Australian Government

Australian Fisheries Management Authority

Fishery Management Strategy

Eastern Tuna and Billfish Fishery (ETBF) 2019 - 2023

Distribution List

Title	Name	Date
AFMA	Staff and Commissioners; AFMA Website	
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Glossary

AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
ARC	AFMA Research Committee
B	Biomass
B_{LIM}	Biomass limit reference point
B_{MEY}	Biomass that provides the maximum economic yield
B_{MSM}	Biomass that provides the maximum sustainable fishing mortality
B_{MSY}	Biomass that provides the maximum sustainable yield
B_{TARG}	Target biomass
BRD	Bycatch Reduction Device
bSAFE	base Sustainability Analysis for Fishing Effects
CDR	Catch Disposal Record
CEO	Chief Executive Officer
CPUE	Catch per unit effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and the Environment
EBFM	Ecosystem Based Fisheries Management
EM	Electronic Monitoring
EMS	Environmental Management System
EPBC 1999	Environmental Protection and Biodiversity Conservation Act 1991
ERA	Ecological Risk Assessment
ERAEF	Ecological Risk Assessment for the Effects of Fishing
ERM	Ecological Risk Management
eSAFE	enhanced Sustainability Analysis for Fishing Effects
ESD	Ecologically Sustainable Development
ETBF	Eastern Tuna and Billfish Fishery
F	Fishing Mortality
FAA 1991	Fisheries Administration Act 1991
FAP	Fisheries Administration Paper
F_{crash}	Minimum unsustainable instantaneous fishing mortality rate that, in theory, will lead to population extinction in the long term
FIS	Fishery Independent Survey
F_{LIM}	Fishing mortality limit reference point
FMA 1991	Fisheries Management Act 1991
FMB	Fisheries Management Branch
FMP	Fisheries Management Plan
FMF	Fisheries Management Framework

AFMA	Australian Fisheries Management Authority
FMS	Fishery Management Strategy
F_{TARG}	Target fishing mortality rate
HCR	Harvest Control Rule
HMR	Harvest Monitoring Rule
HSF	Harvest Strategy Framework
HSP	Harvest Strategy Policy 2018
ICCAT	International Commission for the Conservation of Atlantic Tunas
ISO	International Standards Organisation
ITQ	Individual Transferable Quota
M	Natural mortality
MAC	Management Advisory Committee
MSE	Management Strategy Evaluation
MEY	Maximum Economic Yield
MoU	Memorandum of Understanding
MSC	Marine Stewardship Council
MSM	Maximum sustainable fishing mortality
OBIEE	Oracle Business Intelligence Enterprise Edition
PEER	Policy Environment Economics and Research Section
PSA	Productivity Susceptibility Analysis
R	Intrinsic rate of population increase
RAG	Research Advisory Group
RBC	Recommended Biological Catch
SAFE	Sustainability Analysis for Fishing Effects
SBT	Southern Bluefin Tuna Fishery
SFR	Statutory Fishing Rights
SLA	Service Level Agreement
SICA	Scale Intensity Consequence Analysis
TAC	Total Allowable Catch
TAE	Total Allowable Effort
TAP	Threat Abatement Plan
TEPS	Threatened Endangered and Protected Species
TWG	Technical Working Group
UNCLOS	United Nations Convention on the Law of the Sea
UNSFA	United Nations Straddling Fish Stocks Agreement
VMS	Vessel Monitoring System
WCPFC	Western and Central Pacific Fisheries Commission

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Executive Summary

Introduction

This *Eastern Tuna and Billfish Fishery – Fishery Management Strategy 2019-2024* (the ETBF FMS) describes the key "operational" fisheries management processes and arrangements that will pursue AFMA's legislative objectives in the ETBF (including those outlined in the *ETBF Fishery Management Plan 2010*) over the next 5 years.

It was developed through 18 months of consultation with the Tropical Tuna Resource Assessment Group (TTRAG), the Tropical Tuna Management Advisory Committee (TTMAC), the industry association (Tuna Australia Pty Ltd), the Ecological Risk Assessment Technical Working Group (ERA TWG), the Department of Agriculture, Water and the Environment (DAWE), the AFMA Commission and relevant AFMA staff and executives.

Legislative background

The Fisheries Management Act (1991) requires AFMA *pursue* a number of objectives including those relating to efficient and cost effective management, ecologically sustainable development, maximising the net economic returns to the community, accountability and cost recovery.

It also requires that AFMA *have regard to*: preventing over-exploitation of resources; optimal utilisation; commercial, recreational and indigenous interests; international agreements and the conservation of whale species.

In addition, the Environmental Protection and Biodiversity Conservation Act 1999 (EPBCA 1999) requires that AFMAs fisheries not adversely impact the conservation status of protected species or the survival or recovery of threatened species and take all reasonable steps to ensure EPBC listed species are not killed or injured as a result of fishing. The EPBCA 1999 requires that independent assessments are conducted on the environmental performance of AFMAs fisheries.

ETBF objectives and performance measurement

For each of the above legislative objectives[1], this ETBF FMS specifies fishery-specific operational objectives (consistent with those in the *ETBF Fishery Management Plan 2010)*, which align directly with a range of Commonwealth and internal AFMA fisheries policies and guidelines, including in particular:

- The Commonwealth Fisheries Harvest Strategy Policy (2018) and Guidelines
- The Commonwealth Fisheries Bycatch Policy (2018) and Guidelines
- Guidelines for the Ecologically Sustainable Management of Fisheries (2007)
- AFMA Ecological Risk Management Guide (2017)

For each operational objective, it is intended that the FMS list the indicators and performance measures required to pursue and measure performance against its legislative

[1] With the exception of the cost recovery objective

objectives. This approach has been applied within the ETBF FMS to sustainability/conservation, economic and accountability objectives, and will be soon developed for the remaining operational objectives.

This approach provides transparency and a direct line of sight between AFMAs legislative objectives, operational processes and its performance against those objectives. AFMA uses the FMS to guide section and staff annual work plans. These work plans will be developed taking account of the required resources, activities, outputs, implementation and compliance based outcomes required to achieve each operational and legislative objective. Annual ETBF performance will then be reported upon in an annual *ETBF FMS Report*.

FMS Structure and Approach

A significant proportion of AMFA's management strategies/processes focus on managing the interaction of its fisheries with the environment (with an emphasis on maintaining ecological sustainability and minimising interactions with EPBC listed species) and within that context, maximising economic returns.

For this reason, the ETBF FMS is divided into key sections outlining management processes for:

- **Commercial species** – where the management focus is on sustainability and economic returns
- **Bycatch species** – where the management focus is on sustainability and minimising interactions with EPBC listed species
- **Habitats and Communities** – where the focus is on future work to better understand impacts on ecological communities
- **Data, Monitoring and Research** – where the focus is on identifying and implementing processes to meet the information needs underpinning the Commercial, Bycatch and Habitats/Communities sub-strategies.

However, AFMA also simultaneously pursues a range of other legislative objectives under the FMA 1991. At an operational level, AFMA does this by designing the above "sub-strategies" in a manner that they, to the greatest extent possible:

- Are efficient, cost effective and ensure transparency and accountability (through proper consultation, reporting and performance assessment processes) and,
- Have regard to optimal utilisation of resources, international agreements and the conservation of whales and
- Have regard to the interests of commercial, recreational and indigenous fisheries

Commercial Species Management

Commercial species in the ETBF comprise two groups:

- Key commercial species - Yellowfin Tuna, Bigeye Tuna, Albacore Tuna, Broadbill Swordfish and Striped Marlin and

- Byproduct species - for example; Mahi Mahi, Rudderfish, Rays Bream, Wahoo, Opah and other species. The full list of byproduct species are listed in the ETBF ERA Report 2019.

Southern Bluefin Tuna (SBT) is also harvested by vessels operating in the ETBF but all catches of SBT are managed under the SBT Fishery Management Plan (1995).

The principle ETBF operational objectives for commercial species are:

- To ensure TACCs do not exceed agreed WCPFC national limits/allocations (e.g as specified by WCPFC CMMs)
- Implementation of any adopted WCPFC Harvest Strategy and associated catch limits, or, for species where these are not adopted;
- Implementation of a domestic harvest strategy that:
    - maintains (for at least 90 per cent of the time) ETBF commercial fish stocks above a biomass limit (B_{LIM}) where the risk to the stock (i.e. of recruitment impairment) is regarded as unacceptable
    - maintains ETBF key commercial fish stocks, on average, at the required target biomass (B_{TARG}) to produce the maximum economic yield (MEY) from the fishery
- Ensure fishing is conducted in a manner that does not lead to over-fishing. Where it is identified that overfishing of a stock is occurring, action will be taken immediately to cease overfishing
- Ensure management of commercial species takes account of the precautionary principle
- Minimise discarding of commercial species to the greatest extent possible

To achieve these objectives, key commercial species in the ETBF are managed via one of three approaches, depending on the species:

- **Domestic Harvest Strategy** (Control Rule) Approach - comprises a traditional harvest control rule based harvest strategy approach (tested via Management Strategy Evaluation) to determine RBCCs for some key commercial species in the ETBF. This is normally applied to striped marlin and broadbill swordfish, but noting that a new harvest strategy for striped marlin is currently being developed.

- **Indicators based** and “whole of government position” approach - This approach is applied where a domestic harvest strategy cannot be applied. It combines consideration of local and WCPO stock status indicators with Australia’s whole of government position on national allocation (and resource sharing), to determine TACCs. This is currently applied to all key commercial species except Swordfish. For striped marlin, it will be applied only until a revised domestic HS is adopted. For albacore, yellowfin and bigeye tuna it will be applied until WCPFC Harvest Strategies and associated catch limits are agreed and adopted. Any TACCs set must take account of agreed limits/allocations under CMMs for these species.

- **Monitoring rules based approach** - This approach is applied to byproduct species (non-quota species) in the ETBF, which are assessed every five years under the Ecological Risk Assessment (ERA) cycle. In between assessments, byproduct catch levels are to be monitored annually against trigger levels to ensure AFMA is aware of potential changes in risk level. Byproduct species found to be at high risk from the fishery via ERA will have case specific (not pre-specified) management responses designed to reduce catches and risk to acceptable levels. A number of byproduct species are also subject to catch limits defined under Offshore Constitutional Settlement (OCS) arrangements between the Commonwealth and States and Territories.

A revised Swordfish Harvest Strategy (to assist Annual TACC setting) was implemented in 2020 and utilises a standardised CPUE based harvest control rule (HCR), with a target reference point (TRP) equivalent to the average ETBF std-CPUE for the period 2012-15. The HCR provides a buffer zone around the TRP to ensure some stability in Recommended Biological Commercial Catch (RBCC) when the std-CPUE is near the target level, but acts to reduce the RBCC when the std-CPUE is below the buffer zone and increase the RBCC when the std-CPUE is above the buffer zone. The harvest strategy was MSE tested to ensure consistency with the Commonwealth Harvest Strategy Policy 2018, including its ability to pursue the TRP and avoid the stock falling below the Limit Reference Point (LRP).

A number of key actions for the continual improvement of commercial species management over the next 5 years have been identified and include:

- Redevelopment and implementation of an MSE tested Harvest Strategy for Broadbill Swordfish and Striped Marlin (within 2 years).
- Development of monitoring triggers and process for byproduct species.
- Updating of the FMS for any future requirements relating to discarding of commercial species stemming from relevant domestic or international policies or measures.
- Data collection and research to better understand depth of fishing associated with different fishing strategies.
- Improvements to byproduct species data collection (for example, to improve species identification by fishers).

Bycatch Species Management

EBTF bycatch species comprise two categories: **general bycatch** species (non-retained species) and EPBC listed species.

The principle ETBF operational objectives for general bycatch species are:

- Fishing in the ETBF does not reduce any general bycatch species populations to/below a level at which the risk of recruitment impairment is unacceptably high.
- Where such reductions have occurred, implement management arrangements to support those populations rebuilding to biomass levels above that level.

- ETBF management arrangements draw on best practice approaches to avoid or minimise all bycatch, and minimise the mortality of bycatch that cannot be avoided
- Ensure management of bycatch species takes account of the precautionary principle

The principle ETBF operational objectives for **EPBC listed species** are:

- To not adversely affect the conservation status of protected species by fishing in the ETBF
- To not adversely affect the survival or recovery of threatened species by fishing in the ETBF
- AFMA ensure ETBF operators take all reasonable steps to ensure that protected species (other than conservation dependent species) are not killed or injured as a result of fishing.

The management arrangements put in place to pursue bycatch objectives are diverse in nature. Depending on the specific arrangement or condition, they can be applied to all bycatch species, particular species groups or individual species.

All bycatch species

Must be handled in a manner that returns bycatch to the water quickly and maximises their chance of survival, as per the AFMA Bycatch Handling and Treatment Guide.

Sharks

ETBF measures to reduce the capture and mortality of sharks, and prevent their targeting, include a ban on shark finning and using wire trace, the carriage of line cutters and dehookers (to release live sharks), and a trip limit of 20 retained shark. Four species cannot be landed at all, being Grey Nurse sharks and Great White Sharks (protected under the EPBC Act 1999) and Silky Shark and Oceanic Whitetip Shark (protected by a WPCFC Conservation and Management Measure).

Seabirds

ETBF management arrangements for seabirds are designed to ensure consistency with relevant international agreements and guidelines (e.g. CCM, ACAP, FAO, IPOA-seabirds, and RFMO conservation measures) as well as the Threat Abatement Plan (TAP) for "*Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations*" which requires AFMA to reduce the incidental capture of seabirds in oceanic longline operations and maintain a bycatch rate of less than 0.05 birds per 1000 hooks in five degree latitudinal bands and summer and winter seasons.

At all times ETBF vessels must carry at least one tori line and not discharge offal while setting. When fishing south of 25S, vessels must deploy tori lines (that achieve 90 meter aerial coverage and have streamers no more than 3.5 m apart) during day sets, use non frozen bait, and weight longlines to ensure rapid sinking of baits, or use hook shielding devices. Any bird that has died as a result of an interaction and is brought on board, must be held in view of the electronic monitoring cameras and feather samples must be taken for DNA analysis, to aid in proper species identification.

Vessel specific requirements were also implemented in 2020. Vessels that are regularly unable to maintain interactions below the TAP trigger, or which take more than 10 birds in a season, will be subject to in-season monitoring. Those vessels will be required to implement additional mitigation of they then breach the TAP trigger again in-season or if they fail to report a seabird interaction.

Marine turtles

To minimise interactions with and mortality of marine turtles, and ensure consistency with WCPFC CMM 2018-03, AFMA requires ETBF operators to carry dehookers and line cutters on board at all times, and the compulsory use of large circle hooks on all shallow set longlines (defined as longlines set with less than 8 hooks between bubbles/floats). A key future action will be to provide ETBF operators with information pertaining to spatial, temporal and fishing strategy risk factors that will allow them to take such factors into consideration when planning fishing trips and further reduce turtle interactions.

Marine mammals

Interactions in the form of hooking or entanglements with marine mammals (e.g. cetaceans and seals) are uncommon in the ETBF, however, ETBF operators are required to carry dehookers and line cutters which will assist operators to disentangle, cut free or dehook any marine mammals that may interact with the fishing gear. A future action being considered by industry is the investigation of the use of acoustic pingers to deter interactions with toothed whales which are known to depredate bait and hooked tuna off the lines.

Other species

Blue and black marlin are “recreational only” species, with a ban on their retention in the ETBF and a restriction on the number of hooks per set in the Coral Sea Zone of 500 hooks (to reduce set times and increase at-capture and post-release survival). A number of other species are “no-take” as a result of Offshore Constitutional Settlements.

Compliance

With the implementation of electronic monitoring in the ETBF, along with port and vessels inspections, AFMA has a strong capacity to monitor compliance by ETBF vessels with bycatch management arrangements.

Bycatch Future Management Actions

For bycatch species, AFMA has identified a range of key actions for the continual improvement bycatch management, including:

- Develop and monitor indicators based on catch, effort and gear changes designed to trigger investigation of potential changes in ecological risk to bycatch species.
- Review EM camera positioning to optimise bycatch and mitigation monitoring
- Encourage research into bycatch mitigation and population structure of bycatch species to better understand ETBF impacts relative to international fisheries.
- Hold bycatch mitigation, identification and handling workshops for ETBF crews

- Explore the development of individual vessel accountability based management mechanisms to manage bycatch interactions.

Habitats and Ecological Communities

Pelagic longline fishing is a surface based fishing method which very rarely interacts with benthic habitats. Therefore its impacts on habitats are considered negligible and there are no related management arrangements in place. The impact of the ETBF upon ecological communities has also been assessed under the ETBF ERA to be moderate at Level 1 (for two different ERA hazards) but a subsequent Level 2 assessment has yet to be conducted. To date, there are no *specific* management measures applied in the ETBF to reduce impacts upon ecological communities.

However, the broad suite of species and species group management measures applied across commercial and bycatch species, to ensure their ecological sustainability and to reduce interactions and mortalities at the individual species levels, are very likely to also contribute to reduced impacts by the fishery on ecological communities. An action under this FMS is for AFMA to further consider potential impacts on ecological communities.

Data and Monitoring

Ongoing data collection is needed in the ETBF to; support evidence based fishery management decisions; monitor fishery compliance with management decisions and; measure and report upon the performance of AFMAs management arrangements in achieving its legislative objectives.

As such, data collection in the Eastern Tuna and Billfish Fishery (ETBF) supports the management of commercial species (Section 3) and bycatch species (Section 4) and the pursuit of related and broader management objectives (Section 2.2).

This data strategy clarifies the relationship between ETBF **legislative/operational objectives** (e.g. Economic returns), the **management approach**(es) used to pursue each objective (e.g. harvest strategies for key commercial species), and the multiple **data/information sources** used to support and inform each of these management approaches (e.g. logbook data, CDR data, EM data etc).

It then provides a general overview of each of the data/information sources, including the method of data collection, verification and storage. Key data collection processes in the ETBF include logbooks, electronic monitoring (cameras), catch disposal records (CDRs), vessel monitoring systems (VMS) and human observers (pre 2016).

It specifies for **each** specific objective-linked management approach, a detailed breakdown of the essential data variables required to support that management approach (and achievement of the linked objectives). For each data variable, a description of current collection/availability status and assumptions associated with use of the data is provided. The latter fields help to identify any further actions to improve data collection to support the ETBF FMS objectives, with Table 19 summarising those actions and timeframes to achieve the actions within the 5-year cycle of this FMS.

Key actions under the data strategy predominantly aim to address data gaps include:

- To explore additional logbook data fields to enhance catch rate analyses and clarify requirements for operators on fields that are misinterpreted.
- Explore the use of electronic monitoring to audit additional logbook data fields and to collect additional data to improve assessments and protected species monitoring
- Explore the collection and utilisation of economic costs and returns data for the development of in-season economic indicators
- Exploration of options for future standardised electronic at boat or port collection of fish size data (e.g. via e-CDRs)
- Explore the use of temperature depth recorders (TDRs) in improving understanding of fishing depths by fishing strategy.

Research

The research strategy outlines the key strategic research needs in the tropical tuna fisheries (predominantly the ETBF but including related tropical tuna fisheries - the Western Tuna and Billfish Fishery (WTBF), and the Eastern and Western Skipjack Tuna Fisheries). The strategy was developed in 2017 and will be restructured over the next 12 months to split out other tropical tuna fisheries and focus on the ETBF within this FMS. Associated with this strategy, Annual Research Statements are developed each year for the ETBF to detail the highest priority research topics that have been identified by TTMAC with advice from TTRAG and AFMA.

The drivers of research activities fall into four main categories being biological, ecological, economic and social information needs. As such priority research areas under the strategy are:

- Data collection and provision, particularly biological, economic, environmental and recreational fishery data.
- Biological research to support stock assessments, harvest strategies and knowledge of stock connectivity.
- Ecological and environmental research to understand non-target species and ecological community impacts, climate change impacts.
- Economic/social research including in relation to MPAs, resource sharing and levies.

The key action under the Research sub-strategy is the development of Annual Research Statements to ensure research needs continue to be identified and met in the ETBF.

FMS performance reporting, evaluation and review

AFMA will report on performance against this ETBF FMS through the publication of an ETBF Annual Report. While the FMS is a “living document” and can be updated as circumstances require (for example, changes to Commonwealth fisheries policies, legislation or resource sharing agreements), a formal comprehensive review and revision of the FMS will be undertaken every 5 years, in association with the 5-year ERA cycle.

1 Background

1.1 Introduction

This *ETBF Fisheries Management Strategy 2019-2023* describes the key "operational" fisheries management processes that will pursue AFMA's legislative objectives in the ETBF (including those outlined in the *ETBF Fishery Management Plan 2010*) over the next 5 years. It is the core fishery-level document that describes how government, agency (AFMA) and boat-level management requirements will be met in the ETBF (Figure 1).

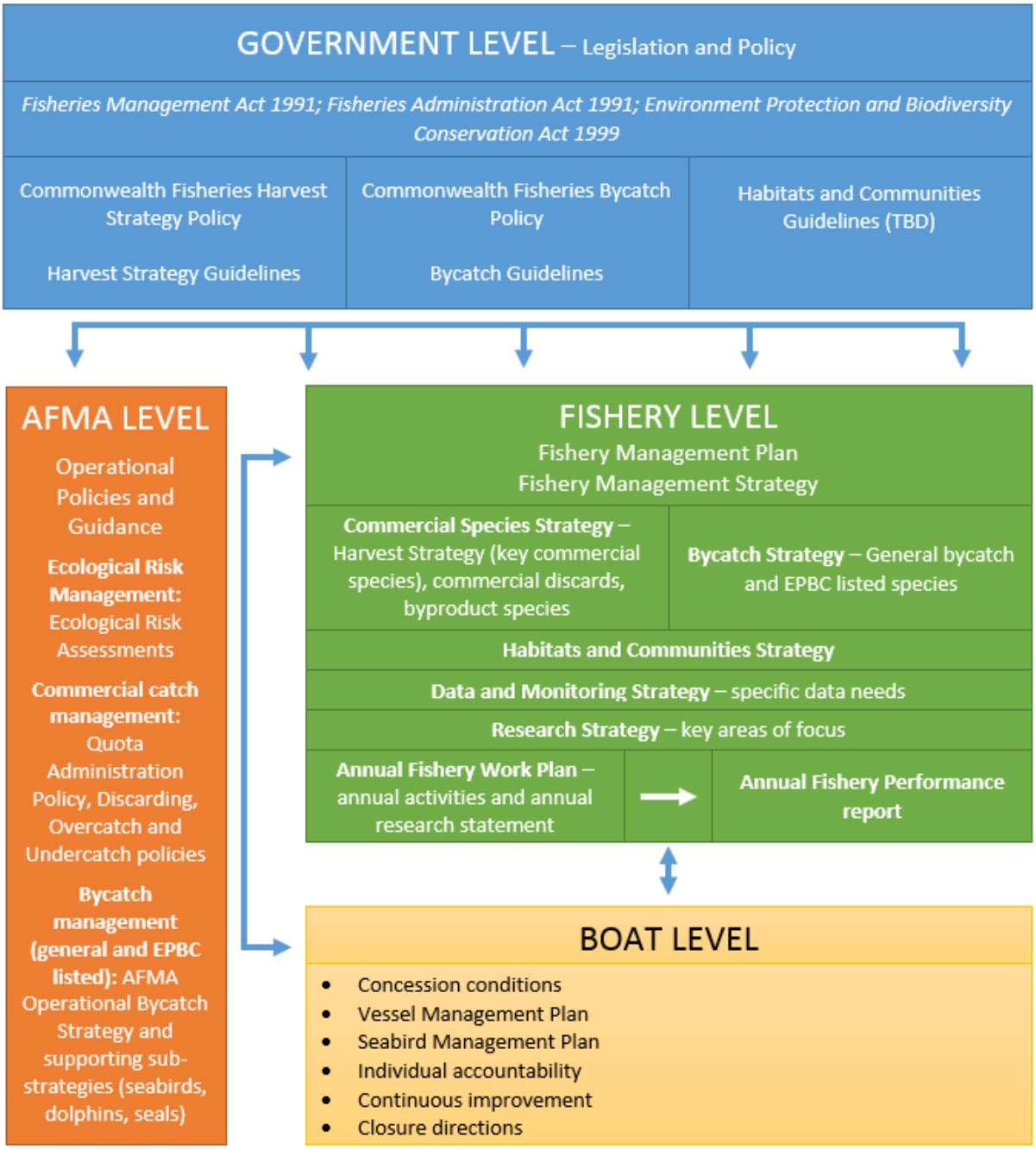

Figure 1. The relationship between government, AFMA level, fishery level and boat level fisheries policy and management mechanisms. Fishery Management Strategies and associated processes are in green. Note – Government level policy and guidelines for habitats/communities are yet to be developed.

The ETBF FMS integrates and replaces previously separate fishery-specific management strategies and plans (i.e. the harvest strategy, ecological risk management strategy, bycatch action plan, research plan and data plan). It is one of a core set of fishery-specific documents (see Section 2.6) which are used to describe the fishery, its management arrangements, and AFMAs performance against its objectives. Further context regarding the need for and role of the ETBF FMS is provided in Sections 1.2 and 1.3 below.

1.2 Legislation and policy

1.2.1 Legislation

In managing Commonwealth fisheries, AFMA must pursue (or have regard to) objectives and requirements outlined in three key pieces of legislation:

1. The Fisheries Administration Act 1991 (FAA 1991)
2. The Fisheries Management Act 1991 (FMA 1991).
3. The Environmental Protection and Biodiversity Conservation Act 1999 (EPBCA 1999).

Other non-fisheries specific Commonwealth legislation also influences how AFMA conducts its business but is not covered further here.

The FAA 1991 served to establish AFMA and outlines AFMAs functions and responsibilities. The FMA 1991 requires that AFMA pursue the following objectives in all of its fisheries:

1. implementing efficient and cost-effective fisheries management on behalf of the Commonwealth; and
2. ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development (which include the exercise of the precautionary principle), in particular the need to have regard to the impact of fishing activities on non-target species and the long-term sustainability of the marine environment; and
3. maximising the net economic returns to the Australian community from the management of Australian fisheries; and
4. ensuring accountability to the fishing industry and to the Australian community in AFMA's management of fisheries resources; and
5. achieving government targets in relation to the recovery of the costs of AFMA;

AFMA must also have regard to the objectives of:

6. ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over exploitation; and
7. achieving the optimum utilisation of the living resources of the AFZ; and
8. ensuring that conservation and management measures in the AFZ and the high seas implement Australia's obligations under international agreements that deal with fish stocks; and
9. to the extent that Australia has obligations:
    a. under international law; or
    b. under the Compliance Agreement or any other international agreement; in relation to fishing activities by Australian‑flagged boats on the high seas that

are additional to the obligations referred to in paragraph (c)—ensuring that Australia implements those first-mentioned obligations; and

10. ensuring that the interests of commercial, recreational and Indigenous fishers are taken into account;
11. but must ensure, as far as practicable, that measures adopted in pursuit of those objectives must not be inconsistent with the preservation, conservation and protection of all species of whales.

Section 17 of the FMA 1991 requires that Commonwealth fisheries develop and maintain *Fisheries Management Plans*[2] (FMPs) to pursue these objectives. The ETBF FMP 2010 outlines at a high level, how these objectives are pursued in the ETBF. Further to this, the EPBC Act (1999) requires ecological sustainability in Australia's fisheries by providing for independent assessment of the environmental performance of fisheries management arrangements, through:

1. Strategic assessments of Commonwealth managed fisheries (Part 10) prior to new management arrangements being brought into effect.
2. Environmental assessment for international trade in wildlife (Part 13A).
3. Environmental assessment of fisheries operating in Commonwealth waters for impacts on protected species (Part 13).

The EPBC Act 1999[3] requires that AFMA ensures its fisheries take all reasonable steps to ensure that EPBC listed species (other than conservation dependent species) are not killed or injured as a result of fishing.

In addition to legislative "Acts", there are also a number of legislative "determinations', specifically those relating to the setting of ETBF TACCs and over and under catches.

