



Department of
**Primary Industries and
Regional Development**

*We're working for
Western Australia.*

Fisheries Management Paper No. 305

**West Coast Demersal Scalefish Resource
Harvest Strategy 2021-2025**

Version 1.0

July 2021

Version Control

Version	Publication Series Title	Change Description	Date
1.0	Fisheries Management Paper No. 305	First published harvest strategy for West Coast Demersal Scalefish Resource	27/07/2021

Important disclaimer

The Chief Executive Officer of the Department of Primary Industries and Regional Development and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

Department of Primary Industries and Regional Development
Gordon Stephenson House
140 William Street
PERTH WA 6000
Telephone: (08) 6551 4444
Website: dpird.wa.gov.au
ABN: 18 951 343 745

ISSN: 0819-4327

Copyright © State of Western Australia (Department of Primary Industries and Regional Development) 2021

Contents

1.0 INTRODUCTION	1
1.1 Review Process.....	1
2.0 SCOPE	2
2.1 Environmental Context	3
2.2 Indicator species.....	4
2.3 Other retained (non-indicator) species	5
2.4 Fishing Activities.....	5
2.5 Catch-Share Allocations	7
3.0 HARVEST STRATEGY.....	9
3.1 Long-term Objectives	9
3.2 Operational Objectives	10
3.3 Harvesting and Management Approach	10
3.4 Harvest Strategy Procedures	11
3.5 Ecological Sustainability	12
3.6 Recovery Plan 2010-2030.....	16
3.7 Fishery Performance	26
3.8 Monitoring and Assessment Procedures	30
4.0 MANAGEMENT MEASURES AND IMPLEMENTATION.....	34
4.1 Management Measures.....	34
4.2 Implementing Changes to the Management Arrangements	35
4.3 Compliance and Enforcement	38
5.0 REFERENCES	40
6.0 APPENDICES.....	44
6.1 Appendix 1 – WCDSR IFM Allocation Determination	44
6.2 Appendix 2 – Calculating Total Fishing Mortality.....	47
6.3 Appendix 3 – Harvest Strategy Control Rules for Retained Species once Recovered	50

List of Acronyms

ARMA	<i>Aquatic Resources Management Act 2016</i>
CAES	Catch and Effort Statistics
CPUE	Catch Per Unit Effort
CSLPMF	Cockburn Sound Line and Pot Managed Fishery
DPIRD	Department of Primary Industries and Regional Development
EBFM	Ecosystem Based Fisheries Management
EPBC (Act)	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERA	Ecological Risk Assessment
ESD	Ecologically Sustainable Development
ETP	Endangered, Threatened and Protected (species)
FRMA	<i>Fish Resources Management Act 1994</i>
FRMR	<i>Fish Resources Management Regulations 1995</i>
HCR	Harvest Control Rule
HSWG	Harvest Strategy Working Group
IFM	Integrated Fisheries Management
MSY	Maximum Sustainable Yield
OCP	Operational Compliance Plan
RFBL	Recreational Fishing from Boat Licence
SWTMF	South West Trawl Managed Fishery
TAE	Total Allowable Effort
TSF	Temperate Shark Fisheries
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WCB	West Coast Bioregion
WCDSR	West Coast Demersal Scalefish Resource
WCDSIMF	West Coast Demersal Scalefish Interim Managed Fishery
WCRLMF	West Coast Rock Lobster Managed Fishery

Executive Summary

The West Coast Demersal Scalefish Resource spans from north of Kalbarri to east of Augusta and out to the extent of the Australian Fishing Zone. The resource includes some of Western Australia's most iconic species such as West Australian dhufish, pink snapper and baldchin groper and provides some of the best recreational fishing experiences and high quality seafood to domestic consumers. This is the first formal harvest strategy for the West Coast Demersal Scalefish Resource and provides a transparent decision making framework to achieve the ecological, social and economic objectives for this resource. This harvest strategy was developed by a stakeholder based harvest strategy working group.

This harvest strategy sets out the ecological objectives for the West Coast Demersal Scalefish Resource and the performance indicators, reference levels and control rules to meet these objectives. The main ecological objective is to maintain spawning biomass of all retained species above maximum sustainable yield. Through the development of this harvest strategy, all stakeholders highlighted their aspiration was high abundance and larger fish, which resulted in a higher target reference level compared to those suggested in Western Australia's harvest strategy policy. The harvest strategy also includes other ecological objectives aimed at maintaining the impacts of fishing activities on other ecological assets such as bycatch species, endangered, threatened and protected species and habitat and ecosystem function to acceptable risk levels.

The recreational and commercial sectors developed economic and social objectives, performance indicators and reference levels aimed at maintaining recreational fishing experiences and the viability of charter and commercial operators.

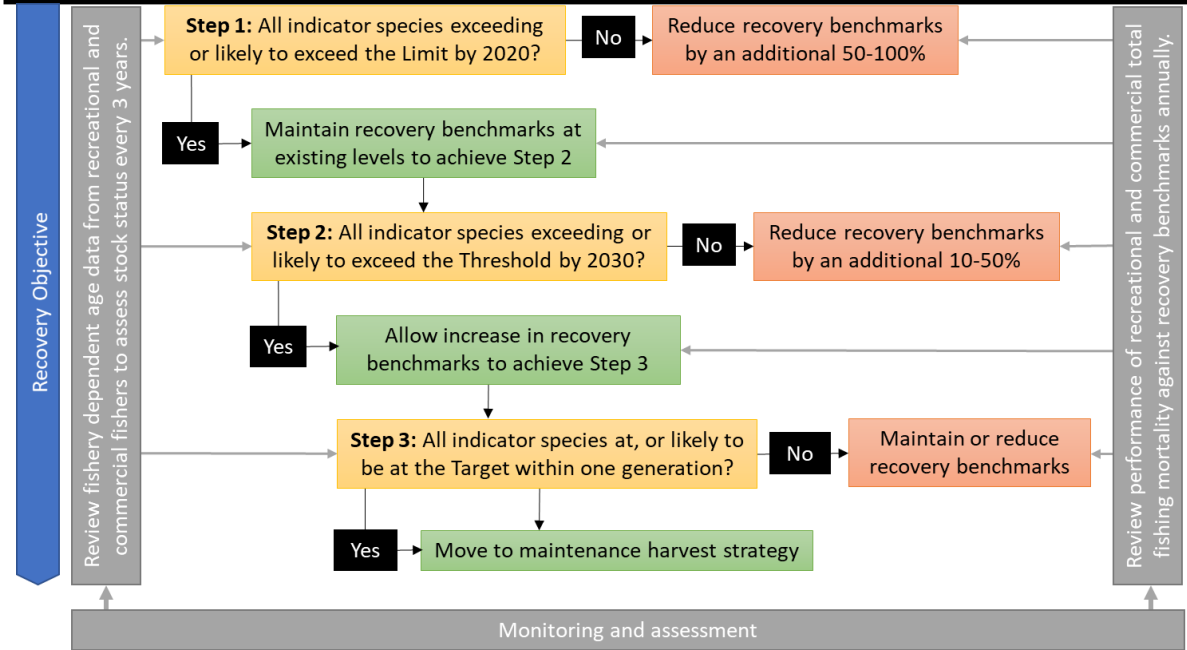
In 2007, a stock assessment of West Coast Demersal Scalefish Resource indicator species found that the resource was subject to overfishing and recommended fishing mortality be reduced by at least fifty percent. Significant reform of the recreational (including charter) and commercial sectors was undertaken between 2007 and 2010 to recover the resource within 20 years. A recovery plan is included in this harvest strategy with the objective of recovering this resource by 2030. The harvest strategy working group included an additional step in the recovery plan so that once ecologically recovered (i.e. spawning biomass above maximum sustainable yield), stocks are rebuilt to target levels to increase the resource's resilience and to reflect stakeholder aspirations. The recovery plan outlines three steps with corresponding recovery milestones to identify if we are on track to meet the recovery objective or if further action is required. Two strategies have been implemented to achieve the recovery objective including maintaining each sector's total fishing mortality below recovery benchmarks and providing targeted protection for key spawning aggregations.

This resource is shared between recreational and commercial fishers under an IFM allocation, with 36 percent allocated to the recreational (including charter) sector and 64 percent allocated to the commercial sector. Consistent with this resource sharing arrangement, each sector needs to play their part to ensure their total fishing mortality remains below recovery benchmarks so the resource can recover by 2030.

West Coast Demersal Scalefish Resource Harvest Strategy

Operational Objectives														
Ecological Objectives	<ol style="list-style-type: none"> 1. Maintain spawning stock biomass of each retained species above B_{MSY}. 2. To ensure fishing impacts do not result in serious or irreversible harm to: <ol style="list-style-type: none"> a. bycatch species populations; b. Endangered, Threatened and Protected species populations; c. habitat structure and function; and d. ecosystem structure and function. 													
Economic & Social Objectives	<ol style="list-style-type: none"> 1. Provide opportunities to ensure commercial fishers can maintain or enhance their livelihood. 2. Provide opportunity to maximise flow of commercial fishing related economic benefit to the broader community. 3. Maintain or improve cultural, recreational and lifestyle benefits for recreational fishing participants. 4. Provide flexible opportunities to ensure charter operators can maintain or enhance their livelihood. 5. Opportunity to maximise flow of recreational (including charter) fishing tourism related economic benefit to the broader community. 													
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #4a7ebb; color: white;"> <th style="width: 50%;">Performance indicators</th> <th style="width: 50%;">Reference levels</th> </tr> </thead> <tbody> <tr> <td>1. Percent of annual WCDSIMF entitlement used</td> <td>1. 75-100% of entitlement used annually</td> </tr> <tr> <td>2. Not yet developed</td> <td>2. Not yet developed</td> </tr> <tr> <td>3. Recreational boat-based fishing participation</td> <td>3. 820,693 hours fished \pm 20%</td> </tr> <tr> <td>4. Fishing tour participation</td> <td>4. 27,901 client days \pm 20%</td> </tr> <tr> <td>5. Not yet developed</td> <td>5. Not yet developed</td> </tr> </tbody> </table>	Performance indicators	Reference levels	1. Percent of annual WCDSIMF entitlement used	1. 75-100% of entitlement used annually	2. Not yet developed	2. Not yet developed	3. Recreational boat-based fishing participation	3. 820,693 hours fished \pm 20%	4. Fishing tour participation	4. 27,901 client days \pm 20%	5. Not yet developed	5. Not yet developed
Performance indicators	Reference levels													
1. Percent of annual WCDSIMF entitlement used	1. 75-100% of entitlement used annually													
2. Not yet developed	2. Not yet developed													
3. Recreational boat-based fishing participation	3. 820,693 hours fished \pm 20%													
4. Fishing tour participation	4. 27,901 client days \pm 20%													
5. Not yet developed	5. Not yet developed													

West Coast Demersal Scalefish Resource Recovery plan



Recovery benchmarks: total fishing mortality (retained catch + post-release mortality)

Maintain each sectors total fishing mortality (retained catch + post-release mortality) of the WCDSR and key species below recovery benchmarks.

Sector	Inshore demersal						Offshore demersal	WCDSR total
	Dhufish	Pink snapper	Baldchin groper	Redfish	Breaksea cod	Emperor		
Recreational recovery benchmark (tonnes)	136 t	35 t	40 t	7 t	15 t	11 t	5 t	270 t
Commercial recovery benchmark (tonnes)	91 t	138 t	22 t	42 t	3 t	102 t	40 t	480 t

Executive Summary Figure. Overview of the West Coast Demersal Scalefish Resource Harvest Strategy including objectives, recovery plan and recovery benchmarks.

1.0 Introduction

Harvest strategies for aquatic resources in Western Australia (WA) that are managed by the Department of Primary Industries and Regional Development (DPIRD) are formal documents that support the decision-making processes and ensure these processes are consistent with the principles of Ecologically Sustainable Development (ESD; Fletcher 2002) and Ecosystem Based Fisheries Management (EBFM; Fletcher et al. 2012). The objectives of ESD are reflected in the objects of the *Fish Resources Management Act 1994* (FRMA) and the *Aquatic Resources Management Act 2016* (ARMA) which will replace the FRMA once enacted.

This harvest strategy has been developed in-line with DPIRD's over-arching Harvest Strategy Policy for Aquatic Resources (Department of Fisheries 2015a) and is consistent with relevant national harvest strategy policies and guidelines (e.g. Sloan et al. 2014; Department of Agriculture and Water Resources 2018a). It makes explicit the performance indicators, reference levels, and harvest control rules designed to achieve the specific long- and short-term management objectives for the resource, and the broader goals of ESD, EBFM and Integrated Fisheries Management (IFM).

The publication of this harvest strategy is intended to make the decision-making considerations and processes for the management of specified aquatic resources publicly transparent and provide a basis for informed dialogue on management actions with resource users and other stakeholders (Department of Fisheries 2015a).

This strategy provides guidance for decision-makers, but does not derogate from or limit the exercise of discretion required for independent decision-making under the FRMA (or ARMA) by either the Minister for Fisheries, the Director General of the DPIRD (as Chief Executive Officer) or other delegated decision-makers in order to meet the objects of the FRMA or ARMA.

This harvest strategy has been developed by a stakeholder-based harvest strategy working group (HSWG) with representation from Recfishwest, the Western Australian Fishing Industry Council (WAFIC), Marine Tourism WA, recreational fishers, charter fishers, commercial fishers and DPIRD. Consistent with the DPIRD's Stakeholder Engagement Guideline (Department of Fisheries 2016), this harvest strategy has been subjected to public consultation processes. This harvest strategy has been approved by the Minister for Fisheries.

1.1 Review Process

The WA Harvest Strategy Policy recognises that fisheries change over time and that a review period should be built into each harvest strategy to ensure that it remains relevant (Department of Fisheries 2015a). This harvest strategy will remain in place for a period of five years, after which time it will be fully reviewed. However, this harvest strategy may be subject to review and amended as appropriate within this five-year period.

2.0 Scope

This harvest strategy relates to the West Coast Demersal Scalefish Resource (WCDSR) of WA and the fishing activities that impact this resource. The WCDSR comprises over 100 demersal scalefish species that inhabit the inshore and offshore waters of the West Coast Demersal Scalefish Interim Managed Fishery (WCDSIMF, Black Point, east of Augusta, to the Zuytdorp Cliffs, north of Kalbarri, all marine waters south of 26° 30' S and west of 115° 30' E) (Figure 1).

Demersal scalefish in open marine waters are primarily harvested by the commercial sector within the WCDSIMF and the recreational (including charter) sector within the West Coast Bioregion (WCB) under a formal catch share arrangement. In December 2012, the Minister for Fisheries determined sectoral IFM allocations for the WCDSR and sectoral proportional allocation guidelines for key species (see section 2.5 and section 6.1 for additional information).

Fishers mainly target three demersal species including pink snapper (*Chrysophrys auratus*) West Australian dhufish (dhufish; *Glaucosoma hebraicum*) and baldchin groper (*Choerodon rubescens*). Redthroat emperor (*Lethrinus miniatus*) and bight redfish (*Centroberyx gerrardi*) also comprise a significant proportion of commercial catch and breaksea cod (*Epinephelides armatus*) comprise a significant proportion of recreational catch in certain management areas of the WCDSR.

In addition, five state-managed fisheries retain demersal scalefish in the WCB:

- the Temperate Shark Fisheries (TSFs) incorporating the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery and Southern Demersal Gillnet and Demersal Longline Managed Fishery;
- West Coast Rock Lobster Managed Fishery (WCRLMF);
- Cockburn Sound Line and Pot Managed Fishery (CSLPMF); and
- South West Trawl Managed Fishery (SWTMF).

Commercial vessels in the Commonwealth-managed Western Deepwater Trawl Fishery, which operate outside of the 200 m isobath, may also retain demersal scalefish but primarily target deep-water crustaceans. All catches from this Commonwealth fishery are accounted for in another harvest strategy (Australian Fisheries Management Authority 2011).

Monitoring and assessment of the WCDSR is based on identification and sustainability evaluation of indicator species (Newman et al. 2018; Department of Fisheries 2011). Indicator species are determined using a risk-based approach that calculates the:

- 'sustainability risk' of the stocks (based on the inherent vulnerability and the current risk to the wild stock); and
- current or likely future 'management risk' of the species or stock to the community (measured as a combination of the current management information requirements and their economic and social values).

The status of these fished stocks is subsequently used as a robust indicator of the sustainability status and risks within the suite of inshore and offshore demersal

scalefish exploited in that region. In accordance with this approach, the focus of this harvest strategy is based on the indicator species for the inshore demersal scalefish suite of species (dhufish, pink snapper and baldchin groper) and offshore demersal suite of species (hapuku, bass groper and blue-eye trevalla) that comprise the WCDSR. Periodic assessments of selected non-indicator species are also undertaken to validate the indicator species approach and ensure that the status of other retained species remains at acceptable levels.

The use of indicator species as the basis for developing harvest strategies of an entire resource has facilitated the successful management of multi-species fisheries in WA. The precautionary element of this approach means that should an indicator species breach a threshold or limit reference level, the entire suite of species covered by that indicator species will be deemed to have breached this level. Therefore, to enable recovery of an overfished species an overall reduction in fishing intensity across the entire resource is often required.

