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Research and Development Plan 2008-09

Western Australian Department of Fisheries
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Department of **Fisheries**

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INTRODUCTION

Background

The following document outlines the key research activities that are currently planned or identified for all of the fishery, ecosystem and aquaculture sectors within each bioregion of Western Australia. The research outlined in this plan is specifically directed at supporting the collection of information that will assist in achieving the objectives of the *Fish Resources Management Act* (1994). Consequently, the plan may not cover all the research activities that could be necessary for a fishery; in particular the industry development elements and marketing aspects are not covered in a comprehensive fashion. Given the interactive nature of research into natural systems, in some cases the same project may be mentioned in more than one report to provide the most comprehensive description of activities and where their outputs are used.

This document should be read in conjunction with the State of Fisheries report where comprehensive analyses of the current status of each of the fisheries and fish habitats are described. Furthermore, it should also only be used as a general guide on the current types of research; it may not always cover the precise detail of some programs. It not only documents research being done by the Department but it also covers most of the research being done by other agencies that has been identified as being directly relevant to the particular fishery/issue.

The current objectives and research focus documented in this plan are generally the results of deliberations and discussions with the relevant management advisory committee (MAC), industry working groups and other advisory bodies. A major responsibility for each of these advisory groups is the development of research plans and priorities that need to be reviewed and updated on an annual basis. Where these MAC level research plans exist, this document will have repeated or summarised this information.

It will become apparent from reading this document that there are large difference in the levels of research activity among different fisheries and ecosystems. This reflects a combination of the differing levels of risk that are associated with these issues and the also the requirements for information for the management process to operate effectively. Formal risk assessment processes are now used to prioritise each of these components to ensure that resources are directed to those most in need.

The compilation of previous and current research plus outlining additional requirements within each resource sector within WA, will assist with the management of future research initiatives and planning. This information can enable major gaps in issues, resources and expertise to be identified. It should also be used to minimise the development of proposals on issues that are already determined to be adequately covered by previous research. Consequently the information should also be of benefit to a number of other groups:

- Each of the MACs and industry sectors can use this document to facilitate their discussions and formulation of their short and long term research priorities;
- Individual fishers can examine and compare the research that is occurring, or is proposed, in their fishery. This knowledge may help increase the level of input received by the sector advisory bodies and therefore result in higher quality industry feedback;
- Research institutes and Universities can use the plan to assist in developing possible new projects to address the major research issues identified by industry;
- National research co-ordinating bodies such as the AFMF and major funding agencies such as the Fisheries Research and Development Corporation (FRDC), can use this information

to assist in the future planning of national priorities and sub-program development;

- The general public and conservation groups will have the opportunity to comment upon the research which is proposed or underway, in one of their areas of great general interest, fisheries resources.

Outline of reports

There are separate sections for each of the main wild capture fisheries, each of the main aquaculture industries plus sections on broader ecosystem/biodiversity issues.

Within each of the summary plans, there is a brief overview of the sector that includes a short description of previous research that has occurred in this area, plus the current major research focus and objectives for next five years.

Following these background descriptions, there is a matrix that displays the research topics that have already been completed to a sufficient level for management, those that are currently being studied and the timeframe over which these will occur and the identified research issues not yet being addressed. Any comments concerning these topics and other relevant information (e.g. any EPBC requirements) are also present.

The research issues are divided into a number of categories (based on ESD principles) to clearly indicate where the focus is headed. The categories are

- **Retained/Key Species Stock Analysis** (biology, stock assessment, fishery monitoring)
- **Habitat and Ecosystem** (bycatch, protected species interactions, habitat impacts, ecosystem effects and the environment)
- **Management Analysis** (Socio-economic surveys, Resource Access issues, Compliance Research, Management strategy evaluation)
- **Industry Development** (Production technology, post Harvest, Marketing, OHS)

This document is to be updated annually as part of the normal planning cycle.

Key to symbols in the matrix/summary tables:

■ Indicates that the activity is funded and planned to occur.

O Indicates that the activity is part of a proposal but is not yet funded.

▒ Indicates a proposal is under consideration.

Dr Rick Fletcher

Director, Fisheries Research

December 2008

WEST COAST BIOREGION

West Coast - Biodiversity Issues

Description and Scope of Issues

The West Coast is characterised by exposed sandy beaches and a limestone reef system which creates surface reef lines often about 5 km off the coast. Sea floors further offshore on the continental shelf are typically coarse sand interspersed with low limestone reef associated with old shorelines. There are few areas of protected water along the west coast, the exceptions being in the Abrolhos Islands, in the lee of some small islands off the mid-west coast, and behind Rottnest and Garden Islands off the metropolitan area. The major significant marine embayments of the west coast are Cockburn Sound and Geographe Bay. Beyond Cape Naturaliste the coastline changes from limestone to predominantly granite and becomes more exposed to the influences of the Southern Ocean. Along the west coast there are four significant estuarine systems, the Swan/Canning, Peel/Harvey and Leschenault estuaries and Hardy Inlet (Blackwood estuary), all of which are permanently open to the sea and form an extension of the marine environment except when freshwater runoff displaces the oceanic water for a short period in winter and spring

Current Research Focus

A number of research activities are underway within this bioregion, many are undertaken by agencies other than the Department.

- Marine Futures – (NHT) The project aims to collect baseline scientific data to develop marine resource indicators for marine habitats, biodiversity and human use patterns in SW Australia.
- The physical impact of fishing with lobster pots on coral communities at the Abrolhos Islands, is being monitored.
- Interactions between gill net fishing with sealion foraging activity (WAMSI), plus a project monitoring the efficacy of sealion exclusion devices in the lobster fishery.
- Deep water Lobster – (FRDC, WAMSI) this project focuses on determine the ecosystem effects of removing lobster from the ecosystem on the west coast bioregion.
- Information on the status of introduced marine pest species (IMPs) on the west coast is being gathered at the ports Fremantle and Geraldton, as well as Cockburn Sound.
- SRFME/WAMSI Jurien Bay studies – focuses on a host of projects in the marine environment on the West Coast of Western Australia
- Swan Catchment Council – Development of long-term monitoring of fish, rock lobster and sessile benthic communities inside and outside sanctuary zones of the NRM Swan region.
- WAMSI 4.2 work on biodiversity and community structure – 4.2.1, 4.2.2 and 4.2.4.
- Development of an environmental monitoring and carrying capacity estimation framework for coastal aquaculture

Priority Setting Process

WAMSI projects were developed by executive direction of the Department with research input.

West Coast Biodiversity Research Issues

WC Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Western rock lobster diet	Underway	■	■				Diet analysis is being conducted for both inshore and deepwater populations by WAMSI and FRDC projects
Western rock lobster movement	Underway	■	■				Movement analysis is being conducted for both inshore and deepwater populations by WAMSI and FRDC projects
Coral Trout (Abrolhos)	Underway	■					Currently being conducted by a PhD at ECU
Finfish populations at Jurien	Underway	■					Research on finfish population is currently being conducted by SRFME. Likely that research will be ongoing
1.2 Other Biology							
1.3 Stock Assessment							
1.4 Fishery Monitoring	Developing	■	■				WAMSI 4.4.1 - Captured species assessments: bycatch
Catchability of Western Rock lobster	Ongoing	■					FRDC deepwater ecology project
2. Habitat & Ecosystem							
2.1 Bycatch	Developing	■	■				WAMSI 4.4.1 - Captured species assessments: bycatch
2.2 Listed Species	Developing	■	■				WAMSI 4.4.1 - Captured species assessments: bycatch
Australian sea lion (ASL) Population monitoring	Developing	■					Monitoring of pup production and mortality rates for the west coast breeding colonies (Buller Is, North Fisherman Is, Beagle Is & Abrolhos Is). Pup counts have been conducted seasaonally over the last 3 years.
2.3 Habitat							
Developing RCTs for benthic habitats	Underway	■					MF – DoF, UWA WAMSI 4.2
Swan River fish community	Developing	■	■				MU WAMSI
Deepwater rock lobster habitat	Ongoing	■	■	■			Identification of deep and shallow water habitat is being conducted by WAMSI & FRDC funded projects

WC Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Marine Futures	Ongoing						Habitat mapping and biodiversity sampling is being conducted at the Abrolhos, Jurien, Rottnest and the Capes
Coral habitats in Abrolhos	Ongoing						A DOF project is currently underway examining the effects of lobster potting on sensitive coral habitats at the Abrolhos
Near shore seagrass	Ongoing						Seagrass communities are currently being studied by ECU as part of SRFME
Swan Catchment Council	Completed						A program to monitor rock lobster, fish and sessile benthic communities inside and outside of sanctuary zones at Rottnest Island, Marmion and Shoalwater Islands marine parks has been completed
Environmental monitoring for coastal aquaculture	Developing						For aquaculture sites: characterising benthic habitats, determining hydrodynamics, defining discharge characteristics and developing carrying capacity model.
2.4 Ecosystem/ Environment							
Trophic interaction, anthropogenic influences etc	Underway	■	■				WAMSI 4.2 & 4.3.
Climate change, ecological processes	Underway	■	■				WAMSI Projects 1 & 2 (CSIRO, UWA, AIMS): e.g.
Western Rock lobster	Ongoing	■	■	■			FRDC deepwater ecology project and SRFME are examining the effects of rock lobster fishing on the ecosystem It is likely that research will be ongoing in these areas
Ecosystem modelling	Ongoing	■	■				Currently being conducted by Murdoch University with FRDC and WAMSI funding
Fish Kills	Ongoing	■	■	■	■	■	Gov't response to fish kills coordinated through Fisheries Research (Fish Health).
2.5 Oceanography							
Hydrodynamic modelling	Completed						Some fine- and broad scale work has been completed (e.g. CSIRO/ DoF WRL larval dispersal model)
	Developing (some underway)	■	■				WAMSI Projects 1, 2 & 3 (CSIRO, UWA, AIMS): e.g, ,
Nutrient/plankton cycles on shelf	Completed						Two Rock transect - SRFME
Southern Surveyor Eddy cruise 1	Completed						cruise completed; papers accepted
Southern Surveyor Eddy cruise 2 – LC/shelf interactions	Underway						– data analysis underway. Another cruise is planned.
2.6 Other impacts on fishery							

WC Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Introduced marine pests	Nearing completion						Currently funded by Natural Heritage Trust to analyse what species have been introduced.
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Developing	■					WAMSI 4.5: implications of proposed resource allocations. Universities?
Economic Analysis	Developing	■					WAMSI 4.5: implications of proposed resource allocations
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
Validation of Catch Records							
3.4 Management Systems	Underway	■	■	■			WAMSI 4.1. Applying EBFM framework.
	Developing						EPBC/NOO south west regional plan
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - Abrolhos Islands FHP Region

Description and Scope of System

The Houtman Abrolhos is a complex of islands and reefs located at the edge of the continental shelf between 28°15'S and 29°S, approximately 60km offshore from the mid-west coast of Western Australia and it is an extremely important component of the Western Australian environment. The "Abrolhos System" is of major significance for the conservation of flora and fauna, and is also significant in geological terms.

The adjoining State territorial waters contain some of the most highly valued marine systems in the State. Furthermore, these waters include the sites of some of the most important historic shipwrecks in Australia, with associated historic sites located on the islands themselves. In recognition of its importance, the Abrolhos was declared in 1999 as the first Fish Habitat Protection Area in Western Australia. It remains the largest in the State and is the only area in which DoF has primary management responsibility for the entire area (including the terrestrial component) . A detailed overall management plan, released in 1998, is currently being revised. There are also management plans for tourism and aquaculture.

Current Research Focus

To develop programs to meet the following objectives:

1. Assess the status of key indicator fish and invertebrate stocks distributed within FHPAs, particularly the Abrolhos FHPA.
2. Satisfy the relevant fish and invertebrate abundance and biodiversity key performance indicators set to maintain the FHPAs, particularly the Abrolhos FHPA.
3. Determine the effectiveness of the FHPA fish and fishery related management procedures.
4. Establish a system of benthic habitat monitoring in the Abrolhos FHPA to provide a baseline against which future anthropogenic changes can be assessed.

Priority Setting Process

AIMAC, departmental processes and WAMSI processes.

WC - Abrolhos Islands FHP

Abrolhos Is. Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Dhufish Regional Biology	Completed						
Dhufish Reproductive Biology	Completed						Completed last year
Pink Snapper Biology	Completed						
Balchin Groper Biology	Completed						
Breaksea Cod Biology	Completed						MU Hon
1.2 Other Biology							
Spawning Aggregations	Underway	■					PhD + ECU
Release Mortality	Underway						
Movement	Underway	■					FRDC + ECU
Coral Trout Biology	Underway	■					PhD + ECU
Spangled Emperor Biology	Underway						
Red Throat Emperor	Underway	■					PhD + ECU
General fin fish assemblages	Ongoing	■					UWA
1.3 Stock Assessment							
Annual C & E Assessment	Ongoing	■	■				
Age Structure Models (indicator species)	Periodic	■					Every 2 years after management
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■			Introduce new logbook
Age Structure of Indicator Species	Ongoing	■					Baldchin Groper
Fishing Power		O					
Recreational Creel	Periodic		O				Periodic
Recreational Indicator	Developing	O	O				
Charter Boat Catch and Effort	Ongoing	■	■	■			
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
Foraging ecology of Australian sea lions	Ongoing	■	■	■			
2.3 Habitat	Ongoing	■					Study currently underway to examine the effects of lobster fishing on sensitive coral habitats includes ROA's
	Completed						Marine futures habitat mapping. Future assessment of indicators will occur through WAMSI 4.2
QuickBird Assessment	WAMSI -	■					
2.4 Ecosystem/Environment WC Bioregion ecosystem study							
WAMSI 4.2 developing indicator sites and measures		■	■				

Abrolhos Is. Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
Validation of Catch Records							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

West Coast - Abrolhos Islands and Midwest Trawl

Description and Scope of Fishery

The Abrolhos Islands Midwest Trawl Fishery operates in the waters of the Abrolhos Islands off the mid west coast of Western Australia. The main target species is the southern saucer scallop with Western King prawns being the minor target species.

This is an otter trawl fishery and the area was first fished commercially for scallops during the late 1960's. It became limited entry in 1986 and there are currently 17 licences operating in the fishery.

Research into the biological and environmental aspects of WA scallop stocks and commercial exploitation, has been carried out by the Department of Fisheries since the late 1960s. This research was initially aimed at determining basic biology of the species to ensure that the scallops were being harvested at ecologically sustainable levels whilst achieving the best economic returns from the available scallop resource.

Current Research Focus

Current research is primarily aimed at the monitoring of the fishery and completing pre-season surveys to forecast the following seasons catch and to determine opening and closing dates. A comprehensive ESD assessment of this fishery determined that performance should be measured annually for breeding stocks of target species (saucer scallop). Some information on ongoing bycatch levels and composition will be required to meet the requirements of the EPBC assessments.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Research issues have been discussed at industry asscociation meetings at least once a year. Additional research needs have also been highlighted throught the ESD Assessment processs for which a re-assessement has been completed in 2008.

WC - Abrolhos Islands and Mid West Trawl

AIMWT Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, natural mortality)							
Scallop biology	Completed						Studies completed in the 1980's
1.2 Other Biology							
Recruitment Dynamics	Completed						Studies completed in the 1980's
1.3 Stock Assessment							
Stock-recruit-environ. effects	Ongoing	■	■	■	■	■	
Fishery independent surveys and monitoring	Annual	■	■	■	■	■	Determines forecasts of next years catch
Survey indices-catch relationships	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Logbooks	Ongoing	■	■	■	■	■	Became mandatory in 2008
Fishing power monitoring	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation	Completed						Implemented in 2003
Bycatch monitoring	Completed	O	O				NHT (MF) Funding for 07/08 - limited
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat mapping and videoing – sensitive habitats	Completed						NHT (MF) Funding for 07/08
Habitat impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic	■					EPBC requirement
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	
Modelling water movements and larval transport	Possible	O					In collaboration with UWA
2.6 Other impacts on fishery	Not needed						No other risk identified
Aquaculture sites	Possible						
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						
Economic Analysis –average price data	Ongoing	■	■	■	■	■	
- Fuel consumption./expenses	Ongoing	■	■	■	■	■	
3.2 Resource Access (Shares)							

AIMWT Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Rock Lobster – Scallop interaction	Underway	■					
3.3 Compliance							
Enforcement efficiency							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
Re-seeding	Ceased						FRDC funding – project now ceased.
4.2 Post Harvest							
4.3 Marketing							

West Coast - Blue Swimmer Crab Fishery

Description and Scope of Fishery

Blue swimmer crabs (*Portunus pelagicus*) are found along the entire Western Australian coast, in a wide range of inshore and continental shelf areas, from the intertidal zone to at least 50 m in depth. They have been fished commercially in WA since at least the mid 70's. Originally, commercial crab fishers in WA used set (gill) nets or drop nets, but most have now converted to purpose-designed crab traps.

Crabbing activity in the West Coast Bioregion is centered largely on the estuaries and coastal embayments from Geographe Bay north to the Swan River and Cockburn Sound. There are currently 5 commercial crab fisheries covered by the West Coast bioregion. Blue swimmer crabs also represent the most important recreational inshore species in the south-west of Western Australia in terms of participation rate.

A significant level of research has been conducted on the biology, ecology and distribution of the blue swimmer crab since the early 1970's. A number of projects were instigated during 1997/98 with funding from FRDC that included the basic biology of crabs along the WA coast, gear-catchability relationships, recreational catch surveys, commercial catch monitoring, discard mortality estimation and stock assessment modelling In addition, a three-year project to develop stock allocation and assessment techniques in WA blue swimmer crab fisheries, has been completed.

Current Research Focus

The Cockburn Sound fishery has experienced low recruitment in recent seasons as a result of the brood stock having become depleted through a combination of fishing pressure and unfavourable environmental conditions in the four years from 2003-2006. As a result, the Minister for Fisheries closed the fishery to both the commercial and recreational sectors in December 2006. Commercial fishers were prohibited from taking crabs in the whole of the Cockburn Sound Managed Crab Fishery, while recreational fishers were prohibited from taking crabs south of a line from Woodman Point across to Garden Island.. Assessment of research data collected during 2007 to monitor recovery of the stock during closure indicated that breeding stock and recruitment levels remained below acceptable levels. Consequently, the fishery remained closed for the 2007/08 season - A further 12-month closure covering the 2008/09 season is being considered as stocks remain below acceptable levels with recovery slower than expected. Concerns have also been raised from various quarters regarding the state of stocks in the Peel-Harvey system.

Commercial catch and effort and catch population dynamics are assessed using fishers' compulsory catch and effort returns, voluntary daily log books from fishers in the Mandurah to Bunbury developing fishery and data from on-board catch monitoring. Research trawl programs provide information on the status of the spawning stock and subsequent strength of recruitment, along with data on the general crab population. An FRDC project completed in 2005 developed a catch prediction model for the Cockburn Sound blue swimmer crab fishery that forecasts future commercial catches within the Sound.

Research will continue in Cockburn Sound while the fishery is closed (recruitment surveys, recruitment and breeding stock trawl surveys aboard *RV Naturaliste*, commercial catch monitoring for research purposes).

Research funding (DBIF) was obtained in 2007 to (a) assess recovery of blue swimmer crab

spawning stock and recruitment in Cockburn Sound (b) examine the genetic difference between the Cockburn Sound stock with that in Warnbro Sound and the Swan River; (c) undertake a 12 month recreational survey in the Peel-Harvey estuary; (d) assess the status of the crab population in the Peel-Harvey estuary (e) undertake commercial monitoring in the West Coast Estuarine, Warnbro Sound and Mandurah-Bunbury fisheries. Further funding has been provided to assess the impact of the Fremantle Port Authority's Outer Harbour development proposed for the southern area of Jervois Bay in Cockburn Sound on resident crab stocks (2007-08).

Priority Setting Process

Research priorities are set in consultation with management, and feedback obtained during meetings with industry and major stakeholder groups (WAFIC, RecFishWest and RFAC) as required.

West Coast Blue Swimmer Crab

West Coast BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Blue swimmer crab biology	Completed						Studies completed in 90's
1.2 Other Biology							
Size at sexual maturity	Completed						
Release mortality	Completed						
Genetic structure of populations	Completed						DBIF funding to determine whether there are genetic differences between Warnbro Sound, Cockburn Sound and Swan River 2007/08.
1.3 Stock Assessment							
Stock Assessment	Ongoing	■	■	■	■	■	For Cockburn Sound
Annual C&E Assessment	Ongoing	■	■	■	■	■	
Warnbro Sound			■	■			
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■	■	
Processor Returns	Ongoing	■	■	■	■	■	
Commercial Monitoring	Ongoing	■	■	■	■	■	Twice monthly for Cockburn Sound and Peel-Harvey, monthly monitoring in Warnbro Sound, Swan River, Comet Bay and Mandurah-Bunbury fisheries.
Recreational Catch and Effort	Underway	■					Peel-Harvey in 2008. Other areas part of National rec. fishing program.
Research Surveys	Ongoing	■	■	■	■	■	Trawl surveys to determine recruitment and breeding stock levels. Extra trapping in inshore regions for FPA work (08 only)
Stock & recruitment	Ongoing	■	■	■	■	■	Commercial catch prediction for Cockburn Sound only

West Coast BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Dedicated logbook	Ongoing	■	■	■	■	■	Mandurah-Bunbury fishery only
Heavy metal content of crabs	Completed						Single sampling and analysis completed for Cockburn Sound, Peel-Harvey and Mandurah-Bunbury fisheries in 2006.
2. Habitat & Ecosystem							
2.1 Bycatch	Nil						Low Risk
2.2 Listed Species	Nil						Low Risk
2.3 Habitat							
	Underway	■					Relationship between habitat and life stage being investigated for Cockburn Sound
2.4 Ecosystem/Environment	Underway	■					Information (sea grass beds) on Cockburn Sound being collaged from various sources (eg. Cockburn Sound Management Council). Some data also for Peel Harvey
2.5 Oceanography	Ongoing	■	■	■	■	■	Environmental data for Cockburn Sound being compiled from various sources (eg. Cockburn Sound Management Council, Bureau of Meteorology). Temperature loggers have been deployed in Cockburn Sound and Peel-Harvey; spot readings of various water measurements taken monthly in Cockburn Sound and Peel-Harvey
2.6 Other impacts on fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Periodic						Social assessment has been conducted in Cockburn Sound previously
Economic Analysis	Periodic						Economic assessment has been conducted in Cockburn Sound previously
3.2 Resource Access (Shares)							
Detailed determination of access shares	Periodic						For Cockburn sound only. Required for IFM
Monitoring of shares	Periodic						As above
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - South West Trawl Fishery

Description and Scope of Fishery

This fishery includes two of the state's smaller scallop fishing grounds, Fremantle and Geographe Bay. It is a multi-species fishery which targets western king prawns (*Penaeus latisulcatus*) and saucer scallops (*Amusium balloti*) using otter trawls. The fishery is managed under an input control system that limits boat numbers, gear size and fishing areas.

Research into the biological and environmental aspects of WA scallop stocks and commercial exploitation, has been carried out by the Department of Fisheries since the late 1960s. This research was aimed at determining basic biology of the species to ensure that the scallops are being harvested at ecologically sustainable levels whilst achieving the best economic returns from the available scallop resource. A detailed study of this fishery was completed by the Department (Laurenson et al., 1993) that examined the potential impacts on bycatch species and the benthic habitat of this region and found it had minimal impacts.

Current research Focus

Monitoring of the scallop stocks in this fishery is undertaken using fishers' monthly returns data.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. These have been internally updated annually.

South West Trawl

SW Trawl Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Scallop biology	Completed						Completed in 1990s
1.2 Other Biology							
Scallop Reproductive dynamics	Completed						Completed in 1990s
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	CAES data only
1.4 Fishery Monitoring							
CAES returns	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch							
Bycatch in trawled and untrawled areas	Completed						Study completed in 1990s Low Risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment							

SW Trawl Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Habitat mapping	Completed						Completed in the 1990s. Low Risk
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	Low level monitoring
2.6 Other impacts on fishery	Not needed						No risks identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
3.3 Compliance							
VMS							
3.4 Management Systems							
Unitisation							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - Deep Sea Crab Fishery

Description and Scope of Fishery

The West Coast Deep Sea Crab (Interim) Managed Fishery operates between Cape Leeuwin and the Northern Territory border and is divided into five areas. The fishery targets giant (king) crabs, crystal (snow) crabs and champagne (spiny) crabs using baited pots operated in a longline formation in the offshore waters if the west coast.

In the late 1990s when this fishery first commenced, it targeted champagne crabs. However, within a couple of years the fishery moved into deeper waters targeting crystal crabs. Since 2001 catches of champagne crabs have been insignificant.

The FRDC has funded research on aspects of both the giant and the champagne crab fisheries. These projects have now been finalised.

Current Research Focus

Research monitoring of the west coast deep sea crab fishery is currently undertaken utilising fishers' monthly returns data to monitor activities.

Priority Setting Process

Research and management meetings are held with industry as required.

