A decorative graphic at the top of the page features several stylized fish swimming in waves. The fish are rendered in a light blue, line-art style, and the waves are represented by overlapping, wavy lines. The background is a gradient of blue, with a darker teal triangle in the top-left corner and a lighter blue triangle in the bottom-right corner.

East coast Spanish mackerel fishery harvest strategy: 2023–2028

Business area owner Management & Reform

Endorsed by Deputy Director-General (Fisheries and Forestry) in accordance with delegated powers under Part 2, Division 1 (Harvest Strategies) of the *Fisheries Act 1994*

Approved by Minister responsible for fisheries in accordance with section 16 of the *Fisheries Act 1994*

Revision history

Version no.	Approval date	Comments
0.1	July 2022	Draft harvest strategy for consultation
1.0	October 2022	Approval of final harvest strategy

Enquiries and feedback regarding this document can be made as follows:

Email: info@daf.qld.gov.au
Telephone: 13 25 23 (Queensland callers only)
(07) 3404 6999 (outside Queensland)
Monday, Tuesday, Wednesday and Friday: 8 am to 5 pm, Thursday: 9 am to 5 pm
Post: Department of Agriculture and Fisheries GPO Box 46 BRISBANE QLD 4001 AUSTRALIA
Website: daf.qld.gov.au

Interpreter statement



The Queensland Government is committed to providing accessible services to Queenslanders from all culturally and linguistically diverse backgrounds. If you need an interpreter to help you understand this document, call 13 25 23 or visit daf.qld.gov.au and search for 'interpreter'.

© State of Queensland, 2022

The Queensland Government supports and encourages the dissemination and exchange of its information. The copyright in this publication is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

Under this licence you are free, without having to seek our permission, to use this publication in accordance with the licence terms.



You must keep intact the copyright notice and attribute the State of Queensland as the source of the publication.

Note: Some content in this publication may have different licence terms as indicated.

For more information on this licence, visit <https://creativecommons.org/licenses/by/4.0/>.

The information contained herein is subject to change without notice. The Queensland Government shall not be liable for technical or other errors or omissions contained herein. The reader/user accepts all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from using this information.

Contents

What the harvest strategy is trying to achieve	4
Fishery overview.....	4
Stocks covered by the harvest strategy.....	5
Management units for the harvest strategy	5
Summary of management information.....	6
Fishery objectives	7
Catch shares	7
Managing the performance of the fishery	8
Management of target species.....	11
Management of ecological risks from fishing	12
Monitoring social and economic performance	13
Data collection, validation and assessment	14
Information and research priorities	15
Schedule of performance monitoring, assessment and review.....	16
Acronyms and definitions.....	18
Appendix A: Overview of decision rules for east coast Spanish mackerel.....	20

What the harvest strategy is trying to achieve

This harvest strategy has been developed in line with the *Queensland harvest strategy policy* to manage harvest in the Queensland east coast Spanish mackerel fishery (ECSMF). The east coast Spanish mackerel stock was assessed in 2021 as overfished, requiring urgent action to rebuild stocks. This harvest strategy aims to rebuild the stock to a level that achieves maximum sustainable yield (MSY) and, subsequently, pursues the long-term goal of achieving maximum economic yield (MEY), while maintaining catch shares amongst the commercial, recreational, charter and Indigenous fishing sectors.

This harvest strategy will manage fishing mortality of east coast Spanish mackerel stock, primarily through setting a total allowable catch (TAC) for all sectors at a level that allows the stock to achieve defined biomass targets. Other management tools (e.g. size limits, spawning closures) may also be used to support the sustainable management of this stock under this harvest strategy.

Fishery overview

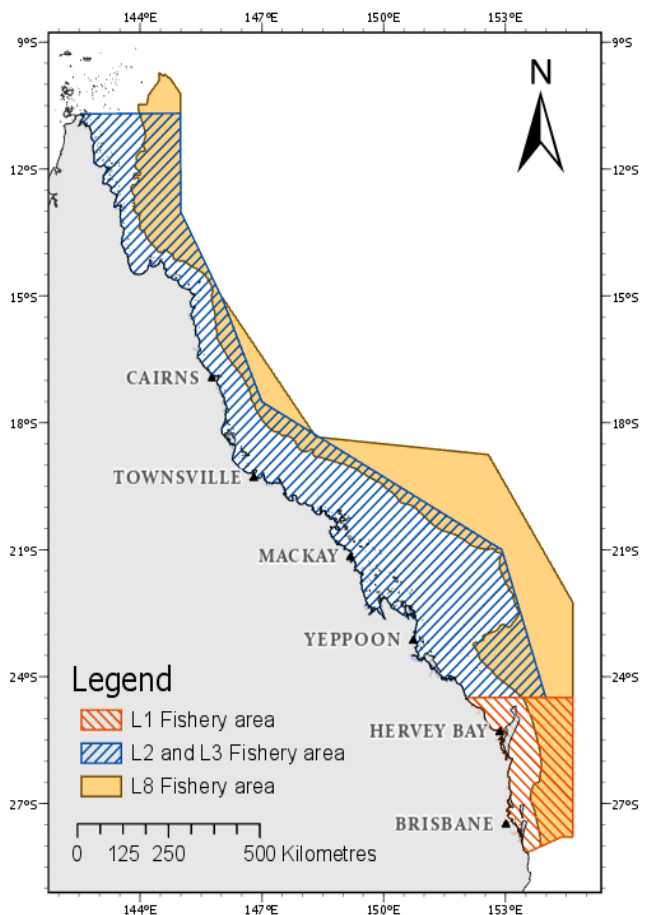
The ECSMF is a line-only fishery that exclusively targets Spanish mackerel (*Scomberomorus commerson*) by trolling or towing lures and baited lines behind the vessel and near the surface of the water.

