Australian Government

Australian Fisheries Management Authority

Harvest Strategy Framework

For the Southern and Eastern Scalefish and Shark Fishery

2009 (*Amended 2026*)

Contents

Version	Updates	Author	Date
Version 1.1 to 1.2	Drafting the Harvest Strategy Framework into template	Sharon Koh, Steve Auld	22 September 2009
Version 1.3	Redraft following outcomes of SESSFRAG meeting February 2011	Sharon Koh	July 2011
Version 2	Updates to web links and accessibility changes. Integration of GAB section, multi-year TACs, consistent application of discards and discount factor guidance. Removal of Catch per Unit of Effort (CPUE) multiplier. Research needs, now included in the strategic research plan and the annual research plan, have been removed.	George Day	February 2014
Version 3	Providing for alternative TACs to those produced by the Tier 1 harvest control rule (HCR) in defined circumstances. Removal of the small change limiting rule. Clarification of how to apply the discount factor. Documenting the limit placed on the Tier 3 HCR multiplier as recommended by SESSFRAG in March 2013. Specifying the approach for setting TACs when the Recommended Biological Catch is 0. To provide guidance on 'step down' and 'step up' TACs.	George Day	February 2015
Version 4	Providing for alternative assessment methods in defined circumstances. Adopting a weighted average of state catch rather than a simple average for the purposes of TAC calculation.	George Day	March 2017
Version 5	Apply a weighted average of state catches to gummy shark as is the case for other Southern and Eastern Scalefish and Shark Fishery (SESSF) species. Clarification of treatment of discards and state catch in Tier 4 assessments and Recommended Biological Catch (RBC) calculations. Review of GABT triggers at Appendix A.	George Day	March 2019
Version 6	To incorporate SESSFRAG agreed approaches into the SESSF Harvest Strategy Framework. Largely, the revisions will enable species assessments to be transitioned between tiers or where the current assessment tier does not work. In particular, where: • species have high discards	Cate Coddington	March 2020

	• CPUE does not index biomass • tier 1 assessments are rejected, and TACs may be rolled over (subject to sustainability concerns) • regime shift/productivity change needs to be considered for some species.		
Version 7	To incorporate SESSFRAG agreed approaches into the SESSF Harvest Strategy Framework: • Address technical and editorial errors throughout the document; • enable multispecies considerations in setting TACs • include considerations about what to do when a species falls outside the MYTAC period without an updated stock assessment. Discount factors should be also considered on a case-by-case basis. • enable application of discount factors for lower tier assessments be the default process, and that exceptions are only made where the relevant resource assessment group is satisfied there are alternative equivalent precautionary measures in place • include the use of the FishPath tool to determine the 'preferred' Tier 5 methods. • include how RBCs are calculated at each assessment Tier level using HCRs.	AFMA / CSIRO	August 2021
Version 8	To incorporate 'Trigger Species' category and reference to MYTAC Decision Support Tool	Daniel Corrie	March 2024
Version 9	The first criteria for a 'Trigger Species' changed from "*Stock status is estimated to be above the target reference point (TRP)*" to "*Stock status is estimated to be near† or above the TRP*" with the following footnote: *Recognising that HCRs are designed to accommodate natural fluctuations around the TRP, 'near' the TRP refers to situations where the stock biomass (or proxy) is within 10% of the TRP and there is no clear declining trend or evidence of stabilisation below the target.*	Mark Grubert	May 2025
Version 10	Re-introduction of Tier 2 assessments and revision of the Tier 3 and Tier 5 assessment definition. The discount factors implemented to each tier assessment outputs have been updated to 5% for Tier 2, 10% for Tier 3, 15% for Tier 4, and 20% for Tier 5 (25% for trigger species). Review of the criteria for setting TACs where an assessment has been rejected for the different tier levels, along with guidelines added for where a TAC is reduced to constrain catch of a depleted companion species.	AFMA/CSIRO	October 2025

Table 1: Harvest Strategy Summary

Tier level (species vary)	Reference point / trigger point	Reference point function*	Information requirements to monitor reference point	Control rule
Tier 1	B_{20}	Limit	Catch, CPUE, discards, age, length, relative abundance, information from: - Logbook and catch landing records - ISMP - fishery independent data	<B_{20}: No targeted fishing; rebuilding strategy will be developed
	B_{35}	HCR inflection	Same as above	<B_{35}: TACs are set at levels that allow stocks to rebuild to target levels
	B_{48}	Target	Same as above	<B_{48}: Rebuild stocks towards B_{48} >B_{48}: At or above target, fish at F_{48}.
Tier 2	B_{20}	Limit	Catch, CPUE, discards, age, length, relative abundance, information from: - Logbook and catch landing records - ISMP - fishery independent data	<B_{20}: No targeted fishing; rebuilding strategy will be developed
	B_{35}	HCR inflection	Same as above	<B_{35}: TACs are set at levels that allow stocks to rebuild to target levels
	B_{48}	Target	Same as above	<B_{48}: Rebuild stocks towards B_{48} >B_{48}: At or above target, fish at F_{48}.
Tier 3	F_{20}	Limit	Catch, discards, age, length information from: - Logbook and catch landing records - ISMP	>F_{20}: No targeted fishing, rebuilding strategy will be developed

	F_{40}	MSY proxy	Same as above	>F_{40}: TACs are set at levels that allow stocks to rebuild to target levels
	F_{48}	Target	Same as above	>F_{48}: Rebuild stocks towards F_{48} <F_{48}: At or above target, fish at F_{48}.
Tier 4	$CPUE_{20}$	Limit	Catch, effort, discards information from: - Logbook and catch landing records - ISMP	<$CPUE_{20}$: No targeted fishing, rebuilding strategy will be developed
	$CPUE_{40}$	MSY proxy	Same as above	<$CPUE_{40}$: TACs are set at levels that allow stocks to rebuild to target levels

N.B. The Harvest Strategy Policy allows alternative reference points to the recommended defaults - B_{MEY}, B_{MSY}, B_{LIM} - to be used where they better pursue the objectives of the Policy

Table 2: Assessment tier discount factors summary

Tier level	Discount factor	Function
Tier 2	5%	Reduces the TAC derived from the RBC – applied for all species assessed as a Tier 2.
Tier 3	10%	Reduces the TAC derived from the RBC – applied on an individual species basis[1]
Tier 4	15%	Reduces the TAC derived from the RBC – applied on an individual species basis.
Tier 5 (and Trigger species)	20%	Reduces the TAC derived from the TBC – applies on an individual species basis. *Trigger species are not subject to an additional discount factor because the trigger approach effectively provides a discount of at least 25%.

[1] SESSFRAG 4-5 March 2014 recommended guidance for the Commission for when the Tier 3 and Tier 4 discount factors are not applied - see below at section 6.4.1.

All Tier levels	50% Large change limiting rule	TACs between fishing seasons to change by no more than 50% where this will not pose a significant risk to stock status.

Glossary

Types of reference points

Reference point	Description
Metarule	a rule that describes how the RBCs obtained from an assessment should be adjusted in calculating a recommended TAC
Target	relates to a target reference point as per the Harvest Strategy Policy. May be expressed in terms of biomass, fishing mortality or CPUE
Limit	relates to a limit reference point as per the Harvest Strategy Policy. Fishing stops at this reference point. May be expressed in terms of biomass, fishing mortality or CPUE
MSY	maximum sustainable yield
MEY	maximum economic yield
Override	under exceptional circumstances, enables adjustment to a recommended TAC where certain conditions are met; e.g. to take advantage of a “boom” period of highly variable species, or to impose additional restrictions when stocks are thought to under threat.
Inflection point	the reference point below which TACs are adjusted to allow stocks to rebuild to target levels. Also known as a breakpoint

Notation

Notation	Description
B	spawning biomass level
B_{CUR}	the current spawning biomass level
B_0	the unfished spawning biomass (determined from an appropriate reference point)
B_x	the biomass level representing x% of the unfished spawning biomass B_0
B_{LIMIT}	the biomass level limit
F	fishing mortality rate
F_{CUR}	the current fishing mortality rate
F_{TARGET}	the fishing mortality rate target
F_x	the fishing mortality rate which would achieve a spawning biomass level of B_x
M	the natural stock mortality rate

