Australian Government

Australian Fisheries Management Authority

Small Pelagic Fishery Harvest Strategy

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SPF Harvest Strategy

1. Scope and Overview

The Small Pelagic Fishery (SPF) Harvest Strategy (HS) reflects obligations under the Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2018 (HSP), which is currently being reviewed. The SPF HS has similarities to the harvest strategies of other large-scale small pelagic fisheries, such as the South Australian Sardine Fishery. The SPF HS recognises that small and medium sized pelagic fishes such as those taken in the SPF grow faster and are more productive than most other commercial scale-fish species and can undergo large interannual variations in distribution, abundance and recruitment. The risk of localised depletion of small pelagic species is low due to their high mobility and capacity for rapid re-distribution.

- Jack Mackerels (primarily *Trachurus declivis*, occasionally *T. murphyi*)
- Blue Mackerel (*Scomber australasicus*)
- Redbait (*Emmelichthys nitidus*)
- Australian Sardine (*Sardinops sagax*)

The SPF is divided into three sub-areas: Eastern, Western and Sardine (Figure 1). Finer scale spatial management arrangements may also be established to address information about sub-structuring of stocks within zones or to reduce the potential for localised depletion.

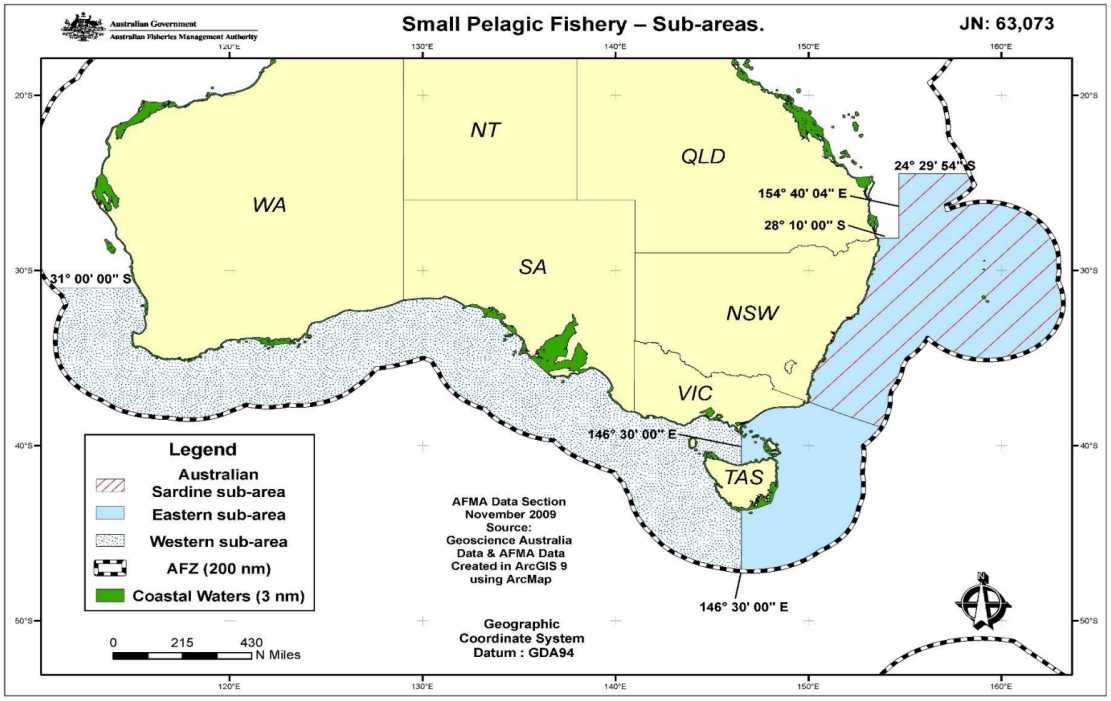

Figure 1. Sub-areas of the Small Pelagic Fishery

The SPF HS uses a tiered approach to balance the different risks to stocks associated with higher and lower exploitation rates against the levels of information collected to monitor and assess stock status. Recommended Biological Catches (RBCs) and Total Allowable Catches (TACs) are set for each species in each sub-area by applying exploitation rates to estimates of spawning biomass obtained using the Daily Egg Production Method (DEPM). The SPF HS was reviewed in 2024 in response to the recent growth of the fishery (i.e., annual catch of ~21,000 t in 2022/23) and to address the need to establish decision rules that reduce the exploitation rate as the biomass approaches the point at which recruitment may be impaired.