West Coast Deep Sea Crab

WC Deep Sea Crab Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, natural mortality)							
Giant Crabs	Completed						
Crystal and Champagne Crabs	Completed						
Growth & Reproduction	Completed						
Migration	Completed						
1.2 Other Biology	Not needed						No other species caught in number
1.3 Stock Assessment							
Annual assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring	Ongoing	■	■	■	■	■	
Commercial catch and effort	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Commercial length freq monitoring	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch	-						
West coast lobster; molluscs;	Nil						Negligible risk
Sponges; coral; octopus; fin fish	Nil						Negligible risk
Spider crabs; sea lice; manta rays	Nil						Negligible risk
2.2 Listed Species							

WC Deep Sea Crab Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Whales; dolphins; turtles	Nil						Negligible risk
2.3 Habitat							
Benthic muds	Nil						Negligible risk
2.4 Ecosystem/Environment							
Ghost fishing; other trophic levels	Nil						Negligible risk
2.5 Oceanography							
2.6 Other impacts on fishery							Nothing identified
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - Western Rock Lobster Fishery

Description and Scope of Fishery

The West Coast Rock Lobster Managed Fishery (WCRLF) operates on the west coast of Western Australia between Shark Bay and Cape Leeuwin. The target species is the western rock lobster, which is endemic to the lower west coast of WA are taken using baited traps (pots) and is managed using a comprehensive set of regulations.

The fishery began in the 1940's and expanded rapidly over the next 15 years. In 1963, the commercial fishery was declared a limited-entry fishery with the total number of pots controlled since 1965. During the last 20 years the annual catch has averaged approximately 10,000 t but has varied from 8-14,000 t due to natural variations in the level of recruitment. In 1999, the WRL was the first fishery worldwide to be awarded Marine Stewardship Council chain of custody certification on the basis of demonstrating the ecological sustainability of its fishing and management operations.

Extensive research and monitoring of the WRL fishery has been conducted for over 50 years and it has one of the best biological and fishery datasets in the world. This work is currently conducted mostly by the Research Division of the Department of Fisheries. However, during the 1970s-80s, CSIRO was heavily involved in lobster recruitment and habitat research and a number of tertiary institutions are also currently involved in lobster research, particularly in the area of post harvest technology.

Current Research Focus

Research activities continue to focus on the core business of assessing stock sustainability and forecasting future catch levels. This involves fishery-independent monitoring of breeding stock levels and puerulus settlement. Industry performance is monitored through compulsory catch and effort records from both fishers and processors and comprehensive data from the voluntary logbook scheme, all of which are used for modelling and stock assessment.

An environmental management strategy was developed for use in the assessment of the broader ecosystem impacts of rock lobster fishing in the context of ESD and MSC certification. This strategy includes research into the ecosystem effects of rock lobster fishing in deep water. A Fisheries Research and Development Corporation (FRDC) funded project to examine the effects of western rock lobster fishing on the deep-water ecosystem off the west coast of Western Australia began in 2004/05 and this has now been completed. This project provided critical baseline data on the relationships between the abundance and size distributions of rock lobster and the different benthic habitats located in deeper waters, plus preliminary data on diets and the trophic role of rock lobster within these depths. Further ecological research (WAMSI/FRDC) in deep waters will be based on comparing fished and unfished areas using research closures. A new FRDC project will begin in 2009 after suitable fished and unfished areas within deep water have been established in collaboration with industry.This collaborative project between the Department of Fisheries, CSIRO and UWA will collect baseline information on lobster stocks, habitat and community structure to facilitate comparisons between fished and unfished areas. The ultimate outputs of this project will enable any impactsof lobster fishing on deepwater ecosystems to be quantified.

A further project focusing on the impact that fished and unfished zones have on lobster populations, funded by the Swan Catchment Council, was completed in June 2008. Results from this project have identified the short-term impacts 'no-take' areas have on lobster populations in

shallow waters. Further funding will be sought to continue this monitoring.

Four new research initiatives have been developed in mid-late 2008 aimed at investigating the unusually low puerulus settlements of 2007/08 and 2008/09. These projects include three short tactical projects (i-iii):

i). Evaluating source-sink relationships of the Western Rock lobster Fishery using oceanographic modelling.

ii). Evaluating the use of novel statistical techniques for determining harvest rates and efficiency increases in the Western Rock Lobster Fishery.

iii).Assessing possible environmental causes behind the reduced colonisation of puerulus collectors by a wide suite of species.

The forth application is a three year FRDC project "Identifying factors affecting the low Western Rock lobster puerulus settlement in recent years".

These projects will help produce more robust estimates of breeding stock throughout the fishery as well as identify possible important areas of the breeding stock (i.e. source locations) and how the environment may alter any source-sink relationships.

The Department has also initiated the monitoring of small lobsters in shallow (< 20 fm) and deep (> 20 fm) waters by commercial fishers. This project which is being conducted under cost-recovery will produce size estimates of one and two-year post settlement lobsters in these two depth ranges. This information will assist the Dept. in understanding the extent of juvenile settlement occurring in the more offshore deeper waters of the fishery, relative to that along the coast. Data from this trial (when run during the whites) will also enable the Dept. to identify the various size classes of animals that undergo the whites migration each season. This will provide insight into the steady reduction in the mean size of whites reported at the 2007 and 2008 RLIAC coastal tours. Furthermore, robust size composition data will improve juvenile growth rate estimates, which are vital for the integrated stock assessment model.

For the recreational component of this fishery, an annual mail-based survey of participants has been used to estimate the annual catch and effort for the past 20 years. These trends, together with data on puerulus settlement, are used to predict the recreational catch and effort in following seasons.

Telephone diary surveys of recreational rock lobster fishers have been undertaken in most years since 2000/01. Estimates of recreational catch using this method are compared to the estimates from mail surveys. Phone diary surveys are considered to be more accurate than those from mail surveys because they eliminate the recall bias in the mail surveys and additionally, there is a higher participation rate in the survey from random sample selection. Sample sizes for the phone diary surveys have been increased since the 2006/07 survey to improve the accuracy of the result.

Priority Setting Process

Priorities are set an annual basis through consultation with the Research and Development RLIAC sub-committee. More recently the Western Rock Lobsters Council has also provided feedback on research priorities for this fishery.

West Coast Rock Lobster

West Coast Rock Lobster Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Lobster Biology	Completed						Many studies completed
1.2 Other Biology							
Recruitment Dynamics	Completed						
Migration	Completed						
Lobster spawning rates	Completed						
By-product Octopus basic biology	Ongoing	■					The basic life history studied
1.3 Stock Assessment							
Annual Assessment	Ongoing	■	■	■	■	■	
Develop New Model	Ongoing	■	■	■			Models updated as new data developed
Shallow Water Depletion Assess.	Ongoing	■	■	■			
Deep Water Depletion Assessment	Underway	■					Initial trials underway
Change in Ratio and Index Removal	Submitted	■	■				Application submitted to the FRDC
Actions from MSC Review	Periodic	■	■				Required for MSC
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■	■	
Processor Returns	Ongoing	■	■	■	■	■	
Commercial Monitoring	Ongoing	■	■	■	■	■	
Puerulus Monitoring	Ongoing	■	■	■	■	■	
Research Logbooks	Ongoing	■	■	■	■	■	
Spawning Stock Survey	Ongoing	■	■	■	■	■	
Fishing Power	Ongoing	■	■	■	■	■	
Recreational Catch and Effort	Ongoing	■	■	■	■	■	
Stock & recruitment	Ongoing	■	■	■	■	■	
Meshed Pot monitoring	Underway	■					Initial trials underway
2. Habitat & Ecosystem							
2.1 Bycatch (Low Risk)	Nil						Low Risk
2.2 Listed Species							
Sea lions (moderate risk) Develop Methods to reduce sealion interactions	Ongoing / Monitoring	■					Implementation of SLEDs may be required at the Abrolhos Islands
Monitoring of Interactions	Ongoing	■	■	■			EPBC Requirement
2.3 Habitat (Low Risk)							
Seagrass and Limestone reef effects	Completed						Sufficient for management
Coral Reef effects	Underway	■					Study at the Abrolhos Islands
2.4 Ecosystem/Environment							
Deep water ecosystem study	Underway	■	■	■	■		A further extension of this work is required – WAMSI /FRDC funding received
Jurian Bay inshore	Underway	■	■	■			SRFME/WAMSI study

West Coast Rock Lobster Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Dongara inshore	Completed						CSIRO studies in the 1980s
Rottnest Sanctuary zones	Completed	■	■	■	■	■	Continued funding is being sought
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■			
Oceanographic Modelling	Ongoing	■	■	■			Funding for further development of this work is being sought from the FRDC
Impacts of ocean conditions on catch rates	Completed						
2.6 Other impacts on fishery							Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Periodic						Completed
Economic Analysis (MEY)	Ongoing	■	■				Examination of Maximum Economic Yield
3.2 Resource Access (Shares)							
Determination of access shares	Periodic			■			Needed for IFM
Monitoring of shares	Ongoing	■	■	■			Needed for IFM
3.3 Compliance							
Enforcement efficiency	Ongoing	■	■	■			
3.4 Management Systems							
Input vs output controls	Ongoing	■					Business case being developed for Management review
4. Industry Development							
4.1 Production Technology							
Puerulus growout	First Stage Completed						On Hold awaiting outcomes of policy on ownership of puerulus
More Efficient Lobster Pot Design		■	■	■			FRDC project
4.2 Post Harvest							
4.3 Marketing							

West Coast - Abalone Managed Fishery

Description and Scope

The Western Australian commercial abalone fishery is a dive fishery operating in shallow coastal waters along WA's western and southern coasts and is divided into eight management areas. The commercial fishery targets three species: greenlip abalone, brownlip abalone and Roe's abalone, which are harvested by a single diver working off 'hookah' (surface supplied breathing apparatus) using a diving 'iron' to prise abalone off rocks. In the West Coast, the main recreational fishery operates in the metropolitan region, mostly for Roes abalone. This fishery has a very restricted set of seasonal and daily opening times.

There is an extensive amount of relevant and accurate information on the biology and stock status of these three abalone species and this along with the sophisticated suite of management arrangements in place and the proactive management used in the Abalone Fishery have resulted in the maintenance of abalone stocks as well as the successful continuation of the fishery.

Current Research Focus

Current research is focused on stock assessment using data supplied by the commercial fishers including catch and effort statistics, meat weight indices and, where available, length-frequency sampling to estimate fishing mortality.

There is also fishery independent surveying of stock levels which are undertaken by the Department. An FRDC project entitled 'Digital video techniques for assessing population size structure and habitat of greenlip and Roe's abalone', which is designed to test the possibility of underwater video for monitoring density and size structure of abalone stocks is nearing completion which should compliment the independent surveys.

The recreational fishery is monitored through a combination of mail and phone surveys, plus a field based survey for the metropolitan fishery.

Priority Setting Process

Research priorities are set through annual industry-departmental meetings, AbMAC, RFAC, and DEWHA assessments and recommendations for maintaining export licenses.

West Coast Abalone

West Coast Abalone Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Roe's Biology	Completed						Sufficient for management
Early juvenile life history and habitat, natural mortality and predation	Completed						
Reproduction/Fecundity, spawning Periodicity	Completed						
Fish health and diagnostics	Ongoing	■	■	■	■		
Disease survey/atlas	Completed						
1.2 Other Biology							

West Coast Abalone Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Environmental effects on recruitment	Underway	■					
1.3 Stock Assessment							
Catch statistics (wildstock)	Ongoing	■	■	■	■		
Mapping of areas	Ongoing	■					
Fishing efficiency	Ongoing	■	■	■	■		
Commercial length frequency monitoring	Ongoing	■	■	■	■		
Population dynamics and harvest strategy assessment model	Ongoing	■	■	■	■		
Recreational Impact	Ongoing	■	■				
Yield and egg-per-recruit analysis for size limits	Underway	■					
1.4 Fishery Monitoring							
Research monitoring and recruitment sites	Ongoing	■	■	■	■		
Industry video monitoring sites	Underway	■					Moving to implementation
Recreational fishery monitoring – on site surveys	Ongoing	■	■	■	■		
Recreational Fishery Monitoring –phone surveys	Ongoing	■	■	■	■		
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							
2.5 Oceanography							
2.6 Other impacts on fishery							
Site survey/food availability/density							
External Threats, pollution, bio-invasion, red tides, contaminants							Watch in brief
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)		■					IFAAC process
3.3 Compliance							
3.4 Management Systems							
Abalone Health - Translocation/ protocol	Ongoing	■	■	■	■		
Abalone Health - Contingency plan	Ongoing	■	■	■	■		
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - Beach Bait Managed Fishery

Description and Scope of Fishery

The West Coast Beach Bait Managed Fishery (WCBBF) extends from the mouth of the Moore River, north of Perth, to Tim's Thicket in the south. The south-west fishing activities occur from Tim's Thicket south to Point D'Entrecasteaux, with activity typically concentrated in Geographe Bay (Cape Naturaliste to Preston Beach). The primary target is whitebait (*Hyperlophus vittatus*) and the main fishing method is beach seine netting, although non-powered purse seining and haul netting from small boats are also utilised.

A significant research project on the biology and stock assessment of whitebait along the lower west coast of Western Australia was undertaken between 1991 and 1994 (Gaughan et al., 1996).

Current Research Focus

Ongoing monitoring of catches as a de facto indicator of abundance forms the basis of current research to assess the status of the whitebait stocks.

Priority Setting Process

Priorities are reviewed on an annual basis through consultation between Scientists of the Finfish Branch (Research Division) and Fishery Managers. This fishery is currently considered as low risk and reprioritisation of research resources is likely to occur, with resources allocated to other, higher-risk fisheries.

West Coast Beach Bait

West Coast Beach Bait Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Whitebait	Complete						Adequate for management
1.2 Other Biology	Not needed						No other issues identified
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■	■		
1.4 Fishery Monitoring							
CAES data	Ongoing	■	■	■	■		
Recruitment index	Underway	■	■	■	■		Whitebait only, may be phased out.
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Annual	■	■	■	■		Link between Leeuwin Current and recruitment
	Completed						Critical for penguins (Murdoch Uni.)
2.5 Oceanography	Annual	■	■	■	■		As above

West Coast Beach Bait Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

West Coast - Cockburn Sound Fishery

Description and Scope of Fishery

Three Cockburn Sound Managed Fisheries, (Crab, Fish Net and Line and Pot) operate entirely within the Sound, while the West Coast Beach Bait and West Coast Purse Seine Managed Fisheries operate partly within Cockburn Sound. Methods used by the Line and Pot Fishery include handlines, longlines, squid jigs and unbaited octopus pots. The Fish Net Fishery uses gill nets and haul nets. Currently there are 14 licences (a reduction from 42) within the two entirely operational managed fisheries.

Commercial landings of finfish (excluding baitfish) in Cockburn Sound have been declining since 1992. In 2007, 84% of the catch consisted of Australian herring and southern sea garfish. The next most important species were sharks and rays, pink snapper and yellowtail scad. Commercial landings of octopus in CS rapidly increased from 2 t in 2000 to 45 t in 2006. In 2007 the catch was 35 t. Minor quantities of squid and cuttlefish were also taken. In recent years, 20% of the total west coast commercial catch of octopus was taken in Cockburn Sound. The progression of the commercial octopus fishery from a developing fishery to an interim managed fishery is currently being considered.

Many of the species taken commercially in Cockburn Sound are also targeted by recreational fishers, including Australian herring, garfish, squid, crabs (*Portunus pelagicus*) and pink snapper. Whiting, trevally and tailor are also important recreational target species. Cockburn Sound is one the state's most popular recreational fishing areas. Recreational fishers take an estimated 80% of the total finfish catch in the Sound.

Research has been conducted on the main finfish species within the Sound. The basic biology is complete for most of the target species caught (see following R&D table), with further research currently underway on pink snapper. A creel survey conducted in September 2001-August 2002 provided the most recent information on Cockburn Sound recreational shore- and boat-based fishing. These surveys were repeated at boat ramps in Cockburn Sound during January to March of 2002 – 2004 to provide further data describing recreational boat-based fishing.

Current Research Focus

The status of the fish stocks in this fishery is primarily assessed from monthly CAES returns provided by industry, fishery-independent recruitment surveys and recreational logbooks. Given the decline in commercial fishing activity there is a need to increase the level of information obtained from the recreational sector.

New research to develop programs to representatively sample the age structure of herring, tailor, trevally and whiting fisheries will commence in 2009 (subject to FRDC funding).

The sharp increase in catches of the octopus fishery in recent years and the likely progression of the octopus fishery from developing to interim management requires basic information on the taxonomy, biology and population structure of octopus in Cockburn Sound. Preliminary result from an honours project in 2007/08 showed that only small immature female octopus occur in CS while large mature females migrate from CS to deeper offshore waters.

Priority Setting Process

Internal Departmental Risk Assessment.

WC - Cockburn Sound Finfish

Cockburn Sound Fish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Australian herring	Complete						Adequate for management
Sea garfish	Possible						Reason for catch decline unclear
whiting	Complete						Adequate for management
trevally	Complete						Adequate for management
Pink snapper	Underway						Part of FPA and SCC study
tailor	Possible	O	O	O	O		Lack of data on reproduction, early life history. Recruitment dynamics to be examined in proposed FRDC project
Octopus	Required						Only preliminary information available
1.2 Other Biology							
Octopus population structure	Required						Information on the linkage of CS populations with the rest of WA required for management
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■			
Age-based model (herring)	Underway	O	O	O			Otoliths being collected Update existing model
Sea garfish	Possible						Possible impacts of seagrass loss & fishing.
1.4 Fishery Monitoring							
CAES data	Ongoing	■	■	■			
Juvenile recruitment index	Underway	■	■	■			Herring, whiting, tailor only
Recreational angler logbooks	Underway	■	O	O	O		RAP
Fishing tournament & club records	Underway	■	O	O	O		RAP
Sea garfish	Possible						
Creel survey	Periodic						Need boat & shore-based data
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk from fishery-
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Not needed	■					FPA study on proposed extension to harbour
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							

Cockburn Sound Fish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	Not needed						Nothing identified
4.2 Post Harvest	Not needed						Nothing identified
4.3 Marketing	Not needed						Nothing identified

West Coast - Demersal Scalefish Fishery

Description and Scope of Fishery

The West Coast Demersal Scalefish Fishery (WCDSF) comprises commercial wetline fishing, charter boat fishing and recreational fishing activities that each occur within the west coast bioregion (26°30'S to 115°30'E). Note that at present the northern boundary remains at 27°S for the charter and recreational sector, but is proposed to change to 26°30'S. The commercial sector became a managed fishery at the beginning of 2008. In the case of the commercial sector, the managed fishery is divided into four inshore management zones (Kalbarri, mid-west, metropolitan and south-west), that extend from the coast to the 250m depth contour and an offshore zone which extends from the 250m contour to the boundary of the AFZ and from 26°30'S to 115°30'E (Fig.1). For the recreational and charter sectors of the WCDSF, the Kalbarri, mid-west, metropolitan and south-west zones extend from the coast outwards to the boundary of the AFZ (Fig. 1)

The main species targeted by all sectors in the fishery in waters of *ca* 100m or less are the West Australian dhufish *Glaucosoma hebraicum* and pink snapper *Pagrus auratus*. Other species that form an important part of the catch of some or all sectors include emperors (spangled emperor *Lethrinus nebulosus* and red throat emperor *Lethrinus miniatus*), baldchin groper *Choerodon rubescens* and breaksea cod *Epinephelides armatus*. A range of species are also taken in deeper water (> 100m) and include ruby snapper *Etelis carbunculus*, eightbar grouper *Epinephelus octofasciatus* and hapuku *Polyprion oxygeneois*.

Several studies on growth, age structure, reproductive biology, mortality and/or diet of indicator species are complete. Such data, collected from the commercial and recreational sectors in the different zones of the WCDSF, have been used in stock assessments of dhufish, pink snapper and baldchin groper (Wise *et al.*, 2007).

Current Research Focus

- Monitoring age compositions and assessments of fishing mortality of dhufish, pink snapper and baldchin groper in the commercial and/or recreational sectors in the WCDSF is continuing in 2008/09, 2009/10 and 2010/11.
- Recreational fishery boat-based creel surveys continued in the metro zone in 2007/08 and are being analysed. A survey is being conducted in each zone of the west coast bioregion in 2008/09.
- The stock structures of dhufish, pink snapper and baldchin groper are being examined using genetic and otolith microchemistry techniques under WAMSI sub-project 4.4.2 in collaboration with Murdoch University and CSIRO.
- Examine existing commercial data and assess possibilities of further fishery dependent sources of data (RAP, commercial fishers and/or charter fishers) and independent methods for monitoring recruitment strength of dhufish.
- At the beginning of 2009, commercial fishers will be allocated the number of days that they can fish in the WCDSF. Data on catch and effort from daily/trip logbooks in conjunction with a vessel monitoring system will allow analyses on a fine spatial scale. On-board validation of the log-book system will be carried out.
- FRDC final reports are in their final stages from studies of (1) regional variation in the biological characteristics of dhufish and pink snapper, (2) movements and barotrauma of

snapper and dhufish and (3) spawning aggregations of west coast species, including samson fish, dhufish and pink snapper and coral trout at the Abrolhos Islands.

- A FRDC funding application has been submitted as a collaborative project between Murdoch University (PI) and DOFWA to investigate aspects of the biology and stock structure of bight redfish *Centroberyx gerrardi*.
- Review of current monitoring programme for WCDSF indicator species to determine most appropriate way to monitor stock status into the future.

Priority Setting Process

Assessments of required research are made through departmental meetings, which involve discussions of stock status, previous research conducted, current research and existing research gaps required for more informed management. Relevant discussions of research outcomes and needs with stakeholder groups occur regularly.

West Coast Demersal Fishery

WC Demersal Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Dhufish	Completed						Several studies completed. Required: data on important locations for spawning, e.g. south-west coast, mechanisms for larval dispersal.
Pink Snapper Biology	Completed						Studied at Carnarvon, Cockburn Sound and south coast. No fecundity data. Required: Importance of south-west coast as spawning aggregation site
Baldchin Groper Biology	Completed						Studies completed at Abrolhos and in mid-west.
Breaksea Cod Biology	Completed						Studies in metro and west coast complete. Required: Further data on age structure to conduct stock assessment
1.2 Other Biology studies							
Spawning Aggregations	Underway						FRDC final report submitted
Release Mortality	Underway						FRDC final report submitted. Required: Knowledge of mortality of undersize fish.
Movement	Underway						Conventional tagging study (dhufish, pink snapper) complete (FRDC final report submitted). Acoustic tagging studies: proposed for pink snapper in CS – emigration/ immigration. Coral trout at Abrolhos underway. Dhufish, baldchin groper required.
Coral Trout Biology	Underway						PhD at ECU (Jason How)
Spangled Emperor Biology	Underway						In Gascoyne bioregion.

WC Demersal Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Red Throat Emperor	Underway						Needed urgently (no longer part of PhD project, Jason How)
Bight redfish	Proposed		■	■			FRDC proposal submitted (MU/FWA) for biology, genetics study.
Mobility and stock structure of key species (genetics, microchemistry)	Underway	■	■				WAMSI 4.4.2 collaboration. Sample collection for dhufish, pink snapper and baldchin groper underway.
1.3 Stock Assessment							
Annual C & E Assessment	Ongoing	■	■	■			Commercial fishery
Mortality assessments against benchmarks (indicator species)	Periodic	■		■			State Govt funded. Sampling each year, but assessments to be completed in 2010/11.
Recruitment strength	Underway	■	O	O	O	O	Egg survey of pink snapper in CS, funded by FPA/WCDSF, in conjunction with DEPM model. Alternative methods for acquiring data on recruitment of dhufish being investigated.
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■		Daily/trip logbook commenced in 2008. Data to be collated/analysed when database is fully functional (2008/09).
Age Structure of Indicator/ important species	Ongoing	O	O	O	O		Funding required to assess breaksea cod, red throat emperor stock status
Recreational Creel	Periodic	■					Whole of west coast bioregion
Developing long term stock monitoring methods	Underway	■					
2. Habitat & Ecosystem							
2.1 Bycatch	Possible						Assessment of bycatch, including mortality of undersize fish, is required for fishery, onboard monitoring of commercial vessels.
2.2 Listed Species	Not needed						Low Risk
2.3 Habitat	Not needed						Low Risk from fishery.
2.4 Ecosystem/ Environment WC Bioregion ecosystem study	Underway						
2.5 Oceanography	Under Review						Further work by UWA, CSIRO etc (WAMSI) increase knowledge of oceanography of shelf waters relevant to dispersal and survival of larvae.
2.6 Other impacts on fishery	Under Review						Snapper spawning habitat in Cockburn sound may be impacted by industry development (De- sal plant, new harbour)
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible	■	■				WAMSI project
Economic Analysis	Completed						Completed as case study for FRDC
Evaluation of Rec fisher incentives		■	■				WAMSI project
3.2 Resource Access (Shares)							

WC Demersal Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Detailed determination of access shares	Underway	■					Underway for IFM
Monitoring of shares	Ongoing	■	■	■	■		Required for IFM
3.3 Compliance	None						
3.4 Management Systems							
	Underway	■	■	■			Exploration of the effectiveness of alternative management responses to variable recruitment, Murdoch University, Dr Alex Hesp.
	Underway	■	■	■			Development of an agent-based model to communicate implications of recruitment variability of finfish to recreational fishers. Murdoch University, Dr Alex Hesp.
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

This assessment does not include the special needs of the Abrolhos Islands (see the Abrolhos Islands section for details).

West Coast - Estuarine and Inshore Fisheries

Description and Scope of Fishery

The West Coast Estuarine Managed Fishery (WCEF) operates in the Swan/Canning and Peel / Harvey Estuaries, is a multi-species fishery targeting many finfish species. Other major estuary fisheries within the WC bioregion include the Leschenault Inlet (recreational only) and the Hardy Inlet (1 commercial operator). The commercial target finfish species are sea mullet, yellow-eye mullet, western sand whiting, Perth herring, Australian herring, black bream and King George whiting. Blue swimmer crabs also make up a significant proportion of the catch. The main fishing methods used are gillnets and haul nets, though crab pots are also used in the Peel/Harvey Estuary.

