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Draft NSW Mulloway Harvest Strategy

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harveststrategies@dpird.nsw.gov.au

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Introduction

Purpose

A harvest strategy is a framework that specifies pre-determined actions in a fishery for defined species (at the stock or management unit level) necessary to achieve the agreed ecological, economic and social management objectives (Sloan et al. 2014).

This harvest strategy applies to the NSW stock of Mulloway (*Argyrosomus japonicus*).

The Goal of the NSW Mulloway Harvest Strategy is:

> '*To rebuild the NSW Mulloway stock biomass to levels supporting ongoing community benefits including sustainable seafood supply, profitable commercial fishing, quality recreational and charter fishing opportunities, and ongoing protection for the continuation of Aboriginal cultural fishing*'

The harvest strategy includes specific decision rules for managing harvest to support rebuilding Mulloway stock biomass towards achieving longer term management objectives.

The harvest strategy is established in accordance with the NSW Fisheries Harvest Strategy Policy, and brings together key scientific monitoring, assessment and management components necessary to meet legislated objectives including those established under the *Fisheries Management Act 1994* (the Act), the *Marine Estate Management Act 2014*, the Fisheries Management (Share Management Plan) Regulations, and objectives established under the strategy.

Introduction of harvest strategies and evaluation of ecological risk in NSW Fisheries are key activities under Initiative 6 of the NSW Marine Estate Management Strategy 2018-2028.

The Mulloway Stock

Mulloway has a wide distribution across southern Australia from the Wide Bay-Burnett region in Queensland to the Gascoyne region in Western Australia, including throughout coastal NSW.

Regional differences in genetics and otolith (ear bone) morphology and chemistry indicate separate Mulloway stocks on the eastern, western and southern coasts of Australia. Analyses of changes in the relative biomass of the stock inform determination of stock status and are currently undertaken at the jurisdictional (state and territory) level, with status determined according to criteria described within the national Status of Australian Fish Stocks (SAFS) classification framework (Earl et al. 2021).

Key nursery habitat for small juveniles includes deep holes in estuaries. Larger juveniles and adult fish occur in estuarine and nearshore coastal waters from the upper tidal limits of estuaries to surf zones and around rocky reefs in coastal waters to ~100 m depth.

The species exhibits fast initial growth and reaches large sizes (~180 cm & 75 kg), with a longevity of more than 30 years. Female maturity occurs at around 70 cm length and 3-4 years of age, noting considerable variability in length at age. Successful spawning and recruitment are irregular and appear closely linked to suitable environmental conditions, notably years of high rainfall. Mulloway generally do not move among locations extensively, with the majority being resident within single

estuaries, however smaller numbers have been shown to move larger distances, including between estuaries.

Analyses of relative biomass of the Mulloway stock have suggested the NSW stock to be at a critically low level since the early 2000's (Silberschneider & Gray 2005, Scandol et al. 2008, Silberschneider et al. 2009, Rowling et al. 2010, Hughes 2015, Earl et al. 2014, 2016, 2018, 2021).

Following improvements to biomass and fishing mortality indicators in recent years, the stock status of Mulloway in NSW has been classified as *Recovering* in 2023 (Earl et al. in press, Hughes 2024). Due to uncertainty around estimates of biomass, it is not possible to conclude with certainty that the stock is either above or below a biomass limit usually associated with a depleted stock.

Whilst Mulloway in NSW are considered to be part of a single broad genetic stock on the east coast, limited movement patterns support the presence of sub-populations existing within the broader stock, with the potential that the current state-wide status determination may not adequately capture regional variability. This may mean that fishers' "on water" experiences of the status of local Mulloway populations may vary between areas.

Overall, stock health is recognised to have been significantly degraded from historical levels. Despite some uncertainty around the specific level of depletion, improving stock health aims to improve fishery performance, including population resilience to harvest and potential environmental changes.

Analyses of current stock status are based on information informed by a number of data-limited assessment methods informed primarily by commercial and recreational fishery data. A primary data source is derived from commercial estuary mesh-netting which predominantly targets specific sizes of fish using specific gear. Other data sources include commercial catch rates, ages from a sub-sample of commercial and recreational fish, and lengths from a sub-sample of commercial fish from all methods including line fishing, meshing and hauling.

Programs to support more robust analyses are described in this strategy, including to further develop available data and improve the accuracy and precision of stock status determinations over time.