1.2.2 ETBF Fishery Management Plan 2010

The ETBF FMP 2010 is the legislative instrument that specifies at a high level how the objectives of the FMA 1991 and EPBCA 1999 are to be pursued in the ETBF. The ETBF FMP 2010 requires that AFMA implement in the ETBF:

- Specific ecosystem requirements including for ecological risk management and harvest strategies
- Limitations on total catches of key commercial species through the determination of Total Allowable Commercial Catches (TACCs).
- Access rights to the fishery via Statutory Fishing Rights (SFRs) including both quota SFRs (that are individually transferable) for each of the five key commercial species and three types of boat SFRs (being ETBF Longline, Coral Sea Zone* and Minor Line).
- Conditions around allowed fishing areas, scientific research, carrying and processing fish, foreign fishing and overcatch and undercatch.

[2] FMPs are also legislative instruments
[3] Sections 208A, 222A, 245 and 265

Further detail of the links between this Fishery Management Strategy and the ETBF FMP 2010 are explained in the following chapters.

1.2.3 Supporting polices, guidelines and frameworks

To support and guide AFMA in pursuing its legislative objectives and requirements, a number of additional fisheries policies, guidelines and frameworks have been developed over time. Table 1 (below) outlines these in chronological order of implementation. This array of policies and guidelines is intended to provide AFMA with clear guidance on its objectives, performance benchmarks, and the operational/technical processes that must be implemented in order to achieve AFMAs legislative objectives. Each addresses gaps in such guidance that previously existed. They ensure consistency, transparency, accountability in how AFMA pursues its legislative objectives. The full list of AFMA policies is found here.

Table 1 Key policies and guidelines for developing fishery management arrangements.

Policy/Guideline	Purpose
Commonwealth Fisheries Bycatch Policy and Guidelines 2018 (CFPB 2018)	Primary objective is to minimise fishing-related impacts on **general** bycatch species in a manner consistent with the principles of ESD and with regard to the structure, productivity, function and biological diversity of the ecosystem.
Commonwealth Harvest Strategy Policy and Guidelines 2018 (HSP 2018)	Requires the ecologically sustainable and profitable use of Australia's Commonwealth commercial fisheries resources (where ecological sustainability takes priority)—through the implementation of harvest strategies for key commercial species. It specifies target (economic) reference points for key commercial species and limit (sustainability) reference points for key commercial and byproduct species.
Guidelines for the Ecologically Sustainable Management of Fisheries 2007 (GESMF 2007)	Used to assess ecological sustainability of fisheries under EPBCA 1999. Principle 1 (commercial and byproduct species) requires the avoidance of overfishing (either recruitment or growth overfishing) and recovery of overfished stocks. Principle 2 requires that fishing not "threaten" bycatch species (bycatch levels must be demonstrably sustainable); that fishing avoid mortality of, or injury to, protected species; and fishers avoid or minimise impacts on threatened ecological communities.
AFMA Guide to Ecological Risk Management 2017 (ERM Guide)	Provides AFMA fishery managers and advisory groups updated technical guidance on how to implement both ecological risk assessment (ERA) and ecological risk management (ERM) in the pursuit of ecological sustainability for all species (commercial and bycatch), habitats and communities with which its fisheries interact. It also outlines requirements for development of FMS.

Policy/Guideline	Purpose
AFMA Bycatch Strategy 2017	Establishes guiding principles that AFMA will use in identifying bycatch issues in order to minimise and avoid bycatch of EPBC listed and general species. It provides guidance to AFMA management of interactions with EPBC listed species which are not a focus of the Commonwealth Fisheries Bycatch Policy 2018.
Quota Administration Policy 2013	Sets out the Australian Fisheries Management Authority (AFMA) policy for administering Individual Transferable Quotas (ITQs)
Policy on management of overcatch and undercatch	This sets out the principles that will be applied by AFMA in managing undercatch of quota (also known as carryover) and overcatch of quota (also known as carryunder). Allows flexibility in annual catches against quota but without risk to sustainability objectives.
AFMA's Five Year Strategic Research Plan	Sets out a framework for each fishery to review its information and development needs and to plan and develop its individual five-year research programs.
AFMA Science Quality Assurance Policy 2018	Provides a framework, referencing the FRDC funded *"Guidelines for quality assurance of Australian fisheries research and science Information" (*Penney et al 2016), to ensure the quality and integrity of research and scientific information used in AFMA's fisheries management and policy decision processes.

1.2.4 International agreements and requirements

Commonwealth fisheries legislation requires that AFMA fisheries comply with relevant international fisheries agreements and conventions that Australia is party to. Many of the key commercial, byproduct and bycatch species caught in the ETBF are highly migratory and their stocks or populations often span both high seas areas and the EEZs of many Pacific countries. For this reason, the management of these stocks requires international cooperation.

The Western and Central Pacific Fisheries Commission (WCPFC) was set up to facilitate the cooperative management of tuna and billfish fisheries in the Western Central Pacific Ocean and is made up of a large number of member countries, of which Australia is one. The WCPFC meets annually to review the catch, effort and scientific information for all member countries and to identify and implement management measures required to achieve the sustainable harvest and conservation of the targeted fish stocks and ecologically related species. AFMA must implement any fisheries measures agreed by WCPFC, including any catch limit for ETBF species. AFMA must also consider any rules or management arrangements (Resolutions, and Conservation and Management Measures (CMMs)), of the WCPFC in developing management arrangements for the ETBF.

The ETBF also interacts with southern bluefin tuna and Australia must also abide by measures adopted by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). All longline management measures of CCSBT must be implemented by the ETBF. Management plans and other policy measures for Commonwealth fisheries incorporate the conservation measures adopted by both CCSBT and WCPFC.

1.3 AFMAs Fisheries Management Framework

1.3.1 Historical context

In response to the above legislation, policies and international obligations, and utilising associated guidelines, a number of plans and strategies were developed for the ETBF (and other fisheries) over many years to help pursue AFMAs legislative objectives.

In the ETBF specifically, the most important of these is the *ETBF Fishery Management Plan 2010*, a legislative instrument established under section 17 of the FMA 1991. Its objectives mirror those of the FMA 1991 and are described in detail in Section 2.2. Other ETBF strategies were developed to operationalise the ETBF FMP 2010, including the ETBF Harvest Strategy 2011, the ETBF Ecological Risk Management Report 2012, the ETBF Bycatch and Discard Workplan 2014-2016, the ETBF Five Year Research Strategy 2017-2021, the ETBF Data Strategy 2006 and a number of cross fishery plans for EPBC listed species (e.g. Seabird Threat Abatement Plan; NPOA Sharks; Shark and ray handling guide).

However, each was developed at different time points, with different review cycle timeframes, making it difficult to ensure consistency and compatibility across strategies. This was commonly the case in other Commonwealth fisheries also.

1.3.2 Review recommendations

Between 2012 and 2014, an independent review was undertaken into AFMA's ERM framework and its broader fisheries management planning, implementation and reporting processes. Amongst a suite of recommendations (see ERM Guide), the review concluded that AFMA's Fishery Management Branch (FMB) processes could be significantly strengthened by:

a. Updating and aligning those processes to a four phase Fishery Management Framework based on planning, implementation, monitoring and evaluation phases.
b. Within the planning phase of the FMF, develop fishery-specific **Fishery Management Strategies**, utilising a planning approach called "*logic modelling*".
c. Underpin the framework with an ISO standard management system, specifically ISO9001 – Quality Management System.

Described in detail in the "*Guide to AFMAs Ecological Risk Management*" (the ERM Guide) the following provides a brief overview of each of these elements being either implemented or considered for future implementation by AFMA in the ETBF and other fisheries.

1.3.3 Framework structure

AFMA's fisheries management framework (FMF) (Figure 2) requires that each fishery implement its management processes in a 5 year cycle comprising 4 components:

1. **Planning** – this phase involves the development/updating of an integrated fishery management strategy (FMS), which would integrate and replace the previously separate fishery strategies, and develop annual work plans (to implement the FMS) and annual research statements (identifying research priorities to support FMS).
2. **Implementation** – carrying out of FMS implementation activities identified in the annual workplans.
3. **Monitoring/reporting** - monitoring of progress against FMS objectives and reporting of these in an Annual FMS Report.
4. **Evaluation/review** - every five years, an evaluation and review of the FMS and identification of areas for improvement.

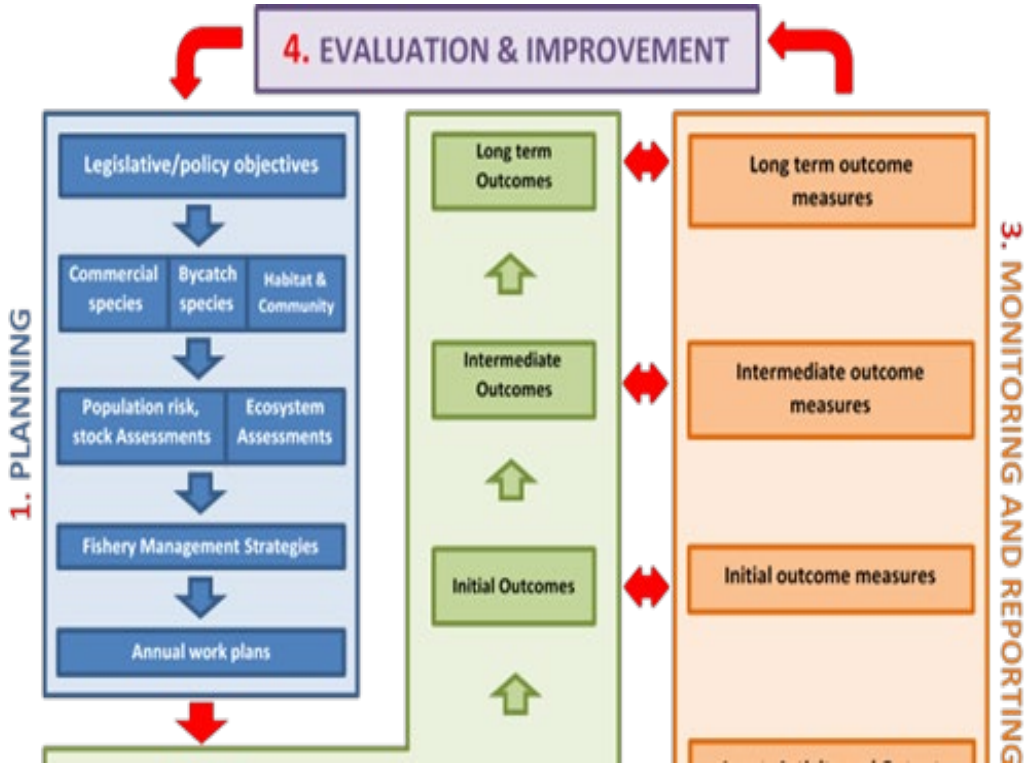

Figure 2 Generalised representation of the Fisheries Management Framework used to support the development, implementation, monitoring and improvement of Fishery Management Strategies (FMS) in Commonwealth fisheries.

While Figure 2 represents the FMF processes as a cycle, some subcomponents fall into two categories (for example, species assessments can be integral to management planning but are also an implementation activity) and some will feed back into planning and FMS amendments annually or earlier than 5 years, as needed.

1.3.4 Fishery Management Strategies

The development of fishery-specific FMS are central to the FMF concept, with FMS designed to integrate and replace the previously separate fishery strategies, and represent a single, easily understood, transparent and cost-efficient management strategy to pursue

AFMAs objectives. AFMA developed guidance for implementing FMS as part of the *AFMA ERM Guide 2017*. Initially the focus of FMS will be species level management, focussed on key commercial, byproduct and bycatch species, but elements on habitat and ecological community management will be included in future.

A key process recommended by the independent review to assist in the development and implementation of FMS is the use of **logic models**. These models require AFMA to document how it intends to pursue its fishery level operational objectives (which align to legislative objectives) and ensure it takes account of:

- inputs (resources), core management activities and outputs resulting from those activities;
- short (implementation), medium (e.g. compliance) and long term intended/required (i.e legislative) outcomes (Figure 3), and
- the performance indicators and reference points that will be used to measure performance against the required short, medium and long-term outcomes.
- underpinning assumptions (relating to the previous elements) that might impact on the likelihood of achieving the objectives

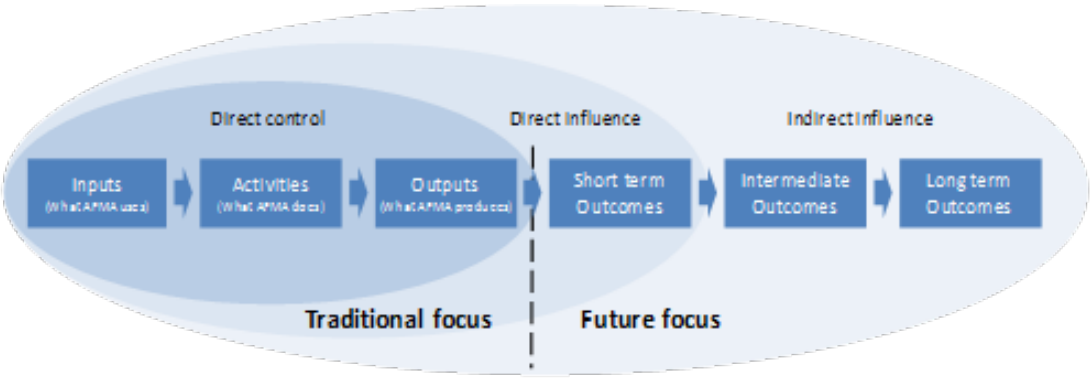

Figure 3. Relationship between inputs, activities, outputs and outcomes under AFMA's Fisheries Management Framework. This ensures management activities and outputs are explicitly linked to management outcomes that meet AFMA's ERM and legislative objectives.

The resources, activities, outputs and short term (implementation) and medium term (compliance) outcomes associated with pursuing each objective are taken account of as part of staff and section workplans and performance reviews. The FMS then specifies the performance criteria associated with long term outcomes associated with each objective (i.e. allowing assessment of performance against AFMAs pursuit of operational/legislative objectives).

Once developed, FMS will be used to guide the development of an integrated Annual Fishery Work Plan, and AFMA's progress against each FMS (and thus its performance against legislated objectives and requirements) is to be reported on via Annual FMS Performance Reports for each fishery. In combination, this approach is intended to provide firstly, greater clarity regarding AFMAs fishery-specific operational management

arrangements, and secondly, greater transparency and accountability regarding AFMA's performance against its objectives.

As such, for each fishery, the core documentation will comprise:

- **Fishery Overview** – a basic description of the fishery
- **Fishery Management Plan** (for fisheries that have them)
- **Fishery Management Strategy**
- **Annual Fishery Work Plan**
- **Annual Research Statement**
- **Annual FMS Performance Report**

1.3.5 Potential future ISO 9001 certification

AFMA may in future explore the potential for the FMF to be underpinned by an ISO standard management system, specifically ISO9001 – Quality Management System.

ISO 9001 is in simple terms a system of documented Standard Operating Procedures (SOPs) that will ensure consistency in core processes (activities) that AFMA uses to plan, monitor, assess, manage, and report on risks to its objectives across its fisheries. The development of the ERM Guide and the adoption of an FMF based around FMS and utilising logic model based planning and performance monitoring will significantly assist in positioning AFMAs Fisheries Management Branch for potential ISO accreditation, should it decide to pursue that in future.

2 ETBF FMS Overview

2.1 Scope

This FMS applies to the Eastern Tuna and Billfish Fishery (ETBF) which operates both in the Australian Exclusive Economic Zone (EEZ) - from Cape York to the Victoria-South Australia border including waters around Tasmania - and the high seas of the Pacific Ocean. It covers all gears allowed to be used in the fishery (pelagic longline and some minor line methods) and all species which interact[4] with the fishery. A description of the ETBF is provided on the AFMA website. Species that interact with the ETBF are divided into **commercial** and **bycatch** species and within those groups are a number of sub-categories (Table 2). Full lists of these species by category are available in the CSIRO ETBF ERA Report (2019).

Table 2 Commercial and Bycatch species definitions.

Commercial species (including discards[5])	Key commercial species	Defined in the HSP (2018) as those species *most* relevant to the objective of maximising net economic returns to the Australian community from the management of the fishery. For the ETBF these are Yellowfin Tuna, Albacore Tuna, Bigeye Tuna, Broadbill Swordfish and Striped Marlin. Southern Bluefin Tuna is targeted by ETBF vessels but managed under the SBT Fishery Management Plan.
	Byproduct species	Defined in the HSP (2018) as species which make a lesser contribution to the value of the catch in a fishery. They are occasionally landed and retained—ranging from rarely encountered and usually retained, to frequently encountered and rarely retained. For the ETBF these are listed in Table 8. The categorisation of commercial species into key commercial and byproduct is based on economic and retention criteria described in the CHSP Guidelines 2018 and AFMA ERM Guide 2017.
Bycatch species (species incidentally	General bycatch species	Defined in the CPFB (2018) as all bycatch species in a fishery that are not listed under the EPBC Act. General bycatch are separated from byproduct species using criteria developed by TTRAG following guidance in the AFMA ERM Guide 2017.

[4] AFMA will be developing a consistent definition for “interaction” for use in its policies and processes.
[5] “Discards” in this document refers to the non-retained component of commercial species catches, as per CPFB 2018 definition.

Commercial species (including discards[5])	Key commercial species	Defined in the HSP (2018) as those species *most* relevant to the objective of maximising net economic returns to the Australian community from the management of the fishery. For the ETBF these are Yellowfin Tuna, Albacore Tuna, Bigeye Tuna, Broadbill Swordfish and Striped Marlin. Southern Bluefin Tuna is targeted by ETBF vessels but managed under the SBT Fishery Management Plan.
	Byproduct species	Defined in the HSP (2018) as species which make a lesser contribution to the value of the catch in a fishery. They are occasionally landed and retained—ranging from rarely encountered and usually retained, to frequently encountered and rarely retained. For the ETBF these are listed in Table 8. The categorisation of commercial species into key commercial and byproduct is based on economic and retention criteria described in the CHSP Guidelines 2018 and AFMA ERM Guide 2017.
taken and returned to sea *or* killed/injured interacting with fishing gear but not taken)	EPBC listed species	Comprise those species protected under Part 13 of the EPBC Act 1999, including whales and other cetaceans and listed threatened, marine and migratory species (except for conservation dependent species managed through rebuilding strategies under the Harvest Strategy Policy in line with the requirements of the EPBC Act).

2.2 Objectives

This FMS is designed to help AFMA pursue (or have regard to) AFMA's **legislative objectives** (as described in the FMA 1991, FAA 1991 and EPBC Act 1999, and the *ETBF Fishery Management Plan 2010*) in the ETBF. To do this, it describes fishery-specific **operational objectives** linked to each legislative objective. ETBF operational objectives are listed in Table 3 and are drawn, where possible, from a suite of existing Commonwealth fisheries policies and guidelines (see Section 2.3 + references in Table 3).

2.3 Performance criteria

AFMA's performance against ETBF operational (and legislative) objectives will be assessed using indicators, reference points and performance measures linked to each of the operational objectives. Performance criteria are specified in sections 3 – 6 of this FMS.

2.4 Structure

As described in Section 2.2 a number of operational objectives differ for commercial species compared to bycatch/EPBC listed species, and even where broader objectives (e.g. pertaining to accountability and cost-effectiveness) apply across fisheries management processes, the approach to pursuing those broader objectives can still differ between bycatch and commercial species management processes. For this reason, the remainder of this FMS is divided into five sections:

1. **Commercial species** (Section 3) – This specifies the ETBF operational objectives for commercial species in line with the CHSP 2018 and ERM Guide 2017 and outlines management strategies for key commercial and byproduct species, and approaches for commercial discards and "protected" commercial species[6].
2. **Bycatch species** (Section 4) – This specifies ETBF operational objectives and management strategies for general bycatch species and EPBC listed bycatch species in line with the CPFB 2018*, requirements of the EPBC Act 1999, and ERA/ERM processes outlined in the AFMA ERM Guide 2017.
3. **Habitats and communities** (Section 5)
4. **Data and monitoring** (Section 6) – outlines the key monitoring and data collection processes required to support the commercial and bycatch species strategies
5. **Research** (Section 7) – specifies the ETBF 5-year research strategy which aims to identify key information gaps and the research required to support the implementation of the ETBF FMS in pursuit of AFMAs objectives.

Each of the above "sub-strategies" has two main components being a **General overview** of the core elements of each strategy and an **action item list** of any additional "one-off" actions required to strengthen the FMS over the 5-year cycle, for incorporation into the Annual FMS Workplan.

The Commercial Species and Bycatch Species sections also have performance measures that will be used to monitor and report on performance against the operational objectives.

[6] E.g. species which are classed as protected species under the EPBCA 1999, but which have a provision for limited commercial retention (e.g. mako and porbeagle sharks)

Table 3. Legislative and operational objectives for the ETBF Fisheries Management Strategy

Overarching legislative objectives that AFMA *pursues* or *has regard to*.		Operational objectives	
		Commercial Species	**Bycatch species**
ECOLOGICALLY SUSTAINABLE DEVELOPMENT	AFMA will ***pursue***: • Ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of **ecologically sustainable development**[7] in particular the need to have regard to the impact of fishing activities on non-target species and the long term sustainability of the marine environment *[FMA 1991]*. • To promote **ecologically sustainable development** through the conservation and ecologically sustainable use of natural resources *[EPBCA 1999]*. AFMA will ***have regard to***: • Ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation *[FMA 1991]*. • Must ensure, as far as practicable, that measures adopted in pursuit of those objectives must not be inconsistent with the preservation, conservation and protection of all species of whales *[FMA 1991]*.	1. Ensure agreed international (e.g. WCPFC) catch limits/allocations are not exceeded. 2. Ensure the domestic implementation of either: • Internationally agreed harvest strategies and associated catch limits where agreed via the Western and Central Pacific Fisheries Commission (WCPFC); or • A domestic harvest strategy consistent with the requirements of the CHSP 2018 – where an international HS has not been agreed and Australia's catch proportion is sufficient to exert sufficient feedback control on the stock[8]. 3. For domestically implemented harvest strategies: • maintain (for at least 90 per cent of the time) ETBF commercial fish stocks above a biomass limit (B_{LIM}) where the risk to the stock (i.e. of recruitment impairment) is regarded as unacceptable. (CHSP 2018). 4. Ensure fishing is conducted in a manner that does not lead to over-fishing[9]. Where it is identified that overfishing of a stock is occurring, action will be taken immediately to cease overfishing (Ref: CHSP 2018; others). 5. Ensure management of commercial species takes account of the precautionary principle[10].	**General Bycatch species** 1. Fishing in the ETBF does not reduce any general bycatch species populations to/below a level at which the risk of recruitment impairment is unacceptably high. .[Ref: CPFB 2018; ERM Guide] 2. Where such reductions have occurred, implement management arrangements to support those populations rebuilding to biomass levels above that level.[Ref: CPFB 2018; AFMA ERM Guide 2017] 3. ETBF management arrangements draw on best practice approaches to avoid or minimise all bycatch, and minimise the mortality of bycatch that cannot be avoided [Ref: CPFB 2018] 4. Ensure management of bycatch species takes account of the precautionary principle. **EPBC listed species** 5. To not adversely affect the conservation status of protected species by fishing in the ETBF [Ref: EPBCA 1999; GESMF 2007] 6. To not adversely affect the survival or recovery of threatened species by fishing in the ETBF [Ref: EPBCA 1999] 7. AFMA ensure ETBF operators take all reasonable steps to ensure that protected species (other than conservation dependent species) are not killed or injured as a result of fishing. [Ref: EPBCA 1999]
ECONOMIC RETURNS	AFMA will ***pursue***: **Maximising** the **net economic returns** to the Australian community from the management of Australian fisheries *[FMA 1991]*.	1. Utilising harvest strategies, as per the CHSP 2018, maintain ETBF key commercial fish stocks, on average, at the required target biomass (BTARG) to produce maximum economic yield (MEY) from the fishery[8]; [ref: HSP 2018]	Not applied for bycatch

[7] The principles of ecologically sustainable development include the need for consideration of long and short term economic, environmental, social and equity considerations; inter-generational equity, biological diversity and ecological integrity and valuation, pricing and incentives. They hold that scientific uncertainty should not delay measures to prevent environmental degradation (Ref: FMA 1991).

[8] Where Australia is not a major harvester of an international shared stock (ETBF catches are a small proportion of total catches) and domestic harvest strategies would be unable to exert sufficient feedback control on ETBF key commercial stocks, the Australian Government should pursue implementation of regional harvest strategies (or secondarily, conservation measures) that implement an LRP that meets CHSP 2018 requirements.

[9] Overfishing – A stock that is experiencing too much fishing. The rate of removals is likely to result in the stock becoming overfished. For an overfished stock, overfishing is a rate of removals that will prevent stock recovery in accordance with its rebuilding strategy (CHSP 2018)

[10] The Precautionary Principle - Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. – see https://www.legislation.gov.au/Details/C2016C00844 for full definition.

Overarching legislative objectives that AFMA *pursues* or *has regard to*.		Operational objectives	
		Commercial Species	**Bycatch species**
ACCOUNT-ABILITY	AFMA will ***pursue***: Ensuring **accountability** to the fishing industry and to the Australian community in AFMA's management of fisheries resources *[FMA 1991].*	1. Advisory committees (TTRAG, TTMAC) and Tuna Australia are consulted on the management of the fishery. 2. ETBF objectives, management decisions, arrangements and strategies are clearly explained, transparent, documented and communicated to industry and the broader community. 3. AFMA reports performance against it objectives via Annual FMS Performance Reports	
COST EFFECTIVENESS	AFMA will ***pursue***: Implementing **efficient** and **cost-effective** fisheries management on behalf of the Commonwealth *[FMA 1991].*	Management approaches described in this FMS are efficient and cost-effective (including consistent with the risk-cost-catch trade off model) [Ref: HSP 2007; ERM Guide 2017]	
OPTIMAL UTILISATION	AFMA will ***have regard to***: Achieving the optimum utilisation of the living resources of the AFZ *[FMA 1991]*;	Minimise discarding of commercial species as much as possible (CHSP 2018)	Where commercial markets open up for general bycatch species, and subject to legislative objectives that AFMA pursues, AFMA will look to ensure management arrangement do not hinder species transition to commercial species status.
INTERNATIONAL OBLIGATIONS	AFMA will ***have regard to*** *[FMA 1991]*: • Ensure that conservation / management measures in the AFZ and high seas implement Australia's obligations under international agreements that deal with fish stocks to the extent that Australia has obligations under international law, the Compliance Agreement or any other international agreement; • in relation to fishing activities by Australian-flagged boats on the high seas that are additional to the obligations referred to in paragraph (c)—ensure that Australia implements those obligations	1. ETBF Management Arrangements are consistent with and meet relevant obligations under WCPFC Convention, CMMs and other relevant international agreements and international law.	
MULTI-SECTOR INTERESTS	AFMA will ***have regard to***: Ensuring that the interests of commercial, recreational and Indigenous fishers are taken into account *[FMA 1991]*	1. Consultative committees to include representatives from all relevant stakeholder groups 2. AFMA has regard to consultative committee advice when making management decisions.	

2.5 Implementation

The implementation of the ETBF FMS (and FMF) effectively comprises four components, as outlined in Section 2 and Figure 2, being: Planning, Implementation of management arrangements, Monitoring/Reporting and Review/Evaluation. Table 4 below provides a general outline of the key stages, processes and tasks associated with implementing this FMS including timing, roles/responsibilities and key associated documents. These processes are described in more detail in Sections 3-6. It is expected some aspects may change over time as fishery circumstances, resources and policies change/evolve.