After progressive reductions in commercial effort since 1980, the recreational sector now takes the majority of the total finfish catch in these estuaries. The recreational finfish catch share is estimated to be at least 30% in the Peel/Harvey Estuary, 50% in the Swan/Canning Estuary, 75% in the Hardy Inlet/Blackwood River and 100% in all other estuaries of the region, including Leschenault Inlet.

The recreational catch is diverse but mainly comprises Australian herring, whiting (various species), tailor, black bream, blowfish, sea garfish, silver trevally, bar-tailed flathead, yellow-eye mullet and tarwhine.

Knowledge of the fish stocks in these estuaries is extensive, and comes from the research that has been conducted by the Department of Fisheries and Murdoch University Scientists since the 1970's. This knowledge is used to assist in the interpretation of monitoring data from various sources.

Current Research Focus

With reduced levels of commercial fishing in these estuaries, the research focus has shifted to gather a greater level of information from the recreational sector and fishery-independent sources. Research to monitor the status of the fish stocks in this fishery is based on fishery-independent surveys of annual recruitment, monthly CAES returns provided by industry and voluntary recreational logbooks.

Given the current uncertainties for key stocks and the possible increase in pressure due to changes in the west coast demersal fishery, a series of project applications have been submitted for herring and whiting stocks in this fishery. There is also a significant number of ecological projects being completed by Murdoch University for the Swan and Peel Harvey Estuaries detailed in Biodiversity section.

Priority Setting Process

Internal Departmental Risk Assessment and RFAC.

West Coast Estuarine and Inshore Fisheries

WC estuarine and inshore fisheries Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Black bream	Complete						Adequate for management
King George whiting	Complete						Adequate for management
Cobbler	Complete						Adequate for management
1.2 Other Biology							
Spawning/larvae of Perth herring	Underway	■					Declining stock, highly vulnerable, low fishery value but potential indicator species & important prey for higher value species. Study of Swan R. larvae underway.
River prawns	Underway						Vulnerable species. Previously targeted by comm. & rec. fishers but now rare. Low fishery value but potential indicator species & prey for other species. Murdoch Uni commenced sampling in 2007/08.
1.3 Stock Assessment							3 FRDC Applications submitted
Annual C&E trends	Ongoing	■	■	■	■		CAES data & angler logbooks
Age-based model	Underway	O					Swan R. bream only. Murdoch Uni project.
1.4 Fishery Monitoring							
CAES	Ongoing	■	■	■	■		Minimal Swan R. & Hardy Inlet data, no Leschenault data.
Creel survey	Periodic						None Proposed within 5 y
Angler daily logbook	Ongoing	■	O	O	O		Research Angler Program (RAP)
Fishing tournament & club records	Ongoing	■	O	O	O		RAP
Cobbler	Developing	O	O	O			Catch & release survey, use as indicator of estuary health
Recruitment Surveys	Ongoing	■	■	■	■		Long term beach seining & volunteer angling projects to monitor recruitment of some key species (whiting, tailor, herring mullet, blowfish)
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Developing	O	O				See biodiversity section: Swan River community project (MU funded by DoF, SRT and DoW)
2.4 Ecosystem/Environment		■	■	■			Ecosystems Modeling in Swan & Peel Harvey by Murdoch University
Fish kills	Occasional	■	■	■	■		Opportunistic sampling, logistically difficult, limited resources available
Red-spot disease outbreak	Occasional	■					Mainly bream, opportunistic sampling to assess impacts

WC estuarine and inshore fisheries Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Acid-sulphate soil runoff	Possible						
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Underway						Murdoch University study in Swan Estuary
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	Not needed						Nothing identified
4.2 Post Harvest	Not needed						Nothing identified
4.3 Marketing	Not needed						Nothing identified

West Coast - Purse Seine Fishery

Description and Scope of Fishery

The West Coast Purse Seine Fishery operates between 33°S latitude and 31°S latitude (the metropolitan fishery) and there are also two purse seine development zones currently operating north and south of this area; the Northern Development Zone and the Southern Development Zone. The metropolitan fishery mainly targets both pilchards (*Sardinops sagax*) and sardinella (the tropical sardine *Sardinella lemuru*), the Northern Development Zone targets sardinella and the Southern Development Zone targets pilchards.

As many aspects regarding the biology of this species, including its reproductive and distributional characteristics were largely unknown, a major research project was completed over/in the early-mid 1990s to gather data on the biology and stock assessment of Western Australian pilchards.

Exploratory fishing for the *Sardinella lemuru*, offshore of Geraldton on the Midwest coast of Western Australia, in the early 1990s led to the establishment of a developmental purse seine fishery in this region. This fishery showed potential for substantial expansion, but as there was no information on *S. lemuru* in WA there was a need to undertake research during the developmental period. The biology and fishery for *S. lemuru* in WA were therefore investigated over a three-year period between July 1995 and June 1998 with the aim of providing stock assessment advice (Gaughan and Mitchell, 2000). While most samples were collected during the project, others from 1990 to 1994 were also available. Detailed data on catch, effort and fleet dynamics (e.g. effects of vessel size and weather) were collected from research logbooks.

Current Research Focus

Directed research is currently only carried out on pilchards. This research continues to focus on fishery-independent spawning biomass surveys, which are completed as part of a six-year FRDC-funded project examining the regrowth of the pilchard stocks in WA. Depending on future management arrangements, these biomass surveys may not continue on a regular basis. Monitoring of pilchard catches will continue to be undertaken monthly to provide robust age-composition data, from which relative recruitment strengths can be inferred. Owing to the importance of sardinella in the metropolitan catch in recent years, this species is also sampled.

Priority Setting Process

Priorities are reviewed on an annual basis through consultation between Scientists of the Finfish Branch (Research Division) and Fishery Managers. This fishery is currently considered as low risk and reprioritisation of research resources is likely to occur, with resources allocated to other, higher-risk fisheries.

West Coast Purse Seine Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Pilchard Biology	Completed						Many studies - sufficient
Sardinella Biology	Completed						Study Completed in 90s
1.2 Other Biology							
1.3 Stock Assessment							
Annual Assessment	Ongoing	■	■	■	■		Relative recruitment strength
DEPM Estimates	Periodic		O				Every 3 years; may be phased out.
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■		
Age samples of pilchard catch	Ongoing	■	■	■	■		May be phased out.
2. Habitat & Ecosystem							
2.1 Bycatch (Low Risk)	Nil						Low Risk
2.2 Listed Species	Nil						Low risk
2.3 Habitat (Low Risk)	Nil						Low risk
2.4 Ecosystem/Environment							
Impact on Seabirds	Completed						Critical prey studies completed by Murdoch Uni.
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■		
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic	Not needed						Low value, small scale
3.2 Resource Access (Shares)	Not needed						
3.3 Compliance	Not needed						
3.4 Management Systems	Not needed						
4. Industry Development							
4.1 Production Technology	Not needed						
4.2 Post Harvest							
Product quality	ongoing						Industry initiatives
4.3 Marketing							
Value adding	ongoing						Industry initiatives for human consumption

GASCOYNE BIOREGION

Gascoyne - Biodiversity Issues

Description and Scope of Issues

The naturally attractive features of the Gascoyne, including its protected coastal waters and productive fish stocks, have resulted in the area being a focus of marine management, beginning in the 1960s. The state's earliest marine habitat protection areas, in the form of extensive prawn nursery trawl closures over the sand flats and seagrass beds, were introduced in the 1960s in both Shark Bay and Exmouth Gulf. This system of fisheries closures, later expanded to cover all significant coral areas, has provided long-standing protection to virtually all fragile marine habitats in the bioregion. The subsequent development of marine parks over Ningaloo Reef and the inner gulfs of Shark Bay have added further, complementary protection to these highly valued areas.

Specific commercial fishing regulations implemented in the 1970s and 1980s also preclude the use of large-mesh gillnets and longlines throughout the Gascoyne, to prevent the incidental entanglement of the large populations of dugongs and turtles which inhabit the region. These controls have also provided protection for the large shark species which are a feature of this region. More recently, bycatch reduction devices (grids) installed in trawl nets have increased the protection for sharks, rays and the occasional loggerhead turtle encountered on the trawl grounds.

Current Research Focus

Many of the studies in this region are being done as part of WAMSI Nodes 1 and Node 3.

Priority Setting Process

WAMSI processes.

Gascoyne Biodiversity Issues

Gascoyne Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
General finfish communities	Ongoing						Includes movement, habitat usage etc occurring as part of WAMSI
1.2 Other Biology							
1.3 Stock Assessment							
1.4 Fishery Monitoring							
2. Habitat & Ecosystem							
2.1 Bycatch							
	Developing	■	■				WAMSI 4.4.1 - Captured species assessments & monitoring
2.2 Listed Species							

Gascoyne Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
	Developing	■	■				WAMSI 4.4.1 - Captured species assessments & monitoring
2.3 Habitat							NRP (*including WAMSi Project 3) – CSIRO, AIMS, unis.
Habitat Mapping	Ongoing						Habitat Mapping at Ningaloo is occurring as part of WAMSI
2.4 Ecosystem/Environment							
Biodiversity, Trophic interaction, anthropogenic influences etc	Developing (some underway)	■	■				WAMSI 4.2 & 4.3 –
Climate change	Developing						WAMSI Project 1, 2 (CSIRO, UWA, AIMS)
Fish Kills	Ongoing	■	■	■	■	■	Gov't response to fish kills coordinated through Fisheries Research (Fish Health)
2.5 Oceanography							
Hydrodynamic modelling	Developing (some underway						WAMSI Projects 1, 2 & 3 (CSIRO, UWA, AIMS): e.g,
Hydrodynamics & nutrient dynamics of shelf waters in relation to LC.	Completed						SRFME (including Southern Surveyor cruise). .
	Underway						Southern Surveyor – cruises completed; data analysis underway. Another cruise is planned.
2.6 Other impacts on fishery							
Introduced Marine Pests	Underway	■					Currently funded by Natural Heritage Trust to analyse what species have been introduced.
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Underway						NRP/WAMSI, CSIRO Cluster, Sustainable Tourism CRC, NRM. E.g. Human Usage survey. Note: some underway but more work is planned
Economic Analysis							As above
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
Validation of Catch Records							
3.4 Management Systems	Developing						WAMSI 4.1. Applying EBFM framework.
	Developing						DEH/NOO south west regional plan
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

Gascoyne - Blue Swimmer Crab Fishery

Description and Scope of Fishery

Blue swimmer crabs (*Portunus pelagicus*) are found along the entire Western Australian coast, in a wide range of inshore and continental shelf areas, from the intertidal zone to at least 50 m in depth.

Crabbing activity in the Gascoyne Bioregion is centered in the embayments of Shark Bay and Exmouth Gulf, with the Shark Bay Crab (Interim) Managed Fishery having developed into the largest crab fishery in Western Australia. There are currently 9 licence or exemption holders in the 2 commercial crab fisheries covered by the Gascoyne bioregion. A small amount of local recreational crabbing occurs in Shark Bay and Exmouth Gulf.

A significant level of research has been conducted on the biology, ecology and distribution of the blue swimmer crab since the early 1970's. A number of projects were instigated during 1997/98 with funding from FRDC under the umbrella of the national collaborative blue swimmer crab research initiative. This research included the basic biology of crabs along the WA coast, gear-catchability relationships, recreational catch surveys, commercial catch monitoring, discard mortality estimation and stock assessment modelling, and was completed in 2000/1. In addition, a three-year project to develop stock allocation and assessment techniques in WA blue swimmer crab fisheries resulted in a comprehensive stock assessment of the Shark Bay blue swimmer crab fishery. A further wide-ranging ESD assessment of the Shark Bay fishery has determined that performance should be reported annually against measures relating to the breeding stock of crabs.

Current Research Focus

Data for the ongoing assessment of blue swimmer crab stocks in the Gascoyne Bioregion are obtained from fishers' compulsory catch and effort returns, voluntary daily log books and on-board catch monitoring conducted by Fisheries Research staff.

Priority Setting Process

Research priorities are set in consultation with management, and feedback obtained during meetings with industry groups and major stakeholders (WAFIC, RecFishWest and RFAC) as required.

Gascoyne Blue Swimmer Crab

Gascoyne BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Blue swimmer crab biology	Completed						Many studies Completed
1.2 Other Biology							
Size at sexual maturity	Completed						
Release mortality	Completed						
Genetic structure of populations	Completed						

Gascoyne BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1.3 Stock Assessment							
Stock Assessment	Completed						For Shark Bay
Annual C&E Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■	■	
Processor Returns	Ongoing	■	■	■	■	■	For Shark Bay only
Commercial Monitoring	Ongoing	■	■	■	■	■	3 – 4 times per year for Shark Bay and once per year for the developmental crab fishery in Exmouth Gulf.
Recreational Catch and Effort	Periodic						Assessed as part of National rec. fishing program.
Stock & recruitment	Ongoing	■	■	■	■	■	
Dedicated logbook	Ongoing	■	■	■	■	■	
Heavy metal content of crabs	Completed						
2. Habitat & Ecosystem							
2.1 Bycatch	Underway	■	■				For Shark Bay fishery only
2.2 Listed Species							Low Risk
2.3 Habitat							Low Risk
2.4 Ecosystem/Environment							Low Risk
2.5 Oceanography	Periodic						Environmental data for Shark Bay being compiled from various sources
2.6 Other impacts on fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Periodic						Social assessment has been conducted in Shark Bay previously
Economic Analysis	Periodic						Economic assessment has been conducted in Shark Bay previously
3.2 Resource Access (Shares)							
Detailed determination of access shares	Periodic						
Monitoring of shares	Periodic						
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

Gascoyne - Shark Bay Prawn Fishery

Description and Scope of Fishery

The SBP fishery is the largest prawn trawl fishery in Western Australia and is located in the waters in and near Shark Bay. The fishery targets western king prawns, brown tiger prawns and a variety of smaller prawn species including coral prawns and endeavour prawns. The seasonal and area opening and closing dates vary each year based on advice from the Research Division to ensure adequate breeding stocks are maintained and optimise yields.

The SBP fishery began in 1962 with only four vessels and rapidly expanded with a total of 35 boats operating by 1976. Following declines in catch rates in the 1980's, a buy back scheme reduced the number of boats to 27 and further rationalisations are being discussed. In 2007, on a trial basis, the number of boats fishing has been reduced to 18 with each towing four 5.5-fathom nets (22 fathoms per boat) whilst in 2008 17 boats towed four 5.5 fathom nets and one boat towed smaller quad nets.

Research and monitoring of the fishery has been conducted since 1962. This research studied the biology of the main target species and was completed in the 1970's. Similarly, the determination of the habitat requirements of each of the species and the stock recruitment dynamics were also completed in the 1980's.

Current Research Focus

Stock assessment and monitoring of the status of prawn stocks, particularly tiger prawns is the primary focus. This includes fisheries dependent monitoring (logbook program and processor unload records) and fishery-independent surveys that provide recruitment and spawning stock indices and within season prawn size and abundance information for 'real-time' management. The changes in gear configuration and any increases in fishing efficiency are being monitored through specific boat-to-boat comparisons and analysis of daily logbook data.

Between 2002 and 2004 bycatch reduction devices were implemented in this fishery and an FRDC funded project that examined the biodiversity of bycatch within trawled and untrawled areas was completed in 2007. A FRDC collaborative project with the department and Edith Cowan University to analyse prawn survey and logbook data using geostatistics to provide a better understanding of stock and fleet dynamics and to enable better delineation of tiger prawn spawning areas will be completed by the mid 2008. A two-year FRDC project on research into to prawn/scallop gear interactions, scallop and prawn larval movement patterns in Shark Bay and usefulness of area closures in scallop/prawn management commenced in March 2008.

A comprehensive ESD assessment of this fishery has determined that performance should be reported annually against measures relating to the breeding stocks of target prawn species, bycatch species impacts, protected species interactions, habitat effects and provisioning effects.

A strategic review of the Shark Bay trawl fisheries was conducted in 2006 with the final outcomes likely to be published by end of 2008.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. In 2006 a review of the Shark Bay prawn and scallop fisheries was undertaken which involved workshops with licensees and other stakeholders. At these workshops, current

research and research gaps were discussed and prioritised. In subsequent years, research issues were discussed with Shark Bay prawn fishery licensees during their association meetings. Additional research needs have also been highlighted throught the ESD Assessment processs for which a re-assessement has been completed in 2008.

Shark Bay Prawn

Shark Bay Prawn Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Brown tiger prawn biology	Completed						Completed in the 1970s and 1980s
Western king prawn biology	Completed						Completed in the 1970 and 1980s
Coral prawn biology	Minimal						Low Risk
1.2 Other Biology							
Juvenile habitat monitoring	Completed						Completed in 1970s
1.3 Stock Assessment							
Tiger prawn spawning stock assessment (Catch rate analysis)	Ongoing	■	■	■	■	■	Provides key PIs for fishery
Stock-recruit-environ effects	Ongoing	■	■	■	■	■	Undertaken for tigers and kings Since 1990s
Modelling	Ongoing	■	■	■	■	■	Some work done in late 1990s
Yield/recruit, $/recruit	Ongoing	■	■	■	■	■	Review needed
Spatial analysis	Competed						ECU FRDC project completed in early 2008
1.4 Fishery Monitoring							
Commercial catch monitoring	Ongoing	■	■	■	■	■	
Fishery independent surveys/size composition and abundance surveys	Ongoing	■	■	■	■	■	
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns							No longer used
Effort – benthic impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
Fishing power monitoring/gear modifications	Ongoing	■	■	■	■	■	
Processor returns (target spp. and byproduct)	Ongoing	■	■	■	■	■	
Database maintenance	Ongoing	■	■	■	■	■	
Electronic logbooks	Future		■				
Spatial analysis of logbook and survey data	Completed						ECU collaboration completed in 2008
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation (turtle grids)	Completed						Implemented in 2002
BRD Implementation (secondary devices)	Completed	■	■	■	■	■	Implemented in 2004 with limited Observer work Ongoing

Shark Bay Prawn Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Bycatch monitoring	Periodic	■					Review every 5 years
Square-mesh cod-end trials		■	■				Industry initiative – observers to document effectiveness
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
Coral/sponge habitat mapping	Required	O					DEC
Closure of sensitive habitats	Possible	O					Consultation required
2.4 Ecosystem/Environment							
Biodiversity of trawled and untrawled areas	Completed		■				Review every 5-10 years
Formal risk assessment	Periodic	■					EPBC requirement
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	
Temperature loggers	Ongoing	■	■	■	■	■	To be reviewed in 2007/08
2.6 Other impacts on fishery							
Spatial closures	Possible	O	O				Component of FRDC project
3. Management Research							
3.1 Socio-economic							
Social assessment	Possible						Partly done during SB review in 2006/07
Economic Analysis – average price data	Ongoing	■	■	■	■		
- Fuel consumption/expenses	Ongoing	■	■	■	■		
3.2 Resource Access (Shares)							
Prawn – Scallop fleet interactions and catch share – Snapper interactions	Periodic						Currently review of prawn scallop fishery management/ research arrangements
Prawn-Scallop gear interactions	Underway	■	■				FRDC 2007/08 (2 yr project)
Aquaculture							
Native Title							
World Heritage Areas							
3.3 Compliance							
4. Industry Development							
4.1 Production Technology							
Onboard handling							
OHS	Possible	O					Changes to fishing hours
Product quality certification							
Hoppers	Completed						Industry Lead initiative – all boats now using them
4.2 Post Harvest							
4.3 Marketing							

Gascoyne - Shark Bay Scallop Fishery

Description and Scope of Fishery

The Shark Bay Scallop fishery (SBS) operates within the waters of Shark Bay off the mid west coast of Western Australia (for precise boundaries see SoF) and is usually WA's most significant scallop fishery. This is an otter trawl fishery which catches southern saucer scallops. Exploratory trawling was undertaken in Shark Bay in the late 1950s and 60s (Penn and Stalker, 1979). The first scallop landings were reported in 1966 mostly as byproduct from vessels fishing for prawns. The early 1980s saw a dramatic increase in vessels in Shark Bay and resulted in the introduction of a specific management plan for scallop fishing in 1987. Research into the biological and environmental aspects of WA scallop stocks and commercial exploitation, has been carried out by the Department of Fisheries since the late 1960s.

Current Research Focus

Research for monitoring the status of the scallop stock in Shark Bay is based on detailed research logbook records and factory receivals provided by industry. In addition, an annual research survey is carried out in November, which, together with existing detailed biological knowledge, enables an annual catch forecast to be provided. These survey data are also used as the basis for the management arrangements in the following year. In the last few years fishing for scallops has commenced earlier to optimise the meat size of scallops and this has required real-time monitoring (daily) of catch rates as fishing has ceased at an agreed catch rate level.

Additional research to investigate the environmental influences that affect recruitment to scallop stocks in Shark Bay, in particular the effects of the Leeuwin current and temperature continue.

Between 2002 and 2004 bycatch reduction devices were implemented in this fishery and a FRDC funded project on the biodiversity of bycatch within trawled and untrawled areas was completed in 2007. A FRDC funded project in collaboration with ECU analysing scallop survey and logbook data using Geostatistics was completed in early 2008. An FRDC proposal to conduct further research into to prawn/scallop gear interactions, scallop and prawn larval movement patterns in Shark Bay and usefulness of area closures in scallop/prawn management was approved for funding and the project commenced in early 2008 and will run for two years.

The five-year Ecologically Sustainable Development accreditation with the Commonwealth Department of Environment, Heritage and Water was renewed in late 2007. A comprehensive ESD assessment of this fishery was undertaken as part of the Commonwealth accreditation process to identify any potential sustainability risks requiring direct management. The issues identified through this process were breeding stock levels of target scallop species and interactions with protected species (loggerhead turtles).

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. In 2006 a review of the Shark Bay prawn and scallop fisheries was undertaken which involved workshops with licensees and other stakeholders. At these workshop, current research and research gaps were discussed and prioritised. In subsequent years, research issues were discussed with Shark Bay scallop fishery licensees during their association meetings. Additional research needs have also been highlighted throught the ESD Assessment processs for which a re-assessement has been completed in 2008.

Shark Bay Scallop

Shark Bay Scallop Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Scallop Biology	Completed	■	■	■			Competed in the 1970s and 1980
							Additional information on spatial and temporal differences in meat size and quality will be collected on an opportunistic basis
1.2 Other Biology							
Recruitment Dynamics	Completed						Studies Completed in the 1980's
Larval Advection	Future	■	■				FRDC project UWA Masters student
1.3 Stock Assessment							
Stock-recruit-environ effects	Ongoing	■	■	■	■	■	
Fishery independent surveys and monitoring	Ongoing	■	■	■	■	■	
Survey indices-catch relationships	Ongoing	■	■	■	■	■	Review of methodology in 2008/09
Modelling/Depletion exp.	Underway						Partly Completed
Spatial GIS	Ongoing	■	■	■	■	■	
Spatial analysis	Completed						ECU FRDC project completed in 2008
Catchability	Underway	■					Partly Completed including day-night trials
Mesh selectivity trials	Underway	■	■				FRDC project
1.4 Fishery Monitoring							
Research logbooks	Ongoing	■	■	■	■	■	
Fishing power monitoring	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Database maintenance	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
Spatial analysis of survey and logbook data	Completed	O	O				ECU collaboration – possible further student project
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation	Completed						Completed in 2003
Bycatch monitoring	Periodic		■				Review every 5 years
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
Closure of sensitive habitats	Possible	O					Consultation required
2.4 Ecosystem/Environment							

Shark Bay Scallop Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Biodiversity of trawled and untrawled areas	Completed			■			Review every 5-10 years
Formal risk assessment	Periodic	■					EPBC requirement
Marine Park Monitoring	Possible						
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	
Temperature loggers	Ongoing	■	■	■	■	■	
Modelling of currents	Underway	■	■				FRDC UWA Masters project
2.6 Other impacts on fishery							
Spatial closures	Possible	O	O				Component of FRDC project
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible	O					Partly completed during SB Review 06/07
Economic Analysis – average price data	Ongoing	■	■	■	■	■	
- Fuel consumption/expenses	Ongoing	■	■	■	■	■	
3.2 Resource Access (Shares)							
Prawn – Scallop- fleet interactions and catch share - Snapper	Ongoing	■	■	■	■	■	Needed for the review of the three fisheries
Prawn-Scallop gear interactions	Future	■	■				FRDC Project
4. Industry Development							
4.1 Production Technology							
Aquaculture /reseeding	Completed						Completed in 1990s
4.2 Post Harvest							
4.3 Marketing							

Gascoyne - Exmouth Gulf Prawn Fishery

Description and Scope of Fishery

The Exmouth Gulf Prawn (EGP) fishery is the second largest prawn fishery in WA and is located in the relatively sheltered waters in and to the north of Exmouth Gulf (for precise boundaries see the most recent SoF). This otter trawl fishery targets western king prawns, brown tiger prawns, endeavour prawns and banana prawns when available. The seasonal and area opening and closing dates vary each year based advice from the Research Division to ensure adequate breeding stocks are maintained and optimise yields.

The EGP fishery began in 1963 initially targeting banana prawns, however as the fishery increased in the following years, the initial target species changed to mainly tiger, king and endeavour prawns and these became the consistent catch. Tight management restrictions were introduced in 1980 in order to rebuild tiger prawn stocks. Catches of king prawns have increased since the early 1980's due to increased targeting and due to changes in the fishing management arrangements.