2. Objective

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.

3. Ecological and Economic Context

Extensive dietary analyses and ecological modelling have shown that in waters off south-eastern Australia depleting SPF target species, both singly and in combination, has only minor impacts on other parts of the ecosystem (Bulman et al. 2011; Goldsworthy et al. 2013; Smith et al. 2015). The biomass depletion levels associated with maximum sustainable yield (B_{MSY}) for SPF species range between B_{30} and B_{35} and have been shown to be ecologically sustainable in these marine ecosystems (Smith et al. 2015). It has also been shown that maximum economic yield (B_{MEY}) is equal to B_{MSY} for SPF target species (Pascoe and Hillary 2016).

To address scientific uncertainty in the outputs of the Management Strategy Evaluation (MSE), including those arising from limitations in the biological data available for SPF species and assumptions underpinning the ecosystem and populations models used to estimate B_{MSY}, Smith et al. (2015) recommended that the precautionary default settings in the HSP, i.e., target reference point of B_{50} and limit reference of B_{20}, should be adopted in the SPF HS.

The approach adopted in the SPF HS represents a trade-off of an optimal economic target reference point (B_{MEY}) for an ecologically conservative target (B_{50}) that is explicitly designed to address scientific uncertainty (Smith et al. 2015; Pascoe and Hillary 2016; Grammer et al. 2022). The MSEs undertaken to estimate the exploitation rates for individual SPF species (e.g., Smith et al. 2015) were designed to:

- maintain the spawning biomass of each species, on average, at 50% of the unfished level (B_{50})
- achieve a less than 10% chance over a 50-year period of the spawning biomass falling below the 20% of the unfished level (B_{20}).

4. Principles for Recommending TACs from RBCs

RBCs are calculated from estimates of spawning biomass (Section 5) by applying species–specific exploitation rates established in the SPF HS (Section 6). TACs are calculated by subtracting known sources of mortality from the RBCs. Adjustments for catches taken in other state and Commonwealth fisheries are based on the best estimate available (e.g., the average of recently recorded annual catches).

In the absence of formal catch sharing arrangements for SPF stocks taken in State and Commonwealth fisheries, commensurate adjustments to catch limits cannot be assured among jurisdictions. AFMA will pursue catch sharing arrangements with relevant States as a matter of priority to provide certainty of access to SPF resources.

5. Assessment and Monitoring

The SPF HS is currently underpinned by estimates of spawning biomass obtained using the DEPM (Lasker 1985). This fishery-independent method generates estimates of spawning biomass from plankton (egg) and adult surveys undertaken during the spawning season (Stratoudakis et al. 2006). Estimates of the total number of eggs spawned per day during the spawning season (i.e., total daily egg production) are converted into estimates of spawning biomass by applying estimates of the average number of eggs produced per day per kilogram of adult fish (i.e., mean daily fecundity) (Stratoudakis et al. 2006). The maximum number of seasons between applications of the DEPM for each species varies among tiers as outlined in the HS Framework (see Section 6).

Alternative or additional methods for estimating the size of the spawning stock of SPF species will be considered if/when they become available.

The amount of fishery-dependent information collected for a stock varies among tiers as outlined in the HS Framework (see Section 6). An Annual Fishery Assessment is required for stocks at Tier 1 and Tier 2, whereas a review of available catch and effort data is undertaken for stocks at Tier 3. The Annual Fishery Assessment provides a detailed analysis of the data obtained from the fishery during the previous fishing season (i.e., 1 May to 30 April) and evaluates stock status between applications of the DEPM. The Annual Fishery Assessment is used by SPF RAG to evaluate if there are reasons to recommend exploitation rates lower than the maximum rates identified in the HS Framework (see Section 6). The Annual Fishery Assessment must include:

- historical catch, effort and CPUE data from 2001 onwards
- detailed analyses of catch, effort and CPUE data from the previous fishing season
- length–frequency and age structure information from catches for each stock fished*
- analysis of spatial and temporal patterns of effort and catch, and
- 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.

*Guidelines have been developed to identify the quantity of length–frequency and age structure (from otoliths) that should be collected annually.