In addition to considering fishing impacts from all fishing activities on retained species, this harvest strategy also covers impacts on bycatch, endangered, threatened and protected (ETP) species, habitats and ecosystems, to ensure any risks to these elements are managed effectively. Note, this harvest strategy only considers the impact of fishing activities by the WCDSIMF and the recreational (including charter) sector on these ecological components of the WCDSR. Future versions may be expanded to include the impacts from other state-managed commercial fisheries (i.e. the TSFs, the WCRLMF, the CSLPMF and the SWTMF) where relevant.

2.1 Environmental Context

The WCDSR includes demersal species that inhabit inshore (shelf) waters of 20-250 m depth and offshore >250 m depth in the WCB. The WCB marine environment is predominantly a temperate oceanic zone. The WCB is characterised by exposed sandy beaches and a limestone reef system that creates surface reef lines, often about 5 kilometres off the coast. Further offshore, the continental shelf habitats are typically composed of coarse sand. Southward of Cape Naturaliste, the coastline changes from limestone to predominantly granite and becomes more exposed to the influences of the Southern Ocean.

The waters off the WCB are also strongly influenced by the southward-flowing Leeuwin Current, generated by flow from the Pacific through the Indonesian archipelago. The low productivity associated with the Leeuwin Current restricts total finfish production off the WA coast to a globally modest level (Molony et al. 2011). Weaker counter-currents on the continental shelf (shoreward of the Leeuwin Current), such as the Capes Current that flows northward from Cape Leeuwin as far as Shark Bay, occur during summer and influence the distribution of many of the coastal finfish species.

Two significant marine embayments in the WCB are Cockburn Sound and Geographe Bay. The Abrolhos Islands also represent a significant area for its biological and social significance.

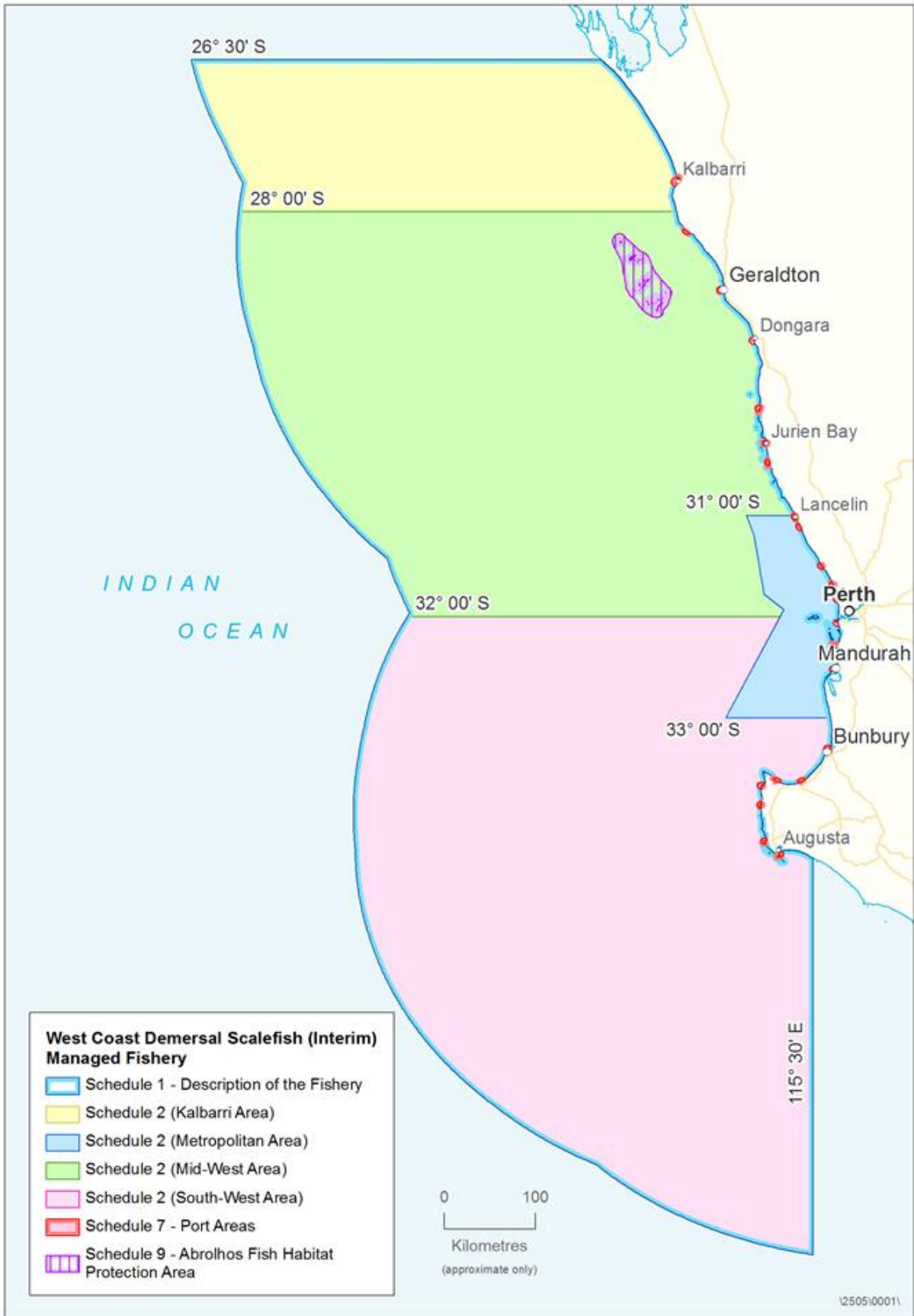


Figure 1. Boundaries and management areas of the WCDSR.

2.2 Indicator species

The two indicator species selected for assessing the inshore demersal scalefish suite of species of the WCDSR are dhufish and pink snapper. Baldchin groper is an indicator for Baldchin groper in only the Mid-West Area of the WCDSR. The three indicator species selected for assessing the offshore demersal scalefish suite of species of the WCDSR are hapuku (*Polyprion oxygeneios*), bass groper (*Polyprion americanus*) and blue-eye trevalla (*Hyperoglyphe antarctica*). These inshore and offshore demersal scalefish indicator species represent approximately 75% of the total demersal scalefish catch taken by all sectors from the WCDSR in 2017/18.

The performance of the fisheries against catch-management objectives and of the stocks against spawning biomass (B) and fishing mortality (F) based objectives in both the recovery and post-recovery harvest strategies are evaluated at the bioregion level for dhufish and pink snapper. Briefly, these two species are important in the fishery across all or most of the WCB. Thus, catches and stock status are monitored at the bioregion (stock) level. Performance will also be assessed at the management area (assemblage) level if control rules around either the threshold or limit reference points are triggered, allowing status of assemblages at the smaller scale to be estimated. This is necessary because the commercial fisheries (i.e. WCDSIMF and TSFs) are prohibited from fishing in the Metropolitan Area and the size of the recreational sector differs among areas, resulting in different combinations of total fishing effort in each area.

The performance of the fisheries against catch-management objectives and of the stocks against spawning biomass (B) and fishing mortality (F) based objectives in both the recovery and post-recovery harvest strategies are evaluated at the Mid-West level for baldchin groper. Thus, stock status is monitored at the Mid-West level while catches are monitored at the WCB and Mid-West levels. This is due to baldchin groper abundance being focussed in the Mid-West Area, including at the Arolhos Islands.

2.2.1.1 Pink snapper

Pink snapper are distributed around southern Australia from northern Queensland to north-west WA (Kailola et al. 1993) and around the north island of New Zealand (Parsons et al. 2014). Stock structure of this species within Australian waters is complex, particularly in WA, where six biological stocks/management units are currently recognised (Jackson et al. 2012). Juveniles typically inhabit inshore waters while adults and sub-adults inhabit waters of the continental shelf out to depths of more than 300 m. Pink snapper are long-lived (maximum age around 41 years in the WCB), mature around 3-5 years of age and form spawning aggregations in embayment and coastal areas in the WCB (i.e. Cockburn Sound, Owen Anchorage and Warnbro Sound) and nearshore reefs during spring and summer (Dias et al. 2016). Under the Marine Stewardship Council (MSC) Standard, one generation time for pink snapper in the WCDSR is 14 years.

2.2.1.2 *Dhufish*

Dhufish are endemic to the south-western coast of WA, between Shark Bay and the Recherche Archipelago (~26°S to 123°E) (McKay 1997; Hutchins and Swainston 1999). Within this range, dhufish is most abundant in the WCB between the Abrolhos Islands and Cape Naturaliste (Lenanton et al. 2009). The stock structure of dhufish indicates geographic residency of adult dhufish in the different management areas of the WCB, with recruitment occurring primarily from adjacent multiple nurseries within this region (Fairclough et al. 2013). Small juveniles typically inhabit areas of sand inundated low profile reef (<50m depth) with larger juveniles found over low-lying reef and will have recruited to the area where they will remain as adults (Fairclough et al. 2013). Dhufish are long-lived (~40 years), mature around 3-4 years of age and form complex social systems, spawning in pairs or small groups over reef from November to April (Hesp et al. 2002; Lenanton et al., 2009; Mackie et al., 2009). Under the MSC Standard, one generation time for dhufish in the WCDSR is 12.5 years.

2.2.1.3 *Baldchin groper*

Baldchin groper are endemic to WA, between Geographe Bay to Coral Bay (Allen, 2009). The stock structure of baldchin groper consists of a single or a series of overlapping stocks within the WCB, with limited movement of adults and juveniles over one years old (Fairclough et al. 2011b). Baldchin groper typically occur on, or in the vicinity of, benthic reef habitat. Baldchin groper are a long-lived (~20 years) functional protogynous hermaphrodite, maturing as females around 3-4 years of age and undergoing sex change at 10-12 years (Fairclough 2005; Nardi et al. 2006). Spawning in the WCB occurs from July to January, peaking in November at the Abrolhos Islands (Fairclough 2005; Nardi et al. 2006). Under the MSC Standard, one generation time for baldchin groper in the WCDSR is 8.9 years.

2.3 Other retained (non-indicator) species

For other retained species, annual risk (including vulnerability) assessments are undertaken to identify if there have been any substantial changes, particularly in the catches of these species, relative to historical levels. If an increase in risk is identified, a review is triggered to investigate the reasons for the variation. If the increase in risk is considered significant a higher level of monitoring and assessment of the species is necessary (e.g. collection of an age sample to allow for estimation of fishing mortality and/or some other proxy for biomass of the stock).

2.4 Fishing Activities

2.4.1 Governance

The WCDSR is targeted by the commercial, recreational (including charter) and customary fishing sectors. Although not an exhaustive list, these fishing sectors are managed by DPIRD under the following key legislation:

- FRMA (will be replaced by the ARMA once enacted);
- *Fish Resources Management Regulations 1995* (FRMR);

- *West Coast Demersal Scalefish (Interim) Management Plan 2007;*
- *Cockburn Sound (Line and Pot) Limited Entry Fishery Notice 1995;*
- *Southern Demersal Gillnet and Longline Managed Fishery Management Plan 2018;*
- *West Coast Demersal Gillnet and Demersal Longline Interim Managed Fishery Management Plan 1997;*
- *West Coast Demersal Scalefish Interim Managed Fishery Vessel Monitoring System Approved Directions;*
- *Southern Demersal Gillnet and Longline Managed Fishery Vessel Monitoring System Approved Directions; and*
- *West Coast Demersal Gillnet and Longline Interim Managed Fishery Vessel Monitoring System Approved Directions.*

Fishers must also comply with the requirements of:

- *The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);*
- *Marine Safety (Domestic Commercial Vessel) National Law Act 2012;*
- *Western Australian Marine Act 1982;*
- *Western Australian Biodiversity Conservation Act 2016; and*
- *Western Australian Conservation and Land Management Act 1984.*

2.4.2 Commercial Fishing

Commercial line fishing in WCB is managed under the WCDSIMF. Demersal scalefish are caught using hydraulic or electric powered reels (up to 10 per vessels) rigged with up to 30 snoods and circle hook(s) baited with herring, mullet, sardines and squid.

The WCDSIMF commenced in 2008, following restructuring of the previous open access wetline fishery. The WCDSIMF operates between 26°30' south (north of Kalbarri) and 115°30' east (east of Augusta) and comprises four management areas, i.e. Kalbarri, Mid-West, Metropolitan and South-West (Figure 1). These Areas extend from the coast outwards to the boundary of the Australian Fishing Zone, with the exception of the Metropolitan Area which extends to a line which approximates the 200 m depth contour. The WCDSIMF was developed as a limited entry fishery, with initially only 61 permits allowed access to the fishery. Each of the four management areas is allocated a maximum number of annual hours of fishing time, with the Metropolitan Area allocated zero hours (i.e. fishing is not permitted). Units are allocated to permits and provide entitlement in "hours" of fishing time. The use of a VMS allows fishing effort to be monitored and entitlement use acquitted. The total capacity of the fishery, which can be adjusted by altering unit values as required, restricts fishing effort in the fishery. Gear and other restrictions apply (in the form of maximum numbers of lines and hooks that may be used and arrangements regulating the carriage of lines and fish), including minimum legal lengths for retention of species.

2.4.3 Recreational Fishing

Recreational (and charter) fishing for demersal scalefish in the WCB is mostly line-based fishing from boats however, a small quantity is also taken by spear fishers. Fishers operate out of a large number of West Coast locations including Kalbarri, Geraldton, Dongara, Jurien Bay, Cervantes, Lancelin, Perth Metropolitan harbours, Mandurah, Bunbury, Busselton and Augusta and catch a similar range of demersal species as the commercial WCDSIMF.

Between 2011/12 and 2017/18, estimated recreational boat-fishing effort in the West Coast has ranged between approximately 717,000 hours and 821,000 hours fished (Ryan et al. 2020).

The WCB has the highest number of charter operators in WA, with limited entry arrangements introduced in 2001 (Department of Fisheries 2012; Fletcher and Santoro 2012). Logbooks became compulsory in 2002/03 and demonstrate an overall contraction in total charter effort and operational area of charter activity in the WCB since then. However, charter effort has been consistently high off Perth, Kalbarri and at the Abrolhos Islands.

2.4.4 Customary Fishing

Limited information is available on the customary fishing for demersal scalefish in the WCB however, demersal scalefish catches from oceanic waters are likely to be low.

2.5 Catch-Share Allocations

The allocation of aquatic fisheries resources in WA is currently undertaken in accordance with the Integrated Fisheries Management (IFM) Government Policy 2009 (IFM Policy). The IFM Policy sets out the information requirements, harvest levels, management, allocation processes, compensation and funding. The IFM Policy also sets out nine guiding principles adopted as the basis for the IFM Policy and guides the allocation (or any reallocation) of an aquatic fisheries resource.

The WCDSR is fished by commercial and recreational (including charter) sectors under an explicit catch share allocation determined by the Minister for Fisheries on 12 December 2012 (Appendix 1; Figure 2). In accordance with the IFM Policy, this initial allocation is subject to review and reallocation from time to time. For example, where a review process (section 3.4) identifies the need to adjust management arrangements, a formal reallocation of the resource may be considered as an option however, this option would need to be progressed in accordance with the IFM policy. Business rules regarding the management of each sector within their allocation are outlined in Section 3.7.1.

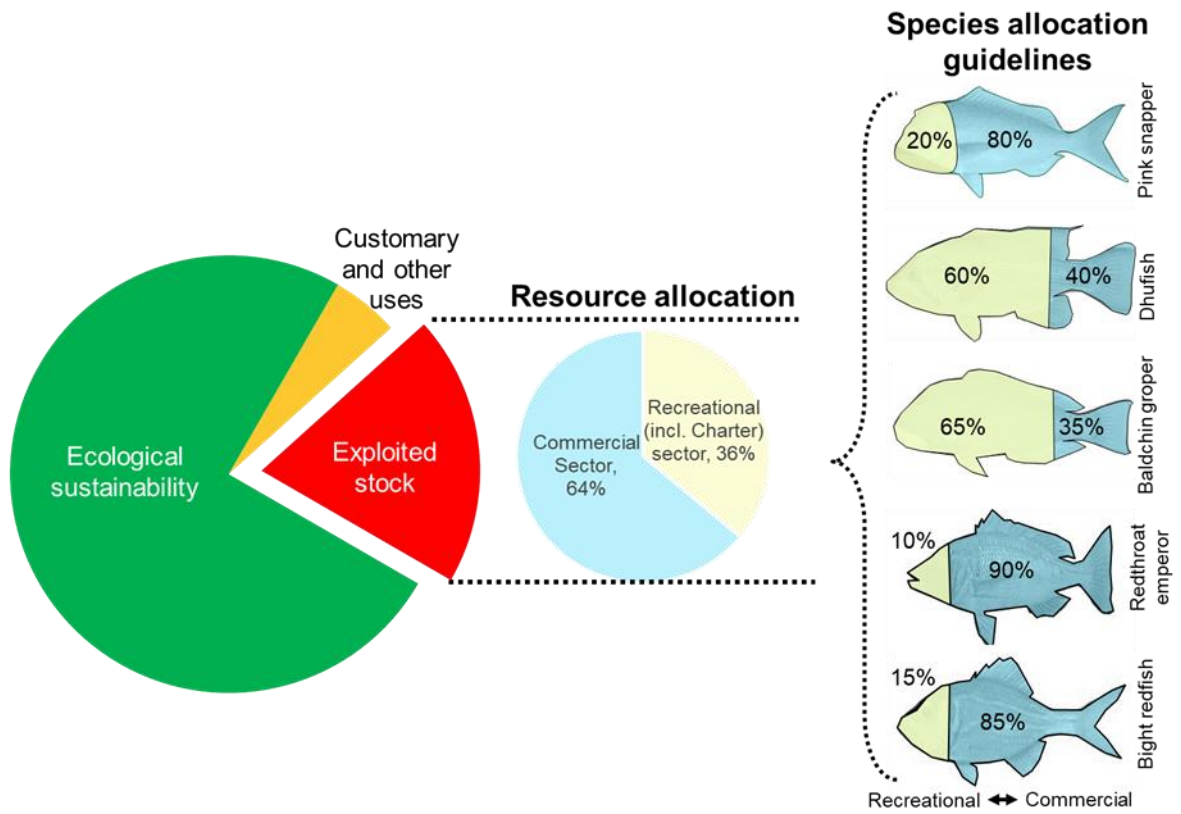


Figure 2. Current WCDSR resource allocation and key species allocation guidelines for the WCDSR as approved by the Minister for Fisheries.