Research and monitoring of the fishery has been conducted for about 40 years. This includes catch and effort statistics for stock assessments. Between 2002 and 2004 bycatch reduction devices were implemented in this fishery.

Current Research Focus

Building up and maintaining an adequate spawning stock of tiger prawns is imperative in the Exmouth Gulf prawn fishery. Current research activities continue to focus on stock assessment and monitoring of the status of prawn stocks, particularly tiger prawns. This includes fisheries dependent monitoring (logbook program and processor unload records) and fishery-independent surveys, which provide recruitment and spawning stock indices and size composition information during the year on which to base flexible closures to optimise prawn catch and value. This requires close monitoring of the catch rates of tiger prawns during the fishing season and closure of areas when catch rates are above or at the threshold limit

King prawn ground have been included as part of annual surveys to provide a better understanding of the stock distribution, size and abundance of king prawns and preliminary assessment of variation in recruitment levels for this species.

The research logbooks that have been voluntarily been completed by 100% of the boats are now the mandatory catch and effort return.

Continued monitoring of seagrass abundance in nursery sites may be required to validate an apparent correlation between seagrass abundance and recruitment for tiger prawns. This is likely to be done in early 2009.

An FRDC funded project on the biodiversity of bycatch within trawled and untrawled areas was completed in 2007.

A comprehensive ESD assessment of this fishery has determined that performance should be reported annually against measures relating to the breeding stocks of target prawn species, bycatch species impacts, protected species interactions, habitat effects and provisioning effects.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. A formal risk assessment including reviewing research priorities was undertaken in late 2002 for the Exmouth Gulf prawn fishery. In additon, regular meetings have been held with the Reseraech Division and industry (sometimes also attended by WAFIC) was undertaken as part of research subcommittee meetings until 2003. At this time the Joint Trawl Management Advirosy Committee was established for the cost recovered fisheries and the formal sub-committees were disbanded. However, regular meetings (two or three times a year) are still held with industry to discuss reseeach priorities and planning. Additional research needs have also been highlighted throught the ESD Assessment processs for which a re-assessement has been completed in 2008.

Exmouth Gulf Prawns

Exmouth Gulf Prawn Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet and Natural mortality)							
Brown tiger prawn biology	Completed						Completed in 1970-1990s
Western king prawn biology	Completed						Completed in 1970s
Endeavour prawn biology	Minimal						Low Risk
Banana prawn biology	Possible						Only caught infrequently. Low Risk
1.2 Other Biology							
Recruitment dynamics of western king prawns	Ongoing	■	■	■	■	■	
1.3 Stock Assessment							
Stock-recruit-enviro effects	Ongoing	■	■	■	■	■	Reports published 1980s and 1990s
Modelling (banana)	Ongoing	■	■	■	■	■	
Yield/recruit, $/recruit	Ongoing	■	■	■	■	■	
Catch/effort relationships	Ongoing	■	■	■	■	■	
Recruitment-catch relationship	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns							No longer used.
Processor returns (target spp. and byproduct)	Ongoing	■	■	■	■	■	
Database maintenance	Ongoing	■	■	■	■	■	
Recruit and spawning stock indices	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
Juvenile habitat monitoring	Periodic	■		■			Every 2 or 3 years or if disturbance occurs
Fishing power monitoring	Ongoing	■	■	■	■	■	
Commercial catch monitoring (king prawns)	Possible						

Exmouth Gulf Prawn Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Electronic logbooks	Underway	■					Trialling commencing in 2007/08
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD implementation (grids)	Completed						Completed in 2002
BRD implementation (secondary devices)	Completed	■					Completed in 2004 with observer work Ongoing and additional trials to be done in 2008/09
Bycatch monitoring	Periodic	■					Review every 5 years
Square mesh cod-ends	Underway	■					Industry initiative – requires observers to document effectiveness
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort monitoring	Ongoing	■	■	■	■	■	EPBC requirement (area of trawling only)
Closure of sensitive habitats on trawl grounds	Possible	O					Requires industry consultation
2.4 Ecosystem/Environment							
Biodiversity of trawled and untrawled areas	Completed						Completed in 2007 – may review every 5-10 years
Formal risk assessment	Periodic	■					EPBC requirement
2.5 Oceanography							
Tidal movement	Possible						Information available from other sources
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						Social assessment
Economic Analysis – average price data	Ongoing	■	■	■	■	■	Economic Analysis – average price data
- Fuel consumption/expenses	Ongoing	■	■	■	■	■	- Fuel consumption/expenses
3.2 Resource Access (Shares)							
Byproduct	Underway	■					Trialling size limits for crabs and bugs
3.3 Compliance							
4. Industry Development							
4.1 Production Technology							
Onboard handling							
OHS							
Product quality certification							
4.2 Post Harvest							
4.3 Marketing							

Gascoyne - Demersal Scalefish Fishery (Shark Bay Snapper)

Description and Scope

The fishery includes commercial and recreational fishing activities (including charter vessels) that target demersal scalefish in offshore waters of the Gascoyne bioregion (between 114° 50' E and 27° S). Commercial line fishing here is now almost exclusively undertaken by Shark Bay Snapper Managed Fishery (SBSF) licensed vessels, that have historically targeted the oceanic stock of pink snapper. Commercial fishing in oceanic waters off Shark Bay has occurred since the early 1900's, however catch data are only available from the 1950s onwards. The SBSF came under formal management in 1987 and became a fully quota-based fishery in 2001. SBSF vessels also catch a range of other 'non-quota' species including goldband snapper, red emperor, various other emperors (including spangled emperor), cods, ruby snapper, pearl perch, mulloway and trevallies. Increased fishing activity in deeper waters (~150-250 m depth) for species such as goldband and ruby snapper has been observed since 2000-2001. The SBSF is well documented and received EPBC certification in 2005 (due for review in 2009).

A limited number of commercial 'open-access' wetline vessels without SBSF-quota also operate in Gascoyne waters outside of the SBSF management zone. These vessels catch similar species as do a limited number of licensed charter vessels and large numbers of recreational vessels fishing out of Denham, Carnarvon and the Ningaloo area (Coral Bay, Tantabiddi, Exmouth). 'Open-access' wetline fishing is to come under formal management for the first time as an outcome of the 'Wetline Review' with the creation of a Gascoyne Demersal Scalefish Fishery. Management arrangements for this fishery (that will incorporate the SBSF) and a Gascoyne Inshore Net Fishery are now being developed. In addition, Integrated Fisheries Management (IFM) is scheduled for implementation in the Gascoyne in 2009-2010.

Pink snapper in oceanic waters off Shark Bay have been the focus of significant research effort over the past 30 years. An FRDC project (completed in 2003) used the size and age composition of commercial catches (1982-2000), to develop a stock assessment model for the first time. This research showed that the oceanic spawning stock was depleted to an unacceptable level at that time. More recently, as part of the Gascoyne IFM process, four key Gascoyne indicator species have been identified - pink snapper, goldband snapper, spangled emperor and Spanish mackerel – and are currently the focus of research activities. Concern in relation to the sustainability of fishing for the more vulnerable deeper-water species (goldband snapper, ruby snapper) remains.

Current Research Focus

The Research Division continues to monitor the recovery of the oceanic spawning stock following reductions to the pink snapper TACC in 2004 and again in 2007 and 2008 via catch-at-age sampling. Current research is also focussed on two other demersal indicator species, spangled emperor and goldband snapper, as part of the Gascoyne IFM initiative. This research will provide important information (previously unavailable) on the biology, stock status and existing catch shares (commercial, charter, recreational) for these two species, as well as for pink snapper, in late 2009.

Priority Setting Process

Research and Development priorities are reviewed annually by researchers and managers, typically prior to the Shark Bay Snapper Managed Fishery AGM, the most recent of which was held in June 2008. Priorities are set based on the current level of understanding of the key

species, stock status and fishery, and potential future pressures and issues identified, using a simple risk assessment approach and expert opinion. The creation of a Gascoyne Demersal Scalefish Fishery and outcomes of Gascoyne IFM process (late 2009) may see the above review process change.

Gascoyne Demersal Finfish Research

Gascoyne Demersal Finfish Research	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, Natural mortality)							
Pink snapper (oceanic stock) biology	Complete						Adequate for management
Goldband snapper biology	Underway	■	O				Gascoyne IFM project, to be completed late 2009
Spangled emperor biology	Underway	■	O				Gascoyne IFM project, to be completed late 2009
1.2 Other Biology							
Pink snapper juvenile recruitment	Ongoing	■	O	O	O	O	Shark Bay trawl surveys
Stock structure – pink snapper (oceanic)	Underway	■	■	■			WAMSI 4.4.2-1, genetics, otolith chemistry
1.3 Stock Assessment							
Age-structured modelling for pink snapper	Ongoing	■	O	O	O		Need to monitor stock recovery to 40% target level
CAES catch and effort data analysis	Ongoing	■	O	O	O		
Age-based assessments for goldband and spangled emperor	Proposed	■	O				Gascoyne IFM project, to be completed late 2009
1.4 Fishery Monitoring							
Pink snapper, size and age structure of catch	Ongoing	■	O	O	O		Need to monitor stock recovery to 40% target level
Spangled emperor, size and age structure of catch	Ongoing	■	■	O			
CAES catch and effort data	Ongoing	■	O	O	O	O	Daily logbooks since Feb 2008
Charter boat catch and effort	Ongoing	■	O	O	O	O	
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Low risk
2.5 Oceanography							
Potential project with UWA, recruitment and environment		O	O	O			
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							

Gascoyne Demersal Finfish Research	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

Gascoyne - Inner Shark Bay Scalefish Fishery

Description and Scope of Fishery

This fishery includes commercial and recreational fishing activities that target scalefish species within the waters of inner Shark Bay (includes the Shark Bay Beach Seine and Mesh Net Managed Fishery [SBBSMNF] and Inner Shark Bay Recreational Fishery). The SBBSMNF uses a combination of beach seine and haul net gears to take four main species/groups: whiting, sea mullet, tailor and yellowfin bream. Most recreational fishing is boat-based with some limited fishing from the shore. Most vessels launch from boat ramps at Denham, Monkey Mia or Nanga. The main recreational scalefish species are black snapper (grass or blue-lined emperor), pink snapper, whiting, tailor, western butterfish and blackspot tuskfish. A limited number of licensed charter vessels operate out of Denham and Monkey Mia.

Considerable research has been conducted on the main SBBSMNMF target species since the 1960s. Overall the fishery has remained relatively stable over the past several decades with the main target species being fished at sustainable levels. A comprehensive review of the SBBSMNF management plan was completed in 2005 in consultation with license holders. At present there are no dedicated research funds available for this fishery. A comprehensive research program has been undertaken on inner Shark Bay pink snapper since 1996/97. Research has also been conducted on black snapper (Dept of Fisheries), and yellowfin bream, whiting and tuskfish species (Murdoch University) in inner Shark Bay.

Current Research Focus

Research monitoring of the status of the species taken by the SBBSMNF is undertaken annually using industry-based data coupled with the extensive scientific knowledge gained from previous research. A comprehensive draft ESD report has been completed which suggested performance indicators based on catch and catch rates for each of the four main species in the fishery (whiting, sea mullet, tailor and yellowfin bream).

An increase in yellowfin bream catches between 2002 and 2005 was investigated and shown to be the result of particularly strong recruitment in 1999.

Model-based assessments for inner gulf pink snapper stocks are now undertaken on a 3-year basis, and used to determine appropriate levels of TAC for each stock. Management arrangements for pink snapper were reviewed by the Inner Shark Bay Pink Snapper Working Group in July 2008 (next review scheduled for mid 2011). Research funding has now been directed away from inner gulf pink snapper towards Gascoyne IFM research.

Priority Setting Process

Research and Development priorities for inner gulf pink snapper are reviewed every 3 years by the Inner Shark Bay Pink Snapper Working Group, most recently in July 2008. At this meeting, The Department committed to updating inner Shark Bay pink snapper stock assessments by the next review (scheduled for mid 2011).

The creation of a Gascoyne Demersal Scalefish Fishery and Gascoyne Inshore Net Fishery, and the outcomes of the Gascoyne IFM process, may require research priorities within the Finfish Group more broadly to be re-assessed.

Inner Shark Bay Fishery

Inner Shark Bay Fishery	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, Natural mortality)							
Whiting	Complete						Adequate for management
Sea mullet	Complete						Adequate for management
Tailor	Complete						Adequate for management
Western yellowfin bream	Complete						Adequate for management
Pink snapper	Complete						Adequate for management
1.2 Other Biology							
1.3 Stock Assessment							
CAES catch and effort data	Ongoing	■	■	■	■	■	Adequate at this stage
Model-based assessment for pinks	Ongoing	O	O	O	?	?	Next review mid 2011
1.4 Fishery Monitoring							
CAES data	Ongoing	■	■	■	■	■	
Age structure of yfb catch	Ongoing		O	O			Investigation of recruitment variation
Recreational fishing survey	Proposed		O	O	?	?	Need for estimate of catch in 2010, prior to 2011 review
Recreational angler logbooks	Proposed	O	O	O	O	O	NHT funding for one year
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Low risk
2.5 Oceanography	Not needed						Low risk
2.6 Other impacts on fishery	Not needed						Low risk
3. Management Analysis							
3.1 Socio-economic	Not needed						
3.2 Resource Access (Shares)	Not needed						
3.3 Compliance	Not needed						
3.4 Management Systems	Not needed						
4. Industry Development							
4.1 Production Technology	Not needed						
4.2 Post Harvest	Not needed						
4.3 Marketing	Not needed						

NORTH COAST BIOREGION

North Coast - Biodiversity Issues

Description and Scope of Issues

On the north coast, marine habitats have been locally affected by port developments, oil and gas exploration and extraction, and some fishing activities across the continental shelf. The offshore Pilbara area in particular, was heavily trawled by international vessels in the 1960s and 1970s; however, this activity was completely phased out by the Australian Government in the early 1980s. Since that time, extensive fisheries closures over coastal and most offshore waters have been introduced to manage finfish trawling by Australian vessels (North Coast Habitat Protection Figure 1). Trawling for prawns is permitted at a number of locations and occurs on a series of small grounds associated with inshore nursery areas (see specific commercial trawl fishery reports). In each of these fisheries, trawling occurs over a small proportion of the habitat, and is managed to ensure that impacts are acceptable and localised to areas of high target species abundance.

In addition to the extensive fisheries closures protecting marine habitats, the bioregion has a number of Reef Protected Areas under Fisheries legislation and marine parks and reserves around offshore islands and reefs (North Coast Habitat Protection Figure 2).

Current Research Focus

Information on the status of introduced marine pest species (IMPs) is being gathered at the port of Dampier.

A project is underway, which will make recommendations and develop a suggested approach, to inform and guide a future Coastal and Marine Resource Condition Monitoring Program for the Pilbara and Kimberley Regions.

Priority Setting Process

North Coast Biodiversity Issues

North Coast Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
1.2 Other Biology							
1.3 Stock Assessment							
1.3 Fishery Monitoring							
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							

North Coast Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Fish Kills	Ongoing	■	■	■	■	■	Gov't response to fish kills coordinated through Fisheries Research (Fish Health)
Resource Condition Monitoring	Just commenced	■					Funded by Natural Heritage Trust to determine what RCM research has been conducted in Pilbara and Kimberley. Undertake trial of RCM methods in intertidal region (Pilbara) and propose long term sub-tidal RCM strategy for Pilbara and Kimberley regions.
2.5 Oceanography							
2.6 Other impacts on fishery							
Introduced Marine Pests	Nearing completion						Currently funded by Natural Heritage Trust to analyse what species have been introduced.
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
Validation of Catch Records							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

North Coast - Onslow Prawn Managed Fishery

Description and Scope of Fishery

The Onslow Prawn Managed Fishery operates along the western part of the North West Shelf, with a functional fishery area that comprises only a few relatively discrete areas offshore from nursery areas (less than 5% of overall fishery area). This otter trawl fishery targets western king prawns, brown tiger prawns, endeavour prawns and banana prawns. The opening and closing dates vary from year to year based on advice from the Research Division to maintain spawning stock and optimise yields.

Extensive research has been completed on the biology of the western king prawn and brown tiger prawn in other regions in WA. Some research on the biology, including the distribution and life history of the banana prawn and endeavour prawn has been completed.

Current Research Focus

No independent stock assessment surveys are completed for the target species. In the last few years, a pre-season survey and within season surveys have been undertaken by one boat to determine prawn abundance and distribution and size composition to assist with harvesting strategies. Size management fish grounds and permanently closed areas are now fully implemented.

The trends in annual catches are, however, monitored through logbooks provided by industry and information direct from boat skippers which are then used for the management of the fishery.

Annual meetings are held with boat operators to consider the status of the stocks and recommend changes to fishing operations.

A comprehensive ESD assessment of this fishery has determined that performance should be reported annually against measures relating to the breeding stocks of target species (e.g. tiger and king prawns) and secondary target species (black tiger prawns).

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Research issues have been discussed with industry during surveys and at annual general meetings at least once a year. Additional research needs have also been highlighted throught the ESD Assessment processs.

Onslow Prawn

Onslow Prawn trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, natural mortality)							
Brown tiger prawn biology	Completed						
Western king prawn biology	Completed						
Endeavour prawn biology	Minimal						Low Risk

Onslow Prawn trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Banana prawn biology	Possible		O				Only caught in high numbers occasionally
1.2 Other Biology							
Biology of bugs	Completed						Desktop study done – trialling size limits
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research Logbooks	Ongoing	■	■	■	■	■	All skippers fill in logbooks
CAES returns	Ceased						Phased out with introduction of mandatory logbooks
Processor returns	Ongoing	■	■	■	■	■	
Database maintenance	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation(grids)	Completed						Completed in 2004
BRD Implementation(secondary devices)	Completed						Further evaluation/trialling may take place
Bycatch monitoring	Periodic		■				Review every 5 years
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic		■				EPBC requirement
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery							
Marine Park Boundaries	Ongoing						As required
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
Gear development/changes	Ongoing	■	■	■	■	■	
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Pearl Oyster Managed Fishery

Description and Scope of Fishery

The Western Australian pearl oyster fishery is the only remaining significant wild-stock fishery for pearl oysters in the world. It is a dive fishery operating in shallow coastal waters along the North West Shelf. The species targeted is the Indo-Pacific, silver-lipped pearly oyster (*Pinctada maxima*) and they are harvested by drift diving.

The collection of pearl oysters has a long history in WA dating back to 1850, with the first recorded operations being in Shark Bay. By the end of the 1970s most of the industry had started to move into cultured pearl production and the catch of MOP shell had significantly declined (Malone et al., 1988).

There is an extensive amount of relevant and accurate information on the biology of the silver lipped pearl oyster and about the history of this fishery (in excess of 30 years for the culture shell fishery and almost 100 years for the Mother Of Pearl fishery), as well as extensive catch and effort data. This information combined with the current management arrangements, have resulted in the maintenance of pearl oyster stocks as well as the successful continuation of the fishery.

Current Research Focus

Current research is focused on:

- Stock assessment using catch and effort statistics and recruitment and length-frequency sampling to estimate the total allowable catch.
- Development of an index of recruitment for predicting future years catch levels using the relative number of piggy back spat.
- Decision rules for determining the TAC.
- An externally funded FRDC study investigating bioeroding sponges (Clionidae) which infect pearl oysters.
- The fish pathology group also provides a comprehensive disease testing program to the industry. Several other research projects are being carried out within the pearling industry focusing on environmental management, pearl oyster health, and improved health and safety for pearl divers.

Priority Setting Process

Research priorities are set through annual industry-departmental meetings of PIAC and the PIAC R&D subcommittee, and DEWHA assessments and recommendations for maintaining export licenses.

Pearl Oyster

Pearl Oyster Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, Natural mortality)							
Environmental effects on recruitment	Ongoing	■	■	■	■		
MOP (FRDC)	Completed						
Growth rate of wildstock (FRDC)	Completed						
Heavy metals	Completed						
1.2 Other Biology							
Genetics (FRDC)	Completed						
Genetics	Underway						
1.3 Stock Assessment							
Annual Assessment of catch rates and sizes	Ongoing	■	■	■	■		
1.4 Fishery Monitoring							
Statistics (wildstock)	Ongoing	■	■	■	■		
2. Habitat & Ecosystem							
2.1 Bycatch	Not Needed						Negligible Risk
2.2 Listed Species	Not needed						Negligible Risk
2.3 Habitat	Not Needed						Negligible Risk
2.4 Ecosystem/Environment							
Environmental impact of pearl oyster fishing	Not Needed						Low Risk
Juvenile Survival (links to fish health)							
Environmental impact farm site	Underway	■					
Environmental impact/monitoring	Underway	■					
Site survey/food availability/density	Needed						
Site selection parameters	Needed						
EMS Template Pilot Project	Underway		■	■			
2.5 Oceanography							
NW Shelf study	Underway						
Kimberley inshore bio-oceanography	Completed						
80 Mile beach bio-oceanography	Ongoing		■	■			FRDC proposal for 09/10 – joint project with CSIRO
2.6 Other impacts on fishery							None identified
3. Management Analysis							
3.1 Socio-economic							
Occupational Health & Safety							
Diver safety/farm profiles	Underway						To be completed In 2007/08
3.2 Resource Access (Shares)							
3.3 Compliance							
Compliance evaluation							
3.4 Management Systems							

Pearl Oyster Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Statistics (value)							
4. Industry Development							
4.1 Pearl Culture Development							
Culture development (move to longlines)							
Irukandji Jellyfish Stings							Proposed
Antifouling	Proposed	■	■	■			
Seeding techniques (private)							
Lustre/colour							
Pearl grading (systems intellect)							
Genetic selection (private)							
Sibou (private)							
Farm security and surveillance	Underway						To be completed In 2007/08
Hallmarking of Pearls/nucleii		O	O				
Hatchery development project (FRDC)							
Growth rates/nursery spat (FRDC)							
Technician training (private)							
MOP nuclei production (FRDC)							
4.2 Post Harvest							
4.3 Marketing							
Market research/intelligence		O	O	O			
Promotion/Branding Mkt Resch			■	■			
4.4 Fish Health							
Fish health and diagnostics	Ongoing	■	■	■	■		
Husbandry wildstock							
Disease survey/atlas (FRDC)	Completed						
Translocation/protocol	Periodic		■				
Pearl production (Scoones)							
Contingency plan							
Ciliate Project	Underway						
Haplosporidian Project	Underway						
Cliona Management in wild stocks (FRDC)	Underway	■					Three years into study
Diagnostic test for OOD	Underway	■	■	■	■	■	FRDC funded projects on Chlamydiales-like organisms, stress response; industry funded work on oedema disease.
Test for Oyster Stress	Proposal	■	■				FRDC proposal

North Coast - Beche-de-mer Managed Fishery

Description and Scope of Fishery

Beche-de-mer, also known as sea cucumbers or trepang are in the Phylum Echinodermata, Class Holothuroidea. They are soft-bodied, elongated animals that usually live with their ventral surface in contact with the benthic substrate or buried in the substrate. The Western Australian Beche-de-mer fishery is based in the northern half of the state, from Exmouth Gulf to the Northern Territory border. It is a hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading.

There are six target species caught commercially in Western Australia, however 99% of the catch is sandfish (*Holothuria scabra*). Currently, the fishery is in a developmental phase and its policy instrument is an endorsement to fish for bech-de-mer on the licenses. However following a review in 2007, the fishery will be developed into a "Managed Fishery" under the definitions of the FRMA.

Current Research Focus

Current research is focused on:

- stock assessment using monthly catch and effort statistics.
- Development of a daily catch and effort logbook to provide finer-scale, species-specific information.

There are significant gaps in knowledge about the biology of the species that are taken in this fishery.

Priority Setting Process

Research priorities are set through annual industry-departmental meetings and DEWHA assessments and recommendations for maintaining export licenses.

Beche-de-mer

Beche de mer Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, Natural mortality)							Information on growth and size at maturity are needed to improve the management of the Kimberley and Pilbara stocks
Growth	Minimal						
Size-at-maturity	Minimal						
1.2 Other Biology							
Genetics	Minimal						Genetics work on *H. scabra* would help establish appropriate management boundaries
1.3 Stock Assessment							
Sustainability of stocks		■	■	■	■		
1.4 Fishery Monitoring							
Statistics (wildstock) as above		■	■	■	■		

Beche de mer Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2. Habitat & Ecosystem							
2.1 Bycatch							Negligible Risk
2.2 Listed Species							Negligible Risk
2.3 Habitat							Negligible Risk
2.4 Ecosystem/Environment							
ESD Recommendations and implementation							
2.5 Oceanography							
Kimberley inshore bio-oceanography	Completed						
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
Statistics (value)							
Development of an interim management plan							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							
Research logbook implementation							

North Coast - Broome Prawn Managed Fishery

Description and Scope of Fishery

The Broome Prawn Managed Fishery operates in a designated trawl zone off Broome (for precise boundaries see SoF). The permitted trawl area is only a very restricted part of the total licence area for the fishery, so as not to interfere with the Pearl fishery. This otter trawl fishery targets western king prawns and coral prawns. The BPMF currently contains five WA-based Northern Prawn Fishery (Gulf of Carpentaria) vessels licensed to operate in this fishery. The BPMF operates during the Northern Prawn Fishery (NPF) closure period.

Current Research Focus

The biology of the western king prawn has been extensively researched but there is significantly less information available on the life history of coral prawns and this should be addressed.