Recognised as a high-quality eating fish and for its status as a powerful sports fish, Spanish mackerel are targeted by Aboriginal and Torres Strait Islander fishers and the commercial, recreational and charter fishing sectors. The commercial fishery supplies domestic markets.

During September to November each year, Spanish mackerel school to form one of the most notable and predictable spawning aggregations of fish on the Great Barrier Reef. These spawning aggregations, primarily located in the Lucinda region in waters north of Townsville, support a disproportionate amount of fishing effort and catch (~40% of the Queensland commercial harvest is generally taken from the region during the spawning season).

The predictable schooling and aggregation behaviour of Spanish mackerel is a characteristic that has been associated with vulnerability to overexploitation and rapid stock depletion. Schooling behaviour can often lead to issues of hyperstability, where catch rates remain generally stable as the fish population declines and fishery performance is overestimated. Long-term fishers' information suggests that the size of spawning aggregations and their reproductive capacity have diminished over time.

The stock is also fished in New South Wales, where approximately 9.5% of the total harvest is taken by commercial and recreational fishers each year.



Stocks covered by the harvest strategy

East coast Spanish mackerel form a single genetic stock between the Cape York Peninsula in north Queensland and Newcastle on the New South Wales mid-coast. This harvest strategy only relates to the management of Spanish mackerel in east coast Queensland waters (Table 1).

Table 1: Summary of fish stocks covered by this harvest strategy

Feature	Details
Target species	Spanish mackerel (<i>Scomberomorus commerson</i>)
Biology	<p>Spanish mackerel are large pelagic fish and, on Australia's east coast, have been observed to live up to 26 years and weigh more than 30 kg. They reach sexual maturity above the minimum legal size limit of 75 cm between 2 and 4 years of age.</p> <p>Movement patterns are varied and depend on spawning and feeding behaviours, water temperatures and currents. Some fish can remain localised, whereas some fish move along the east coast. Spanish mackerel generally aggregate more in northern tropical waters during winter and spring for feeding and spawning, and some fish move to southern waters during summer and autumn to extend their feeding range. Seasonal and spatial patterns of fishing follow the predictable locations of schooling fish.</p> <p>Previous research has characterised east coast Spanish mackerel as an obligate transient aggregator, meaning their spawning–schooling behaviour was generally restricted to specific reef locations. Acoustic fish tag monitoring identified some fish as having strong reef fidelity during the spawning season. This predictable schooling and aggregation behaviour signified that east coast Spanish mackerel were vulnerable to overexploitation.</p>

Management units for the harvest strategy

The management unit for this harvest strategy is all tidal waters in Queensland east of longitude 142°31'49" east.

Summary of management information

A summary of the management arrangements for the ECSMF is set out in Table 2. Copies of fisheries legislation are available at legislation.qld.gov.au, or visit fisheries.qld.gov.au for the latest information on fishing rules.

Table 2: Summary of management arrangements for the ECSMF fishery

Feature	Details
Commercial access	Primary commercial fishing licence with: <ul style="list-style-type: none"> • a SM fishery symbol • one or more of the following line symbols: L1, L2, L3 and L8 • sufficient SM individual transferable quota.
Relevant fisheries legislation	<i>Fisheries Act 1994</i> Fisheries (General) Regulation 2019 Fisheries (Commercial Fisheries) Regulation 2019 Fisheries Declaration 2019 Fisheries Quota Declaration 2019
Other relevant legislation	<i>Great Barrier Reef Marine Park Act 1975</i> and Great Barrier Reef Marine Park Regulations 2019 (Cwlth) <i>Marine Parks Act 2004</i> <i>Environment Protection and Biodiversity Conservation Act 1999</i> and Environment Protection and Biodiversity Conservation Regulations 2000 (Cwlth)
Working group	East coast Spanish mackerel fishery working group Terms of reference and communiques are available at fisheries.qld.gov.au
Gear	The following apparatus are permitted for use: <ul style="list-style-type: none"> • commercial – hook and line apparatus (additional restrictions depending on fishery line symbol used) • recreational – recreational hook and line apparatus Refer to fisheries legislation for specific gear requirements and rules.
Main management methods	All sectors: <ul style="list-style-type: none"> • Gear restrictions • Minimum legal size limit • Spatial and temporal (seasonal) closures Commercial only: <ul style="list-style-type: none"> • Individual transferable quota • Total allowable commercial catch (TACC) • Limited entry and defined fishery areas • Vessel and tender restrictions Recreational only: <ul style="list-style-type: none"> • In-possession limits • Boat limits
Fishing year	1 July – 30 June

