



Australian Government  
Australian Fisheries Management Authority

# Small Pelagic Fishery Harvest Strategy

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## Background

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This Small Pelagic Fishery (SPF) Harvest Strategy (Harvest Strategy) reflects obligations under the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2018* (HSP).

This Harvest Strategy is similar to harvesting approaches successfully applied in other large fisheries for small pelagic species (e.g. South Australian Sardine Fishery, USA Pacific Sardine Fishery) and has been developed to account for key fishery specific attributes. These include:

- Small pelagic species are fast growing relative to most commercial scalefish, have variable annual recruitment, high overall productivity and rapid shifts in distribution related to oceanographic changes.
- There is potential for substantial inter-annual variations in spatial distribution, availability and abundance of small pelagic species.
- The risk of localised depletion in the SPF is considered to be low due to the high mobility and rapid re-distribution of small pelagic species. That risk is further diminished by the application of spatial management arrangements to spread fishing effort.
- The Harvest Strategy adopts exploitation rates to:
  - maintain the spawning stock biomass, on average, at the target reference point of 50 per cent of unfished levels
  - achieve a less than 10 per cent chance over a 50 year period of the spawning stock biomass falling below the limit reference point of 20 per cent of unfished levels
- SPF species are prey items for many pelagic predators. However, extensive dietary analyses and ecosystem modelling in Australian waters have shown that these predators are not dependent on one or two prey species and have a high capacity for prey switching. Ecosystem modelling by Smith et al. 2015 has shown that harvesting SPF species at the exploitation rates proposed in the Harvest Strategy will have minimal impacts on predator populations or ecosystem function.
- Recent catches of a number of the SPF stocks have been limited by economic constraints and are considered by the SPF Resource Assessment Group (SPFRAG) to be below the sustainable levels, so there is potential for sustainable expansion of the fishery.
- Small pelagic species are caught in high volumes and have low unit value. Small pelagic species are subject to rapid degradation in quality unless rapidly chilled or frozen, which means that post-harvest processing affects the ability to access markets for human consumption. These markets typically provide higher returns than alternate markets for animal feeds.
- As a result of the rapid migratory behaviour of small pelagic species in response to shifts in current and wind patterns, the low unit value of small pelagic species, and the requirement to chill or freeze immediately after capture to provide high quality product, net economic returns are increased by the use of vessels with the capability to chill or freeze fish at sea.
- As for other fisheries, the management arrangements for protected species are addressed separately.

# SPF Harvest Strategy

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## 1.1 Objectives

Consistent with the HSP, the objective of the Harvest Strategy is:

*The sustainable and profitable utilisation of the SPF in perpetuity through the implementation of a harvest strategy that maintains key commercial stocks at ecologically sustainable levels and, within this context, maximises the net economic returns to the Australian community.*

## 1.2 Scope

This Harvest Strategy applies to each zone of the fishery and is used to develop advice on Recommended Biological Catches (RBCs) and Total Allowable Catches (TACs) for each quota species. RBCs derived from the SPF HS apply to fish stocks throughout their range and to mortality resulting from all types of fishing.

There is capacity to establish finer scale spatial management within zones on the basis of information about stock structure or regional fisheries management requirements.

This Harvest Strategy applies to:

- jack mackerels (primarily *Trachurus declivis*, also *T. murphyi*)
- blue mackerel (*Scomber australasicus*)
- redbait (*Emmelichthys nitidus*)
- Australian sardine (*Sardinops sagax*) in Commonwealth waters adjacent to NSW.

## 1.3 Principles for Recommending TACs from RBCs

Recommended Biological Catches (RBCs) are recommended based on estimates of stock size (biomass) and species-specific harvest rates established in the Harvest Strategy. Recommended TAC's are calculated by subtracting any significant known sources of mortality from the RBCs. Adjustments for catches taken in other fisheries will be based on the SPFRAG's best estimate of future catch in other fisheries (e.g. average of recent recorded annual catches).

In the absence of formal catch sharing arrangements for straddling SPF stocks between State and Commonwealth fisheries, commensurate adjustments to catch limits cannot be assured between jurisdictions.

AFMA considers that catch sharing arrangements should be pursued with the relevant States as a matter of priority to provide certainty of access to SPF resources.