Table 4 Outline of key stages, processes and tasks required to implement this ETBF Fishery Management Strategy, including timing, roles and responsibilities and key associated documents

			Year					Roles and responsibilities		
Stage	**Process**	**Task**	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Lead role**	**Review/Advisory**	**Documentation**
PLANNING	ERA Assessment	Funding/budget process				X	X[1]	AFMA	Research Provider	Fishery Budget Statements
		Data collation				X		Research Provider	AFMA	ETBF ERA Report
		Scoping and Level 1					X	Research Provider	AFMA, TTRAG	ETBF ERA Report; TTRAG minutes
		Level 2 Assessment					X	Research Provider	AFMA, TTRAG	ETBF ERA Report; TTRAG minutes
		Residual Risk Analysis					X	Research Provider/AFMA	TTRAG, ERA TWG	ETBF ERA Report; TTRAG minutes
	Management Strategy Development or Revision	Develop bycatch ERM options					X	AFMA	TTRAG, TTMAC	Management Options paper to RAG and MAC; MAC/RAG minutes
		Revise/ Develop FMS - Commercial species (include harvest strategy), Bycatch, Data and Research strategies	#	#	#	#	X	AFMA	TTRAG, TTMAC, AFMA (ERM OG, EM, Commission)	Revised FMS; TTMAC/TTRAG minutes
	Annual Planning	Annual Work Plan	X	X	X	X	X	AFMA Manager	AFMA (Senior Manager)	Annual Work Plan
		Annual research statement	X	X	X	X	X	AFMA Manager	TTRAG, TTMAC	Annual Research Statement; MAC/RAG minutes
IMPLEMENTATION	Implement Annual work plan to achieve FMS	Commercial species assessment (e.g. harvest strategy and byproduct monitoring), management and compliance activities	X	X	X	X	X	AFMA/Research Providers	AFMA (Senior Manager)/ TTRAG	Bi-annual update report to Senior manager; TTRAG and TTMAC minutes. Staff performance reviews. Annual FMS Report
		Bycatch species management activities	X	X	X	X	X	AFMA/Industry	TTRAG/TTMAC/AFMA Senior Manager	
		Data collection activities	X	X	X	X	X	AFMA/Industry	AFMA/TTRAG/TTMAC	
		Research support activities	X	X	X	X	X	AFMA	-	
MONITOR/REPORT	Short term (annual)	Annual work plan activity completion	X	X	X	X	X	AFMA (Manager)	AFMA (Senior Manager)	Annual FMS Report; Other reports
		Harvest Strategy results; Bycatch and byproduct trigger monitoring	X	X	X	X	X	AFMA/TTRAG	TTMAC/AFMA Commission	Annual FMS Report
	Medium term	Industry compliance with management regulations;		X	X	X	X	AFMA Compliance	AFMA (Senior Manager Compliance)	Annual FMS Report; Other reports
	Long term (5 years)	Fishery biological and economic status					X	AFMA	RAG if required	Annual FMS Report; Other reports
REVIEW	Review	Auditor review of FMS					X	Auditor	AFMA, TTRAG, TTMAC	Auditors Report
		Revision of FMS					X	AFMA	TTRAG,TTMAC, ERM/FMS OG Commission	Revised FMS, TTRAG and TTMAC minutes

2.6 Documentation

Under the FMF approach outlined in Section 1.3, there are six key ETBF documents/resources that effectively form the full set of strategic and operational planning and reporting documents for the fishery (Table 5). They are:

Table 5. Key planning and reporting documents for the ETBF.

Document	Purpose
ETBF Fishery Management Plan 2010	Established under the Fisheries Management Act 1991, this is the key fishery-specific legislative instrument which the ETBF FMS aims to operationalise.
ETBF FMS 2019 – 2024	Outlines in detail the operational strategies in place to achieve the objectives of the ETBF FMP (Planning Phase).
ETBF Annual Work Plan	Developed/updated each year to specify activities required to implement the ETBF FMS, including resource requirements, roles and responsibilities (Planning and Implementation Phases).
ETBF Annual Research Statement	Identifies annual research priorities to support the implementation of the FMP and FMS (Planning Phase).
ETBF Annual FMS Report	Developed/updated each year to report on performance of the ETBF FMS against the objectives of the FMS and FMP (Monitoring phase).
ETBF Fishery Overview	A web based description (here) of the fishery updated on a regular basis

2.7 Consultation

AFMA actively involves a wide range of stakeholders in the process of developing and implementing fisheries management arrangements in the ETBF. These stakeholders include scientists, commercial fishers and fishing associations, researchers, environment and conservation organisations and recreational fishers. This approach is supported by specific consultative processes which are embodied in AFMA's governing legislation.

2.7.1 Consultation process for the ETBF FMS

Consultation in relation to the ETBF FMS occurs in three phases:

1. consultations associated with the initial development of the FMS.
2. consultations associated with updating different components (sub-strategies) of the FMS as required within the 5-year cycle.
3. consultations associated with evaluation and review of the FMS every 5 years.

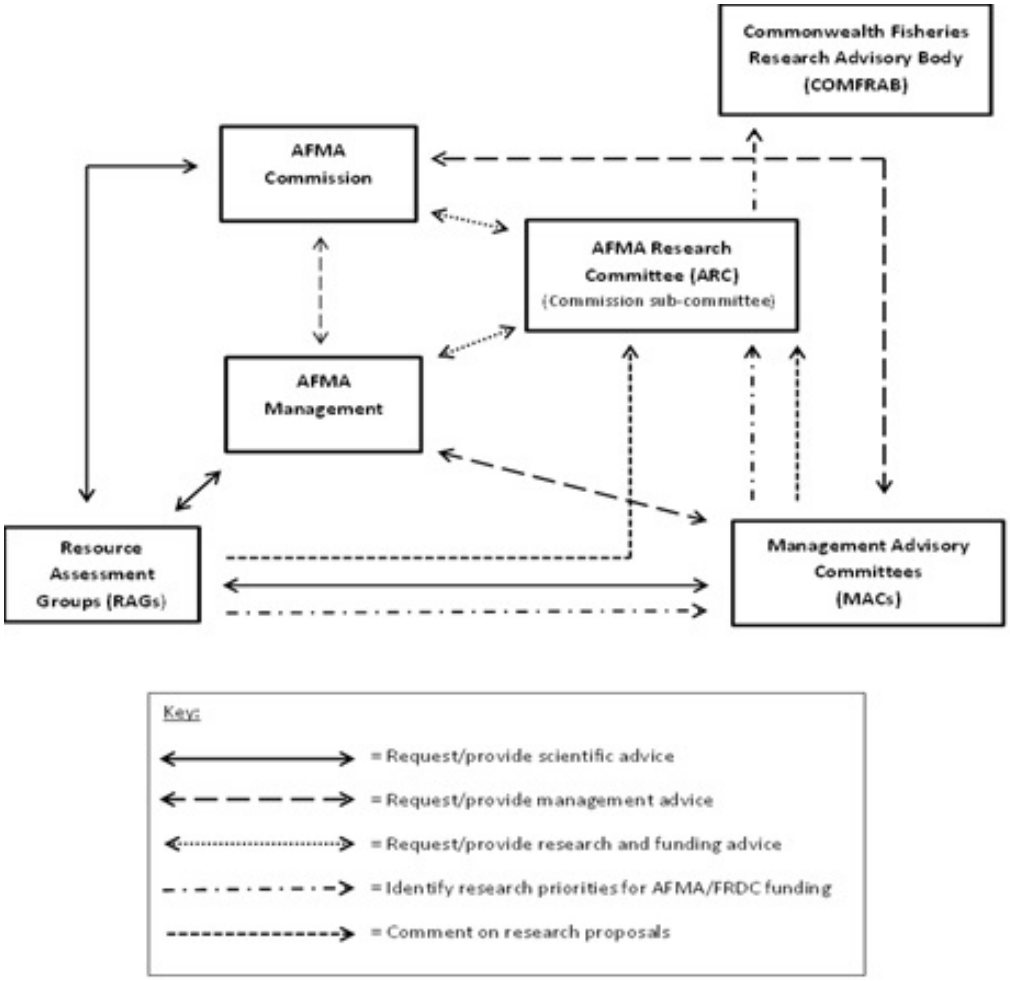

Figure 3. Consultation flow chart indicating key consultation processes that underpin the ETBF fishery management strategy. Industry consultation (for example with Tuna Australia) also occurs outside these formal processes.

2.7.2 AFMA Commission and Chief Executive Officer

AFMA's domestic fisheries management functions and powers are the responsibility of the AFMA Commission (the Commission). The Chief Executive Officer of AFMA is also a commissioner and is responsible for assisting the Commission, including giving effect to its decisions. The AFMA Commission is subject to limited government policy direction as stated in section 91 of the *Fisheries Administration Act 1991*. The Minister for Agriculture and Water Resources is the approving authority for all fishery management plans determined by AFMA. RAGs provide scientific advice on management options and strategies to AFMA managers, to the MAC and to the Commission. MACs provide management advice to the Commission for use when making decisions about fisheries management. To assist the AFMA Commission in making informed decisions, advice should always look to assist AFMA in pursuing or having regard to its legislative objectives.

2.7.3 Tropical Tuna Management Advisory Committee

The Tropical Tuna Management Advisory Committee (TTMAC) is the key management advisory body for the ETBF. The committee includes representatives from AFMA, industry, scientific agencies, the recreational/charter fishing sector, state government and an

environmental consultant. Agencies such as the Department of Agriculture, Water and the Environment and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) have attended MAC meetings as observers. Two meetings are held each year to discuss issues relating to this fishery, review scientific information and develop possible management measures. All management arrangements, including the current Plan, have been developed in consultation with TTMAC, operators and other stakeholders.

2.7.4 Tropical Tuna Resource Assessment Group

The Tropical Tuna Resource Assessment Group (TTRAG) provides research and scientific advice for the fishery. The group is composed of fishery scientists, fishing industry members, an economist, an AFMA representative and recreational representatives. Agencies such as the Department of Agriculture, Water and the Environment (DoAWE) have attended meetings as observers. The group provides advice to the AFMA, TTMAC and the AFMA Commission on the status of fish stocks, sub stocks, species (target and non-target), the impact of fishing on the marine environment and the type of information needed for stock assessments. They also evaluate the impact over time of different harvest strategies, stock depletion and recovery rates, confidence levels for fishery assessments and risks to the success of fishery objectives. Compliance and economic factors affecting the fishery, together with other issues related to the general performance, reporting requirements and operational issues of the fishery, are also evaluated and reported on by the group.

2.7.5 ETBF Industry Association – Tuna Australia

The ETBF industry association – Tuna Australia – was formed in 2016. Representing the majority of ETBF license and quota holders, Tuna Australia is the primary industry representation body. Tuna Australia's is a "not-for-profit company and its object is to promote the cause of sustainable fishing in Australia and to undertake all acts, matters and things (or any of them) of and incidental to that object" (TA Constitution 2016). AFMA consults with Tuna Australia during the process of developing management arrangements and the Director/CEO of Tuna Australia is an invited participant to both TTMAC and TTRAG meetings.

2.7.6 ERA and ERM Working Group

The ERM Working Group (ERM WG) is responsible for providing advice regarding ecological risk assessment methodologies and ecological risk management processes and for reviewing, where necessary, fishery-specific ERA and ERM to ensure consistency in the application of ERA across Commonwealth fisheries.

2.7.7 Western and Central Pacific Fisheries Commission

Australia is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that is responsible for managing highly migratory fish stocks in the Western Pacific Ocean. Any conservation and management measures agreed to by the Commission are binding on Australia to the extent they are consistent with Australian Legislation. Therefore the AFMA Commission, TTMAC and WCPFC (and its science and compliance committees) are all involved in determining management measures for the fishery.

2.8 Compliance

A critical component of the management of AFMAs fisheries is the compliance activities undertaken by the AFMA Fisheries Operations Branch (FOB). This FMS does not cover the operational objectives or activities of AFMA FOB which are described and reported upon elsewhere (please see AFMA website for relevant documents), however it does describe the role of compliance activities and data in relation to performance criteria for the achievement of fisheries management objectives where necessary and addresses some compliance data collection needs in Data and Monitoring (Section 6).

2.9 Reporting requirements

AFMA's performance against the objectives of the ETBF FMS will be reported annually in the ETBF Annual FMS Report, based on an assessment of performance criteria outlined in Sections 3-6 of this FMS. The **ETBF Annual FMS Report** will support ETBF reporting requirements outlined in Table 6 below.

2.9.1 Action

Following adoption of this ETBF FMS, AFMA will look to develop a short web-based FMS snapshot focussed on its key strategic elements and actions to facilitate accessibility and understanding by all stakeholders regarding the management of the ETBF.

2.10 Review Process

The ETBF FMS is to be reviewed every five years. However, within this five-year review cycle different components of the FMS should be revised as legislation or policies or guides are updated or management arrangements need to be changed in response to changes in fishery conditions, risks, resource sharing agreements or WCPFC requirements.

The level of clearance required for any given update to the FMS will depend on the nature of the update. Clarifications of text or corrections of errors in explanations of adopted management arrangements (for example) may only require Manager or Senior Manager clearance. At the other end of the scale, new or substantially revised management arrangements require consultation with industry, TTRAG and/or TTMAC and clearance at either the Executive Manager, CEO or AFMA Commission level.

As specified in the AFMA ERM Guide, the five-year FMS revision must include:

a) An independent reviewer/auditor - to undertake an initial review and provide an assessment of performance (against the indicators outlined in the FMS) and review recommendations. The auditor should include consultation with AFMA, the TTRAG and TTMAC, industry members (including Tuna Australia) and other relevant stakeholders.
b) AFMA, TTMAC and TTRAG – to consider the recommendations of the independent reviewer; and to revise the FMS in light of the reviews.
c) The ERM/FMS oversight group – to review the revised FMS and provide recommendations for further improvement or endorsement.

2.10.1 Review Action

The ETBF FMS is to be annually checked and if necessary updated to reflect any changes in domestic legislative, policy, resource sharing or international (e.g. WCPFC) requirements. This update should occur in conjunction with ETBF permit condition and management arrangements revisions.

Table 6. Summary of reporting requirements in the ETBF. It is intended that most of these reporting requirements will be covered by the Annual FMS Report for the ETBF

Reporting Driver	Reporting Requirement	Reporting Frequency
Commonwealth Harvest Strategy Policy 2018	Report on implementation and performance of the ETBF management arrangements for commercial species, specifically the implementation of the ETBF Harvest Strategy, against the objectives and requirements of the CPFB 2018 (Requirements listed **here**.)	Report Annually in FMS Annual Performance Report
Commonwealth Policy on Fisheries Bycatch 2018	Report on implementation and performance of the ETBF management arrangements for general (non EPBC listed) bycatch species against the objectives and requirements of the CPFB 2018 (Requirements listed **here**)	Report Annually in FMS Annual Performance Report
EPBC Act 1999	1. Status reporting against Wildlife Trade Operation (WTO) accreditation conditions and recommendations. Requirements listed **here**. 2. MOU with Department of Agriculture, Water and the Environment: AFMA must report quarterly to DAWE on interaction rates for each of the EPBC listed species and High Risk Species under the ERA. Requirements listed **here**.	1. Report Annually in FMS Annual Performance Report 2. Report Quarterly to DAWE and publish online
Seabird Threat Abatement Plan	AFMA is required to report results to the Australian Antarctic Division and TAP Stakeholder Group. This requirement is described **here**.	Annual TAP meeting
WCPFC Annual CCM Reporting	1. **Part 1** Annual Report on fisheries, research and statistics (and including reporting requirements of many CMMs for protected species) drafted by DAWE with AFMA assistance/review. Requirements listed **here**. 2. **Part 2** Annual Report on management and compliance measures taken by CCMs in the previous year, is drafted by DoAWR with AFMA assistance/review. Requirements listed **here**.	1. Annual Part 1 reports to WCPFC Scientific Committee 2. Annual Part 2 reports to WCPFC Technical and Compliance Committee
WCPFC Conservation and Management Measures; separate to above	**CMM 2018-04** – Sea Turtles: Australian Government (DAWE/AFMA) reports to the WCPFC in Part 2 of its annual report, on the progress of implementation of 2018-04, including information collected on interactions with sea turtles in the ETBF.	Annually to WCPFC TCC
TTMAC/ TTRAG/ Industry	AFMA monitors catches for each quota species throughout the fishing season and provides updates to TTRAG and TTMAC meetings, as well as maintaining “Catchwatch” reports on AFMA website.	Monthly website Catchwatch’ reports and reports to RAG/MAC meetings
Australias NPOA (Sharks)	DAWE Shark Plan Implementation and Review Committee assess the overall implementation of this document.	Every four years
AFMA Corporate Reporting	Key performance metrics by fishery	Source: FMS Annual report

3 Commercial Species

3.1 Introduction

This section describes how AFMA will pursue its core legislative and policy based objectives pertaining to the management of commercial species[11] that interact with the ETBF. These high-level objectives require AFMA pursue ecological sustainability and maximise the economic returns from the fishery to the Australian community (see Section 3.2 and Table 7 below) and are reflected in the *ETBF Fishery Management Plan 2010* to which this ETBF FMS is aligned.

In order to operationalize and achieve these objectives and associated policy requirements, this ETBF Commercial Species Strategy draws upon guidance from:

- The ETBF Fishery Management Plan 2010
- The Commonwealth Harvest Strategy Policy and Guidelines 2018, but also;
- Guidelines for Ecologically Sustainable Management of Fisheries 2007
- AFMA Ecological Risk Management Guide 2017
- Relevant research into byproduct monitoring indicators and triggers.

3.1.1 ETBF Fishery Management Plan 2010

The ETBF FMP 2010 outlines the legislative requirements for the management of commercial species in the ETBF, principally that there are implemented:

- Limitations on total catches of key commercial species through the determination of Total Allowable Commercial Catches (TACCs). The determination of TACCs will take into account scientific information on Recommended Biological Commercial Catches (RBCCs) derived from, where appropriate, harvest strategies (see 3.1.2) and will specify allowed annual overcatch/undercatch provisions.
- Access rights to the fishery via Statutory Fishing Rights (SFRs) that were granted under the ETBF FMP 2010. These include both:
    - **Quota SFRs** (that are individually transferable) for each of the five key commercial species and
    - Three types of **Boat SFRs** being ETBF Longline, Coral Sea Zone* and Minor Line.
- Additional boat SFRs (above those granted under the Plan) are not permitted under the plan, placing an upper limit on the number of active vessels that can operate in the fishery. However, SFRs can be leased (for one or more seasons) or sold on (permanently).

3.1.2 Commonwealth Harvest Strategy Policy – Principles and requirements

The Commonwealth Fisheries Harvest Strategy Policy (hereafter referred to as the HSP) was first implemented in 2007 in response to a Ministerial Direction (2005) and recently revised in 2018. The HSP provides a framework for the development of harvest strategies for **key commercial species** taken in Australia's Commonwealth fisheries, and also

[11] Commercial species are those species that are caught and either occasionally or regularly retained for sale and include key commercial species and byproduct species.

requires appropriate management of **byproduct species**. Harvest strategies consistent with the Policy are intended to:

- provide the Australian community with a high degree of confidence that commercial fish species are being managed for long-term biological sustainability and economic profitability.
- provide the fishing industry with a more certain operating environment.

The HSP 2018 states that harvest strategies must outline:

- Processes for monitoring and assessing the biological and economic conditions of commercial fish species within fisheries in relation to fishery-specific reference levels (a reference point or points); and
- Pre-determined rules that control fishing activity according to the biological and economic conditions of the fishery (as defined by monitoring or assessment). These rules are referred to as harvest control rules or decision rules.

Control rules are designed to keep the fishery on track in pursuit of its defined objectives by specifying the management actions or decisions that need to be taken. For control rules to be clear and effective, the objectives need to be expressed in the form of quantifiable reference points. These reference points are used to guide management decisions.

3.1.3 HSP 2018 Objectives

The high-level objective of the HSP (2018) is:

- the ecologically sustainable and profitable use of Australia's Commonwealth commercial fisheries resources (where ecological sustainability takes priority)—through the implementation of harvest strategies.

More specifically, to meet the objective of the Harvest Strategy Policy 2018[12], AFMA must implement harvest strategies that:

- ensure the exploitation of fisheries resources and related activities are conducted in a manner consistent with ESD principles and the precautionary principle.
- maximise net economic returns to the Australian community—always in the context of maintaining commercial fish stocks at sustainable levels
- maintain key commercial fish stocks, on average, at the required target biomass to produce maximum economic yield from the fishery
- maintain all commercial fish stocks, including byproduct, above a biomass limit (B_{LIM}) where the risk to the stock is regarded as unacceptable, at least 90 per cent of the time;
- ensure fishing is conducted in a manner that does not lead to over-fishing. Where overfishing of a stock is occurring, take action immediately to cease overfishing.
- minimise discarding of commercial species as much as possible.

[12] Additional guidance material on the Harvest Strategy Policy available at: Guidelines to the Harvest Strategy Policy (Commonwealth Fisheries Harvest Strategy Policy Guidelines 2018).

- are consistent with the EPBC 1999 and the associated Guidelines for the Ecologically Sustainable Management of Fisheries (2nd edition).

The HSP further holds that:

- Maximising the net economic return from a fishery to the Australian community will in most cases be consistent with maximising the net economic returns from the commercial fishery.
- Where it is clear there is a significant non-commercial interest in a fishery, the need to share the resources appropriately should be considered.
- In multi-species fisheries it may be necessary to manage individual stocks to different target reference points to achieve fishery level maximum economic yield.
- For a stock assessed as below the biomass limit reference point (i.e. overfished), targeted fishing must cease and a stock rebuilding strategy developed to rebuild the stock to above the limit biomass level.

3.1.4 International Fisheries

The HSP 2018 states that:

- In the case of fisheries that are managed jointly by an international organisation or arrangement, the Harvest Strategy Policy does not prescribe management arrangements. However, it does articulate the government's preferred approach.
- The government (including the Australian Fisheries Management Authority) must implement decisions taken by all relevant RFMOs and other international arrangements that Australia is a party to (except where Australia has made a permissible reservation about the decision).
- Through these forums, Australia will pursue the adoption of measures that are consistent with the HSP and domestic management measures.
- AFMA will set Commonwealth catch levels taking into account available science and evidence, the Australian negotiating position, advice from the government and any relevant decisions of the applicable regional organisation.
- AFMA must determine a domestic catch level that is the same or less than that permitted under the relevant international arrangement and can impose additional constraints on fishing effort and/or biomass based on recommendations or rebuilding targets. AFMA cannot set a domestic catch level greater than that permissible under the relevant international arrangement.
- AFMA may impose additional constraints on fishing effort, biomass based recommendations or rebuilding targets.
- If Australia **is** a major harvester of the stock and no harvest strategy has been determined internationally, the AFMA must develop and implement a harvest strategy consistent with the objective of this policy.
- Where Australia **is not** a major harvester of the stock and no harvest strategy has been determined internationally, the key consideration in setting catch limits will be consideration Australia's negotiating position in bilateral, regional or international negotiations.

AFMA also takes into account local stock indicators when setting domestic TACCs.

3.1.5 Byproduct species management

The CHSP 2018 now includes byproduct species. While the Policy states that byproduct will be maintained above the LRP "*where risk to the stock is regarded as unacceptable at least 90% of the time*", the CHSP Guidelines recognise that for byproduct assessed under Level 1/2 of the ERA, there is currently no technical way to undertake the testing required (e.g. MSE) to demonstrate consistency with that requirement. Achieving that requirement may become possible in future as data and analytical methods improve.

The HSP and Guidelines 2018 provides relatively limited guidance on the management approaches to management of commercial byproduct species, referring guidance to the CPFB 2018 Guidelines, with further guidance provided by the AFMA ERM Guide 2017 (which itself draws in part from operational objectives and management approaches of the GESMF 2007). The AFMA ERM Guide advocates the application of monitoring rules to the management of byproduct species (see Section 4).

3.1.6 MEY and multispecies

For Commonwealth fisheries with multiple key commercial species, the CHSP 2018 and Guidelines advocates the setting of fishery wide MEY targets, recognising that it is generally not possible to have such fisheries target species specific B_{MEY} at the same time (i.e. fishing effort levels achieving B_{MEY} for one species will likely achieve B levels higher or lower than B_{MEY} for other species). The Guidelines advocate for compromise approaches, with a simplistic example being the combining of species specific sustainable revenue curves to determine total fishery revenue curves and determining fishery MEY as the point at which the gap between total revenue and total costs is greatest. This may represent an effort level resulting in some stocks being fished above B_{MSY} and others below – but above B_{LIM} for all.

Pursuing such an approach in the ETBF is highly constrained due to the complex international nature of the fishery and with differing levels of ETBF catch (relative to total stock catches) and hence differing levels of Australian management control for each stock. This issue is recognised by the CHSP 2018. Currently, only two stocks (broadbill swordfish and striped marlin) of the five key commercial ETBF stocks might be managed to a target reference point under a *domestic* harvest strategy. The other three tuna species will be managed cooperatively under regional harvest strategies through a separate harvest strategy process being developed by the WCPFC. A further complication is the complex spatial and temporal variability in multi-species targeting in the ETBF relative to highly variable economic costs and returns. In combination, the above issues significantly constrains the ability to estimate and apply fishery-wide MEY in the ETBF.

3.2 Operational objectives

The key operational objectives pertaining to the management of Commercial species in the ETBF are listed in Table 7 below. For each of the ecological sustainability, economic and accountability objectives there are associated performance criteria tables specifying the performance indicators and reference points that AFMA will use to monitor and report upon its performance against those objectives.

For other objectives in Table 7, AFMA is in the process of developing performance criteria that can be applied consistently across fisheries. Their development is an FMS action and they will be added to the FMS when completed.

Table 7. Operational objectives for commercial species.

Objective type	Objective	Performance criteria
Economic returns	• Ensure development and implementation of either internationally (WCPFC) agreed, or domestic harvest strategies (where Australia's catch proportion is sufficiently high to exert sufficient feedback control on the stock)[13]. • For domestic harvest strategies, maintain ETBF key commercial fish stocks, on average, at the required target biomass (BTARG) to pursue maximum economic yield (MEY) from the fishery;	Table 25 (Appendix B)
Ecological sustainability	• Ensure ETBF TACCs do not exceed internationally agreed catch limits/allocations. • For domestic harvest strategies: • ……maintain (for at least 90 per cent of the time) ETBF commercial fish stocks above a biomass limit (B_{LIM}) where the risk to the stock (i.e. of recruitment impairment) is regarded as unacceptable[13]. • …….Ensure fishing is conducted in a manner that does not lead to over-fishing[14]. Where it is identified that overfishing of a stock is occurring, action will be taken immediately to cease overfishing. • Ensure management of commercial species takes account of the precautionary principle[15]	Table 25 (Appendix B)
Accountability	• Advisory committees and industry association (s) are consulted on the commercial species management arrangements; • ETBF Management objectives, decisions, arrangements and strategies are clearly explained, transparent, documented and communicated to industry and the broader community;	Table 25 (Appendix B)

[13] Where Australia is not a major harvester of an international shared stock (ETBF catches are a small proportion of total catches) and domestic harvest strategies would be unable to exert sufficient feedback control on ETBF key commercial stocks, the Australian Government should pursue implementation of regional harvest strategies (or secondarily, conservation measures) that implement an LRP that meets CHSP 2018 requirements.

[14] Overfishing – A stock that is experiencing too much fishing. The rate of removals is likely to result in the stock becoming overfished. For an overfished stock, overfishing is a rate of removals that will prevent stock recovery in accordance with its rebuilding strategy (CHSP 2018)

[15] The Precautionary Principle - Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. – see https://www.legislation.gov.au/Details/C2016C00844 for full definition.

Objective type	Objective	Performance criteria
	• AFMA reports performance against its objectives via Annual FMS Reports.	
International agreements	ETBF Management Arrangements are consistent with and meet relevant obligations under the WCPFC Convention, CMMs and other relevant international agreements and international law.	To be developed
Cost-effective management	Commercial species management approaches are efficient and cost-effective (including consistent with the risk-cost-catch trade off model)	
Optimal Utilisation	Minimise discarding of commercial species as much as possible.	

3.3 Strategy overview

3.3.1 Key Changes

This Commercial Species sub-strategy updates and replaces the ETBF Harvest Strategy (2011). Consistent with the HSP and Guidelines 2018 and the ERM Guide (2017), this revised strategy has three key features that distinguish it from the previous ETBF Harvest Strategy.

Firstly, it has an expanded scope which now encompasses byproduct species in addition to key commercial species. Table 8 lists the species contained in each of these categories for the ETBF. The classification of each species into these categories was determined based on the expert opinion of ETBF TTRAG and TTMAC (Link minutes), taking into account fishery catch and value (by species), consistent with methods described in the CHSP Guidelines 2018.

Secondly, it more explicitly addresses how the strategy is consistent with pursuing broader objectives relating to cost-effectiveness and accountability (in addition to economic and sustainability objectives).

