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Research and Development Plan 2007-2008

Western Australian Department of Fisheries

Department of Fisheries

Fish for the future

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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 (SoF) 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 Ministerial Advisory Committees (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 Australian Fisheries Management Forum (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 under way, 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 *Environmental Protection and Biodiversity Conservation Act 1999* requirements) are also present.

The research issues are divided into a number of categories (based on Ecologically Sustainable Development (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, occupational health and safety)

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
November 2007

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 kilometres 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 under way within this bioregion, many are undertaken by agencies other than the Department.

- Marine Futures – (Natural Heritage Trust - 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 sea lion foraging activity (WA Marine Science Institute-WAMSI), plus a project monitoring the efficacy of sea lion 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.
- Strategic research Fund for the Marine Environment-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.

West Coast Biodiversity Research Issues

WC Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
Western rock lobster diet	Ongoing	■					Diet analysis is being conducted for both inshore and deepwater populations by SRFME and FRDC projects
Western rock lobster movement	Ongoing						Movement analysis is being conducted for both inshore and deepwater populations by SRFME and FRDC projects
Coral trout (Abrolhos)	Ongoing	■					Currently being conducted by a PhD at ECU
Finfish populations at Jurien	Ongoing	■					Research on finfish population is currently being conducted by SRFME. Likely that research will be ongoing
Fishery Monitoring	Developing	O					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	Ongoing	■					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 invertebrate and fish biodiversity.	Under way	■	■				MF – DoF, UWA
Swan River fish community	Developing	■	■	■			MU funded by DoF, DoW, Swan River Trust - July 07 start
Swan marine region inshore fish assemblages	Proposed						MU seeking Swan NRM
Deepwater rock lobster habitat	Ongoing	■					Identification of deep and shallow water habitat is being conducted by SRFME and FRDC funded projects . It is likely that research will be ongoing in these areas.
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 under way 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
Sanctuary zone monitoring	Under way	■					Monitoring of rock lobster, fish and sessile benthic communities inside and outside of sanctuary zones at Rottnest Island, Marmion and Shoalwater Islands marine parks.

WC Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
2.4 Ecosystem/Environment							
Trophic interaction, anthropogenic influences etc.	Developing	■	■	■			WAMSI 4.2 & 4.3.
Climate change, ecological processes	Developing						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 funding
2.5 Oceanography							
Hydrodynamic modelling	Completed						Some fine- and broad scale work has been completed (e.g. CSIRO/DoF WRL larval dispersal model)
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	Under way						Data analysis under way. Another cruise is planned.
2.6 Other Impacts on Fishery							
Introduced marine pests	Under way	■					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	Developing						WAMSI 4.1. Applying EBFM framework.
	Developing						EPBC/NOO south west regional plan

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 60 kilometres 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. These waters also 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 (FHPA) in Western Australia. It remains the largest in the State and is the only area in which the Department of Fisheries 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.

WC – Abrolhos Islands FHP

Abrolhos Is. Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Dhufish regional biology	Completed						
Dhufish reproductive biology	Completed						Completed last year
Pink snapper biology	Completed						
Baldchin groper biology	Completed						
Breaksea cod biology	Completed						MU Hon
1.2 Other Biology							
Spawning aggregations	Under way	■	■				PhD + ECU
Release mortality	Under way						
Movement	Under way	■	■				FRDC + ECU
Coral trout biology	Under way	■	■				PhD + ECU
Spangled emperor biology	Under way						
Red throat emperor	Under way	■	■				PhD + ECU
General finfish assemblages	Ongoing	■	■				UWA
1.3 Stock Assessment							
Annual catch & effort 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	O				
Recreational creel	Periodic	■		O			Periodic
Recreational indicator	Developing	O	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 under way to examine the effects of lobster fishing on sensitive coral habitats includes ROAs
	Completed						Marine futures habitat mapping
QuickBird assessment	WAMSI -		■				
2.4 Ecosystem/Environment West Coast Bioregion ecosystem study							
WAMSI 4.2 developing indicator sites and measures		■	■	■			
2.5 Oceanography							
2.6 Other Impacts on Fishery							
3. Management Analysis							
3.1 Socio-economic							

Abrolhos Is. Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 (*Amusium balloti*) with western king prawns (*Penaeus latisulcatus*) being the minor target species.