A Mulloway recovery program was initiated in 2013, with further measures to reduce fishing mortality implemented in 2018, however demonstrable improvements to the stock were not evident in analyses completed before 2023. Other than mortality due to fishing, additional factors are likely to adversely impact the stock (e.g. habitat degradation, pollution, water quality, climate change), noting the impacts of these factors on the Mulloway stock are not currently well understood.

Signs of improvement in the health of the NSW Mulloway populations in analyses completed in 2023 may be a result of management changes, favourable environmental conditions or changes in the movement patterns of Mulloway (or combinations thereof). Nonetheless, management of fishing mortality provides the most direct and feasible approach to support persistence of any recent recruitment and rebuilding of stock biomass towards target levels.

Given current levels of uncertainty, a constant harvest level approach has been developed to promote stock rebuilding in a defined rebuilding phase of the harvest strategy, with progressive integration of dynamic adjustment in response to assessment outcomes as information improves.

Simultaneous with this rebuilding phase, a research program has commenced to collect additional data to improve certainty in the assessment and integration of dynamic management responses to changes in stock biomass.

The Mulloway Fishery

Mulloway are an iconic species important to many Aboriginal, commercial and recreational fishers, taken as both targeted and incidental catch.

The majority of commercial harvest is taken in the Estuary General Share Management Fishery by meshing net and in the Ocean Trap and Line Share Management Fishery by line methods, with smaller harvest taken in the Ocean Hauling Share Management Fishery by hauling net. Periodic incidental mortality is likely to occur in the Estuary Prawn Trawl and Ocean Trawl Share Management Fisheries.

The majority of recreational and charter fishing harvest is taken by line fishing using bait, followed by line fishing using lures, and then spearfishing.

There are limited data on the level of Aboriginal cultural harvest. Harvest is assumed to be relatively low, noting Mulloway have been harvested for thousands of years by Aboriginal people and remain a culturally iconic species for coastal communities.

A summary of key harvest sectors comprising the Mulloway fishery and respective management measures is provided at Table 1.

Table 1: Summary of reported Mulloway harvest* and key management measures

Fishery	Assumed % of retained catch**	Methods	Key management measures
Commercial	Total commercial harvest assumed comparable to estimated recreational catch levels, further defined by key commercial fisheries below		Minimum size 70cm Spatial and temporal closures Limited entry Vessel restrictions Daily/possession limits Crew limits
Estuary General	71% of commercial harvest	Meshing net Hauling net Line (various)	Total Allowable Effort (Meshing, Hauling) Net length and mesh size Hook limits
Ocean Trap and Line	20% of commercial harvest	Line (various) Demersal fish trap	Hook limits Trap limits
Ocean Hauling	8% of commercial harvest	Hauling net	Net length and mesh size Daily/possession limit
Ocean Trawl	1% of commercial harvest	Otter Trawl net Danish seine net	Net length and mesh size Bycatch Reduction Devices

Recreational (including Charter)	Total estimated recreational harvest assumed comparable to commercial catch levels based on recreational survey estimates	Line Spearfishing	Minimum size 70cm Spatial closures Daily/possession limits Boat limits Rod/handline limits Hook limits
Aboriginal cultural	Unknown, recognised to be part of total harvest	Line Spearfishing Meshing and hauling net methods under Cultural Fishing Authority	Minimum size 70cm Aboriginal Cultural Fishing Interim Access Arrangement Section 37 Cultural Fishing Authorities Rod/handline limits Hook limits Aboriginal Cultural Fishing Local Management Plans Indigenous Land Use Agreements

*Nominal harvest assumptions based on commercial data 2009/10-2021/22 and periodic recreational survey data.

**Additional incidental (bycatch) fishing mortality is assumed and currently unquantified.

More detailed descriptions and analysis of these fisheries is available at:

https://www.dpi.nsw.gov.au/fishing/commercial/fisheries

https://www.dpi.nsw.gov.au/fishing/recreational

https://www.dpi.nsw.gov.au/fishing/aboriginal-fishing

Support Measures

A range of measures have been developed to support the objectives of this harvest strategy, in addition to existing management arrangements. These measures include:

1. Targeted compliance operations to strengthen education and compliance in all sectors of the Mulloway fishery
2. Enhancing recreational and commercial data collection programs to improve monitoring data and available performance indicators to improve accuracy of performance monitoring
3. Investing in research programs to reduce knowledge gaps regarding population structure, updated life-history parameters, gear selectivity and discard/release mortality, to improve assessment and management
4. Reducing risks of incidental mortality through ongoing research, education and mitigation programs
5. Restocking of hatchery bred Mulloway to supplement natural localised recruitment

6. Communications programs to promote awareness of Mulloway status and encourage responsible fishing practices.
7. Changes to management arrangements applying from 1 September 2023 to achieve reductions in retained annual catch interim to implementation of the harvest strategy

Strategy scope

The NSW Mulloway Harvest Strategy provides an operational framework to manage fishing mortality[1] and therefore biomass, of the NSW Mulloway stock. The strategy includes objectives, monitoring arrangements, assessment methodology and management actions for changing harvest levels for key sectors of the Mulloway fishery in accordance with changes in stock biomass. The initial focus of the harvest strategy is on rebuilding stock biomass, with subsequent progress to longer term management targets.