Thirdly, it explicitly recognises that there are two different approaches used to determining RBCC and TACCs for key commercial species in the ETBF, and a third separate approach for managing and monitoring byproduct species. These approaches are:

- **Harvest strategy (control rule) approach** - This approach is described in Section 3.4 and comprises a traditional harvest control rule based harvest strategy approach (tested via Management Strategy Evaluation) to determine RBCCs for some key commercial species in the ETBF (previously striped marlin and broadbill swordfish); ***Note****: AFMA is redeveloping and updating the ETBF harvest strategy for Striped Marlin. Until that work has been completed, the AFMA Commission has requested that the "indicators approach" (below) be applied to that species.*

- **Indicators-based and "whole of government position" approach -** This approach is described in detail in Section 3.5 and combines consideration of local and WCPO stock status indicators with Australia's whole of government position on national allocation (and resource sharing), to determine TACCs for those key commercial species (currently albacore, yellowfin and bigeye tuna) for which the HCR based approach has been determined by MSE testing to be ineffective. That is due to the ETBF harvesting only a small proportion of the total catch of these species in the southwest Pacific; and

- **Monitoring rules-based approach -** This approach is described in Section 3.7 and is applied to byproduct species (non-quota species) in the ETBF,

which are only assessed every five years under the ERA cycle but for which fishery effort and/or catch levels are to be monitored annually against trigger levels in the period in between assessments. Byproduct species found to be at high risk from the fishery via ERA will have case specific (not pre-specified) management responses designed to reduce catches and risk to acceptable levels. (**Note:** A number of byproduct species are also subject to catch limits derived from Offshore Constitutional Settlement (OCS) arrangements between the Commonwealth and States and Territories).

3.3.2 Criteria for applying each approach

The conditions under which the *HCR based harvest strategy* can be applied to a given species (currently striped marlin and swordfish) are:

- All sources of fishing mortality in the ETBF are managed as a response to outcomes of the harvest strategy; or
- The ETBF contributes a large proportion of the fishing mortality on the stock of the species, so that any changes in the ETBF mortality in response to the outcome of the Harvest Strategy will have an influence on the future state of the stock; and
- The proportion of the ETBF mortality (relative to regional mortality) remains large and does not decrease, meaning that any changes (reductions) in fishing mortality undertaken by the ETBF fleet are not offset by changes (increases) in fishing mortality by other fleets or users, and;
- MSE testing indicates the HS should achieve the HSP objectives.

Where the above conditions are not met for key commercial species managed under quota, then the "***Indicators and whole of government position***" approach will be applied. For byproduct and any commercial species not managed under TACCs and quota, the "***Monitoring rules***" based approach will be applied, noting that these species are not required by policy to achieve a target reference point, only to stay above the limit reference point (or a proxy F or risk based level used in the ERA).

It should be noted that the classification of commercial species as key commercial or byproduct in the ETBF was conducted by TTRAG in 2017/18 and took into account species catch and fishery GVP contributions (as per the HSP guidelines 2018).

3.3.3 Cost effective management of commercial species

The current management approach for commercial species in the ETBF is designed to be cost effective. Target species are subject to more data intensive domestic or regional harvest strategy development in recognition of their higher catch, value and potential risk posed by the fishery. Lower value/catch byproduct species are assessed via less costly ERA methods and subject to less intensive management.

Table 8. Key commercial and byproduct species managed under the commercial species sub-strategy.

Species Category	Common Name	Scientific Name	Management Approach
Key Commercial	Broadbill Swordfish	*Xiphias gladius*	Harvest Control Rules
	Striped Marlin	*Kajikia audax*	
	Yellowfin tuna	*Thunnus albacares*	CPUE indicators and whole of government position
	Bigeye tuna	*Thunnus obesus*	
	Albacore tuna	*Thunnus alalunga*	
Byproduct	Dolphin Fish (mahi mahi)	*Coryphaena hippurus*	Monitoring Rules and Triggers; Some OCS based catch limits
	Rudderfish	*Centrolophus niger*	
	Oilfish	*Ruvettus pretiosus*	
	Escolar or Black Oil fish	*Lepidocybium flavobrunneum*	
	Wahoo	*Acanthocybium solandri*	
	Ray's Bream	*Brama brama*	
	Spotted moonfish	*Lampris guttatus*	
	Yellowtail Kingfish	*Seriola lalandi*	
	Skipjack Tuna	*Katsuwonus pelamis*	
	Northern Bluefin Tuna	*Thunnus orientalis*	
	Australian bonito	*Sarda australis*	
	Blue Shark	*Prionace glauca*	
	Bronze Whaler	*Carcharhinus brachyurus*	
	Dusky Shark	*Carcharhinus obscurus*	
	Tiger Shark	*Galeocerdo cuvier*	
	Grey Reef Shark	*Carcharhinus amblyrhynchos*	
	Sailfish	*Istiophorus platypterus*	
	Shortbill spearfish	*Tetrapturus angustirostris*	

3.4 Key commercial species - Harvest Strategy Approach

3.4.1 General Overview

***Note**: AFMA is currently redeveloping and updating the previous ETBF harvest strategy for Striped Marlin. Until that work has been completed (due at the end of 2020), the AFMA Commission has requested that the "indicators approach" (Section 3.5) be applied to that species.*

In simple terms, the ETBF Harvest Strategy based approach will aim to achieve and maintain the key commercial species stock biomass at target biomass levels which are intended to help maximise the economic yield from the fishery, and in the process, ensure the biomass stays above levels that might pose an unacceptable level of risk to the ecological sustainability of those stocks.

The HS approach (once finalised) will apply a decision rule to key indicator data from the fishery (for example, standardised CPUE data), so as to calculate a Recommended Biological Commercial Catch (RBCC) that is intended to ensure the target stock biomass is achieved. The RBCC is then used to assist AFMA set a Total Allowable Commercial Catch (TACC) for each species.

This section of the ETBF FMS will be updated to describe the revised ETBF harvest strategy once that work is finalised. Initial analyses and revised harvest strategy options will be presented to the TTRAG in 2020. The final report for the revised harvest strategy redevelopment project will be completed and recommended to the TTRAG by the end of 2020.

3.5 Swordfish Harvest Strategy

3.5.1 Background – Historical context

The following harvest strategy for ETBF Swordfish was adopted by the AFMA Commission on 8 September 2020, following the cessation of the previous Swordfish harvest strategy in 2018[16]. Development and MSE testing of this revised harvest strategy was led by CSIRO during 2019 and 2020, in close consultation with TTRAG and TTMAC. The MSE testing process involved:

- Development of a bespoke operating model designed to allow testing of the robustness of candidate harvest strategies to uncertainties in stock biology and future international fishery catch levels.
- Identifying a general form of harvest control rule to test, along with variations of that HCR and a range of candidate target reference points (TRPs).
- Identifying an appropriate and useful set of performance statistics by which to assess MSE outcomes.
- Undertaking the full MSE utilising the agreed scenarios, candidate HS and performance statistics, to facilitate the identification and adoption of a final revised harvest strategy (described below).

Full details of the MSE project methods and results are provided in the MSE project report (*link to be added when report finalised*).

[16] by recommendation of the AFMA Commission, after MSE testing had determined that it would not meet the requirements of the CHSP.

3.5.2 Overview – ETBF Harvest Strategy Components

The key components of this revised ETBF Harvest Strategy for Swordfish, are described in Figure 1 and include the following:

- **Monitoring (Data Collection)** – data pertaining to ETBF catch of swordfish, fishing effort and sizes of fish caught, along with significant additional information pertaining to fishing methods and gear settings used and environmental conditions, are collected on an ongoing basis via a variety of data collection programs.
- **Assessment/Analyses** – The data collected above are used to inform the development/updating of a standardised catch rate (std-CPUE) index for pre-adult (age classes 3 and 4) swordfish in the ETBF which is used as an indicator of relative local abundance/availability of swordfish (of that size/age) for application in the harvest control rule. The above data are also summarised to provide other fishery indicators to assist TTRAG advice development.
- **Harvest Control Rule** – The harvest control rule uses the recent standardised catch rate level to help determine a multiplier to apply to the current season's RBCC to determine the next season's RBCC to either move the fishery CPUE towards or maintain it at or near the target std-CPUE level.

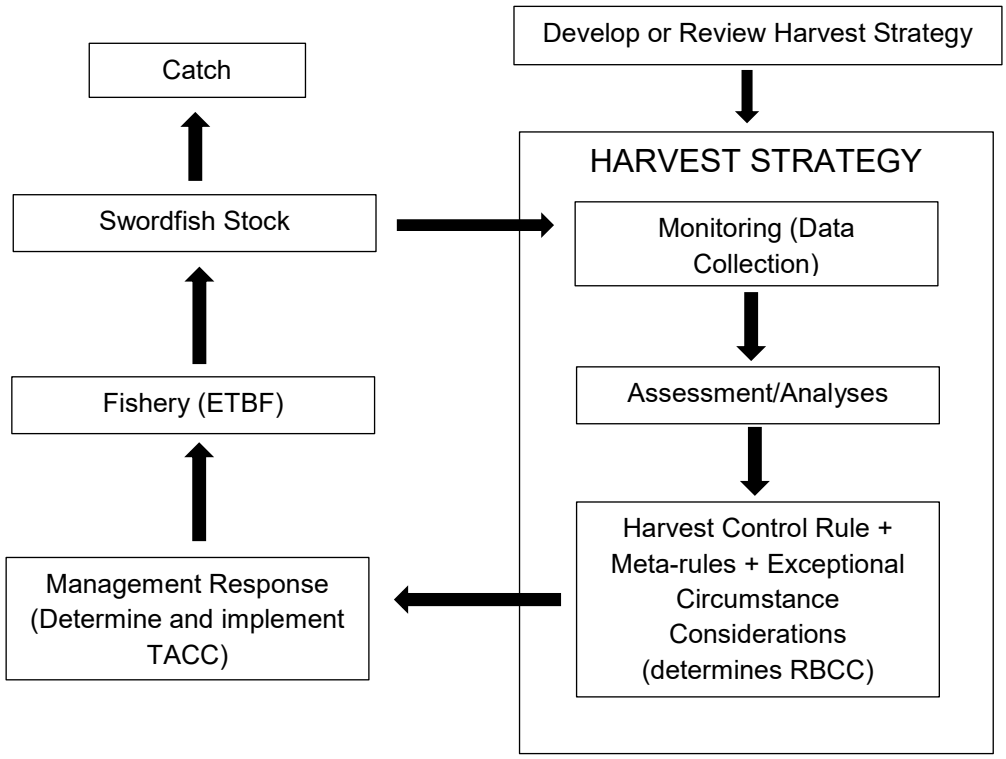

Figure 4 – Key components of the ETBF Swordfish Harvest Strategy and linkages to TACC setting and ETBF catch removals from the stock.

- **Meta-rules** – Meta-rules are used to adjust, under specific conditions, the RBCC after the application of the harvest control rule.

The AFMA Commission is responsible for making the **final TACC decision** for the following fishing season. It will do this taking into account advice from both TTRAG (including the harvest strategy outcomes) and TTMAC. AFMA management are responsible for implementing the Commission decision.

A final component of the HS process is a **review and MSE testing** of the harvest strategy after a pre-determined time period to ensure that the harvest strategy is achieving its objectives and meeting the requirements of the Commonwealth Harvest Strategy Policy.

The full technical details for each of the above components, for ETBF Swordfish, are described below.

3.5.3 Data and monitoring

The application of this harvest strategy relies on the implementation of a range of data collection/monitoring programs to collect specific data required to inform the assessment/analyses of trends in local swordfish abundance and provide the key indicator for the harvest control rule. The specific data programs and data collected are:

- **Logbook Program** – mandatory electronic logbooks (and in the past, paper logbooks) are used to collection data pertaining to all retained and discarded swordfish catches (numbers and estimated weights), fishing effort (hooks per set), fishing locations, date, time of day and fishing methods and gear settings used (e.g. hooks per float, light stick use, bait type etc).
- **Size monitoring program** – Individual retained swordfish sizes (processed weights in kilograms) are collected from fish processors throughout the fishery with coverage typically exceeding 80% of all swordfish retained in the fishery.
- **Environmental data** – a range of observed, remote sensed and modelled (predicted) environmental data are collected from a range of sources by the CSIRO as inputs to the catch rate standardisation process. They include sea surface temperature data, temperature at depth, chlorophyll, ocean height, moon phase, current direction.
- **Electronic monitoring program** – although not directly used in the HS assessment or HCR, electronic monitoring program plays an important role in monitoring the accuracy of the logbook data collected in the fishery.

Specific details of these data collection programs are provided in Chapter 5 of the FMS and CSIRO catch rates methods paper (link to be added) includes the full list of data included in the CPUE standardisation.

3.5.4 Data analyses – CPUE Standardisation

3.5.4.1 Introduction

The primary indicator upon which the harvest control rule is based is a standardised catch per unit effort (std-CPUE) for sub-adult (age 3 and 4) swordfish (See section 3.5.5). Additional std-CPUE indices, not used in the harvest strategy directly, are generated for age 1 and 2 fish (recruits) and age 5+ fish (adults) to help TTRAG monitor fishery trends and inform TTRAG advice development each year. The full technical detail of how the std-CPUE analyses are conducted are provided here (*link to be added*). The following is a brief summary of the key technical components of that process.

3.5.4.2 General approach

The process of swordfish catch rate standardisation takes the raw (nominal) catch rate of the number of fish reported on logbooks, for a specific size/age class of fish (see below), and adjusts that annual catch rate in a manner intended to ***remove*** the influence of factors which are ***not*** related to the long term underlying abundance trend but which do nonetheless impact on catch rates (i.e. it attempts to remove the influence of effects other than fish abundance on the catchability of the fishing gear). This process seeks to produce a final index that predominantly reflects changes in relative abundance over time.

There are two key parts to the process – firstly, apportioning the catch data by size (age) category, to allow estimation of catch rates for specific age cohorts. Secondly, the statistical modelling process that removes the effect on non-abundance related factors upon the catch rate index.

3.5.4.3 Apportioning catch by size categories

Over 80% of swordfish retained and recorded in logbooks have had individual sizes (processed weights) recorded and reported by fish processors over 21 years of the size sampling program – with this high sampling rate it is assumed the data is representative of the size(age) cohorts taken in the fishery.

To assist the apportioning of catch by sizes/ages, a methodology (cohort analysis) was developed to identify and follow over time the contribution of different age based cohorts to the total distribution of size samples collected in each year and quarter (Campbell 2018a,c). Using this approach and size/age at maturity data for this species, three size/age categories were defined upon which to develop standardised CPUE series, these being based on age cohorts:

- Age 1 and 2 fish (recruits),
- Age 3 and 4 fish (sub-adults) and
- Age 5 and older fish (adults).

The sub-adult category is the basis for the HCR std-CPUE index.

Table – Processed weight cut-offs (kilograms) used to apportion the catches in the ETBF to various age-based categories.

Species	Size-Category Cut-Off	Quarter			
		1	2	3	4
Broadbill	Recruits - Sub Adult	20.47	22.62	27.53	30.36
	Sub Adult - Adult	47.96	49.57	57.09	59.84

Using the above cut-off weights (Table 1), the proportion of fish in each size category can be determined at the vessel trip level (from size sampling data) and then those proportions used to assign fish taken at the set level (from logbook catch data) into size categories linked to each sets fishing effort. This effectively assumes a similar size distribution for each set within a trip.

This method is used to assign size proportions to fishing sets for about 67% of swordfish caught. However for some trips, the processor has not recorded the vessel name, and for some trips no corresponding size sample was collected. In these cases, size proportions are assigned to sets based on a higher level aggregation of the size data (e.g. swordfish size proportions for 25% of sets are derived from size samples aggregated at 5 degree and one month strata). Higher aggregation levels are used for the remaining 8% of data.

3.5.4.4 Generalised linear models

A generalised linear modelling (GLM) approach is adopted to develop a standardised catch rate index for sub-adult fish that will, as best as possible, provide an index of relative changes in the abundance of swordfish (of those age cohorts) in the area of the ETBF.

The factors accounted for by this modelling approach include:

- **Spatial and temporal factors** – year, quarter and subregion – to account for spatial and temporal changes in availability of the fish (e.g. due to seasonal shifts in distribution) that are not related to the longer term underlying abundance trend.
- **Fishing strategy factors** – Time of set, bait type, hooks per float, % hooks with light sticks, mainline length, distance between floats, hooks/km of mainline, target species – to account for differences in the effectiveness of the fishing effort due to different targeting and fishing methods.
- **Environmental factors** – sea surface temperature, southern oscillation index, east-west current, north-south current, current speed, current direction, bathymetry and moon phase – to account for differences in availability of fish to the fishing gear due to behavioural responses to local environmental conditions.

- **Cooperative/competitive factors** – number of other vessels in same 1 degree square (daily effect and monthly effect) – to account for the influence of vessels cooperating or competing in similar areas of the fishery.

There are a number of additional technical aspects of the approach used that should be noted including:

- **Defining "catch rate"** – The catch rate used for the index is catch (in number of fish for the age cohorts of focus) per unit effort (number of hooks) at a fishing set level, where catch includes both retained and discarded fish.
- **Age classes included -** this index is for age 3 and 4 (sub-adult) fish. This cohort was chosen on the basis that it provides a precautionary element to the harvest strategy. Specifically, these two age classes occur just prior to maturity and provides early reactivity to future potential declines in adult abundance or forecasting future increases due to strong recruitments coming through. They are also key cohorts taken in the fishery, accounting for around a third of the total catch each year, meaning the index has direct economic relevance.
- **Accounting for discarded fish sizes** - Sizes of discarded fish are not recorded on logbooks (or by processors) so historical observer data was used to estimate the average proportion of fish discarded by size class, with 91% of discards for swordfish being smaller fish (recruits), 5% sub-adults and 4% mature fish. Historically, the total proportion of fish caught that are discarded has been relatively low, but in 2019 it increased. Further consideration should be given by TTRAG to if and how further information should be collected on the size of discarded swordfish.
- **Accounting for zero inflated data** – There are statistical challenges associated with trying to model "zero inflated" data (data that composes a disproportionately high number of zero catches). To overcome this, two separate indices are initially developed, the first to estimates the probability of obtaining a positive catch (i.e. catching at least one fish) and the second to estimate the magnitude of positive catch rates (i.e. distribution of catch rates where at least one fish was caught). The mean values of the two indices are then combined to generate the final single mean abundance index.
- **Temporal strata** – the models use a quarterly time strata (Q1-January to March; Q2-April-June; Q3-July-Sept; Q4-October-December)
- **Area strata** – data included in the models are restricted to the core areas of the fishery that have been consistently fished through time and where swordfish have consistently been caught (i.e. those areas with an ongoing time series of data). The overall core area is divided into 7 subregions (for swordfish) based on areas with relatively homogenous catch rates and sufficient data continuity.

- **Other data filtering and restrictions** – the final data set was restricted to data for the period 1998 onwards, for which sufficient fishing method, size and other data are available. The final data set also had any fishing operations (set) removed that either lack required information on fishing methods or environmental factors, fished too few hooks (<200) or had unrealistically high catch numbers recorded (assumed data recording errors).
- **Removing index biases due to heterogeneity in sample sizes** – The amount of fishing also varies by time and area, leading to significant differences in sample sizes by time-area contributing to the overall CPUE index. In order to avoid those differences biasing the final index towards time-area strata with more data, the year-quarter-region strata were "weighted" to remove that effect and ensure the final index is reflective of abundance through the area of the fishery, not just the most fished sub-areas.
- **Scaling of index** - The annual std-CPUE index was scaled so that the mean of the index over the entire time series was equal to 1.
- **Model fit checks** – the models are checked for model fit, including diagnostics relating to normality of the distribution of residuals, residuals versus year effects and residuals against fitted values.

The method used to standardise CPUE in the ETBF was selected from a suite of methods tested within an extensive simulation analysis (link to be added). Full details of the CPUE standardisation process applied to all ETBF target species is provided in the following paper (link to be added).

3.5.5 Harvest Control Rule

The HCR adopted for ETBF Swordfish is a rule (depicted in Figure 2 below) that is used to determine, for any given level of recent std-CPUE, an appropriate scalar (multiplier) to apply to the current RBCC, to estimate next season's RBCC. In this way the HCR works to adjust RBCCs over time in response to whether the recent catch rates (standardised) are above, below or equivalent to a chosen target standardised catch rate level (that the fishery would like to achieve). So, where std-CPUEs are sufficiently:

- above the target std-CPUE, RBCCs are increased. Increased catches will reduce biomass and subsequently reduce the associated catch rates to the target level.
- below the target std-CPUE, RBCCs are decreased. Decreased catches will allow biomass to increase and so too the associated catch rates to the target level.
- equivalent to the target std-CPUE, RBCCs are not changed.

The harvest control rule for ETBF Swordfish is described graphically in Figure 2 and comprises the following components:

- **Standardised CPUE indicator** – as described above, this index is for sub-adult fish. The index is applied in the HCR as a four year rolling average – the reason for this is to ensure that the HCR is responding to actual changes in underlying abundance and not simply observation or other errors in the index.
- **Target reference point** – is the average std-CPUE for the period 2012-2015. This reference period was chosen as a period when both the catch rates were relatively high, actual landed catches in the fishery relatively steady and quota latency relatively low, indicating favourable economic returns from the stock. The TRP is consistent with the intent of the CHSP 2018, as pertains to pursuing fishery wide MEY, but noting the significant constraints on the ETBF as an international multi-target fishery taking highly migratory species that are managed in collaboration with many other countries through the WCPFC. See section 3.4 in FMS for further detail. The target reference point is represented within the HCR as a scalar value equal to 1.0 and a CPUE value equal to 1.0 (Figure 2).
- **Buffer zone** – a buffer zone of +-20% applies either side of the TRP. Within this range of std-CPUE no changes to the RBCC apply. This is intended to ensure that RBCCs are not simply following noise in the std-CPUE, but rather respond to real changes in underlying abundance. This helps to avoid small changes in the RBCC in response to small changes in the std-CPUE, providing greater business planning certainty to industry.

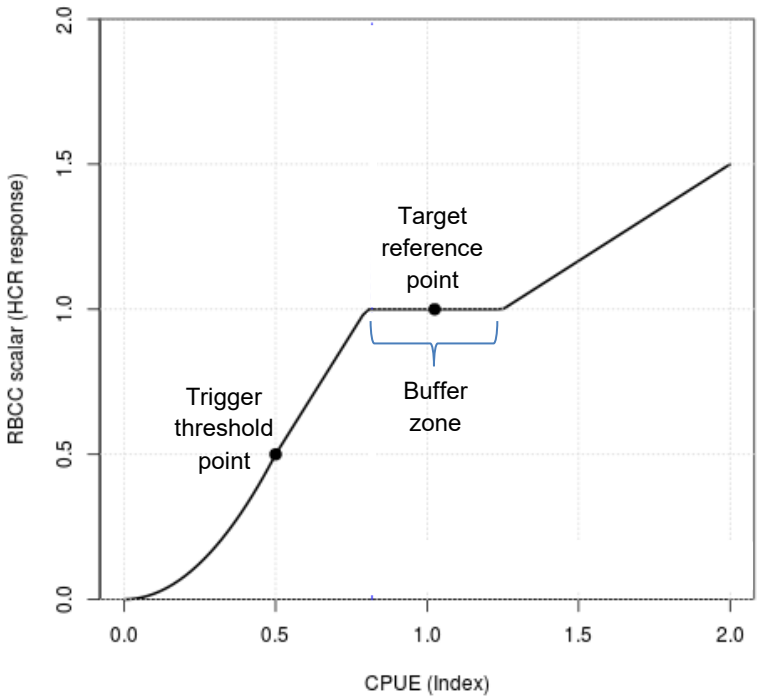

Figure 5 – The harvest control rule used in the ETBF Swordfish Harvest Strategy

- **Threshold trigger point** – this trigger point is at 0.5 of the std-CPUE target level (Figure 2 above) and is used to indicate a CPUE level below which recruitment overfishing is more likely to occur and thus should be avoided. The CHSP default LRP of 20% of unfished spawning biomass cannot be
- explicitly built into a HCR based on subregional CPUE. However, MSE testing of this HS demonstrated that it would not result in stock depletion to below 20%SSBf=0, even under the most pessimistic scenarios tested.
- **Gradient above and below the buffer** – these determine the RBCC scalar level to be applied to the previous years RBCC, based on the level of recent (4 year average) std-CPUE. The gradients were selected based on achieving the best tuning during MSE testing, being typically a steeper slope below the buffer than above it.
- **RBCC scalar** – the RBCC scalar is the multiplier applied to the current RBCC to determine next seasons RBCC. The degree of increase or decrease in scalar is determined by the gradient of the control rule above and below the buffer zone. It is implemented such that when the CPUE:
    - is within the buffer zone, the scalar is 1 (i.e. no change to RBCC)
    - when the CPUE drops below the buffer, the scalar drops below 1, resulting in reduced RBCCs, and
    - when CPUE rises above the buffer, the scalar increases above 1, increasing the RBCC.

3.5.6 Meta-rules and Exceptional Circumstances

Following the determination of the initial RBCC using the harvest control rule, a number of meta-rules and exceptional circumstance checks should be applied/conducted, including:

3.5.6.1 10% maximum change rule

This rule requires that no annual change in RBCC can be greater than 10% (either up or down). Thus a recommended increase or decrease in RBCC of 15% as recommended by the HCR scalar would be restricted to 10% for that season. This rule is applied to provide greater stability for industry in TACCs to aid financial planning. It is understood that this type of rule may mean that successive TACC cuts may be required to turn a declining stock around, or gains in TACC will be slower to be realised in a rapidly increasing stock.

3.5.6.2 Exceptional circumstance checks

When making an RBCC recommendation in a given year, the following checks on the data are recommended:

1. That the index is not outside the range of values tested in the MSE work. This is done simply by seeing if the actual observed index for that

year/those years are contained within the confidence intervals of the simulated indices generated in the MSE work.

2. That the size data used to construct the index are not inconsistent with previous years' data and that simulated in the MSE work.
3. That a review of any **additional or new** biological/fishery information that suggests that the resource or fishery might be outside parameters ranges or assumptions that were tested in the MSE work.
4. That the ratio of catch taken to TAC is within the bounds tested in the implementation model used in the MSE work.
5. That the catch share of the ETBF relative to the other fisheries (international and recreational) is not too low to justify the application of the HS (at all) and/or full implementation of RBCCs as TACCs. Potential scenarios to be checked and for TTRAG to advise TTMAC/AFMA Commission on include:
    a. If the application of the HS is *unlikely* to result in the ETBF achieving the HS TRP, even if the ETBF bears the full implementation of any TACC reductions. An example of where this could occur is if international catches increased to a level that no level of ETBF TACC adjustment could achieve the objectives of the harvest strategy.
    b. If the application of the HS is *likely* to result in achieving the TRP, however only whereby the ETBF is subject to reduced TACCs to compensate for increased international (or other) fishery catches and impacts on local abundance.

    Thus TTRAG should provide information on the effectiveness of the HS given relative catch shares, stock structure and ETBF and foreign fishery trends and where information is available, their relative and combined stock impacts (see also Section 2.9 of the CHSP Guidelines)[17].

    It will be for TTMAC, and ultimately the AFMA Commission, to consider TTRAG advice and other relevant information and decide whether the HS should continue to be used, and if it is, then the issue of equity in how conservation/economic HS outcomes should achieved between the ETBF and other fisheries (i.e. whether RBCCs should be fully or partially applied in ETBF TACCs).

    This process is required to address the concern that increases in foreign catches that drive std-CPUE down and result in reductions in the RBCC

[17] These checks are included in recognition that there is already significant international catch of swordfish and it is possible that international (and recreational) catches of swordfish in the adjacent and broader stock region could increase to levels that would mean that the ETBF was no longer the primary fisheries contributor to changes in local abundance/availability of swordfish.

from the HS, will unfairly impact on the ETBF, or in the worst case scenario, mean that no level of ETBF catch reduction will be effective.

6. Every three years consider updating the Operating Models to both check that stock status is not manifestly different (providing a new assessment is available) from what was tested (i.e. outside the domain of stock status scenarios considered in the MSE) and as a longer-term performance assessment of how the harvest strategy is working.

3.5.7 TACC decision process

The ETBF Harvest Strategy for Swordfish will be used *each year* to determine a recommended biological commercial catch (RBCC), which will be used as the primary scientific input to inform the TACC for the following ETBF fishing season. It is the role of:

- TTRAG to provide advice regarding an RBCC to AFMA Management, TTMAC and the AFMA Commission.
- TTMAC and AFMA to provide advice to the AFMA Commission on a recommended TACC.
- The AFMA Commission to determine the TACC. The TACC may be the same as the RBCC or may be adjusted from the RBCC taking into account other factors (for example economic factors identified in the advice provided by TTRAG and TTMAC, resource sharing considerations, etc).