Notation	Description
$CPUE_x$	catch per unit effort which would achieve a spawning biomass level of B_x

Other acronyms

Acronym	Description
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
CDR	Catch Disposal Record
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CPUE	Catch per unit of effort
ERA	Ecological Risk Assessment
FIS	Fishery Independent Survey
GAB	Great Australian Bight
GABTS	Great Australian Bight Trawl Sector
GHAT	Gillnet, Hook and Trap
HSP	Commonwealth Fisheries Harvest Strategy Policy 2007
HSF	Harvest Strategy Framework
HCR	Harvest Control Rule
ISMP	Independent Scientific Monitoring Program
MAC	Management Advisory Committee
MSE	Management Strategy Evaluation
RAG	Resource Assessment Group
RBC	Recommended Biological Catch
SEMAC	South East Management Advisory Committee
SESSF	Southern and Eastern Scalefish and Shark Fishery
TAC	Total Allowable Catch
TEP	Threatened, Endangered and Protected

1 Overview of the SESSF harvest strategy

1.1 The Harvest Strategy Policy

The objective of the *Commonwealth Fisheries Harvest Strategy Policy 2018* (2018 HSP) is the sustainable and profitable use of Australia's Commonwealth commercial fisheries resources (where ecological sustainability takes priority) through the implementation of harvest strategies that maintain key commercial fish stocks, on average, at the required target biomass to produce maximum economic yield from the fishery.

To meet this objective, harvest strategies are designed to pursue an exploitation rate that keeps fish stocks at a level required to produce maximum economic yield (MEY) and ensure stocks remain above a limit biomass level (B_{LIM}) at least 90% of the time. Alternative TRPs may be adopted for some stocks to account for the multi-species nature of the fishery and to better pursue the objective of maximising economic returns across the fishery as a whole.

The HSP provides for the use of proxy settings for reference points to cater for different levels of information available and unique fishery circumstances. This balance between prescription and flexibility will encourage the development of innovative and cost-effective strategies to meet key policy objectives. Proxies must ensure stock conservation and economic performance as envisaged by the HSP. Such proxies, including those that exceed these minimum standards, must be clearly justified.

With a harvest strategy in place, fishery managers and industry are able to operate with greater confidence, management decisions are more transparent, and there are fewer unanticipated outcomes necessitating hasty management responses.

Further detail on how to use harvest strategies is provided in the *Guidelines for the implementation of the Commonwealth Fisheries Harvest Strategy Policy 2018* (*HSP* Guidelines).

1.2 The SESSF Harvest Strategy Framework

The SESSF Harvest Strategy Framework (HSF) sets out the management actions necessary to achieve defined biological and economic objectives, and describes the indicators used for monitoring the condition of stocks, the types of assessments conducted and the rules applied to determine the recommended total allowable catches.

The HSF was developed in 2005. Since that time, it has been reviewed in line with the *Commonwealth Fisheries Harvest Strategy Policy* 2007 (2007 HSP) which was developed to help give effect to the requirements of the Ministerial Direction (2005). A new harvest strategy is in the process of being developed for the SESSF to take into account the objectives of the 2018 HSP. Until the new harvest strategy has been developed, this framework will continue to be implemented (with revisions).

The HSF uses a tiered approach designed to apply different types of assessments and cater for different amount of data available for different stocks. The HSF adopts increased levels of precaution that correspond to increasing levels of uncertainty about stock status, in order to reduce the level of risk associated with uncertainty. In this approach, each stock is assessed using one of five types of assessments depending on the amount, type and quality of information available to assess stock status. Tier 1 represents the highest quality of information available (i.e. a robust integrated quantitative stock assessment), Tier 2 indicates a less robust integrated quantitative stock assessment with uncertain outputs, and Tier 3-5 represents progressively lower quality assessments.

Each Tier has its own HCR that is used to determine a recommended biological catch (RBC). The RBCs provide the best scientific advice on what the total fishing mortality (landings from all sectors plus discards) should be for each species/stock. For all Tier levels, once the RBC is determined from the results of the assessment and the application of the relevant HCR, a recommended total allowable catch (TAC) is calculated based on the TAC setting rules described in section 6.4.

The HCRs for the five tier levels differ depending on the types of indicators used. For Tier 1 and Tier 2, the HCR is based on the following reference points:

- *The limit biomass* B_{LIM} – represents the spawning biomass level below which the risk to the stock is unacceptably high and the stock is defined as "overfished". The default B_{LIM} proxy is B_{20} = 20% of the unfished spawning biomass.
- *The* B_{MSY} – represents the spawning biomass level which would result in a maximum sustainable yield (MSY), which is the point at which additional fishing effort is most likely to decrease the total catch and any profit. The default B_{MSY} proxy is B_{40} = 40% of the unfished spawning biomass.
- *The target biomass* B_{TARG} – represents the spawning biomass level which would result in a MEY, which is the point at which the sustainable catch or effort level for the fishery maximises profits. B_{TARG} is generally equal to B_{MEY}, for which the default proxy is approximated by 1.2*B_{MSY}. If the default B_{MSY} proxy is used, this results in B_{48} = 48% of the unfished spawning biomass.

Tier 3, Tier 4 and Tier 5 assessments use other indicators (relating to fishing mortality, catch rates and catches, respectively) and reference points, which are taken as proxies for the biomass reference points for Tier 1 and Tier 2. The HCRs for each tier level are outlined below.

Under some circumstances, an assessment tier or approach that has previously been used for determining a species/stock RBC is no longer appropriate and options are provided below as to possible alternative actions. These circumstances include:

- that CPUE is no longer an index of abundance (1.2.3);
- the data available does not enable an acceptable assessment (6.4.11);
- productivity shifts (6.4.10); and

- where species are no longer targeted (by-product) and have high discards (6.4.2).

1.2.1 Tier 1

A Tier 1 stock assessment uses an integrated biological and statistical approach that combines a wide variety of data inputs, generally including CPUE, other abundance indices and size and age composition. The Tier 1 HCR applies to species and/or stocks where there is a robust quantitative assessment that provides estimates of current biomass levels, and where estimates or appropriate proxies are available for B_{LIM}, B_{TARG} and F_{TARG}. The default targets and limits are set to comply with the HSP. The RBC is calculated by applying target fishing levels determined from the HCR to the current biomass, to calculate the total catch (including discards) in the next year, using the agreed base case assessment model.

In some circumstances, a different TAC to that produced by the Tier 1 HCR may be set - refer to section 6.4.7.

1.2.2 Tier 2

A Tier 2 stock assessment uses the same approaches and data inputs as a Tier 1 stock assessment (i.e. an integrated assessment) but is considered less robust. A species and/or stock is considered for a Tier 2 assessment due to one or more of the following:

- **Model instability or diagnostic concerns:** poor fits to data, weak model diagnostics, conflicting signals across data inputs, or retrospective patterns may indicate instability in model outputs or underlying problems with model structure or data quality.
- **Significant methodological changes:** significant changes in assessment approach or the quality of data inputs into an assessment can introduce uncertainty about future performance. However, if the new method is well understood (e.g. MSE tested), improves on the previous assessment, uses reliable data, and is implemented using well-established practices, it may still quality for Tier 1.
- **New or unproven assessments:** newly developed assessments that may increase the risk, or if applied to a stock for the first time, may be Tier 2 due to initial uncertainty in the assessment. However, if the method is well understood, uses reliable data, and is implemented using well-established practices, it may still qualify for Tier 1. A new assessment approach may have preliminary support but has not yet been tested in the context of the fishery, whereas an unproven assessment is untested and lacks evidence of reliability and required further testing of a methodological change[2].

[2] Total Allowable Catch (TAC) setting process. Guidelines for provision of data and stock assessment processes (2021). Australian Fisheries Management Authority.

1.2.3 Tier 3

A Tier 3 stock assessment uses information available on the age structure of annual catches and annual total catch weight, as well as knowledge of basic biological parameters, e.g. natural mortality, length at age, weight at length, fecundity at age and selectivity at age. The estimation of current fishing mortality is made using all this information. Tier 3 assessments may also include data-limited population dynamic models and simple surplus production models.