Programs are also undertaken to protect or improve environmental conditions (such as habitat and water quality) which may also contribute to stock improvements, noting these are not directly managed or within scope of this harvest strategy.

This harvest strategy provides an interim approach to resource sharing noting existing uncertainties around fishery data and pending development of formal resource sharing policy.

Ecologically sustainable development

The NSW Fisheries Harvest Strategy Policy outlines ecologically sustainable development as a key legislative objective of the NSW *Fisheries Management Act 1994*, and the basis of the *Guidelines for the Ecologically Sustainable Management of Fisheries* to support fishery assessment for export under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Further, the policy states that NSW harvest strategies will seek to integrate the ecological, economic, social and cultural dimensions of fisheries management as data and information becomes available.

An Environmental Impact Statement (EIS), Fishery Management Strategy and Share Management Plan are available for key commercial fisheries interacting with the Mulloway Fishery, and an environmental assessment for recreational fishing is being developed to guide development of a Recreational Fishing Management Strategy. Broader environmental, social, cultural and economic assessment, which includes Mulloway habitats has been undertaken through the New South Wales Marine Estate Threat and Risk Assessment (MEMA 2017).

An Ecological Risk Assessment (ERA) has been developed to build on previous assessments and to progress assessment of the ecological, economic, social and cultural impacts of the Mulloway fishery as data and information improves. The ERA includes quantitative evaluation of fishery management controls and the risk assessment framework, and impacts specific to Mulloway have been published as a case study (Astles and Cormier, 2018). This ERA is being extended to include recent management changes and further assessment of the pressures on Mulloway from non-fishing human activities and environmental factors that may affect rebuilding biomass, as data becomes available.

[1] Retained harvest, noting allowances may also be made to account for incidental and illegal fishing mortality

Objectives

Goal

To rebuild the NSW Mulloway stock biomass to levels supporting ongoing community benefits including sustainable seafood supply, profitable commercial fishing, quality recreational and charter fishing opportunities, and ongoing protection for the continuation of Aboriginal cultural fishing

Strategic objectives

The strategic objectives of the harvest strategy are to:

1. Rebuild the NSW Mulloway stock to target levels, sharing the responsibilities and benefits across fishing sectors
2. Once the rebuilding objective is met, progress the NSW Mulloway stock biomass to the agreed target level aimed to:
    a. Protect the continued access of Aboriginal fishers for cultural fishing
    b. Support the profitability of the commercial fisheries over the long term
    c. Support quality fishing opportunities for recreational and charter fishers, including opportunities to encounter larger Mulloway

Operational objectives

The operational objectives of the harvest strategy are to:

1. Rebuild the NSW Mulloway stock to 25% of unfished biomass (B25) within 5 years and 30% of the unfished biomass (B30) within two generations (11 years)
2. Once the rebuilding objective of B30 has first been achieved, to:
    a. Maintain biomass around a target of 50% of the unfished level (B50), being a biomass supporting balanced benefits for commercial, recreational and Aboriginal fishers
    b. Ensure biomass remains above 20% of the unfished level (B20), this being the level below which recruitment to the stock may be severely compromised

Reference points

Rebuilding target reference points

B_{25} : 25% of unfished biomass (within 5 years)

B_{30} : 30% of unfished biomass (within two generations; 11 years)

Target reference point

B_{TARGET} : 50% of unfished biomass

Trigger reference point (after rebuilding target (B_{30}) is first achieved)

B_{30} : 30% of unfished biomass

Limit reference point (after rebuilding target (B_{30}) is first achieved)

B_{20} : 20% of unfished biomass

Indicators

Indicators are used to measure performance of the Mulloway fishery against the harvest strategy objectives.

The primary indicator is an estimate of current biomass ($B_{CURRENT}$) as a proportion of unfished biomass ($B_{UNFISHED}$, or B_0) as a measure of the current level of biomass depletion, as described under 'Analyses'. The primary indicator is used to monitor Mulloway stock biomass against the operational objectives of the harvest strategy, and is also used through the decision rules to adjust catch levels in accordance with changes in biomass to achieve the operational objectives.