A comprehensive ESD assessment of this fishery determined that performance should be measured annually for the breeding stock of target prawn species (king and coral). This involves stock monitoring and assessment utilising daily logbook data provided by industry and information from boat skippers.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Research issues have been discussed at annual general meetings once a year. Additional research needs have also been highlighted throught the ESD Assessment processs.

Broome Prawn

Broome Prawn Trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
King prawn biology	Completed						Completed in 1970's and 1980's
Coral prawn biology	Possible			O			
1.2 Other Biology							
1.3 Stock Assessment							
Lunar Phase	Ongoing	■	■	■	■	■	
Delury Depletion Analysis	Ongoing	■	■	■	■	■	
C&E Stock Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research logbooks	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation(grids)	Completed						Completed in 2004

Broome Prawn Trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
BRD Implementation(secondary devices)	Completed						
Bycatch monitoring	Periodic/ Possible	O		■			Limited - opportunistically, Review every 5 years
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
Habitat mapping outside 'box'	Completed						No significant areas identified in 2007 but industry may wish to revisit
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic		■				EPBC requirement
2.5 Oceanography	Not needed						None Identified
2.6 Other impacts on fishery	Not needed						None identified
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
VMS	Ongoing	■	■	■	■	■	
3.4 Management Systems							
375 rule/unitisation	Underway						
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Kimberley Prawn Managed Fishery

Description and Scope of Fishery

The Kimberley Prawn Fishery operates along the western part of the North West Shelf and targets banana prawns, western king prawns, brown tiger prawns and endeavour prawns using otter-trawl.

The Kimberley prawn fishery was declared a managed fishery in 1993 and uses a comprehensive set of regulations that include limits on vessel numbers, gear controls, boat restrictions, seasonal and spatial closures, all of which have been refined through time. Whilst a total of 137 boats have access to the KPMF under various licensing arrangements, in recent years only 20 to 40 boats actually fish in any one year.

Extensive research has been completed on the biology of the western king prawn and brown tiger prawn. Some research on the biology, including the distribution and life history of the endeavour prawn has been completed.

Current Research Focus

In 2008, logbooks have become mandatory and will replace CAES monthly returns. Research assessments (e.g. catch and effort trends) are provided to annual meetings of boat operators and provide the basis for recommending changes to management arrangements each year. A relationship has been identified between rainfall and catches of banana prawns (the dominant species taken in this area) that provides a degree of forecasting.

A comprehensive ESD assessment of this fishery determined that performance should be measured annually for breeding stocks of target species (banana, king and brown tiger) and secondary target species (endeavour).

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Research issues have been discussed at annual general meetings once a year. Additional research needs have also been highlighted throught the ESD Assessment processs.

Kimberley Prawn

Kimberly Prawn Trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, Natural mortality)							
Banana prawn biology	Possible						
Brown tiger prawn biology	Completed						Completed in the 1990's
Endeavour prawn biology	Possible						
1.2 Other Biology							
Biology of Squid	Possible						
1.3 Stock Assessment							
C& E Assessment	Ongoing	■	■	■	■	■	

Kimberly Prawn Trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Catch rainfall relationship	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
AFMA Logbooks	Ongoing	■	■	■	■	■	
Logbooks	Ongoing	■	■	■	■	■	
CAES Returns							Replaced by daily logbooks
Processor Returns	Ongoing	■	■	■	■	■	
Effort trends	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch							
BRD Implementation	Completed						Completed in 2004
Secondary BRDS	Completed						Limited trials may be undertaken by industry on new BRD types
Bycatch monitoring	Possible			■			Limited, Review every 5 years
2.2 Listed Species							
Listed species interactions – logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic		■				EPBC requirement
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
Marine Park Planning	Ongoing	■	■	■			Advice as required
3.3 Compliance							
3.4 Management Systems							
Latent effort/effort trends	Ongoing	■	■	■	■	■	
Size Management Fish Grounds	Established	■	■	■	■	■	
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Nickol Bay Prawn Managed Fishery

Description and Scope of Fishery

The Nickol Bay Prawn Fishery operates along the western part of the North West Shelf and targets banana prawns (*Penaeus merguiensis*), western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*) and endeavour prawns (*Metapenaeus endeavouri*) using otter-trawl.

There is extensive literature on the biology of the western king prawn and brown tiger prawn. Some research on the biology, including the distribution and life history of the banana prawn and endeavour prawn has been completed.

Current Research Focus

Research for the management of the fishery has involved stock monitoring and assessment utilising monthly return data provided by industry, information from boat skippers, and rainfall records. From 2008 all skippers will be completing daily logbooks to provide better spatial information of catch and effort in this fishery. Stock assessment of the banana prawn stocks involves updating the catch–rainfall relationship for the NBPMF. The introduction of Size Management Fish Grounds and permanently closed areas will require close consultation with fishers during the next few years and may require limited fishery independent surveys to monitor prawns size and abundance as well as record bycatch/byproduct species.

A comprehensive ESD assessment of this fishery has determined that performance should be reported annually against measures relating to the breeding stocks of target (banana, king and brown tiger) and secondary target prawn species (endeavour).

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Research issues have been discussed at annual general meetings once a year. Additional research needs have also been highlighted throught the ESD Assessment processs.

Nickol Bay Prawn

Nickol Bay Prawn Trawl Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, natural mortality)							
Banana prawn biology	Possible						Opportunistically
King prawn biology	Completed						Completed in 1970s
Tiger prawn biology	Completed						Completed in 1970-1990s
Endeavour prawn biology	Minimal						Low Risk
1.2 Other Biology							
Biology of squid	Possible						Irregular catches
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	Annual C&E Assessment

Nickol Bay Prawn Trawl Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Banana Prawn Catch vs rainfall relationship	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research Logbooks	Ongoing	■	■	■	■	■	
CAES returns	Replaced						Discontinued due to mandatory logbooks being introduced in 2008
Processor returns	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	EPBC requirement
2. Habitat & Ecosystem							
2.1 Bycatch							
BRD Implementation(grids)	Completed						
BRD Implementation(secondary devices)	Completed						
Bycatch monitoring	Periodic		■				
2.2 Listed Species							
Listed species interactions	Ongoing	■	■	■	■	■	
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic		■				
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery							
Marine Park Boundaries	Ongoing						
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
Size Management Areas and Permanent Closures							
375 Rule/Unitisation							
Gear development/changes	Ongoing	■	■	■	■	■	
Byproduct rules	Underway		■				
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Blue Swimmer Crab Fishery

Description and Scope of Fishery

Blue swimmer crabs (*Portunus pelagicus*) are found along the entire Western Australian coast, in a wide range of inshore and continental shelf areas, from the intertidal zone to at least 50 m in depth. They have been fished commercially in WA since at least the mid 70's and comprise the bulk of the state's commercial inshore crab catches. Crabbing activity in the North Coast Bioregion is centered largely on the inshore waters from Onslow through to Port Hedland, with most commercial and recreational activity occurring in and around the embayment of Nickol Bay. There are currently 2 commercial licence or exemption holders in the North Coast bioregion.

A significant level of research has been conducted on the biology, ecology and distribution of the blue swimmer crab since the early 1970's. A number of projects were instigated during 1997/98 with funding from FRDC under the umbrella of the national collaborative blue swimmer crab research initiative. This research included the basic biology of crabs along the WA coast, gear-catchability relationships, recreational catch surveys, commercial catch monitoring, discard mortality estimation and stock assessment modelling, and was completed in 2000/1. In addition, a three-year project to develop stock allocation and assessment techniques in WA blue swimmer crab fisheries, has been completed.

Current Research Focus

Data for the assessment of blue swimmer crab stocks in the North Coast Bioregion are obtained from fishers' compulsory catch and effort returns, voluntary daily log books and on-board catch monitoring conducted by Fisheries Research staff.

Priority Setting Process

Research priorities are set in consultation with management, and feedback obtained during meetings with industry (WAFIC, RecFishWest and RFAC) as required.

North Coast Blue Swimmer Crab

North Coast BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Blue swimmer crab biology	Completed						Many studies Completed
1.2 Other Biology							
Size at sexual maturity	Completed						
Release mortality	Completed						
Genetic structure of populations							
1.3 Stock Assessment							
Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■	■	

North Coast BSC Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Processor Returns							
Commercial Monitoring	Ongoing	■	■	■	■	■	once per year for the developmental crab fishery in the Pilbara
Recreational Catch and Effort	Periodic						Assessed as part of National rec. fishing program.
Stock & recruitment	Ongoing						
Dedicated logbook	Ongoing	■	■	■	■	■	
Heavy metal content of crabs							
2. Habitat & Ecosystem							
2.1 Bycatch	Not Needed						Low Risk
2.2 Listed Species	Not Needed						Low Risk
2.3 Habitat	Not needed						Low Risk
2.4 Ecosystem/Environment	Not Needed						Low Risk
2.5 Oceanography							
2.6 Other impacts on fishery	Not Needed						Low Risk
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Northern Demersal Scalefish Fishery

Description and Scope

The Northern Demersal Scalefish Managed Fishery (NDSF) operates off the north-west coast of Western Australia in the waters east of 120° E longitude. The permitted means of operation within the fishery include handline, dropline and fish traps. Commercial catches are dominated by tropical snappers, emperors and groupers (cods).

The NDSF is managed primarily through input controls in the form of annual fishing effort quotas, with supplementary gear controls and area closures. The annual effort quota is determined by dividing the notional target TAC by the average catch rates per vessel per day within the fishery and dividing this allocation equitably among vessels in the fishery.

Baseline research data on growth rates, age structure, reproductive biology and yield analyses, together with information gathered from the fishery, have been used within age-based stock assessment models to assess the status of the two key species, red emperor and goldband snapper.

Current Research Focus

Ongoing monitoring of this fishery is being undertaken using both CAES data and VMS records to determine the annual catch and catch rate for the total finfish catch and that of the indicator species – goldband and red emperor.

The third largest component of the NDSF catch is the cod/grouper group. Information currently available on their species composition and relative abundance is limited to CAES records. This gap in the knowledge of the NDSF represents an area of future research work, as does an improved understanding of the catchability of the key species in the fishery that would facilitate improved stock assessments and management arrangements.

Priority Setting Process

Initial assessments were made through internal departmental meetings and forums discussing the history of research in the fishery, research activities that have been completed, current research as well as research and development gaps. Research issues have been discussed at annual industry consultation meetings once a year. Additional research needs have also been highlighted throught the ESD assessment processs.

Northern Demersal Scalefish

NDSF Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Red Emperor	Competed						Sufficient for management
Goldband Snapper	Completed						Sufficient for management
Cod species	Developing	O	O	O	O	O	Project identified – High risk
1.2 Other Biology							Nothing identified
1.3 Stock Assessment							

NDSF Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Annual Catch and Effort Assessment	Ongoing	■	■	■	■	■	Ongoing
Age Structured Models (indicator species)	Periodic		■			■	Data collected every 3 yrs
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Age Structure of Indicator Species	Periodic		■			■	Every 3 years
Commercial Monitoring	Ongoing	■	■	■	■	■	
Recreational Creel	Periodic		O				Periodic every 5 years for IFM
Charter Boat Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Catchability		O	O	O			FRDC project
2. Habitat & Ecosystem							
2.1 Bycatch	Periodic		■		■		Low risk
2.2 Listed Species	Periodic		■		■		Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Developing	O	O	O	O	O	Indonesian impacts
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible		O				May be needed for IFM
Economic Analysis	Possible		O				May be needed for IFM
3.2 Resource Access (Shares)							
Detailed determination of access shares	Periodic			O			Needed for IFM
Monitoring of shares	Ongoing			O			Needed for IFM
3.3 Compliance							
Validation of Catch Records	Ongoing	O	O	O	O	O	Required for ESD assessment
3.4 Management Systems							
Management of Rec sector	Proposed			O			May be needed for IFM
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Kimberley Gillnet and Barramundi Fishery

Description and Scope of Fishery

The Kimberley Gillnet and Barramundi Managed Fishery (KGBF) extends from the WA/NT border to the top of Eighty Mile Beach, south of Broome. It includes the taking of any fish by gillnet in inshore waters and the taking of barramundi by any means.

The species taken are predominantly barramundi (*Lates calcarifer*), giant threadfin salmon (*Polydactylus macrochir*) and blue threadfin salmon (*Eleutheronema tetradactylum*). The main areas of the fishery are the river systems and tidal creek systems of the Cambridge Gulf, the Ria coast of the northern Kimberley, King Sound, Roebuck Bay and the top end of Eighty Mile Beach.

The KGBF is managed primarily through input controls in the form of limited entry, seasonal and spatial area closures and gear restrictions

Current Research Focus

A collaborative three-year FRDC-funded research project between Murdoch University and Department of Fisheries to study the biology of both the threadfin salmon species along with estuary cod, Malabar grouper and mangrove jack was completed in 2005. A detailed stock assessment of threadfin salmon in the KGBF will be undertaken when resources become available.

The bycatch of elasmobranchs in the KGBF and the Pilbara coast fishing area was examined during 2002 and 2003, as part of two FRDC-funded projects. Results from these studies are documented in the final report for FRDC project 2000/134.

Research data for monitoring this fishery are provided by Western Australian fishers' monthly returns. Research assessments (e.g. catch and effort trends) are provided to industry and regional management.

Priority Setting Process

Initial assessments were made through internal departmental meetings and forums discussing the history of research in the fishery, research activities that have been completed, current research as well as research and development gaps. Research issues have been discussed at annual industry consultation meetings once a year.

Kimberley Gillnet and Barramundi

Kimberley Gillnet and Barramundi Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Giant Threadfin Biology	Completed						Sufficient for management
Blue Threadfin Biology	Completed						Sufficient for management
Barramundi	Developing	O	O	O	O	O	Project identified – High risk
1.2 Other Biology							
Sawfish	Developing	O	O	O	O	O	Project identified – High risk

Kimberley Gillnet and Barramundi Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Pig Eye Shark	Developing	O	O	O	O	O	Project identified – High risk
Lemon Shark	Developing	O	O	O	O	O	Project identified – High risk
1.3 Stock Assessment							
Annual Catch and Effort Assessment	Ongoing	■	■	■	■	■	Ongoing
Age Structured Models (indicator species)	Developing	O	O	O	O	O	Being developed – national model
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Age Structure of Indicator Species	Developing	O	O	O	O	O	Periodic
Commercial Monitoring	Developing	O		O		O	Periodic
Recreational Creel	Periodic	O					Periodic
Charter Boat Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
2. Habitat & Ecosystem							
2.1 Bycatch	Periodic		■				Low risk- already completed
2.2 Listed Species	Developing	O	O	O	O	O	High risk – sawfish
2.3 Habitat	Not needed						Low risk – gillnet fishery
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible	O	O				May be needed for IFM
Economic Analysis	Possible	O	O				May be needed for IFM
3.2 Resource Access (Shares)							
Detailed determination of access shares	Periodic			O			Needed for IFM
Monitoring of shares	Ongoing			O			Needed for IFM
3.3 Compliance							
Validation of Catch Records	Ongoing	O	O	O	O	O	Required for ESD assessment
3.4 Management Systems							
Management of Rec sector	Proposed		O				May be needed for IFM
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - Northern Shark Fisheries

Description and Scope of Fishery

The northern shark fisheries comprise the state-managed WA North Coast Shark Fishery (WANCSF) in the Pilbara and western Kimberley and the Joint Authority Northern Shark Fishery (JANSF) in the eastern Kimberley. Until July 2005, when new management arrangements were agreed for the two fisheries, the primary fishing method was demersal longlining in the WANCSF with only a small and intermittent amount of pelagic gillnetting in the JANSF. The intent of the agreed management revisions was to reduce the total effort capacity of the fisheries and re-target fishing towards more productive blacktip whaler stocks in the Kimberley. However, as fishers have so far been reluctant or unable to reconfigure vessels for gillnetting, there has been negligible effort in the fisheries between 2005 and 2008. Formal resolution of management arrangements for these fisheries is still being negotiated by the Joint Authority (comprising the Western Australian and Commonwealth ministers). In 2008, the Wildlife Trade Operation (WTO) export approval for the JANSF was revoked by the Minister for the Environment, Water Heritage and the Arts. Due to the small number of authorised fishing vessels and as the principal method and target species has been and is intended to be common between the WANCSF and JANSF, data from these fisheries are generally combined and the two regions considered as a single fishery for reporting purposes.

Since 2005, the Department has become increasingly concerned about the status of the northern Australian blacktip shark species complex. These concerns primarily relate to uncertainties in the historical time-series of CPUE data (on which previous assessments have been based), assumptions in and the structure of the assessment model and recent research that suggests the species composition of this multi-species stock may have changed dramatically over the last three decades. Available data also suggest that several other northern shark stocks have been significantly impacted by a combination of: documented and undocumented catches in the domestic target-fisheries, foreign fishing vessel catches and a high level of under-reporting of historical catches by the Taiwanese-operated targeted shark fisheries that fished in the area between mid-1970s and the late-1980s. In addition, there remains considerable uncertainty in the actual levels of risk to the sustainability of mackerel stocks and to recoveries of Threatened, Endangered and Protected (TEP) species from a full-scale resumption of targeted northern shark fishing activities.

Research to monitor the status of northern shark stocks was initiated as an extension of the south and west coast shark research project. A three-year FRDC funded project, provided an age-structured demographic assessment of the status of the fisheries' principal historical target species, the sandbar (thickskin) shark and an improved general understanding of the fisheries and the biology of northern shark stocks. Additional information on these fisheries and those which, under new whole-of-State shark management provisions, will continue to be permitted to land sharks as bycatch on the north coast, was collected during a series of Department of Environment, Water, Heritage and the Arts and FRDC-funded research projects that began in 1999. Results from these projects have further improved our understanding of the sustainability risks of the various fishing sectors that exploit elasmobranchs across the northern half of Australia.

Current Research Focus

The resumption of fishing (and reassessment of the fisheries' ecological sustainability) in the northern shark fisheries is contingent on adequate funding for a comprehensive observer

program (notionally 30% of effort coverage) to evaluate bycatch issues (particularly associated with mackerel) and Threatened, Endangered and Protected (TEP) species interactions. Should fishing eventually resume, further research to estimate key biological parameters and rates of fishing mortality for a variety of species will be required as a high priority.

Priority Setting Process

Research priorities are generally identified through the annual stock assessment processes and periodic analyses of data from the fisheries. Alternatively, research priorities are identified by the Northern Science and Management Working Group, NAFM, fishery managers, the MAC (which has not met since 2006), and increasingly through external processes, eg. National Shark Recovery Group, EPBC approval, Marine Bioregional planning, NPOA, etc.

Northern Shark Fisheries

Northern Shark Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Sandbar shark	Completed						
1.2 Other Biology							
2^{ary} spp. reproduction	Ongoing	O					
2^{ary} spp. age and growth	Ongoing	O					
1.3 Stock Assessment							
Sandbar demographic analysis	Completed						
Blacktip age structured	Unreliable	O					Although a spatially and age specific assessment model was developed in 1997, outputs are considered unreliable
Elasmobranch Risk Assessment	Completed						
1.4 Fishery Monitoring							
CAES analyses	Completed - superseded by mandatory logbooks						
Daily logbook development & analysis	Ongoing	O					Logbook data validation issues have been identified but there are currently no resources to address these.
At sea observers	None	O					
Landing inspections	Ongoing but v. limited	O					
VMS	Cannot be implemented in the JANSF due to the fishery's lack of legal status	O					
DNA fingerprinting	Completed for some spp.	O					
2. Habitat & Ecosystem							

Northern Shark Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2.1 Bycatch							Dependant on resolution of new management objectives for these fisheries
Elasmobranchs	Comprehensive observer data for period 2000-2003. Further investigation will be subject to funding	O					Future requirements are dependant on resolution of new management objectives for these fisheries
Teleosts		O					Future requirements are dependant on resolution of new management objectives for these fisheries
2.2 Listed Species							
Grey nurse shark	Some work completed						
Sawfish	Subject to funding for research/ observer program	O					Some previous research and Caring For Country application pending
Dolphins		O					
Turtles		O					
2.3 Habitat							
2.4 Ecosystem/Environment							
Trophic effects	Requires investigation						
Ghost fishing							
2.5 Oceanography							
2.6 Other impacts on fishery							
Illegal, Unreported and Unregulated (IUU) fishing		O					Peak in Foreign Fishing Vessel (FFV) activities appears to have passed. However, no meaningful estimates of FFV impacts have yet been published.
Indigenous fishing		O					Requires investigation, NPOA and EPBC requirements
3. Management Analysis							
3.1 Socio-economic							
Dependence on fins	Ongoing	O					NPOA requirement
Mercury and other toxins	Dependent on funding	O					Requires investigation
3.2 Resource Access (Shares)							
Indigenous fishing	Requires investigation	O					NPOA requirement
3.3 Compliance							
Catch under-reporting		O					There is evidence of recent unreported fishing activity
Illegal, Unreported and Unregulated (IUU) fishing		O					There is evidence of recent unreported fishing activity

Northern Shark Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
3.4 Management Systems							
Pilbara closure		O					Requires further investigation and monitoring
Effort reduction & zoning		O					Requires further investigation and monitoring
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							
Full utilisation (dependence on fins)	Ongoing	O					NPOA requirement

North Coast - Pilbara Demersal Finfish Fishery

Description and Scope

There are two fisheries that make up the Pilbara Demersal Finfish Fishery; the Pilbara Fish Trawl Interim Managed Fishery (PFTIMF) and the Pilbara Trap Managed Fishery (PTMF). Together these fisheries operate within the waters north of latitude 21°35' S and between longitudes 114°9'36 E and 120° E.

The Pilbara region was initially trawled by the Japanese from 1959 to 1963 and then the Taiwanese from 1979 to 1989. The domestic trap fishery commenced in the early 1980s (Moran *et al.* 1988). The domestic demersal trawling operations began in 1989, with catches rapidly expanding up to 1996.

The majority of demersal finfish caught within this fishery are taken by the PFTIMF. The fish trawl fishery targets 10 main species, namely bluespot emperor, rosy threadfin bream, brownstripe snapper (previously flagfish), crimson snapper (previously red snapper), red emperor, saddletail snapper (previously scarlet perch), goldband snapper, spangled emperor, frypan snapper and Rankin cod. The trap fishery targets six of the above species listed (red emperor, goldband snapper, crimson snapper, saddletail snapper, spangled emperor, and Rankin cod). The trawl and trap fisheries are both managed primarily by the use of input controls in the form of individual transferable effort allocations monitored with a satellite-based vessel monitoring system.

Baseline research for managing these important fish stocks was conducted in two FRDC funded projects from 1993 to 1999, providing a basis for long-term research monitoring of the stocks.

Current Research Focus

The monitoring of the Pilbara now focuses on the collection of spatial data on effort and catch of the 10 major target species in the trawl and trap fisheries. Age composition data is collected for four indicator species annually on a rotational basis, one species each year. The four indicator species are red emperor, bluespot emperor, Rankin cod, and goldband snapper. Catch, effort and age composition data are used in an integrated stock assessment model at three to four yearly intervals to generate the level of spawning biomass remaining for the four key indicator species.

The catch of protected species has been a focus of research since 2002. Three projects on collecting baseline data (NHT project) and evaluating mitigation devices (FRDC and DBIF) being completed. In 2008 a project to analyse the behaviour of bottlenosed dolphins was completed (Endeavour Grant project) and a Murdoch University has commenced to look into gear modifications commenced in 2008.

An industry funded observer program commenced in 2004 in the trawl fishery to improve estimates of the quantity of bycatch, especially protected species. This observer programme will continue at a level of coverage of 22%.

Priority Setting Process

Annual industry/department meeting and internal risk assessment.

Pilbara Demersal

Pilbara Demersal Finfish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis	Pilbara red emperor						
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Red emperor	Completed						
goldband snapper	-						Gap
Rankin cod	Completed						
bluespot emperor	Completed						
Brownstripe snapper	Completed						
Rosy threadfin bream	Completed						
Crimson snapper	-						Not needed
Saddletail snapper	-						Not needed
Spangled emperor	Completed						
Frypan snapper	-						Not needed
1.2 Stable isotope analysis							
Red emperor /Rankin cod	Completed						
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	
Age Structured Models	Periodic	■					
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	
VMS	Ongoing	■	■	■	■	■	
Logbook+unload return (trawl)	Ongoing	■	■	■	■	■	
Age composition for -							
red emperor	Periodic			■			
goldband snapper	Periodic	■				■	
Rankin cod	Periodic		■				
bluespot emperor	Periodic	■			■		
Flagfish	Completed						
Rosy threadfin bream	Completed						
2. Habitat & Ecosystem							
2.1 Bycatch	Underway	■	■	■	■	■	
2.2 Listed Species							
Dolphins (moderate risk), turtles (low risk). Sygnathids (low risk), sea snakes (low risk), sea horses(low risk). Sawfish (moderate risk)	Underway						Observer programme with 22% coverage is continuing
Mitigation - acoustic pingers	Completed						Pingers were ineffective
- selection grids	Underway						Dolphin catch has halved since 2005
2.3 Habitat (low risk)							

Pilbara Demersal Finfish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Survival of benthos	Work Completed in 90s						Managed by restricting areas of operation.
2.4 Ecosystem/Environment							Low Risk
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						
Economic Analysis							
3.2 Resource Access (Shares)							
Determination of shares	Periodic						
Monitoring shares	Ongoing						
3.3 Compliance							
Validation of catch records	Ongoing	■	■	■	■	■	
3.4 Management Systems							
Trawl: effort monitored by VMS	Ongoing	■	■	■	■	■	
Trap: effort monitored by VMS	Ongoing	■	■	■	■	■	
Line: effort monitored by VMS	Gap						
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

North Coast - The Mackerel Fishery

Description and Scope

The Mackerel (Interim) Managed Fishery operates within three management sectors, Kimberley, Pilbara and Gascoyne/West Coast but the largest catches are taken in the North Coast Bioregion. The primary species is the Spanish mackerel (*Scomberomorus commerson*), which is fished commercially between Geraldton (in the Gascoyne/West Coast Sector) and the Northern Territory border (Kimberley Sector). Grey mackerel (*S. semifasciatus*) are targeted to a lesser extent in the Gascoyne and West Coast regions. The main method of fishing is trolling, while jigging methods are also used to catch grey mackerel. A number of new management controls were recently introduced by amendment to, or determination under, the Mackerel Fishery (Interim) Management Plan 2004. These controls include license restrictions, a total allowable commercial catch, and closed fishing seasons.