The catch control rule uses the ratio of the target exploitation rate to the actual exploitation rate as a multiplier on the current average catch to determine the RBC. The previous Tier 3 analysis is no longer being used but the Tier remains for possible future use.

LRPs and TRPs, which may be estimated using a yield-per-recruit analysis, are applied to the fishing mortality and are comparable to the LRPs and TRPs used in the Tier 1 HCR. The period over which average current catch is estimated is chosen to match the period to which the estimated fishing mortality applies. The estimate of fishing mortality is limited to not less than 0.1 of natural mortality.

1.2.4 Tier 4

The Tier 4 assessment is based entirely on catch and CPUE.

The Tier 4 analysis determines an RBC by selecting CPUE reference points that are taken as proxies for the estimated B_{LIM} and B_{TARG}. This is done by assuming that the CPUE is proportional to stock abundance, an assumption that is made in most SESSF assessments. If the stock was at unexploited equilibrium at the start of fishing, then the initial CPUE level at the start of the time series would correspond to the unexploited biomass or B_0, and the other reference points are the appropriate fractions of this (e.g. 20% for B_{20}). For most SESSF stocks there is not a full CPUE time series back to the start of fishing, so it is necessary to choose a reference period from the data series that we do have where we think we can make a reasonable estimate of the level of depletion of the stock. Most SESSF species are considered to be fully exploited by 1986, so a reference period against which current rates are compared is chosen around this time when CPUE levels and catches were relatively stable. The default period is 1986-1995, but other periods are used for some species and fisheries which were not fully developed in 1986.

It is then assumed that during the reference period the stock was at the level that will provide maximum economic yield, i.e. the CPUE corresponds to B_{MEY} (which as a default is assumed to be B_{48}). This is why, for these stocks, the Tier 4 rule uses the average CPUE in the reference period as a CPUE target, and the average catch in that period as a catch target.

Dynamic Tier 4

A ‘Dynamic’ Tier 4 assessment is a surplus production model fitted to CPUE data, where the sustainable yield is assumed to occur during a historical period of pre-determined reference years.

Unlike the standard Tier 4, and depending on data availability, the Dynamic Tier 4 can estimate some or all of the parameters of the production function such as the intrinsic rate of population increase parameter (*r*), mortality corresponding to B_{MSY}/B_0 (*z*), and the maximum population size parameter (*K*).

Testing through Management Strategy Evaluation (MSE) has shown that Dynamic Tier 4 assessments perform better than the standard method for several SESSF species (e.g. tiger flathead, redfish, school whiting), using the same data inputs. It is less sensitive to the choice of reference years and recent CPUE changes, and it produces more stable RBCs.

Where CPUE does not index the biomass of the stock, the application of a tier 5 assessment method should be explored.

1.2.5 Tier 5

Tier 5 assessments include a wide range of alternative assessments methods including weight-of-evidence approaches (incorporating expert judgement and multiple indicators), indicators derived from data-limited stock assessments (e.g. $Catch_{MSY}$), or indicators derived from risk-based assessments. These may be adopted in certain circumstances as outlined in paragraph 6.3.4 below.

Trigger species, introduced under section 6.4.4 Species categories and TAC periods, are also considered Tier 5 assessments but are subject to specific management rules.

1.3 Alignment of the HSF with the HSP

The HSF meets the requirements of the 2018 HSP by applying a precautionary approach, standards for reference points, and measures to be implemented in accordance with the reference points as specified in the 2018 HSP. These are reflected in the use of a tiered approach to control rules, and decreases in exploitation rates as the stock size decreases below a TRP. Discount factors will also be applied at lower Tiers to account for the inherent uncertainty with these approaches. Exception will only be considered where the resource assessment group is satisfied there are alternative equivalent precautionary measures in place. The HSF involves the use of MEY as a target, a biomass LRP to trigger no further targeted fishing, and the proxies B_{LIM} = 20% of B_0, B_{MSY} = 40% of B_0, and $B_{MEY} = 1.2B_{MSY}$. The HSF also requires rebuilding strategies for stocks below B_{LIM}, and TACs are set an appropriate level to rebuild stocks to B_{MSY} or B_{MEY} in line with the HSP.

For multi-species fisheries, the HSP requires MEY to be applied to the fishery as a whole and optimised across all species in the fishery. This means that not all species can be maintained at an MEY target, and some species may be fished at levels that will result in their biomass remaining below B_{MEY}, but above B_{LIM}. The SESSF will continue to move towards applying MEY at fishery level, but the way that this can be best achieved may develop over time.

1.4 Governance

The status of fish stocks in the SESSF, and how they are tracking against the HSF, is reported to the RAGs, MACs and AFMA Commission as part of the yearly TAC Setting process (see section 6.1). Stock assessments for each quota species, produced by the RAGs each year, include consideration of the catch rates for each quota species in the current and previous fishing years, how catches compare to the TAC, where the stock status indicators sit in relation to the reference points, and a RBC for the upcoming fishing year. The TACs are determined by the AFMA Commission on the basis of the RBCs and advice from the RAGs, MACs, and AFMA Management.

2 Background to the SESSF

An overview of the fishery can be found in the latest SESSF Management Arrangements booklet, which is available on the AFMA website at: https://www.afma.gov.au/commercial-fishers/management-arrangements/management-booklets#referenced-section-10

3 Commercial species or stocks and ERA priority

This HSF applies to all 34 species subject to quota (including target and non-target species) in the SESSF. An Ecological Risk Assessment (ERA) was first conducted for the SESSF in 2007 to assess the impact of fishing on those species not subject to stock assessments under this HSF. The ERA was updated in 2012 to include distribution and effort data from 2007-2010 in the fishery, and again in 2019 for the period 2012-2016. Further information can be found in the Guide to AFMA's Ecological Risk Management Framework.

4 Objectives of the SESSF Harvest Strategy

4.1 Biological

- To maintain stocks at (on average), or return to, a target biomass point B_{TARG} or equivalent proxy (e.g. F_{TARG} or $CPUE_{TARG}$) equal to the stock size that aims to maximise net economic returns for the fishery as a whole.
- To maintain stocks above the limit biomass level, or an appropriate proxy, at least 90% of the time.
- A reduced level of fishing if a stock is below B_{TARG} but above B_{LIM} (or an appropriate proxy).
- To implement rebuilding strategies, no-targeting and incidental bycatch TACs if a stock moves below B_{LIM} (or an appropriate proxy).
- To ensure the sustainability of fisheries resources, including consideration of the individual fishery circumstances and individual species or stock characteristics, when developing a management approach.

4.2 Socio-economic

- To maintain stocks at (on average), or return to, a target biomass point B_{TARG} equal to the stock size that aims to maximise net economic returns for the fishery as a whole.
- To maximise the profitability of the fishing industry and the net economic returns to the Australian community.
- To minimise costs to the fishing industry, including consideration of the impacts on the industry of large or small changes in TACs and the appropriateness of multi-year TACs.

4.3 Ecosystem

To be consistent with the principles of ecologically sustainable development, including the conservation of biological diversity, and the adoption of a precautionary risk approach.

5 Monitoring

The biological and economic conditions in the fishery are monitored by the following three methods:

5.1 Logbooks and catch records

AFMA requires fishers to record catch and effort information in logbooks at sea, and in catch disposal records (CDRs) which record the actual landed catch at port. CDRs are considered more accurate than logbook records.

The following data is recorded for each fishing operation: the port and date of departure and return; gear type and fishing method; number of fish kept and discarded; and resultant catch including what is included in the weight (e.g. trunked, gutted, filleted, whole). Further information on logbooks and CDRs is available at: www.afma.gov.au/fisheries-services/logbooks-and-catch-disposal

5.2 The Integrated Scientific Monitoring Program (ISMP)

A key component of the ISMP is the sampling and recording of catches at ports and on-board fishing vessels using fishery-independent observers. The purpose of the ISMP is to provide reliable, verified and accurate information on the fishing catch, effort and practice of a wide range of vessels operating inside and, periodically, outside the Australian Fishing Zone.