In general, TTRAG meet three times per year (typically at the end of the first, second and third quarters) with the key harvest strategy and RBCC advice steps being:

- 2nd Meeting – TTRAG is required to review all new catch, effort and size data that will provide key inputs to target species catch rate standardisations (including those used in harvest strategies) and to also review the updated standardised CPUE series.
- 3rd Meeting – TTRAG is required to run the harvest strategy with the updated indicator data and determine the RBCC. A range of other indicators for both the ETBF and other fisheries within the broader south-west Pacific will also be reviewed. TTRAG will develop an annual advice paper for submission to TTMAC and AFMA Commission. This paper will include information regarding the HS outcome (RBCC), key fishery indicator trends, the TTRAG review of exceptional circumstances indicators, and trends in key fishery economic indicators.

TTMAC typically meets twice per year (generally April and October) and will consider TTRAG advice on TACCs at its second meeting and develop a recommendation for the AFMA Commission.

The AFMA Commission meets multiple times through the year and is required to make a decision on the following seasons TACC generally at its last meeting of the year (typically November).

3.5.8 Areas of further research/investigation

TTRAG identified that as part of the continual improvement process for harvest strategy application in the ETBF, further consideration should be given to the need to collect size data for discarded swordfish and to collecting data on recreational catches of swordfish. TTMAC recommended that additional consideration be given, leading into and during the three year review (below), to the development and use of quantitative economic data and analyses to further refine the Target Reference Point used in this harvest strategy.

3.5.9 Review period and process

The ETBF Swordfish Harvest Strategy (and all its elements, including in particular key inputs such as the standardised CPUE indices) will be fully reviewed and tested after 3 years of implementation, to assess if the harvest strategy is functioning in a manner consistent the results of the MSE and CHSP requirements and at the same time providing settings that meet AFMAs objectives and industries preferences of stability/reactivity.

3.6 Key commercial species – Indicators & whole of government approach

In 2013, the AFMA Commission determined that the harvest strategy originally developed for all five key commercial species in the ETBF would no longer be applied to the tropical tuna species of yellowfin tuna, bigeye tuna and albacore tuna. This change was introduced since the majority of the catch taken within the principal 'region of interest' to the ETBF for the three tropical tunas is taken by international fleets other than the ETBF. This has the consequence that:

- Uncontrolled increasing catches by foreign fleets in the region would likely simply result in the ETBF RBCCs being ratcheted continuously downward and subsequently that
- The successful management of these resources cannot be undertaken by Australia alone but will require a regional management approach.

Consistent with the CHSP and Guidelines 2018, TACCs for these species are now set after taking into consideration:

- Australia's negotiating positions (including claimed allocation) for each stock within the WCPFC (which is based on 2001-2004 historical catch levels for yellowfin and bigeye and 2006 levels for albacore tuna), and

- current fishery indicators of stock status both within the ETBF and the western and central Pacific Ocean (WCPO).

The domestic and regional fishery/stock indicators for the three tropical tunas and two billfish species are estimated each year and provided in an overall advice paper from TTRAG to TTMAC and to the AFMA Commission. These indicators include:

- Stock Region
- Stock Status
- WCPFC Scientific Committee Advice
- Present WCPFC Management Arrangements
- Catch: WCPO and ETBF
- CPUE: WCPO and ETBF
- Mean Catch Weight: WCPO and ETBF

The Commission considers this advice from TTRAG, as well as advice from TTMAC, Tuna Australia (the industry association) and AFMA management, along with consideration of Australia's negotiating position at the WCPFC, in coming to a final decision on the TACC for each of these three stocks for the following season.

In 2018, the AFMA Commission determined that this approach will also be applied temporarily to Striped Marlin and Broadbill Swordfish, in the period while a revised harvest strategy for these species is developed. This decision followed MSE based analyses of the previous harvest strategy that indicated it may continue to cut catches even when the stock was above target biomass levels. Subsequently, a harvest strategy for Swordfish has been developed (below) while the HS for Striped Marlin is in development.

3.7 Byproduct species - Harvest monitoring rules

3.7.1 Background

Byproduct species were included under the scope of the CHSP in 2018. That policy and associated Guidelines provide some hypothetical examples of data rich byproduct harvest strategies. However, for data poor and lower value byproduct (i.e. most byproduct in the ETBF) it references guidance in the Bycatch Policy and Guidelines which in turn reference the AFMA ERM Guide and the GESMF Guidelines (2007) (see provisions 1.1.1 – 1.1.8 under Principle 1).

Byproduct species are assessed and managed under a different approach to those used for key commercial species in the ETBF. For byproduct species:

- Ecological Risk Assessments are undertaken every five years using level 2 methodology (generally the SAFE tool) of the ERA process unless a pre-existing higher level assessment is available (see AFMA ERM Guide).

- Byproduct species determined to be at high risk from the fishery (after residual risk analysis) will have case specific management arrangements put in place to reduce the risk to acceptable levels. The form of such action is not pre-specified under this approach but would be determined on a case specific basis, taking into consideration the need to ensure management impacts on catches of key commercial species are minimised.
- Harvest monitoring rules are then used in between assessment periods to ensure a review of catches occurs if they increase above pre-set trigger levels. Pending the result of that review, it may be necessary to re-assess the byproduct species in question, and pending that re-assessment, to take management action to reduce the level of risk posed by the fishery to the stock.
- For species determined to be at high risk, the decision to re-assess at a higher level or directly manage the risk will be dependent on a range of factors. See Chapter 5.5 in AFMA ERM Guide for further discussion on these factors and available management options.

This approach to managing byproduct recognises a number of factors including:

- the need to ensure that all species stocks biomass remain above the level at which the risk of recruitment impairment is unacceptably high.
- their generally lower economic contribution to the fishery,
- a generally lower inherent risk from the fishery (due to their not being targeted);
- A requirement by the AFMA ERM Guide to put in place fishery monitoring triggers for byproduct and bycatch including those based on fishery effort (distribution and level), fishing method changes, catches and catch rates.

At the same time, the management approach should allow where appropriate for the increased (but sustainable) exploitation of byproduct species where they have previously been under-utilised. As exploitation increases, the level of monitoring, assessment and management should increase also. Triggers can provide a way for controlled increases in fishing mortality providing that is always below the limit reference point level.

3.7.2 Summary of byproduct risk assessments

The 2019 CSIRO ETBF ERA Report provides a full overview of the most recent ERA for byproduct species in the ETBF. The report highlights that the ETBF does not pose a high risk to ecological sustainability of any byproduct species with which it interacts.

3.7.3 Ecological Risk Management arrangements for high risk byproduct species

The most recent ERA for the ETBF indicates that there are no high risk byproduct species in the ETBF. Monitoring triggers will be developed in 2019/20 to monitor potential changes in risk to these species through time.

3.7.4 OCS based catch limits for byproduct species

Table 32 - Table 33 display the State and Territory limits for byproduct species that interact with the ETBF. The State and Territory restrictions apply to all waters extending out from the coastline of the respective State or Territory. These restrictions are not linked to the ETBF ERA and more often reflect resource sharing considerations between Commonwealth and State fisheries.

3.7.5 Harvest monitoring rules and triggers

3.7.5.1 Setting monitoring triggers

The implementation of electronic monitoring in the ETBF has led to a much higher level of confidence in the total catch of many byproduct species, meaning that catch based triggers may offer a more viable option for monitoring potential changes in fishery risks to ecological sustainability of many byproduct species than in the period prior to EM.

Byproduct catch monitoring triggers should be set at a level below that which would result in a high risk to ecological sustainability. Determining what catch or effort level that be might be is not straightforward due to the data poor nature of many byproduct species. Such monitoring triggers have not yet been set in the ETBF. A required action under this FMS is that within 12 months of its implementation, TTRAG will provide advice on appropriate monitoring triggers for TTMAC/AFMA consideration. The advice should take account of recent technical work done by the AFMA ERM Working Group to provide guidance on this issue. AFMA will implement processes to monitor these triggers and report annually to TTRAG and in the ETBF FMS Annual Report.

3.8 Commercial Discards

In requiring Commonwealth fisheries to implement harvest strategies that will achieve its primary objective (ecological sustainability and maximising economic returns), a key strategy stated by the CHSP 2018 is to:

- minimise discarding of commercial species as much as possible

The CHSP 2018 also states:

- Harvest strategies will account for all known sources of fishing mortality on a stock, including recreational and Indigenous fishing; *discards*; and fishing under the management of another jurisdiction.

- Discarding of commercial species in order to retain higher value catch shall not be supported by management arrangements and fishers must minimise discarding of commercial species to the greatest extent possible. Where evidence suggests systematic and avoidable discarding, steps to halt it will be developed and implemented. AFMA will monitor and report on the ongoing level of discarding and processes in place to monitor and reduce discarding.
- Estimates of fishing mortality from discarding must be taken into account in stock assessments and risk assessments, when implementing management measures, assessing quota usage and in the operation of harvest control rules to minimise the incentives for discarding.

The CHSP Guidelines 2018 require AFMA to:

- Collect data on the amount of discarded catch, and document/report the extent of discarding of commercial species and the actions taken to both monitor and reduce discarding

From an ERM perspective, discarding can play a significant role in increasing the risk posed by fishing to the ecological sustainability of commercial species populations, particularly where discarding is poorly monitored or not properly taken into account in assessments designed to monitor the status of stocks and risk of fishing to those stocks. There are other legislative and policy objectives (e.g. optimal utilisation) that require commercial discards to be monitored and managed.

AFMA is considering the development of an overarching “AFMA Discard Management Strategy” to provide further guidance for fishery managers on how to implement discarding related requirements of the revised CHSP 2018. In addition, WCPFC is also considering the issue of commercial discarding and international requirements will likely also evolve over time. This FMS includes an action item to ensure that management of discards in the ETBF is consistent with future AFMA policy and WCPFC arrangements.

3.9 Harvest Strategy Review process

The CHSP Guidelines 2018 indicate that while harvest strategies are to be reviewed every five years, it may be necessary to amend harvest strategies earlier if:

- a marked change in stocks targeted occurs, leading to a change in which stocks are categorised as key commercial.
- new information substantially changes understanding of the fishery, leading to revised estimates of indicators relative to reference points.
- external drivers have unexpectedly increased the risk to a fishery and fish stocks, including environmental or climate drivers that have substantially altered the productivity characteristics (growth or recruitment) of the stock.

- performance indicators show that harvest strategies are not working effectively, and that the intent of the HSP is not being met.

Harvest strategies should include review triggers to respond to significant and unexpected changes in fishery conditions, outside the ranges tested. Where a harvest strategy is significantly amended, it should be re-tested to ensure it has a high likelihood of achieving HSP objectives under the changed circumstances.

3.10 Commercial Species Management Actions

Table 9. Commercial Species related actions to be undertaken in the period of this FMS.

Category	#	Future Actions
Key Commercial Species	1	AFMA will oversee the development of a revised and MSE tested harvest strategy for broadbill swordfish and striped marlin by 2021.
	2	AFMA will ensure that this FMS is updated to include provisions consistent with any future AFMA Discards Policy and with any future (e.g. WCPFC) international requirements relating to commercial species discarding.
	3	AFMA will take into account any new information pertaining to stock structure, climate change impacts or other biological information as it becomes available and if necessary adjust ETBF management approaches (harvest strategy or indicators based approaches) to manage risks to achieving its operational objectives.
	4	TTRAG to explore the collection of logbook data relating to: i) skipper and skipper experience data as proxy for fishing efficiency in CPUE analyses; ii) vessel log speed, line shooting speed and mainline length and HPB for proxying depth of hooks (in CPUE analyses).
	5	TTRAG to explore options for better understanding hook depths for different fishing strategies in the ETBF; including consideration of TDR based research and/or collecting gear information to better proxy fishing depths in CPUE analyses. Such information may also assist understanding of gear interactions with protected species such as turtles and seabirds (Section 4).
	6	AFMA, TTRAG and TTMAC to explore the development of in-season economic indicators for provision as part of TTRAG/TTMAC advice on TACCs to the AFMA Commission.
	7	AFMA to develop and include performance criteria for objectives relating to cost effectiveness, international agreements, and optimal utilisation.

Category	#	Future Actions
Byproduct Species	8	Within 18 months of the implementation of this FMS, TTRAG will provide advice on appropriate byproduct monitoring triggers for TTMAC/AFMA consideration and AFMA will implement processes to monitor these triggers and report annually to TTRAG and in the FMS Annual Report.
Multi-sector interests	9	AFMA will undertake work to identify how to best have regard for commercial, recreational and indigenous fisheries in a consistent manner across its fisheries.

4 Bycatch Species

4.1 Introduction

This section outlines the key management arrangements that AFMA implements to pursue its core legislative and policy based objectives pertaining to the management of bycatch species (both general bycatch and EPBC listed bycatch) that interact with this fishery. These high-level objectives require AFMA pursue ecological sustainability, minimisation of bycatch and avoidance of injury/mortality to EPBC listed species (see Section 1.2) and are reflected in the ETBF Fishery Management Plan 2010 to which this ETBF FMS is aligned.

In order to operationalize and achieve these objectives and associated policy requirements, this ETBF Bycatch Strategy has drawn upon guidance from:

- the Commonwealth Policy on Fisheries Bycatch 2018 and associated Guidelines – which address management requirements relating to ***general*** bycatch species;
- the AFMA Bycatch Strategy 2017-2022 and associated sub-strategies - which focusses on requirements for managing interactions with ***EPBC listed*** species;
- the AFMA Ecological Risk Management Guide 2017;
- the Guidelines for Ecologically Sustainable Management of Fisheries 2007; and

This FMS is designed to be consistent with the overarching **AFMA Bycatch Strategy 2017-2022** guiding principles:

- Management responses are proportionate to the conservation status of affected species and Ecological Risk Assessment results
- Consistency with Government policy and legislative objectives (including to 'avoid' and 'minimise') and existing national protected species management strategies such as Threat Abatement Plans and National Plans of Action
- Incentives should encourage industry-led solutions to minimise bycatch of EPBC listed species utilising an individual accountability approach
- Cumulative impact of Commonwealth fisheries on EPBC listed species is accounted for when making management decisions on mitigation
- There is appropriate and consistent monitoring and reporting arrangements across fisheries.

And in line with AFMA Bycatch Strategy actions to:

- Improve monitoring;
- Streamline bycatch management arrangements;
- Streamline consultative arrangements; and

- Improve environmental stewardship by fishers

Currently the AFMA Bycatch Strategy is the main guiding document in relation to AFMAs overarching approach to managing fishery interactions with EPBC listed species, which are not explicitly covered by the CPFB 2018.

4.2 Commonwealth Policy on Fisheries Bycatch 2018

The primary objective of the CPFB 2018 for bycatch management is to minimise fishing-related impacts on ***general*** (not EPBC listed) bycatch species in a manner consistent with the principles ESD and with regard to the structure, productivity, function and biological diversity of the ecosystem. The implementation of the policy will be pursued via AFMAs bycatch strategies (which form part of an FMS). At a minimum these strategies must detail:

- the **species**, or groups of species, of relevance
- the **risk assessment methodology and results**
- **consideration of cumulative impacts** on bycatch populations
- **management responses** for areas of identified risk
- **data collection, reporting and monitoring processes**
- **performance and evaluation processes and outcomes**.

In delivering on this objective the Bycatch Policy requires fisheries managers to:

- draw on best-practice approaches to avoid or minimise all bycatch, and minimising the mortality of bycatch that cannot be avoided;
- manage fishing-related impacts on general bycatch species to ensure that populations (i.e. discrete biological stocks) are not depleted below a level where the risk of recruitment impairment is regarded as unacceptably high
- where fishing-related impacts have caused a bycatch population to fall below the level described above, implement management arrangements to support those populations rebuilding to biomass levels above that level.
- Ensure FMS objectives are equivalent to legislative and policy requirements and consistent with international requirements and agreements.

The CPFB 2018 does not specify requirements for EPBC listed species but notes that fishing interactions with EPBC Act-listed species are treated differently (than interactions with general bycatch species) and their management is prescribed under the EPBC Act. This involves ensuring that:

    - fishing operations take all reasonable steps to avoid the mortality of, or injury to, species protected under the EPBC Act
    - all interactions with EPBC Act-listed species, are reported to DAWE
    - fishing operations do not adversely affect the survival or recovery in nature of EPBC Act-listed species

- bycatch management gives priority to implementation of relevant threat abatement plans and recovery plans.

The CPFB Guidelines 2018 state that “EPBC Act-listed species are managed in parallel, and where feasible, jointly with general bycatch, however, due to their status under Australia’s national environment legislation, additional management may be required and these guidelines do not aim to alter or change existing practices for EPBC Act-listed species”.

The CPFB Guidelines 2018 notes that:

- there is a requirement to track performance using indicators, reference points and performance measures.
- Due to current data and knowledge gaps that exist for general bycatch, estimating performance using biomass limit reference point for general bycatch is not a cost-effective option for most bycatch species. Equivalent fishing mortality (F)and/or ecological risk reference points are recommended when biomass limit reference points cannot be estimated.
- In practical terms, the F-based limit reference point (F_{LIM}) invoked by the bycatch policy is a F that, if maintained for an extended period of time, depletes a population to a level that results in sustained and significant reduction in recruits below average levels (i.e. recruitment impairment).The ecological risk assessment methods adopted by the Commonwealth assume that “high” risk equates to an unacceptably high probability of breaching the bycatch limit reference point.
- The 90% risk criterion adopted by the CHSP does not currently apply to bycatch.

The CPFB Guidelines also provide some detailed guidance pertaining to how AFMA can pursue and demonstrate performance against the objective of avoiding and minimising interactions with general bycatch including encouraging adoption of codes of conduct and best practice, encouraging innovation, and ensuring there is evidence for the performance of the mitigation measures. They require that AFMA seek measures that:

- maximise the potential for live release and post-release survival,
- do not increase fishery impacts on other high-risk or EPBC species;
- multi-optional measures have a similar level of performance
- multiple mitigation measures effects are additive.
- are based on statistically robust experimental trial designs that have demonstrated statistically significant reductions in bycatch mortality
- are cost effective
- differences between research trials and commercial operations are anticipated;

AFMA should measure and report on the degree of compliance with measures and use ERA tools to explore management options relating to availability, encounterability, selectivity and post capture mortality, assessing these options against risk-catch-cost trade-offs.

4.3 Bycatch objectives and performance criteria

The key operational objectives for the ETBF Bycatch Species sub-strategy are listed in Table 10 below. For the ecological sustainability (including conservation status) and accountability operational objectives there are performance criteria tables which explain the performance indicators and reference points that AFMA will use to monitor and report upon its performance against those objectives.

For the other objectives in Table 10, AFMA is currently in the process of developing performance criteria that can be applied consistently across fisheries, which once developed will be included in this FMS. See actions in Table 16.

Table 10. Operational objectives for bycatch species.

Objective type	Objective	Performance criteria
Ecological sustainability	1. Fishing in the ETBF does not reduce any bycatch species populations to/below a level at which the probability of recruitment impairment is unacceptably high. .[Ref: CPFB 2018; AFMA ERM Guide 2017] 2. Where such impacts have occurred, implement management arrangements to support those populations rebuilding to biomass levels above that level.[Ref: CPFB 2018; AFMA ERM Guide 2017] 3. ETBF management arrangements seek to avoid or minimise bycatch, and minimise the mortality of bycatch that cannot be avoided [Ref: CPFB 2018] 4. To not adversely affect the conservation status of EPBC listed species by fishing in Commonwealth fisheries 5. To not adversely affect the survival or recovery of threatened species by fishing in Commonwealth fisheries 6. AFMA to take all reasonable steps to ensure that EPBC listed species (other than conservation dependent species) are	Tables 27, 28 Appendix B

	not killed or injured as a result of fishing in the ETBF	
Accountability	1. Advisory committees (TTRAG, TTMAC) and Tuna Australia are consulted on the management of the fishery. 2. AFMA management decisions, arrangements and strategies are clearly explained, transparent, documented and communicated to industry and the broader community. 3. AFMA's reporting obligations under fisheries policies and guidelines, and international agreements are met.	Table 26 (Appendix B)
International agreements	ETBF Management Arrangements are consistent with and meet relevant obligations under WCPFC Convention, CMMs and other relevant international agreements and international law; and ETBF vessels comply with these.	To be developed (see action in Table 16)
Cost-effective management	ETBF Management approaches described in this FMS are efficient and cost-effective (including consistent with the risk-cost-catch trade off model)	
Multi-sector interests	1. Consultative committees to include representatives from all relevant stakeholder groups 2. AFMA has regard to consultative committee advice when making management decisions.	
Optimal utilisation	Where commercial markets open up for general bycatch species, and subject to legislative objectives that AFMA pursues, AFMA will look to ensure ETBF management arrangement do not hinder general bycatch species transition to commercial species status.	

4.4 Risk Assessment Summary

4.4.1 Ecological sustainability

4.4.1.1 Assessment methods

There are four key types of assessments undertaken to determine AFMAs performance against bycatch objectives stated in Table 10. These are:

- A local scale[18] **Ecological Risk Assessment (ERA)** of the risk posed by the ETBF to ecological sustainability (assessed against the risk of recruitment impairment) of general bycatch and EPBC listed bycatch populations that the fishery interacts with. The most recent assessment was undertaken by the CSIRO through 2017/18, in consultation with AFMA, TTRAG, TTMAC and the ERA TWG. This *local scale* ERA is an assessment of relative local impacts, assuming that bycatch stocks are confined to the fishery/EEZ area. This precautionary assumption is made in the absence of information on the stock structure of most bycatch species. The methodology used to undertake ERA in Commonwealth fisheries is described in detail in the AFMA ERM Guide which provides updates to the methodology of Hobday et al., 2007.
- **Regional stock and risk assessments** are conducted on some bycatch species by the WCPFC (SPC) and provide information relating to risk posed by the regional WCPFC fishery (which includes the ETBF) to regional stocks. The methodologies used in these assessments are specific to each assessment and are linked in the results sections below but generally found here.
- **Assessments of species conservation status** under the EPBC Act 1999 are conducted by the Threatened Species Scientific Committee (TSSC) for DoAWE. These assessments provide information to assess fisheries against the objective that they not adversely affect the conservation status of listed marine species, migratory species or cetaceans, nor adversely affect the survival or recovery in nature of listed threatened species. The TSSC assessment methodology is described here.
- **Assessments of environmental performance of fisheries** under the EPBC Act 1999. Part 13A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) regulates: i) import and export of specimens protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); ii) exports of Australian native specimens; and iii) imports of live specimens.

  The EPBC Act 1999 requires the Australian Government to assess the environmental performance of fisheries and promote ecologically sustainable

[18] In the context of the ETBF, noting that some species that are assessed under the ERA are part of a broader regional stock.

fisheries management. These assessments ensure that, over time, fisheries are managed in an ecologically sustainable way. The assessments are conducted against the Guidelines for the Ecologically Sustainable Management of Fisheries (the Guidelines). The Guidelines outline specific principles and objectives designed to ensure a strategic and transparent way of evaluating the ecological sustainability of fishery management arrangements.

Approval of a Wildlife Trade Operation **(**WTO**)** is made through an instrument signed by the Minister or his delegate and published in the Gazette. The Minister or his delegate may specify that the declaration only applies during a particular period or while certain circumstances apply or while a certain condition is complied with (subsection 303FT(4)).

4.4.1.2 Ecological Risk Assessment Results

The 2019 CSIRO ETBF ERA Report provides a full overview of the most recent ERA for bycatch species in the ETBF. The report highlights that the ETBF does not pose a high risk to ecological sustainability of any bycatch species with which it interacts.

4.4.1.3 Results - Regional stock/risk assessments

Four bycatch species taken in the ETBF have had broader regional assessments undertaken by WCPFC:

- The Southern Hemisphere porbeagle (*Lamna nasus*) and Pacific bigeye thresher shark (*Alopias superciliosus*) species have undergone spatially explicit sustainability risk assessments in 2017. The assessments estimate fishing mortality which is compared to a set of three reference points (Fmsm, Flim and Fcrash) similar to the AFMA ERA. In the context of the AFMA ERA risk ratings southern hemisphere porbeagle would be assessed as low risk and Pacific bigeye thresher as medium risk according to these assessments.
- Stock assessments for silky shark (*Carcharhinus falciformis*) and oceanic whitetip (*Carcharhinus longimanus*) in the Western and Central Pacific Ocean were also conducted in 2012. The results indicated that both stocks were subject to overfishing by the WCPFC fishery and both stocks were overfished. ETBF management arrangements for these species are described in Table 13.

4.4.1.4 Results – EPBC conservation status assessments

A number of bycatch species that the ETBF very rarely interacts with have been determined by the TSSC to be “threatened” species (due to causes other than the ETBF) under the EPBC Act. These are:

- Great white shark (*Carcharodon carcharias*) - Vulnerable
- Grey nurse shark (*Carcharias Taurus*) – Critically endangered

- School shark – conservation dependent

Management arrangements (i.e. “no-take” rules) for these species are described in Table 14.

4.4.1.5 EPBC Act assessment

The ETBF was first declared an approved Wildlife Trade Operation (WTO) under the EPBC Act in July 2005. The current export approval is valid for three years, expiring in August 2022. Periodic status reports are required to be submitted to the DAWE annually, under which AFMA must report against a number of conditions stipulated by the DAWE being:

1. The ETBF is to be managed in accordance with the ETBF FMP 2010 in force under the FMA 1991.
2. DAWE to be notified of any changes to management of ETBF that may affect its assessment against EPBC Act.
3. AFMA to provide annual reports to DoAWE as per Part B of the GESMF 2007.
4. AFMA to consult with DAWE prior to a change to the management arrangements being implement for a CITES listed species.
5. AFMA to continue to determine the extent of the impact of fishing in the ETBF on shark species.
6. AFMA to ensure a) data monitoring and analysis in the ETBF is sufficient to meet recovery and threat abatement plans and the monitoring requirements of the WCPFC, and implement management measures as required, and: b) for EPBC listed species, compare logbooks with independent data and report on measures to address any inconsistencies between them.
7. AFMA to continue efforts to determine the extent of the impact of fishing in the ETBF on marine turtle species.

The most **recent assessment** (in 2019) of the ETBF for the purposes of the protected species provisions of Part 13 and the wildlife trade provisions of Part 13A of the EPBC Act determined that, as a result of the management arrangements in place:

- It is unlikely that fishing operations conducted in accordance with the ETBF FMP 2010 will adversely affect the conservation status of listed marine species, migratory species or cetaceans, nor adversely affect the survival or recovery in nature of listed threatened species.
- Under the Plan, operators are required to take all reasonable steps to avoid killing or injuring of species protected under Part 13 of the EPBC Act.
- The fishery operates in accordance with the Guidelines for the Ecologically Sustainable Management of Fisheries – 2nd Edition.

For the latest full ETBF assessment see link here.

4.5 Bycatch management arrangements

4.5.1 Introduction

This management strategy is designed to achieve bycatch objectives outlined in Table 10 and Section 2, taking into account the most recent assessments of performance against those objectives summarised in Section 4.4. Bycatch management arrangements can be divided into three categories (Table 11):

Table 11. Categories of bycatch management arrangements

Category	Purpose
General	Relevant to all species
Species group	Designed to address bycatch objectives for groups of related species. AFMA has determined that such strategies will better achieve objectives relating to overall bycatch minimisation, sustainability and conservation, and avoidance of injury/death than species specific measures, and also allow for consistent management across fisheries and consideration of cumulative risks, and are more efficient and cost-effective approaches to managing bycatch.
Species specific	Designed for a particular species only, often due to resource sharing agreements with recreational or State fisheries and international stock status agreements or local ERA risks and ERM.

While specific management responses to bycatch species identified as at high risk from ERA are implemented via either species group strategies or species-specific measures, AFMA has also identified a series of “future actions” that will be undertaken in a manner consistent with former bycatch action plans to support and develop existing management measures. These actions are summarised in Section 4.8.

4.5.2 General management arrangements requirements

4.5.2.1 Catch reporting

Fishers must record all bycatch, byproduct and discards under the ‘Catch Details’ section of their logbook and any interactions with EPBC listed species under the ‘Wildlife and other Protected Species’ section of their logbook. Accuracy of logbook reporting is verified by auditing of electronic monitoring footage.