This is an otter trawl fishery and the area was first fished commercially for scallops during the late 1960s. 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.

WC – Abrolhos Islands and Mid West Trawl

AIMWT Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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 1980s
1.2 Other Biology							
Recruitment dynamics	Completed						Studies completed in the 1980s
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							
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns	Ongoing	■	■	■	■	■	
Fishing power monitoring	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)??	Ongoing	■	■	■	■	■	EPBC requirement
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
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
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible	O					
Economic analysis – average price data	Ongoing	■	■	■	■	■	
- fuel consumption/expenses	Ongoing	■	■	■	■	■	

AIMWT Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
3.2 Resource Access (Shares)							
Rock lobster – scallop interaction	Under way	■	■				
3.3 Compliance							
Enforcement efficiency							
3.4 Management Systems							
4. Industry Development							
4.1 Production Technology							
Re-seeding	Ceased	O					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 metres in depth. They have been fished commercially in WA since at least the mid-1970s. 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 and crabs are also caught extensively by recreational fishers.

A significant level of research has been conducted on the biology, ecology and distribution of the blue swimmer crab since the early 1970s. A number of projects were instigated during 1997/98 with funding from FRDC this 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.

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 2003 season. The Minister for Fisheries closed the fishery for one year in December 2006, and a further 12-month closure is being considered. Concerns have also been raised from various quarters regarding the state of stocks in the Peel/ Harvey system.

Current Research Focus

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, limited commercial fishing for research purposes).

Research funding (DBIF) was obtained in 2006 to (a) examine the genetic difference between the Cockburn Sound stock and that in Warnbro Sound and the Swan River; (b) undertake recreational surveys in the Peel-Harvey; (c) undertake commercial monitoring of the fleet 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 project proposed for the southern area of Jervois Bay in Cockburn Sound on resident crab stocks.

West Coast Blue Swimmer Crab

West Coast BSC Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	Under way	■					Some sites completed. A funding application has been approved to determine whether there are genetic differences between Warnbro Sound, Cockburn Sound and Swan River.
1.3 Stock Assessment							
Stock assessment	Completed	■					For Cockburn Sound
Annual catch & effort assessment	Ongoing	■	■	■	■	■	
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, and Mandurah-Bunbury fisheries.
Recreational catch & effort	Under way	■					Peel-Harvey. Other areas part of National rec. fishing program.
Research surveys	Ongoing	■	■	■	■	■	Trawl surveys to determine recruitment and residual levels. Extra trapping in inshore regions for FPA work
Stock & recruitment	Ongoing	■	■	■	■	■	Commercial catch prediction for Cockburn Sound only
Dedicated logbook	Ongoing	■	■	■	■		Mandurah-Bunbury fishery only
Heavy metal content of crabs	Under way	■					Single sampling and analysis completed for Cockburn Sound, Peel-Harvey and Mandurah-Bunbury fisheries in 2006. Potential collaborative sampling in Peel-Harvey was undertaken in 2007 with Dept of Water and is continuing.
2. Habitat & Ecosystem							
2.1 Bycatch							Low Risk
2.2 Listed Species							Low Risk
2.3 Habitat							
	Under way	■					Relationship between habitat and life stage being investigated for Cockburn Sound
2.4 Ecosystem/Environment	Under way	■					Information (sea grass beds) on Cockburn Sound being collaged from various sources (e.g. Cockburn Sound Management Council). Some data also for Peel/Harvey

West Coast BSC Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 that 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) which 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.

South West Trawl

SW Trawl Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Scallop biology	Completed						Completed in 1990s
1.2 Other Biology							
Scallop reproductive dynamics	Completed						Completed in 1990s
1.3 Stock Assessment							
Annual catch & effort 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							
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

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 (*Pseudocarcinus gigas*), crystal (snow) crabs (*Chaceon bicolor*) and champagne (spiny) crabs (*Hypothalassia acerba*) using baited pots operated in a longline formation in the offshore waters off the west coast.

In the late 1990s when this fishery began, 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 using fishers' monthly returns data to monitor activities.