3.0 Harvest Strategy

This harvest strategy is structured to describe, hierarchically:

- 1) the high-level, long-term objectives of management (Section 3.1);
- 2) the short-term, operational objectives (Section 3.2); and
- 3) how these translate into the management approach for this resource (Section 3.3).

This is followed by a more detailed description of:

- 4) the harvest strategy procedures (Section 3.4);
- 5) the processes for assessing ecological sustainability (Section 3.4);
- 6) the recovery plan for the WCDSR (Section 3.6);
- 7) the processes for assessing fishery performance (Section 3.7); and
- 8) the specific monitoring and assessment procedures used to ascertain if objectives are being met (Section 3.8).

3.1 Long-term Objectives

In addition to ensuring the biological sustainability of all captured aquatic resources (through the use of the indicator species approach), this harvest strategy includes broader ecological objectives for each ecosystem component relevant to the WCDSIMF and recreational (including charter) sector, as well as social and economic objectives for each sector targeting this resource. It is important to note that the social and economic objectives are applied within the context of ESD and are considered once the ecological objectives have been met (Department of Fisheries 2015a, see Section 3.6 for more information).

3.1.1 *Ecological Sustainability*

- 1) To maintain spawning stock biomass of each retained species above BMSY to maintain high productivity and ensure the main factor impacting recruitment is the environment.
- 2) To ensure fishing impacts do not result in serious or irreversible harm to bycatch species populations.
- 3) To ensure fishing impacts do not result in serious or irreversible harm to ETP species populations.
- 4) To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.
- 5) To ensure the effects of fishing do not result in serious or irreversible harm to ecosystem structure and function.

3.1.2 *Economic and Social Benefits*

- 1) To provide flexible opportunities to ensure commercial fishers can maintain or enhance their livelihood (economic and social), within the constraints of ecological sustainability and catch share allocations, while having regard for the objectives of other fishing sectors.

- 2) To maintain and provide opportunity to maximise the flow of commercial fishing related economic benefit to the broader community within the constraints of ecological sustainability and catch share allocations, while having regard for the objectives of other fishing sectors.
- 3) To maintain or improve cultural, recreational and lifestyle benefits for recreational fishing participants within the constraints of ecological sustainability and catch share allocations, while having regard for the objectives of other fishing sectors;
- 4) To provide flexible opportunities to ensure charter operators can maintain or enhance their livelihood (economic and social), within the constraints of ecological sustainability and catch share allocations, while having regard for the objectives of other fishing sectors.
- 5) To maintain and provide opportunity to maximise the flow of recreational (including charter) fishing tourism related economic benefit to the broader community within the constraints of ecological sustainability and catch share allocations, while having regard for the objectives of other fishing sectors.

3.2 Operational Objectives

Long-term management objectives are typically operationalised as short-term (e.g. annual or periodic) objectives through one or more performance indicators that can be measured and assessed against pre-defined reference levels so as to ascertain actual performance. Within the context of the long-term ecological objectives provided above, operational objectives aim to maintain each resource above the threshold level (and, where relevant, close to the target level), or rebuild the resource if it has fallen below the threshold or the limit levels (Section 3.5).

3.3 Harvesting and Management Approach

The regulatory harvesting system for the WCDSR is based on a constant catch approach (where catch is kept constant) when a stock is in recovery, and a constant exploitation approach (where the catch varies in proportion to variations in stock abundance) when a stock is above B_{MSY} (i.e. above the threshold).

In line with this harvesting approach, the WCDSIMF (main commercial fishery that targets the WCDSR) is primarily managed using input controls via an Individual Transferable Effort (ITE) system. Total Allowable Effort (TAE) is allocated (i.e. hours within the Kalbarri, Mid-West and South-West Areas of the WCDSIMF).

The recreational (including charter) fishery in the WCB is primarily managed using a combination of input (i.e. temporal and spatial closures) and output controls (i.e. size limits, daily bag limits, boat limits and possession limits, etc.). Recreational fishers operating from a boat are required to hold a current Recreational Fishing from Boat Licence (RFBL). Unlicensed fishers on boats can fish if at least one other person on board has an RFBL, provided the total catch of everyone on board stays within the bag limits of the licensed fisher(s). Charter operators are required to hold a Fishing Tour Operators Licence, which also enables passengers to fish without the need to hold an RFBL.

The decision-making process required to ensure the objectives are being met is framed around a series of linked procedures within the operational part of this harvest strategy (Section 3.4).

3.4 Harvest Strategy Procedures

The procedures used within this harvest strategy involve two interrelated decision-making processes. Power to change management arrangements to meet operational objectives as an outcome of these processes is vested in the Minister for Fisheries.

The first decision-making process constitutes a formal review of indicator species and other ecological assets against defined reference levels to determine performance against management objectives relating to ecological sustainability (Figure 3). This resource-level review process is currently undertaken every three years for the WCDSR following a stock assessment of indicator species and/or an ecological risk assessment. See section 3.5 for further information on processes for assessing ecological sustainability.

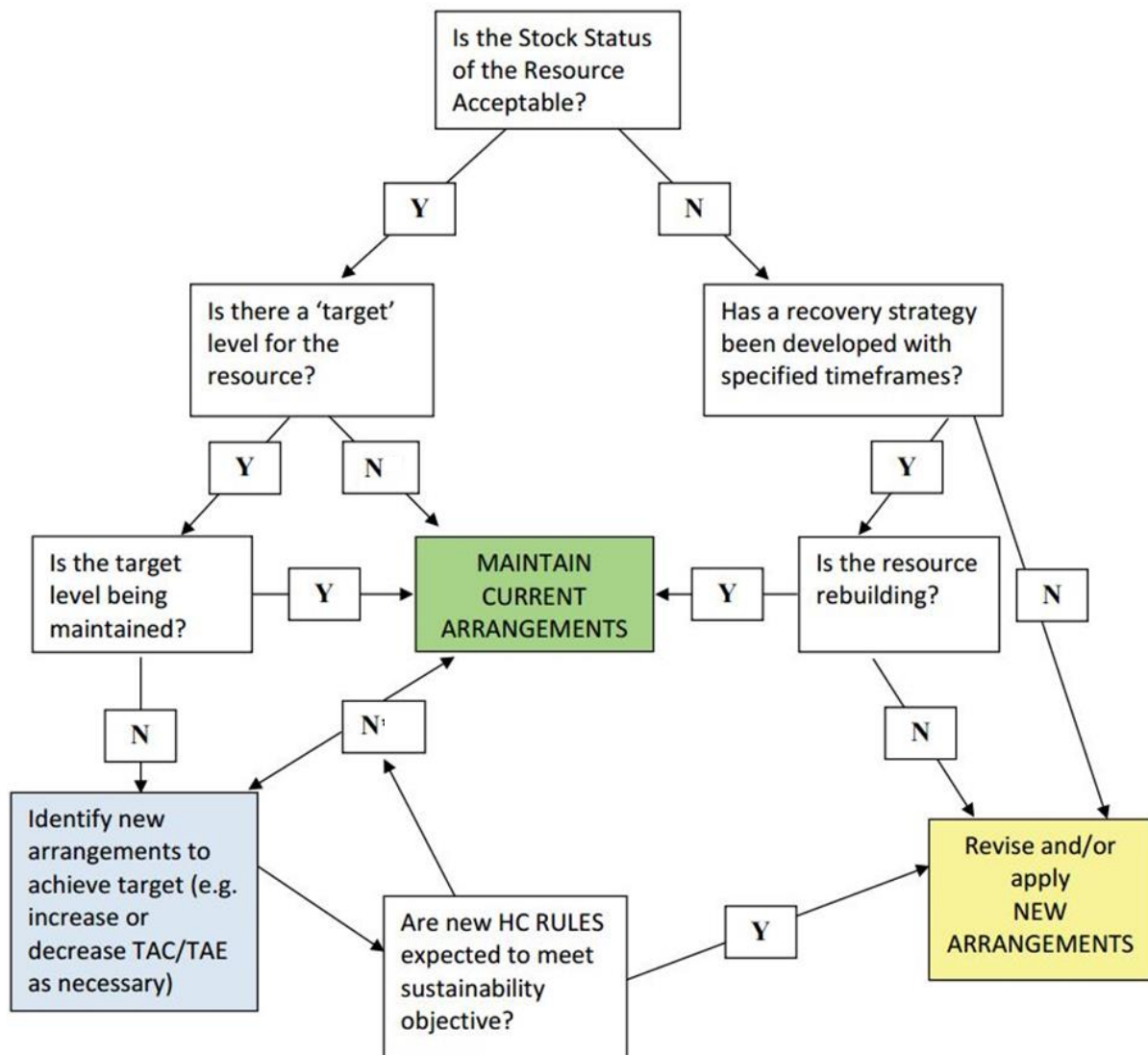


Figure 3. Decision tree for regular resource-level review of the WCDSR (Source: Department of Fisheries 2015a).

The second process involves a fishery-level review (Figure 4) that assesses fishery performance to determine if:

- the current catch/effort by each of the relevant fisheries/sectors is consistent with the levels expected when ecological objectives are met; and
- the relevant fisheries/sectors are achieving their social and economic objectives.

This fishery-level review process is currently undertaken annually for the WCDSR. See Section 3.6 for further information on assessing fishery performance.

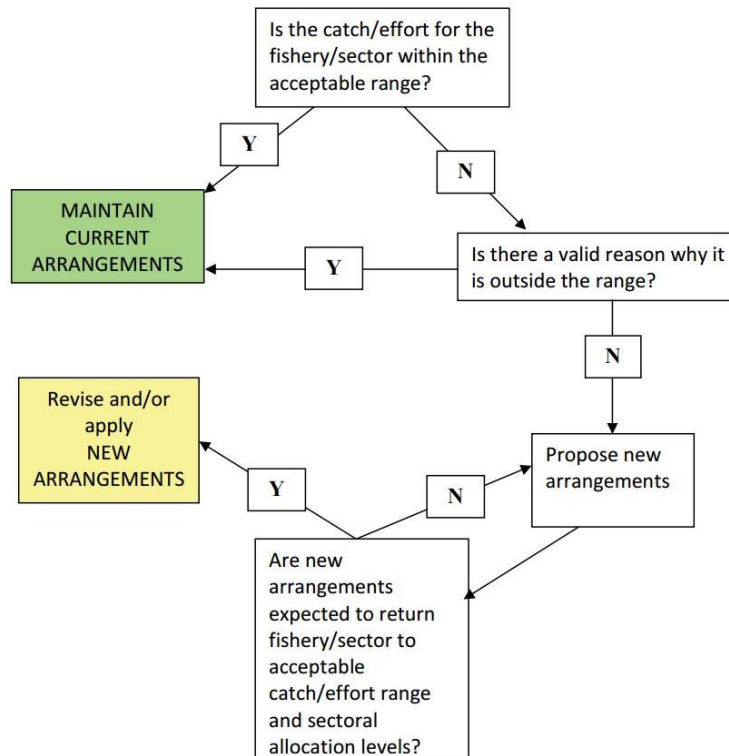


Figure 4. Decision tree for the annual fishery-level review – based on allowable catch/effort tolerance levels and any sectoral allocation decisions (Source: Department of Fisheries 2015a).

3.5 Ecological Sustainability

A formal, resource-level review process is undertaken by DPIRD to assess the status of relevant indicator species and performance in relation to each ecological objective (Section 3.4). Suitable performance indicators have been selected to determine the status of the WCDSR, and other ecological assets, against defined reference levels established to separate acceptable from unacceptable performance (Section 3.5.1). Where relevant, these levels include:

- A target level (i.e. where you want the indicator to be);
- A threshold level (i.e. where you review your position); and
- A limit level (i.e. where you do not want the indicator to be and there is a significantly increased risk of recruitment impairment).

Harvest Control Rules (HCRs) define the management actions that relate to the status of each indicator compared to the reference levels (Section 3.5.2). A summary of the management objectives, performance indicators, reference levels and HCRs is provided in Table .

3.5.1 Performance Indicators and Reference Levels

3.5.1.1 Retained (Indicator and Non-Indicator) Species

The performance indicators used to evaluate the stock status of indicator species and non-indicator species in the WCDSR are Spawning Biomass (B) or an appropriate proxy (i.e. Spawning Potential Ratio; SPR) and Fishing Mortality (F) (see Table 1). For each indicator species, the performance indicator is estimated every 3 years in stock assessments and compared to associated reference levels (Target, Threshold and Limit). Reference levels are consistent with those used by DPIRD in other similar resources and based on internationally accepted benchmarks for moderate to long-lived fish species (Caddy and Mahon 1995; Gabriel and Mace 1999; Mace 2001; Wise et al. 2007).

This harvest strategy aims to maintain all WCDSR species at a level above that at which Maximum Sustainable Yield (MSY) can be achieved, i.e. $B > B_{MSY}$. The life history characteristics of the indicator species for this fishery are commensurate with a steepness (of the stock recruitment relationship) of around 0.75. Investigation into the relationship between virgin biomass (B_0) and B_{MSY} for stocks with a range of steepness values around this level (0.6 to 1.0) indicates B_{MSY} is likely to be close to B_{30} (30% of unfished biomass) (Forrest et al. 2010; Mangel et al. 2013). Accordingly, the B_{30} threshold level is used for this fishery as a proxy to B_{MSY} . By extension the B_{20} limit levels correspond to $0.67 B_{MSY}$, which is more conservative than the $0.5 B_{MSY}$ level required for meeting the MSC standard.

The HSWG was of the view that each fishing sector aspired for higher abundance of WCDSR and that the target reference level should be set somewhere between B_{40} and B_{60} (i.e. $1.33 B_{MSY} - 1.5 B_{MSY}$). The HSWG recommended research be undertaken prior to the 5-year review of this Harvest Strategy to determine an appropriate target reference level within this range, taking into consideration the views of each fishing sector. However, until this research is undertaken to refine the target reference level and remove any ambiguity, the HSWG has recommended the target reference level be set at B_{50} to reflect each sectors aspiration for higher abundance and to be more in line with other Australian jurisdictions (Department of Agriculture and Fisheries 2017; Department of Agriculture and Water Resources 2018).

In line with the ecological objectives of this harvest strategy, the reference levels and control rules act to maintain stocks of all retained species above B_{MSY} , with management action triggered should any indicator species spawning biomass drop below this level. Any stock size above the B_{MSY} threshold is consistent with meeting the objectives for biological sustainability. Maintaining the stock at or above the B_{MSY} threshold is also sufficient to meet the stock status requirements as defined for purposes of certification under the MSC standard. Note that while being above the B_{MSY} threshold meets the objectives of this harvest strategy, the HSWG has proposed an additional step to aspire to increase Spawning Biomass (B) to the target reference level. From an ecological perspective, there would generally be no need to adjust management settings when Spawning Biomass (B) and Fishing Mortality (F) is between the threshold and target levels. However, if stock size exceeds the target

reference level, there may be a need to review management settings to ensure other objectives are being met.

Table 1. Performance indicators and reference levels used to evaluate the status of indicator species and non-indicator species in the WCB.

Performance Indicator	Target	Reference Levels Threshold (B_{MSY})	Limit
Spawning Biomass (B)	B_{40-60}	B_{MSY} (Proxy: B_{30})	B_{20}
Proxy: Spawning potential ratio (SPR)	SPR_{40-60}	SPR_{30}	SPR_{20}
Fishing mortality (F)	$F = 2/3M$	$F = M$	$F = 1.5M$

For the non-indicator species, risk (vulnerability) assessments are undertaken annually to identify if there have been any substantial changes, particularly in the catches of these species relative to historic levels. If an increase in risk is identified, the reasons for the variation will be assessed and if appropriate, management action will be initiated to reduce the risk to an acceptable level (Table).

3.5.1.2 Total fishing mortality

A portion of catch is retained and landed and a portion of catch is released/discarded (dead or alive) before landing due to a range of reasons (i.e. regulations).