## 1.4 Assessment and Monitoring

The Harvest Strategy is primarily based on fishery-independent Daily Egg Production Method (DEPM) surveys. This method generates estimates of spawning stock size based on surveys of eggs during the spawning seasons for each species. DEPM estimates are currently used as absolute estimates of stock size for the purpose of calculating RBCs. If alternative or additional methods are developed for assessing small pelagic stocks, these will be considered by AFMA in the context of the Harvest Strategy. In addition to the DEPM assessment, the Harvest Strategy also makes provision for monitoring of fishery-dependent data such as catch, effort and size/age catch structure information and, where no DEPM surveys have been conducted, the use of the Atlantis ecosystem model to provide estimates of biomass.

Despite the limitations of the current low level of fishery-dependent data for assessment of small pelagic fishes (as a result of low catches), continued fishery-dependent monitoring is required to understand size and age composition of catches, to potentially provide indices of stock composition, fishing mortality rates,

recruitment variability and changes in fishing practices. These data are required for any future application of integrated stock assessment models.

DEPM approaches were developed specifically for small pelagic fishes and provide estimates of spawning biomass calculated from information on daily egg production and daily fecundity (Lasker 1985). In the event that alternative assessment methods are identified and proven to be cost-effective, the Harvest Strategy may be amended to incorporate decision rules appropriate for those assessments.

An Annual Fishery Assessment is required for the RBC setting processes under Tier 1 and Tier 2. At Tier 3, a review of available catch and effort data should be undertaken. An Annual Fishery Assessment is a fishery assessment covering the previous fishing year (i.e. 1 May to 30 April) that informs the SPFRAG's advice regarding the level of fishing that should be permitted, or provides scientific evidence of changes in stock status since the DEPM estimate, to support recommendations of lower than maximum harvest rates. Progressive information available from the season to date, if available, may also be considered. The Annual Fishery Assessment must include:

- length–frequency and age information from catches for each stock fished. Guidelines have been developed on the quantity of length–frequency data and otolith information required on an ongoing basis;
- updated catch and effort data; and
- information on changes in spatial and temporal patterns of effort and catch.

The Annual Fishery Assessment should aim to provide evidence suitable for detecting stock depletion, localised depletion or changes in the size and age structure of the catch that cannot be adequately explained by reasons other than a decline in abundance.

For SPF stocks where a DEPM has never been undertaken, biomass estimates derived from the Atlantis ecosystem model developed for the SPF (Atlantis– SPF) are applied under Tier 3. Atlantis is an ecosystem model that provides estimates of the likely biomass of key species that are required to support the functioning of the modelled ecosystem. The model uses all available information on species distribution, relative abundance and dietary requirements (<http://atlantis.cmar.csiro.au/>). The Harvest Strategy explicitly recognises that biomass estimates derived from the Atlantis–SPF model are more uncertain than those based on DEPMs.

## 1.5 Harvest Strategy Framework

A tiered Harvest Strategy framework is applied to the SPF to accommodate different information levels for different stocks, potential growth of the fishery, the consequent collection of additional information to support more complex stock assessments and responds to the reduction in information levels as assessments become dated. Underpinning the tiered approach is the need to balance risk with certainty by establishing exploitation rates that are initially very conservative, but increase (while remaining conservative) as additional information (i.e. quantitative measures of spawning biomass) becomes available. The framework includes three tier levels with different information needs and harvest control rules:

- Tier 1, based on a quantitative stock assessment and an Annual Fishery Assessment incorporating a DEPM estimate, provides the greatest certainty in RBC setting and allows the highest potential harvest rate.
- Tier 2 provides a medium level of assessment based on an Annual Fishery Assessment and previous DEPM assessment, and allows a lower potential harvest rate than for Tier 1.

- Tier 3 is the lowest level of assessment, applies when the requirements of other Tier levels are not met, and has a lower potential harvest rate than Tier 1 or Tier 2. A review of available catch and effort data should be undertaken annually.