4.5.2.2 Bycatch handling/treatment:

Fishers are responsible for handling bycatch species appropriately to maximise the chance of their survival. Mishandling bycatch species can significantly reduce their chances of survival and have long-term impacts on the sustainability of the species.

Fishers must not mistreat bycatch. Mistreat is defined as the taking of an action or actions, or the failure to take an action or actions, which results, or is likely to result, in the death of, injury to, or causing of distress to any bycatch. AFMA has developed six bycatch handling and treatment principles to minimise the risk of breaching bycatch handling and treatment (Table 12).

Table 12. Overarching principles for bycatch handling

Principle		Description
1	Safety of the boat and its crew are paramount	Mishandling does not include actions taken (or not taken), which are reasonably necessary1 to ensure the safety of the boat and or its crew.
2	All reasonable steps should be taken	Operators are expected to take all reasonable steps to ensure that bycatch is returned to the water as quickly as practicable and in a manner which does not reduce its chance of survival.
3	Minor gear recovery is not 'reasonably necessary'	Actions taken for the sole purpose of recovering minor fishing gear, are not considered 'reasonably necessary'.
4	Expediting removal from gear is not 'reasonably necessary'	It is not 'reasonably necessary' to injure bycatch when removing it from fishing gear to save time.
5	Harm, injury or death caused during capture is not mishandling	Mishandling does not include where bycatch is already dead, injured or stressed when it is brought on-board
6	Compliance with approved bycatch management plans	Handling of bycatch in accordance with AFMA approved bycatch management plan(s) is not mishandling.

For the full AFMA Bycatch Handling and Treatment Guide see: https://www.afma.gov.au/sites/default/files/uploads/2017/03/AFMA-Bycatch-Handling-and-Treatment-Guide_-2016-17_Public-Doc_FINAL.pdf

4.5.3 Species Groups Management Strategies

4.5.3.1 Sharks and rays

It is recognised that sharks populations tend to be more vulnerable to fisheries impacts than bony fish, as they tend to be slow-growing, mature at a later age and have few young (Last and Stevens 1994) and some shark species have naturally

small population sizes (Shark Plan 2, 2012). There is global concern that high levels of shark catch are affecting shark species in several areas of the world's oceans (FAO 1999; Clarke 2009). In recognition of this, AFMA (and the Commonwealth Government) is committed to minimising, to the extent possible, ETBF and other fishery impacts upon shark populations including shark bycatch species.

Fishery wide measures are in place to reduce the capture and mortality of all shark species, regardless of conservation or ecological risk status. These measures include:

- A ban on the use of wire trace (to minimise shark captures)
- A ban on shark finning
- Requirement for vessels to have line cutters (which can be used to release sharks prior to hauling on deck) and dehookers
- A requirement that retained shark numbers (byproduct) per trip do not exceed quota species (tuna and billfish) catch numbers, with a total trip limit of 20 sharks (this effectively prevents trips targeting shark). Any excess sharks are classified as bycatch and must be discarded whether alive or dead.

In addition to these requirements, there are a suite of documents developed to assist fishery managers and fishers with the mitigation of sharks and rays. These include:

- Quick identification guides for shark species (including Shortfin Mako, Longfin Mako, Dusky Shark, Silky Shark and Bronze Whaler sharks) to assist operators in accurate identification and reporting of these species:
  - Marine species ID manual developed by SPC.
  - Sharks caught in SBT Fishing grounds identification guide
- The Chondricthyan guide for managers. This guide was developed in 2009, by ABARES and AFMA, the guide aims to provide fisheries managers with practical options to mitigate chondrichthyan TEP and high risk species bycatch.
- A *National Plan of Action for the Conservation and Management of Sharks 2012 Shark-plan 2* developed by the Commonwealth Government. Shark-plan 2 provides an updated assessment of the conservation and management issues concerning sharks in Australian waters and identifies the research and management actions across Australia's state, territory and Commonwealth jurisdictions that will be pursued over the life of the plan.

Educational port visits for ETBF operators and skipper education programs have also been conducted to highlight bycatch obligations to fishers in relation to sharks.

4.5.3.2 Management measures

A local scale assessment (CSIRO 2018) of risk posed by the ETBF to ecological sustainability of shark bycatch species populations/stocks determined that the ETBF did not pose a high risk to any shark populations. However, impacts by other

fisheries (state and international) on some shark species populations that the ETBF interacts with have been significantly greater and have resulted in a number of species being given protected status under the EPBC Act 1999 or placed under a conservation and management measure by the WCPFC (Table 13). These species may not be retained.

Table 13. Shark species with additional protection under the EPBC Act or the WCPFC Convention

Species	Protected under	Condition
Grey nurse shark	EPBC 1999	Landing is prohibited
Great white shark		
Silky shark	WCPFC Convention	Landing either species is prohibited and they must be released with as little harm as possible.
Oceanic whitetip shark		

4.5.4 Seabirds

The term 'Seabirds' is used generally to describe any species of bird which spends a substantial part of its life foraging and breeding in the marine environment. These species include albatrosses, petrels, gulls, shearwaters, boobies, gannets, cormorants, and terns. Seabird populations globally face threats from various sources including climate change, competition and pests at breeding sites and interactions with commercial fisheries. The latter has led to a suite of global and domestic agreements, plans and measures which aim to mitigate and reduce fishery impacts on seabird populations.

Through measures described in this Bycatch Strategy, and implemented via fishing permit conditions, AFMA aims to ensure that the ETBF is fully compliant with both international agreements, regional fishery management organisation measures, domestic legislation and policies, and AFMAs Bycatch Strategy (and Seabird sub-strategy).

At an international level, this Bycatch Strategy (including the conditions AFMA places on ETBF permit holders) is consistent with the requirements of:

- Convention on the Conservation of Migratory Species of Wild Animals
- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- The Food and Agriculture Organization of the United Nations (FAO)
- Guidelines for implementing responsible fisheries management practices.
- Code of Conduct for Responsible Fisheries
- International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA – Seabirds)
- The Western and Central Pacific Fisheries Commission (WCPFC) Conservation and Management Measure on seabirds (CMM 2018-03)

- The Commission for the Conservation of Southern Bluefin Tuna (CCSBT) non-binding measures relating to seabirds

At a domestic level, oceanic longline fishing is listed as a key threatening process for seabirds under the EPBC Act, and as such required the development of a Threat Abatement Plan (TAP) for the ETBF (by AAD and AFMA), which now forms a key component of this Bycatch Strategy. A revised TAP was adopted in 2018.

The 2018 TAP requires the ETBF to:

- further reduce the bycatch of seabirds in oceanic longline operations and
- maintain a bycatch rate of less than 0.05 birds per 1000 hooks set in all fishing areas (by five degree latitudinal bands) and all seasons (1 September – 30 April; 1 May – 31 August).

The TAP requires these objectives are pursued by the following key actions: mitigation, education, international initiatives, research and development and uptake, innovation and data collection and analyses. AFMAs work relating to each of these are detailed below (management measures section and bycatch actions Table 16) and through the research and data strategy sections of this FMS.

Further responses are required by AFMA if the bycatch rate above is triggered in one season or in consecutive seasons in any five degree latitudinal band. Details of the required responses are located in the online Threat Abatement Plan (TAP).

Guidance for AFMA and industry regarding management of seabird interactions is provided in the AFMA Seabird Bycatch Operational Guidelines for Commonwealth Fisheries (October 2018).

4.5.4.1 Management measures (mitigation)

In response to its international and domestic requirements (including the TAP), AFMA has implemented fishery wide measures to improve reporting of, reduce the interactions with and mortality of all seabird species. These measures include the following.

Firstly, to allow for independent verification of species identification, fishery operators are required to firstly, collect and submit (to the government) feather samples from all seabirds that have died as a result of the interactions, and secondly, present these birds in clear view of the vessels electronic monitoring camera's. The feather samples are analysed using genetic techniques to identify species.

Secondly, to minimise interactions with seabirds, at all times vessel must:

- Carry one or more assembled tori lines onboard; and
- Not discharge offal while setting (Fisheries Management Regs 76(1)) and discharge during hauling should be avoided if possible.

When fishing south of 25° South vessels must:

- Deploy a tori line before commencing a shot when fishing between the hours of nautical dawn and nautical dusk[19];
- A tori line is not required to be deployed when performing fishing operations between the hours of nautical dusk and nautical dawn.
- Use only non-frozen bait;
- Weight longlines with either a minimum of:
    - 60g swivels at a distance of no more than 3.5m from each hook; or
    - 98g swivels at a distance of no more than 4m from each hook; or
    - 40g weights immediately adjacent to the hook, or at no more than 0.5m from the hook, with dead, non-frozen baits attached to the hooks; or
    - "Smart Tuna Hooks" with a cap and weighing at least 38g may be deployed

Vessels tori line must be:

- must be a minimum of 100 metres in length and deployed so that it remains above the water surface for a minimum of 90 metres from the stern of the boat;
- must have streamers attached to it with a maximum interval between the streamers of 3.5 metres and streamers lengths as close to the water as possible;

Thirdly, individual vessels that fail to consistently avoid or minimise interaction rates with seabirds are subject to additional monitoring and mitigation requirements. Specifically, vessels that exceed a rate of 0.05 birds/1000 hooks - in two of the last three consecutive Summer (or Winter) TAP seasons, or in consecutive Summer and Winter seasons, or take more than ten birds in a season - will be notified and placed on a watchlist. If that vessel then breaches the trigger again *in-season*, it will be required to implement additional mitigation for the remainder of the TAP season. That will comprise either stronger line weighting, night setting, hook shields, or moving the area of operation at least five degrees north (to a lower seabird abundance area). Additional mitigation will be required on top of this if the vessel continues to have seabird interactions.

In addition to these compulsory measures, Tuna Australia are in the process of developing an *Industry Code of Practice* that will assist in the mitigation and management of seabird interactions, and are undertaking research to look at ways to further mitigate against interactions and improve the safety of current mitigation approaches.

[19] Note: Nautical Dawn is defined as the instant in the morning, when the centre of the Sun is at a depression angle of twelve degrees (12°) below an ideal horizon. Nautical Dusk is defined as the instant in the evening, when the centre of the Sun is at a depression angle of twelve degrees (12°) below an ideal horizon. At both times, the sea horizon is not normally visible.

Ongoing and future TAP activities relating to education, research and development, innovation and data collection/analyses are described in Table 16.

4.5.5 Marine turtles

Six of the seven existing species of marine turtle are found in Australian waters, including the loggerhead turtle (*Caretta caretta)*, green sea turtle (*Chelonia mydas)*, hawksbill sea turtle (*Eretmochelys imbricate)* olive ridley sea turtle (*Lepidochelys olivacea)*, flatback sea turtle (*Natator depressus)* and leatherback sea turtle (*Dermochelys coriacea.)*

Many species of marine turtle are considered vulnerable to local and even global extinction due to declining numbers that are a result of many different factors (including but not limited to fisheries). Reduction in mortality from all human related factors is important for the long-term viability of these species. In the ETBF, a high proportion of turtles that interact with the gear are brought to the boat alive and released alive. Historically, the majority of interactions that have occurred in the ETBF have been with green and leatherback turtles.

4.5.5.1 Management measures

The ETBF implements two main measures (included as compulsory conditions on concession holder permits) aimed at reducing the mortality of turtles interacting with the ETBF. These are:

- Use of dehookers to remove hooks from turtles. Line cutters and de-hookers must be carried on board the boat at all times and must meet strict design criteria (described in permit conditions) to ensure that they are effective in the safe removal of hooks from turtles (and other animals).
- Compulsory use of large circle hooks on all shallow sets (less than 8 hooks per bubble) which have been demonstrated to significantly lower sea turtle catch rates, and post release mortality, without undue adverse effects on catch rates of Swordfish.

These measures are consistent with WCPFC CMM 2018-04.

4.5.6 Marine Mammals

Monitoring data indicates that the ETBF occasionally interacts with marine mammals, predominantly cetaceans (whales and dolphins), and very rarely, seals also.

4.5.6.1 Cetaceans

The majority of interactions with cetaceans (whales and dolphins) involve cetaceans being hooked or entangled in the fishing gear while predating on tuna from longlines. All cetacean species are protected under the EPBC Act. Recent data summaries for the ETBF, including during the recent period of electronic monitoring, show relatively few interactions occurring with cetaceans. The most common whales that have been reported interacting with longlines in the ETBF include Short

Finned Pilot whales and Toothed whales, followed by Melon Headed whales. The majority of whales entangled are released alive.

4.5.6.2 Seals

There are nine species of seals found in Australian waters and all of which are protected by the EPBC Act 1999. The Australian fur seal and the New Zealand fur seal are the only species which breed on the Australian mainland and in Tasmanian waters. The ETBF very rarely interacts with seals but such interactions have historically occurred. In the event that a seal is hooked, ETBF fishers should use the dehooker to ensure the safe release of the seal.

4.5.7 Other bycatch

There are a number of other species in the ETBF which are not allowed to be retained due to legislation and/or Offshore Constitutional Settlement (OCS) agreements with States and Territories.

4.5.7.1 Blue and Black Marlin

Since 1998, a legislative ban has been in place prohibiting the commercial take of blue and black marlin (dead or alive), as a recognition of the importance of these species to the Australian game fishing sector. In addition, the Coral Sea Zone closure (Formally Area E, See Appendix A) was introduced to protect spawning grounds of Black Marlin and covers the waters outside the Great Barrier Reef from Cape Greville to the waters off Townsville. Due to the importance of this area to black marlin, operations in the Coral Sea Zone are limited to a small number of permits which are subject to restrictions limiting the amount of hooks which can be set (500 per shot). This is to ensure short hauling times so that any black marlin caught are more likely to be released alive.

4.5.7.2 Species under OCS arrangements

The ETBF operates in the waters adjacent to a number of coastal States in Australia, and overlaps with or is adjacent to a number of other Commonwealth fisheries, thus the potential exists for the ETBF to interact with species managed as part of a separate fishery. As a result of Offshore Constitutional Settlement (OCS) negotiations between the Commonwealth and the States, and agreements between Commonwealth fisheries, a number of species are now “no take” in the ETBF (while others are limited – see Section 3.7 on byproduct) to ensure that species which are managed through other arrangements are not taken in commercial quantities by ETBF operators (Table 14 and Table 15).

While the amount of catch discarded due to the limits imposed by the current OCS and Commonwealth fishery arrangements has not yet been fully quantified in the ETBF, it is believed to be small for most species. With electronic monitoring in place, quantifying these interaction levels should be possible during the period of this Strategy.

Table 14. Species not allowed to be taken in the ETBF (not including protected species under the EPBC Act)

Common Name	Scientific Name
Blue Eye Trevalla	*Hyperoglyphe antarctica* and *Schedophilus labyrinthica*
Blue Grenadier	*Macruronus novaezelandiae*
Black Marlin	*Makaira indica*
Blue Marlin	*Makaira mazara*
Blue Warehou	*Seriolella brama*
Flathead	Platycephalus and Neoplatycephalus sp.
Gemfish	*Rexea solandri*
Jackass Morwong	*Nemadactylus macropterus*
John Dory	*Zeus faber*
Ling	*Genypterus blacodes*
Mirror Dory	*Zenopsis nebulosus*
Ocean Perch	Helicolenus sp.
Orange Roughy	*Hoplostethus atlanticus*
Redfish	*Centroberyx affinis*
Royal Red Prawn	*Haliporoides sibogae*
School Whiting	*Sillago findersi*
Silver Trevally	*Pseudocaranx dentex*
Spotted Warehou	*Seriolella punctata*
Black Cod	*Epinephelus daemelii*
Great White Shark	*Carcharodon carcharias*
Grey Nurse Shark	*Carcharias taurus*
School Shark	*Galeorhinus galeus*
Gummy Shark	*Mustelus antarcticus*
Elephant Fish	Families *Callorhinchidae, Chimaeridae* and *Rhinochimaeridae*
Sawshark	*Pristiophorus cirratus* and *Pristiophorus nudipinnis*
Deepwater Sharks	*Centroscymnus coelolepis* *Centroscymnus crepidater* *Centroscymnus owstoni* *Centroscymnus plunketi* *Centroscyllium kamoharai*

Common Name	Scientific Name
	Dalatias licha *Dalatias calcea* *Dalatias quadrispinosa* *Etmopterus bigelwi* *Etmopterus dianthus* *Etmopterus dislineatus* *Etmopterus evansi* *Etmopterus fusus* *Etmopterus granulosus* *Etmopterus lucifer* *Etmopterus molleri* *Etmopterus pusillus*

Table 15. Species not allowed to be taken off Tasmania

Common Name	Scientific Name
Australian Anchovy	*Engraulis australis*
Australian Salmon/Tommy Ruff	Genus *Arripis*
Banded Morwong	*Cheilodactylus spectabilis*
Black Bream	*Acanthopagrus butcheri*
Blue Sprat	*Spratelloides robustus*
Dusky Morwong	*Dactylophora nigricans*
Garfish	*Hyporhamphus melanochir*
Grassy (rock) Flathead	*Platycephalus laevigatus*
King Gar	*Scomberesox forsteri*
King George Whiting	*Sillaginodes punctata*
Luderick	*Girrella tricuspidata*
Magpie Morwong	*Cheilodactylus nigripes*
Mulloway	*Argyrosomus hololepidotus*
Pilchard	*Sardinops neopilchardus*
Red Mullet	*Upeneichthys vlamingii*
Sea Sweep	*Scorpis aequipinnis*
Snook	*Sphyraena novaehollandiae*
Sprat	*Clupea bassensis*
Wrasse	Family *Labridae*

Common Name	Scientific Name
Yellow Eye Mullet	*Aldrichetta forsteri*
Yellow-finned Whiting	*Sillago schomburgkii*

4.6 ERA monitoring triggers

As part of the ERM process, AFMA has committed to implementing a system of catch and effort triggers which will be used to detect changes in fishery conditions that may result in significant increases or decreases in risk posed by ETBF to species it interacts with. This will enable management responses to potential changes in risks to occur in a timely manner. These triggers will be set up to initiate:

- Firstly, an investigation by AFMA regarding the circumstances that have resulted in the trigger breach. If those circumstance suggest ongoing breaches in future then,
- Secondly, an investigation by TTRAG into the likely change in risk and if necessary (e.g. ecological risk is deemed to be “high”) then,
- Thirdly, consideration of options by AFMA and TTMAC of management measures to reduce that risk, leading to implementation of management arrangements that achieve that.

As an action under the Bycatch Strategy (Table 16), ERA triggers for the ETBF, and associated automated monitoring processes, are to be developed by AFMA in consultation with TTRAG and TTMAC and using advice from the ERM Working Group, within 12 months of the implementation of this FMS.

4.7 Compliance

With the implementation of electronic monitoring in the ETBF, AFMA now has a very strong capacity to ensure the accurate reporting and appropriate treatment of bycatch species in the ETBF. The development of an industry association (Tuna Australia) in 2016 has also allowed for industry to take a much more coordinated approach to working with AFMA on bycatch issues and to educate its members so improve compliance with this strategy and with fishing permit conditions. ETBF bycatch management arrangements are designed to be consistent with the overarching AFMA Bycatch Strategy 2017-2022 core principles Section 4.1.

4.8 Actions

This Strategy includes actions to be taken under during the period of this FMS (2017-2022). These actions replace those that would have been previously specified as part of the former ETBF Bycatch and Discard Work Plans. These actions must at a minimum be revised and updated as part of the 5 year review of the FMS, but may be amended and updated sooner as required. Table 16 below summarises a suite of actions identified to contribute towards future bycatch mitigation and management arrangements to achieve the objectives of this Strategy.

Table 16. Actions to support and improve bycatch management

Species group	#	Future Actions
All bycatch	1	Continue to identify and work with vessels with unacceptably high interactions with EPBC Listed species to improve mitigation, handling and find solutions to reducing interactions. Explore incentives based and individual accountability based management options.
	2	Within 12 months of adoption of this FMS, develop ERA triggers (for fishery effort, species interactions and gear changes) and associated automated monitoring processes in consultation with TTRAG and TTMAC. This is to ensure changes in ETBF conditions that change risks to species are monitored and investigated.
	3	Maintain supply of line cutters and dehookers to ETBF vessels and maintain ongoing education in the use of these tools to minimise harm and ensure healthy release of marine animals.
	4	Review camera angles on vessels and requirements around bringing bycatch into view
	5	Implement automated notifications for bycatch and byproduct species for when OCS season limits are approached or exceeded, or trip limits are exceeded.
	6	Develop performance criteria (indicators, reference point and performance measure) for the optimal utilisation and cost efficiency objectives.
Sharks	7	Include information on shark identification and handling practices in bycatch education activities to be conducted with industry.
Seabirds	8	Monitor seabird interaction levels against TAP triggers in-season
	9	Ensure consistency with the ‘National recovery plan for threatened albatrosses and giant petrels 2011-2016’ and DoAWE “National Plan of Action for the incidental catch of seabirds in Australian fisheries” (NPOA – Seabirds).
	10	Implement any new or revised requirements from the revised Seabird TAP once this is in force.
	11	Support and encourage further research into seabird mitigation
	12	Undertake seabird bycatch education activities (including species identification, mitigation and handling) and workshops with ETBF industry.

Species group	#	Future Actions
	13	Explore the development of predetermined management responses and individual vessel level accountability based triggers and rules.
Turtles	14	Review interaction rates, life status and total mortalities, spatial and temporal trends in turtle interactions. Explore further management options and collaborative industry approaches for reducing sea turtle interactions.
	15	Ensure consistency of Bycatch Strategy in line with the DoAWE finalised Marine Turtle Recovery Plan.

5 Habitats and Communities

5.1 Introduction

This section outlines the key management arrangements that AFMA implements to pursue legislative and policy based objectives relevant to the management of ETBF impacts upon ecological habitats and communities.

5.2 Policy background and objectives

Unlike for bycatch and commercial species, there is no specific Commonwealth Policy yet that provides requirements and guidance relating to the interaction of Commonwealth fisheries with marine habitats and ecological communities.

However, the FMA 1991 has relevant legislative objectives being:

- Ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ESD in particular the need to have regard to the impact of fishing activities on non‑target species and the long term sustainability of the marine environment.
- Ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation.

In addition, the CPFB 2018 primary objective makes a clear connection between bycatch species sustainability and ecosystem function (which would encompass communities), with that objective being:

- to minimise fishing-related impacts on ***general*** (not EPBC listed) bycatch species in a manner consistent with the principles ESD and with regard to the structure, productivity, function and biological diversity of the ecosystem.

5.3 Assessments

The ETBF Ecological Risk Assessment 2019 is the most recent assessment of the potential impact of the ETBF upon marine habitats and ecological communities. The assessment was carried out under Level 1 of the ERAEF framework which applies a Scale-Intensity-Consequence Analysis (SICA) in relation to Habitats and Communities. That assessment determined that:

- Habitats results – The ETBF poses a low risk to marine habitats. This is due to the pelagic nature of the fishery whose gear does not interact with demersal substrate/habitats.
- Ecological Communities results – The ERA qualitative SICA scored the fishery capture hazard as having a consequence score of 3 and the translocation of species hazard as having a consequence score of 4.

5.4 Management arrangements

Because of the low risk of the ETBF to habitats, there are no management arrangements in place to manage the interaction of the fishery with habitats.

There are currently no specific arrangements to manage the interaction between the ETBF and ecological communities. However, the large suite of management arrangements designed to monitor, assess and manage impacts on commercial and bycatch species should also contribute to reducing fishery impacts upon ecological communities as a whole.

5.5 Actions

To date, resources for quantitative assessments of fishery impacts have tended to have a species based focus, but moving forward AFMA will be looking to further explore how to more quantitatively assess the ecological community based risks posed by fishing (at a level higher than ERA SICA), including in the ETBF. Ecosystem model based risk assessment methods are being developed by researchers and may assist in understanding this issue in future.

6 Data and Monitoring

6.1 Introduction

The purpose of this section is to provide a review and plan for ongoing data collection needed to support evidence based fishery management decisions in the Eastern Tuna and Billfish Fishery (ETBF), in particular as relates to the management of commercial species (Section 3) and bycatch species (Section 4) and the pursuit of related and broader management objectives (Section 2.2). The Strategy was developed following a review of current data collection processes against data needs (including consultation with industry, TTRAG and TTMAC), with a focus on addressing data gaps and assumptions that might pose a risk to achievement of management objectives.

This data strategy complements (and supports) other information sources that are also used by AFMA in decision making processes including:

- Fishery dependent or independent research.
- Expert opinion (including advisory committees).
- Other published information/research.

The data strategy is also designed to comply with the data related requirements of:

- The ***CHSP 2018 and Guidelines***
- The ***CPFB 2018 and Guidelines*** which requires general bycatch are identified, quantified and verified with data collection to support appropriate risk assessments (of fishery impacts), inform effective management options, monitor bycatch interactions and industry compliance, enable assessment of the efficacy (performance) of any management measures against objectives and be aligned with risk-cost-catch principles. It also states independent verification of fishing activity supports an effective reporting and monitoring framework and data collection, reporting and monitoring should meet EPBC Act requirements.
- The ***GESMF 2007***
- The ***AFMA Science Quality Assurance Policy*** and
- The ***AFMA Data and Information Dissemination Policy***.

6.2 Purpose of data collection

The data collected through AFMA fishery data collection programs is used to:

1. **Inform management decisions that ensure** appropriate and cost efficient management systems and arrangements that best pursue/achieve AFMAs legislative and policy objectives (either indirectly by supporting/underpinning research that provides management advice or directly by providing data for indicators of key processes).

2. **Monitor compliance with management decisions** by the fishery (e.g. TAC limits; mitigation use etc.) and ultimately achieve the fishery's operational objectives.
3. **Measure and report** on AFMAs progress/performance against those objectives.

Both the commercial species section and bycatch species section outline a broad suite of ETBF assessment and management approaches (e.g. ERA, stock assessments, harvest strategies, mitigation strategies etc.) that AFMA utilises in its pursuit of its legislative objectives. These assessment and management approach and associated monitoring and reporting requirements effectively define the data needs of the ETBF.

6.3 Objectives

The overarching objective of this ETBF Data Strategy is to ensure the collection of data from the ETBF (and other sources as appropriate) that will support AFMAs pursuit of its legislative objectives in the fishery. More specifically, the ETBF Data Strategy objectives are to:

- For the management of key commercial species, define the data/information needed to support the harvest strategy applied to Striped Marlin and Swordfish, and provide local stock indicators for Tropical Tuna species (Albacore Tuna, Bigeye Tuna and Yellowfin Tuna).
- For bycatch and byproduct species management, define data needs and data collection methods to support the ecological risk assessment and management responses.
- Define the data needed to monitor compliance by the fishing industry with management arrangements for commercial and bycatch species.
- Ensure the collection of any additional data required to meet AFMAs data provision and reporting obligations under fishery policies and guidelines, international agreements and obligations.
- Ensure that data collection processes are cost effective and efficient.
- Ensure the data collected supports the research needs of the fishery.
- Ensure data processes (collection, storage, dissemination, use) are consistent with the data related requirements of AFMAs Science Quality Assurance Policy and AFMAs Data and Information Dissemination Policy

For each (relevant) objective above the strategy will:

- Describe how the data is to be collected and managed, considering frequency, quantity, representativeness, reliability, auditing, risk, and cost efficiency.
- Identify gaps in current data processes and actions to rectify those gaps over the period of this FMS.

6.4 Drivers of data needs

In pursuing legislative objectives, AFMA develops management approaches and associated monitoring and reporting requirements that require a wide range of data and information to be collected in the ETBF.

Table 17 summarises the relationship between:

- ETBF **legislative/operational objectives** (e.g. Economic returns),
- the **management approach**(es) used to pursue each objective (e.g. harvest strategies for key commercial species), and
- the multiple **data/information sources** used to support and inform each of these management approaches (e.g. logbook and size data, CDR data, EM data etc).

Section 6.4 (and Table 18) then provides a general overview of each of the data/information sources described in Table 17, including the method of data collection, verification and storage.