Post-release mortality refers to the portion of demersal scalefish that are released and subsequently die due to the impacts of fishing activities (although in the case of depredation, mortality may also occur during capture). A range of factors including species biology (e.g. susceptibility to barotrauma), depth of capture, capture and handling practices, hooking injuries and shark depredation influences the rate of post-release mortality. DPIRD has developed three post-release mortality categories for WCDSR species based on likely depth of capture, available scientific literature and anecdotal information from fishers:

- 1) Moderate – 25% post-release mortality rate (i.e. 25% of released fish die);
- 2) High – 50% post-release mortality rate (i.e. 50% of released fish die); and
- 3) Very High – 90% post-release mortality rate (i.e. 90% of released fish die).

Total fishing mortality accounts for the combined mortality associated with **both** retained catch and the proportion of released catch that dies (i.e. post-release mortality) as a result of fishing (Figure 5). Calculation of total fishing mortality is outlined in Appendix 2.

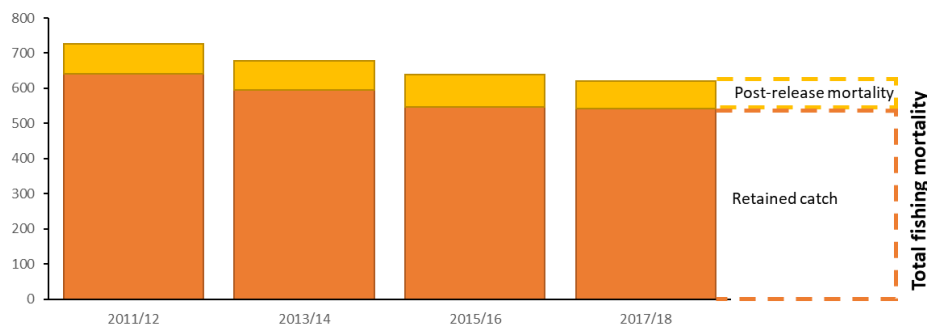


Figure 5. Example of WCDSR estimated total fishing mortality (retained catch + post-release mortality) by all fishing sectors. Orange boxes indicate estimated retained catch and yellow boxes indicate estimated post-release mortality by all fishing sectors.

3.5.1.3 Other Ecological Assets

Other ecological assets incorporated in this harvest strategy include bycatch, ETP species, habitats and ecosystem processes that may be affected by fishing activities in the commercial WCDSIMF and the recreational (and charter) fisheries (Table 3). For all ecological components, reference levels have been set to differentiate acceptable fishery impacts from unacceptable fishery impacts according to the risk levels defined in Fletcher (2015). An ecological risk assessment is undertaken at least every five years to inform these components of the harvest strategy, with these risk scores to be reviewed after no more than five years (see Section 3.8.2.3).

3.5.2 Application of Harvest Control Rules

For each ecological performance indicator and reference level, an accompanying HCR directs the management needed to meet sustainability objectives (Table). These HCRs are designed to maintain the resource above the threshold (i.e. at the target level), or rebuild it where it has fallen below the threshold (undesirable) or the limit (unacceptable) levels.

If the Threshold is breached¹ by any indicator species (i.e. $B < B_{MSY}$ or $F > F_{Threshold}$) a review will be initiated immediately and completed within 3 months to develop a recovery plan, determine the level of recovery benchmark reduction required (10-50%) and develop a management response. Appropriate management action will be taken as soon as is practicable to reduce each fishing sectors total fishing mortality below revised recovery benchmarks, to enable all indicator species to recover (i.e. $B > B_{MSY}$ and $F < F_{Threshold}$) within one generation time.

If the Limit is breached¹ by any indicator species (i.e. $B < B_{Limit}$ or $F > F_{Limit}$), a review will be initiated immediately and completed within 3 months to develop a recovery plan, determine the level of recovery benchmark reduction required (50-100%) and develop a management response. Appropriate management action will be taken as soon as is practicable to reduce each fishing sectors total fishing mortality below revised recovery benchmarks, to enable all indicator species to recover (i.e. $B > B_{MSY}$ and $F < F_{Threshold}$) within two generation times (maximum of 20 years).

For the recreational (including charter) sector, the harvest level from which the total fishing mortality (retained catch + post-release mortality) reduction is calculated is the most recent annual estimate of total fishing mortality (retained catch + post-release mortality) where both recreational and charter catches were estimated. Recreational sector examples may include reducing bag or boat limits or introducing spatial or temporal closures.

For the commercial sector, the harvest level from which the total fishing mortality (retained catch + post-release mortality) reduction is calculated is the most recent annual estimate of total fishing mortality (retained catch + post-release mortality). Examples of potential management responses for the commercial fishery include reducing effort via unit value reductions or introducing spatial or temporal closures.

¹ See section 3.7.4.

For more information on the management tools available to achieve the total fishing mortality reductions specified by the HCR, and the legal instrument under which the management measure occurs, see Section 4.1.

3.6 Recovery Plan 2010-2030

A resource that has fallen below the acceptable level, and for which suitable management adjustments have been implemented to reduce catch and/or effort (as outlined in the HCRs), is considered to be in a recovery phase (Department of Fisheries 2015a). For indicator species that fall below the limit reference level, a recovery strategy will be developed and implemented to ensure that the resource can rebuild within two generation times (maximum of 20 years). This is consistent with world's best practice under the Marine Stewardship Council Standard. Where the environmental conditions have led, or contributed significantly, to the resource being at an unacceptable level, the strategy needs to consider how this may affect the speed and extent of recovery.

A 2007 WCDSR stock assessment of indicator species dhufish, pink snapper and baldchin groper found that fishing mortality was above F_{Limit} and recommended total fishing mortality by all sectors (recovery benchmarks) be reduced by 50-100% to allow the WCDSR to recover within 20 years (Wise et al. 2007; Department of Fisheries 2013).

The WCDSR has been operating under a 20 year recovery plan since 2010 following the implementation of significant management action between 2007 and 2010 to reduce catches by all sectors by at least 50% of 2005/06 levels to allow the WCDSR to recover by 2030 (Table 2).

Table 2. Recreational and commercial sector management changes between 2007 and 2010 to achieve at least a 50% catch reduction.

Measure	Recreational sector changes	Commercial sector changes
Licence framework	RFBL introduced	New limited entry arrangements for WCDSIMF (~1250 to 64 licences)
Spatial closures		Closed the Metropolitan Area to the WCDSIMF and the WCDGDLIMF
Limited effort	Introduced WCB demersal scalefish closure (15 October to 15 December)	Introduced ITE system limiting the number of fishing hours in each WCDSIMF area.
Bag limits	Reduced mixed daily bag limit (from 4 to 2). Reduced dhufish, blue groper, coral trout and coronation trout species daily bag limits (from 4 to 1)	
Boat limit	Introduced dhufish boat limit of 2 (6 on charter)	
Possession limit	Reduced Abrolhos Islands possession limit from 20 kg to 10 kg of fillets	
Fishing gear controls		Limited number of lines and hooks to be used on each vessel Requirement to carry a release weight on board vessels fishing for demersal scalefish
Size limits	Increased pink snapper minimum size limit	South of Lancelin (40cm to 50cm)

3.6.1 Recovery Plan Objective

The recovery plan objective is to ecologically recover all indicator species by 2030 (i.e. $B > B_{MSY}$ & $F < F_{Threshold}$) and once ecologically recovered, increase resilience of all WCDSR indicator species (i.e. $B = B_{Target}$ & $F = F_{Target}$) within one generation, subject to economic and social objectives being met (Figure 6).

Two key strategies have been identified to achieve the recovery plan objective:

Key Strategy 1: Maintain each sectors total fishing mortality (retained catch + post-release mortality) below recovery benchmarks.

Key Strategy 2: Provide targeted protection for key spawning aggregations.

Three steps to achieve the recovery plan objective are outlined in the following sections.

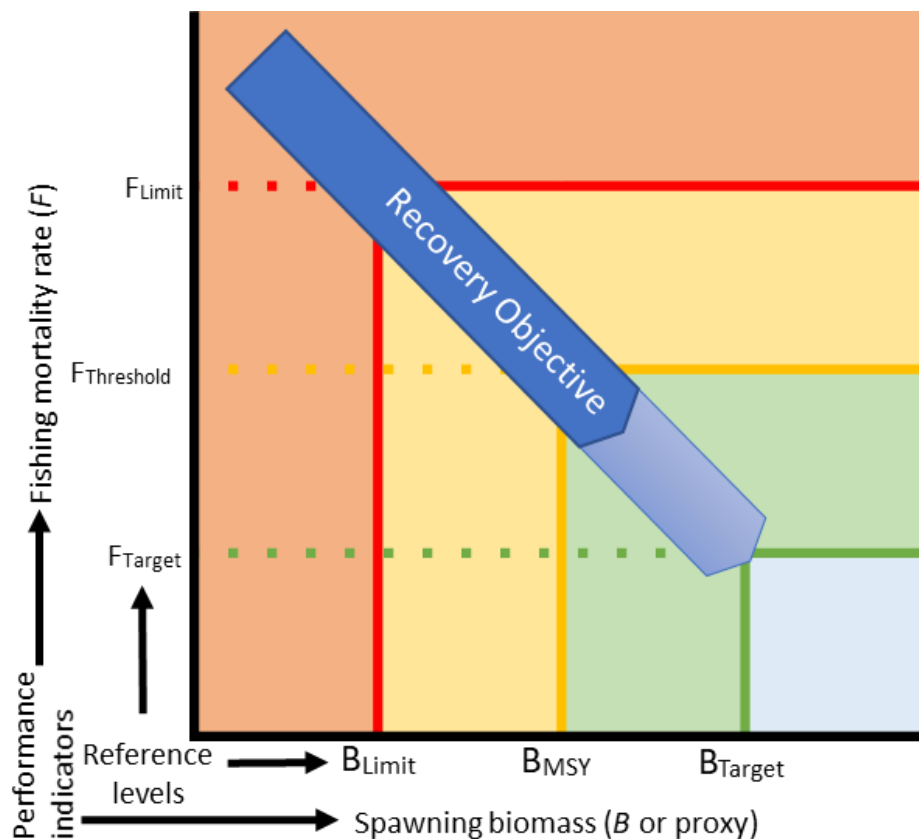


Figure 6. WCDSR recovery plan objective.

3.6.2 Step 1: Initiate recovery of the WCDSR

Step 1 Aim: Initiate recovery (i.e. $B > B_{Limit}$ & $F < F_{Limit}$) of all WCDSR indicator species by 2020 (B and F for 2020 will be available in the 2023 stock assessment).

Under Step 1:

- Significant management reform of recreational and commercial fisheries was undertaken from 2007-2010 to reduce WCDSR catches by at least 50% (Table 2).
- Targeted reductions in the capacity of some commercial fisheries were undertaken in 2014/15 to reduce the catches in those fisheries below recovery benchmarks.

- Additional protection for pink snapper key spawning aggregations in Cockburn and Warnbro Sounds has occurred in 2007 and 2019.
- Maintain each sectors total fishing mortality (retained catch + post-release mortality) below recovery benchmarks. In the event that a sector exceeds its recovery benchmark, a review is to be completed within three months to develop a management response. Appropriate management action will be undertaken as soon as practicable to reduce that sectors fishing mortality below its recovery benchmark (See section 3.8 for further information).
- Maintain and/or increase targeted protection of indicator species' key spawning aggregations to fast track achieving the recovery plan objective.
- If Step 1 aim is not achieved, or not likely to be achieved by all indicator species by 2020 (2023 stock assessment), a review will be initiated immediately and completed within three months to reduce recovery benchmarks by an agreed level (50-100%) and to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce total fishing mortality below revised recovery benchmarks, applicable to all fishing sectors, to enable all indicator species to ecologically recover (i.e. $B > B_{MSY}$ & $F < F_{Threshold}$) by 2030.
- To provide targeted protection of WCDSR indicator species' key spawning aggregations, further action is required if any sector increases:
 - effort resulting in increased incidental catch of spawning fish within an existing spawning closure; or
 - targeting of key spawning aggregations outside existing closure periods or areas.

If this occurs, a review is to be initiated immediately and completed within three months. If deemed appropriate, management action will be taken as soon as is practicable to provide targeted protection of that key spawning aggregation.

If step 1 aim is achieved (i.e. $B > B_{Limit}$ & $F < F_{Limit}$) for all indicator species by 2020 (2023 stock assessment), move to step two.

3.6.3 Step 2: Ecologically recover the WCDSR

Step 2 Aim: Recover all WCDSR indicators species ecologically (i.e. $B > B_{MSY}$ & $F < F_{Threshold}$) by 2030 (B and F for 2030 will be available in the 2032 stock assessment).

Under Step 2:

- maintain recovery benchmarks and the level of targeted protection of indicator species key spawning aggregations from Step 1 to achieve Step 2 aim.
- maintain each sectors total fishing mortality (retained catch + post-release mortality) below recovery benchmarks. In the event that a sector exceeds its recovery benchmark, a review is to be completed within three months to develop a management response. Appropriate management action will be undertaken as soon as practicable to reduce that sectors fishing mortality below its recovery benchmark (See section 3.8 for further information).

- if Step 2 aim is not achieved, or not likely to be achieved for all indicator species by 2030 (2032 stock assessment), a review will be initiated immediately and completed within three months to reduce recovery benchmarks by an agreed level (10-50%) and to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce total fishing mortality below revised recovery benchmarks, applicable to all fishing sectors, to enable all indicator species to ecologically recover (i.e. $B > B_{MSY}$ & $F < F_{Threshold}$) by 2030.
- To provide targeted protection of WCDSR indicator species key spawning aggregations, further action is required if any sector increases:
 - effort resulting in increased incidental catch of spawning fish within an existing spawning closure; or
 - targeting of key spawning aggregations outside existing closure periods or areas.

If this occurs, a review is to be initiated immediately and completed within three months. If deemed appropriate, management action will be taken as soon as is practicable to provide targeted protection of that key spawning aggregation.

If Step 2 aim is achieved (i.e. $B > B_{MSY}$ & $F < F_{Threshold}$) for all indicator species by 2030 (2032 stock assessment), move to step three.

3.6.4 Step 3: Build WCDSR resilience

Step 3 Aim: Build the resilience (i.e. $B = B_{Target}$ & $F = F_{Target}$) of all WCDSR indicator species within one generation, subject to economic and social objectives being met.

Under Step 3:

- undertake a review in consultation with the HSWG to consider the appropriate levels of increased recovery benchmarks and reduced level of protection of key spawning aggregations required to allow WCDSR indicator species to achieve Step 3 aim within one generation, subject to economic and social objectives being met.
- maintain each sectors total fishing mortality (retained catch + post-release mortality) below recovery benchmarks. In the event that a sector exceeds its recovery benchmark, a review is to be completed within three months to develop a management response. Appropriate management action will be undertaken as soon as practicable to reduce that sectors fishing mortality below their recovery benchmark (See section 3.8 for further information).

Once step 3 aim is achieved (i.e. $B = B_{Target}$ & $F < F_{Target}$) for all indicator species, move to maintenance harvest strategy (see Appendix 3).

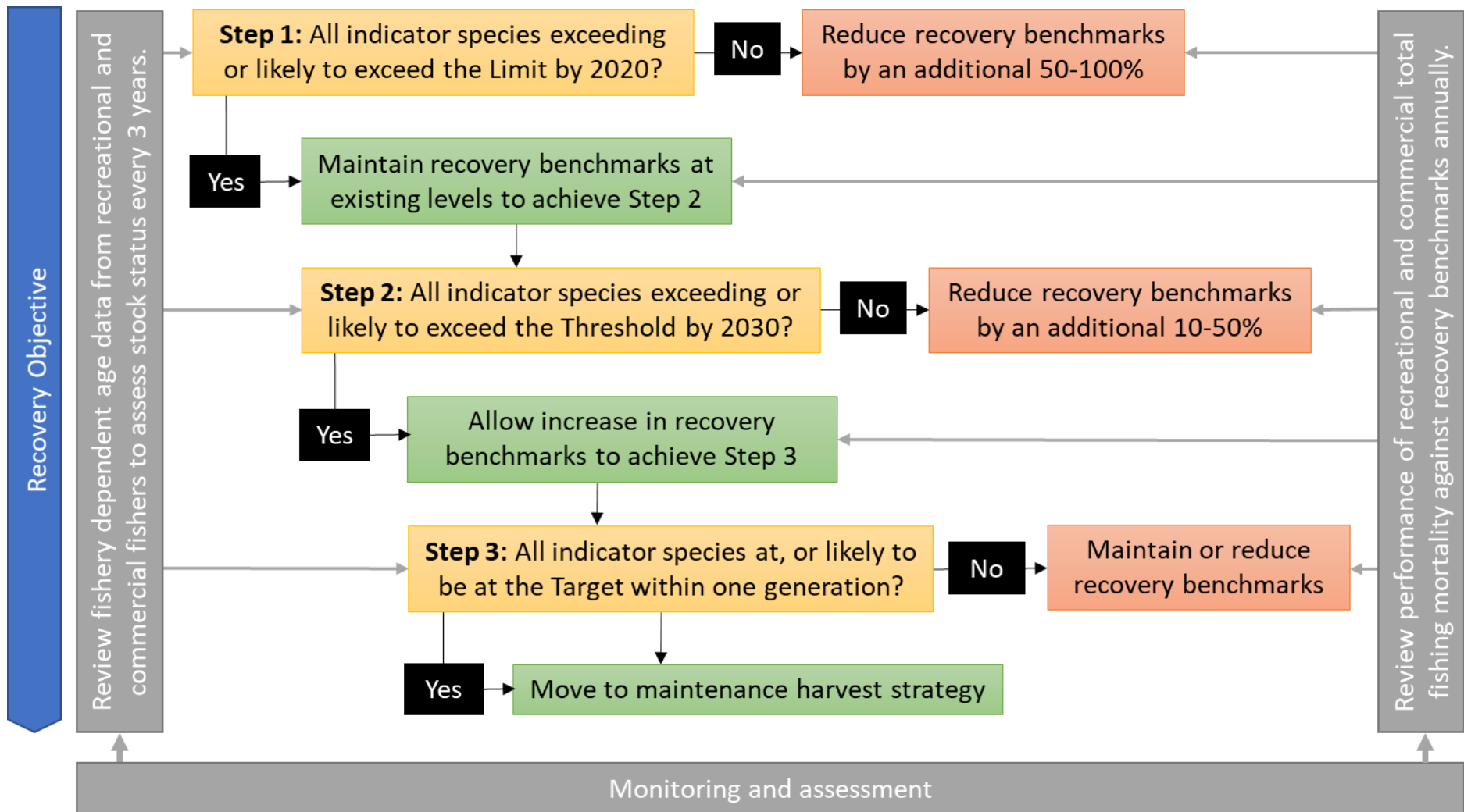


Figure 7. Overview of WCDSR recovery plan: Steps supported by control rules, monitoring, assessment and performance reviews to achieve the recovery objective.