The following secondary indicators are also provided to monitor regional stock biomass, size composition, fishing pressure and spatial movement or abundance patterns:

1. Regional biomass level
2. Proportion of larger fish in the Mulloway stock
3. Tag-recapture rate

The regional biomass indicator is an estimate of current regional biomass ($BR_{CURRENT}$) as a proportion of unfished regional biomass $BR_{UNFISHED}$, or BR_0) as a measure of the current level of regional biomass depletion. The indicator will be measured within the following regions:

- Region 1: Estuary General regions 1-3 (Queensland border to Diamond Head)
- Region 2: Estuary General region 4 (Diamond Head to Wamberal Point)
- Region 3: Estuary General regions 5-7 (Wamberal Point to Victorian border)

The length indicator is used as a measure of opportunities to encounter larger Mulloway against strategic objective 2(c), inferred from the current proportion of fish above lengths (L_{PROP}) of 100 cm and 130 cm.

The tag-recapture indicator is used as a measure of fishing pressure, abundance and spatial movement patterns, inferred from tag-recapture rates.

The rebuilding targets will be considered met where the estimate is above the reference point with 70% confidence. Once rebuilding is achieved, the limit reference point will be considered breached if the estimate is within 70% confidence of the reference point. All other reference points will be considered met where the estimate intersects the reference point. As additional data become available, analyses to inform these measures will be revised and updated to ensure estimates are generated from the most robust data and most applicable analytic methods available.

Primary indicator

$B_{CURRENT}/B_{UNFISHED}$: Current biomass relative to unfished biomass

Secondary monitoring indicators

$BR_{CURRENT}/BR_{UNFISHED}$: Current regional biomass relative to unfished regional biomass

L_{PROP} : Proportion of fish above lengths of 100 and 130 centimetres

Tag-recapture rate : Percentage of tagged fish recaptured

Data and Monitoring

Mulloway is monitored via NSW fishery dependent data from commercial fishery monitoring programs (including mandatory logbooks and DPIRD port monitoring programs), as well as estimates of recreational catch derived from recreational fishing surveys.

Snap-shot data collection has and continues to occur through research projects and management programs. These data programs aim to fill knowledge gaps, reduce uncertainty in the outputs of analyses and inform the effectiveness of management actions and have included aspects of biological information including fishery-dependent and fishery-independent data informing sex specific age and length relationships and maturity.

Performance of the harvest strategy will be informed by relevant data available at the time of analyses (e.g. incorporating improved size and age composition data from the commercial and recreational fishery and fishery independent sampling programs), acknowledging limitations in currently available data and taking into consideration relevant uncertainty.

Existing data sources

1. Daily commercial fishery logbook data: catch, effort, location
2. Surveys of recreational catch in NSW (historical and biennial surveys)
3. Length composition from commercial sector (via NSW DPIRD Port Monitoring Program)
4. Age composition from commercial sector (via NSW DPIRD Port Monitoring Program) supplemented by age data derived from donations to the NSW Research Angler Program

Future data sources (in addition to continued existing data sources)

1. Recreational catch information (length composition and numbers harvested by area) via fisher reporting
2. Length composition from commercial sector via:
    a. Fisher length reporting
    b. Fishery-independent sampling using standardised methods from key locations and habitats
3. Age composition from commercial sector via fishery-independent sampling using standardised methods from key locations and habitats
4. Surveys or other estimates of Aboriginal cultural knowledge and harvest
5. Information on reproductive biology (spatio-temporal spawning patterns, maturity, fecundity) via fishery-independent sampling using standardised methods from key locations and habitats
6. Information derived from resolution of fine-scale stock structure
7. Information to inform discarding, discard mortality, selectivity and retention in the commercial sector
8. Information to inform post-release mortality in the recreational sector

Analyses

Estimates of current biomass ($B_{CURRENT}$ and $BR_{CURRENT}$) relative to unfished biomass ($B_{UNFISHED}$ and $BR_{UNFISHED}$) will be mean estimates derived from the integrated model developed within the Stock Synthesis framework (Methot & Wetzel 2013). This assessment approach provides a statistical framework for the development of a dynamic population model using a range of fishery-dependent and survey data. Data used will include catch, and combinations of abundance indices (e.g. catch rate), age and/or length compositions, and requires up-to-date information on population productivity parameters (e.g. species biology), the spatial scale of stock structure and connectivity, and fishery operational data (e.g. gear selectivity, discard/release rates and mortality).