Two mackerel-related FRDC funded research projects were completed in 2002. These projects focused on narrow-banded Spanish mackerel and provided description of the biology, spatial structure and status of these stocks in WA waters, serving as a basis for management arrangements to control future catches from the fishery.

Sufficient data are not available for the assessment of stocks of the other mackerel species.

Current Research Focus

The fishery is currently monitored using the monthly CAES returns submitted by fishers. The spatial and temporal resolution of fisheries data was recently improved with implementation of a compulsory daily logbook in 2006. This will replace the monthly returns over the next two years and be the principal means of monitoring the fishery now that catch and effort has been constrained under the management plan.

Priority Setting Process

Priorities are reviewed on an annual basis through consultation between Scientists of the Finfish Branch (Research Division), Fishery Managers and at the Annual Mackerel Management meeting (February each year). This fishery is currently considered as moderate risk and reprioritisation of research resources may occur to other, higher-risk fisheries.

Mackerel

Mackerel Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Narrow barred Spanish mackerel	Completed						
Grey/other mackerel	Minimal						Insufficient for management
1.2 Other Biology							
Stock structure of Spanish mackerel	Completed						
Grey mackerel stock structure	Current	■					As part of a QLD based research project
Spanish mackerel biological/fishery	Current						

Mackerel Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■		New daily log books in 2006
Biomass Dynamics and Yield/Egg Per Recruit Modelling	Completed 1998						No planned update
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■		
Charter Boat C&E	Ongoing	■	■	■	■		
Recreational Creel Surveys	Periodic						1-2 years of data per region
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Nothing identified
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery							
Impact of losses due to shark-depredation	Possible						An issue in some areas
3. Management Analysis							
3.1 Socio-economic							
Effects of IMP	Possible	O	O				Assessment of Plan
3.2 Resource Access (Shares)							
Determination of access shares	Periodic						
Monitoring of shares	Possible						
Review of IMP	Upcoming	■	■				Current Plan ends 2009 and need review of data requirement and assessment of Plan; may be postponed
3.3 Compliance							
Monitoring of vessel activities	Ongoing	■	■	■			Using VMS
Quota compliance	Ongoing	■	■	■			
3.4 Management Systems							
Assessment of IMP	Proposed						How fits with IFM
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

SOUTH COAST BIOREGION

South Coast - Biodiversity Issues

Description and Scope of Issues

The inshore marine habitats of the south coast are largely unaffected by human activities, the exceptions being some estuaries and marine embayments (e.g. Princess Royal Harbour, Oyster Harbour and Wilson Inlet) where significant eutrophication associated with farming has occurred. Fishing methods which can impact on marine habitats are naturally restricted due to the relatively low productivity and abundance of species capable of trawl capture. A small, limited-entry scallop trawl fishery focused in the Esperance region is the only state-managed fishing activity which can have any significant physical interaction with the marine habitat.

Trawling in deep water off the edge of the continental shelf, is managed by the Australian Government. This area, particularly the western part of the Great Australian Bight, was subject to significant exploratory trawling by locally based and international vessels prior to the 1980s, but is only sporadically fished now. There is a coastal trawling closure of state waters along the western Bight sector, enacted under Australian Government fisheries legislation, to ensure deep-sea trawlers do not venture into sensitive coastal areas (South Coast Habitat Protection Figure 1).

Reef protected area closures cover the *Sanko Harvest* wreck site, the end of the old Esperance Jetty and the HMAS *Perth* wreck site

Current Research Focus

- The Marine Futures project habitat mapping and biodiversity sampling is being undertaken from present until mid-2008.
- Information on the status of introduced marine pest species (IMPs) on the south coast is being gathered at the ports of Albany and Esperance.
- Australian sea lion foraging ecology and gill net fishery interaction over the whole south coast region.

Priority Setting Process

No formal process in place.

South Coast Biodiversity Issues

South Coast Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
1.2 Other Biology							
1.3 Stock Assessment							
1.4 Fishery Monitoring							
2. Habitat & Ecosystem							
2.1 Bycatch							

South Coast Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2.2 Listed Species							
Seabirds							Study to mitigate seabird interactions with purse seine fishing. (see above)
Australian sea lions-foraging ecology and fishery interaction	Underway						Investigating interaction with demersal gillnetting-Probable EPBC requirement
2.3 Habitat							
Marine Futures	Ongoing						Habitat mapping and biodiversity sampling is currently being conducted by Marine Futures in the Esperance to Albany region. More habitat assessment and development of indicators will occur in WAMSI 4.2
2.4 Ecosystem/Environment							
Fish Kills	Ongoing	O	O	O	O	O	Gov't response to fish kills coordinated through Fisheries Research (Fish Health)
Introduced Marine Pests	Nearing completion						Currently funded by NHT. Likely that ongoing research will be required throughout the state
2.5 Oceanography							
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares							
Monitoring of shares							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

South Coast - Abalone Managed Fishery

Description and Scope

The Western Australian commercial abalone fishery is a dive fishery operating in shallow coastal waters along WA's western and southern coasts and is divided into eight management areas. The fishery targets three species: greenlip abalone, brownlip abalone and Roe's abalone, which are harvested by a single diver working off 'hookah' (surface supplied breathing apparatus) using a diving 'iron' to prise abalone off rocks.

There is an extensive amount of relevant and accurate information on the biology and stock status of these three abalone species. The sophisticated suite of management arrangements, including a number of proactive systems, have resulted in the maintenance of abalone stocks and a profitable fishery.

Current Research Focus

Current research focuses on stock assessment using catch and effort statistics, meat weight indices and, where available, length-frequency sampling to estimate fishing mortality. Growth studies of greenlip abalone were initiated in 2003 at three locations, and detailed morphometric data collected from fished stocks, are continuing. The FRDC project entitled 'Digital video techniques for assessing population size structure and habitat of greenlip and Roe's abalone', designed to test the use of underwater video for monitoring density and size structure of abalone stocks, was completed in 2007.

Both greenlip and roe's abalone now have a fishery independent stock-monitoring programme in significant areas of the fishery, and current research is focused on refining the fishery performance indicators, and examining the growth and survival of seeded greenlip abalone.

Due to increased catches of brownlip abalone (*Haliotis conicopora*), a growth experiment for this species is planned for in Windy Harbour in 2007 to assist in determining whether the increased catches are sustainable.

Priority Setting Process

Research priorities are set through annual industry-departmental meetings, AbMAC, and DEWHA assessments and recommendations for maintaining export licenses

South Coast Abalone

Sth Coast Abalone Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Roes Biology	Completed						Sufficient for management
Growth rate of Green Lip abalone – spatial, juveniles (hatchery)	Underway						
Early juvenile life history and habitat, natural mortality and predation	Completed						
Reproduction/Fecundity, spawning Periodicity	Completed						

Sth Coast Abalone Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Fish health and diagnostics	Ongoing	■	■	■	■	■	
Disease survey/atlas	Completed						
Brown Lip Growth	Proposed	O					
1.2 Other Biology							
Environmental effects on recruitment							
Genetics							
1.3 Stock Assessment							
Mapping of areas	Ongoing	■					
Fishing efficiency	Ongoing	■	■	■	■	■	
Population dynamics and harvest strategy assessment model	Ongoing	■	■	■	■	■	
Recreational Impact	Ongoing	■	■	■	■	■	
Yield and egg-per-recruit analysis for size limits	Periodic						
Stunted stock assessment and management	Underway	■	■	■	■	■	
1.4 Fishery Monitoring							
Catch statistics (wildstock)	Ongoing	■	■	■	■	■	
Commercial length frequency monitoring	Ongoing	■	■	■	■	■	
Research monitoring and recruitment sites	Ongoing	■	■	■	■	■	
Industry video monitoring sites	Underway	■	■				
2. Habitat & Ecosystem							
Oceanography/shelf – bathymetric survey							
Site survey/food availability/density							
Environmental assessment for export - DEH	Ongoing	■	■	■	■	■	
Remote sensing							
External Threats, pollution, bio-invasion, red tides, contaminants							
Abalone habitat assessment	Proposed	O					
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Public awareness / interest groups							
Biological training / scientific methods							
3.2 Resource Access (Shares)							
3.3 Compliance							

Sth Coast Abalone Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
3.4 Management Systems							
Abalone Health - Translocation/ protocol							
Abalone Health - Contingency plan							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							
Relocation of stocks							
Reseeding of stocks (experimental)	Underway	■	■	■			
Reseeding of stocks (commercial)							
Setting appropriate fishing size controls							
Diver safety/profiles							
Compliance assistance							
Historical record of industry development							
Timing of fishing							

South Coast - Crustacean Fisheries

Description and Scope of Fishery

The south coast crustacean fisheries cover a series of pot-based fisheries, which operate from Windy Harbour to the South Australian border. They include Windy Harbour/Augusta Rock Lobster Managed Fishery, the Esperance Rock Lobster Managed Fishery (ERLF), the rock lobster pot fishery (a Regulation fishery) operating in the Albany and Great Australian Bight (GAB) sectors, and the deep-sea crab fishery (a Section 43 Order fishery). The fisheries are multi-species and take southern rock lobsters and western rock lobsters as well as deep sea crab species including giant crabs, crystal crabs and champagne crabs.

Whilst this form of fishing has been operating since the late 1960s, for many years, only rock lobsters were targeted. It was not until the early 1990s when landings of crabs (champagne, giant and crystal crabs) began to appear in the commercial catch landing statistics for all four zones.

Compulsory catch and effort data, which are collected for the south coast crustacean fishery, have been used to model the southern rock lobster fishery (Melville-Smith and Wright (2001) in the Esperance Rock Lobster Managed Fishery. The WA southern rock lobster fishery occurs on the western edge of the distribution range and a large amount of published biological research is available on the species in South Australia, Victoria, Tasmania and New Zealand, where it is more common and supports large fisheries. The Windy Harbour/Augusta fishery is situated south of the main western rock lobster fishery, which has been extensively researched.

The FRDC has funded research on aspects of the giant crystal and champagne crab fisheries on the south coast.

Current Research Focus

Only compulsory commercial catch and effort returns and a few voluntary catch log books are obtained from these fisheries. Given the downturn in southern rock lobster landings (which are the mainstay of the fishery) in recent years, there is a need for basic biological research to be undertaken, as well as for a regular length frequency monitoring programme to be established.

Priority Setting Process

Internal Departmental Risk Assessment.

South Coast Crustacean

South Coast Crustacean Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Crystal crabs	Preliminary						Information on growth, movement patterns, size at maturity, are available for stocks on the west coast (probably similar on south coast)
Reproduction champagne crabs	Completed						

South Coast Crustacean Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Movement champagne crabs	Completed						Only some data
Movement giant crabs	Completed						
Reproduction giant crabs	Completed						
Growth data giant crabs	Completed						
Western rock lobster	Completed						
Southern Lobster genetic structure of the populations							Information is needed for management
Southern rock lobster biology							Information is needed on size at maturity, growth rates, movement patterns
1.2 Other Biology	nil						
1.3 Stock Assessment							
Annual assessment (rock lobster)	Ongoing	■	■	■	■		Rudimentary
Rock Lobster Model	Prelim. model						Requires updating
Crystal crabs	Preliminary						One-off survey funded by FRDC.
1.4 Fishery Monitoring							
Commercial catch and effort	Ongoing	■	■	■	■		
Processor returns	Ongoing	■	■	■	■		
Commercial length freq monitoring							At least some sampling is essential for future monitoring of stocks
2. Habitat & Ecosystem							
2.1 Bycatch	-						
Fin fish and sharks	Nil						Negligible risk
Octopus	Nil						Negligible risk
Spider crabs, hermit crabs starfish	Nil						Negligible risk
cuttlefish	Nil						Negligible risk
2.2 Listed Species							
Seals and sea lions	Monitoring	■	■	■			Low risk
Whales and dolphins	Nil						Negligible risk
2.3 Habitat	Nil						
2.4 Ecosystem/Environment							
Debris							Negligible risk
2.5 Oceanography							
2.6 Other impacts on fishery	Nil						
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)	Nil						
3.3 Compliance	Nil						
3.4 Management Systems	Nil						
4. Industry Development							
4.1 Production Technology	Nil						
4.2 Post Harvest	Nil						
4.3 Marketing	Nil						

South Coast - Trawl Fishery

Description and Scope of Fishery

The South Coast Trawl Fishery is located off the south coast of Western Australia. There are currently four fishing boat licenses that have licence conditions that allow them to operate in this fishery. The target species are scallops (*Amusium balloti*) and associated by-products, taken by twin-rig otter trawl.

During the mid 1980's, several small trawlers operating out of Esperance and Albany discovered beds of saucer scallops in south coastal waters. Scallop landings for the fishery have varied dramatically over the years, depending primarily on the strength of recruitment. While the fishery has theoretical access to a large section of the coastal waters, it is effectively restricted to small areas of higher scallop abundance.

The Australian Government Department of Environment and Heritage has assessed the fishery under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999,* and has conditionally granted a special exemption, allowing product from the fishery to be exported from Australia until August 2008. A draft management plan is currently being developed for this fishery as part of the conditions of exemption.

Research into the biological and environmental aspects of WA scallop stocks and commercial exploitation, has been carried out by the Department of Fisheries since the late 1960s.

Current Research Focus

Research monitoring of the scallop stocks in this fishery is currently undertaken utilising fishers' monthly returns data to monitor activities. However, the draft management plan for this fishery will stipulate the requirement to fill in compulsory daily logbooks which will assist in documentation spatial catch and effort data.

Some information on bycatch levels and composition will be required to meet the future requirements of the EPBC assessments although some limited information has been gained from a current NHT funded project.

Priority Setting Process

Initial assessments were made through internal departmental meetings in 1998 discussing research undertaken, current research and research and development gaps and a plan was drafted for five years. Additional research needs have also been highlighted throught the ESD Assessment processs.

South Coast Trawl

SC trawl Fishery Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Scallop biology	Completed						Completed in 1980's
1.2 Other Biology							
Recruitment dynamics	Possible						
Other fish species biology	Possible						
1.3 Stock Assessment							
C&E Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
CAES returns	Ongoing	■	■				
Daily logbooks	Future	■	■	■	■	■	Will be a requirement as part of new management plan (currently in draft)
2. Habitat & Ecosystem							
2.1 Bycatch							
Bycatch monitoring	Underway						NHT (MF) Funding for 07/08
2.2 Listed Species	Future	■	■	■	■	■	Any interactions will be listed in logbooks in the future – Low Risk
2.3 Habitat							
Establishing historical fishing grounds	Possible	O					Requires consultation with industry
Habitat mapping and videoing – sensitive habitats	Completed						Limited areas NHT (MF) Funding for 07/08
2.4 Ecosystem/Environment							
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

South Coast - Estuarine Managed Fishery

Description and Scope of Fishery

The South Coast Estuarine Fishery comprises the 13 estuaries and inlets, located between the Cape Beaufort and the WA/SA border that are open to commercial fishing. In practice, only 9 are fished. It is a multi-species fishery targeting many finfish species. The main target species are generally cobbler, King George whiting, sea mullet, Australian herring and black bream with the main fishing methods being gill net and haul net. Most estuaries are intermittently open to the sea. Therefore, recruitment by marine-spawned fish is determined by sand bar openings and water levels within each estuary, independent of estuarine fishing pressure. Cobbler and black bream are the only target species that are vulnerable to localised fishing pressure, being true estuarine species with discrete stocks in each estuary. Environmental factors are the main threat to fish stocks in these estuaries.

Recreational fishing occurs in each of the 25 major estuaries on the south coast, including those commercially fished.

The extensive knowledge of the fish stocks in these estuaries comes from research that has been conducted by the Department of Fisheries and Murdoch University Scientists since the 1970's. This knowledge is used to assist in the interpretation of data from monthly CAES returns provided by industry.

Current Research Focus

Annual assessment of the fish stocks in south coast estuaries is mainly based on CAES data and monitoring of juvenile recruitment for some species. A creel survey in 2002/3 and the National Rec. Fishing Survey are the only sources of recreational catch data. Levels of commercial fishing have been declining since 1992 as a result of voluntary buy-back of commercial access. Overall, fishery data is very limited for most south coast estuaries, making stock assessments difficult.

The Research Angler Program is being promoted to provide more data. Future sources of funding for this program are uncertain.

Annual fishery-independent monitoring of cobbler in Wilson Inlet commenced in 2007.

Priority Setting Process

Internal Departmental Risk Assessment.

South Coast Estuarine

South Coast Estuarine Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2011/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Black bream	Complete						Adequate for management
King George whiting	Complete						Adequate for management
Cobbler	Complete						Adequate for management
1.2 Other Biology							
1.3 Stock Assessment							
Annual C&E trends	Ongoing	■	■	■			CAES data
1.4 Fishery Monitoring							
CAES	Ongoing	■	■	■			
Commercial daily logbook	Developing	■	■	■			Draft trialled in 2006/07
Creel survey	Periodic						None Proposed in 5 y.
Recreational angler logbook	Ongoing	O	O	O			RAP
Fishing tournament & club records	Developing	O	O	O			RAP
Juvenile recruitment surveys	Ongoing	■	■	■			trapping & beach seining
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Nothing identified.
2.2 Listed Species	Not needed						Low risk
2.3 Habitat							
Benthic habitat quality	Possible						seagrass loss & hypoxia possible causes of recent cobbler decline in Wilson Inlet
2.4 Ecosystem/Environment							
Climate change, river flows & eutrophication	Possible						ecological flow requirements for estuaries are unclear. flow effects on bream reproduction & early life history may be major determinant of recruitment success.
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
Stock enhancement							Black bream
4. Industry Development							
4.1 Production Technology							Nothing identified
4.2 Post Harvest							Nothing identified
4.3 Marketing							Nothing identified

South Coast - Purse Seine Managed Fishery

Description and Scope of Fishery

The South Coast Purse Seine Managed Fishery consists of three primary management zones; the Albany Zone (of which the King George Sound zone is a subset), the Bremer Bay zone and the Esperance zone. The fishery is based on the capture of pilchards (*Sardinops sagax*) by purse seine nets in the waters off the south coast of WA between Cape Leeuwin and the WA/SA border. The management plan also covers the take of yellowtail scad (*Trachurus novaezelandiae*), Australian anchovy (*Engraulis australia*) and maray (*Etrumeus teres*).

Biological data on Australian pilchards was sparse, particularly for Western Australian populations (Fletcher 1990) prior to 1989. Plankton and gonad samples had been collected only sporadically in the south coastal region, and most of them were obtained in the 1940s (Blackburn 1950). During the 1990s an extensive programme of investigations into the growth, reproduction and population dynamics of pilchards was undertaken. The level of stock separation of pilchards along the coast was determined. Stock assessments were developed using age structured models and by using the fishery independent egg-production method which were used to set the annual Total Allowable Catches for pilchards along the south and west coasts.

The final major research activity was the investigations of the major pilchard mortality events that occurred in 1995 and 1998.

Current Research Focus

Research has focussed on fishery-independent spawning biomass surveys, which since 2000 have been completed as part of a six-year FRDC-funded project examining the regrowth of the pilchard stocks in WA. Depending on future management arrangements, these biomass surveys may not continue on a regular basis.

Monitoring of pilchard catches continues to be undertaken monthly to provide robust age-composition data, from which relative recruitment strengths can be inferred.

A second FRDC project to assess any future threat from viral disease was completed in 2006.

A survey of the bycatch of birds by the fishery has been undertaken by Murdoch University.

Priority Setting Process

Priorities are reviewed on an annual basis through consultation between Scientists of the Finfish Branch (Research Division) and Fishery Managers. This fishery is currently considered as low risk and reprioritisation of research resources is likely to occur, with resources allocated to other, higher-risk fisheries.

South Coast Purse Seine

South Coast Purse Seine Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Pilchard Biology	Completed						Many studies - sufficient
1.2 Other Biology							
Egg and larvae distribution	Completed						
Stock identification	Completed						Several studies - sufficient
1.3 Stock Assessment							
Annual Assessment	Ongoing	■	■	■	■		Relative recruitment strength
DEPM Estimates	Periodic		■				Every 3 years; may be phased out.
1.4 Fishery Monitoring							
Commercial Catch & Effort	Ongoing	■	■	■	■		
Age samples of pilchard catch	Ongoing	■	■	■	■		May be phased out.
2. Habitat & Ecosystem							
2.1 Bycatch (Low Risk)							
See 2.2							Medium risk, can involve listed species
2.2 Listed Species							Low risk
Some interactions with e.g. seabirds	Underway						Study by DFWA, Seanet, Murdoch Uni.
2.3 Habitat (Low Risk)							Low risk
2.4 Ecosystem/Environment							
Impact on Seabirds	Completed						Critical prey – studies by Murdoch Uni.
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■		Low priority
Productivity cycles	Completed						Assessment completed by UWA, DoF MU (SRFME)
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic	Not needed						
3.2 Resource Access (Shares)	Not needed						Commercial only fishery
3.3 Compliance	Not needed						
3.4 Management Systems				■			Low risk, but improvement required
4. Industry Development							
4.1 Production Technology	Not needed						
4.2 Post Harvest							
Product quality	ongoing						Industry initiatives
4.3 Marketing							
Value adding	ongoing						Industry initiatives for human consumption

South Coast - Temperate Demersal Gillnet and Longline Fisheries

Description and Scope of Fishery

The temperate demersal gillnet and longline fisheries comprise the state-managed West Coast Demersal Gillnet and Demersal Longline (interim managed) Fishery (WCDGDLF) and the Joint Authority Southern Demersal Gillnet and Demersal Longline Fishery (JASDGDLF), which is co-managed by the State and Commonwealth governments. The WCDGDLF extends from 26° 00' S in the north to 33° 00' S latitude in the south, however the use of demersal gillnets, longlines with metal snoods and powered reels is prohibited north of 26° 30' S latitude (Steep Point), effectively making this the fishery's northern boundary. The JASDGDLF is essentially divided into 2 zones. Zone 1 extends from 33° 00' S latitude to 116° 30' E longitude and Zone 2 from 116° 30' E to 129° 00' E longitude. Both fisheries are managed via limited entry, unitised input (effort) controls and gear-specification restrictions. The overwhelming majority of fishing effort (*ca*. 97%) is from demersal gillnets.

These fisheries target a variety of shark species but scalefish (teleosts) account for between 15 and 20% of total fishery landings. Target species vary by zone, with the primary targets being the sandbar shark (*Carcharhinus plumbeus*) in the WCDGDLF, dusky sharks (*Carcharhinus obscurus*) in Zone 1 and gummy sharks (*Mustelus antarcticus*) in Zone 2. The whiskery shark (*Furgaleus macki*) and school shark (*Galeorhinus galeus*) were also historically important target species of the fisheries. However, due to declines in their abundance caused by periods of overfishing by the JASDGDLF and the adjacent Commonwealth-managed South Eastern Scalefish and Shark Fishery, respectively, these are no longer actively targeted.

Major FRDC funded studies were undertaken on these four target stocks over the period 1993-2005. These studies have provided extensive information on the biology and stock status of these species.

Current Research Focus

Current research monitoring involves analysis of the CAES and logbook data and limited biological sampling of commercial catches.

Priority Setting Process

Research priorities are generally identified through the annual stock assessment processes and periodic analyses of data from the fisheries. Alternatively, research priorities are identified by fishery managers, the MAC (which has not met since 2006), the industry Association, WAFIC and increasingly through external processes, eg. National Shark Recovery Group, EPBC approval, Marine Bioregional planning, NPOA, etc.