Table 3. Harvest Strategy performance indicators, reference levels and control rules for WCDSR retained (indicator and non-indicator) species when under recovery (inshore demersal) and maintenance (offshore demersal) and other ecological assets that may be impacted by fishing activities undertaken by commercial and recreational fishers while targeting demersal scalefish.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Indicator species	To achieve the recovery plan objective (section 3.6.1).	<u>Inshore demersal scalefish suite indicator species:</u> Pink snapper Dhufish Baldchin groper (Mid-West only)	Periodic estimates (every 3 years) of spawning biomass (B , or appropriate proxy) and fishing mortality (F)	Target: B_{Target} and F_{Target} (refer to Table 1)	Once Step 2 aim is achieved (Section 3.7.4), a review will be undertaken within 3 months of achieving Step 2 aim to consider appropriate levels of increased recovery benchmarks and reduced level of protection of key spawning aggregations to achieve Step 3 aim (Section 3.6.4). Appropriate management action will be taken as soon as practicable to adjust total fishing mortality below revised recovery benchmarks, applicable to all fishing sectors, to enable all indicator species to reach the Target (i.e. $B=B_{Target}$ & $F=F_{Target}$) within one generation. Once step 3 aim is achieved (i.e. $B=B_{Target}$ & $F<F_{Target}$) for all indicator species, move to maintenance strategy (Appendix 3).
				Threshold: B_{MSY} and $F_{Threshold}$ (refer to Table 1)	If Step 2 aim (Section 3.6.3) is not achieved (Section 3.7.4), or likely to be achieved (Section 3.7.4) for all indicator species by 2030 (2032 stock assessment), a review will be initiated immediately and completed within three months to reduce recovery benchmarks by an agreed level (10-50%) and to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce total fishing mortality below revised recovery benchmarks, applicable to all fishing sectors, to enable all indicator species to ecologically recover (i.e. $B>B_{MSY}$ & $F<F_{Threshold}$) by 2030. If Step 2 aim is achieved (i.e. $B>B_{MSY}$ & $F<F_{Threshold}$) for all indicator species by 2030 (2032 stock assessment), move to Step 3.
				Limit: B_{Limit} and F_{Limit} (refer to Table 1)	If Step 1 aim (Section 3.6.2) is not achieved (Section 3.7.4), or likely to be achieved (Section 3.7.4) by all indicator species by 2020 (2023 stock assessment), a review will be initiated immediately and completed within three months to reduce recovery benchmarks by an agreed level (50-100%) and to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce total fishing mortality below revised recovery benchmarks, applicable to all fishing sectors, to enable all indicator species to ecologically recover (i.e. $B>B_{MSY}$ & $F<F_{Threshold}$) by 2030. If Step 1 aim is achieved (i.e. $B>B_{Limit}$ & $F<F_{Limit}$) for all indicator species by 2020 (2023 stock assessment), move to Step two.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Indicator species	To maintain spawning stock biomass of each retained species above B_{MSY} to maintain high productivity and ensure the main factor impacting recruitment is the environment.	<u>Offshore demersal scalefish suite</u> <u>indicator species:</u> Bass groper Blue-eye trevalla Hapuku	Periodic estimates of spawning biomass (B , or appropriate proxy) and fishing mortality (F)	Target: B_{Target} and F_{Target} (refer to Table 1)	Continue management aimed at achieving ecological, economic and social objectives. If the Threshold is breached (Section 3.7.4) by any indicator species (i.e. $B < B_{MSY}$ or $F > F_{Threshold}$), a review will be initiated immediately and completed within 3 months to develop a recovery plan, determine the level of recovery benchmark reduction required (10-50%) and develop a management response. Appropriate management action will be taken as soon as is practicable to reduce each fishing sectors total fishing mortality below revised recovery benchmarks, to enable all indicator species to recover (i.e. $B > B_{MSY}$ and $F < F_{Threshold}$) within one generation.
				Threshold: B_{MSY} and $F_{Threshold}$ (refer to Table 1)	
				Limit: B_{Limit} and F_{Limit} (refer to Table 1)	
Target species	To manage each sectors total fishing mortality (retained catch + post-release mortality) below each sectors recovery	<u>Commercial sector:</u> Total demersal scalefish <u>Recreational (including charter) sector:</u> Top 15 species	Total fishing mortality (retained catch + post-release mortality) for each sector	Target Range: Between Recovery Benchmark and Lower Tolerance	Continue management aimed at achieving ecological, economic and social objectives. If a sectors Recovery Benchmark is breached (Section 3.7.4), a review will be initiated immediately and completed within 3 months to develop a management response. Management action will be taken as soon as is practicable to reduce the total fishing mortality by that sector below their Recovery Benchmark.
				Recovery benchmark: Recovery benchmark _{Commercial} Recovery benchmark _{Recreational} (section 4.1.1.)	

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
	benchmark and in line with catch share allocations (where applicable)	<u>Key species:</u> Dhufish Pink snapper Baldchin groper Bight redfish Redthroat emperor Breaksea cod		Lower Tolerance: ≤75% of recovery benchmark	If the Lower Tolerance is breached (Section 3.7.4), a review is triggered to investigate the reasons for the low total fishing mortality and completed within 3 months. If sustainability is identified as the reason, implement an appropriate management response to reduce the risk to an acceptable level as soon as practicable. This may include additional monitoring and/or undertaking a spawning biomass/fishing mortality assessment. If social or economic impacts are identified as the reason, implement an appropriate management response (where possible) to meet social and/or economic objectives as soon as practicable.
Retained non-indicator species	To maintain spawning stock biomass of each retained species above B_{MSY} to maintain high productivity and ensure the main factor impacting recruitment is the environment.	Non-indicator species (additional monitoring may be periodically undertaken to facilitate an age-based assessment)	1. Annual risk (vulnerability) assessments incorporating current management arrangements, catch levels, species information and available research 2. Estimate of spawning stock biomass (B , or proxy) if risk is >moderate	Target: B_{Target} ; and Fishing impacts expected to generate an acceptable risk level, e.g. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Threshold: $B_{Threshold}$; and Fishing impacts are considered to generate an undesirable level of risk to any species' populations, i.e. high risk.	If the Threshold is breached a management review will be completed within 3 months to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce the total fishing mortality by an agreed level (10 to 50%), applicable to all fishing sectors, to enable a return to above the threshold within one generation.
				Limit: B_{Limit} ; and Fishing impacts are considered to generate an unacceptable level of risk to any species' populations, i.e. severe risk.	If the Limit is breached, a review will be initiated immediately and completed within 3 months to develop a management response. Appropriate management action will be taken as soon as is practicable to reduce the total fishing mortality by an agreed level (50 to 100%), applicable to all fishing sectors, to enable a return to above the threshold within one generation.
Bycatch (non-ETP species)	To ensure fishing impacts do not result in serious or irreversible	All bycatch species (commercial and recreational sector)	Periodic risk assessments incorporating current management	Target: Fishing impacts expected to generate an acceptable risk level to bycatch species' populations, e.g. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
	harm to bycatch species populations.		arrangements, catch levels, species information and available research	<p>Threshold: A potential material change to risk levels is identified; or fishing impacts are considered to generate an undesirable level of risk to any bycatch species' populations, i.e. high risk.</p> <p>Limit: Fishing impacts are considered to generate an unacceptable level of risk to any bycatch species' populations, i.e. severe risk.</p>	<p>Review the reasons for this variation and develop a management response within three months. Implement an appropriate management response to reduce the risk to an acceptable level as soon as practicable.</p> <p>Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.</p>
Endangered, threatened and protected (ETP) species	To ensure fishing impacts do not result in serious or irreversible harm to ETP species populations.	All ETP species	Periodic risk assessments incorporating current management arrangements, number of reported interactions, species information and available research.	<p>Target: Fishing impacts expected to generate an acceptable risk level to ETP species' populations, i.e. moderate risk or lower.</p>	Continue management aimed at achieving ecological, economic and social objectives.
				<p>Threshold: Fishing impacts are considered to generate an undesirable level of risk to any ETP species' populations, i.e. high risk.</p>	Review the reasons for this variation and develop a management response within three months. Implement an appropriate management response to reduce the risk to an acceptable level as soon as practicable.
				<p>Limit: Fishing impacts are considered to generate an unacceptable level of risk to any ETP species' populations, i.e. severe risk.</p>	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.	All habitats	Periodic risk assessments incorporating current management arrangements, extent of fishing activities, habitat distribution and available research.	Target: Fishing impacts are considered to generate an acceptable level of risk to all benthic habitats, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Threshold: Fishing impacts are considered to generate an undesirable level of risk to any benthic habitats, i.e. high risk.	Review the reasons for this variation and develop a management response within three months. Implement an appropriate management response to reduce the risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any benthic habitats, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.
Ecosystem	To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.	Trophic interactions	Periodic risk assessments incorporating current management arrangements, catch levels, extent of fishing activities, ecosystem information and available research.	Target: Fishing impacts are considered to generate an acceptable level of risk to ecological processes within the ecosystem, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Threshold: Fishing impacts are considered to generate an undesirable level of risk to any ecological processes within the ecosystem, i.e. high risk.	Review the reasons for this variation and develop a management response within three months. Implement an appropriate management response to reduce the risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any ecological processes within the ecosystem, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

3.7 Fishery Performance

Defining annual or periodic tolerance levels for fisheries provides a formal and efficient basis to evaluate the effectiveness of current management arrangements in delivering the levels of catch, total fishing mortality and/or effort specified by the HCRs and, where relevant, any sectoral allocation decisions (Fletcher et al. 2016). In line with the principles of ESD, this fishery-level review process can also consider the performance against any objectives relating to the economic and social amenity benefits of fishing. Where possible, and in due consideration of ecological sustainability, fisheries management arrangements can be adjusted or reformed to help meet these economic and/or social objectives.

3.7.1 Recovery Benchmarks

For the WCDSR, the catch tolerance ranges used to assess annual recreational (including charter) and commercial fishery performance within the WCDSRF are currently based on recovery benchmark levels and IFM allocations. The current catch tolerance ranges used to assess annual fishery performance are evaluated by comparing the total fishing mortality (retained catch + post-release mortality) of demersal scalefish and each key species by each sector against their respective catch tolerance range. As part of the annual performance review, vulnerability of all species will be assessed (e.g. with regard to current management arrangements, catch levels, new species information).

For the WCDSR, the current total fishing mortality (retained catch + post-release mortality) tolerance ranges for each sector are currently defined as achieving between their recovery benchmarks and 75% of their recovery benchmarks. Recovery benchmarks are currently set based on 50% of 2005/06 levels of total fishing mortality (retained catch + post-release mortality) for the WCDSR (Table 4) and key species (Table 5). Recovery benchmarks have been adjusted to conform to the WCDSR IFM allocation and species proportional allocation guidelines (see section 2.4.4 and section 6.1), with the exception of breaksea cod, where no allocation guideline was provided for in the IFM determination and therefore remains proportional to 2005/06 levels.

If a sector breaches a recovery benchmark, a review is to be initiated immediately and completed within three months to investigate options to adjust that sectors total fishing mortality back within the target range (see Table 3). Appropriate management action will be taken as soon as is practicable to adjust that sector's catch back into the tolerance range.

If the status of the WCDSR changes such that the control rules trigger additional management adjustments or if the catch share allocations change into the future, the tolerance ranges must also be adjusted accordingly.

Table 4. Total fishing mortality (retained catch + post-release mortality) recovery benchmarks and lower tolerance range for the WCDSR.

Sector	Fishery	Lower tolerance	Recovery benchmark
Recreational sector (top 15 species)	Recreational boat based	172 tonnes	230 tonnes
	Charter	29 tonnes	40 tonnes
	Total recreational sector	201 tonnes	270 tonnes
Commercial sector	WCDSIMF	332 tonnes	437 tonnes
	Other WA commercial	31 tonnes	43 tonnes
	Total commercial sector	360 tonnes	480 tonnes

Table 5. Total fishing mortality (retained catch + post-release mortality) recovery benchmarks for key WCDSR inshore demersal scalefish species and the offshore demersal scalefish suite.

Suite	Species	Recreational sector		Commercial sector	
		Lower tolerance	Recovery Benchmark Recreational	Lower tolerance	Recovery Benchmark Commercial
Inshore demersal	Baldchin groper	30 tonnes	40 tonnes	17 tonnes	22 tonnes
	Redfish sp.	5 tonnes	7 tonnes	32 tonnes	42 tonnes
	Breaksea cod	11 tonnes	15 tonnes	2 tonnes	3 tonnes
	Dhufish	102 tonnes	136 tonnes	68 tonnes	91 tonnes
	Pink snapper	26 tonnes	35 tonnes	104 tonnes	138 tonnes
	Emperor sp.	8 tonnes	11 tonnes	77 tonnes	102 tonnes
Offshore demersal	Total offshore demersal suite of species	3 tonnes	5 tonnes	30 tonnes	40 tonnes

3.7.2 Economic and Social Benefits

Achieving economic and social benefits is intrinsic to the status of the WCDSR. The periodic and annual reviews of the WCDSR incorporate all available fishery-independent and fishery-dependent data for the stock, as well as environmental, economic and social information.

Specific performance indicators and reference levels to evaluate economic and social benefits have been developed for some of the economic and social operational objectives (see below). If the performance indicator for an economic and social operational objective is within the Target range, then the management response is to continue management aimed at achieving ecological, economic and social objectives. If the performance indicator for an economic and social operational objective has breached a Threshold level, then a review is triggered to investigate the reasons for the threshold reference level being breached. If possible, initiate commercial, recreational and/or charter initiatives aimed at moving the performance indicator back into the target range and/or review whether fisheries management arrangements impose constraints, for reasons other than ecological sustainability, that limit the ability to achieve that economic or social objective.

In line with the principles of ESD, this harvest strategy also includes objectives and performance indicators for the economic and social benefits of fishing which have been developed by a stakeholder working group. It is important to note that management actions relating to these objectives are to be applied within the constraints of meeting objectives for ecological sustainability and while having regards to the objectives of other sectors.

3.7.2.1 *Commercial Sector Economic and Social Benefits*

The economic and social benefit operational objectives for the commercial WCDSIMF are to:

- 1) provide for the maximum economic efficiency so that sustainable catch for the WCDSIMF maximises profits or creates the largest difference between total revenues and the total cost of fishing; and
- 2) maintain or provide opportunity to maximise the flow of commercial fishing related economic and social (including supplying consumers with quality line caught demersal scalefish) benefit to the broader community.

The percent of annual entitlement (in hours) used in the WCDSIMF has been chosen as a performance indicator to evaluate whether commercial fishers in the WCDSIMF have been able to maximise their economic efficiency. Percentage of annual entitlement used is calculated by dividing the total number of hours utilised in each management area of the WCDSIMF by the total capacity of hours available in each area of the WCDSIMF in that year. The target reference level ($\text{Efficiency}_{\text{Target}}$) has been set at equal to or above 75% of entitlement being utilised each year.

It is noted that catch per unit effort (CPUE) is monitored in the WCDSIMF, included in assessments and could also be used as a performance indicator for objective 1. However, due to the current complexities regarding CPUE standardisation in the WCDSIMF, the HSWG did not support the inclusion of CPUE as a performance indicator for this objective at this time. Future reviews of this harvest strategy may consider incorporating CPUE as a performance indicator for this objective.

No performance indicators or reference levels currently exist to evaluate flow of commercial fishing related economic benefit to the broader community. It is envisaged that this objective will be measured using socio-economic surveys in the future.

3.7.2.2 *Recreational (including Charter) Sector Economic and Social Benefits*

The economic and social benefit operational objectives for the recreational fishing sector are to:

- 1) maintain or improve cultural and recreational lifestyle benefits for recreational fishing participants; and
- 2) maintain or provide opportunity to maximise the flow of recreational fishing tourism related economic benefit to the broader community.