Biological and environmental data are collected on: catch composition including size and weight; amount and type of incidental catch; number of fish kept and discarded; fate of target and non-target species; interactions with (Threatened, Endangered and Protected) TEP species; and fishing effort. Further information on the Observer program is available at: www.afma.gov.au/fisheries-services/observer-services

5.3 Fishery independent data

The Fishery Independent Surveys (FIS) are industry-based fishery-independent resource surveys that provide a time-series of relative abundance indices for key target species. A FIS trawl survey has been conducted for deepwater flathead and Bight redfish in the Great Australian Bight Trawl Sector (GABTS) every two to three years since 2005. And for other areas in the SESSF, these were conducted for key target species biannually from 2008 to 2016.

Biological and environmental data are collected such as target species, catch rate (kg/shot), fishing method and fishing depth. Information which provides a relative abundance index of other main byproduct and incidental catch species is also obtained.

Current methods of collecting fishery independent data in the SESSF include (but not limited to):

- acoustic surveys of the eastern zone and Cascade Plateau orange roughy stocks and the blue grenadier spawning aggregation;
- trawl surveys in the GABTS for deepwater flathead and Bight redfish; and
- close-kin mark recapture (CKMR) is currently applied for school shark and is being explored for other species.

Other methods for collecting fishery independent data in the SESSF are begin explored.

5.4 Data Availability

The ability to meet the objectives of the HSF relies on obtaining the required data in time for stock assessments to be carried out.

Future information and ongoing monitoring requirements are identified through regular reporting from the above monitoring programs, and regular meetings of RAGs which are responsible for overseeing and managing the stock assessment process under the HSF.

6 Reference points and decision rules

6.1 TAC setting process

The data used for input into the stock assessment process are collected by the ISMP, AFMA logbooks and CDRs and independent data sources (such as FISs, acoustic surveys, CKMR). Otoliths from the biological sampling are provided to a private contractor for ageing. All catch, effort, sampling and age data along with fishery independent data sources are provided to stock assessment scientists for analysis or reporting. The analyses are then discussed by RAGs, which produce final stock assessment reports for quota species in the SESSF at the end of each calendar year.

The stock assessment reports provide RBC amounts for each quota species. Each stock is assessed under the appropriate Tier level as advised by the RAGs and SESSFRAG.

In mid-December, AFMA produces a position paper with recommended TACs for quota species for the upcoming fishing season, based on the stock assessments and RAG advice. The paper is distributed to interested parties and undergoes a public comment period. For some GAB species, TAC recommendations are conducted according to a pre-agreed set of decision rules, which are associated with the FIS or CPUE and incorporated into the TAC-setting cycle.

In early February, a SEMAC TAC Setting meeting is held where TAC recommendations are made.

The outcomes of RAGs and SEMAC, together with the AFMA position paper and any public comments received, are then sent to the AFMA Commission to determine TACs for the upcoming fishing season in mid-February. In determining the TACs, the AFMA Commission may provide AFMA with direction in instances where there is concern that current management strategies for depleted or at risk stocks may not meet the objectives of the HSP in a timely manner. The TACs for Bight redfish and deepwater flathead are set using the decision rules outlined in section 6.5 under co-management arrangements with the Great Australian Bight Fishing Industry Association.

6.2 Stock status and reference points

Stock status is expressed in relation to the reference points prescribed in the HSP, and is measured in terms of biomass (B, the size of the stock) and fishing mortality (F, the level of fishing pressure on a stock).

Reference points in the HSP Guidelines are:

- TRPs: express the desired status of stocks (B_{TARG}) and desired fishing intensity (F_{TARG}). The biomass target level for individual stocks may vary in order to achieve overall maximum economic yield from the fishery and are generally set at:
    - B_{MEY} (the stock biomass required to produce maximum economic yield from the fishery); or
    - B_{MSY} (average biomass that corresponds to maximum sustainable yield).
- LRPs (B_{LIM} and F_{LIM}) express situations to be avoided because they represent a point beyond which the risk to the stock is regarded as unacceptably high.

The target fishing mortality rate F_{TARG} represents the fishing mortality rate that would result in a spawning biomass of B_{TARG} (equal to B_{MEY}). The default value for F_{TARG} is F_{48}, the value of *F* corresponding to a B_{TARG} of B_{48}.

The HSP Guidelines provide that in multi-species fisheries MEY applies to the fishery as a whole and is optimised across all species in the fishery. As a result, alternative TRPs may be adopted for some stocks to account for technical interactions and the multi-species nature of the fishery, and to better pursue the objective of maximising economic returns across the fishery as a whole. In such

circumstances, the estimated biomass of these stocks must be maintained above their LRP, B_{LIM}. Consideration should also be given to:

- demonstrating that economic modelling and other advice clearly supports such action;
- no cost-effective, alternative management options (e.g. gear modification or spatial management are available); and
- the associated ecosystem risks have been considered in full.

Consideration should also be given to whether the quota species is targeted, its contribution to the value of the fishery, any sustainability concerns and the level of quota latency for that species.

Further information about how stock status is assessed is contained in the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) Fishery Status Reports[3].

6.3 Determining RBCs using HCRs

HCRs use TRPs and LRPs, and an indicator/s of stock status (biomass, depletion, CPUE), to guide management decisions relating to future catch (or other management measure). HCRs are often depicted as a phase diagram comparing fishing mortality against biomass, or variants of this, such as recommended catch versus catch rate (for example, the SESSF Tier 4). A generic HCR is provided in Figure 1 (from Haddon *et al*. 2012[4]), that shows the elements of a HCR (but is not the one used in the SESSF). In general, the key elements of these control rules are:

- that fishing mortality reduces to zero (or is greatly limited) once the biomass is estimated to be below an agreed biomass LRP.
- that fishing mortality is reduced if above the target fishing mortality rate; and
- that the recommended fishing mortality when above the target biomass is constant at the fishing mortality that will reduce the stock to the target biomass. This allows increased catches when above the target biomass.
- there is a linear decline in recommended fishing mortality from the biomass breakpoint to the limit. This is designed to promote rebuilding to the target biomass.

HCRs also often include a buffer region due to the potential imprecision in assessment of stock status as the input to the control rule (Haddon *et al.,* 2012). The HCR of Figure 1 assumes that once the estimated stock status is below the target, it immediately reduces fishing mortality (and thereby catch). Due to natural fluctuation in abundance, even a perfect assessment of status would lead to biomass estimates that move between being under and over the target biomass, resulting in

[3]Patterson, H, Larcombe, J, Woodhams, J and Curtotti, R 2020, *Fishery status reports 2020*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. CC BY 4.0.

[4] Haddon, M., Klaer, N., Smith, D.C., Dichmont, C.D. and A.D.M. Smith (2012) *Technical reviews for the Commonwealth Harvest Strategy Policy*. FRDC 2012/225. CSIRO. Hobart. 69 p.

considerable reductions in fishing mortality when below target. To improve stability, the point at which the fishing mortality rapidly declines can be less than the target biomass, allowing a buffer to assessment imprecision and natural variation in stock size (Tier 1; **Figure 2**; see Day, 2009[5]).

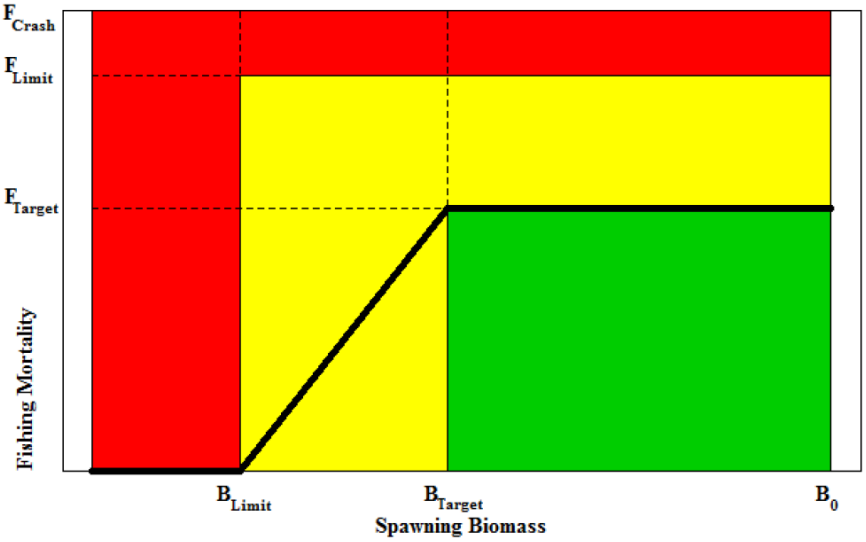


Figure 1. A generic HCR showing the relationship between fishing mortality and spawning biomass related reference points. The red area reflects situations where a stock would be experiencing overfishing and be overfished. The green area would be considered as under-fished and under-fishing, while the yellow areas reflect areas where the harvest control rule (thick black line) would act to reduce catches and fishing mortality to move the stock back towards the targets[6] (from Haddon et al., 2012).