Estimates of current fishing mortality ($F_{CURRENT}$), evaluated relative to the level of fishing mortality associated with maintaining target biomass (F_{TARGET}), will similarly be derived from the integrated assessment approach. The analytical approach provides: i), retrospective estimates of biomass to examine past trends, ii), current estimates relative to target, trigger and limit reference points, and iii) projected estimates of future biomass according to the model-optimised F_{TARGET} level.

The structure of the assessment framework is underpinned by the Stock Synthesis model environment and supports development of improved models as data improves. This is therefore an expandable assessment approach, capable of determining stock status with reasonable confidence from limited data available during the stock rebuilding phase, with the ability to integrate additional data as they become available to provide a logical progression and comparison with previous assessments. Assessments will utilise all available robust data at the time of the analyses. Future data sources may include improved catch information, rates of discarding, post-release/discard mortality, abundance indices, representative age and length structures (to examine trends in annual age composition, mean length-at-age, mean maturity at age), tag-recapture information, hydroacoustic surveys, and up-to-date information on species biology, stock structure and fishery operational data.

Decision rules

Decision rules are constructed to manage retained harvest to achieve the biomass targets established under the operational objectives, including building biomass to initial rebuilding targets (B_{25} and B_{30}) and subsequent progression to the post-rebuilding target (B_{50}).

During the rebuilding phase of the harvest strategy, a constant harvest limit of 125 tonnes will apply to the commercial and recreational (including recreational charter) sectors. Decision rules will be used to alter the constant harvest limit if estimates of biomass indicate rebuilding targets are unlikely to be met within the objective timeframes (Table 2).

The rebuilding phase will apply until biomass has recovered to the rebuilding target reference point (B_{30}) within two generations (11 years), with an interim target of B_{25} within 5 years, coinciding with the review of this harvest strategy.

Once the rebuilding objective is achieved, the decision rules apply harvest limits based on the harvest rate (level of fishing mortality) allowing biomass to progress to or be maintained around the target level B_{50} (Table 3).

Harvest limits will apply to retained catch for each sector (see ‘Applying harvest limits), noting that harvest limits will be determined taking into account levels of Aboriginal cultural harvest levels,

incidental (including discard) mortality and illegal/unreported catch where information is available. Arrangements to monitor or manage incidental mortality may also be established separate to this strategy and may be reviewed or amended as necessary.

Harvest limits will apply to an annual fishing period from 1 March to the last day of February in the following year.

The constant harvest limit

The initial constant harvest limit has been determined with advice from the independent Total Allowable Fishing (TAF) Committee, which is established under the Act to set catch and effort levels that meet the objects of the Act, including supporting sustainability of fish stocks and benefits to fishers and the community.

The objective of the constant harvest limit is to implement a catch level that will remain at the same level during the rebuilding period, that will achieve the rebuilding objectives within the objective timeframe, considering all relevant scientific information. The constant harvest limit may be adjusted in accordance with the decision rules of the harvest strategy if it becomes evident the rebuilding objectives will not be met.

Management arrangements applying to the commercial or recreational sector may be adjusted if, considering the best available scientific information, harvest is determined or forecast to exceed the share provided to the sector.

This approach acknowledges limitations in current data sources and existing uncertainty in the most recent stock assessments regarding the current level of Mulloway biomass and harvest levels.

As information improves, catch levels will be determined through the harvest strategy decision rules based on stock assessments that incorporate a range of additional information, including improved catch and effort data, and integration of additional scientific information and modelling from commencing research programs.

Rebuilding strategy

The harvest strategy commences with a focus on rebuilding the NSW stock biomass to higher levels, with an initial objective and staged targets to rebuild biomass to 25% (B_{25}) and 30% (B_{30}) of unfished biomass using a constant harvest limit (Table 2, Figure 1). The constant harvest limit is determined as the harvest level considered, based on available evidence, to be the level of harvest that will allow the rebuilding objectives to be achieved within the objective timeframes.