Temperate Demersal Gillnet and Longline Fisheries

DGLL Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Gummy shark	Partially completed						Reproduction complete, age & growth incomplete

DGLL Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Whiskery shark	Completed						
Dusky shark	Completed						
Sandbar shark	Completed						
Wobbegongs	Completed						
Pencil	Completed						
1.2 Other Biology							
Other 2^{ary} spp. reproduction	Ongoing	O					
Other 2^{ary} spp. age and growth	Ongoing	O					
Grey nurse movements/habitat use	Partially completed						
1.3 Stock Assessment							
Gummy age structured	Completed	O					Model and age structure require updating
Whiskery age structured	Completed	O					Age structure requires updating
Dusky demographic analysis	Completed	O					Fishing mortality rates will require updating periodically
Sandbar demographic analysis	Completed	O					Fishing mortality rates will require updating periodically
1.4 Fishery Monitoring							
CAES analyses	Completed						Superseded by daily logbooks
Daily logbook development & analysis	Ongoing	O					Logbook data validation issues have been identified but there are currently no resources to address these.
At sea observers	Ongoing but v. limited	O					
VMS	Partially completed	O					All vessels (>6.5m) are currently fitted with ALCs. VMS will be used to acquit effort entitlements from 2009-10 onwards.
DNA fingerprinting	Completed for some spp.	O					
2. Habitat & Ecosystem							
2.1 Bycatch							
Elasmobranchs	Comprehensive observer data for period 1994-1999						Requires periodic re-investigation
Teleosts	Comprehensive observer data for period 1994-1999						Requires periodic re-investigation
2.2 Listed Species							
Grey nurse shark	Some work completed						
White shark	Some work completed and underway	■					
Pinnipeds	Limited observer data						Emerging management risk via NPOA (pinnipeds) and EPBC assessment

DGLL Fishery Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Dolphins	Limited observer data						
Turtles	Limited observer data						
2.3 Habitat							
2.4 Ecosystem/Environment							
Trophic effects	Require investigation						
Ghost fishing							
2.5 Oceanography							
2.6 Other impacts on fishery							
Catch by Commonwealth Fisheries	Ongoing	■					
Bycatch in Commonwealth Fisheries	Partly completed for SWTBF						
Illegal, Unreported and Unregulated (IUU) fishing	Ongoing	O					
Recreational fishing	Requires investigation						NPOA and EPBC approval requirement
Indigenous fishing	Requires investigation						NPOA and EPBC approval requirement
3. Management Analysis							
3.1 Socio-economic							
Mercury and other toxins	Requires investigation						
3.2 Resource Access (Shares)							
Indigenous fishing	Requires investigation						NPOA and EPBC approval requirement
IFM teleost spp.	Requires further investigation						NPOA and EPBC approval requirement
Areas of conflict with rec. fishers	Requires investigation						NPOA and EPBC approval requirement
3.3 Compliance							
Dusky shark max. size	Ongoing	O					
Gear prohibitions/restrictions	Ongoing	O					
Time gear unit usage	Ongoing	O					
Seasonal closure	Ongoing	O					
3.4 Management Systems							
Dusky shark max. size	Ongoing	O					
Gear prohibitions/restrictions	Ongoing	O					
Time gear unit usage	Ongoing	O					
Seasonal closure	Ongoing	O					
Catch and effort triggers	Ongoing	O	O	O	O	O	EPBC approval requirement
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

South Coast - Australian Herring Fishery

Description and Scope of Fishery

The Australian Herring Fishery operates along the lower west coasts and south coasts of Western Australia. Herring can be taken commercially, by holders of an unrestricted fishing boat licence throughout their range of distribution. Fishing is primarily undertaken by herring trap nets (know as 'G' trap nets) on south coast beaches, by seine nets on west coast beaches and by 'wetline' vessels and other licensed fishers on both the south and west coasts.

Australian herring were first fished commercially in the 1940's. Research into the biological and environmental aspects of WA herring has been carried out over a long time period, including a large FRDC-funding project between 1996 and 1999. A stock assessment model for this fishery was developed using all available research data and CAES information from Western Australia and South Australia, however final validation and testing of this model is still needed. West and south coast herring populations were modelled as a single stock but there is now uncertainty about their connectivity. An FRDC project in the 1990s developed an index of juvenile recruitment for Australian herring, which is now used to predict herring catches.

Current Research Focus

The status of the Australian herring stock is assessed using CAES data, recreational logbook data and annual juvenile recruitment. The age-structured spatial model developed for this fishery has insufficient data available to be run successfully. A simpler model needs to be developed to utilise the limited fishery data currently accessible. Age structure of rec. fishery is being sampled as input for model. Representative sampling of age structure in all sectors will commence in 2009 and nursery signatures in otoliths will be examined to better determine sources of recruitment to each region (subject to FRDC funding).

Priority Setting Process

Internal Departmental Risk Assessment.

Australian Herring

Aust. Herring Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Australian herring	Complete						
1.2 Other Biology							
Recruitment dynamics	Developing		O	O	O		identify nursery signatures in otoliths (subject to FRDC application)
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■	■		
Age-based model (herring)	Developing	■	O	O	O		Otoliths being collected (west coast only). Review & expand otolith collections, develop ongoing monitoring (subject to FRDC application). Update existing model.
1.4 Fishery Monitoring							
CAES	Ongoing	■	■	■	■		
Creel survey	Periodic						Need boat & shore-based data from west & south coasts
Angler daily logbook	Ongoing	■	O	O	O		Research Angler Program “RAP”
Juvenile recruitment index	Underway	■	■	■	■		
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Low risk
2.5 Oceanography							
Leeuwin current monitoring	Ongoing						Qualitative use of data
2.6 Other impacts on fishery	Not needed						Low risk
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

South Coast - Western Australian Salmon Managed Fishery

Description and Scope

The WA Salmon Managed Fisheries comprises two salmon fisheries, the South Coast Salmon (SCS) and the South West Coast Salmon (SWCS) managed fisheries. The target species in these fisheries is the Western Australian salmon and catch is taken by beach seining along the exposed coastline and as a byproduct of commercial gill netting activities in shark and estuarine fisheries. In Western Australia, the salmon fishery was first established in the Hopetoun area, in the 1930's. There is a substantial level of historical biological and catch data available on this fishery. This includes factory sampling and logbook information back to the 1970s.

The two managed salmon fisheries are controlled through limited entry and spatial and gear restrictions. On the south coast the fishers are restricted to designated beaches, on the west coast the fishers can fish at any of a number of beaches. There is also a very strong recreational fishery on this species in both regions.

Current Research Focus

The main information used to monitor this important commercial and recreational stock is obtained from compulsory monthly commercial fishing returns and fishery-independent surveys of annual recruitment. These are analysed in conjunction with the substantial level of historical biological research information available.

Two FRDC projects have been completed, using different methods to assist in prediction of future Australian salmon catches. The recruitment index showed a good correlation with commercial catch rates 3–4 years later. Annual sampling (beach-seining) of juveniles recommenced in 2005 using methods developed in the FRDC projects,

Priority Setting Process

Internal Departmental Risk Assessment.

WA Salmon

SW and SC Salmon Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Australian salmon	Complete						
1.2 Other Biology	Not needed						
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■			
1.4 Fishery Monitoring							
Voluntary commercial logbooks	Ongoing	■	■	■			
Age structure	Proposed	O	O				ESD requirement. Logistically difficult due to low & infrequent catches
Observer program	Underway	■	■				ESD requirement. Logistically difficult due to low & infrequent catches
Creel survey	Periodic						Need shore-based data from west & south coasts. None Proposed in 5 y.
Recreational angler logbooks	Underway	■	O	O	O		Research Angler Program “RAP”
Juvenile recruitment index	Underway	■	■	■	■		
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk.
2.2 Listed Species	Not needed						Low risk.
2.3 Habitat	Not needed						Low risk.
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography							
Leeuwin current monitoring	Ongoing						Qualitative use of data
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (Shares)							
3.3 Compliance							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

NORTHERN INLAND BIOREGION

Northern Inland - Lake Argyle Freshwater Catfish

Description and Scope of Fishery

The only commercial freshwater fishery in Western Australia is contained in the impounded waters of the Ord River at Lake Argyle in the north-eastern Kimberley. This gillnet fishery specifically targets the shovel-nosed catfish or silver cobbler.

Data for assessing the status of the freshwater catfish stock in Lake Argyle are derived from the catch and effort returns provided by industry. These data are compiled annually and used as the basis for this assessment. Biological data on the species' specialised reproductive behavior and low fecundity are used to interpret these assessments.

Current Research Focus

The catch and effort data provided by industry are used to develop stock assessment models for the fishery, however the modeling approach used in the assessment of the fishery requires a number of assumptions, which creates a high degree of uncertainty around the results generated from the models. The only way to reduce this uncertainty is to allocate more resources to the gathering of the necessary data from the fishery, and to gain an understanding of some key characteristics of both the fishery and the biology of the species.

Priority Setting Process

Initial assessments were made through internal departmental meetings and forums discussing the history of research in the fishery, research activities that have been completed, current research as well as research and development gaps. Research issues have been discussed at annual industry consultation meetings once a year.

Lake Argyle Silver Cobbler

Lake Argyle Silver Cobbler Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Silver Cobbler	Developing	O	O	O	O	O	Project identified
1.2 Other Biology							
1.3 Stock Assessment	Developing	O	O	O	O	O	Project identified
Annual Catch and Effort Assessment	Ongoing	■	■	■	■	■	Ongoing
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Commercial Monitoring	Proposed		O			O	Proposed every 3 years
Charter Boat Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
2. Habitat & Ecosystem							
2.1 Bycatch	Developing	O	O			O	Low risk
2.2 Listed Species	Developing	O	O	O	O	O	High risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						Low risk
Economic Analysis	Possible						Low risk
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						Nothing identified
Monitoring of shares	Not needed						Nothing identified
3.3 Compliance							
Validation of Catch Records	Not needed						Low risk
3.4 Management Systems							
Management of Rec sector	Not needed						Low risk
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

SOUTHERN INLAND BIOREGION

Southern Inland - Biodiversity Issues

Description and Scope of Issues

This region contains the state's only natural permanent freshwater rivers, which are fed by rainfall through winter and spring. These permanent rivers are restricted to the high-rainfall south-west corner of the state and flow through the significant native forest areas. Some of the rivers are more saline in their upper reaches owing to the effects of agricultural clearing of native vegetation in more inland areas.

The southwest region of Western Australia is recognised by Conservation International as one of 34 global biodiversity hotspots. The rivers of the southwest have the largest percentage of native endemic fish species (80%) and crustacean species (100%) in Australia. As result they have been recognised by WWF as one of the Earth's 53 most biologically outstanding freshwater habitats. Significantly, the southwest rivers and streams in Australia are also one of 28 freshwater habitats identified by WWF as a Global Ecoregion that is considered to have a conservation status of critical or endangered.

The conservation of the 13 species of freshwater native fish which exist in Western Australia is a growing issue for the Department of Fisheries. Some of these species are endemic to Western Australia, and therefore their survival depends on proper environmental management. Most of these fish are under pressure because of deteriorating environmental conditions. Therefore the Department of Fisheries is working with other agencies and institutions to undertake research on the distribution and life history of these animals to obtain the information required to protect them. Further, the Department has an approval process in place for assessing proposals to translocate fish into and within Western Australia, to minimise the risks associated with movement of fish which may impact on endemic species.

Current Research Focus

The identification of the 'hairy' marron in the Margaret River catchment as a separate species or sub-species has focused attention on the decline of this stock. Specific management actions to recover this unique stock and remove competing 'smooth' marron species from the catchment are underway.

A captive breeding program to support this initiative has also been implemented at the Department's Pemberton Freshwater Research Centre and the Aquaculture & Native Fish Breeding Laboratory at Shenton Park. The key species in this program are the critically endangered Western trout minnow (*Galaxias truttaceus hesperius*), Margaret river hairy marron (*Cherax cainii*) and Balston's pygmy perch (*Nannatherina balstoni*) which is listed as vulnerable to extinction. In addition several species such as Mud minnow (*Galaxiella munda*) and Black-stripe minnow (*Galaxiella nigrostriata*) offer potential for restocking waterways as although not yet listed as critically endangered they have severely restricted and fragmented distributions due to widespread habitat degradation.

Priority Setting Process

Research priorities for this program are developed through consultation with freshwater fisheries managers, university research groups and natural resource managers.

Southern Inland Biodiversity Issues

Southern Inland Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Broodstock collection, reproduction, larval rearing and nutrition	Ongoing	■	■	■	■		Develop broodstock collection, genetic fingerprinting, husbandry practices and breeding protocols to enable the large scale production of endangered species to prevent their extinction by restocking natural and artificial wetlands
1.2 Other Biology							
Restocking artificial wetlands	Ongoing	O	■	■	■		Replacement of gambusia with native fish for mosquito control as an alternative to chemical spraying
Restocking natural wetlands	Ongoing	O	■	■	■		Restocking critically endangered native fish to prevent extinction
1.3 Stock Assessment							
Native fish distribution	Ongoing	■	■	■	■		Identification of species of conservation concern
	Ongoing	■	■	■	■		Development of GIS database for native fish distribution & decline
1.4 Fishery Monitoring							
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
Critically endangered species	Ongoing	■	■	■	■	■	Restocking of species listed as critically endangered to prevent extinction
2.3 Habitat							
2.4 Ecosystem/Environment							
Environmental monitoring	Ongoing	■	■	■	■	■	Investigation of environmental factors affecting decline in native fish stocks
Fish Kills	Ongoing	■	■	■	■	■	Gov't response to fish kills coordinated through Fisheries Research (Fish Health)
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Ongoing	■	■	■	■	■	Involving community & school groups in native fish conservation and restocking programs
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares							

Southern Inland Biodiversity Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Monitoring of shares							
3.3 Compliance							
Validation of Catch Records							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology	None						
Large scale production techniques	Ongoing	■	■	■	■	■	Development of large scale production technology for native fish species to enable successful restocking programs to be implemented
4.2 Post Harvest	None						
4.3 Marketing	None						
Native Fish Strategy	About to start	■					Development database distribution freshwater fish through research permits

Southern Inland - Marron Aquaculture Research Plan

Description and Scope

The majority of marron (*Cherax tenuimanus)* farming occurs in purpose-built earthen ponds. Marron farms extend from Esperance to Hutt River, north of Geraldton, however the bulk of farms are concentrated in the higher-rainfall south-west coastal areas. Potential exists to expand production by the utilisation of irrigation dam water in transit to agricultural farms on the south-west coastal plain. There are around 180 licenced marron farms in WA.

The marron farming industry developed from research commenced by the Department of Fisheries in the 1970's. The Department developed techniques to breed, feed and grow marron at PFRC (Pemberton Freshwater Research Centre) and transferred this technology to industry in the late 1980's. More recently, from 2000-05 Department researchers used selective breeding to increase the growth rate of marron and developed improvements in husbandry and farm management strategies.

A significant number of marron farms have been developed and they currently represent the majority of aquaculture licences in WA. This should progressively contribute to expansion in state production. However, while some farmers have recognised the need for better broodstock management and feeding practices, production gains may not be evident at some farms unless improved farm design and production strategies developed by the Department of Fisheries are implemented.

Current Research Objectives

- Selective breeding to improve production and transferring these domesticated genetic lines to industry for commercialisation
- Transfer to industry improved management strategies and farm designs developed by Department researchers.
- Captive breeding of and restocking of critically endangered Margaret River marron
- Production of repository stocks to preserve key genetic lines

Priority Setting Process

Research priorities for this program were initially developed through annual research seminars from 1999 – 2007 involving licensed farmers and industry association members. In addition, national freshwater crayfish research priorities were identified at workshops co-ordinated by Department of Fisheries researchers at bi-annual conferences. Since 2007 research effort in this program has been reduced and a strategic approach implemented to address industry priorities as they arise.

Marron Farming

Marron Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Growth	Ongoing	■	■	■	■	■	Monitoring of genetic improvement

Marron Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Reproduction	Ongoing	■	■				There appears to be variation in reproduction variation among some river lines
Diet	Future		O				Basic diet developed, but nutritional requirements are still unknown
Genetic improvement	Ongoing	■	■	■	■		Major selective breeding project Complete, low level selection continuing with repository stocks
1.2 Other Biology							
Reproduction (Margaret River marron)	Underway	■	■	■	■	■	Margaret river marron Captive breeding program (to new Biodiversity program)
Stock enhancement (Margaret River marron)	Future			■	■	■	Margaret river marron (to new Biodiversity program)
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
1.3 Stock Assessment	Not Needed						
1.4 Fishery Monitoring	Not Needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not Needed						
2.2 Listed Species							
Margaret river marron	Underway	■	■	■	■	■	Captive Breeding program for recovery of Margaret river marron (to new Biodiversity program)
2.3 Habitat	Not Needed						
2.4 Ecosystem/Environment	Not Needed						
2.5 Oceanography	Not Needed						
2.6 Other impacts on fishery	Not Needed						
3. Management Analysis							
3.1 Socio-economic							
Economic evaluation	Complete						Completed in 2000-05 on commercial farms
3.2 Resource Access (Shares)	Not Needed						
3.3 Compliance	Not Needed						
3.4 Management Systems	Not Needed						
4. Industry Development							
4.1 Production Technology							
Production technology	Complete						Developed in 1980's, validated in 2000-05 FRDC project
4.2 Post Harvest							
Post harvest handling	Future		O				11% mortality in purging systems requires investigation
4.3 Marketing	Not Needed						

Southern Inland - Native & Non-Native Ornamental Fish Aquaculture Research Plan

Description and Scope of Sector

A wide range of both native and non-native ornamental fish species are produced in Western Australia. Most ornamental fish are farmed in ponds, although smaller operations may use aquaria to breed and rear juveniles, particularly for high value species. While many ornamental producers are relatively small-scale operations, there are several large commercial farms in WA. Production of ornamentals occurs throughout the state, but is mainly focused in metropolitan areas adjacent to the main markets. There are around 25 licensed ornamental fish farms in WA. Aquaculture production of ornamental fish in Western Australia is not sufficient to meet demand from local aquarists and as a result the majority of non-native ornamental fish sold in Australia are imported.

Techniques for farming non-native ornamentals, such as goldfish and koi, are well established overseas. This research has been adapted to farm non-native ornamental species in Western Australia. The Department of Fisheries has not conducted research on any non-native ornamental species. In 2003/04 Department of Fisheries researchers provided expertise to assist University of Western Australia colleagues in a pilot program to develop improved stocks of koi for export based upon selective breeding of local genetic lines. This program received offers of collaboration from universities in South Africa and Scotland, however funding from WA to continue this project was not available.

In comparison to non-native ornamentals, little is known about native ornamental species. The Department of Fisheries has conducted small scale holding of south-west native fish at PFRC since the early 1990's. Recently the Department of Fisheries established a captive breeding program at PFRC in 2005 to develop production techniques for pygmy perch, a species native to the south-west of WA. This species offers potential not only as an ornamental fish but also for stocking wetlands and lakes for mosquito control. In addition the department provides technical support to producers of a high value export species, ornamental blue marron.

Current Research Objectives

- Production techniques for pygmy perch for restocking waterbodies and replacement of Gambusia for mosquito control

Priority Setting Process

Research priorities for this program are developed consultation with major ornamental fish producers. They involve a strategic approach to address industry problems as they arise. Discussions with industry have resulted in the establishment of a marketing co-operative for the production of ornamental blue marron. This should assist in developing a more formal annual priority-setting process for native ornamental species in the near future.

Ornamental Fish Farming

Ornamental Fish Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Introduced Ornamental fish							
Growth	Completed						
Reproduction	Completed						
Diet	Completed						
Native Ornamental fish							
- Growth	Ongoing	■	■	■	■	■	Production for restocking waterbodies & replacement of Gambusia for mosquito control (to new Biodiversity program)
- Reproduction	Ongoing	■	■	■	■	■	Production for restocking waterbodies & replacement of Gambusia for mosquito control (to new Biodiversity program)
- Diet	Possible		O				Diet evaluation for native species
1.2 Other Biology							
Introduced Ornamental fish							
Improved varieties	Possible		O	O	O	O	Improved stocks for export based upon local genetic & specific pathogen free lines
Native Ornamental fish							
1.3 Stock Assessment	Not needed						
1.4 Fishery Monitoring	Not needed						
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						
2.2 Listed Species	Ongoing	■	■	■	■	■	Captive breeding program for critically endangered fish species has now transferred to new Biodiversity program
2.3 Habitat	Not needed						
2.4 Ecosystem/Environment	Not needed						
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Introduced Ornamental fish	Possible		O				Economic value of industry
Native Ornamental fish	Possible		O				Economic value of industry
3.2 Resource Access (Shares)	Not needed						

Ornamental Fish Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
3.3 Compliance	Possible		O				Differentiate between wild caught and farmed
3.4 Management Systems	Not needed						
4. Industry Development							
4.1 Production Technology							
Introduced Ornamental fish	Possible	O	O	O	O		Hormonal control of reproduction
Native Ornamental fish	Possible			O	O		Induced spawning protocols
4.2 Post Harvest							
Introduced Ornamental fish	Possible			O			
Native Ornamental fish	Possible			O			
4.3 Marketing							
Introduced Ornamental fish	Possible			O			
Native Ornamental fish	Possible		O				Export marketing co-operative

Southern Inland - Recreational Freshwater Angling

Description and Scope of Issues

The south-west recreational freshwater fishery is focused primarily on angling for rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) which are the subject of an annual controlled stocking program by the Department of Fisheries. In addition, anglers take the native freshwater cobbler (*Tandanus bostocki*) and an exotic species redfin perch (*Perca fluviatilis*). Redfin perch was previously released in the south-west and now occurs as self-breeding populations in most water bodies. Licensed anglers may only use a single rod, reel and line or single handline when targeting these species. Access to this fishery is controlled by license, seasonal closures, minimum sizes, and bag limits. People under 16 years of age are not required to hold a license to go freshwater angling.

The extent and success of the freshwater angling fishery in the south-west is dependent mainly upon availability of high-quality fresh waters for stocking. The degraded nature (e.g. increased salinity) of many freshwater streams and rivers coupled with the effect of climate change (e.g. reduced flow and water levels) has a strong negative effect on the future of recreational fishing. The availability of water is dependent on rainfall and access to irrigation dams. Thus low rainfall and reduced access to permanent water bodies are having a negative influence on the freshwater angling fishery.

Current Research Focus

- development of logbook program and integration in the RAP program
- securing external funding to study the interaction between native fish and stocked trout

Priority Setting Process

Freshwater Angling research priorities are developed in consultation with the Recreational Freshwater Fisheries Stakeholder Subcomittee.

Recreational Freshwater Angling

Southern Inland recreational Fisheries Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Trout: Growth, Mortality	needed						Limited information of wild stock; tagging program?
Trout: Reproduction	needed						Determine location and success of self sustaining populations
Trout: diet	ongoing						data collected as part of FRDC 2003/027; co-operation with Murdoch University
Redfin (growth, diet, mortality)	completed						Several publications available; additional data collected as part of FRDC 2003/027

Southern Inland recreational Fisheries Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Freshwater Cobbler (growth, diet, mortality)	completed						Several publications available; additional data collected as part of FRDC 2003/027; focus of several research projects by Murdoch University
1.2 Other Biology							
1.3 Stock Assessment							
Annual Assessment	none						
1.4 Fishery Monitoring							
Phone survey	ongoing	■	■	■	■		
Logbook survey	ongoing						Trial logbook program
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Nothing identified
2.2 Listed Species	needed						Urgent need to determine interaction stocked trout and (protected) native fish species
2.3 Habitat	Not needed						Nothing identified
2.4 Ecosystem/Environment							
2.5 Oceanography	N/A						N/A
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	needed						Determine off-set lose of dams by Water Corporation
Economic Analysis	needed						Determine off-set lose of dams by Water Corporation
3.2 Resource Access (Shares)							
Detailed determination of access shares	N/A						
Monitoring of shares	N/A						
3.3 Compliance							
Validation of Catch Records	None						
3.4 Management Systems	None						
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

Southern Inland - Recreational Marron Fishery

Description and Scope of Issues

Marron are endemic to Western Australia and are the third largest crayfish in the world. Recreational fishing occurs in freshwater dams and rivers throughout the southern part of the State extending from as far north as Geraldton to Esperance in the east. This fishery is managed through input controls of licences, closed seasons and gear restrictions, and the output controls of size and bag limits. A Ministerial Review of the fishery in late 2002, aimed at ensuring the long-term sustainability of the stocks, resulted in changes in the management arrangements for the 2003 season, most notably the reduction of the fishing season from 55 days to 16 days. The reduced length of the fishing season (16 days) was maintained in the 2006 and 2007 season but in slightly increase (23 days) in the 2008 season.

The main external factors which affect the marron fishery are degradation of freshwater habitat, winter rainfall, access to dams, and introduced species. Degradation of freshwater habitat (mainly salinisation in the upper reaches of catchments) has significantly reduced the natural range of marron. Winter rainfall plays a major role in marron reproduction, growth and survival. Rainfall increases the quality of areas for marron by transporting leaf-litter into streams (providing food sources for marron growth and reproduction) and by maintaining water volume and quality. It may also affect the ease with which fishers can access the water bodies, reducing pre-season illegal fishing. Another major issue in this fishery is access to irrigation dams. The Department of Fisheries is working closely with the Water Corporation to ensure the refurbished and refilled dams will provide a high-quality marron fishery by installing refuges, adding marron and controlling introduced species. The installation of large scale-artificial habitats will be trailed in Drakesbrook Dam in 2008. The trials in Waroona Dam showed that the artificial habitat (rock wall) provide an important refuge for juvenile marron. Introduced species that impact on the marron fishery either through predation or competition for similar resource are redfin perch (*Perca fluviatilis*), trout (*Oncorhynchus mykiss* and *Salmo trutta*) and yabbies (*Cherax albidus*).

Current Research Focus

- improvement annual stock assessment
- development long-term tagging program
- trial large-scale artificial habitat to improve production and fishery in dams
- improvement logbook survey

Priority Setting Process

Marron research priorities are developed in consultation with the Recreational Freshwater Fisheries Stakeholder Subcomittee.