The framework allows the level of investment in research and assessment to be varied to match commercial interest in exploiting the resource while generating the information required to manage each stock. Assessment costs increase as the fishery moves towards a Tier 1 assessment, although an increase in the level of assessment may not necessarily result in a commensurate increase in the RBC. Rather, the RBC will be dictated by the status of the stock. Assuming a stock is at the same biomass, additional certainty associated with the data and assessment requirements of higher Tiers allow for higher harvest rates and higher catches.

The Harvest Strategy recognises that:

- Tiers apply to individual species by zone in the fishery, i.e. the Eastern Zone and the Western Zone (**Attachment A**);
- the SPF quota species have different biological characteristics and accordingly exploitation rates are species-specific at every Tier;
- the reliability of estimates of spawning biomass declines over time as uncertainty around how stock status might have changed in the elapsed period increases;
- information on the stock status is determined for each zone; and
- exploitation rates should reflect levels of knowledge about stock status.

## 1.6 Decision Rules and Reference Points

This Harvest Strategy adopts exploitation rates tested to provide a high likelihood that stocks will be maintained, on average, at the target reference point of 50 per cent of unfished levels, with a less than a 10 per cent chance over 50 years of falling below the limit reference point of 20 per cent of unfished levels.

These target and limit reference levels are consistent with those established in the Commonwealth Harvest Strategy Policy, and have been shown to be ecologically sound for the Australian small pelagic stocks as a result of the low dietary dependency of higher trophic level predators in south east Australia on the targeted SPF species (Smith *et al.* 2015).

The  $B_{50}$  reference point represents a trade-off of an optimal economic reference point for an ecologically conservative reference point. This is because economic research (Pascoe and Hillary, 2016) found that  $B_{MEY}$  is equal to  $B_{MSY}$  for SPF stocks and  $B_{MSY}$  for these stocks is estimated to be between  $B_{30}$  and  $B_{36}$  (Smith *et al.* 2015). Given these  $B_{MSY}$  levels are uncertain (Smith *et al.* 2015), and the ecosystem in southern and eastern Australia is not highly dependent on these species, the higher target of  $B_{50}$  is considered safe from an ecological perspective.

The exploitation rates applied are maximum limits only; lower harvest rates may be recommended, refer to 'Metarules' section below.

### 1.6.1 Tier 1

#### 1.6.1.1 Assessment and Monitoring

A spawning biomass estimate derived from a DEPM survey within the last five years and an Annual Fishery Assessment.

### 1.6.1.2 RBC Decision Rules

The RBC for each stock within each management zone will be recommended by SPFRAG based on the biomass estimate of the DEPM survey. The maximum exploitation rates to be used for each species to determine RBCs are listed in **Table 1**.

**Table 1 Tier 1 maximum exploitation rates**

Species	Western Zone	Eastern Zone	Maximum time at Tier 1* without a DEPM (number of fishing seasons**)
Australian sardine	N/A	20%	5 seasons
Blue mackerel	15%	15%	5 seasons
Jack mackerels	12%	12%	5 seasons
Redbait	10%	10%	5 seasons

\* The differences in the exploitation rates at Tier 1 results from the different productivity of each species (Smith et al. 2015).

\*\*The SPF fishing season starts on 1 May each year and ends on 30 April in the following year.

A DEPM survey can only be used to set the RBC at Tier 1 for five consecutive seasons, after which the stock will move to being assessed under Tier 2. Recognising that there can be a delay between doing the survey and having the results to inform the RBC, the first season the DEPM is used to inform the RBC may be the year after the survey is undertaken. The first year the DEPM is used to inform the RBC is considered the first season.

## 1.6.2 Tier 2

### 1.6.2.1 Assessment and Monitoring

An Annual Fishery Assessment must be undertaken.

### 1.6.2.2 RBC Decision Rules

The RBC for each stock within each management zone will be recommended by SPFRAG based on the most recent biomass estimate from a DEPM survey. The maximum exploitation rates to be used for each species to determine RBCs are listed in **Table 2**.

**Table 2 Tier 2 maximum exploitation rates**

Species	Western Zone	Eastern Zone	Maximum time at Tier 2* without a DEPM (number of fishing seasons**)
Australian sardine	N/A	10%	5 seasons
Blue mackerel	7.5%	7.5%	5 seasons
Jack mackerels	6%	6%	10 seasons
Redbait	5%	5%	10 seasons

\* The differences in the exploitation rates and maximum time at Tier 2 results from the different productivity of each species (Smith et al. 2015).

