}/F_{\text{MSY}} = 0.86$; 80% CI 0.51–1.23). The probability that the recent fishing mortality was above $F_{\text{MSY}}$ was about 32%.

**Stock status determination**

Based on the uncertainty grid, the spawning biomass is highly likely above the limit reference point of 0.2$SB_{\text{BF}}$ adopted for tunas (noting that the WCPFC Commission has yet to adopt a limit reference point for this stock). As a result, the swordfish stock in the SWPO (including the ETBF) is classified as **not overfished**. Recent fishing mortality is also likely below $F_{\text{MSY}}$. The stock is therefore classified as **not subject to overfishing**.
Albacore (*Thunnus alalunga*)

**Stock structure**

Two distinct stocks of albacore (north Pacific and south Pacific) are found in the Pacific Ocean, generally associated with the 2 oceanic gyres. These 2 stocks are assessed separately (WCPFC 2015). Information for the south Pacific albacore stock (0–50°S, 140°E–130°W) is reported here.

**Catch history**

Catches in the ETBF increased slightly to 923 t in 2019 (Figure 21.8). Catches in the south Pacific (Pacific-wide south of the equator) have been somewhat variable over recent years, in the range of 68,000 t to 93,000 t (Figure 21.9). The WCPFC Scientific Committee recommended that longline fishing mortality be reduced if the WCPFC goal is to maintain economically viable catch rates.

**FIGURE 21.8 Albacore catch and TACC in the ETBF, 1984 to 2019**

![Graph showing albacore catch and TACC from 1984 to 2019](image)

Note: TACC Total allowable commercial catch. TACC in 2018 was adjusted for a 10-month season.

Source: AFMA
**Stock assessment**

The assessment for albacore in the south Pacific was updated in 2018 using MULTIFAN-CL (Tremblay-Boyer et al. 2018). Significant improvements in the 2018 stock assessment included modifications to the catch rate index of abundance, inclusion of a higher natural mortality (0.4) in the grid, inclusion of alternative growth models and a simplified regional structure. These changes resulted in more optimistic outcomes than the 2015 assessment. The WCPFC Scientific Committee provided advice based on the full set of 72 models in the uncertainty grid, with equal weighting for all axes of uncertainty.

The median recent spawning stock biomass was 52% of the levels predicted to occur in the absence of fishing ($S_{B recent}/S_{BF=0} = 0.52; 80\% \text{ CI} 0.37–0.63$). The probability that the recent spawning stock biomass had breached the limit reference point was zero. The median recent fishing mortality was 20% of the level associated with MSY ($F_{recent}/F_{MSY} = 0.20; 80\% \text{ CI} 0.08–0.41$). The probability that the recent fishing mortality was above $F_{MSY}$ was zero.

**Stock status determination**

The most recent estimate of spawning biomass is very likely above the default limit reference point of 20% of initial unfished levels. The most recent estimates of fishing mortality are very likely below the levels associated with MSY, and recent catches are around MSY. As a result, albacore in the south Pacific Ocean (including the ETBF) is classified as **not subject to overfishing** and **not overfished**.
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Bigeye tuna (*Thunnus obesus*)

Genetic data have indicated that bigeye tuna in the Pacific Ocean is a single biological stock (Grewe & Hampton 1998).

**Catch history**

Catches of bigeye tuna decreased in the ETBF in 2019, from 367 t in 2018 to 284 t (Figure 21.10), the lowest catch since 1996. Catches increased in the WCPFC area in 2018 (Figure 21.11). Recent bigeye tuna catch in the WCPFC area (147,985 t in 2018) is below the estimated MSY (median 158,551 t). Catches have been close to, and occasionally substantially above, this MSY level since around 1997 (Figure 21.11).