Recreational boat-based fishing participation (hours fished) has been chosen as a performance indicator used to measure whether cultural and recreational lifestyle benefits have been maintained or improved. Recreational boat-based participation has been estimated through four state-wide boat-based recreational fishing surveys completed in 2011/12 (Ryan et al. 2013), 2013/14 (Ryan et al. 2015), 2015/16 (Ryan et al. 2017) and 2017/18 (Ryan et al. 2019). The target reference level ($\text{Participation}_{\text{Target}}$) has been set at 820,693 hours fished, the upper participation estimate for recreational boat fishing for demersal scalefish in the West Coast Bioregion from the 2011/12-2017/18 surveys. The threshold reference level ($\text{Participation}_{\text{Threshold}}$) is set at $\pm 20\%$ the target.

The economic and social benefit objectives for the charter fishing sector are to provide flexible opportunities to ensure fishing tour operators can maintain or enhance their livelihood. Fishing tour participation (client days) has been chosen as the performance indicator to evaluate whether this objective is being met. Fishing tour participation has been recorded through statutory logbook information since 2002. The target reference level (Client Days_{Target}) has been set at the 10-year average (2009 to 2018) of 27,901 client days, with the threshold reference level (Client Days_{Threshold}) set at $\pm 20\%$ of the target.

No performance indicators or reference levels currently exist to evaluate whether the recreational and charter fishing tourism related economic benefits are being maximised. It is envisaged that this objective will be measured using socio-economic surveys in the future.

3.7.3 Unacceptable Performance Review Timelines

Performance against recovery plan objective and steps are reviewed (Section 3.4) periodically every three years following a stock assessment of WCDSR indicator species.

Ecological Risk Assessments are undertaken every five years to assess the risk of fishing activities against other ecological assets.

Performance against recovery benchmarks is reviewed (Section 3.4) annually (i.e. commercial and charter) or periodically (i.e. recreational surveys) and published in the State of Fisheries and Aquatic Resource Report and in DPIRD's Annual report to the WA Parliament (see Section 3.7.3).

Where one or more unacceptable performance levels have been identified, a review is to be completed within three months, and management outcomes implemented as soon as is practicable.

3.7.4 Dealing with Uncertainty

For indicator species, the Threshold and Limit levels are considered breached when there is greater than a 20% probability that these levels have been exceeded. That is, the 20th percentile of a distribution of the estimated performance indicator (i.e. the lower bound of a 60% confidence interval) falls below the Threshold or Limit level for spawning biomass (*B*) and above the Threshold or Limit level for fishing mortality (*F*).

A recovery benchmark is considered breached when there is greater than a 20% probability that these levels have been exceeded. That is, the 20th percentile of a distribution of the estimated performance indicator (i.e. the lower bound of a 60% confidence interval) falls above the recovery benchmark.

3.8 Monitoring and Assessment Procedures

3.8.1 Information and Monitoring

3.8.1.1 Commercial Fishing Information

Since 2008, commercial catch and effort in the WCDSIMF has been monitored using statutory daily/trip logbooks (reporting blocks 10 x 10 nautical miles) and VMS has been used to monitor fishing activity. Prior to 2008, commercial catch and effort information was monitored using statutory monthly Catch and Effort Statistics (CAES) returns. Monitoring of catch and effort data from compulsory logbooks is conducted annually for each of the commercial fisheries that exploit the WCDSR (i.e. TSFs, WCRLMF, CSLPF and SWTMF). Commercial discard rates are monitored periodically using voluntary logbooks and on-board observers.

3.8.1.2 Recreational Fishing Information

Estimates of recreational fishing effort and demersal scalefish catches and releases on the WCB are available from a number of recreational fishing surveys undertaken by DPIRD, including four creel surveys of boat-based recreational fishing in the West Coast in 1998/99, 2005/06, 2008/09 and 2009/10 (Lai et al. 2019). More recently, a periodic state-wide survey providing a broader-scale and an integrated system involving several survey methods has been used to estimate effort and catch by boat-based recreational fishers in WA (Ryan et al. 2013). Four state-wide recreational fishing surveys have been completed to date using this methodology, in 2011/12 (Ryan et al. 2013), 2013/14 (Ryan et al. 2015), 2015/16 (Ryan et al. 2017) and 2017/18 (Ryan et al. 2019).

Information on charter fishing effort, catches and releases has been routinely collected since 2001, when a licensing framework and compulsory logbook system was implemented.

The recreational and charter catches are used together with the commercial catch to inform the stock assessment of the indicator species.

The HSWG recommended that during the life of this harvest strategy, DPIRD trial electronic reporting of recreational total catches of demersal scalefish at the Abrolhos.

3.8.1.3 Economic and Social Benefits

The percentage of annual entitlement used in the WCDSIMF is monitored through DPIRD's VMS system (see section 4.2.1.2) and an annual report is provided to WCDSIMF licence holders at their management meeting.

DPIRD's triennial (i.e. 3 yearly) survey of boat-based recreational fishing collects economic and social information including expenditure data and recreational fisher satisfaction. This information will be investigated to determine appropriate indicators for social and economic objectives in the future.

3.8.1.4 *Fishery-Dependent and Fishery-Independent Sampling*

Biological monitoring is currently either using or exploring the following fishery dependent and independent methods:

- Monitoring of fishery-dependent length and age composition data from fish sampled from both commercial and recreational sectors in each Management Area on a monthly basis over a three-year period (for more detail about the sampling regimes, see Fairclough et al. 2014). Age composition data are used to assess the status of stocks via estimation of fishing-mortality rates with reference to recovery strategy reference points as described in Section 3.5, Section 3.6 and Fairclough et al. (2014).
- Fishery-independent ichthyoplankton surveys are conducted periodically in Cockburn and Warnbro Sounds and Owen Anchorage where pink snapper aggregate to spawn each spring.
- An annual fisheries-independent Baited Remote Underwater Video survey is being used to monitor recruitment strength of pink snapper at the new recruit (0+) stage in Cockburn and Warnbro Sounds and Owen Anchorage. Once sufficient years of data are available, these will be used to compare with recruitment variation in the age structure data, to egg abundance from the above surveys and trawl surveys conducted in Cockburn Sound for blue-swimmer crabs which also collect 0+ recruits of pink snapper.
- Monitoring of fishery-independent length and age composition data from fish sampled from each Management Area may be conducted over the next 5 years to compare against fishery-dependent data (Department of Fisheries 2015b).

The HSWG recommended that during the life of this harvest strategy, a project to capture efficiency increases in all sectors on the WCDSR over time be undertaken.

3.8.2 **Assessment Procedures**

The different methods used by DPIRD to assess the status of aquatic resources in WA have been categorised into five broad levels, ranging from relatively simple analysis of annual catch levels and catch rates, through to the application of more sophisticated analyses and models that involve estimation of fishing mortality and biomass (Fletcher and Santoro 2015). Irrespective of the types of assessment methodologies used, all stock assessments undertaken by DPIRD take a risk-based, weight of evidence approach that considers all of the available (fishery-dependent and fishery-independent) information (Fletcher 2015).

3.8.2.1 *Indicator Species*

In the absence of direct estimates of spawning stock biomass, the stock status of dhufish, pink snapper and baldchin groper in the WCB is assessed primarily based on estimated spawning biomass or proxies for biomass (e.g. SPR; Goodyear 1993) and estimated fishing mortality (F) from catch curve and per-recruit analyses. The estimates are periodically compared to specified reference points (Table 1) for the stock.

3.8.2.2 *Non-indicator species*

In the absence of direct estimates of spawning stock biomass, the stock status of non-indicator species in the WCB is assessed primarily based on estimated proxies for biomass, e.g. SPR (Goodyear 1993) and / or fishing mortality from catch curve and per-recruit analyses. The estimates are periodically compared to specified reference points (Table 1) to determine the status of each stock.

Annual risk assessments are undertaken to identify any marked changes, primarily in the level of catch (relative to available estimates of MSY or long-term levels) of WCDSR species. Where the risk is considered unacceptable, a review will be undertaken within 3 months to develop a management response. A management response will be implemented to reduce the risk to an acceptable level as soon as practicable. This may involve additional analyses of data to estimate the biomass of the stock relative to unfished levels.

3.8.2.3 *Risk Assessments*

DPIRD uses a risk-based EBFM framework to assess the impacts of fishing on all parts of the marine environment, including the sustainability risks of retained species, bycatch, ETP species, habitats and the ecosystem. This framework has led the development of the periodic risk assessment process, which is used to prioritise research, data collection, monitoring needs and management actions to ensure that fishing activities are managed both sustainably and efficiently.

As explained in Section 2, only impacts of fishing by the commercial WCDSIMF and the recreational (and charter) fishing sector on these ecological components are currently assessed within this harvest strategy.

Due to the highly selective nature of line fishing, bycatch and interactions with ETP species are negligible. Any impacts on habitats through anchoring have previously been assessed as low risk (Department of Fisheries 2002; Department of Environment and Heritage 2004).

Risk assessments will continue to be undertaken periodically (every 5 years) to reassess any current or new issues that may arise in the WCDSR; however, a new risk assessment can also be triggered if there are significant changes identified in fishery operations or management activities or controls that are likely to result in a change to previously assessed risk levels.

3.8.2.4 *Economic and Social Benefits*

Economic and social benefit objectives, and their associated performance indicators and controls continue to be developed for WA commercial and recreational fisheries. Provisional economic and social benefit objectives and associated performance indicators and control rules have been developed for the WCDSR by the HSWG with representation from the Western Australian Fishing Industry Council (WAFIC), Recfishwest, Marine Tourism WA, commercial, recreational and charter fishers and DPIRD.

The working group selected per cent of annual entitlement utilised as a performance indicator for the WCDSIMF on the basis that it can be influenced by factors such as

catch rates, economic return from the fishery, continuity of supply and annual demand.

Participation (hours fished) was selected by the working group as a performance indicator for the recreational fishing sector on the basis that is a broad measure of the social amenity of recreational fishing in the West Coast Bioregion. Social amenity is influenced by a variety of factors including an individual's ability to realise their fishing experience expectations (e.g. catch, catch rate, species composition and access etc.). Participation (client numbers) was selected as the performance indicator for the charter sector as a measure of economic performance.

While changes in participation over time provides a measure that the amenity or economic value associated with a recreational fishery may have been affected (in a positive or negative manner), additional tools (such as satisfaction/economic surveys) may be required to determine exactly what factors are driving the change.

4.0 Management Measures and Implementation

4.1 Management Measures

There are a number of management measures in place for managing the WCDSR (Table 6). These measures can be amended as needed to ensure the management objectives are achieved; however, these do not preclude the consideration of other options.

Table 6. Management measures and instrument of implementation for the WCDSR.

Measure	Description	Instrument
Entitlement System	The WCDSIMF is managed via an ITE system, with separate TAE's for the Kalbarri, Mid-West and South West Areas. A minimum debit rule for each fishing trip applies in each management Area.	WCDSIMF Management Plan
Licence Requirements	Operators in the commercial WCDSIMF must hold an Interim Managed Fishery Permit (renewed annually). Operators in the commercial WCDGLIMF must hold an Interim Managed Fishery Permit (renewed annually). Operators in the commercial SDGDLF must hold a Managed Fishery Licence (renewed annually). Recreational fishers must hold a RFBL if fishing for demersal scalefish from a boat (renewed annually). Charter operators must hold a Fishing Tour Operators Licence (renewed annually).	WCDSIMF Management Plan; WCDGLIMF Management Plan; SDGDLF Management Plan; FRMR
Bag and possession limits	Daily recreational bag limits apply for all demersal species. A boat limit also applies to dhufish. There is a recreational possession limit of 2 days' bag limit; or 20 kg of fillets; or one day's bag limit and 10 kg of fillets.	FRMR
Gear restrictions	Operators in the commercial WCDSIMF are only permitted to fish using handlines and droplines. Commercial fishers are permitted to use up to 10 lines per vessel and must have VMS installed. Operators in the commercial TSFs are permitted to fish using demersal gillnets and demersal longlines. Recreational fishers are permitted to catch demersal scalefish by hook and line (up to three hooks per line) or by pointed instrument.	WCDSIMF Management Plan; TSFs Management Plans; Approved Directions; FRMR
Processing restrictions	All caught fish must be landed whole or trunked/filletted with a minimum length of 300 mm and skin and scales attached.	WCDSIMF Management Plan; Instrument of Exemption; FRMR
Species Restrictions	Restrictions on the species permitted to be retained apply to all commercial and recreational fishers (e.g. they may not retain any protected species).	WCDSIMF Management Plan; FRMR
Size Limits	Minimum size for: <ul style="list-style-type: none"> dhufish 500 mm (Total Length – TL); pink snapper 410 mm TL north of Lancelin and 500mm TL south of Lancelin; baldchin groper 400 mm TL. 	FRMR
Spatial Closures	Commercial closures: Metropolitan Area, and Commonwealth Marine Reserve waters. Recreational and commercial closures: Marine Park sanctuary zones. Recreational closures: Blue groper protected at Rottneest Island.	WCDSIMF Management Plan; FRMR Marine Park Orders
Temporal Closures	Recreational and commercial closures: Cockburn Sound and Warnbro Sound snapper closure; Abrolhos Islands baldchin groper closure. Recreational closures: WCB demersal closure.	FRMR; Prohibition Orders

4.2 Implementing Changes to the Management Arrangements

Decision-making processes can be triggered following the identification of new or potential issues as part of a risk assessment (generally reviewed every 3–5 years), results of research, management or compliance projects or investigations, monitoring or assessment outcomes (including those assessed as part of the harvest strategy) and/or expert workshops and peer review of aspects of research and management.

There are two main processes for making decisions about the implementation of management measures and strategies for the WCDSR:

- annual decision-making processes that may result in measures to meet the short-term fishery objectives (driven by the control rules); and
- longer-term decision-making processes that result in new measures and/or strategies to achieve the long-term fishery objectives (i.e. changes to the management system).

However, if there is an urgent issue, consultation with stakeholders may be undertaken to discuss the issue and determine appropriate management action, as needed.

4.2.1.1 *Recovery benchmark setting and sectoral allocations*

The recovery benchmark setting and review process for the WCDSR and its allocation between sectors is undertaken by DPIRD based on research advice and in consultation with key stakeholders in accordance with the control rules outlined in this harvest strategy (see Table 3). During this process consideration is also given to the fishery performance (see Section 3.6), and the economic and social benefit objectives. Once the recovery benchmark is set, the WCDSR recovery benchmark is allocated between sectors (and intra-sectoral proportions within sectors where relevant) in accordance with the IFM allocation (Figure 8). Please note that if the WCDSR recovery benchmark is adjusted for sustainability reasons or due to a reallocation of sectoral catch shares, key species recovery benchmarks should also be adjusted proportional to the WCDSR recovery benchmark adjustment.

Recovery benchmarks are reviewed following each periodic age-based assessment of indicator species. Where the performance indicator (i.e. spawning biomass and fishing mortality) triggers management action, the recovery benchmarks should be adjusted to give effect to the relevant HCRs.

The capacity for the WCDSIMF is contained in the management plan. A change in capacity is given effect through an amendment to the management plan following statutory consultation with licence holders and the approval of the Minister for Fisheries. Changes in capacity of other commercial fisheries that access the resource (such as TSFs) follow a similar process.

In the event that a change in the recovery benchmark causes a sector(s) total fishing mortality level to breach that recovery benchmark, a review and action should be undertaken in accordance with the control rules outlined in section 3.7.

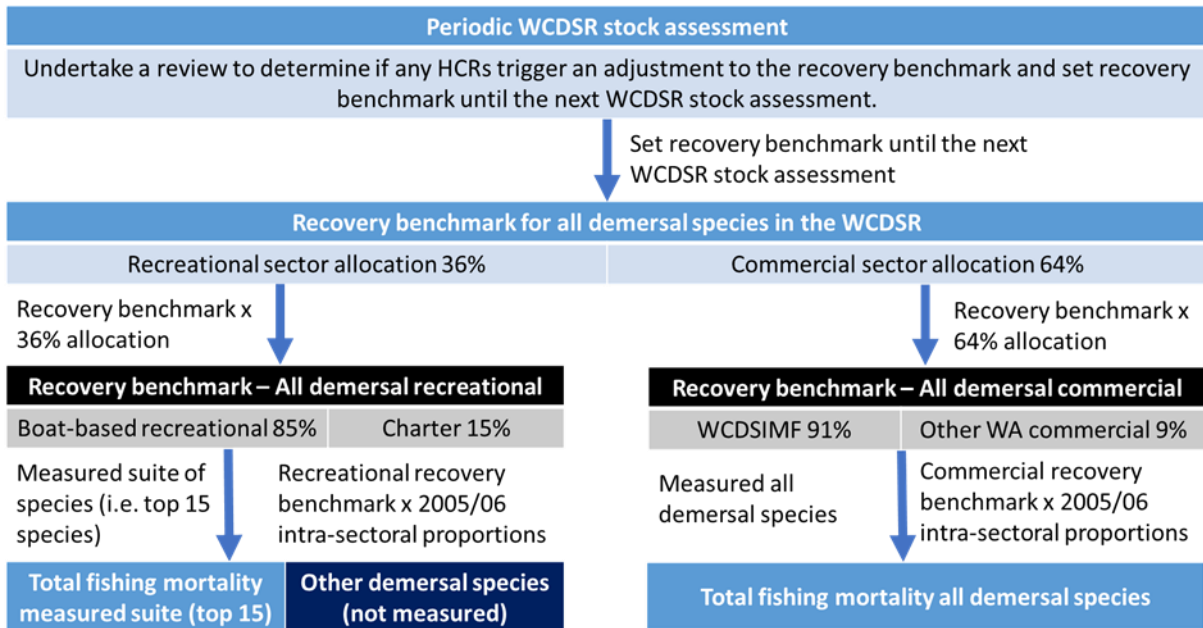


Figure 8. Allocation of WCDSR recovery benchmarks in accordance with IFM allocation. Note that the top 15 species is used to monitor the recreational sector total fishing mortality against its recovery benchmark.