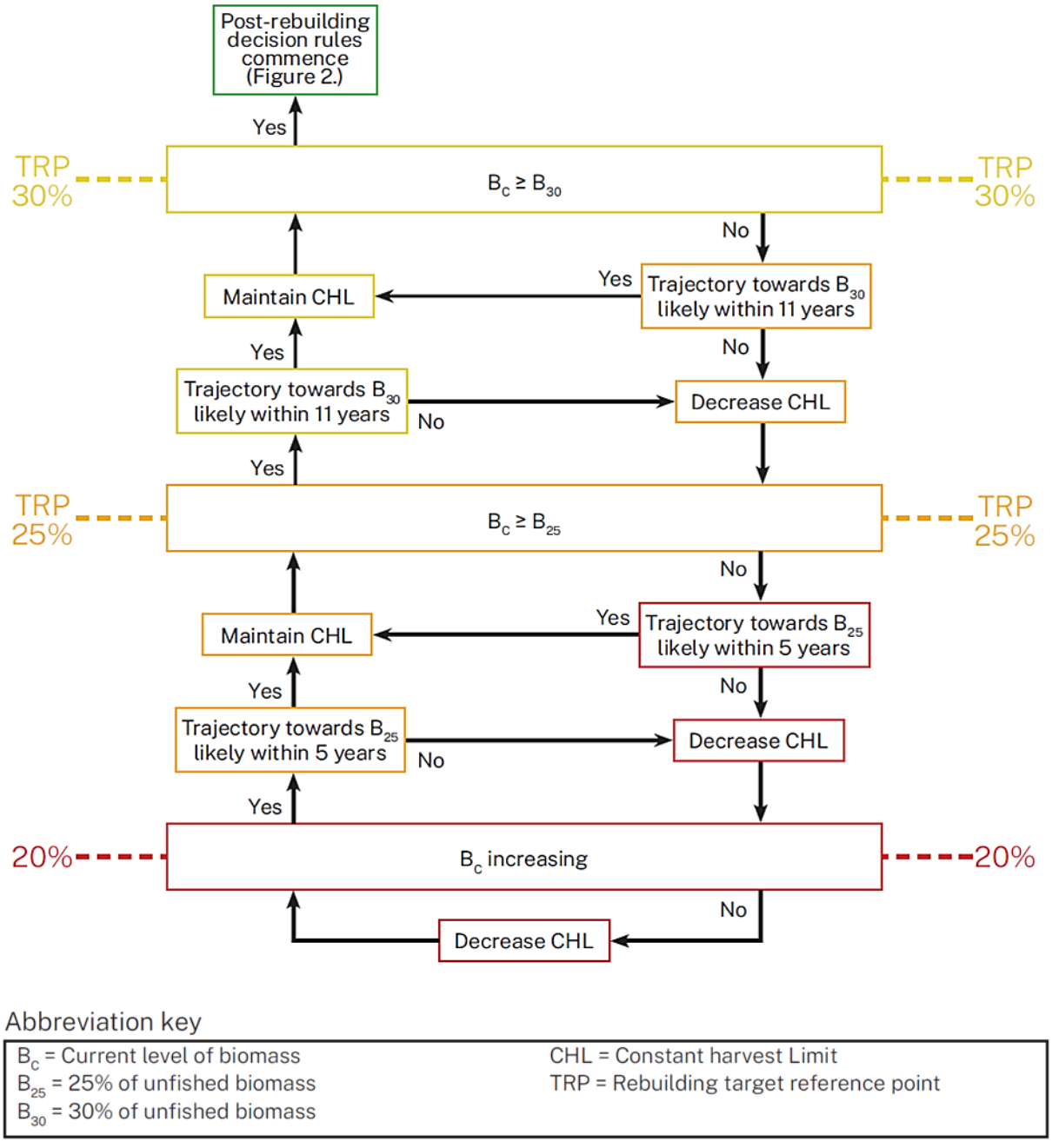
Should available evidence indicate that the rebuilding target(s) are unlikely to be achieved within the specified timeframes, the constant harvest limit will be adjusted to provide greater certainty that the rebuilding objectives will be achieved, which may include reducing the harvest limit or implementing additional actions to minimise all sources of fishing mortality.

Table 2: Decision rules for determining harvest limits before rebuilding is achieved

Condition	Rule
$\mathbf{B_{CURRENT} < B_{30}}$ within 11 years (and B_{25} within 5 years)	Constant harvest limit of **125 tonnes**

(Biomass is at or below the rebuilding target reference point, before the rebuilding target is first achieved), **and** Biomass is projected to be at or above the rebuilding target within the objective timeframe.	
$B_{CURRENT}$ < B_{30} within 11 years (and B_{25} within 5 years) (Biomass is at or below the rebuilding target reference point, before the rebuilding target is first achieved), **and** Biomass is projected to be below the rebuilding target within the objective timeframe.	Review and adjust constant harvest limit to meet rebuilding target and timeframe (including cease of targeted fishing, if necessary).