Recreational Marron Fishery

Southern Inland recreational Fisheries Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reprod., diet, nat. mortality)							
Growth	ongoing	■	■	■	■	■	Limited data on growth in field, need for long-term tagging program; some data collected as part of FRDC 2003/027
Reproduction	ongoing	■	■	■	■	■	Size-at-maturity and fecundity data collected as part of FRDC 2003/027; sampling more catchments; size-at-maturity highly variable.
Diet	partly						Some publications available
Mortality	ongoing						data collected as part of FRDC 2003/027; need for long-term tagging program
1.2 Other Biology							
1.3 Stock Assessment							
Annual Assessment	ongoing	■	■	■	■	■	2006 introduction new sampling program using traps
1.4 Fishery Monitoring							
Phone survey	ongoing	■	■	■	■	■	
Logbook survey	Under review						continuation and/or integration with RAP program currently under review
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Nothing identified
2.2 Listed Species	Not needed						Nothing identified
2.3 Habitat	Not needed						Nothing identified
2.4 Ecosystem/Environment							
2.5 Oceanography	N/A						N/A
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	None						
Economic Analysis	None						
3.2 Resource Access (Shares)							
Detailed determination of access shares	None						
Monitoring of shares	None						
3.3 Compliance							
Validation of Catch Records	None						
3.4 Management Systems	None						
4. Industry Development							
4.1 Production Technology	None						
4.2 Post Harvest	None						
4.3 Marketing	None						

Southern Inland - Silver Perch Aquaculture Research Plan

Description and Scope of Fishery

Silver perch (*Bidyanus bidyanus*) is an introduced freshwater fish species from the Murray–Darling region. In Western Australia they are farmed in purpose-built earthen ponds equipped with aeration, water supply and a drain to facilitate harvesting. Silver perch production has increased rapidly over the past few years, mainly due to improved hatchery supply of juveniles. There are around 12 licensed silver perch farms in WA.

Techniques for breeding, feeding and farming silver perch were developed by researchers in New South Wales in the late 1980's. In the early 1990's Department of Fisheries researchers in Western Australia developed extension material to facilitate the adoption of this technology by local farmers. In the mid 1990's failure by industry in WA to breed silver perch led to Department of Fisheries breeding silver perch to confirm the protocols developed by NSW Fisheries researchers. In 2003 and 2004, due to continued difficulties by farmers in WA to breed silver perch, Department of Fisheries researchers bred silver perch on a commercial farm to demonstrate spawning techniques to industry.

Current Research Objectives

None apart from providing some advice

Priority Setting Process

Research priorities for this program are developed through consultation with key silver perch producers and involve a strategic approach to address industry problems as they arise.

Silver Perch Farming

Silver Perch Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Growth	Completed						Completed in NSW
Reproduction	Completed						Completed in NSW
Diet	Completed						Completed in NSW
1.2 Other Biology							
Reproduction in WA	Ongoing	■	■	■	■	■	Trouble shooting/problem solving for industry hatcheries to prevent spawning failures.
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
1.3 Stock Assessment	Not needed						
1.4 Fishery Monitoring	Not needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						
	Not needed						

Silver Perch Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
2.2 Listed Species							
2.3 Habitat	Not needed						
2.4 Ecosystem/Environment	Not needed						
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic	Possible						
3.2 Resource Access (Shares)	Not needed						
3.3 Compliance	Not needed						
3.4 Management Systems	Not needed						
4. Industry Development							
4.1 Production Technology	Completed						Completed in NSW
4.2 Post Harvest	Possible						
4.3 Marketing	Possible						

Southern Inland - Trout Aquaculture Research Plan

Description and Scope

The majority of trout (both rainbow trout, *Oncorhynchus mykiss* and brown trout, S*almo trutta*) are produced in purpose-built ponds for the food market. Intensive culture is confined to the lower south-west by summer water temperatures and limited by the need for a large throughput volume of water. In addition, some large gully dams and ponds are stocked with trout for pay fishing by recreational fishers and tourists. Some farmers located in salt-affected regions have constructed ponds to trial trout production in saline groundwater. There are around 10 licensed trout farms in WA producing.

Trout farming is well established internationally and as a consequence considerable research on breeding, feeding and rearing these species has been conducted overseas. This research has been adapted to farm trout in Western Australia.

Since trout were introduced to WA in the late 1800's the Department of Fisheries strain at PFRC have evolved to tolerate warmer water temperatures than those farmed overseas. With trout farms in the northern hemisphere reporting mortalities attributed to increased water temperatures due to global warming, there is considerable potential to supply eyed ova from WA to farms overseas. Selective breeding to increase this temperature tolerance could result in WA becoming a major supplier of trout to the northern hemisphere.

Potential exists to expand production by the utilisation of irrigation dam water in transit to agricultural farms on the south-west coastal plain. In addition, inland farmers with saline underground water are evaluating the performance of rainbow trout, stocked as yearlings and grown out in dams or ponds during cooler months.

Current Research Objectives

- Selective breeding to increase temperature tolerance and growth of PFRC trout population
- The cause of a 60% decline in egg viability of brown trout needs to be identified
- Improved production of triploids by pressure shock
- Control of inbreeding in PFRC population

Priority Setting Process

Research priorities for this program are developed through consultation with key trout producers, researchers involved in inland saline trials and recreational fishing representatives (WATFFA, RFFAC) and fishery managers.

Trout Farming

Trout Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Growth	Completed						
Reproduction	Completed						

Trout Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Diet	Completed						Nutrition of trout is well understood. Some potential for work on replacement of fishmeal in trout feeds
Temperature tolerance & Climate change	Current	■	■	■	■	■	Trout in WA appear to have a higher temperature tolerance than stocks elsewhere in the world. If correct this could create a large export industry for eggs from WA
1.2 Other Biology							
Brown trout reproduction	Current	■	■	■	■		The cause of a decline in egg viability from 70% - 10% is being identified
Triploid production	Current	■	■	■	■		Improved production of triploids by pressure shock
Redfin eradication	Future		O				Efficiency of trout for eradicating redfin and triploid redfin production
Genetic improvement	Future	■	■	■	■	■	1). Selective breeding for heat tolerance & growth 2). Control of inbreeding in PFRC population
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
1.3 Stock Assessment	Not needed						
1.4 Fishery Monitoring	Not needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						
2.2 Listed Species	Not needed						
2.3 Habitat	Not needed						
2.4 Ecosystem/Environment	Not needed						
2.5 Oceanography	Not needed						
2.6 Other impacts on fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic	Commencing	■	■				Economics of trout production in WA are unknown, required for PFRC review process
3.2 Resource Access (Shares)	Not needed						
3.3 Compliance	Not needed						
3.4 Management Systems	Not needed						
4. Industry Development							
4.1 Production Technology							
Pond production	Completed						
Inland saline	Underway	■	■				ADU/TAFE FRDC project
4.2 Post Harvest	Possible						
4.3 Marketing	Possible						

Southern Inland - Yabby Aquaculture Research Plan

Description and Scope of Fishery

Yabbies (*Cherax albidus*) are farmed in stock watering dams in the drier inland agricultural areas of the south-west. Yabbies are an introduced species and so for translocation reasons, the licensed commercial yabby farming industry is restricted to these inland areas and farming is only permitted to the north and east of the 'yabby boundary', which approximately follows the direct line from Perth to Albany. The yabby farming industry is located away from the marron zone, therefore poses little threat to marron fisheries. However, yabbies can suffer from the microsporidian *Thelohania* and this may pose a risk to native freshwater crayfish stocks if they escape from farm dams.

Yabbies require minimal management other than supplementary feeding and harvesting by baited traps. There are around 15 licensed yabby processors in WA, who receive animals from around 4000 farm dams across the state.
Research conducted by the Department of Fisheries from 1994-2000 resulted in improved methods for stocking, feeding, harvesting, managing and farming yabbies. It also developed a hybrid yabby that grows twice as fast as the most commonly farmed species.

Current Research Objectives

- Eradication of feral yabby populations within the marron region

Priority Setting Process

Research priorities for this program were initially developed through annual research seminars from 1993 – 2000 involving licensed farmers and industry association members. In addition, national freshwater crayfish research priorities were identified at workshops co-ordinated by Department of Fisheries researchers at bi-annual conferences. Since 2000 research effort in this program has been greatly reduced and a strategic approach implemented to address industry priorities as they arise.

Yabby Farming

Yabby Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction,Diet, nat. mortality)							
Growth	Completed						
Reproduction	Completed						
Diet	Future		O				Basic diet developed, but nutritional requirements are still unknown
Genetic improvement	Completed						
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
1.2 Stock Assessment	Not Needed						

Yabby Farming Research Project	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1.3 Fishery Monitoring	Not Needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not Needed						
2.2 Listed Species	Not Needed						
2.3 Habitat	Completed						
2.4 Ecosystem/Environment							
Eradication of feral populations	Future		O				The spread of yabbies into the marron zone is of concern
2.5 Oceanography	Not Needed						
2.6 Other impacts on fishery	Not Needed						
3. Management Analysis							
3.1 Socio-economic	Completed						Completed in 1990's
3.2 Resource Access (Shares)	Not Needed						
3.3 Compliance	Not Needed						
3.4 Management Systems	Not Needed						
4. Industry Development							
4.1 Production Technology							
Production technology	Completed						Developed in 1990's FRDC projects
4.2 Post Harvest							
4.3 Marketing	Not Needed						

STATEWIDE FISHERIES

Marine Aquarium Fish

Description and Scope of Fishery

The Marine Aquarium Fish Managed Fishery (MAF) targets more than 250 species of fish under the management plan. By way of endorsements the fishery also takes coral, live rock and invertebrates. It is primarily a dive-based fishery that uses hand-held nets to capture the desired target species from boats up to 8 m in length. While the MAF operates throughout all Western Australian waters, catches are relatively low in volume due to the special handling requirements of live fish. Fishing operations are heavily weather-dependent due to the small vessels used and the potentially hazardous conditions (e.g. waves, swell) encountered. In addition, human constraints (i.e. physiological effects of decompression) limit the amount of effort exerted in the fishery, the depth of water and the offshore extent where collections can occur.

Current Research Focus

Information provided by the fishery in the form of statutory monthly catch and effort returns is used as the basis to provide research advice for fisheries management. Statutory catch and effort reporting at the fine spatial scale of 10 minutes of latitude and longitude commenced in September 2004.

Priority Setting Process

Initial assessments were made through internal departmental meetings and forums discussing the history of research in the fishery, research activities that have been completed, current research as well as research and development gaps. Research issues have been discussed at annual industry consultation meetings once a year. Additional research needs have also been highlighted throught the ESD assessment processs.

Marine Aquarium Fish

Marine Aquarium Fish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Sygnathids	Developing	O	O	O	O	O	Project identified – High Risk
1.2 Other Biology							
1.3 Stock Assessment							
Annual Catch and Effort Assessment	Ongoing	■	■	■	■	■	Ongoing
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Commercial Monitoring	Proposed		O				Proposed
Charter Boat Catch and Effort							

Marine Aquarium Fish Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
Disease diagnostic service	Ongoing	O	O	O	O	O	Provided by Fisheries Research as part of surveillance and monitoring of State aquatic disease status.
2. Habitat & Ecosystem							
2.1 Bycatch	Developing		O				Low risk
2.2 Listed Species	Developing		O				High risk
2.3 Habitat	Not needed						Low risk
2.4 Ecosystem/Environment	Not needed						Nothing identified
2.5 Oceanography	Not needed						Nothing identified
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						Low risk
Economic Analysis	Possible						Low risk
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						Nothing identified
Monitoring of shares	Not needed						Nothing identified
3.3 Compliance							
Validation of Catch Records	Proposed						Low risk
3.4 Management Systems							
Management of Rec sector	Not needed						Low risk
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

Indian Ocean Territories

Description and Scope of Fishery

In November 2002, the territorial seas (out to 12 nautical miles) of the Cocos (Keeling) Islands and Christmas Island were declared as 'excepted waters' from the *Fisheries Management Act 1991*. Management responsibilities for these waters were transferred from the Australian Fisheries Management Authority (AFMA) to the Attorney General's Department (AGD). The Government of Western Australia's Department of Fisheries (the Department) has now taken on management responsibilities on behalf of AGD out to 12 nm, and AFMA continues to manage the waters from 12 to 40 nm. The location of the Indian Ocean Territories and their proximity to the Western Australian coast are illustrated in Indian Ocean Territories Figure 1.

Under the Service Delivery Agreement with the AGD, the Department now manages commercial, recreational and aquaculture activities at the Cocos (Keeling) Islands and Christmas Island, in addition to providing fish health diagnostic services, biosecurity, pathology and licensing services. The Commonwealth Minister Home Affairs currently holds responsibility for these excepted waters under the *Fish Resources Management Act 1994 (WA) (CI/CKI)* (the 'Applied Act').

The commercial fishery around Christmas Island primarily targets pelagic species, mainly wahoo (*Acanthocybium solandri*) and yellowfin tuna (*Thunnus albacares*). In addition, limited demersal fishing activities are also undertaken targeting deepwater snappers and groupers.

Large amounts of recreational fishing are also undertaken around the Cocos (Keeling) Islands and Christmas Island targeting both finfish and invertebrates.

Current Research Focus

Risk assessment workshops were undertaken in August 2006 and September 2007, to identify and refine fisheries research and management priorities at the Indian Ocean Territories. Following these workshops finfish fisheries research has focused on collecting biological material to assess the wahoo stock at Christmas Island and on collecting tissue samples from a suite of species to examine their connectivity with other sites along the Western Australian coast and locations to the north. Invertebrate fisheries research has focussed on surveys to assess the abundance and biology of gong gong (*Lambis lambis*) and also to understand the abundance and distribution of bêche-de-mer and clams (*Tridacna* spp.).

Priority Setting Process

Initial assessments were made through internal risk assessment workshops in 2007 and 2008, through departmental meetings and forums discussing the history of research in the region, research activities that have been completed, current research as well as research and development gaps. Research issues have been discussed through consultaions with communities on each island group at least once a year.

Indian Ocean Territories

Indian Ocean Territories Research Projects	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)							
Gong gong	Developing	O	O	O	O	O	Project identified – High Risk
Wahoo	Developing	O	O	O	O	O	Project identified – High Risk
Coronation trout	Developing	O	O	O	O	O	Project identified – High Risk
1.2 Other Biology							
Stock structure – representative species	Developing	O	O	O	O	O	Project identified – High Risk
1.3 Stock Assessment							
Annual Catch and Effort Assessment	Ongoing	■	■	■	■	■	Ongoing
Dist. and Abundance - Clams	Ongoing	■	■	■	■	■	Ongoing
Dist. and Abundance – Beche de Mer	Ongoing	■	■	■	■	■	Ongoing
Dist. and Abundance – Gong gong	Ongoing	■	■	■	■	■	Ongoing
1.4 Fishery Monitoring							
Commercial Catch and Effort	Ongoing	■	■	■	■	■	Ongoing
Commercial Monitoring	Proposed		O				Proposed
Charter Boat Catch and Effort							
Fish Kills	Proposed						As part of Commonwealth surveillance and monitoring
2. Habitat & Ecosystem							
2.1 Bycatch	Developing		O				Low risk
2.2 Listed Species	Developing		O				High risk
2.3 Habitat	Developing		O				High risk
2.4 Ecosystem/Environment	Developing		O				
2.5 Oceanography	Developing		O				
2.6 Other impacts on fishery	Not needed						Nothing identified
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible						Low risk
Economic Analysis	Possible						Low risk
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						Nothing identified
Monitoring of shares	Not needed						Nothing identified
3.3 Compliance							
Validation of Catch Records	Proposed						Low risk
3.4 Management Systems							
Management of Rec sector	Not needed						Low risk
4. Industry Development							
4.1 Production Technology							
4.2 Post Harvest							
4.3 Marketing							

Artemia Aquaculture

Description and Scope of Aquaculture

Early life stage husbandry, and in particular larval nutrition is a key element for marine fish culture. The use of live food for successful hatchery culture of marine fish larvae is currently considered obligatory.

Live food is expensive (up to $100-500 / kg), especially during recent years where global harvests of Artemia cysts have decreased sharply leading to a worldwide shortage. Compounding this issue, new AQIS regulations and biosecurity issues in Australia may limit future importation. The reliance that Australian hatcheries have on imported Artemia is a major constraint to the sustainable development and expansion of this industry.

FRDC project 2001/220 provided significant breakthroughs in Artemia culture using Dunaliella salina algae, which created the potential for commercial production of Artemia in Australia. A subsequent project aimed at commercializing the Artemia production at Hutt Lagoon, Western Australia is currently in its final stages. The first commercial system module was recently being commissioned (8 months earlier than stated in the milestone objectives). This stage included 10 x 32 tonne production tanks and all the peripheral systems, such as air and water supply, a harvesting system for biomass and cysts, biosecurity outlet filtration and PLC auto controlled shutdown and overflow safety.

It is envisaged that the company that culture both the D. salina and the Artemia (Cognis Australia Pty Ltd) will expand the production facility to include 40 x 32 tonne tanks and may expand the production to other locations.

Current Research Focus

During project 2004/238 –'Further development towards commercialisation of marine fish larvae feeds – Artemia' a commercial system and methods for production of Artemia and Artemia products was developed and implemented in collaboration with Cognis Australia. After commissioning the pilot system, Cognis Australia is looking at production optimization, new product identification and further development of the site aimed at expanding production. It is envisaged that at the first stage, the production will meet the demand of the Australian market followed by export to overseas markets.

The project is heavily reliant on the technical and professional support of the Department of Fisheries team. It will be extremely difficult for the company to move forward without the assistance and the unique knowledge that the team has gained during the current and previous projects. With the successful commercialisation of tank grown Artemia, Cognis envisages a substantial reduction in the production costs for their primary product –atural Betacarotene. They are hoping this will allow them to be more cost competitive with synthetic, and non-aquaculture based "natural" alternatives and allow expansion into this very lucrative but increasingly competitive market.

Artemia co-production is considered to have the best chance of successful delivery of necessary cost savings in a business heavily affected by rapidly rising fuel, energy and raw material costs.

The objectives of the projects are as follows:

1 To further develop new Artemia products with a focus on aquaculture

2 To develop and improve methods for rearing and harvesting Artemia

3 To assist in further developing the commercial production of Artemia

Priority Setting Process

The project is a direct result and continuation of the current project with Cognis Australia. The company will fund all the capital and operational costs. The project is also supported and endorsed by several Australian prawn hatcheries that are intending to use the Artemia in their hatcheries. Cognis Australia have currently committed $800,000 to the expansion of the production facility.

Artemia Aquaculture

Artemia Aquaculture	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)		■	■	■	■	■	ongoing
1.2 Other Biology							
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						
Monitoring of shares	Not needed						
3.3 Compliance	Not needed						
Validation of Catch Records							
3.4 Management Systems							
Management of Rec sector	Not needed						
4. Industry Development							
4.1 Production Technology	ongoing	■	■	■	■	■	Under FRDC proposal
4.2 Post Harvest	ongoing	O	O	O	O	O	In collaboration with Cognis Pty Ltd.
4.3 Marketing	ongoing	O	O	O	O	O	

Live Rock Aquaculture

Description and Scope of Aquaculture

Live rock is a 'trade name'or a substrate (generally a rock or dead coral) that has subsequently been colonised by a range of benthic flora and fauna and used as an architectural structure in marine aquaria (both public and private). The rock is not 'live' but the variety of organic matter around or on it is alive.

The biota covering may include algae (green, brown and red), coralline algae and other organisms. The porous nature of 'wild' live rock means that often within the live rock there are crabs, shrimp, fish, nudibranchs and mollusks taking refuge in the protected lair once placed in the aquarium.

The biological features of live rock and the technology required for its culture make it a good candidate for aquaculture. In principle, live rock can be man-made then cultured by placing the newly formed rock as substrate in the marine environment and later harvesting the rock and the coralline algae that settles on it.

While the culture technology is simple and has proven limited commercial success in several places such as Fiji and Bali, it will require considerable fine-tuning and adaptation to the WA conditions. Moreover, in most cases natural rocks picked up from the surroundings were used as substrate. In the current project aboriginal communities would form rocks made from locally acquired raw materials. The use of the raw materials and artificial coloring will ensure that no illegal wild harvest will occur due to the fact that the man-made rock would be easily recognizable under inspection.

Currently, there is no research or commercial project looking at the possibilities of the hatchery production of live rock, being conducted in Australia. However, there is a need to develop coral/live rock aquaculture to provide these products as a viable alternative to natural coral collection.

The wild collection of corals and live rock in WA is under scrutiny and it is likely that in the near future will be reduced and/or restricted. DoFWA is currently preparing a policy paper regarding coral and live rock aquaculture. This area of aquaculture is gaining interest locally and around the world since the Australian corals and rocks are fetching high prices in the EU and US markets.

Current Research Focus

An FRDC proposal was submitted together with Kimberley TAFE. The project is aiming directly at the Kimberly indigenous communities. It is believed that, if successful, the project can establish a new source of income through sustainable aquaculture. This project will reduce the need to harvest live rock and corals from the natural environment and will contribute to the sustainable management of our coral reefs.

The objectives of the project are as follow:

1. To develop grow-out techniques for live rock, suitable to the conditions in the far north of Western Australia
2. To identify suitable indigenous communities in the Kimberley that are keen on developing live rock Aquaculture
3. To develop a sustainable (economically, environmentally and socially) industry that is suitable for indigenous communities based on local sites and using local materials

Priority Setting Process

Live rock has been identified as a priority culture species in recent Kimberley aquaculture planning meetings. The project will initially involve the 'One Arm Point' indigenous community, north of Broome. The community has expressed interest in the project and is already involved in aquaculture production of trochus. Emama Nguda Aboriginal Corporation is also keen to be involved through several smaller communities in the Kimberley region. These communities will be approached as part of the first stage of the project. These communities includes: Kalumburu, Lombadina, Mudnunn, Djodood, Chile Creek, Beagle Bay, and Norman Creek.

The Kimberley Development Commission is fully supporting this project and included a similar concept in their business plan for the Dampier peninsula region. Agri-Food Industry Skills Council, and the Department of Education, Employment and Workplace

Relations (DEEWR) both support the project and might contribute to training during the project.

Walt Smith International, a US commercial company culturing live rocks in Fiji and has business in Tonga has expressed an interest to be involved in the project. It is envisage that the company can help with fast tracking some of the technology as well as open direct marketing and distribution channels to the final product.

Live Rock Aquaculture

Live Rock Aquaculture	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)	Developing	O	O	O	O	O	Proposed
1.2 Other Biology							
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment		O	O	O	O	O	Proposed
Economic Analysis		O	O	O	O	O	Proposed
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						
Monitoring of shares	Not needed						
3.3 Compliance	Not needed						
Validation of Catch Records							
3.4 Management Systems							
Management of Rec sector	Not needed						
4. Industry Development							
4.1 Production Technology	Proposed	O	O	O	O	O	Under FRDC proposal
4.2 Post Harvest	Proposed	O	O	O	O	O	In collaboration with Walt Smith Int.
4.3 Marketing	Proposed	O	O	O	O	O	

Octopus Aquaculture

Description and Scope of Aquaculture

During the past decade, the octopus fishery in WA has doubled, while human consumption of octopus has increased 5-fold. This trend is reflected by an increase in market price from around $4 to over $12 per kilogram. The same trend can be observed overseas, mainly in the Mediterranean, where both the local demand for octopus and as an export item to Japan resulted in short supply due also to over fishing in the Mediterranean Sea and the North West Coast of Africa.

The local Western Australian octopus *Octopus tetricus,* has potential to be a very good candidate for aquaculture. Initial trials conducted by Occoculture Pty Ltd, a Western Australian company have indicated that *O. tetricus* can easily acclimate to captivity, have high growth rates of 20% per two-week period, readily accepts frozen/moist foods, have a high reproductive rate and high market price. In 2007, the company processed around 70 tonnes of octopus and have predicted double that amount for 2008 if raw product is available. Occoculture Pty Ltd will soon start 'sea ranching' of octopus (permit recently granted), which involves fattening wild-capture juveniles under their existing Developmental Licence to market size. This is the first attempt to culture octopus in Australia and there are still a great deal of unknown factors.

The ranching period, from juvenile to market size, is expected to take approximately 10 weeks depending on captured size and grading. However, octopuses are seasonal spawners and this may restrict wild capture / ranching production to only a period of the year. Therefore, closing the life cycle and shifting the focus towards aquaculture of hatchery-reared octopus, in order to prolong the annual production period is the next logical step.

Current Research Focus

Although octopus larvae is relatively robust compared to marine fish larvae, the hatchery techniques for mass culture including nutrition, physiology and husbandry is still very much unknown. The project will focus on closing the life cycle and will look at different aspects including brood stock nutrition and husbandry, larvae nutrition and systems management. An FRDC proposal was submitted together with Occoculture Pty Ltd and the project is planned to start in April 2009.

Priority Setting Process

Initial assessments were made through internal departmental meetings followed by research application to FRDC. Research issues have been discussed with industry bodies as well as government departments in SA, Victoria and NSW. Both AQWA and WA FRAB supported the application.

Octopus Aquaculture

Octopus Aquaculture	Research Status	2008/09	2009/10	2010/11	2011/12	2012/13	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of indicator species (Growth, Reproduction, Diet, nat. mortality)	Developing	O	O	O	O	O	
1.2 Other Biology							
Closing the life cycle		O	O	O	O	O	Proposed
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
2.3 Habitat							
2.4 Ecosystem/Environment							
2.5 Oceanography							
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment							
Economic Analysis							
3.2 Resource Access (Shares)							
Detailed determination of access shares	Not needed						
Monitoring of shares	Not needed						
3.3 Compliance	Not needed						
Validation of Catch Records							
3.4 Management Systems							
Management of Rec sector	Not needed						
4. Industry Development							
4.1 Production Technology	Proposed	O	O	O	O	O	Under FRDC proposal
4.2 Post Harvest							
4.3 Marketing							