Feature	Details
Stock status	Stock status is assessed using the nationally agreed Status of Australian Fish Stocks (SAFS) classification framework (visit fish.gov.au) – east coast Spanish mackerel is listed as ‘depleted’ (SAFS 2020).
Accreditation under the Environment Protection and Biodiversity Conservation Act 1999	Part 13: Accredited Part 13A: Included in the list of exempt native specimens (LENS) (expires 28 August 2025) Visit environment.gov.au

Fishery objectives

The objective of the harvest strategy is to manage the fishery in accordance with the objectives of the *Fisheries Act 1994* and the *Queensland Sustainable Fisheries Strategy: 2017–2027*. Fishery objectives set out the direction and aspirations to be achieved in the long term.

The primary objectives for this fishery are to:

1. rebuild the east coast Spanish mackerel stock within an appropriate timeframe (2TMIN) to an interim rebuilding target spawning biomass level that aims to maximise sustainable yield (*Bmsy*) for the fishery and
2. once the east coast Spanish mackerel stock has been rebuilt to or above *Bmsy*, return it to, and maintain it at, a target spawning biomass level that aims to maximise economic yield (*Bmey*) for the fishery.

In pursuing the primary objectives, the harvest strategy aims to:

- minimise and mitigate any unacceptable ecological risks arising from fishing-related activities
- maintain appropriate sectoral allocations for the ECSMF
- maximise economic performance of the commercial sector
- monitor the broader social and economic benefits of the fishery to the community.

Catch shares

This harvest strategy aims to maintain the existing catch shares between sectors. The resource allocation arrangements set out in Table 3 overleaf ensure that catch shares among sectors can be maintained in response to changes in the TAC.

Future reviews of the TAC will consider the results from the latest statewide recreational fishing survey, any other available information relating to recreational harvest, and validated commercial catch over corresponding years. Table 3 outlines existing catch shares (rounded to nearest 5%) for all sectors based on available data up to 2020.

The traditional fishing rights of Aboriginal peoples and Torres Strait Islanders are protected under native title legislation and relate to harvest for domestic, communal and non-commercial purposes. Accordingly, traditional and customary fishing is recognised in Queensland and is not a defined allocation.

Aboriginal peoples and Torres Strait Islanders and their communities continue to express a desire for more economic opportunities through fishing, particularly in their own sea country. The *Aboriginal and Torres*

Strait Islander commercial fishing development policy provides for an Indigenous fishing permit to be issued, on a case-by-case basis and in accordance with section 54 of the Fisheries (General) Regulation 2019, to provide opportunities to take part in fishing-related business.

Table 3: Resource allocation arrangements for the ECSMF

Management unit	Commercial fishing ¹	Recreational fishing (including charter) ²	Indigenous commercial fishing development ³
East coast Spanish mackerel	60%	40%	Up to 2 tonnes

¹ Commercial catch share is informed by average harvest from 2004 to 2021, based on commercial logbooks and quota reporting.

² Recreational catch share is informed by average harvest from 2004 to 2021, based on statewide recreational fishing surveys and charter logbooks.

³ Applications for an Indigenous commercial fishing developmental permit will be assessed on a case-by-case basis, but the total allocation across all active permits will not exceed the 2-tonne limit in any given fishing year.

Managing the performance of the fishery

Suitable performance indicators have been selected to describe fishery performance in relation to the objectives, with associated reference points identified to established acceptable performance. The primary performance indicator used to evaluate the status of the key species is spawning stock biomass. Spawning stock biomass is assessed periodically and is compared to the associated reference points.

The default biomass reference points identified in this harvest strategy are:

- an interim rebuilding target reference point of 40% of the spawning biomass (B_{40}) being the relative biomass level the harvest strategy aims to achieve in the short term – this is considered a proxy for the biomass achieving maximum sustainable yield (B_{msy})
- an overarching target reference point (B_{targ}) of 60% of the spawning biomass (B_{60}) being the relative biomass level the harvest strategy aims to achieve in the long term – this is considered a proxy for the biomass achieving maximum economic yield (B_{mey})
- a limit reference point of (B_{lim}) of 20% of the spawning biomass (B_{20}) being the biomass level that the harvest strategy aims to avoid – if the stock is assessed to be below B_{lim} , the risk to the stock is unacceptably high and the stock is defined as ‘overfished’.