Figure 1: Decision rule summary flowchart – Rebuilding strategy



Abbreviation key

B_c = Current level of biomass	CHL = Constant harvest Limit
B_{25} = 25% of unfished biomass	TRP = Rebuilding target reference point
B_{30} = 30% of unfished biomass	

Post-rebuilding strategy

Once the rebuilding objective and targets are achieved, the harvest strategy aims to increase stock biomass to the target of 50% of the unfished biomass (B_{50}) and maintain biomass around this level[2].

The decision rules are applied in response to estimates of current biomass (Table 3, Figure 2).

Where biomass is at or above the target reference point, harvest limits will be determined based on the level of harvest required to maintain biomass around the target level. Where biomass is below the target reference point, harvest limits will be determined using a linear reduction in harvest rate between the target and limit reference points to support biomass returning to the target level.

Should biomass breach the trigger reference point of 30% of the unfished biomass (B_{30}), a review of the harvest strategy will also be undertaken to determine the reasons and significance of the decline.

Should biomass decline to the limit reference point of 20% (or less) of the unfished biomass (B_{20}), harvest limits will be reduced to zero (i.e. fishery closure)[3]. If this occurs, appropriate surveys may be undertaken to determine reopening of the fishery where reopening is considered consistent with the objectives of this strategy.

Table 3: Decision rules for determining harvest limits after rebuilding is achieved

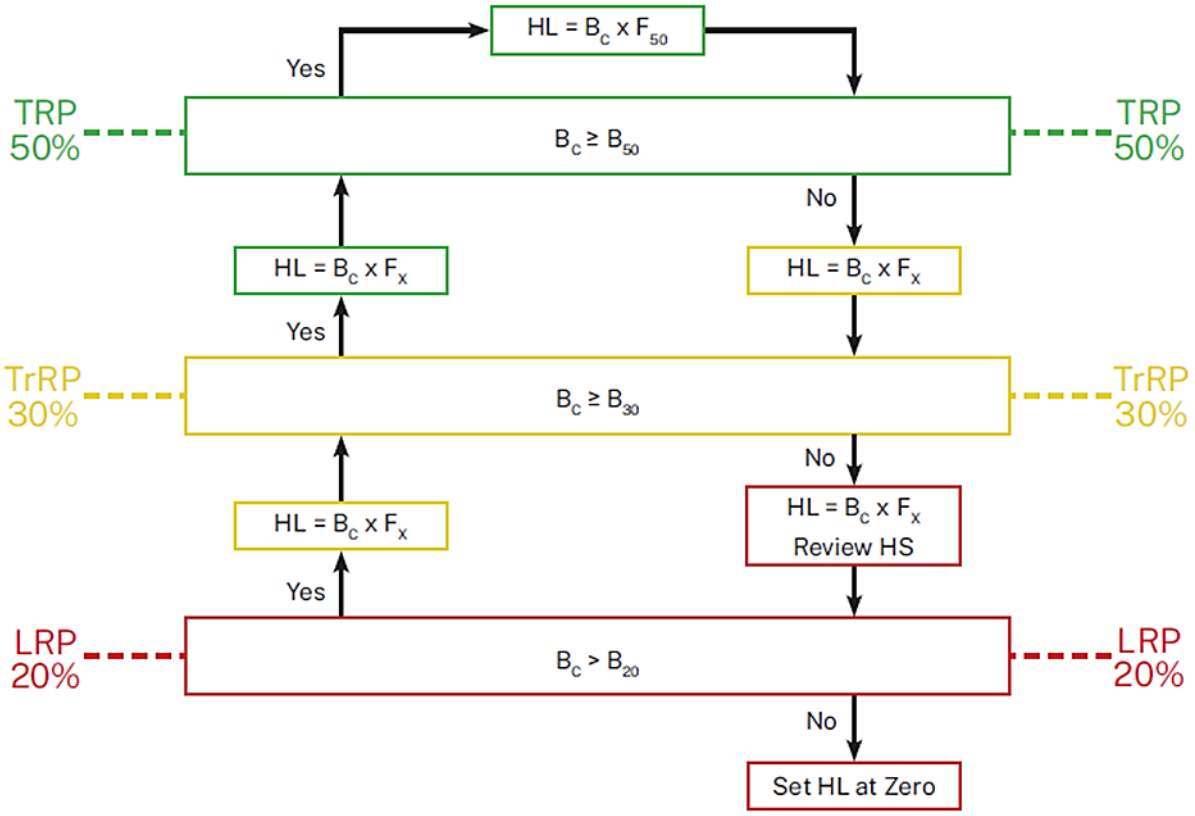
Condition	Rule
$B_{CURRENT} \sim B_{50}$ (Biomass is at or above the target reference point)	Harvest limit* = $B_{CURRENT}$ x F_{50}
$B_{50} > B_{CURRENT} > B_{20}$ (Biomass is below the target and above the limit reference point)	Set harvest limit based on reducing fishing mortality rate: $F_X = F_{50}$ x ($B_{CURRENT} - B_{20}$)/($B_{50} - B_{20}$) Harvest limit* = $B_{CURRENT}$ x F_X **and**, if biomass breaches the trigger reference point (B_{30}), Review Harvest Strategy
$B_{CURRENT} \leq B_{20}$ (Biomass is at or below the limit reference point)	Harvest limits set to zero