6.3.1 Tier 1

The Tier 1 HCR applies to species and/or stocks where there is a robust quantitative assessment that provides estimates of current biomass levels (B_{CUR}) and where estimates are available for B_{35}, B_{20} and F_{48}.

The maximum recommended fishing mortality rate from the Tier 1 HCR is F_{MEY} (the default proxy for which is F_{48}) (**Figure 2**). The HCR inflection point occurs at B_{35} (see Table 1 and section 6.3). The breakpoint, or HCR inflection point, at B_{35} occurs at the intersection of the 20:40:40 trajectory and F_{48} (**Figure 2**). The F determined by the HCR is constant at F_{48} when biomass is between B_{35} and B_{48} to allow a discount factor to account for the uncertainty in the outputs of a Tier 1 assessment, and only reduces fishing mortality once the stock is below B_{35}. If $\underline{B<B_{35} \text{ or } F>F_{48}}$, the control rule reduces fishing mortality to limit catch (Haddon *et al.,* 2012).

The formula for calculating F_{TARG} is as follows:

[5] Day, J. (2008) Modified breakpoint for the 2008 Tier 1 HCR, report to the Shelf Resource Assessment Group 6 November 2008.

[6] Haddon, M., Klaer, N., Smith, D.C., Dichmont, C.D. and A.D.M. Smith (2012) *Technical reviews for the Commonwealth Harvest Strategy Policy*. FRDC 2012/225. CSIRO. Hobart. 69 p.

F_{TARG}	Biomass level
$F_{TARG} = F_{48}$	where $B_{CUR} > B_{35}$
$F_{TARG} = F_{48} * (B_{CUR}-B_{20})/(B_{35}-B_{20})$	where $B_{35} > B_{CUR} > B_{20}$
$F_{TARG} = 0$	where $B_{CUR} < B_{20}$

The RBC is calculated by applying F_{TARG} to the current biomass B_{CUR} to calculate the total catch (including discards) in the next year, using the agreed base case assessment model:

$$RBC = Catch[F_{TARG} \rightarrow B_{CUR}]$$

At Tier 1, $B_{LIM} = B_{20}$, the maximum value for $F_{TARG} = F_{48}$ and the breakpoint in the HCR occurs at B_{35}. Alternative reference points may be adopted for some stocks to account for the multi-species nature of the fishery and to better pursue the objective of maximising economic returns across the fishery as a whole.

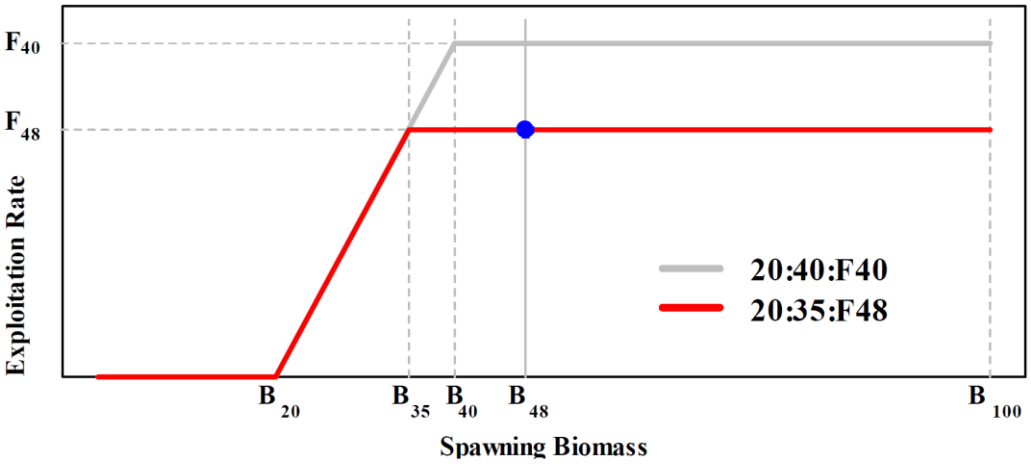


Figure 2: The harvest control rule for Tier 1 assessments in the SESSF, with a breakpoint at *B35* as a modification of the older 20:40:40 rule to become 20:35:48. The blue dot represents the biomass and fishing mortality targets (Day, 2009)[7].

6.3.2 Tier 2

Tier 2 assessments follow the same fundamental modelling approach as Tier 1 (e.g. integrated assessments) but are classified separately due to reduced robustness such as diagnostic concerns, significant methodological changes (data inputs (i.e. gear method changes) or/pr assessment methods) or being newly developed or unproven.

Accordingly, the HCR applied to Tier 2 is the same as Tier 1. To account for the increased uncertainty and reduced reliability of Tier 2 assessments, a discount factor is applied to the RBC output – see

[7] Haddon, M., Klaer, N., Smith, D.C., Dichmont, C.D. and A.D.M. Smith (2012) *Technical reviews for the Commonwealth Harvest Strategy Policy*. FRDC 2012/225. CSIRO. Hobart. 69 p.

6.4.1 Discount Factor. This precautionary adjustment ensures that management remains conservative in the face of greater assessment uncertainty.

6.3.3 Tier 3

The Tier 3 HCR applies to species and/or stocks that do not have a quantitative stock assessment, but where estimates of fishing mortality and other biological information are available[8].

Yield per recruit calculations are used to calculate *F* values that will reduce the spawning biomass to 20% (F_{20}), 40% (F_{40}) and 48% (F_{48}) of the unexploited level. The relationship given in **Figure 3** is then used to assign a value for F_{RBC} using F_{CUR}. This relationship has properties similar to the Tier 1 HCR, with the default proxies of F_{20} as the limit and F_{48} as the target fishing mortality rate.

The recommended maximum fishing mortality rate from the Tier 3 HCR is F_{MEY} (the default proxy for which is F_{48}) (see **Figure 3**). This represents the fishing mortality rate that would cause the spawning biomass to equilibrate at a biomass of B_{MEY} (the default proxy for which is B_{48}).

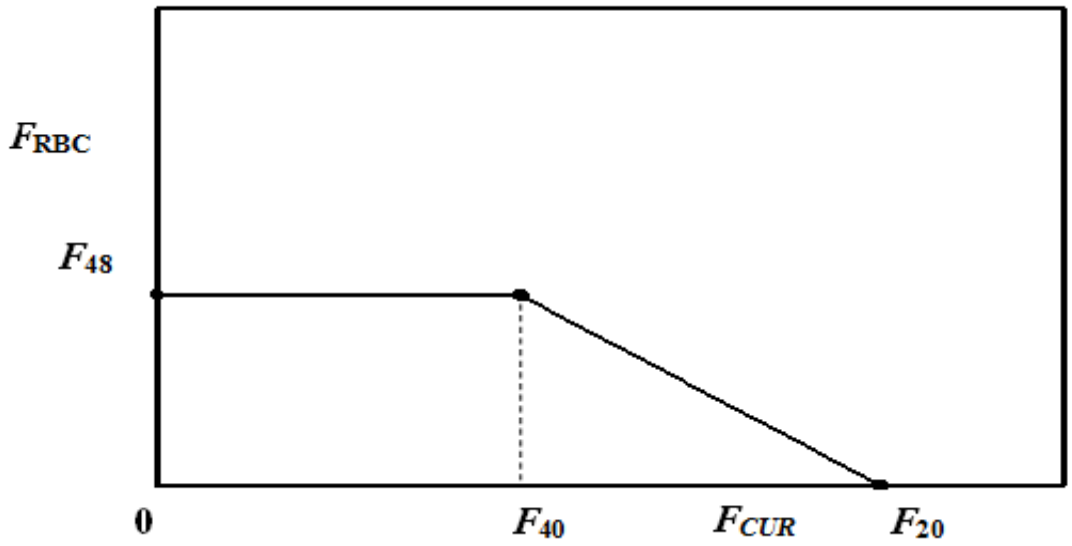
The following formula, which adjusts the current catch C_{CUR} according to the ratio of the intended and current exploitation rates, is then used to calculate the recommended biological catch C_{RBC}:

$$C_{RBC} = \frac{(1 - e^{-F_{RBC}})}{(1 - e^{-F_{CUR}})} C_{CUR}$$

where F_{CUR} is the estimated current fishing mortality, and F_{RBC} is the selected *F* for the recommended biological catch from the control rule. The estimate of fishing mortality is limited to be no less than 0.1 of natural mortality.