If a stock assessment provides a direct estimate of B_{msy} , B_{mey} or B_{lim} , these may be used to replace the respective proxy values of B_{40} , B_{60} and B_{20} .

Table 4: Performance indicators and reference points for the ECSMF

Performance indicator	Type of reference point	Reference level
Spawning stock biomass	Interim rebuilding target reference point	40% spawning biomass (B_{40}), proxy for biomass at maximum sustainable yield (B_{msy})
	Target reference point (B_{targ})	60% spawning biomass (B_{60}), proxy for biomass at maximum economic yield (B_{mey})
	Limit reference point (B_{lim})	20% spawning biomass (B_{20}), proxy for biomass at limit reference point

For Spanish mackerel, spawning stock biomass and sustainable harvests for all sectors will be estimated using a stock assessment. The aim is to measure the capability for the stock to attain the relevant target biomass level (40% and 60%), and at which point the harvest strategy will be considered as meeting its objectives.

Until the stock has been rebuilt to B_{40} (primary objective 1 achieved), the decision rules maintain the TACC at 165 tonnes and the recreational in-possession limit at 1 fish per person.

Once the stock is at or above B_{40} , the decision rules for setting a sustainable harvest to pursue B_{targ} are based on a ‘hockey stick’ approach. This is where the TAC is set based on a linear relationship between B_{lim} , where the level of fishing mortality (F) is equal to zero, and B_{targ} , where the exploitation rate and TAC are set at the level to achieve MEY (Figure 1 overleaf).

The decision rules take into account the current biomass level of the stock for determining the TAC to achieve the B_{targ} . The recommended TAC is calculated by applying the rate of fishing mortality to achieve B_{targ} to the current spawning biomass level. As a result, the recommended TAC represents the total catch from all sectors that can be harvested in the following years to move the current biomass level towards the target level. A discount factor may also be included to account for uncertainty and to reduce the risk of a fishery not achieving its objectives.

If the spawning biomass falls below, or fails to rebuild above, B_{lim} after four years of management intervention (1 July 2026), targeted fishing of the stock must cease and the decision rules of the harvest strategy will be reviewed to ensure that rebuilding will be achieved within the required timeframe. This period of time aligns with the age at which most Spanish mackerel are fully recruited and provides sufficient time for the effects of management intervention on spawning biomass to be observed.

In accordance with the *Queensland harvest strategy policy*, timeframes are specified relative to the minimum timeframe for rebuilding in the absence of fishing (TMIN). Timeframes are defined within the range of TMIN and 2TMIN, equating to a rebuilding timeframe for east coast Spanish mackerel of 7–14 years from 1 July 2023.