6. Harvest Strategy Framework

6.1 Tiered Approach

The SPF HS Framework is designed to achieve the ecological, economic and social outcomes outlined in the objective of the Harvest Strategy (Section 2). It is designed to maintain the spawning biomass of each species (B), on average, at the **Target Reference Point of B_{50}** with a less than 10% chance over a 50-year period of the spawning biomass falling below the **Limit Reference Point of B_{20}** (Section 3). The settings of the SPF HS Framework largely reflect the recommendations of the MSE undertaken by Smith et al (2015).

The SPF HS Framework has three tiers (Table 1). Each tier is defined by the number of years since the last DEPM survey was conducted. The aim of this tiered approach is to balance the different risks to stocks associated with higher and lower exploitation rates against the level of information collected to monitor stock status (Section 5). The SPF HS Framework is designed to allow the level of investment in research and assessment to be varied to match commercial interest in exploiting the resource. Assessment costs and the level of information available to manage each stock are highest at Tier 1 and lowest at Tier 3.

At each tier, RBCs are estimated by applying the species-specific exploitation rate to the most recent estimate of spawning biomass obtained using the DEPM (Section 5). The exploitation rates are highest at Tier 1 and lowest at Tier 3 (Table 1). The exploitation rates and maximum number of seasons at each tier reflect the productivity and level of biological information available for each species. Exploitation rates for Sardine and Blue Mackerel are more precautionary (lower) than those recommended by Smith et al. (2015). The same exploitation rates are currently applied to each target species in the Eastern and Western sub-areas (Table 1). The exploitation rates applied are maximum limits only; lower harvest rates may be recommended if there is scientific evidence or a sound rationale for doing so (Section 5).

6.2 Harvest Control Rule for Reducing Exploitation Rates when Spawning Biomass Declines

The SPF HS Framework has Harvest Control Rules (HCRs) that reduce the exploitation rates if the spawning biomass of a stock declines more than 20% below the Target Reference Point of B_{50} and towards the Limit Reference Point of B_{20} where recruitment is likely to be impaired.

Table 1. The SPF Harvest Strategy Framework showing maximum exploitation rates (Max ER) and maximum number of fishing seasons (1 May to 30 April) between applications of the DEPM (Max Seasons) for each species at each tier. An Annual Fishery Assessment is required at Tier 1 and Tier 2. A review of available catch and effort data is undertaken at Tier 3.

Species Sub-area(s)	**Tier 1**		**Tier 2**		**Tier 3**	
	Max ER	**Max Seasons**	**Max ER**	**Max Seasons**	**Max ER**	**Max Seasons**
Sardine						
Sardine	20%	5 seasons	10%	5 seasons	5%	Indefinite
Blue Mackerel						
Eastern	15%	5 seasons	7.5%	5 seasons	3.75%	Indefinite
Western	15%	5 seasons	7.5%	5 seasons	3.75%	Indefinite
Jack Mackerels						
Eastern	12%	5 seasons	6%	10 seasons	3%	Indefinite
Western	12%	5 seasons	6%	10 seasons	3%	Indefinite
Redbait						
Eastern	10%	5 seasons	5%	10 seasons	2.5%	Indefinite
Western	10%	5 seasons	5%	10 seasons	2.5%	Indefinite

As the DEPM has now been applied to each target species in each sub-area (e.g., Grammer et al. 2022), some information is now available about the spawning biomass of all stocks. In many cases, especially in the Western Sub-area, the DEPM surveys have only covered a limited portion of the potential spawning area and therefore provide conservative estimates of the spawning biomass of each stock. In most cases, the DEPM has been applied when levels of fishing mortality were relatively low and the surveys therefore provide conservative estimates of the unfished spawning biomass of each stock (i.e., a proxy for B_0).

The HCRs specify that the maximum exploitation rates applied to a stock (Table 1) is reduced linearly (i.e., using a hockey stick rule, Figure 2) if the estimate of spawning biomass from the latest DEPM survey is below the **Trigger Reference Point of B_{40}** and above the **Limit Reference Point of B_{20}**. The maximum exploitation rate for a stock is maintained if the spawning biomass is above **B_{40}** (Figure 2). Targeted fishing is ceased if the spawning biomass is below **B_{20}**. Reductions in the exploitation rate for each species at Tier 1 (i.e., a DEPM survey conducted within the last five years) under these HCRs are shown in Figure 2. Maximum exploitation rates at Tiers 2 and 3 are also reduced (i.e., to 50% and 25% of the Tier 1 level, respectively) if the estimate of spawning biomass from the latest DEPM survey was between **B_{40}** and **B_{20}**. The maximum exploitation rate at each tier is maintained if the estimate of spawning biomass from the latest DEPM survey was above of B_{40}. Targeted fishing is ceased at all tiers if the spawning biomass is below **B_{20}**.