West Coast Deep Sea Crab

WC Deep Sea Crab Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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							
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

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 (*Panulirus cygnus*), 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 1940s 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 tonnes but has varied from 8-14,000 tonnes due to natural variations in the level of recruitment. In 1999, the WCRL was the first fishery worldwide to be awarded Marine Stewardship Council (MSC) chain-of-custody certification on the basis of demonstrating the ecological sustainability of its fishing and management operations.

Extensive research and monitoring of the WCRL 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, the 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 activities of assessing stock sustainability and forecasting future catch levels. This includes fishery dependent and independent monitoring of catch rates, size distributions and puerulus settlement. The status of the breeding stock of rock lobsters is assessed annually using a synthesis of this information, all of which was subject to external review by a panel of experts during 2007.

An investigation of the impacts of unequal sex ratios in the rock lobster breeding stocks and whether larval viability varies within the fishery is almost completed. A new lobster stock assessment model is being developed to incorporate the information gained over the past 5 years and facilitate the development and assessment of future management options.

Other studies, including those needed to continue MSC accreditation and to meet EPBC requirements, were identified during an environmental risk assessment. These include an assessment of any potential ecosystem impacts of the fishery in deeper water and minimizing interactions with protected species such as sea lions. This accreditation has also produced an external assessment of the current stock assessment methods and results used by the Department. Outcomes from this review have led to additional areas of research in 2007/08 and beyond. The recent review of management arrangements for this fishery has required the collection of socio-economic information.

West Coast Rock Lobster

West Coast Rock Lobster Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Secies (growth, reproduction, diet, natural mortality)							
Lobster biology	Completed						Many studies completed
1.2 Other Biology							
Recruitment dynamics	Completed						
Migration	Completed						
Lobster spawning rates	Under way	■					
By-product octopus basic biology	Part						The basic life history studied
1.3 Stock Assessment							
Annual assessment	Ongoing	■	■	■	■	■	
Develop new model	Periodic	■					New models built when required
Shallow water depletion assessment	Ongoing	■	■	■	■		
Deep water depletion assessment	Under way	■	■				Initial trials under way
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 & effort	Ongoing	■	■	■	■	■	
Stock and recruitment	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch (Low Risk)	Nil						Low risk
2.2 Listed Species							
Sea lions (moderate risk) - develop methods to reduce sea lion interactions	Completed						
Monitoring of interactions	Ongoing	■	■	■	■		EPBC Requirement
2.3 Habitat (Low Risk)							
Seagrass and limestone reef effects	Completed						Sufficient for management
Coral reef effects	Under way	■	■				Study at the Abrolhos Islands
2.4 Ecosystem/Environment							
Deep water ecosystem study	Under way	■	■	■	■		A further extension of this work is required – FRDC application submitted
Jurian Bay inshore	Under way	■	■	■	■		SRFME/WAMSI study
Dongara inshore	Completed						CSIRO studies in the 1980s
Rottnest sanctuary zones	Under way	■					Swan Catchment Council funding
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■		
Oceanographic modelling	Completed						

West Coast Rock Lobster Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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						Needed for assessment of potential change to management system
Economic analysis	Periodic						as above
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	Completed						Needed 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		■	■				Seafood CRC 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 (*Haliotis laevigata*), brownlip abalone (*Haliotis cornicopora*) and Roe's abalone (*Haliotis roeii*), 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 complement 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.

West Coast Abalone

West Coast Abalone Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Roe's abalone 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							
Environmental effects on recruitment	Under way	■	■				
1.3 Stock Assessment							
Catch statistics (wild stock)	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	Under way	■					
1.4 Fishery Monitoring							
Research monitoring and recruitment sites	Ongoing	■	■	■	■	■	
Industry video monitoring sites	Under way	■	■				Moving to implementation
Recreational fishery monitoring – on site surveys	Ongoing	■	■	■	■	■	
Recreational fishery monitoring –phone surveys	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
Site survey/food availability/density							
External threats, pollution, bio-invasion, red tides, contaminants							Watching brief
3. Management Analysis							
3.1 Socio-economic							
3.2 Resource Access (shares)							
3.3 Compliance							
3.4 Management Systems							
Abalone health - translocation/ protocol	Ongoing	■	■	■	■	■	
Abalone health - contingency plan	Ongoing	■	■	■	■	■	

West Coast Abalone Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
4. Industry Development							
4.1 Production Technology							
4.2 Post-harvest							
4.3 Marketing							
Relocation of stocks							This includes potential enhancement trials
Diver safety/profiles							

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 used.