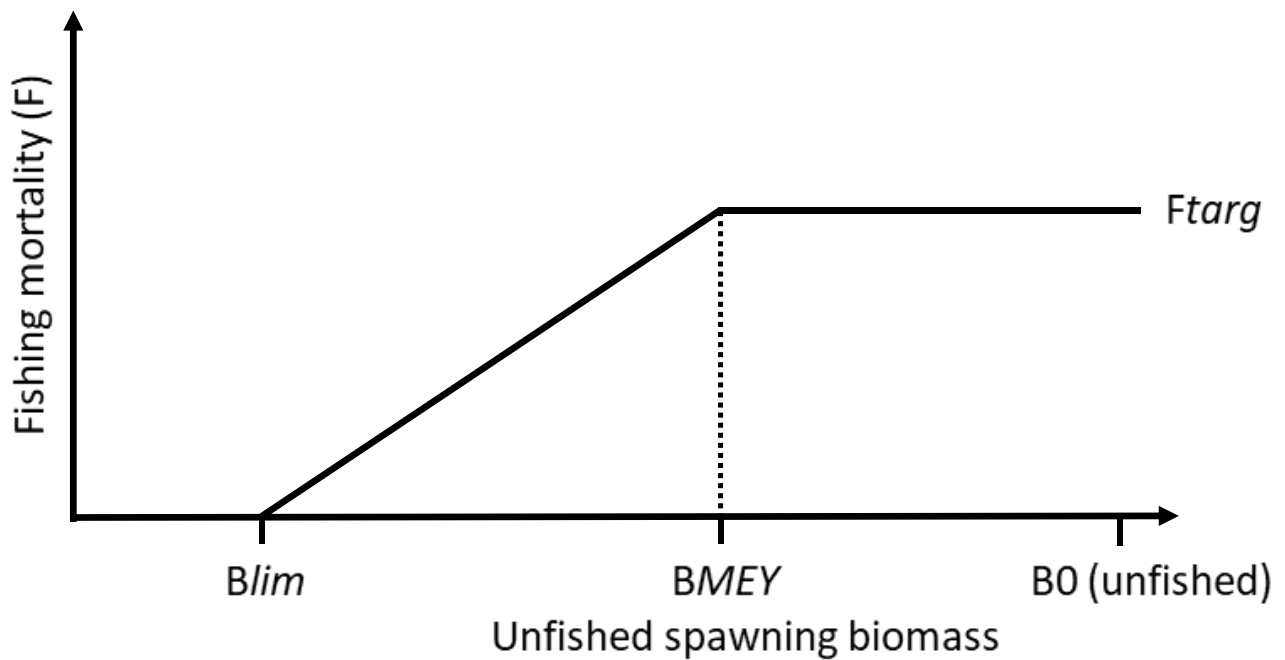


Figure 1: Showing the 'hockey stick' rule – *Blim* is limit reference point, *Bmey* is the biomass at MEY, *B0* is the unfished biomass at 100%, *F* is fishing mortality and *Ftarg* is the level of fishing mortality for *Bmey*

The harvest strategy will also act to constrain all sectors within their allocated catch share. Should a new estimate of recreational harvest or catch from charter fishing logbooks indicate that a sector has increased their catch share outside of their allocated proportion, then decision rules are triggered to constrain that sector's harvest to within its share. Adjustments to the recreational fishing limits may be undertaken if large changes are made to the TAC for a species.

The decision rules, including those to rebuild the stock to B_{40} , are supported by spatial and temporal closures. These closures reduce overall fishing mortality and offer additional protection to Spanish mackerel during critical periods when the fish are aggregating (e.g. for spawning, feeding and migrating) and are vulnerable to overexploitation. The closures are necessary in combination with other measures, including the setting of a TACC and recreational in-possession limit, to rebuild the stock to B_{40} in the required timeframes and achieve the long-term target (*Btarg*) of B_{60} .

Management of target species

1.0 General decision rules

The decision rules below establish general conditions for all fishing sectors to prevent the TAC from being set at an unsustainable level that will not achieve the interim rebuilding target biomass of 40% (B_{40}) or the overarching target biomass (B_{targ}) of 60%. These rules also establish conditions that may trigger a closure of the fishery or a review of the decision rules, reference points or timeframes.

- 1.1 The rate of fishing mortality should not exceed that required to achieve B_{targ} .
 - 1.2 The TAC should not exceed the level of fishing mortality required to maintain a stock at maximum sustainable yield (MSY) at equilibrium.
 - 1.3 If the stock is at or below B_{lim} after 1 July 2026, no targeted fishing for the species will be permitted for any sector until the biomass is at or above 30% of unfished levels (B_{30}).
 - 1.4 If any new information becomes available indicating that the assessment and TAC-setting arrangements are not consistent with the sustainable management of the fishery or that the primary objectives of the harvest strategy will not be achievable, decision rules must be reviewed and, if appropriate, the reference points or timeframes should be adjusted.
-

2.0 Commercial decision rules

The decision rules below provide guidance to set the TACC using the outputs of a stock assessment, and aims to rebuild to the interim rebuilding target biomass of 40% (B_{40}) and subsequently achieve a target biomass (B_{targ}) of 60%.

- 2.1 If the biomass is below B_{40} and has not previously reached B_{40} under this harvest strategy (primary objectives 1 and 2 not achieved), maintain the TACC at 165 tonnes.
 - 2.2 If the biomass is at or above B_{targ} (primary objectives 1 and 2 achieved), set the TACC at a level that maintains biomass at B_{targ} .
 - 2.3 If the biomass is below B_{targ} and above B_{lim} , and B_{40} has been previously reached under this harvest strategy (primary objective 1 achieved but primary objective 2 not achieved), the TACC should be set as inferred by the hockey stick approach, where fishing mortality is reduced to the rate that allows the biomass to increase effectively back to B_{targ} .
-

3.0 Recreational and charter sector decision rules

The below decision rules have been designed to maintain catch shares between sectors (60% commercial; 40% recreational including charter) while rebuilding to the interim rebuilding target biomass of 40% (B_{40}) and achieving the long-term target biomass (B_{targ}) of 60%. If a new estimate of recreational or charter harvest indicates that either sector have increased their catch outside of their allocated catch share, then management action will be taken to constrain them within this share.