\*\* The SPF fishing season starts on 1 May each year and ends on 30 April in the following year.

### 1.6.3 Tier 3

#### 1.6.3.1 Assessment and Monitoring

A review of available catch and effort data should be undertaken annually.

#### 1.6.3.2 RBC Decision Rules

The RBC for each stock within each management zone will be recommended by SPFRAG based on the most recent biomass estimate. The maximum exploitation rates for Tier 3 species are set out in **Table 3** below. For a stock where a biomass estimate has previously been derived based on a DEPM survey but the maximum time at Tier 2 has been exceeded (**Table 2**), the exploitation rate may not exceed half the Tier 2 maximum exploitation rate (**Table 2**):

$$\text{RBC} = 0.5 \times \text{Tier 2 maximum exploitation rate} \times \text{biomass (DEPM- estimated)}$$

For a stock where there has been no previous DEPM survey, the exploitation rate may not exceed a quarter of the Atlantis–SPF derived, mean biomass estimate:

$$\text{RBC} = 0.25 \times \text{Tier 2 maximum exploitation rate} \times \text{biomass (Atlantis–SPF – estimated)}$$

There is no limit to the length of time that a stock can remain at Tier 3.

**Table 3 Tier 3 maximum exploitation rates**

Species	DEPM Survey biomass estimate		No DEPM survey biomass estimate	
	Western Zone	Eastern Zone	Western Zone	Eastern Zone
Australian sardine	N/A	5%	N/A	N/A
Blue mackerel	3.75%	3.75%	N/A	N/A
Jack mackerels	3%	3%	1.5%	N/A
Redbait	2.5%	2.5%	1.25%	N/A

#### 1.6.4 Metarules

If SEMAC or the AFMA Commission consider there is sound scientific evidence that the application of the decision rules does not support the objectives of the HSP, Harvest Strategy or other policies or legislation relevant to the fishery (e.g. Bycatch Policy, EPBC Act), SPFRAG may be asked to provide additional advice about altering catch limits and other controls that may be necessary to support the relevant management objectives. This may include additional information from the Annual Fishery Assessment for Tier 1 and Tier 2 and a review of available catch and effort data for Tier 3.

#### 1.6.5 Exploratory Fishing and Research Catch

Catch allowances may be set to support a research program in accordance with AFMA's existing policies regarding research catch allowance and exploratory fishing. The research program must be considered by SPFRAG and SEMAC. All catch allowances are set by the AFMA Commission.

#### 1.6.6 Accounting for Ecological Impacts

SPF species are prey items for many pelagic predators. However, extensive dietary analyses and ecosystem modelling in Australian waters have shown that these predators are not dependent on one or two prey species and have a high capacity for prey switching. Ecosystem modelling has shown that harvesting SPF species at the exploitation rates proposed in the Harvest Strategy will have minimal impacts on predator populations or ecosystem function (Smith *et al.* 2015).



Notwithstanding, AFMA will continue to take into account the best available science, including that relating to the ecological impacts of fishing small pelagic species, and expert advice when setting catch limits in the SPF. Ecological impacts may include but are not restricted to:

- effects on protected species populations;
- localised depletion; and
- ecosystem function.

## Review

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The Harvest Strategy will be reviewed at least once every three years.

## References

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Lasker, R. (1985). *An egg production method for estimating spawning biomass of pelagic fish: application to northern anchovy, *Engraulis mordax**. NOAA Tech. Rep. NMFS, 36: 1 – 99.

Pascoe, S and Hillary, R. (2016). *Bioeconomic target reference points for the Commonwealth Small Pelagic Fishery*. Report to the Australian Fisheries Management Authority (AFMA), Canberra.

Smith, A., Ward T, Hurtado F, Klaer N, Fulton E, and Punt A. (2015). *Review and update of harvest strategy settings for the Commonwealth Small Pelagic Fishery – Single species and ecosystem considerations*. Hobart. Final Report of FRDC Project No. 2013/028.

Figure 1 SPF Fishery Management Zones