[8] Tier 3 HCR is not currently applied to any of the SESSF species.

Figure 3. Method for selecting F_{RBC} based on F_{48} target and estimated F_{CUR}



6.3.4 Tier 4

The Tier 4 HCR applies to species and/or stocks where there is no reliable information available on either the current biomass or current exploitation rate. It is assumed that there is a time series of total catches and of standardised CPUE, along with an agreed reference period and reference points.

The Tier 4 control rule is of the form:

$$RBC = C * \max\left(0, \frac{\overline{CPUE} - CPUE_{\lim}}{CPUE_{t\arg} - CPUE_{\lim}}\right)$$

where:

$CPUE_{targ}$	is the target CPUE for the species
$CPUE_{lim}$	is the limit CPUE for the species
$\overline{CPUE}$	is the average CPUE over the most recent *m* years
*C**	is a catch target derived from a historical period that has been identified as a desirable target in terms of CPUE, catches and status of the fishery, e.g. 1986 – 1995. It is an average of the total removals for the selected reference period, including any discards.

The form of the rule is shown in **Figure 4.** The linear form of this control rule can theoretically result in large catches at high CPUE levels, however, MSE testing has shown that the large change limiting meta-rule does not allow changes of more than 50% of the previous RBC (in either direction) adequately controls fishing mortality. The multiplier is set to zero when the CPUE is below the limit, thereby setting an RBC of zero.

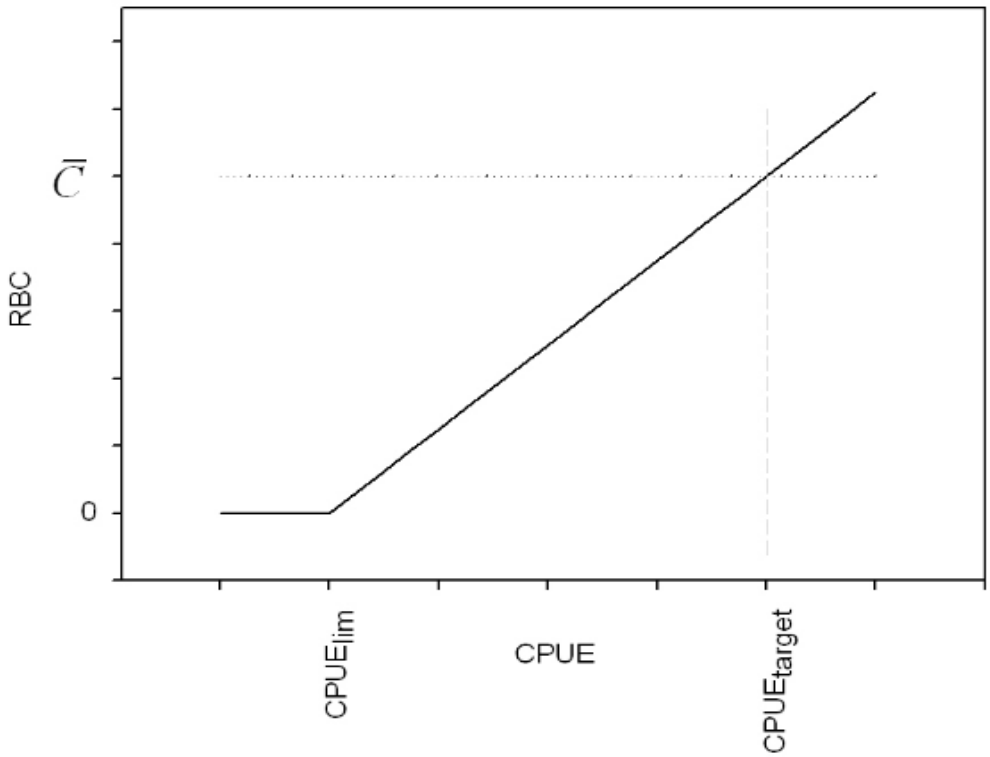


Figure 4. Graphical representation of the Tier 4 harvest control rule. $\overline{C}$ is the average catch over the most recent m years.

6.3.5 Tier 5

The RAG may make RBC recommendations based on Tier 5 or 'alternative assessment methods where it considers the method:

- is more appropriate for a quota species than the assessment method outlined for Tier 1 to Tier 4; and
- meets the intent of the HSP.

In such circumstances, the RAG should apply a discount factor of 20% (see 6.4.1) and provide advice on the expected reliability of any associated HCR.

A variety of 'Tier 5' approaches have been used to inform TAC setting, including weight-of-evidence approaches (incorporating expert judgement and multiple indicators), indicators derived from data-limited stock assessments (e.g. Catch$_{MSY}$), or indicators derived from risk assessments. These may

be applied when Tier 1, 2 or 3 assessments are unable to be undertaken, and when CPUE is unavailable or does not index the biomass of the stock.

In August 2021, SESSFRAG advised that the performance indicators informing the RBC advice be based on the outputs of Tier 5 methods identified using the FishPath tool. If performance indicators cannot be agreed upon given the assessment options identified using FishPath, then an independent weight-of-evidence approach may be used. The resulting performance indicators can then be used in a HCR analogous to the Tier 1-4 rules described above, provided appropriate (in some cases, proxy) TRPs and LRPs can be identified.

Trigger species fall into the Tier 5 category but the TAC is not derived from a "Tier 5 HCR" as such. See section 6.4.4 for how the TAC is set for trigger species.

6.4 Determining TACs from RBCs

The following metarules are applied to the RBCs that are derived from the application of the HCRs. The metarules for discount factors, state catch, discards, research catch allowance and the large change limiting rule are applied in the order below. The other metarules may be applied in the circumstances described. On the basis of the RBCs, TACs may be reduced to support stock recovery and prevent stocks from becoming overfished in the future. Note that the TACs for Bight Redfish and Deepwater flathead are set using the decision rules outlined in section 6.5 (GABTS decision rules) under co-management arrangements with the Great Australian Bight Fishing Industry Association.

6.4.1 Discount Factor

Consistent with the HSP, which establishes a more precautionary approach to HCRs for species with assessments that are more uncertain, it is considered appropriate to apply a discount factor to the RBCs derived from Tier 2-5 assessments. The discount factors to be applied are 5% for Tier 2, 10% for Tier 3, 15% for Tier 4 and 20% for Tier 5. These values take account of the relative uncertainties in the assessments and reference points at each of these Tier levels. Trigger species are subject to triggers at 25% of the agreed TAC, which effectively acts as a discount factor, and are not subject to additional discounts.

The application of the rule can be shown as follows:

Tier 2: $$RBC_{DISC} = RBC\left(1 - \frac{5}{100}\right)$$

Tier 3: $$RBC_{DISC} = RBC\left(1 - \frac{10}{100}\right)$$

Tier 4: $$RBC_{DISC} = RBC\left(1 - \frac{15}{100}\right)$$

Tier 5: $$RBC_{DISC} = RBC\left(1 - \frac{20}{100}\right)$$

While the application of discount factors is the default process, exceptions may be considered where a RAG is satisfied that demonstrable alternative equivalent precautionary measures are in place.