4.2.2 Consultation

Management changes are generally given effect through amendments to legislation, such as the commercial fishery management plan, regulations and orders. These changes generally require consultation with all affected parties and the approval of the Minister for Fisheries and/or DPIRD’s Director General (or appropriate delegates). In making decisions relevant to fisheries, the Minister for Fisheries may choose to receive advice from any source, but has indicated that:

- 1) DPIRD is the primary source of management advice; and
- 2) The peak bodies of the Western Australian Fishing Industry Council (WAFIC) and Recfishwest are the primary source of advice and representation from the commercial and recreational harvesting sectors, respectively.

The peak bodies are funded by Government under Service Level Agreements to undertake their representation / advisory and consultation roles.

4.2.2.1 Commercial Sector Consultation

Under its funding agreement with DPIRD, WAFIC is required to undertake statutory consultation functions related to fisheries management and the facilitation of management meetings for licensed fisheries. Commercial fishers in south-west WA are represented by the Southern Seafood Producers Association.

Management meetings between the Department, WAFIC and licence holders in the fisheries that target the estuarine and nearshore finfish resource in south-west WA are generally held annually and are important forums to consult on the management of these fisheries. During these meetings, Departmental (science, management and compliance) staff, licence holders and WAFIC discuss current and future management issues that may have arisen during the previous fishing season and

any proposed changes to the management plan. Follow-up meetings may be held as required. The Department also consults directly with industry, where relevant, on specific management and operational issues.

4.2.2.2 TAE setting and Review Process

The capacity setting and review process Total Allowable Effort (TAE) in each Area of the WCDSIMF is undertaken by the Department based on research advice and in consultation with WCDSIMF licence holders in accordance with the control rules outlined in this harvest strategy (see Table 3). During this process consideration is also given to the fishery performance (see Section 3.6), and the economic and social benefit objectives.

The capacity (TAE) for each Area of the WCDSIMF is reviewed following each periodic age-based assessment of indicator species. Where the performance indicator (spawning biomass and fishing mortality) triggers management action and recovery benchmarks are adjusted to give effect to the relevant HCRs, the TAE may be adjusted to meet any changes to recovery benchmarks (Section 4.1.1).

The capacity for the WCDSIMF is contained in the management plan. A change in capacity is given effect through an amendment to the management plan following statutory consultation with licence holders and the approval of the Minister for Fisheries.

4.2.2.3 Recreational Sector Consultation

Under the funding agreement with Recfishwest, DPIRD is required to consult with Recfishwest as the recognised peak body for recreational fishing in WA. Recfishwest is required to engage and consult with recreational fishers as necessary in order to meet its obligations. Charter operators are also represented by Marine Tourism WA.

The recreational (including charter) sector tolerance levels are reviewed following each periodic age-based assessment of indicator species. Where the performance indicator (spawning biomass and fishing mortality) triggers management action and recovery benchmarks are adjusted to give effect to the relevant HCRs, recreational fishers and charter operators will be consulted on management options to adjust total fishing mortality levels to meet the adjusted recovery benchmarks.

Recreational and charter management arrangements are generally contained in the FRMR and Orders. A change in management arrangements to maintain fishing mortality within tolerance ranges is given effect through an amendment to the FRMR or relevant Order following public consultation and the approval of the Minister for Fisheries.

4.2.2.4 Consultation with Other Groups

Consultation on estuarine and nearshore finfish management with customary fishers and non-fisher stakeholders, including Government agencies, conservation sector Non-Government Organisations (NGOs) and other affected/interested parties is undertaken in accordance with the Departmental Stakeholder Engagement Guideline

(Department of Fisheries 2016). The Department's approach to stakeholder engagement is based on a framework designed to assist with selecting the appropriate level of engagement for different stakeholder groups and includes collaborating with and involving key stakeholders, seeking input from interested parties through a public consultation process and keeping all parties fully informed through the provision of balanced, objective and accurate information. Key fishery-specific documents such as harvest strategies, recovery plans and bycatch action plans are subjected to both formal key stakeholder consultation and public consultation processes.

4.3 Compliance and Enforcement

As the key regulatory agency, DPIRD's compliance role is to achieve sustainability, economic and social objectives by addressing the:

- ability and capacity to influence compliance with the rules; and
- effectiveness, capacity and credibility of the compliance program.

The Western Australian Fisheries Compliance Strategy (the Strategy; DPIRD 2018) was published in 2018. The purpose of the Strategy is to provide an understanding of the principles underlying the DPIRD's compliance role and how its compliance services are delivered to the WA community. The Strategy aligns with, and complements, DPIRD's Compliance Framework and Risk Assessment Policy which informs the risk-based model, compliance planning and the governance structure applied to fisheries compliance services.

The Department's compliance model is based on the Australian Fisheries National Compliance Strategy 2016-2020 (the National Strategy). DPIRD's compliance program is aligned to support the three key compliance strategies recommended by the National Strategy:

- maximising voluntary compliance;
- effective deterrence; and
- organisational capability and capacity.

Management arrangements for WCDSR are enforced under Operational Compliance Plans (OCPs) that are informed and underpinned by a compliance risk assessment, which is reviewed every two years. These OCPs have the following objectives:

- to provide clear and unambiguous direction and guidance to Fisheries and Marine Officers for the yearly delivery of compliance in the fishery;
- to protect the fisheries' environmental values, while providing fair and sustainable access to the fishery's commercial and social values; and
- to encourage voluntary compliance through education, awareness and consultation activities.

Compliance strategies and activities that are used in the fisheries targeting the estuarine and nearshore finfish resource of south-west WA include:

- land and sea patrols;
- catch validation against managed fishery licences/interim managed fishery permits;

- inspections at wholesale and retail outlets processing facilities and vessels in port;
- at-sea inspection of fishing boats;
- closed area/entitlement monitoring via VMS (WCDSIMF and TSFs);
- inspections at road-side check points; and
- aerial surveillance.

Inspections may involve:

- inspections of all compartments on board vessels;
- Inspection of all authorisations;
- Inspection of logbooks;
- Inspection of fishing gear; and
- Inspection of catch on board the vessel or in vehicle.

4.3.1 Vessel Monitoring System

VMS was introduced to the WCDSIMF in 2008 and is also used in the TSFs to allow real time entitlement monitoring of the commercial fleet and to support the fishing nomination system. VMS also helps to ensure fishers are working in their designated fishing areas.

Vessels operating within a fishery requiring VMS are fitted with an automatic location communicator (ALC), which is used to track the location of a boat by transmitting information such as the geographical position, course and speed of the boat. Information from the ALC is submitted to DPIRD via satellite. The information is processed by specialised software designed to receive, analyse, display and record position reports and messaging via satellites.

5.0 References

- Allen, G.R. (2009). *Marine Fishes of Tropical Australia and South-East Asia: A field guide for anglers and divers: A Field Guide for Anglers and Divers*. 3rd edition. Western Australian Museum, Western Australia.
- Australian Fisheries Management Authority (2011). *Harvest strategy for the Deepwater Trawl Fishery and North West Slope Trawl Fishery*. AFMA, Canberra.
- Caddy, J. and Mahon, R. (1995). *Reference points for fisheries management*. FAO Fisheries Technical Paper 347. FAO, Rome, 84 pp.
- Department of Agriculture and Fisheries (2017). *Queensland Sustainable Fisheries Strategy 2017-2027*. Department of Agriculture and Fisheries, Brisbane QLD.
- Department of Agriculture and Water Resources (2018). *Commonwealth Fisheries Harvest Strategy Policy*. Canberra, June. CC BY 4.0.
- Department of Environment and Heritage (2004). *Assessment of the Western Australian Shark Bay Snapper Fishery*. Department of the Environment and Heritage, Canberra ACT 2601.
- Department of Fisheries (2002) *Application to Environment Australia on the Shark Bay Snapper Managed Fishery Against the Commonwealth Guidelines for the Ecologically Sustainable Management of Fisheries* December 2002. <https://www.environment.gov.au/system/files/pages/465b0cf8-b852-4db8-91f9-8ada7b6c0ff8/files/snapper.pdf>
- Department of Fisheries (2011). *Resource Assessment Framework (RAF) for finfish resources in Western Australia*. Fisheries Occasional Publication No. 85. Department of Fisheries, Western Australia.
- Department of Fisheries (2012). *A review of the management arrangements and licensing framework for the Aquatic tour industry in Western Australia*. Department of Fisheries Western Australia, Perth. 32 pp.
- Department of Fisheries (2013). *Key findings of the 2013 West Coast Demersal Scalefish Resource stock assessment*. Fisheries Management Paper No. 262. Department of Fisheries, Western Australia.
- Department of Fisheries (2015a). *Harvest Strategy Policy and Operational Guidelines for the Aquatic Resources of Western Australia*. Fisheries Management Paper No. 271. Department of Fisheries, Western Australia.
- Department of Fisheries (2015b). *Research, Monitoring, Assessment and Development Plan 2015–2020*. Fisheries Occasional Publication No. 122. Department of Fisheries, Western Australia.
- Department of Fisheries (2016). *Guideline for stakeholder engagement on aquatic resource management-related processes*. Fisheries Occasional Publication No. 131. Department of Fisheries, Western Australia.

- Dias J, Wakefield C, Fairclough D, Jackson G, Travers M, and Snow M. 2016. Development of a species-specific real-time PCR method for the identification of snapper *Chrysophrys auratus* (Sparidae) eggs. *Journal of Fish Biology*. 88: 811819. ESD Steering Committee (1992). National Strategy for Ecologically Sustainable Development. Endorsed by the Council of Australian Governments, December 1992. ISBN0 644 27253 8.
- Fairclough, D. V. (2005). The biology of four tuskfish species (Choerodon: Labridae) in Western Australia. PhD thesis. Murdoch University, Perth. 204 pp. <http://researchrepository.murdoch.edu.au/47/>
- Fairclough, D.V., Edmonds, J.S., Jackson, G., Lenanton, R.C.J., Kemp, J., Molony, B.W., Keay, I.S., Crisafulli, B.M., Wakefield, C.B. (2013). A comparison of the stock structures of two exploited demersal teleosts, employing complementary methods of otolith element analysis. *Journal of Experimental Marine Biology and Ecology* 439: 181-195.
- Fairclough, D., Lai, E. and Holtz, M. (2015). West Coast Demersal Scalefish Resource Status Report. In: Fletcher, W.J. and Santoro, K. (eds.), Status Reports of the Fisheries and Aquatic Resources of Western Australia 2014/15: State of the Fisheries. Department of Fisheries, Western Australia.
- Fairclough, D.V., Molony, B.W., Crisafulli, B.M., Keay, I.S., Hesp, S.A. and Marriott, R.J. (2014). Status of demersal finfish stocks on the west coast of Australia. Fisheries Research Report No. 253. Department of Fisheries, Western Australia.
- Fletcher, W.J. (2002). Policy for the implementation of ecologically sustainable development for fisheries and aquaculture within Western Australia. Fisheries Management Paper No. 157. Department of Fisheries, WA.
- Fletcher, W.J. (2015). Review and refinement of an existing qualitative risk assessment method for application within an ecosystem-based management framework. *ICES Journal of Marine Science* 72: 1043-1056.
- Fletcher, W.J. and Santoro, K. (eds.) (2015). Status Reports of the Fisheries and Aquatic Resources of Western Australia 2014/15: State of the Fisheries. Department of Fisheries, Western Australia.
- Fletcher, W. J., Gaughan, D. J., Metcalf, S. J., & Shaw, J. (2012). Using a regional level, risk based framework to cost effectively implement Ecosystem Based Fisheries Management (EBFM). In: Global progress on Ecosystem-Based Fisheries Management, Kruse, G.H. et al. (eds.), pp. 129-146, Alaska Sea Grant College Program, Fairbanks, Alaska.
- Fletcher, W.J., Wise, B.S., Joll, L.M., Hall, N.G., Fisher, E.A., Harry, A.V., Fairclough, D.V., Gaughan, D.J., Travaille, K., Molony, B.W. and Kangas, M. (2016). Refinements to harvest strategies to enable effective implementation of Ecosystem Based Fisheries Management for the multi-sector, multi-species fisheries of Western Australia. *Fisheries Research*. <http://dx.doi.org/10.1016/j.fishres.2016.04.014>
- Forrest, R.E., McAllister, M.K., Dorn, M.W., Martell, S.J.D., and Stanley, R.D. 2010. Hierarchical Bayesian estimation of recruitment parameters and reference points

- for Pacific rockfishes (*Sebastes* spp.) under alternative assumptions about the stock-recruit function. *Canadian Journal of Fisheries and Aquatic Sciences*, 67(10): 1611–1634. doi:10.1139/F10-077.
- Gabriel, W.L. and Mace, P.M. (1999). A review of biological reference points in the context of the precautionary approach. NOAA Technical Memo NMFS-F/SPO-40, pp. 34-45.
- Goodyear, C.P. (1993). Spawning stock biomass per recruit in fisheries management: foundation and current use. In S.J. Smith, J.J. Hunt and D. Rivard [ed.] Risk evaluation and biological reference points for fisheries management. Canadian Special Publications in Fisheries and Aquatic Science, 120.
- Hesp, S.A., Potter, I.C. and Hall, N.G. (2002). Age and size composition, growth rate, reproductive biology, and habitats of the West Australian dhufish (*Glaucosoma hebraicum*) and their relevance to the management of this species. *Fishery Bulletin*, 100 (2). pp. 214-227.
- Jackson, G., Cheng, Y.W. and Wakefield C.B. (2012). An evaluation of the daily egg production method to estimate spawning biomass of snapper (*Pagrus auratus*) stocks in inner Shark Bay, Western Australia, following more than a decade of surveys 1997-2007. *Fisheries Research* 117-118: 22-34.
- Kailola, P.J., Williams, M.J., Stewart, P.C., Reichelt, R.E., McNee, A. and Grieve, C. (1993). *Australian Fisheries Resources*. Bureau of Resource Sciences, Canberra.
- Nardi, K., Newman, S. J., Moran, M. J. and Jones, G. P. (2006). Vital demographic statistics and management of the baldchin groper (*Choerodon rubescens*) from the Houtman Abrolhos Islands. *Marine and Freshwater Research* 57, 485-496.
- Lai, E.K., Mueller, U., Hyndes, G.A. and Ryan, K.L. (2019). Comparing estimates of catch and effort for boat-based recreational fishing from aperiodic access-point surveys, *Fisheries Research*, 219, 105305.
- Lenanton, R., St John, J., Keay, I., Wakefield, C., Jackson, G., Wise, B. and Gaughan, D. (2009). Spatial scales of exploitation among populations of demersal scalefish: implications for management. Part 2: Stock structure and biology of two indicator species, Western Australian dhufish (*Glaucosoma hebraicum*) and pink snapper (*Pagrus auratus*), in the West Coast Bioregion. Final report to Fisheries Research and Development Corporation, Project 2003/052. Fisheries Research Report No. 174, Department of Fisheries Western Australia. 141 pp.
- Mace, P.M. (2001). A new role for MSY in single-species and ecosystem approaches to fisheries stock assessment and management. *Fish and Fisheries*, 2(1), pp.2-32.
- Mangel, M., MacCall, A.D., Brodziak, J., Dick, E.J., Forrest, R.E., Pourzand, R. and Ralston, S. (2013). A perspective on steepness, reference points, and stock assessment. *Canadian Journal of Fisheries and Aquatic Sciences*, 70(6).
- Molony, B.W., Newman, S.J., Joll, L., Lenanton, R.C.J. and Wise, B. (2011). Are Western Australian waters the least productive waters for finfish across two

oceans? A review with a focus on finfish resources in the Kimberley region and North Coast Bioregion. *Journal of the Royal Society of Western Australia* 94: 323–332.