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.

West Coast Beach Bait

West Coast Beach Bait Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic biology of Indicator Species (growth, reproduction, diet, natural 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	Under way	■	■	■	■	■	Whitebait only. This will be reviewed in 2008
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
2.6 Other Impacts on Fishery	Not needed						Nothing identified

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 2006, about 70 per cent 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 the Sound have rapidly increased in recent years, from 2 tonnes in 2000 to 45 tonnes in 2006. Minor quantities of squid and cuttlefish were also taken. In 2006, 20 per cent of the total west coast commercial catch of octopus was taken in Cockburn Sound.

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 per cent 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 under way on pink snapper. A creel survey conducted in September 2001-August 2002 provides 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 more recent data describing recreational fishing for boat-based fishers.

Current Research Focus

The status of the fish stocks in this fishery is primarily assessed from monthly catch-and-effort (CAES) returns provided by industry. Given the decline in commercial fishing activity, there will be a need to increase the level of information obtained from the recreational sector.

West Coast – Cockburn Sound Finfish

Cockburn Sound Fish Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	Under way	■					Part of FPA and SCC study
Tailor	Possible	O	O	O	O		Lack of data on reproduction, early life history
Octopus	Not needed						
1.2 Other Biology	Not needed						Nothing identified
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■	■		
Age-based model (herring)	Under way	■	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	Under way	■	■	■	■		Herring, whiting, tailor only
Recreational angler logbooks	Under way	■	■	■	■		RAP
Fishing tournament & club records	Developing	O	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							
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) covers commercial wetline fishing activities within this bioregion for which a management plan is currently being developed and boat based recreational fishing. The wetline fleet comprises both 'wetline-only' vessels and the wetline activities of vessels with other managed fishery licences. The major areas for wetlining within the west coast bioregion are the mid west, Kalbarri area, Abrolhos Islands and the southwest coast. The main target species are West Australian dhufish and pink snapper and more recently emperors, but baldchin groper, coral trout and other species including sharks are also targeted, using handlines and droplines.

A major FRDC study on the basic biology and stock assessment of dhufish and pink snapper in three zones within the bioregion has just been completed. Other demersal species studied include baldchin groper (Nardi *et al.*, 2006) and breaksea cod (Eastman 2001, Moore 2005). Research information on the biology of the other target species, including coral trout (Ferreira, 1995; Samoilys, 1997; St John *et al.*, 2001), spangled emperor (Kanashino, 1998) and red throat emperor (Bean *et al.*, 2003: Williams *et al.*, 2003; van Herwerden *et al.*, 2000, 2003; Sumpton and Brown, 2004) has mostly been from studies completed elsewhere, but which provides the basic information about these species.

Current Research Focus

- Continue to monitor the age structure of the three main indicator species (dhufish snapper and baldchin groper).
- Improve the catch and effort information by introducing a daily logbook for commercial operators.
- Complete the FRDC studies on barotrauma of snapper and dhufish plus the study on spawning aggregations of west coast species, including Samson fish, dhufish and pink snapper and coral trout at the Abrolhos Islands.
- Undertake further surveys of the recreational catch and effort on this fishery. Complete the analysis of using a variety of sampling methods.
- A project to determine the most cost effective method for ongoing monitoring of the age structure, commercial and recreational catch for each of the indicator species is nearing completion.