When other sources of mortality arising from discarded catch, or catch taken by other jurisdictions (e.g. state, recreational and indigenous sectors) or research catch allowance are included in assessments, they are subtracted from the RBC to produce a Commonwealth TAC.

The quantity of discards to be deducted should be based on the best available data whether this is derived from observers, logbooks verified by electronic monitoring or other sources.

The discarded catch and state catch are generally estimated for the following fishing season using a four-year weighted average. Estimates are weighted in the ratio of 8:4:2:1 for the most recent four years, with most weight given to the most recent year.

For Tier 4 assessments, if discards or state catches are included in the reference period catches, *C*,* they should be deducted from the RBC to calculate the TAC (see section 6.3.3. above).

When estimating state catch, the impact of management changes in state fisheries (e.g. new spatial closures) are to be considered to forecast the state catch in the following year.

Where appropriate, the methods used to estimate future discards and state catches may be varied if an alternative method is expected to provide a more reliable estimate. This may be appropriate if there are management changes in state fisheries.

To ensure consistency between the RBCs derived through stock assessment models and the resultant TAC, where a stock assessment model is used to estimate a future discard rate, this estimate should be used in determining the TAC.

Species that have high discards (by-product species) should be assessed using a risk-based methodology. TAC setting should be based on the existing TAC (since the TAC is not controlling catch), subject to sustainability concerns and the consideration of whether the TAC is restricting catches of that or other species. Annual monitoring should be undertaken of available fishery indicators on a weight of evidence basis, including SAFE assessments, where available. If fishing mortality needs to be constrained, management measures other than output controls should be considered by SEMAC and AFMA.

The total research catch allowance (RCA) is set by the AFMA Commission when determining TACs for the season and must be consistent with the species/fishery harvest strategy. The RCA is typically deducted from the RBC but may also be set even if the RBC is zero to support research. Research catch allowance is deducted from the RBC as determined by the Commission in accordance with AFMA's *Research Catch and Effort Allowance Policy 2007.*

6.4.2 Latest CPUE Multiplier Rule

This rule is no longer applied.

6.4.3 Large Change Limiting Rule

This rule is designed to limit large changes (up or down) in the TACs from year to year. It is applied last in the sequence of rules and compares the recommended TAC derived after applying the first three rules, with the actual TAC for the previous fishing year.

To limit excessive changes from season to season in the TACs, an override may be applied for some species in setting TACs for the next fishing season, such that the TACs will not change up or down by more than 50% from the previous fishing season where this will not pose a significant risk to stock status. For multi-year TACs, the large change limiting rule may be applied for each year of the period until the RBC is achieved.

6.4.4 Species categories and TAC periods

For the purpose of scheduling stock assessments and setting TACs, SESSF species are categorized into one of three groups based on current stock status (or estimate of fishing mortality - F), percentage of TAC caught, and whether they are a commercial species likely to be nominated as indicators or non-indicators under a revised multi-species harvest strategy (MSHS)[9].

Each year, SESSFRAG identifies species belonging to one of the categories and provides advice regarding TACs, including timeframes and assessment options. Further information is available in the supporting document – TAC Setting Decision Support Tool.

Multi-year TAC (MYTAC) Species

- Stock status is estimated to be between the LRP and TRP; or
- TAC is more than 75% caught; or
- Flagged as a commercial indicator species under a MSHS approach.

Decision rules for setting TACs:

- Update stock assessment; or
- Maintain MYTAC; or
- Review fishery indicators and provide advice regarding assessment/TAC options.

For Tier 1 and Tier 2 species, multi-year TACs should be set using assessment projections and probability estimates. Multi-year TACs for Tier 3, Tier 4 and Tier 5 species are to be determined on a per species basis by the individual RAGs. Where a species' assessment has not been updated within the proposed MYTAC period, the last base case may be re-run to incorporate reliable recent data, to generate an additional year's RBC. Discount factors to account for time-induced risk, should be considered on a case-by-case basis.

[9] Multi-species Harvest Strategy (MSHS) approach – see FRDC Project Report and Harvest Strategy Transitional Arrangements.

In setting a multi-year TAC, the multi-year RBC is applied for each year in the period, with updated state catches, discards and research catch allowance to be deducted annually for the purposes of determining the TAC.

Trigger Species

- Stock status is estimated to be near[10] or above the TRP, or $F<F_{MSY}$; and
- TAC is less than 75% caught; and
- Flagged as a non-indicator species under MSHS approach.

Decision rules for setting TACs:

- Maintain current TAC if it has been less than six years since the last assessment and set trigger at 75% of current TAC (or other lower limit as agreed and documented by relevant RAG); or
- Review fishery indicator data if it has been more than six years since the last assessment and provide advice regarding assessment/TAC options.

A review of fishery indicator data is required if it has been more than six years since the last stock assessment. Trigger species are typically characterised by low catches and are often 'data poor' which means traditional stock assessment approaches may not be possible. The RAG should consider assessment options and provide advice regarding appropriate TACs, triggers and data requirements for the following six-year period.

Depleted Species

- Stock status is estimated to be below the LRP.

Decision rules for setting TACs:

- Review available data and set annual bycatch TAC in accordance with rebuilding strategy. Prioritise data collection for relevant species and update metier analyses as required.

6.4.5 Step up or step down TACs

A different TAC to that produced by applying the HCR and the meta-rules above may be adopted in limited circumstances. This may occur where there is a step up or step down in the TAC to achieve the RBC over a number of years. A step up or step-down TAC may be set to reduce the economic impact of a significant change in RBC and allow fishers time to adjust their operations where the:

- TAC best pursues AFMA's objectives and the objectives of the HSP

[10] Recognising that HCRs are designed to accommodate natural fluctuations around the TRP, 'near' the TRP refers to situations where the stock biomass (or proxy) is within 10% of the TRP and there is no clear declining trend or evidence of stabilisation below the target.

- RAG provides advice on the biological risk to the stock of adopting a step up or step down TAC.

6.4.6 Setting a TAC outside the Tier 1 HCR

In some circumstances it may be appropriate to set a TAC different to that produced by the Tier 1 HCR, for example, where the Tier 1 HCR produces a TAC below the incidental bycatch of the species. A TAC different to that produced by the Tier 1 HCR may be set where the:

- stock is estimated to be above B_{LIM} but below B_{TARG}
- probability of the stock being below B_{LIM}, both at the date of the assessment and in future years, is assessed to meet the HSP objective of ensuring that the stock stays above B_{LIM} at least 90% of the time (i.e. less than a 1 in 10-year risk that stocks will fall below B_{LIM})
- relevant RAG considers that the time that the stock is estimated to take to rebuild to B_{TARG} under the proposed TAC is appropriate given the HSP and biology of the stock.

6.4.7 Incidental bycatch TACs where the RBC is zero

Where the RBC is zero, an incidental bycatch TAC may be set after considering:

- the impact of incidental catches on rebuilding of the stock
- non-targeted catch based on:
    - landed catch
    - logbook discards
    - ISMP estimates of discards
- RAG or MAC advice on whether the incidental bycatch TAC should be adjusted to account for any inefficiency in the quota market for that stock
- RAG or MAC advice on their understanding of the level of targeting and the ability of operators to avoid catching the stock (informed by a companion species analysis)
- whether other management arrangements (including those in the relevant Rebuilding Strategy) have been, or are proposed to be, implemented to prevent targeting.

6.4.8 Variability, regime shift and climate change

Until the new SESSF harvest strategy is developed, TACs should be based on recent recruitment scenarios rather than average recruitment if there is evidence of a productivity change, as recommended by the RAG[11]. The Climate Risk Framework (CRF) support this by integrating climate risk into the decision-making process by identifying climate driven changes in stock biomass and productivity into the TAC setting process.

[11] Unless a regime shift has been identified.

6.4.9 Setting a TAC where assessments have been rejected

Where an assessment has been rejected, the current TAC should be reviewed to assess if there are sustainability concerns that require further adjustments and a more precautionary approach (i.e. a discount factor applied or increased).

Assessors should present the RBCs for longer-term projections (e.g. beyond the usual MYRBC period and those projections used if the new assessment is rejected. Where relevant, consideration should be given to collecting more data, dropping the tier of the assessment (if available), or considering alternative assessment approaches for future use while ensuring that agreed approaches for considering new assessment methodologies is followed.