- 3.1 If the biomass is below B_{40} and has not previously reached B_{40} under this harvest strategy (primary objectives 1 and 2 not achieved), maintain the recreational in-possession limit of 1 fish per person.
-

- 3.2 If a recreational harvest estimate is no more than 10% above the allocated recreational catch proportion, then no management action is required.
 - 3.3 If an estimate of recreational harvest exceeds the catch share by greater than 10%, the recreational in-possession limit will be decreased by an amount that will achieve the allocated recreational catch proportion.
 - 3.4 If the commercial catch share increases by 10% or more according to the commercial decision rules, then the recreational in-possession limit will be increased to return catch shares to allocated proportions.
-

Management of ecological risks from fishing

4.0 Ecological risk decision rules

A foundation of sustainable fisheries management is managing the impact of fishing activities on non-target species and the broader marine ecosystem. Ecological risk assessments (ERA) identify and measure the ecological risks of fishing activity and identify issues that must be further managed under harvest strategies. The decision rules below are in place to minimise and mitigate high ecological risks arising from fishing-related activities.

- 4.1 If an ERA identifies fishing impacts that result in an unacceptable level of risk to any ecological component, a review is triggered to investigate the reason for the increased risk and appropriate management action taken to reduce the risk to an acceptable level.
-

A whole-of-fishery level 1 ERA for the ECSMF was completed in 2019 (visit era.daf.qld.gov.au) and identified one ecological component at higher risk – the target species (Spanish mackerel). As these risks were confined to the single target species, the ERA concluded that they would be best addressed through the harvest strategy framework.

Fisheries Queensland developed the [Ecological risk assessment guideline](#) to assess ecosystem impacts of fishing activities. Future risk assessments will be undertaken in line with the guideline to reassess any current or new ecological risks that may arise in the fishery. ERAs can be undertaken more frequently if there are significant changes identified in fishery operations, management activities or controls that are likely to result in a change to previously assessed risk levels.

Monitoring social and economic performance

The *Queensland Sustainable Fisheries Strategy: 2017–2027* outlines the target to set sustainable catch limits based on achieving *B_{mey}* (around 60% of unfished spawning biomass) to support the most economically efficient use of the resource, improve the fishing experience for all sectors and promote resilience to adverse environmental conditions (e.g. floods, cyclones and bleaching). The harvest strategy rules have been set up to maintain the stock at target biomass level, once rebuilding is complete.

The objectives listed in Table 5 will be used to monitor the social and economic performance of this fishery. The management options outlined are intended to provide some guidance on the options that could reasonably be considered alongside the decision rules if fishery trends are of concern.

Table 5: Social and economic indicators for the ECSMF

Objective	Performance indicators	Management options
Maximise economic performance of the commercial sector	<p>Potential indicators to monitor include:</p> <ul style="list-style-type: none"> • catch per unit effort (average per day/hour fished) • costs, earnings and net financial and economic profit • net economic returns, gross state product, gross value of production • quota sale and lease price • profit decomposition (using profit or lease price) to determine impacts of prices, costs and stock/catch rates on changes in profits 	<p>Consider regulatory and non-regulatory options</p> <p>Adjust management as needed</p> <p>Options include minimum quota holding and latent effort review</p>
Monitor the broader social and economic benefits of the fishery to the community	<p>Potential indicators to monitor include:</p> <ul style="list-style-type: none"> • fisher satisfaction (with their fishing experience – commercial and recreational) • recreational fisher participation and economic information • percentage of quota/licences that are owned (rather than leased) • Gini coefficient of quota owner (measure of concentration) • percentage of total costs/inputs purchased from local businesses/residents • income generated (crew plus profit – gross value added) • proportion of catch sold locally • fish prices • number of platforms / number of active licences / total capacity • community satisfaction (with their fisheries and the way in which they are managed) 	<p>Consider regulatory and non-regulatory options</p> <p>Adjust management as needed</p>

Data collection, validation and assessment

The catch and effort data required to inform harvesting of Spanish mackerel is obtained through commercial logbook returns. For the Queensland east coast line fin fish fisheries logbook, visit business.qld.gov.au.

As the ECSMF is quota-managed, real-time reporting and catch disposal records are also required to provide an accurate record of catch. All vessels in the fishery are required to have a vessel tracking unit installed and operational on all primary and tender vessels to verify fishing effort reported in commercial fishing logbooks. Commercial catch rates are standardised to account for a range of potential influencing variables. The current catch rate standardisation considers fishing year, latitude band, seasonal variables, wind component variables, lunar phase variables, number of fishing operations and individual fishing operations through time, as well as annual changes in fishing power to account for increased fishing effort and improved gear technology. The data collected via boat ramp surveys and the statewide recreational fishing survey helps provide important information on recreational fishing, including total recreational harvest and discarding behaviour. Charter operators also record catch information in logbooks, which is included as recreational harvest.

Fisheries Queensland also collects biological data on Spanish mackerel from commercial and recreational fishers to measure long-term trends in length, age and rate of total mortality, and address emerging knowledge requirements. Biological sampling of Spanish mackerel is separated into distinct regions along Queensland's east coast to account for any substantial variations in the population characteristics of the species over the whole region.