West Coast Demersal Fishery

WC Demersal Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Dhufish regional biology	Completed						FRDC-funded
Dhufish reproductive biology	Completed						FRDC-funded. More needed on timing of spawning, SAM, larval dispersion.
Pink snapper biology	Completed						MU Ph.D on Metro snapper. No fecundity, poor growth data and SAM.
Baldchin groper biology	Completed						MU study completed at AI.
Breaksea cod biology	Completed						MU Hon.
Catch and release	Review						This may affect spawning activity of snapper and dhufish.
1.2 Other Biology							
Spawning aggregations	Under way						Almost complete. Provide ecological info of use in e.g. MPA planning. Additional data on movement from fisher interviews
Release mortality	Under way						Also need to assess mortality of non-retained fish (eg undersized) using RAP logbooks.
Movement	Under way						Limited success thus far (eg dhufish). Study on coral trout at AI under way. Study planned for pink snapper in CS.
Coral trout biology	Under way						Ph.D + ECU
Spangled emperor biology	Under way						Gascoyne mainly?
Red-throat emperor	Under way						Ph.D (student may not complete though)
Mobility and stock structure of key species	Under way	O	O	O			WAMSI 4.4.2 proposal. Under way for dhufish. Not yet for snapper
1.3 Stock Assessment							
Annual catch & effort assessment	Ongoing	■	■	■	■	■	
Age-structure models (indicator species)	Periodic		■				Initial models being developed and to be reviewed every 2 years after management
Egg distribution of snapper in CSound	Under way	■	■				Funded by FPA
1.4 Fishery Monitoring							
Commercial catch & effort	Ongoing	■	■	■	■	■	Introduce new logbook
Age structure of indicator species	Ongoing	O	O	O	O	O	STILL requires increase in funding to complete effectively. Biases in data need evaluation.
Fishing power		O	O				
Recreational creel	Periodic	■	■				Funded by ERC
Recreational indicator	Developing	O	O	O	O	O	e.g. RAP logbook. Provides alternative source of recr C&E incl undersized fish.
Charter boat catch & effort	Ongoing	■	■	■	■	■	

WC Demersal Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 WC Bioregion ecosystem study	Under way						Trophic dynamics
2.5 Oceanography	Under Review						Further work by UWA, CSIRO etc (WASMI) 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 affected by industry development (De-sal plant, new harbour)
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Possible	O	■	■			WAMSI project
Economic analysis	Completed						Completed as case study for FRDC
Evaluation of rec. fisher incentives			■	■			WAMSI project
3.2 Resource Access (shares)							
Detailed determination of access shares	Periodic			■			Needed for IFM
Monitoring of shares	Ongoing	■	■	■	■	■	Needed for IFM
3.3 Compliance							
Validation of catch shares and records	Ongoing	O	O	O	O	O	
3.4 Management Systems	Possible						Awaiting outcomes of Wetline and IFM processes
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, and is a multi-species fishery targeting many finfish species. The 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. This area is also fished heavily by recreational fishers.

Other estuary fisheries within the WC bioregion include the Leschenault Inlet (recreational only) and the Hardy Inlet (1 commercial operator).

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 1970s. This knowledge is used to assist in the interpretation of data from monthly CAES returns provided by industry.

Current Research Focus

Research to monitor the status of the fish stocks in this fishery is primarily based on monthly CAES returns provided by industry. With reduced levels of commercial fishing in these regions the research focus has shifted to gather a greater level of information from the recreational sector.

Monitoring of cobbler and river prawns in Swan Estuary is done as part of a study (funded by the Swan River Trust, the Department of Water and the Department of Fisheries) which began in 2007/08.

West Coast Estuarine and Inshore Fisheries

WC Estuarine and Inshore Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Black bream	Complete						Adequate for management
King George whiting	Complete						Adequate for management
Cobbler	Complete						Adequate for management
1.2 Other Biology							
Perth herring	Possible						Declining stock, highly vulnerable, low fishery value but potential indicator species & important prey for higher value species.
River prawns	Under way						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							
Annual C&E trends	Ongoing	■	■	■	■	■	CAES data & angler logbooks
Age-based model	Under way	O	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 years.
Angler daily logbook	Ongoing	■	■	■	■	■	Research Angler Program (RAP)
Fishing tournament & club records	Ongoing	■	■	■	■	■	RAP
Cobbler	Developing	O	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)
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						Low risk
2.2 Listed Species	Not needed						Low risk
2.3 Habitat	Developing	O	O	O			See biodiversity section: Swan River community project (MU funded by DoF, SRT and DoW)
2.4 Ecosystem/Environment							
Fish kills	Occasional	■	■	■	■	■	Opportunistic sampling, logistically difficult, limited resources available
Red-spot disease outbreak	Occasional	■	■				Mainly bream, opportunistic sampling to assess impacts
Acid-sulphate soil runoff	Possible						
2.5 Oceanography	Not needed						Nothing identified
2.6 Other Impacts on Fishery	Not needed						Nothing identified

WC Estuarine and Inshore Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 during the early to mid-1990s to gather data on the biology and stock assessment of Western Australian pilchards.