**FIGURE 21.10** Bigeye tuna catch and TACC in the ETBF, 1984 to 2019

Note: TACC Total allowable commercial catch. TACC in 2018 was adjusted for a 10-month season.
Source: AFMA
FIGURE 21.11 Bigeye tuna catch in the WCPFC area, 1970 to 2018

Stock assessment

The bigeye tuna stock in the western and central Pacific Ocean (WCPO) was most recently assessed in 2017 (McKechnie, Pilling & Hampton 2017) using the assessment package MULTIFAN-CL. The assessment was re-evaluated in 2018, incorporating an updated growth curve resulting from analysis of an enhanced set of otolith data, but maintaining the other inputs of the 2017 assessment (Vincent, Pilling & Hampton 2018). The stock assessment is based on a structural uncertainty grid that includes steepness, growth, maturity, tagging dispersion, size data weighting and regional structure as the main uncertainties. The uncertainty grid using this approach contained 36 related models after models that used an older and inaccurate bigeye growth curve were removed. The updated assessment of biomass and fishing mortality status is more optimistic (as a result of the inclusion of the new growth curve, new regional structures and increased recruitment), and uncertainty is lower than in the 2017 assessment, primarily due to removal of old growth models within the grid.

The median recent spawning biomass was 36% of the levels predicted to occur in the absence of fishing (SB\textsubscript{recent}/SB\textsubscript{F=0} = 0.36; 80% CI 0.30–0.41). There was a zero probability that the recent spawning stock biomass had breached the limit reference point. The median recent fishing mortality was 77% of the level associated with MSY (F\textsubscript{recent}/F\textsubscript{MSY} = 0.77; 80% CI 0.67–0.93). There was a 6% probability that the recent fishing mortality was above F\textsubscript{MSY}.

Stock status determination

Based on the uncertainty grid, the spawning biomass is very likely to be above the limit reference point of 20%SB\textsubscript{F=0} adopted for tunas. As a result, the stock is classified as not overfished. Similarly, recent fishing mortality is very likely to be below F\textsubscript{MSY}. As a result, the WCPO stock (including the ETBF) is classified as not subject to overfishing.
Yellowfin tuna (*Thunnus albacares*)

Stock structure
Yellowfin tuna in the WCPO is currently considered to be a single biological stock (Langley, Herrera & Million 2012). However, a recent study using newer genomic techniques provided strong evidence of genetically distinct populations of yellowfin tuna at 3 sites (Coral Sea, Tokelau and California) across the Pacific Ocean (Grewe et al. 2015). Further work is underway to confirm and expand on this preliminary study.

Catch history
Catch increased slightly in the ETBF in 2019 to 2,089 t (Figure 21.12). In the wider WCPFC area catches have increased progressively and have risen 6-fold since 1970 to 690,207 t in 2018 (Figure 21.13), which is above the estimated MSY (median 670,800 t).

**FIGURE 21.12** Yellowfin tuna catch and TACC in the ETBF, 1984 to 2019

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia (domestic and charter)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Japan (bilateral and joint venture)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TACC</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: TACC Total allowable commercial catch. TACC in 2018 was adjusted for a 10-month season. Source: AFMA
FIGURE 21.13 Yellowfin tuna catch in the WCPFC area, 1970 to 2018

Stock assessment

The yellowfin tuna stock in the WCPO was most recently assessed in 2017 (Tremblay-Boyer et al. 2017) using the assessment package MULTIFAN-CL. The stock assessment is based on a structural uncertainty grid that includes steepness, tagging dispersion, tag mixing, size frequency and regional structure as the main uncertainties. The uncertainty grid using this approach contained 48 related models. The WCPFC Scientific Committee agreed to use the full grid, with equal weighting for all axes of uncertainty.

The median recent spawning stock biomass was 33% of the levels predicted to occur in the absence of fishing \( \frac{SB_{\text{recent}}}{SB_{F=0}} = 0.33; 80\% \text{ CI } 0.20–0.41 \). The probability that the recent spawning stock biomass had breached the limit reference point was about 8%. The median recent fishing mortality was 74% \( \frac{F_{\text{recent}}}{F_{\text{MSY}}} = 0.74; 80\% \text{ CI } 0.62–0.97 \). The probability that the recent fishing mortality was above \( F_{\text{MSY}} \) was about 4%.