*Harvest limits are determined taking into account levels of Aboriginal cultural harvest, incidental (including discard) mortality, and illegal/unreported catch where information is available

[2] The timeframe to achieve B_{50} will be further evaluated as fishery data and predictive modelling improves.

[3] The decision rules are designed to avoid biomass declining to the limit reference point once rebuilding has been achieved, noting the harvest strategy is also designed to consider all potential future stock conditions including decline to the limit reference point.

Figure 2: Decision rule summary flowchart – Post-rebuilding strategy



Abbreviation key

B_C = Current level of biomass	F_X = Reduced fishing mortality rate
B_{20} = 20% of unfished biomass	HL = Harvest limit
B_{30} = 30% of unfished biomass	HS = Harvest strategy
B_{50} = 50% of unfished biomass	LRP = Limit reference point
F_{50} = Fishing mortality associated with target biomass	TrRP = Trigger reference point
	TRP = Target reference point

Applying harvest limits

Harvest limits will be determined for each fishing period in accordance with the decision rules based on the most recent annual stock assessment.

Harvest limits will be implemented with equal proportions allocated to the commercial and recreational (including charter) sectors, with harvest from each sector managed to remain within the respective limit as a share of total catch.

Applying decision rules to commercial harvest

Harvest limit arrangements

Consultation note:

Consultation is being undertaken alongside consultation on the draft Harvest Strategy to determine the most suitable arrangements to manage harvest to the respective limits for each sector. Following consultation, specific management arrangements may be incorporated into the Harvest Strategy or established separate to the Harvest Strategy.

Applying decision rules to recreational harvest

Harvest limit arrangements

Consultation note:

Consultation is being undertaken alongside consultation on the draft Harvest Strategy to determine the most suitable arrangements to manage harvest to the respective limits for each sector. Following consultation, specific management arrangements may be incorporated into the Harvest Strategy or established separate to the Harvest Strategy.

Applying decision rules to Aboriginal cultural harvest

Application of decision rules for Aboriginal cultural harvest will be determined in consultation with the NSW Aboriginal Fishing Advisory Council.

Harvest Strategy review

This strategy will be reviewed through a consultative process established by DPIRD within 5 years from commencement, or if required by decision rules.

The Executive Director Fisheries may decide to review this harvest strategy at any time if, considering the best available information, that its objectives are unlikely to be achieved, or where clear justification (such as availability of additional stock, economic or operational information) becomes available.

Strategic development

There are several issues that this first harvest strategy does not fully resolve. These could be addressed in a future revised harvest strategy as new information and data become available.

The following issues are identified as strategic priorities to inform review and development of the harvest strategy:

1. Develop a more comprehensive understanding of the Aboriginal cultural fishery for Mulloway, including total catch
2. Progress data collection programs for commercial and recreational catch, including implementation of real/near time reporting
3. Incorporate improved biological and spatial data to further inform stock assessments, including an improved understanding of the spatial dynamics of the Mulloway population
4. On review of the harvest strategy, investigate incorporating an objective operationalising the harvest or encounter rate for large Mulloway currently associated with the secondary length monitoring indicator

Definitions

Decision Rule: pre-agreed management actions to control intensity of fishing in order to achieve the harvest strategy objectives

Indicator: a quantity that can be measured and used to track changes with respect to an objective

Limit Reference Point: the value of an indicator that is unacceptable because the stock or management unit has become depleted or recruitment-overfished

Objective: an objective that has a direct and practical interpretation in the context of a fishery and against which performance can be evaluated

Reference point: the value of an indicator that can be used as a benchmark of performance against an operational objective

Target Reference Point: the value of an indicator that is desirable or ideal and at which fisheries management should aim

Trigger Reference Point: the value of an indicator for a fish stock or management unit at which a change in the level of monitoring or management is considered or adopted

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