Exploratory fishing for the sardinella, offshore of Geraldton on the mid-west 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.

West Coast Purse Seine

West Coast Purse Seine Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Pilchard biology	Completed						Many studies - sufficient
Sardinella biology	Completed						Study completed in 1990s
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	■	■	■	■	■	
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 that 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.

Gascoyne Biodiversity Issues

Gascoyne Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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							
	Developing	■	■	■			WAMSI 4.4.1 - Captured species assessments & monitoring
2.3 Habitat							NRP (*including WAMSi Project 3) – CSIRO, AIMS, universities.
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 under way)	■	■	■			WAMSI 4.2 & 4.3 –
Climate change	Developing						WAMSI Project 1, 2 (CSIRO, UWA, AIMS)
2.5 Oceanography							
Hydrodynamic modelling	Developing (some under way						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). .
	Under way						Southern Surveyor – cruises completed; data analysis under way. Another cruise is planned.
2.6 Other Impacts on Fishery							
Introduced Marine Pests	Under way	■					Currently funded by Natural Heritage Trust to analyse what species have been introduced.
3. Management Analysis							
3.1 Socio-economic							
Social assessment	Under way						NRP/WAMSI, CSIRO Cluster, Sustainable Tourism CRC, NRM. e.g. human use survey. Note: some under way but more work is planned
Economic analysis							As above
3.2 Resource Access (shares)							

Gascoyne Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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.
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 metres 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 nine licence or exemption holders in the two 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 1970s. 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. 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.

Gascoyne Blue Swimmer Crab

Gascoyne BSC Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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						
1.3 Stock Assessment							
Stock Assessment	Completed						For Shark Bay
Annual catch & effort assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Commercial catch & effort	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	For Shark Bay only
Commercial monitoring	Ongoing	■	■	■	■	■	Quarterly 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	■	■	■	■	■	Commercial catch prediction for Shark Bay only
Dedicated logbook	Ongoing	■	■	■	■	■	
Heavy metal content of crabs	Completed	■					
2. Habitat & Ecosystem							
2.1 Bycatch	Under way	■					For Shark Bay fishery only
2.2 Listed Species							Low risk
2.3 Habitat							
	Under way						
2.4 Ecosystem/Environment	Under way						
2.5 Oceanography	Periodic						Environmental data for Shark Bay and Exmouth gulf 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)							

Gascoyne BSC Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 (*Penaeus latisulcatus*), brown tiger prawns (P. *esculentis*) and a variety of smaller prawn species including coral prawns (various species) and endeavour prawns (*Metapenaeus* spp.). 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 1980s, 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).

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 1970s. Similarly, the determination of the habitat requirements of each of the species and the stock recruitment dynamics were also completed in the 1980s.

Current Research Focus

There is regular stock assessment and monitoring of the status of prawn stocks, with tiger prawns as the primary focus. This includes fishery-dependent monitoring (voluntary logbook program and CAES and processor unload records) and fishery-independent surveys that provide recruitment and spawning stock indices. 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. An FRDC project in collaboration with ECU is analysing prawn logbook data is due for completion at the end of 2007. A new FRDC-funded project focusing on minimising gear conflict and resource sharing issues in the Shark Bay trawl fisheries will commence in 2008. This will include hydrographic modelling of scallop larval movement within Shark Bay.

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.

Shark Bay Prawn

Shark Bay Prawn Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	Under way	■					ECU FRDC project
1.4 Fishery Monitoring							
Commercial catch monitoring	Ongoing	■	■	■	■	■	
Fishery independent surveys/size composition and abundance surveys	Ongoing	■	■	■	■	■	
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns	Ongoing	■	■	■	■	■	
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	Under way	■					ECU collaboration
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
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

Shark Bay Prawn Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
Coral/sponge habitat mapping	Required	O	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	Future		■	■			FRDC Application 2007/08 (2 yr project)
Aquaculture							
Native Title							
World Heritage Areas							
3.3 Compliance							
4. Industry Development							
4.1 Production Technology							
Onboard handling							
OHS							
Product quality certification							
Hoppers	Possible						Industry-led 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 *State of the Fisheries*) and is usually WA's most significant scallop fishery. This is an otter trawl fishery that catches southern saucer scallops (*Amusium balloti*). 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 continues to investigate the environmental influences that affect recruitment to scallop stocks in Shark Bay, in particular the effects of the Leeuwin Current and temperature.