6.4.10 Setting a TAC where a MYRBC year has been extended

For species that has not undergone a stock assessment in the final year of a MYTAC, the TAC will be informed by the most recent RBC advice. In determining the TAC, consideration will be given to factors such as recent catch history (e.g. percentage of TAC caught), stock status relative to limit reference points, available discard estimates, and climate-related risk indicators. In the absence of sustainability concerns, the MYTAC may be extended by using the most recent RBC, minus other sources of mortality; however, priority should be placed on completing an updated assessment.

Where a TAC is extended beyond the original MYRBC for more than one season, an additional discount factor should be considered. The discount factor selection may be informed by adopting a continuation of the proportional reduction in the 'annual RBC' projection provided in the most recently accepted assessment, or risk profiles from constant catch projections if they are available.

6.4.11 Setting a TAC for a MYTAC companion species to a depleted species and/or stock

Where a species is expected to result in unsustainable levels of incidental catch of companion species, particularly those under rebuilding strategies, a constraint should be applied to the target species TAC. This constraint is not a generic precautionary discount factor but a quantified, data-driven adjustment, based on either a metier-based (e.g. Burch et al 2021) or another alternative equivalent analysis that estimates expected bycatch using historical catch patterns and fleet behaviour. This process is applicable to any target species regardless of the tier level, where technical interactions are likely to compromise the sustainability of at-risk species. The constraints ensure that cumulative catch remains within sustainable limits for both target and bycatch species, in accordance with the Commonwealth Harvest Strategy Policy and Bycatch Policy.

6.4.12 Other provisions

Other provisions in addition to those above may be considered, including:

- agreed transition rules for TAC setting in the next fishing year, where harvest strategy rules have been revised

- rolling over TACs in the absence of updated stock assessments based on a weight-of-evidence approach
- discount factors will be applied unless the RAG advises otherwise
- companion species TACs (rules still to be determined).

6.5 GABTS Decision Rules

The GABTS operates under a different set of decision rules to the other sectors of the SESSF. These separate arrangements have been agreed to under co-management arrangements. The FIS and the collection of age and frequency data as well as the monitoring of catch and effort information obtained will be analysed and presented to SERAG each year prior to the date at which a decision on the TAC for the next year is made.

- When the FIS has been conducted in two consecutive years, the catch rates from the first leg of the survey will be the indicator of abundance used to make any adjustment to the default TAC.
- In a year when the FIS has not been conducted in two consecutive years, the standardised commercial catch rate for the period July to February inclusive is the indicator of abundance used to make any adjustment to the default TAC.
- If there is a change of ≥20% to the indicator of abundance, a 10% (increase or decrease) to the default TAC will occur.
- If the RAG is concerned with any indicators over the period between stock assessments (length frequency distributions, standardised commercial catch rates, age distributions etc.), then it can decide to undertake a full assessment in that year.
- Multi-year TACs have been agreed to using the same rules outlined in section 6.4.5.

The GABTS has a development strategy for species not currently under a TAC, with actions occurring at specified catch triggers (**Appendix 1**). This strategy is designed to improve the data collected and the knowledge of these species as catch increases.

- The initial catch triggers (set at 400 t for blue grenadier and gemfish, and 100 t for pink ling, blue-eye trevalla, ribaldo and hapuku) require data collection and analysis, and the development of an assessment plan.
- Exceeding the second trigger level requires that fishing for that species cease.
- The third trigger level applies to total catches across the three most recent years and requires a formal stock assessment.

6.6 Evaluation of reference points and decision rules

The HSF expresses the objectives of the Harvest Strategy in the form of quantifiable reference points based on the HSP. These reference points are used to guide management decisions, which are pre-agreed actions linked directly to the status of the fishery relative to those reference points.

The reference points and HCRs have been tested and refined through a MSE project conducted by CSIRO during 2006 and 2007. The MSE evaluated the choice of targets and thresholds for all Tier levels of the HSF. A key result of the project was improvements to the Tier 3 and Tier 4 rules, which now have well defined target harvest levels analogous to those used in the Tier 1 assessments for the major commercial species, recognising that Tier 3 and Tier 4 assessments are based on less information than Tier 1.

A copy of the final report "Evaluation of new harvest strategies for SESSF species" is available at: https://www.afma.gov.au/sites/default/files/2024-03/HSE-AFMA-Report-Aug-2009.pdf

Currently, climate change is not explicitly considered in the HSF. However, changes in the status, composition and population dynamics of the stock is reflected in the data collected – for example, age and length frequencies, catch and effort, stock recruitment, mortality and biomass data and trends.

Both biological and economic targets have been explicitly considered in developing the reference points and decision rules. However, while biological indicators and parameters have been included, economic indicators and parameters are still under development.

Evidence that the decision rules will maintain or move the stock to the biomass targets (or equivalent proxy) within a reasonable timeframe, and that the HSF will ensure that the stocks stay above the limit biomass level (or equivalent proxy) at least 90% of the time, have been provided by MSE testing.

For stocks below B_{LIM}, rebuilding strategies have been implemented in accordance with the HS. The strategies outline measures for rebuilding the stocks to above B_{LIM} (or equivalent proxy), and then additional measures to rebuild the stocks to B_{TARG} (or equivalent proxy) and monitor and maintain the stocks at the target level. The rebuilding strategies include an objective to ensure that the stocks stay above the limit biomass level (or equivalent proxy) at least 90% of the time.

7 Review

Under certain circumstances, it may be necessary to amend harvest strategies between reviews. These circumstances may arise if:

- there is new information that substantially changes the status of a fishery, leading to improved estimates of indicators relative to reference points; or
- drivers external to management of the fishery increase the risk to fish stock/s; or
- it is clear the strategy is not working effectively and the intent of the HSP is not being met.

Further explanation can be found in section 15 of the HSP Guidelines. The consultative and technical processes for amending harvest strategies are set out in the HSP Guidelines in section 9.

The SESSF Harvest Strategy Framework underwent MSE testing by CSIRO in 2006-2007. The project identified problems with the initial implementation of the HSF, developed improvements to the TAC setting procedures, and then tested these using the MSE approach. A MSE procedure was developed and used to test each Tier rule of the HSF.

A final report on the outcomes of the MSE was produced in 2009, entitled “Evaluation of new harvest strategies for SESSF species”. Key outcomes of the project were:

- a discussion paper with nine recommendations for modifications to the HSF
- demonstration that the HSF is consistent with, and meets the requirements of, the Commonwealth Harvest Strategy Policy
- demonstration that the Tier 1 rule achieves its aims for a range of species with differing life histories
- improvements to the Tier 3 and Tier 4 HCRs. The revised rules were presented to and approved by the RAGs during 2008, and applied (where appropriate) to setting the RBCs for 2009
- an evaluation of proposed rules for changing the TAC in response to the most recent year’s CPUE.

The MSE testing framework developed in the project is available for further testing of any future proposed revisions to elements of the HSF.

8 Appendix

GABTS Trigger limits

Species	Trigger to collect biological data	Trigger for analysis of biological data (inc. ageing of otoliths)	Cease fishing for that species	Commence stock assessment
Gemfish	Currently collected	400t	500t/year	1000t/3 years
Blue grenadier	Currently collected	400t	500t/year cease fishing. If a spawning aggregation is found, trigger an acoustic survey (500t) and operator collects 100 whole fish.	1000t/3 years
Ling	Currently collected	100t	250t	250t
Blue-eye trevalla	Currently collected	100t	250t	–
Ribaldo	Currently collected	100t	250t	–
Hapuka	Currently collected	100t	250t	–
Gulper sharks		–	Code of practice by industry to not target these species in addition to area closure.	–
Deepwater sharks (black/brier)		–	Code of practice by industry to not target these species in addition to area closure.	–
Chinamen leatherjacket		–	Management measures on Bight redfish and deepwater flathead influence catch.	–
Angel shark		–	Management measures on Bight redfish and deepwater flathead influence catch.	–
Jackass morwong		–	Management measures on Bight redfish and deepwater flathead influence catch.	–