- Newman, S.J., Brown, J.I., Fairclough, D.V., Wise, B.S., Bellchambers, I.M., Moloney, B.W., Lenanton, C.J., Jackson, G., Smith, K.A., Gaughan, D.J., Fletcher, W.J., McAuley, R.B. and Wakefeld, C.B. (2018). A risk assessment and prioritisation approach to the selection of indicator species for the assessment of multi-species, multi-gear, multi-sector fishery resources. *Marine Policy* 88:11-22.
- Parsons, D.M., Sim-Smith, C.J., Cryer, M., Francis, M.P., Hartill, B., Jones, E.G., Le Port, A., Lowe, M., McKenzie, J., Morrison, M., Paul, L.J., Radford, C., Ross, P.M., Spong, K.T., Trnski, T., Usmar, N., Walsh, C. and Zeldis, J. (2014) Snapper (*Chrysophrys auratus*): a review of life history and key vulnerabilities in New Zealand, *New Zealand Journal of Marine and Freshwater Research* 48: 256-283.
- Ryan, K.L., Wise, B.S., Hall, N.G., Pollock, K.H., Sulin, E.H. and Gaughan, D.J. (2013). An integrated system to survey boat-based recreational fishing in Western Australia 2011/12. Fisheries Research Report No. 249. Department of Fisheries, Western Australia.
- Ryan, K.L., Hall, N.G., Lai, E.K., Smallwood, C.B., Taylor, S.M. and Wise, B.S. (2015). Statewide survey of boat-based recreational fishing in Western Australia 2013/14. Fisheries Research Report No. 268. Department of Fisheries, Western Australia.
- Ryan, K.L., Hall, N.G., Lai, E.K., Smallwood, C.B., Taylor, S.M. and Wise, B.S. (2017). Statewide survey of boat-based recreational fishing in Western Australia 2015/16. Fisheries Research Report No. 287. Department of Fisheries, Western Australia.
- Ryan, K.L., Hall, N.G., Lai, E.K., Smallwood, C.B., Tate A, Taylor, S.M. and Wise, B.S. (2019). Statewide survey of boat-based recreational fishing in Western Australia 2017/18. Fisheries Research Report No. 297. Department of Fisheries, Western Australia.
- Sloan, SR; Smith, ADM; Gardner, C; Crosthwaite, K; Triantafillos, L; Jeffries, B and Kimber, N (2014) National Guidelines to Develop Fishery Harvest Strategies. FRDC Report – Project 2010/061. Primary Industries and Regions, South Australia, Adelaide, March.
- Wise, B.S., St John, J. and Lenanton, R. (eds.) (2007). Spatial scales of exploitation among populations of demersal scalefish: Implications for management. Part 1: Stock status of the key indicator species for the demersal scalefish fishery in the West Coast Bioregion. FRDC Final Report on Project No. 2003/052. Fisheries Research Report No. 163. Department of Fisheries, Western Australia, 130 pp.

6.0 Appendices

6.1 Appendix 1 – WCDSR IFM Allocation Determination

The WCDSR IFM allocation determination by the Minister for Fisheries on 12 December 2012.

DETERMINATION BY THE MINISTER FOR FISHERIES ON THE WEST COAST DEMERSAL SCALEFISH RESOURCE ALLOCATION

Matters that the Minister for Fisheries considers important in setting out his position on the West Coast Demersal Scalefish Resource

- The west coast demersal scalefish resource is a multi-user, multi-zonal and multi-species resource.
- The sectors targeting the west coast demersal scalefish resource have undergone significant management change since 2005/06 in order to reduce their catch by at least 50% of the 2005/06 catch level and are now largely meeting that objective.
- While the commercial and recreational sectors catch the whole suite of west coast demersal scalefish, the indicator species of Western Australian dhufish, pink snapper and baldchin groper are particularly important for both sectors.
- The commercial sector catches large quantities of species that are not generally targeted by the recreational sector, such as emperors or deep-water species such as hapuku. This means, that while the commercial sectors catch is larger than the recreational sectors catch, much of the fish caught is not readily available to all recreational sector participants because they are too far off-shore or species such as emperors are found in waters off less heavily populated areas of the State.
- The fish species that make up this resource are geographically distributed in such a way that, for example, baldchin groper is more common in the northern area of the west coast, and Western Australian dhufish is more common in the southern part of the west coast.
- The Integrated Fisheries Allocation Advisory Committee (the Allocation Committee) is required by the Integrated Fisheries Management policy to make its recommendations on the best available information. The absence of, or any uncertainty in, information should not be used as a reason for delaying or failing to make a decision.

**DETERMINATION BY THE MINISTER FOR FISHERIES ON THE WEST COAST
DEMERSAL SCALEFISH RESOURCE ALLOCATION**

Integrated Fisheries Allocation Advisory Committee Recommendations	Minister for Fisheries' position
Recommendation 1: The initial allocation for the west coast demersal scalefish resource be made for the entire area covered by the West Coast Demersal Scalefish Interim Managed Fishery, 26°30' South to 115°30' East (north of Kalbarri to east of Augusta).	Agree - Bioregional allocations are easier to manage than zonal allocations within bioregions. This is particularly the case for recreational fisheries, as recreational fishers are mobile and able to shift catch and effort between zones.
Recommendation 2: The total recorded commercial catch of all west coast demersal species and the estimated total recreational catch of all west coast demersal species should be used for allocating the west coast demersal scalefish resource.	Agree – The whole suite of species is the resource that is managed by the Department of Fisheries (Department). Monitoring of the commercial sector is comprehensive across the demersal suite. Monitoring of the recreational sector for the foreseeable future is likely to be restricted to representative species because the Department does not have weight-length relationships for all 200 species and issues of identification using a phone logbook survey methodology. Having the allocation apply to the whole suite, even if only a sub-component is monitored for the recreational sector, will guard against shifts in targeting of the resource by either sector. If necessary, species, such as deep water species, may be added to the monitored component if they become significant in the catch. The Department will develop business rules around the use of a species subset (e.g. the predominant 15 species), for which there is quantitative data as a basis for monitoring the allocation.
Recommendation 3: 2005/06 should be used as the reference year for the allocation of the west coast demersal scalefish resource.	Agree - When the Allocation Committee started its west coast demersal scalefish investigations and issued its draft Allocation Report, the 2005/06 creel survey was the most recent creel survey data available before substantial management changes. The catch information for the West Coast Demersal Scalefish Fishery in 2005/06 was the basis on which the Department determined that at least a 50% reduction in catch was required for sustainable management of the fishery. Two independent reviews of the science associated with this decision have confirmed that the 50% reduction is required. 2005/06 was also the year before substantial management changes commenced for the commercial and recreational sectors.
Recommendation 4: No specific allocation to the Customary sector is required and Customary fishing can continue in accordance with existing Customary fishing arrangements.	Agree
Recommendation 5: The formal allocations in the fishery should be made to the recreational and commercial sectors.	Agree
Recommendation 6: The Department of Fisheries should manage the fishery so that the intra-sectoral catch shares remain approximately at their 2005/06 levels.	Agree
Recommendation 7: That for allocation purposes the recreational catch be considered to be 30% greater than the revised 2005/06 recreational creel survey catch.	Accept – It is the Allocation Committee's role to address the issues surrounding gaps and uncertainty with respect to the available data when ascertaining each sectors historical catch shares.
Recommendation 8: The estimate of the recreational catch for 2005/06 should be increased by 39 tonnes to take account of the Abrolhos Island's recreational catch.	See recommendation 7, above.
Recommendation 9: The 2005/06 commercial sectors catch in the metropolitan area should not be taken into account when determining the sectoral allocations for the west coast demersal scalefish resource.	Agree – The commercial licence and permit holders that fished in the metropolitan area were provided with <i>Act of Grace</i> or Voluntary Fisheries Adjustment Scheme payments to take account of the closure. It is the Allocation Committee's role to address issues surrounding how specific sector catches should be allocated.

**DETERMINATION BY THE MINISTER FOR FISHERIES ON THE WEST COAST
DEMERSAL SCALEFISH RESOURCE ALLOCATION**

Integrated Fisheries Allocation Advisory Committee Recommendations	Minister for Fisheries' position
Recommendation 10: That the allocation of shares in the total suite of species in the WCDSF should be 64% to the commercial sector and 36% to the recreational sector.	Agree
<p>Recommendation 11: Within each sectors allocation, the proportions of the five indicator species, be monitored and managed so that as far as practicable, they remain with their relative catch share of:</p> <p>Western Australian dhufish – recreational sector 62%, commercial sector 38%, Pink snapper – recreational sector 21%, commercial sector 79%, Baldchin groper – recreational sector 65%, commercial sector 35%, Emperors – recreational sector 9%, commercial sector 91%, Bight redfish – recreational sector 14%, commercial sector 86%.</p>	<p>Agree in principle – Multispecies fish resources are dynamic and variable over time. To allow for practical management, catch proportions of indicator species to be adopted as guidelines, rather than as specific fixed proportional shares, as follows: Western Australian dhufish – recreational sector 60%, commercial sector 40%, Pink snapper – recreational sector 20%, commercial sector 80%, Baldchin groper – recreational sector 65%, commercial sector 35%, Emperors – recreational sector 10%, commercial sector 90%, Bight redfish – recreational sector 15%, commercial sector 85%.</p> <p>The Department will manage and monitor the catch within these guidelines. This will allow for issues such as individual species recruitment pulses to flow through the sectoral catches without separate management measures for each species necessarily having to be taken.</p>
Recommendation 12: A system of monitoring and managing the sectoral catches, based on the principles set out in the document " <i>Considerations for the Implementation of Western Rock Lobster Sectoral Allocations</i> " should be established to manage allocations in the West Coast Demersal Scalefish Fishery.	Agree – While the principles contained in " <i>Considerations for the Implementation of Western Rock Lobster Sectoral Allocations</i> " can be followed the west coast demersal scalefish resource is a significantly more complex resource and a more adaptive approach to management needs to be taken (see Recommendations 2 and 11 above).
Recommendation 13: Monitoring of boat fishing for silver trevally, King George whiting and other nearshore fish stocks should take place to ensure transfer of effort does not result in overfishing nearshore species.	Agree – The Department is to ensure that effort is not transferred to shore-based fishing.
Recommendation 14: That the initial management changes to enable the sectors to meet their allocation be taken at the same time as any changes to the sustainability management arrangements are made by the Minister for Fisheries as a result of the 2012 review of management arrangements.	Agree – It is expected that the review of management arrangements will occur in 2013/2014.
Recommendation 15: That a moving five-year average be used when determining if sectoral catches have remained within their allocation.	Accept - This is in line with the arrangements in the rock lobster and abalone resources. However, the responsiveness of the five year average for this resource will require further consideration.
Recommendation 16: A reallocation mechanism should be implemented for the west coast demersal scalefish resource as soon as practicable.	Agree
Recommendation 17: The Department should continue to improve its collection methodology for recreational fishing data and improve its community education strategies on the status and management of the west coast demersal scalefish resource.	Agree – The Department has introduced the new Western Australian Recreational Boat Fishing Survey. The Department is also updating its information brochures on the west coast demersal scalefish resource. The Department is also taking steps to improve its collection of commercial data with the development of an entitlement management system.

6.2 Appendix 2 – Calculating Total Fishing Mortality

Total fishing mortality accounts for the combined mortality associated with **both** retained catch and the proportion of released catch that dies (i.e. post-release mortality) generated by fishing activities

$\text{Species total fishing mortality} = \text{retained catch} + (\text{released catch} \times \text{post-release mortality rate})$
--

6.2.1 *Post-release mortality defined parameters*

The defined parameters used to estimate the post-release mortality component of total fishing mortality of WCDSR species by the recreational and commercial fishing sectors are outlined below.

6.2.2 *Recreational and commercial sector release rates*

Recreational (including charter) sector released catch is monitored in terms of number of each species released. Released catch of WCDSR species by boat-based recreational fishers is monitored periodically (every 2-3 years) in numbers as part of the statewide survey of recreational fishing (see section 3.9.1.2). Released catch of WCDSR species by charter fishers is monitored annually through statutory logbooks.

Commercial release rates are not currently recorded in commercial logbooks however, release rate data has historically been monitored on an ad-hoc basis. The Department is currently monitoring WCDSIMF release rates via voluntary log sheets.

6.2.3 *Post-release mortality rate for the WCDSR top 15 species*

The Department has developed three proposed post-release mortality categories for the WCDSR top 15 species based on likely depth of capture, available scientific literature and anecdotal information from fishers (Table 7):

- Moderate – 25% post-release mortality rate (i.e. 25% of released fish die);
- High – 50% post-release mortality rate (i.e. 50% of released fish die); and
- Very High – 90% post-release mortality rate (i.e. 90% of released fish die).

6.2.4 *Average weight of released fish*

Average weights of released fish were determined from average lengths and length-weight equations for species or closely-related taxa (Table 7). Average lengths of released fish were assumed to as 10% less than their MLLs, except for:

dhufish and pink snapper which is based on the average length of released dhufish and pink snapper reported in the Recreational Angler Program logbook;

foxfish where average length of released fish is less than 300 mm (Moore et al.);

breaksea cod where it was assumed that fish less than 300 mm in length are not retained (Cossington et al.); and

sea sweep and sergeant baker where there is no data on lengths of released fish, it was assumed the average length of released fish are 250 mm.

Table 7. Post-release mortality rates, average lengths and weights for main WCDSR species.

Species	Post-release mortality rate	Size limit	Released fish average length	Released fish average weight
Baldchin groper	90%	400 mm	360 mm	1439 g
Bass groper	90%	None	No data	No data
Eightbar grouper	90%	None	No data	No data
Foxfish	90%	None	278 mm	383 g
Hapuku	90%	None	No data	No data
Breaksea cod	50%	300 mm	247 mm	246 g
Dhufish	50%	500 mm	443 mm	1523 g
Bight redfish (incl. Yelloweye redfish and Swallowtail)	25%	300 mm	270 mm	332 g
Blue morwong	25%	410 mm	369 mm	598 g
Blue-eye trevalla	25%	None	No data	No data
Bluespotted emperor	25%	280 mm	252 mm	212 g
Emperors	25%	280 mm	252 mm	250 g
Grass emperor	25%	320 mm	288 mm	352 g
Pink Snapper	25%	500 mm / 410 mm	400 mm	816 g
Redthroat emperor	25%	280 mm	252 mm	250 g
Robinson's seabream	25%	280 mm	252 mm	250 g
Ruby snapper	25%	None	No data	No data
Sea sweep	25%	None	250 mm	238 g
Sergeant Baker	25%	None	250 mm	211 g
Spangled emperor	25%	410 mm	369 mm	713 g
Spotcheek emperor	25%	280 mm	252 mm	212 g
Threadfin emperor	25%	280 mm	252 mm	212 g
Yellowtail emperor	25%	280 mm	252 mm	250 g

6.2.5 Recreational Sector Total Fishing Mortality Calculation

WCDSR retained and released catches by boat-based recreational fishers and charter operators is sourced from state-wide surveys and charter logbooks respectively. Estimates of total fishing mortality for the recreational (including charter) sector are estimated using the following formula:

$$\text{Total fishing mortality} = \text{Retained catch} + \text{Post-release mortality}$$

Total fishing mortality (kg)	=	Retained catch (kg)	+	Number of released fish (#) x Average weight of released fish (kg) x Post-release mortality rate (%)
---------------------------------	---	------------------------	---	--

6.2.6 Commercial Sector Total Fishing Mortality Calculation

WCDSR retained catches by the commercial sector is monitored via statutory logbooks. WCDSR released catches by the commercial sector have historically been

monitored on an ad-hoc opportunistic basis however, a voluntary log sheet program has recently been launched to provide ongoing monitoring information on commercial release rates in the WCDSIMF. Until further information is derived from this monitoring program a proxy of 25% release rate has been implemented for WCDSIMF and a proxy of 10% release rate has been implemented for other commercial fisheries. Estimates of total fishing mortality for the commercial sector are estimated using the following formula:

Total fishing mortality	=	Retained catch	+	Post-release mortality				
Total fishing mortality (kg)	=	Retained catch (kg)	+	Retained catch (kg)	x	Commercial release rate (%)	x	Post-release mortality rate (%)

6.3 Appendix 3 – Harvest Strategy Control Rules for Retained Species once Recovered

Table 8. Harvest Strategy reference levels and control rules for WCDSR retained (indicator and non-indicator) species when under maintenance strategy that may be impacted by fishing activities undertaken by commercial and recreational fishers while targeting demersal scalefish.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Indicator species	To maintain spawning stock biomass of each retained species at a level where the main factor affecting recruitment is the environment.	Pink snapper Dhufish Baldchin groper (Mid-West only)	Periodic estimates (every 3 years) of spawning biomass (B , or appropriate proxy) and fishing mortality (F)	Target: B_{Target} and F_{Target} (refer to Table 1)	Continue management aimed at achieving ecological, economic and social objectives.
				Threshold: B_{MSY} and $F_{Threshold}$ (refer to Table 1)	If the Threshold is breached (Section 3.7.4) by any indicator species (i.e. $B < B_{MSY}$ or $F > F_{Threshold}$), a review will be initiated immediately and completed within 3 months to develop a recovery plan, determine the level of recovery benchmark reduction required (10-50%) and develop a management response. Appropriate management action will be taken as soon as is practicable to reduce each fishing sectors total fishing mortality below revised recovery benchmarks, to enable all indicator species to recover (i.e. $B > B_{MSY}$ and $F < F_{Threshold}$) within one generation.
				Limit: B_{Limit} and F_{Limit} (refer to Table 1)	If the Limit is breached (Section 3.7.4) by any indicator species (i.e. $B < B_{Limit}$ or $F > F_{Limit}$), a review will be initiated immediately and completed within 3 months to develop a recovery plan, determine the level of recovery benchmark reduction required (10-50%) and develop a management response. Appropriate management action will be taken as soon as is practicable to reduce each fishing sectors total fishing mortality below revised recovery benchmarks, to enable all indicator species to recover (i.e. $B > B_{MSY}$ and $F < F_{Threshold}$) within two generations (maximum of 20 years).