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 is analysing scallop survey and logbook data using geostatistics is due for completion at the end of 2007. 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 will likely begin in early 2008.

The fishery currently has a five-year Ecologically Sustainable Development accreditation with the Commonwealth Department of Environment and Water Resources. 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).

Shark Bay Scallop

Shark Bay Scallop Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator species (growth, reproduction, diet, natural 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 1980s
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 2007/08
Modelling / depletion exp.	Under way	■					Partly Completed
Spatial GIS	Ongoing	■	■	■	■	■	
Spatial analysis	Under way	■					ECU FRDC project
Catchability	Under way	■	■				Partly Completed including day-night trials
Mesh selectivity trials	Future						FRDC
1.4 Fishery Monitoring							
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns	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	Under way	■					ECU collaboration
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	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
Biodiversity of trawled and untrawled areas	Completed	■			■		Review every 5-10 years
Formal risk assessment	Periodic		■				EPBC requirement
Marine Park monitoring	Possible	O					
2.5 Oceanography							
Leeuwin Current monitoring	Ongoing	■	■	■	■	■	
Temperature loggers	Ongoing	■	■	■	■	■	To be reviewed in 2007/08
Modelling of currents	Future		■	■			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				
Economic analysis – average price data	Ongoing	■	■	■	■	■	
- Fuel consumption/expenses	Ongoing	■	■	■	■	■	
3.2 Resource Access (shares)							
Prawn – Scallop - fleet interactions and catch share - Snapper interactions	Ongoing	■	■	■	■	■	Needed for the review of the three fisheries
Prawn-Scallop gear interactions	Future		■	■			FRDC
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 *State of the Fisheries* report). This otter trawl fishery targets western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*P. esculentus*), endeavour prawns (*Metapenaeus spp*.)and banana prawns (*P. merguiensis*) 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, but 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 1980s 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

Current research activities need to continue to focus on stock assessment and monitoring of the status of prawn stocks, particularly tiger prawns. This includes fisheries dependent monitoring (voluntary logbook program and CAES and processor unload records) and fishery-independent surveys, which provide recruitment and spawning stock indices. A pre-season survey is also undertaken in the king prawn grounds to assess recruitment strength. 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.

Exmouth Gulf Prawns

Exmouth Gulf Prawn Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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	Ongoing	■	■	■	■	■	
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						
Electronic logbooks	Under way	■	■				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
Bycatch monitoring	Periodic		■				Review every 5 years
Square mesh cod-ends	Under way	■	■				Industry initiative – requires observers to document effectiveness
2.2 Listed Species							
Listed species interactions - logbooks	Ongoing	■	■	■	■	■	EPBC requirement
2.3 Habitat							

Exmouth Gulf Prawn Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
Habitat/effort monitoring	Ongoing	■	■	■	■	■	EPBC requirement (area of trawling only)
Closure of sensitive habitats on trawl grounds	Possible	O	O				Requires industry consultation
2.4 Ecosystem/Environment							
Biodiversity of trawled and untrawled areas	Under way						Nearing completion – 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	Under way	■	■				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 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 entirely carried out by Shark Bay Snapper Managed Fishery (SBSF) vessels that have historically targeted the oceanic stock of pink snapper. Commercial pink snapper fishing in waters off Shark Bay has occurred since the early 1900s, however data on catches are only available from the 1950s onwards. The SBSF came under formal management in mid-1987 and became a fully quota-based fishery in 2001. SBSF vessels nowadays also catch a range of other species including goldband snapper, red emperor, emperors (including spangled emperor), cods, ruby snapper and pearl perch. SBSF is well-documented and received EPBC certification in 2005 (due for review in 2009).

Commercial 'open-access' wetline vessels without SBSF-quota also operate in Gascoyne waters outside of the SBSF management zone. These vessels catch a similar variety of 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' commercial wetline fishing is scheduled to come under formal management as an outcome of the wetline review' with the creation of the Gascoyne Demersal Scalefish Fishery and a Gascoyne Inshore Net Fishery.