Section 6.5 then provides for **each** specific objective linked management approach (in Table 17) a detailed breakdown of the essential data variables required to support that management approach (and achievement of the linked objective(s)). For each data variable, a description of current collection/availability status and assumptions associated with use of the data is provided. The latter fields help to identify any further actions to improve data collection to support the ETBF FMS objectives, with Table 19 summarising those actions and timeframes to achieve the actions within the 5-year cycle of this FMS.

Table 17. Relationship between AFMA's overarching legislative objectives, management approach the data and information sources that are utilised to support ETBF specific strategies.

Legislative Objective	Strategy	Management approach	Data/ Information Sources (see Table 18 for description)
Maximise Economic returns	Commercial Species (Key Commercial)	Harvest Strategy (including stock assessment, indicators, performance measures and decision rule)	1, 2, 4, 6, 9
		TACC Implementation	1, 2, 4, 6, 8, 9
Ecological sustainable development	Commercial Species (Key Commercial)	Harvest Strategy (included assessment, indicators, performance measures and decision rule)	1, 2, 4, 6, 9
		TACC Implementation	1, 2, 4, 6, 8, 9

Legislative Objective	Strategy	Management approach	Data/ Information Sources (see Table 18 for description)
	Commercial Species (Byproduct) and Bycatch Species (All)	ERA and ERM Framework	1, 2, 3, 4, 6, 8, 9, 10, 12, 13
Efficient and cost effective management	Commercial Species (Key Commercial)	Harvest Strategy	1, 2, 4, 6, 9
		Indicators	
		Monitoring triggers	1, 2, 3, 4, 6, 8, 9, 10, 12, 13
	Byproduct and bycatch Species	ERA and ERM Framework	1, 2, 3, 4, 6, 8, 9, 10, 12, 13
Minimise interactions avoid harm injury death etc	Bycatch Species (Protected species)	Mitigation	3, 6, 8, 9, 11, 12, 13
		Education (e.g. Bycatch handling guides)	3, 6, 8, 9, 11, 12, 13
Accountability	All strategies	Performance reporting (e.g. WTO reports, RFMO reporting)	All sources

6.5 ETBF data and information source

6.5.1 Introduction

Table 18 (below) describes each of the key data/information sources used to support the assessment and management tools used in the ETBF to pursue the fishery objectives.

The core data collected includes a measure of what is caught (catch) and how it has been caught (effort). This data is primarily collected and reported by fishers directly through daily fishing logbooks and catch disposal records (CDRs). Following the primary data collection, independent verification of catch reports is extremely important to ensure data is accurate. This includes the use of vessel monitoring systems (VMS) that verify boat location as well as electronic monitoring (e-monitoring) systems that include cameras and sensors to enable independent verification of catch and effort. AFMA is increasingly investing in cost effective data verifications tools.

Table 18. Summary of data and information sources in the ETBF

Source ID	Data/ Information Source	Type of data collected	Collection method / Verification (if any)	Storage and publication
1	Logbook	Catch, effort and fishing operational data recorded by fishers at sea via paper logbook or electronic logbook	Fishery dependent data (self-reported) Verification: EM and cross-checking with CDR reports	AFMA database Data.gov.au[20] AFMA website (catch and effort)
2	Catch Disposal Record (CDR)	All fish landed at port for quota species Aggregate fish weights recorded by species	Fishery dependent data (self-reported) Verification: Compliance port inspections	AFMA database Data.gov.au AFMA website (catch)
3	Electronic Monitoring (EM)	Catch, effort and fishing operational data recorded by cameras and reviewed by third party	Fishery independent data Verification: 2nd reviewer audits	AFMA/AAP database
4	Size Monitoring Program	Processor, area, date, species, weight, processor, export, and process code	Processor and fish market dependent data Verification: CDR	Project PI and CSIRO
5	Vessel Monitoring System (VMS)	Position and date	Fishery dependent data Verification: independent	AFMA database
6	Observers	Catch, effort and fishing operations	Fishery dependent data	AFMA database
7	Licensing & Quota Management	Client/operator information, quota transactions, vessel nominations	Fishery independent data	AFMA licensing database
8	TTMAC	Expert advice on operating environment, economics and management of fishery	Fishery independent data	AFMA website (meeting minutes)

[20] Published in aggregated form

9	TTRAG	Expert advice on stock status, science and research in fishery	Fishery independent data	AFMA website (meeting minutes)
10	ABARES status report	Biological and economic status of fish stocks	Fishery independent data	ABARES website (published annually)
11	Vessel and processor inspections	Logbook/CDR verification, records of vessel/processor compliance	Fishery dependent data	AFMA compliance database
12	Research	Existing and potential Additional data required for scientific or management purposes. e.g. life-history parameters, tagging data and hook-depth monitoring	Research project outcomes and literature searches	Various
13	Related Fisheries	Catch, effort and size data from other fisheries in the WCPO (including recreational data in the ETBF)	Fishery dependent data	Project PI and CSIRO
14	Environmental and oceanographic data	e.g. Sea-surface temperature, current strength, moon-phase	In-situ, remotely sensed and modelled data	Project PI and CSIRO
15	Other	Data/information/ research available to fishery	Fishery independent data	Various

6.5.2 Logbooks and CDRs

AFMA requires ETBF fishers to record catch, fishing effort and fishing method information in paper or electronic logbooks (e-logs) at sea, and in CDRs which record the landed catch at port. AFMA is requiring ETBF operators to move to full e-log implementation in 2019. CDRs are more accurate than logbook records as fish are weighed in port whereas logbook weights are often estimates.

The following data is recorded for each fishing operation: the port and date of departure and return; date and fishing location; gear type and fishing method; number and total processed weight of fish retained (by species) and number of fish

discarded (by species); and processed form of retained fish (e.g. trunked, gutted, filleted, whole).

Catch and effort data from commercial logbooks is the main data source used for an index of abundance in stock assessments for most ETBF commercial species. Logbook data is also used to monitor catch and effort trends, to standardise effort for CPUE analyses, for quota management, reference points for bycatch and by-product species, input into gross value of production estimates, and monitoring and reporting of EPBC listed species interactions to the Department of Agriculture, Water and the Environment.

CDR data is used to monitor quota species, verify logbook weight data for stock assessments, verify logbook recorded catch and input into gross value of production.

6.5.3 E-monitoring

E-monitoring was implemented in the ETBF in 2015 to validate logbook catch and effort data, verify catch composition, mitigation methods and reporting of EPBC listed species interactions. A typical e-monitoring system uses video cameras and sensors to detect and record fishing activity. The AFMA website contains more detailed information regarding E-monitoring at: https://www.afma.gov.au/monitoring-enforcement/electronic-monitoring-program

6.5.4 Size monitoring program

The ETBF Size Monitoring Program was developed to collect individual fish size dta from all fish receivers in the fishery. This data provides essential inputs into both domestic fishery standardised CPUE analyses and the domestic harvest strategy and local fishery indicators, all of which ultimately contribute to advice to the AFMA Commission in relation to setting key commercial species TACCs. Size data is also provided to the WCPFC to support regional stock assessments for these species, noting that those stock assessment models are size-structured models. This information is also used in conjunction with logbook information to estimate commercial landings for the fishery.

In the past, the size database has been represented as much as 80-90% of the total landed catch. This program has been running since the 1997-98 fishing season.

6.5.5 Vessel Monitoring Systems (VMS)

Vessel Monitoring Systems are mandatory for all Commonwealth Fishing vessels are employed by AFMA for the delivery of near real time vessel information in order to effectively monitor the movements of all Commonwealth endorsed fishing vessels. VMS enables cost effective monitoring of vessels operating in all areas of the fishery including those under specific management arrangements. In addition, where an at-sea or aerial patrol is required, reporting from VMS allows a patrol vessel or plane to be directed to the exact location of the vessel, resulting in substantial savings in search time. More information regarding the use of VMS in Commonwealth

Fisheries can be found at https://www.afma.gov.au/monitoring-enforcement/satellite-monitoring-fishing-boats.

6.5.6 Observer program and port sampling

The AFMA Observer program is able to collect data through on-board observers and port sampling to provide fisheries managers, research organisations, environmental agencies, the fishing industry and the wider community with independent, reliable, verified and accurate information on the fishing catch, effort and practice of Commonwealth vessels. The data contribute to biological and fishery operation data to key scientific assessments and assist monitoring of protected species interactions, amongst other uses. The requirement to carry an observer in the ETBF if requested by AFMA is still contained in permit conditions however the e-monitoring program has largely replaced the AFMA Observer Program. Further information about the AFMA Observer Program can be found here.

6.5.7 Licensing and quota management

Licensing and quota management is facilitated through GoFish - an online service that collects and stores information for AFMA's clients. The information held in Gofish includes records of fishing concessions, permit information, Statutory Fishing Rights (SFRs) leasing and holdings, and quota balances. The AFMA Website contains extensive information to assist fishers this service at https://www.afma.gov.au/services-for-fishers.

6.5.8 TTMAC

The Tropical Tuna Management Advisory Committee (TTMAC) provides advice to AFMA on the scientific and economic status of fish stocks, sub stocks, species (target and non-target species) and on the impacts of fishing on the marine environment, as well as advice on other matters related to the performance and management of the fishery.

Members are from industry, conservation, state and territory governments, recreational and research fields. Following a public expression of interest process, members are selected and recommended by an assessment panel to the AFMA Commission for formal appointment. Appointments are expertise based and are for up to a maximum of three years.

Advice provided by the TTMAC must be evidence based and address biological, economic and wider ecological factors affecting the performance of the fishery. Advice and re

6.5.9 TTRAG

The Tropical Tuna Resource Assessment Group (TTRAG) provides advice and recommendations to management advisory committees, AFMA management, the AFMA Commission and the AFMA Research Committee on the status of fish stocks,

sub-stocks, species (target and non-target), fishery economics and on the impact of fishing on the marine environment. TTRAG also gives advice on the type of information required for specific stock assessments.

Members of the TTRAG include fishery scientists, industry members, fishery economists and AFMA management. Having this variety of membership ensures that industry knowledge and developments in management strategies, market prices and the costs of harvesting as well as scientific information are taken into account when making recommendations.

Fisheries Administration Paper 12 – Resources Assessment Groups provides operational and functional guidelines for resource assessment groups and gives detailed advice on membership, roles and responsibilities.

6.5.10 ABARES status reports

The ABARES Fishery status report is published annually and provides an independent evaluation of the biological and economic status of fish stocks managed solely or jointly by the Australian Government.

The report covers the biological status of key commercial fish stocks and summarises the performance of the ETBF against the requirements of fisheries legislation and policy.

6.5.11 Vessel Inspections

AFMA fisheries officers regularly inspect fishing boats and fish receivers. They often visit fishing ports and board boats at sea to try to ensure the rules of fishing are being followed. The targeted risk program for 2017–18 will focus on the risks of quota evasion, failure to report interaction/retention of protected or prohibited species and bycatch mishandling.

6.5.12 Research

Research projects are used to collect and assess additional data required for scientific or management purposes where significant data gaps are identified. In the past this has included the following.

- Determination of life-history parameters (e.g. age-at-length, age-at-maturity) for the target species
- Determination of processing conversion factors
- Tagging programs for migration and stock structure studies
- Oceanographic data in the study of environmental determinants of fishery performance
- Genetic data for studies of stock structure
- Survivorship of discard species

6.5.13 Other available data/information and research

Other information includes Fishery independent surveys and Recreational fishing and other jurisdictions.

6.6 Data types and associated gaps and actions

The management approaches used to pursue ETBF FMS objectives define the data that is required to be collected. Tables 26 – 30 below identify the specific data required to support each of the management approaches and linked objective, as originally listed in Table 17. For harvest strategy, commercial indicators, and ERA processes, the tables include outcomes of a TTRAG review of data coverage, gaps and future data improvement actions.

Table 19. Data types and associated data gaps and actions for the Harvest Strategy for Swordfish and Striped Marlin, and stock indicators for Tropical Tuna species in the ETBF.

Harvest Strategy and stock indicators			Data review					
			Coverage	Purpose and need	Accuracy of data	Data gap	Action	TTRAG comment
Data type (and source)		Variables						
CPUE standardisations	Spatio-temporal (1,6)	Start and End Latitude and longitude of fishing operation	~100%	The CPUE standardisation is spatially structured and contains variables "Area" and Vessel (1x1 degree) derived from latitude and longitude data	Location of fishing can be verified via EM or VMS	No data gap but verification requires checking	Check if AAP audit logbook fishing locations against EM – do they notify AFMA if discrepancy?	None
		Date and time of start and end of fishing operation	~100%	Catch rates can vary depending on time of year and time of day (due to seasonal, diel patterns in species behaviour). The CPUE standardisation include variables "Year" and "Quarter" and "Start set time"	Location of fishing can be verified via EM or VMS	As above	As above	None
	Environmental	SST	~100% (TBD)	Species availability and encounterability impacted by environmental conditions	Modelled data conditioned on real observations	TBD-pending completion of Oceanography	None	None
		SOI	100%	Proxy for the combined effects of climate driven oceanographic conditions on species availability and distributions etc	Accurate	None	None	None

		Moon phase	100%	Some species behaviour and availability to gear varies with moon phase	Accurate	None	None	
		Mixed layer depth	~100% (TBD)	Some species prefer warmer shallower or cooler deeper water	Modelled data	None identified	None	The modelled environmental data is the best estimate of these environmental conditions available for CPUE analyses. Different variables have different update periods. Need to determine what core fields are essential
		Frontal density index	~100% (TBD)	Availability will be higher for some species near ocean current fronts	Modelled data	None identified	None	
		Wind speed	~100% (TBD)	May impact on fishing conditions and gear efficiency etc	Modelled data	None identified	None	
	Future Environmental variables	Kinetic energy, magnetic anomaly, Chlorophyll a	n.a.	May be relevant to CPUE standardisation or helping identify areas of fish aggregation	Modelled and observed data	Uncertain	TTRAG to determine data sources and explore applicability in CPUE analyses	N.a.
	Vessel and Gear (1,2,8,9)	Vessel Name	~100%	Vessel can be included in CPUE analyses as a proxy for skipper, crew and gear/method effects that are not picked up by specific gear/method factors	Accurate (Verification = port inspection)	None identified	NFA	Vessel effect demonstrated for Swordfish but not for other species. To be explored further at a later date.
		Skipper	~100%	Skipper can be included in CPUE analyses as a proxy for fishing method effects that are not picked up by specific gear/method factors	Accurate (Verification TBD)	None identified	For exploration in future CPUE analyses.	For exploration in future CPUE analyses.

		Skipper Experience	~100%	Skipper experience can be included in CPUE analyses as a proxy for fishing efficiency that is not picked up by specific gear/method factors	Data not gathered yet	Yes	For exploration in future CPUE analyses.	It may be sufficient just to look at years of experience in the ETBF but prior experience in other fisheries may be relevant
		Hooks (per fishing operation)	TBD (high)	Fishing effort is one part of CPUE	Unknown	None	Check coverage. Explore use of EM to audit/verify reported operational effort and gear data	EM checks could be random audit. Likely need to use EM on the haul phase not the setting phase (cameras not in right positions on the set)
		Hooks per float	TBD (high)	HPF determines the depth of fishing which impacts CPUE depending on whether species habitat is shallow or deep	Unknown	None		
		Number of light sticks	TBD (high)	Some species are more attracted to bait where light-sticks are used. Used to estimate % hooks with light sticks	Unknown	None		
		Bait type	TBD (high)	Some species are more attracted to different types of bait	Unknown	None		
		Hook type	Low	Hook type impacts on species ability to get hooked and stay hooked	Unknown	Uncertain if data gap - check	AFMA to explore potential for EM to collect hook type size info (e.g. using grid board on vessels etc)	
		Hook size	Low	Hook size can impact on species ability to get hooked and stay hooked	Unknown	Very little data to date.		
		Float line length	TBD	Effects depth of fishing and availability of gear to target species	Unknown	Unknown	Explore potential for EM use. Check coverage	

		Mainline length	Uncertain	Interacts with number of hooks to determine hooks per kilometre which can impact SWO CPUE	Unknown	None identified	Explore potential for EM or VMS to validate. Direct or proxy method (dist between hooks x No. hooks).	
Size monitoring program (4)		Vessel Name	Poor	Allows connection of CPUE with size data	-	Yes – some processors not providing vessel names with size data	AFMA to work with Tuna Australia and processors to address data gap	NA
		Processor name	~100%	Origin of data	Accurate	None	Explore options for future electronic collection and provision of size data via CDRs or other options	NA
		Area (Port)	~100%		Accurate	None		
		Date	~100%	Date of fishing required to understand temporal trends/effects in size data	Unknown	TBD		
		Weights	Generally > 80% by species (YFT, BET, SWO, ALB, STM)	Allows for division of catch data by size class allowing development of size based CPUE indices	Accurate	Some size data not collected (various reasons) but coverage sufficient for purpose		
		Species	~100%	To ensure attribution to correct species CPUE	Accurate	None		
		Process code	~100%	To allow standardisation of sizes across fish	Accurate	None		
		Export	TBD	Potential use in economic analyses (future)	TBD	None		

Regional Stock Assessments	Stock status, fishing mortality, depletion levels	~100% for key commercial species	Important information and context for Commission TACC decisions	Model based information	NA	NFA	NA
Region 5 catch and CPUE	CPUE	~100%	Important information and context for Commission TACC decisions	Reasonable	Not all fleets	NFA	International fleet CPUEs are difficult to verify – no EM, low observer coverage
	Catch proportion in Region 5 and WCPO	~100%	Important information and context for Commission TACC decisions	Uncertain, assumed accurate	Uncertain	NFA	International fleet catches are difficult to verify – no EM, low observer coverage
Estimated catch/mortality from recreational sector		Low. A better measure of recreational catch and mortality is required	Has potential to feed into stock assessments and provide additional indices of local abundance/availability	Uncertain / Low	Yes	May be addressed under Recreational fishing research project	Currently TTRAG is using expert opinion to estimate recreational catches
WCPFC SC management advice		na	Informs TTRAG and AFMA Commission consideration of	✓	NO	NFA	✓

Table 20 Data gaps and actions for data utilised in the Ecological Risk Assessment in the ETBF. Data sources are 1,2,3,4,5,6,13. Note that under the precautionary nature of the ERA methodology, where data gaps for key parameters exist, the PSA assessments assume the highest risk value. TBD = To Be Determined.

Ecological Risk Assessment Data Review							
Attribute	**Attribute name**	**Variables**	**Coverage**	**Purpose and need**	**Accuracy of data**	**Data gap**	**Action**
Scoping	Species	Species ID (for species list)	In the current ERA, generic reported species were expanded	A defined species list in initial scoping is needed to avoid over-expanding the species list past what occurs in the fishery and including species with missing attributes	Will improve with better bycatch and byproduct reporting through EM and through E-reporting program	**N/A**	No Further Action (**NFA**)
dLevel 1	Habitats	Seabed imagery or potential habitat type	Not relevant to ETBF	N/A	N/A	**N/A**	**NFA**
		Area of fishery	High	Defines the area of assessment	N/A	**N/A**	**NFA**
		Spatial habitat boundary	Yes	As above	N/A	**N/A**	**NFA**
		Gear interaction	Currently, gear interaction coverage is interaction with pelagic habitat only	Need to determine the extent of gear interaction with all habitats	There is confidence the pelagic habitat interaction is accounted for	**Yes** Consider the footprint of lost gear and frequency of accidental bottom hook-ups	**NFA** RAG identified it is a rare occurrence, (due to lack of reports of sighted lost gear)
	Community (Unit of Analysis is foodweb)	Foodweb	TBD	Need is to understand trophic interactions	Studies that create foodweb maps are dated (e.g. diet data) and species resolution is poor	**Yes** There are no recent studies currently available	**On hold** Wait for current projects exploring techniques to advance diet (e.g. DNA barcoding), e.g. SESSF shy albatross project

Ecological Risk Assessment Data Review							
					for some groups (e.g. squid not broken down to species)		
		Spatial overlap with fishery	Yes	TBD	TBD	TBD	**NFA**
		Community type	Yes	N/A	N/A	**N/A**	**NFA**
	Species	Catch (CPUE)	High for target spp and improving for some others since EM	TBD	TBD	TBD	**NFA**
		Effort	High	TBD	TBD	TBD	**NFA**
		Species fate (e.g. retained, discarded)	High				
		Life status (e.g. Alive, Dead)	Historic observer data only	Need life status for byproduct and bycatch	Transitioning from Observers to EM may change the confidence in life status	Potential for data gap under EM (which collects life status but uncertain reliability)	**Action** Suggest that the e-reporting bycatch program include life status Ultimate info would be post release survival
P1 P2 P3 P4 P5 P6 P7 (Sources = 4,13)	Average age at maturity Average max age Fecundity Average max size Average size at maturity Reproductive strategy Trophic level	Otoliths biological samples: e.g. swordfish spines length-frequency tagging: capture/recapture Sex-ratio Research projects	P1 missing attributes for 35/267 species (from initial species scoping list) P2= missing attributes for 42/267 P3= missing attributes for 48/267 P4= missing attributes for 18/267 P5= missing attributes for 5/267 P6= missing attributes for 46/267	In applying the residual risk to high risk species, information may be available for some species. For example, For P3 & P6, An expert could provide advice for most species P4 & P5 would require further data collection to determine	Varies between species	Species with missing attributes are considered through the ERA process	**NFA** As per the ERA Residual Risk guidelines, residual risk is only applied to high species

Ecological Risk Assessment Data Review							
			P7= missing attributes for 49/267				
S1=0	Availability (1,6,..oth)	Spatial distribution (overlap with fishery)	Yes	TBD	TBD	TBD	**NFA**
		Effort	Yes	TBD	TBD	TBD	**NFA**
		Species distribution (e.g. depth range)	Yes	TBD	TBD	TBD	**NFA**
		Tagging data	Yes	TBD	TBD	TBD	**NFA**
S2=16	Encounterability (habitat and bathymetry)	Seabed imagery or potential habitat type (water column position, adult habitat)	N/A	TBD	TBD	TBD	**NFA**
		Depth range of gear	Yes	TBD	TBD	TBD	**NFA**
		Depth range of species	Attribute missing for some species	Species range is required to determine overlap with fishing gear	Varies by species	Species specific habitat data missing for some	**NFA** For some species, the required information is unavailable. Information may become available in future.
S3=18	Selectivity (size based)	Species size/weight (at maturity)	Attribute missing for some species	Attribute is required to determine selectivity with fishing gear	Varies by species	Species specific maturity data missing for some	**NFA** For some species, the required information is unavailable. Information may become available in future.
		Length- frequency	Attribute missing for some species	Attribute is required to determine selectivity with fishing gear	Varies by species	Species specific length-frequency data missing for some	**NFA** For some species, the required information is unavailable. Information may become available in future.

Ecological Risk Assessment Data Review							
		Gear attributes (e.g. hook type)	Yes	TBD	TBD	TBD	**NFA**
S4=0	Post-capture mortality (role in fishery based, protected species based)	Catch composition	Yes	TBD	TBD	TBD	**NFA**
		Fate (e.g. retained, discarded)	Yes	TBD	TBD	TBD	**NFA**
		Life status (Alive, dead)	Yes	TBD	TBD	TBD	**NFA**
SAFE P1 & P2	Average age at maturity Average max age	TBD	P1 missing attributes for 35/267 species (from initial species scoping list) P2= missing attributes for 42/267	TBD	Varies by species	**N/A**	**NFA**
	Natural Increase	TBD	Missing attributes for 94 /267 species	TBD	Varies by species	**N/A**	**NFA**
	Natural mortality	TBD	Missing attributes for 49 /267 species	TBD	Varies by species	**N/A**	**NFA**
	L infinity	TBD	Missing attributes for 25 /267 species	TBD	Varies by species	**N/A**	**NFA** Would need a desktop study to fill in
	Growth co-efficient	TBD	Missing attributes for 27 /267 species	TBD	Varies by species	**N/A**	**NFA**

Table 21 Data/information utilised to implement Total Allowable Commercial Catches (TACCs) in the ETBF

TACC Implementation		
Data/information type		**Data/Information source**
RBCC		TTRAG advice
Stock indicators		TTRAG advice
Management recommendation		TTMAC advice
TACC decision		Commission recommendation

Table 22 Data utilised mitigation and monitoring triggers in the ETBF

Mitigation and monitoring triggers		
Data type	**Variables**	**Data/Information source**
Spatio-temporal	Area	
	TAP season	
	Time	
	Date	
Effort	# vessels	
	# shots	
	# hooks	
Catch	Animal type	
	Interaction type	
	# animals	
Gear	Tori line specifications	
	Hook type	
	Hook size	
	HPB	
	Mainline length	

6.7 Data management

6.7.1 Data Provision

Data is provided on request to organisations or individuals requiring the data for research when confidentiality agreements are required.

6.7.2 Data storage

Logbook, CDR, VMS and observer program data is currently stored on the AFMA database for internal use, and is also provided to research organisations for data analysis services.

E-monitoring footage is analysed by an AFMA contractor and annotated catch data is stored in AFMA databases. Annotated e-monitoring data is compared to logbook data for the same shots and comparison reports are sent to fishers and stored by AFMA.

Table 23. Summary of databases held by AFMA

Database at AFMA	Logbook versions
Tunalog	AL02, AL03, OT01, OT02, SF04, SF05, TL01, TL02, TL04, TP03, TP05 and TP06
Tunallog	AL04
Genlog	AL06, AL05, OTO3, PS01, TPB02 and TPB03

6.7.3 Data security

AFMA's Information Security Policy describes AFMA's approach to information security. It has been developed with reference to the Commonwealth Protective Security Manual and Australian Standard AS/NZS 4444.1:1999.

6.8 Assessment and review

TTRAG will annually review the Data Strategy and identify and prioritise data needs and gaps for each of the key management processes (e.g. harvest strategies, ERA, trigger monitoring etc).

Following TTRAG's review, TTMAC and fishery managers should then consider the balance between the risk of accepting the current state of data collection against cost of further investment required to improve data and fill the data gaps in the fishery (if needed).

Annual reviews should assess whether data is collected and managed to acceptable quality standards throughout the full data lifecycle. This may include consideration of data collection and recording, data submissions, data entry, data storage, data access, data analysis, reporting, review and planning.

6.9 Actions summary

Table 24 - Actions to support required data collection

Data source	#	Future Actions
Logbooks	1	AFMA to notify operators of the intent and requirement in I) specifying mainline length on logbooks (set length, not length on drum) and ii) use of zeros or blanks in catch fields
	2	AFMA to consider inclusion of the following fields in e-logs: float line (dropper) length, vessel log speed, line setting speed, branchline length, hook type, hook size (mm min width), line configuration (straight, curved etc). These fields will improve analyses of fishing depth for commercial species CPUE analyses and understanding gear interactions with protected species.
CDRs	3	AFMA to explore options for collection of size monitoring data via future development of e-CDRs
Electronic Monitoring	4	AFMA to review i) vessel camera angles and ii) conditions that improve identification of species cut off in the water; - to assist continued improvement in EM based species identification and logbook verification
	5	AFMA to explore potential to use EM for independent verification (audit) of logbook gear, date, time and location data (see Table 26) similar to its use in verifying logbook catch data.
	6	AFMA to explore options (including EM) for collecting data on; i) hook type and size information – e.g. using a grid board and ii) information relating to fishing depth (e.g. float line length etc)

Data source	#	Future Actions
		and iii) information on bait and target/byproduct catch depredation (i.e. “clean hooks” and head counts see earlier discussion).
	7	AFMA to explore options for improving ongoing collection of data on life status, via EM or other means, important to future ERA and EPBC requirements.
	8	AFMA to request (and assist) DoAWE to push for rapid implementation of EM in longline fisheries throughout the WCPFC, to improve estimates of regional catch and fishing mortality.
	9	AFMA and AAP to review and ensure consistency in species codes between logbook and EM databases
Economic Data	10	AFMA to explore sourcing and acquiring regular data pertaining to key industry costs and returns, including bait prices, fuel prices, fish market prices (dometic, international), and other key data relevant to fishery economic conditions
	11	AFMA and TTRAG to explore development of in-season indicators of fishery economic conditions
	12	Tuna Australia to identify areas it can assist with in the provision of data to assist with economic indicators
Size data	13	AFMA to consider alternate models for size data collection including utilising in-house data expertise or an industry co-management approach.
	14	AFMA and industry to explore options for onboard electronic collection of fish size data to replace port based methods.
	15	AFMA and industry to work with processor to reduce gaps in key size data fields, e.g. vessel name.
	16	AFMA and TTRAG to review and update (if required) target species processing conversion factors.
Other data	16	AFMA and TTRAG to explore the collection of fishing depth data across vessels and fishing strategies using TDRs to assist in the standardisation of key commercial species catch rate indices.
	17	AFMA to encourage State fisheries agencies and gamefishing associations to improve data on effort, catch and mortality of recreationally caught gamefish species (especially marlin, tuna and shark species).
	18	AFMA to encourage and support where feasible university or other agency research that increases understanding of the biology (e.g. growth, reproduction, age, maximum size, productivity etc) of species interacting with tropical tuna fisheries (to reduce uncertainties in parameters feeding into the ERA).