The Australia east coast Spanish mackerel stock assessment uses an annual time-step, two-sex, age-structured population model within Stock Synthesis software. The model incorporated data from 1911 to 2020, including annual estimated commercial, charter and recreational harvest (including recreational released fish mortality), commercial standardised catch rates, fish age-length frequencies and key long-term fishery information on fishing power changes and catch rates. The assessment was conducted at the whole-stock level, including data from across jurisdictions and fishing sectors.

Information and research priorities

Key information and research priorities have been identified in Table 6 to help meet the objectives of this harvest strategy. These will be updated as required.

Table 6: Information and research priorities for the ECSMF

Project description	Explanation of need	Priority
Identify suitable and feasible fishery-independent indices of abundance	<p>Assessment of the east coast Spanish mackerel stock relies on fishery-dependent data, and there are uncertainties around the use of standardised catch rates as an index of abundance (due to hyperstability, different targeting practices, complex fishing effort dynamics, etc.) as well as input parameters. A robust means of assessing abundance and/or recruitment without using fishery-dependent data will reduce uncertainty in the stock assessment and provide a better understanding of how environmental factors influence spawning and recruitment.</p> <p>Due to the range of potential survey options (e.g. Close-Kin Mark-Recapture, egg density surveys) with varying levels of cost-effectiveness depending on species biology and other factors, a feasibility study may be required to consider and compare options.</p>	High
Quantify depredation rates and other sources of fishing mortality (e.g. post-release mortality)	<p>Depredation (typically by sharks) and post-release mortality are both sources of mortality in the Spanish mackerel fishery that have yet to be quantified. This remains a significant data gap and source of uncertainty for future stock assessments in the fishery, and may represent a significant component of mortality contributing to stock decline. Additionally, fishers across all sectors report that depredation is an important issue affecting their catch rates, profit margins and fishing experience.</p>	High
Improve catch-rate standardisations using vessel tracking data	<p>Concerns have been raised regarding the robustness and coarse resolution of catch and effort metrics used in the Spanish mackerel stock assessment process. Consistent high catch rates at spawning aggregations may be masking an overall decline in abundance of the stock due to hyperstability, which is known to occur in fisheries that target spawning aggregations. Improved fishing effort datasets with higher spatial and temporal resolution are necessary to identify if hyperstability is occurring in this fishery and to increase the robustness of the catch-rate standardisations used in stock assessments.</p>	High
Measure the effect of environmental variables on recruitment success and variability	<p>Previous research has identified a number of environmental variables that appear to influence Spanish mackerel recruitment and catch rates (e.g. sea surface temperature). Given the rapidly changing marine environment and newly available information on the fishery, there is a need to re-investigate the influence of these environmental factors with an updated dataset and explore influences that have not been investigated previously (e.g. nearshore water quality). This information will be useful to contextualise changes in the fishery and incorporate these understandings in assessment and management where possible, and may also provide a proxy for recruitment success to use in stock assessments and harvest strategy decision rules.</p>	High

Schedule of performance monitoring, assessment and review

Annual performance monitoring and assessment

Fishery performance will be reviewed against this harvest strategy annually. This review will include convening the Spanish mackerel fishery working group to provide operational advice on the fishery's performance.

The primary performance measure is spawning biomass, which will be used to review the TAC approximately every three years. In the intervening years, a review of standardised catch rate information will also inform fishery performance and if management action is required between scheduled stock assessments. If a stock assessment biomass estimate becomes available prior to the scheduled timeframe that indicates the TAC should be adjusted in order to meet the objectives of the fishery, then the TAC should be reviewed.

While harvest strategies provide certainty and transparency in terms of management decisions in response to certain fishery information, there must also be flexibility to allow new information or changing circumstances to be appropriately considered. There may be instances in which a stock assessment may need to be available prior to, or delayed beyond, the scheduled date. Any change to the stock assessment schedule should be considered by the working group and decided on by the chief executive based on the below conditions:

- If during the period between scheduled stock assessments the chief executive is concerned that a performance indicator (e.g. stock status, standardised commercial catch rate, total harvest) suggests the stock is not performing in a way that will achieve the target biomass level, the chief executive may decide that a stock assessment will be undertaken before the scheduled timeframe.
- If the chief executive is satisfied that (1) indicators for the stock suggest it is achieving, or rebuilding to, target biomass levels and that there is a low ecological risk to the stock under the current management arrangements, or (2) if resourcing requirements prohibit the ability for an assessment to be delivered in the scheduled timeframe, the chief executive may decide that a scheduled stock assessment will be delayed.