Stock status determination

Based on the uncertainty grid, the spawning biomass is very likely to be above the limit reference point of 0.2\( SB_{F=0} \) adopted for tunas. As a result, the WCPFC stock (including the ETBF) is classified as not overfished. Similarly, recent fishing mortality is highly likely to be below \( F_{\text{MSY}} \). As a result, the stock is classified as not subject to overfishing.
21.3 Economic status

Key economic trends

Gross value of production (GVP) in the ETBF declined in real terms (2018–19 dollars) from $119.0 million in 2001–02 to $27.7 million in 2012–13, reflecting lower landed catch and falling average prices. During this period, the number of active vessels and fishing effort fell significantly, suggesting unfavourable economic conditions in the fishery. Additionally, a number of active longline permits were taken out of the fishery through the boat fishery concession buyback component of the Securing Our Fishing Future structural adjustment package (Vieira et al. 2010). Declining prices and rising input costs during this period may have also reduced fishing effort and catch.

In 2015–16, GVP reached an 11-year high in real terms of $51.4 million as a result of increased catch and generally improved prices that year. GVP has since remained below the value achieved in 2015–16, largely as a result of lower catch volume. GVP in the ETBF decreased by 16% in 2018–19 to $32.1 million (Figure 21.14). This decline in GVP was largely the result of lower catch value of key targeted ETBF species: yellowfin tuna and swordfish.

FIGURE 21.14 Real GVP for the ETBF, 2008–09 to 2018–19

Notes: GVP Gross value of production. ‘Real’ indicates that value has been adjusted for inflation.

ABARES has conducted economic surveys of the ETBF since the early 1990s. The survey data are used to estimate the net economic returns (NER) earned in the fishery. Preliminary survey results for the ETBF are available for the 2015–16 and 2016–17 financial years. Non-survey-based estimates for economic performance are available for the 2017–18 and 2018–19 financial years.

In 2015–16, NER for the ETBF are estimated to have increased to $9.6 million—the highest net return to the fishery in real terms since economic surveys of the ETBF began (Figure 21.15). This was supported by an estimated 32% increase in fishing revenue (largely reflective of the very high yellowfin tuna catch that year), favourable prices (as indicated by an improvement in fishers’ terms of trade) and increased productivity (as indicated by an increase in total factor productivity). NER declined in 2016–17 but remained positive at $4.7 million. This was largely the result of a decline in fishing income more than offsetting lower operating costs.
Preliminary non-survey-based estimates of NER for 2017–18 show an increase to $5.7 million, largely as a result of a 10% increase in fishing income. Non-survey-based estimates for 2018–19 indicate a 34% reduction in NER to $3.7 million, largely reflecting income falling more than fishing costs. A decline in total number of fishing days is expected to have contributed to lower overall fishing costs in 2018–19.

**FIGURE 21.15 NER for the ETBF, 2008–09 to 2018–19**

![Graph showing NER for the ETBF, 2008–09 to 2018–19](image)

**Note:** NER Net economic returns.
Source: Mobsby forthcoming

**Performance against economic objective**

Quota latency when the TACC is set at the economic target of maximum economic yield (MEY) can indicate whether the fishery is maximising economic returns. The potential lack of association between domestic management actions and changes in stock biomass for tuna species in the ETBF means that stock-wide biomass at maximum economic yield (B_{MEY}) may not be relevant (Larcombe, Patterson & Savage 2017). In 2017–18, the harvest strategies for swordfish and striped marlin were reviewed and found not likely to be achieving their HSP objectives. AFMA is in the process of redeveloping harvest strategies tested by a management strategy evaluation for these species.

Without an economic-based target for catch (that is, B_{MEY}), the level of catch in the fishery cannot be assessed against MEY. In lieu of meaningful B_{MEY} targets for highly migratory and internationally managed fisheries, increasing total factor productivity in the fishery is consistent with minimising inputs (costs) relative to output (revenue) and thus a movement towards maximising economic returns from the fishery. The productivity index for the ETBF followed an upward trend and increased by an annual average rate of 5% from 2002–03 to 2016–17, suggesting that the fishery is moving towards maximising returns to the fishery (Mobsby forthcoming).