7 Research

7.1 Introduction

This research strategy outlines the key strategic research needs in the ETBF and three additional and related tropical tuna fisheries being - the Western Tuna and Billfish Fishery (WTBF), and the (currently inactive) Eastern and Western Skipjack Tuna Fisheries. Based on the existing 5 Year Strategic Research Plan (developed prior to this FMS) it is due for review in 2021. The additional fisheries will be removed from the ETBF Research strategy once FMS for those fisheries are developed in future.

The research strategy aims to assist AFMA and the Tropical Tuna Management Advisory Committee (TTMAC) to identify and support research that will help achieve the management goals of these fisheries and AFMAs overall legislative objectives. It is aligned with the overarching AFMA Strategic Research Plan 2017-2022.

In addition to this plan, annual research statements will outline annual research priorities that have been identified by TTMAC on an annual basis in consultation with the Tropical Tuna Resource Assessment Group (TTRAG).

7.2 AFMA Corporate goals and strategies

Research activities funded by AFMA must focus on attaining the primary outcome specified by the AFMA Strategic Research Plan 2017 – 2022, being:

- Ecologically sustainable and economically efficient Commonwealth fisheries.

Consideration of this overarching goal, the linked commercial and bycatch species objectives stated in Chapters 3 to 5, as well as AFMA corporate objectives (link) can act as a guide for TTMAC in developing ATBF research plans, identifying research priorities for the annual call for research and assessing research proposals.

7.3 Identifying research needs

Noting that research activities must be consistent with AFMA's pursuit of its legislative objectives, the key drivers of research can be considered to fall into four categories:

7.3.1 Biological

Biological fisheries information is essential to adequately assess the stocks and estimate the size of sustainable harvests from those stocks.

7.3.2 Ecological

Information about the impact of fisheries on the marine ecosystem is essential to assist AFMA achieve our objective of ensuring Commonwealth fisheries are ecologically sustainable. Ecological risk assessments (ERAs) are essential to the development of Ecological Risk Management (ERM) and are conducted on all Commonwealth fisheries. The results of ERAs assist in identifying and prioritising research needs regarding fishery impacts on species populations and the broader marine ecosystem, and in guiding research investment, data collection, monitoring, and future management decisions.

7.3.3 Economic

Many factors influence the overall economic performance of the fishery. AFMA requires an understanding of the effects of economic factors upon the tropical tuna fisheries to manage these fisheries to maximise economic efficiency.

7.3.4 Social

Research into the social aspects of the fishery is important to maximise the social benefits of the fishery to the community. Social research aspects may include investigating access to the resource and resource allocation issues.

The success of fisheries management in the tropical tuna fisheries should be monitored and measured through appropriate performance indicators. These performance indicators, together with appropriate reference points, must relate to the management objectives and have identified actions associated with them.

7.4 Research Priority Areas and Needs

The following research areas have been identified as high priority needs for the period 2017-2021 by TTRAG and TTMAC. These are consistent with AFMA's strategic goals and priorities and are not listed in order of priority.

7.4.1 Provision of Data

- Provision of biological data to support relevant projects (Stock assessments)
- Provision of economic data to support relevant projects
- Provision of environmental data to support relevant projects
- Provision of recreational catch data to support relevant projects

7.4.2 Biological Research Priorities

- Stock assessments
    - Ensure stock assessments are conducted on target species in Australia's Tropical Tuna and Billfish Fisheries.
    - Ensure appropriate assessments are conducted where required for other species caught in Australia's Tropical Tuna and Billfish Fisheries.
    - Improve understanding of biological characteristics of species caught in Australia's Tropical Tuna and Billfish Fisheries.
- Develop harvest strategies for target and byproduct species as needed.
    - Evaluate the effectiveness of the harvest strategies for Australia's Tropical Tuna and Billfish Fisheries.
- Connectivity
    - Improve understanding of stock structure of primary species in Australia's Tropical Tuna and Billfish Fisheries.
    - Investigate the levels of mixing between Australian fish resources and fish resources in the broader Indian and Western and Central Pacific Oceans.
    - Investigate the cross fishery interactions between Australia's Tropical Tuna and Billfish Fisheries and other fisheries.

7.4.3 Ecological Research Priorities

- Bycatch and Byproduct

    - Investigate measures to improve bycatch mitigation in fishing operations.
    - Investigate the effects of fishing in Australia's Tropical Tuna and Billfish Fisheries on non-target species.
- Climate impacts
    - Measure the effects of climate change on key species and ecosystems in Australia's Tropical Tuna and Billfish Fisheries.
    - Investigate oceanographic and environmental factors impacting Australia's Tropical Tuna and Billfish Fisheries.
- Ecological Risk Assessment
    - Review the Ecological Risk Assessment for the Australia's Tropical Tuna and Billfish Fisheries.
    - Evaluate the relevance of certain species rated as high risk.

7.4.4 Economic and Social Research Priorities

- Spatial Management measures
    - Investigate the economic and ecological impacts of Marine Protected Areas and closures.
    - Investigate the need for resource sharing between the Commonwealth and other jurisdictions or sectors.
- Economic viability
    - Determine trends in the economic performance of Australia's Tropical Tuna and Billfish Fisheries.
- Cost / Benefit Analysis of management costs (levies) versus the fishery outputs in Australia's Tropical Tuna and Billfish Fisheries.

This research plan provides a framework for identifying the key research priorities in the ETBF for 2019-2023 that will help achieve the management goals for Australia's Tropical Tuna and Billfish Fisheries, and ensure that endorsed research projects fit within a strategic framework.

7.5 Actions

TTRAG and TTMAC should identify on an annual basis the research needs for management of the stocks consistent with the research priorities of this research strategy.

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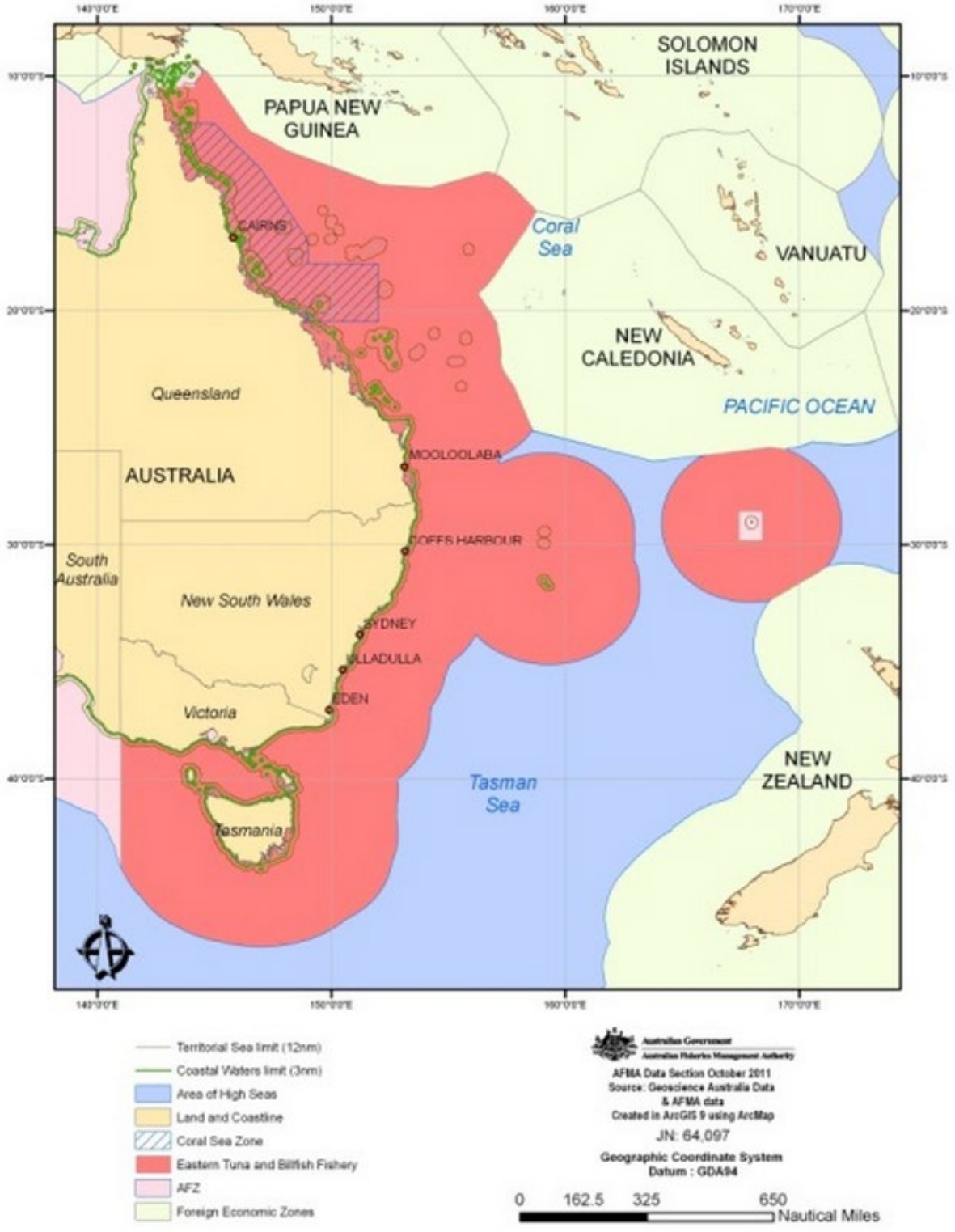
Appendix A – Area of the Eastern Tuna and Billfish Fishery



Appendix B – Performance criteria for ETBF FMS operational objectives

Table 25. Performance measurement criteria for key legislative objectives – Sustainability/Conservation, Economic Yield, and Accountability objectives.

Legislation/Policy Category	Key Commercial Species - Sustainability/Economic Returns	Bycatch/Byproduct Species - Sustainability/ Conservation	Bycatch Species – Avoiding injury/death of EPBC listed species	Accountability
Required outcome	Stocks are ecologically sustainable and maintained at a level that maximises the economic yield from the fishery.[21]	Bycatch and byproduct species /populations are ecologically sustainable	The fishery has implemented all reasonable steps to ensure that EPBC listed species (other than conservation dependent species) are not killed or injured as a result of fishing in the ETBF	AFMA consults on, clearly and transparently documents and communicates management arrangements and publically reports performance against objectives.
Indicator(s)	**For domestic harvest strategies (HS)**[22]: Standardised CPUE (as proxy for biomass) **For species with WCPFC HS** Biomass or CPUE	1 - Relative ecological risk level; or, 2 – Biomass, CPUE or other stock proxy	That the Department of Agriculture, Water and the Environment (DAWE) "Wildlife Trade Operation" assessment indicates that the ETBF has taken all reasonable steps as per the objective.	• Advisory committees (TTRAG, TTMAC) and Tuna Australia have been consulted on the management of the fishery (with proper implementation of conflict of interest procedures) • ETBF objectives, management decisions, arrangements and strategies have been clearly explained, transparent, documented and communicated to industry and other stakeholders • AFMA has reported performance against it objectives via Annual ETBF FMS Reports and reviews, and where feasible, modifies management processes where performance outcomes require it.
Reference point (s)	**For domestic HS**[23]: * Target ~ $CPUE_{ref\ period}$ * Limit or trigger RP – 0.5TRP CPUE **For species with WCPFC HS** * WCPFC TRPs, LRPs	Target – Zero high risk bycatch or byproduct species; No species overfished or subject to overfishing by the ETBF		
Performance Measure	**For domestic HS**[24]: CPUE relative to target and limit CPUE values **For species with WCPFC HS** WCPFC agreed PMs for each species	Number of species at high risk from the ETBF (or subject to overfishing or overfished due to the ETBF)		

[21] The pursuit of fishery level Maximum Economic Yield (MEY) for the ETBF is highly constrained by the international nature of the fishery and the fact that management is based on a mix of domestic harvest strategies and international Consevation and Management Measures (and associated catch limits) and in future, WCPFC Harvest Strategies, where stock TRPs will be based on maximising regionally agreed benefits, not just economic yields to the ETBF.
[22] The ETBF domestic harvest strategy is currently being redeveloped by AFMA. WCPFC harvest strategies are also under development by the WCPFC.
[23] The ETBF domestic harvest strategy is currently being redeveloped by AFMA. WCPFC harvest strategies are also under development by the WCPFC.
[24] The ETBF domestic harvest strategy is currently being redeveloped by AFMA. WCPFC harvest strategies are also under development by the WCPFC.

Appendix C - Timeline of fleet and management changes in Australia's tropical tuna longline fishery

Introduction

Changes in management arrangements in any fishery can have both intended and unintended or unanticipated impacts upon fishing operations and strategies, that can have flow on impacts for monitoring and assessment of the fisheries. Industry or market driven factors can also impact on fishery operations with similar flow on impacts.

For example, management imposed restrictions on fishing methods or implementation of mitigation methods can result in changes to the catchability of target species that will impact catch rates, a key input index into fishery stock assessments and/or harvest strategies.

To assist in AFMA, TTRAG and TTMACs consideration of the impacts of different management, industry and market factors upon fishery monitoring and assessment, TTRAG and CSIRO have developed a brief description of the changes and management measures which have impacted on Australia's domestic tropical tuna longline fishery which fishes off the east coast of Australia. Several changes and measures which impacted on Japanese longliners fishing within the Australian EEZ up until 1997 are also noted.

Timeline of Changes

The following timeline provides a summary of significant events which have occurred and management measures which have been introduced into longline fishing operating for tunas and billfish off eastern Australian. Japanese longline vessels commenced fishing in this region in 1952 and ceased fishing within the Australian EEZ in 1997. Full details of access arrangements during this period are provided in Caton and Ward (2006). The domestic Australian longline fishery developed in the mid-1980s and is known as the Eastern Tuna and Billfish Fishery (ETBF). Several of the management measures outlined below have influenced fishing operations and associated catches for the fleets operating in this region and should be taken into account when interpreting catch rates associated with these fisheries.

1952 Japanese longliners first fish within Coral Sea.

1965 Japanese vessels first catch large quantities of surface schooling YFT and BET using hand lines (Hisada, 1973).

1966 Taiwan first fishes in Coral Sea region.

1968 Before 30 January 1968, Australian sovereignty over fisheries resources was limited to its territorial seas (within 3 nm of the coast). After this time until the declaration of the AFZ in November 1979 sovereignty extended to 12 nm. States retained responsibility for regulating fishing within 3 nm whereas the Commonwealth was responsible beyond this limit.

1975 Korea first fishes in Coral Sea region. The Great Barrier Reef Marine Park come into force in 1975 though regulation of fishing activities did not commence until much later in the Marine Park, e.g. the Cairns section in 1983.

1979 Declaration of the 200nm exclusive AFZ on 1 November 1979. UNCLOS supported the continued access of distant fishing fleets to traditional fishing grounds where there was a sustainable surplus to the host nation's exploitation capacity. Progressive restrictions placed on foreign fishing.

1980 Area off Cairns (coincident with Queensland Trough) closed to Japanese longline fishing but remained open for handline fishing (Figure 2). The restriction was intended to reduce the interaction between Japanese longliners and the northern Queensland recreational and charter boat fisheries which target billfish species within this region.

1985 Australian tuna longline fishery develops off NSW in the mid-1980s, aimed at the often lucrative Japanese sashimi market.

1986 Access to Japanese 'Handline Area' was granted to domestic commercial operators in September 1986, following expressions of interest by the commercial tuna sector in establishing an exploratory fishery in the region. Thirteen permits were ultimately granted with sets limited to a maximum of 500 hooks. Now known as Coral Sea Permits (10).

1990 Southern extension to 'Handline Area' by closing Townsville Tough region (Figure 2). Closed region become known as Area E and has an area of approximately 172,000 square kilometres. Note: the Great Barrier Reef Marine Park occurs inshore of Area E in which all longlining is presently prohibited.

1995 Commonwealth legislation bans the retention of blue and black marlin (dead or alive) by Australian commercial fishing operations. This was to minimise the interaction between commercial and recreational sectors within Area E over the catch of billfish. Most domestic longliners operating out of Cairns also cease the retention of striped marlin in this area.

1995 Targeted fishery for broadbill swordfish develops with vessels operating o0ut of Mooloolaba. Since the mid-1990s the port of Mooloolaba just north of Brisbane has been the main fishing port for the Australian longline fishery off eastern Australia.

1996 Light-sticks first used by Australian longliners.

1997 Japanese access to Australian EEZ ceases. Since that time only Australian vessels have had access to Australian EEZ.

2000 A limit of 20 sharks per trip was introduced. Any sharks caught in excess of 20 are no longer classified as byproduct and become bycatch and must be discarded whether dead or alive.
Restricted zones off southern New South Wales for catching southern Bluefin tuna announced on 9 March. Closures will apply from May to Late September each year unless the operator holds SBT quota and operates VMS.

2003 On-board observer program commences on Australian longline fleet with the aim of monitoring 5.1% of effort (e.g. hooks deployed) in the fishery. Following a Ministerial Directive in December 2005 (as part of the Commonwealth government's *Securing our Fishing Future policy)* this was increased to 8.5%.

2005 Ban on the use of wire leaders or traces on longline branchlines introduced to reduce capture of sharks.

2006 Introduction of Total-Allowable-Catch (TAC) of 1400 tonnes for swordfish to restrict catch to within a sustainable limit.

Introduction of a Catch-Disposal-Record scheme to ensure the accurate recording of the landed catch (an independent licensed fish receiver verifies the landed weight of each species) and to coincide with introduction of swordfish TAC.
Introduction of Threat-Abatement-Plan (TAP) to mitigate seabird bycatch.
Ban on shark-finning at sea.
Commencement of major fleet reduction due to buy back of ETBF fishing licences included in the structural adjustment package announced by the Commonwealth government as part of the *Securing our Fishing Future policy*.
Development of deep-sets (using more than 25 hook-per-float) to target albacore (Figure 3a). Associated changes in the number of hooks deployed per kilometre and distance between floats.

2007 Mandatory use of tori-lines to mitigate seabird bycatch.

2008 Use of circle-hooks increases significantly and becomes dominant across fleet. Observer data indicates use increases from around 20% to over 70% across observed sets (Figure 3b).

2009 Ban on day-light setting to mitigate seabird bycatch.

2010 Sea-turtle mitigation plan comes into effect.
Introduction of management based on Total-Allowable-Hooks.

2011 New management plan adopted for the ETBF based on Individually-Transferrable-Catch quotas (ITQs). Quota season started on 1-March and again each year.

2012 Since mid-2012 the use of circle hooks has been made mandatory for shallow sets (i.e. if less than 8 hooks-per-float are used).

2013 Ban on the retention of live mako sharks and porbeagle sharks.
Ban on retention of oceanic whitetip shark and silky sharks

2015 Mandatory e-monitoring of all longlines vessels fishing in the ETBF commences 1-July.

2016 Switch to use of a single SBT zone (buffer zone removed).

2017 Reduction in Swordfish TACC

2018 Increase in Yellowfin Tuna TACC to 2400mt; Reduction in Swordfish TACC
Shortened 10 month fishing season in preparation to switch to annual season

2019 Switch to annual fishing season starting 1 January
Increase in Swordfish TACC to 1250 mt

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Appendix D – Data Source Fields

Table 26. Australian Tuna Longline Daily Fishing Log – AL06

Section	Details
Annual reporting requirements	
Vessel	Name and distinguishing symbol; home port; hull type and vessel dimensions – length, beam, draught, displacement, fish hold capacity; engine power, fuel capacity, maximum range and cruise speed; technological equipment carried
Permit holder and master	Name and contact details
Fishing gear	Mainline – material, colour, diameter, length; bird mitigation equipment including tori pole description
Shot-by-shot reporting requirements	
Date	Departure date
Time and position	Start and end – position (latitude and longitude) and time
Gear details	Mainline length and number of hooks; targeted depth, number hooks between bubbles, number of lightsticks; bait – type, weight and source
Seabird mitigation	Methods used
Environmental conditions	Sea surface temperature; wind speed and direction
Catch	For each species – number of fish kept and not kept, estimated processed weight
No take species	Number released – alive and dead
Non-fish bycatch interactions	Species group; number released – alive and dead; position caught; number caught during – set or haul; time of interaction
Comments	Any relevant
Non-fishing	Dates of docking and reason; comments
Other methods	Other methods used
Landing	Port of landing; end date; name of fish receiver

Table 27. Australian Tuna Minor Line Daily Fishing Log – OT03

Section	Details
Annual reporting requirements	
Vessel	Name and distinguishing symbol; home port; vessel dimensions – length, beam, draught, displacement, fish hold capacity; engine power, fuel capacity, maximum range and cruise speed; technological equipment carried
Permit holder and master	Name and contact details
Fishing gear	Poles – make and number of pole machines, number of poles – single and double;
Daily reporting requirements	
Date	Fishing date
Position and time	Latitude and longitude; time zone, start time
Gear details	Methods used; poling details – number, type; hours – search and fished; assisting a purse-seine boat (and distribution symbol)
Bait	Types and quantity
Catch	For each species – number of fish caught and kept, estimated total weight, number of fish returned
Wildlife interactions	Species group; number caught; life status on release; comments
Comments	Any relevant
Non-fishing	Dates of not-fishing and reason; comments
Landing catch	Verified weights – export weight and form code, domestic weight and form code
Landing	Port of landing; date; fish sold to

Appendix E – Historical logbook designs

Table 28. Historical logbook designs in the ETBF

Sector	Logbook	Dates	Other information
SBT pole-boat and purse-seine	TP01	Early 1960s	For CSIRO research;
	TP01 (b)	Late 1960s – 1969	For CSIRO research; Added weather data and average size of fish; Voluntary; Extensive data collected
	TP02 (a)	1975 – 1976	For CSIRO research; In response to problems in NSW and SA;
	TP02 (b)	1976 – 1978	Now the responsibility of DPI
	SF03	1978 – 1981	Redesigned to facilitate coding for computer processing
SBT pole-boat	TP03	1981 – 1982	Experimental; Split pole and purse-seine; Voluntary
	TP05	1982 –	Redesigned after comments from fishers; Compulsory; First logbook for WA waters
	TP06	1983 –	Redesigned specifically for WA fishers
Tuna pole boat	TPB01	1995 – 2000	
	TPB02		
	TPB03	1998 – 2015	
	TPB03A	2015 – 2020	Current design (farm only)
Purse seine and pole boat	PS01	2002 – 2013	
	PS01A	2011 – 2020	Current design (farm only)
SBT purse-seine	SF04	1981 – 1982	Experimental; Split pole and purse-seine; Voluntary
	SF05	1982 – 1996	Redesigned after comments from fishers; Compulsory
Longline	AL01	1986	Experimental only
	AL02	1985 – 1997	Incorporated modifications made after liaison with fishers and field staff
	AL03	1995 – 2000	Incorporates some Minor line fishing
	AL04	1997 – 2000	Incorporates some Minor line fishing
	AL05	2000 – 2009	Incorporates some Minor line fishing
	AL06	2007– current	Current design

Sector	Logbook	Dates	Other information
Minor line	OT01	1989 –1996	
	OT02	1995 – 2000	
	OT03	2000 – 2008	
	LN01	2006 – 2013	
	LN01A	2007 – 2020	
	LN01B	2016 – 2020	Current design
Gillnet	NT01	2006 – 2010	
	NT01A	2007 – 2019	
	NT01B	2016 – 2020	
Japanese longline	TL01	1979 – 1980	Photocopies of Japanese Far Seas Fisheries Research Laboratory logbooks
	TL02	1980 – 1983	Bilingual Australian version of TL01
	TL03	1962 – 1980	Japanese yellowbook data (data provided after 1980 for research purposes only)
	TL04	1983 – 1987	Same as TL02 except catch by weight incorporated and half month per page

Appendix F – Byproduct and Bycatch species limits

Table 29. Byproduct species general catch limits

Common name	Scientific Name	Restrictions
Longtail Tuna	*Thunnus tonggol*	A maximum 35 tonne limit by the fleet per fishing year is in place for the ETBF and WTBF. A ten fish trip limit per operator will be imposed should the 35 tonne trigger limit be reached in either fishery in any fishing year.
Northern Pacific Bluefin Tuna	*Thunnus thynnus*	Northern Pacific Bluefin Tuna NBT must be reported prior to landing (via e-mail northernbluefin@afma.gov.au or fax 02 6225 5440) at least 1 hour before landing in port. Further information is provided in the Management Arrangements booklet
Sharks (those that are not subject to limits elsewhere)	Class Chondrichthyes	Not more than the number of tuna and billfish quota species taken per trip, not exceeding a maximum of 20 sharks per trip
Shortfin Mako Shark Longfin Mako Shark Porbeagle	*Isurus oxyrinchus* *Isurus paucus* *Lamna nasus*	May only be retained and landed if brought to the boat dead. If alive on the line, they must be released.

Table 30. Restricted species in Victorian waters with total maximum 200kg take per trip of all species combined

Common Name	Scientific Name	Limits	Total limit
Barracouta	*Thyrsites atun*	200 kg	200 kg total per trip for all species combined
Leatherjackets – all species	Family *Monocanthidae*	200 kg	
Snapper	*Pagrus auratus*	50kg per trip	
Striped Trumpeter	*Latris lineata*	20kg per trip	
Yellowtail Kingfish	*Seriola lalandi*	10 fish per trip	

Table 31. Byproduct limits off Tasmania

Common Name	Scientific Name	Limits
Bastard Trumpeter	*Latidopsis forsteri*	20kg per trip
Blue Groper	*Achoerodus gouldii*	50kg per trip

Common Name	Scientific Name	Limits
Striped Trumpeter	*Latris lineata*	250kg per trip
Yellowtail Kingfish	*Seriola lalandi*	250kg per trip
Snapper	*Pagrus auratus*	250kg per trip

Table 32. Byproduct limits off Queensland

Common Name	Scientific Name	State Limits
Yellowtail Kingfish	*Seriola lalandi*	Combined total of 2 fish per trip
Black Kingfish	*Rachycentron canadus*	
Amberjack	*Seriola dumerili*	
Australian Bonito	*Sardi australis*	Combined total of 10 fish per trip
Australian Spotted Mackerel	*Scomberomus munroi*	
Bar Cod	*Polyprion moeone*	
Cod	Family *Serranidae*, except *Epinephelus daemelii*	
Dog Toothed Tuna	*Gymnosarda unicolor*	
Emperor	Families *Lethrinidae* and *Lutjanidae*	
Frigate Mackerel	*Auxis thazard*	
Grouper	Family *Serranidae* Except *Epinephelus daemelii*	
Hapuku	*Polyprion oxygeneios*	
Leaping Bonito	*Cybiosarda elegans*	
Mackerel Tuna	*Euthynnus affinis*	
Oriental Bonito	*Sarda orientalis*	
Rainbow Runner	*Elagatis bipinnulata*	
Rake-Gilled Mackerel	*Rastrelliger kanagurta*	
Shark Mackerel	*Grammatorcynus bicarinatus, G.Bilineatus*	
Snapper	*Pagrus auratus*	
Spanish Mackerel	*Scomberomorus commerson*	
Trevally	Family *Carangidae*, except Genus *Seriola*	
Tropical Snapper	Families *Lethrinidae* and *Lutjanidae*	
Tuskfish	Family *Labridae*	
Wrasse	Family *Labridae*	

Common Name	Scientific Name	State Limits
Shark	Subclass *Elasmobranchii* and Family *Serranidae*	Combined total of 20 fish per trip
Butterfly Mackerel	*Gasterochisma melampus*	
Slender Tuna	*Allothunnus fallai*	
Wahoo	*Acanthocybium solandri*	

Table 33. Byproduct limits off New South Wales

Common Name	Scientific Name	Limits
Finfish	Class *Osteichthyes* (not including tuna and tuna like species)	Total of 200kg