In applying the HCRs, SPF RAG recognises that the reliability of estimates of spawning biomass can vary over time and often increases as knowledge of the population improves. Rigor and caution must be applied when estimates of spawning biomass with different levels of accuracy and precision are compared.

6.3 Metarules

If SEMAC or the AFMA Commission consider there is sound scientific evidence that the application of the SPF Harvest Strategy Framework 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), SPF RAG 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.

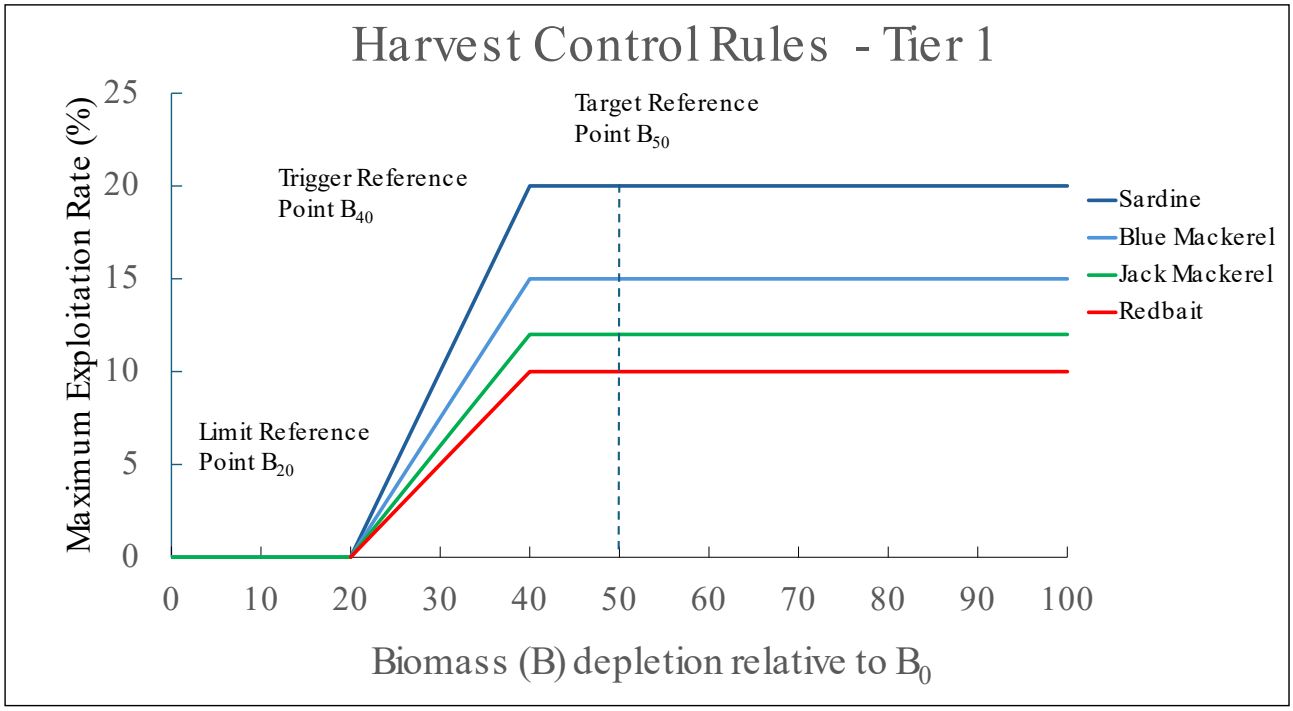

Figure 2. Harvest Control Rules for linearly reducing (i.e. using a hockey stick rule) the exploitation rates for each species at Tier 1 (Table 1) if the estimate of spawning biomass from the latest DEPM survey is below the Trigger Reference Point of B_{40} and above the Limit Reference Point of B_{20}. The maximum exploitation rate is maintained if the spawning biomass is above B_{40}. Targeted fishing is ceased if the spawning biomass is below B_{20}.

6.4 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.

6.5 Accounting for Ecological Impacts

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 populations of threatened, endangered and protected species
- localised depletion of target species
- ecosystem structure and function, and
- impacts of climate change

6.6 Review

The Harvest Strategy will be reviewed every five years.

7. References

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