NER are estimated to have been positive for 7 of the 8 years since the harvest strategy for the fishery was implemented in 2010–11. However, NER were improving in the fishery before the harvest strategy was implemented, and many factors other than the harvest strategy may have influenced the fishery’s economic performance (such as improving terms of trade). It is difficult to untangle the effects of the introduction of ITQs, reduced fleet size, total factor productivity and terms of trade changes on overall improvements in economic performance; further research is required to quantify the individual effects of these variables on NER.
21.4 Environmental status

Product from the ETBF currently has export approval under inclusion on the List of Exempt Native Specimens under the Environment Protection and Biodiversity Act 1999 until 19 August 2022. Conditions under this approval, in addition to standard conditions of reporting and monitoring, include updating the ecological risk assessment for the ETBF, developing and implementing a framework for the management of non-quota and bycatch species, and continuing to determine the impact of fishing in the ETBF on shark species.

The most recent ecological risk assessment (ERA) for the ETBF was finalised in 2019 (Sporcic et al. 2018). Of 261 species evaluated at ERA level 2, 8 species were found to be at potential high risk after productivity–susceptibility analysis or sustainability assessment for fishing effects. The subsequent residual risk analysis examining logbook and observer data demonstrated that there was a low or zero level of reported interactions and/or higher survivability than assumed in the initial analyses, reducing the risk posed by the fishery to these species to medium or low. There was no requirement to progress to a level 3 analysis in the most recent ERA.

The introduction of electronic monitoring in the ETBF from mid 2015 has improved the accuracy of logbooks, particularly in the reporting of discarded or released catch. This improved reporting may be reflected in apparent higher levels of interaction for 2019.

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, logbooks indicated that 1,659 shortfin mako sharks (*Isurus oxyrinchus*) were hooked in the ETBF. Of these, 7 were alive, 574 were dead and 1,078 were released in unknown condition. Five longfin mako sharks (*I. paucus*) were also hooked, with 4 dead and 1 released in unknown condition. One porbeagle shark (*Lamna nasus*) was released in an unknown condition. Fifty-four silky sharks (*Carcharhinus falciformis*) were also released in unknown condition, as were 4 dusky whalers (*C. obscurus*) and 1 white shark (*Carcharodon carcharias*). Fifty-two green turtles (*Chelonia mydas*) were hooked; 42 were released alive and 10 were dead. Fifty-two leatherback turtles (*Dermochelys coriacea*) were hooked, with 51 released alive and 1 dead. Similarly, 12 loggerhead turtles (*Caretta caretta*) were hooked; 5 were released alive and 7 were dead. Eight hawksbill turtles (*Eretmochelys imbricata*) were hooked, with 4 dead and 4 released alive. Eight olive ridley turtles (*Lepidochelys olivacea*) were caught, with 7 released alive and 1 dead. One flatback turtle (*Natator depressus*) was dead after being hooked. Eighteen unidentified turtles were hooked, with 13 alive, 4 dead and 1 released in an unknown condition.

Two black-browed albatrosses (*Thalassarche melanophris*), 3 wandering albatross (*Diomedea exulans*) and 1 shy albatross (*T. cauta*) were all dead after being hooked. Fifty unidentified albatrosses were hooked, with 15 released alive and 35 dead. Two short-tailed shearwater (*Puffinus tenuirostris*) were hooked with 1 dead and 1 released alive. Thirty-seven unidentified shearwaters were hooked, with all except 1 being dead. One cape petrel (*Daption capense*) was hooked and dead, and 4 unidentified birds were released alive.
A number of interactions with marine mammals were recorded; these comprised 7 unidentified dolphins (5 released alive), 1 bottlenose dolphin (Tursiops truncatus) released alive, 3 common dolphins (Delphinus spp.) hooked, with 2 alive and 1 dead, 4 short-finned pilot whales (Globicephala macrocephalus; 3 alive and 1 released in an unknown condition), 4 false killer whales (Pseudorca crassidens) were released alive, 1 unidentified whale was dead, and 2 New Zealand fur seals (Arctocephalus forsteri), 1 dead and 1 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.

21.5 References

Campbell, R 2012, ‘Implementation of the ETBF harvest strategy and calculation of the recommended biological commercial catches for 2013/14’, working paper presented to the fifth meeting of the Tropical Tuna Resource Assessment Group, Canberra, 4 to 5 September 2012.


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