Table 7: Schedule of performance monitoring, assessment and review

Activity	Year 1 2023–24	Year 2 2024–25	Year 3 2025–26	Year 4 2026–27	Year 5 2027–28
Monitoring and assessment	Catch, effort and biological monitoring	Catch, effort and biological monitoring	Catch, effort and biological monitoring	Catch, effort and biological monitoring Modelled assessment	Catch, effort and biological monitoring
Management	Review of catch, effort and biological data	Review of catch, effort and biological data	Review of catch, effort and biological data	Review performance against primary objectives	Review of catch, effort and biological data Review harvest strategy

Harvest strategy review

This harvest strategy will remain in place for a period of five years, after which time it will need to be fully reviewed in accordance with the *Fisheries Act 1994*.

The harvest strategy may be subject to further review and amendment as appropriate within the five-year period if any of the following circumstances arise:

- there is new information that substantially changes the status of the fishery, leading to improved estimates of indicators relative to reference points
- drivers external to management of the fishery increase the risk to fish stock
- a new recreational harvest estimate becomes available that suggests the defined sectorial catch shares may have been set incorrectly or may be unrepresentative
- it is clear the harvest strategy is not working effectively, and the intent of the *Queensland harvest strategy policy* is not being met.

For more information on the processes for amending harvest strategies, refer to the Queensland harvest strategy policy available at publications.qld.gov.au.

Acronyms and definitions

Acronym/term	Definition
Biomass (B)	Total weight of a population or of a component of a population, usually expressed as a ratio that indicates the biomass as a percentage of the unfished biomass (B_0). East coast Spanish mackerel is assessed in terms of spawning stock biomass, which is measured by spawning egg production.
Unfished biomass (B_0)	Mean equilibrium virgin unfished biomass, meaning the average biomass level if fishing had not occurred. For east coast Spanish mackerel, this is currently taken to be the spawning stock biomass in 1911 and prior to the commencement of the commercial fishery.
40% unfished biomass (B_{40})	The biomass at 40% of unfished levels. Used by default as a proxy for the biomass at maximum sustainable yield (B_{msy}) and as the interim target biomass reference point for rebuilding.
Biomass at maximum sustainable yield (B_{msy})	Biomass at maximum sustainable yield (MSY). Without a specific estimate, the default B_{msy} is taken to be 40% of unfished biomass.
Biomass at maximum economic yield (B_{mey})	Biomass at maximum economic yield (MEY). Without a specific estimate, the default B_{mey} is taken to be 60% of unfished biomass (B_{60}).
Biomass limit reference point (B_{lim})	The point below which the risk to the stock is regarded as unacceptably high and urgent management action must be taken to rebuild the stock. The default limit reference point is 20% of unfished biomass (B_{20}).
Target biomass (B_{targ})	The target reference point in terms of the stock's biomass.
Ecological risk assessment (ERA)	An analysis of the best available information about fishery impacts on target species, non-target and protected species (e.g. dugongs, turtles, dolphins and protected fish) and the broader ecosystem. ERAs identify and measure the ecological risks of fishing activity and identify issues that must be further managed under harvest strategies.
Fishing mortality (F)	Describes the part of the stock's total mortality rate due to fishing, often expressed as a rate that indicates the percentage of the population caught in a year.
Fishing mortality target (F_{targ})	The fishing mortality that achieves the target biomass (B_{targ}).
Individual transferable quota	A fully tradeable catch share allocated to individual fishers or companies that allows the holder to catch a portion of the total allowable commercial catch (TACC) each fishing season. Usually assigned a weight value in kilograms that will change as the TACC is set for each season.
Maximum economic yield (MEY)	The sustainable level of annual harvest that allows net economic returns to be maximised (the largest positive difference between total revenue and total costs of fishing, which equals the maximum profit).

Maximum sustainable yield (MSY)	The maximum annual harvest that can be removed from the stock over an indefinite period under prevailing environmental conditions.
Spawning stock biomass	An indicator of the status of the stock and its reproductive capacity. It can be defined as total egg production or the combined weight of all individuals in a fish stock (usually females only) that have reached sexual maturity and are capable of reproducing.
Status of Australian Fish Stocks (SAFS)	A series of assessments of the biological sustainability of a broad range of wild-caught fish stocks against a nationally agreed framework. Reports are published that determine whether the abundance of fish and the level of harvest from the stock can be considered sustainable.
Total allowable catch (TAC)	A harvest limit that is set as an output control on fishing for all sectors, specifying the total amount of fish that can be taken from a fishery each year.
Total allowable commercial catch (TACC)	The harvest limit set for the commercial fishing sector is usually achieved through setting TACC, but sometimes through input controls
TMIN, 2TMIN	Rebuilding timeframes specified relative to the minimum timeframe for rebuilding in the absence of fishing.

Appendix A: Overview of decision rules for east coast Spanish mackerel