Pink snapper in the waters off Shark Bay have been the focus of a large number of research projects over the past 30 years. These include biological studies, stock assessment, stock identification and fishery monitoring studies. An FRDC project (completed in 2003) used the size and age composition of commercial catches (1982-2000), to determine the spawning stock size, which was found to be depleted to an unacceptable level at that time.

Current Research Focus

The Research Division is closely monitoring age structure of commercial pink snapper catches taken by SBSF vessels to continue to monitor recovery of the spawning stock following reductions to TACC (approx. 40 per cent in 2004 and further 12 per cent in 2007). Integrated Fisheries Management (IFM) is scheduled for implementation in the Gascoyne in 2009. Four key indicator species have been identified - pink snapper, goldband snapper (offshore), spangled emperor (inshore) and Spanish mackerel. Research is currently under way that will provide information on existing catch shares and stock assessments for these indicator species by late 2008.

Demersal Scalefish Fishery (Shark Bay Snapper)

Gascoyne Demersal Finfish Research	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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	Under way	■	O	O	O		
Spangled emperor biology	Under way	■	O	O	O		
1.2 Other Biology							
Pink snapper juvenile recruitment	Ongoing	O	O	O	O		Trawl surveys
1.3 Stock Assessment							
Age-structured modeling for pink snapper	Ongoing	■	■	■	■	■	
CAES catch and effort data analysis	Ongoing	■	■	■	■	■	
Age-structured modelling for goldband and spangled emperor	Proposed	■	■				Being done for IFM
1.4 Fishery Monitoring							
Pink snapper, size and age structure of catch	Ongoing	■	■	■	■	■	
CAES catch and effort data	Ongoing	■	■	■	■	■	
Charter boat catch and effort	Ongoing	■	■	■	■	■	
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	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							
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 ramps at Denham, Monkey Mia or Nanga. 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 Monkey Mia and Denham.

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 new management plan has been developed 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 pink snapper since 1996/97. Research has also been conducted on black snapper (Dept of Fisheries) 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). Age structure of commercial yellowfin bream catches in 2005 was investigated; results indicated that the increase in catches in recent years may be explained by particularly strong recruitment in 1999. The minimum legal length for yellowfin bream was increased statewide from 250 mm to 350 mm. However, an exemption to the new 350 mm size limit was issued until April 2008 pending further scientific consideration of other management options.

Model-based stock assessments for inner gulf pink snapper stocks are now undertaken on a 3-year basis, used to determine appropriate levels of TAC for each stock. Current arrangements are to be reviewed in mid-2008. Research funding has now been directed away from inner gulf pink snapper towards Gascoyne IFM research.

Inner Shark Bay Fishery

Inner Shark Bay Fishery	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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	Ongoing	O					Review late 2007
Pink snapper		■	O				Due to review mid 2008
1.2 Other Biology	Not needed						Nothing identified
1.3 Stock Assessment							
CAES catch and effort data	Ongoing	■	■	■	■	■	Adequate at this stage
Model-based assessment for pinks		■					Due to review mid 2008
1.4 Fishery Monitoring							
CAES data	Ongoing	■	■	■	■	■	
Age structure of yfb catch	Complete	■	O	O	O		Investigation of recruitment variation
Recreational fishing survey	Proposed	O	O				Gascoyne IFM, shore and boat? Beyond 2007?
Recreational angler logbooks	Proposed	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.

North Coast Biodiversity Issues

North Coast Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
1.2 Other Biology							
1.3 Stock Assessment							
1.4 Fishery Monitoring							
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							
Introduced Marine Pests	Under way	■					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 five per cent of overall fishery area). This otter trawl fishery targets western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*P. esculentus*), endeavour prawns (*Metapenaeus spp*.) and banana prawns (*P. merguiensis*). 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. The trends in annual catches are, however, monitored through logbooks and compulsory monthly catch returns 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. In the last two years, the introduction of Size Management Fish Grounds and permanently closed areas has required close consultation with fishers and several fishery independent surveys have been conducted in these areas to monitor prawns size and abundance.

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).

Onslow Prawn

Onslow Prawn trawl Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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						
Banana prawn biology	Possible	O	O				
1.2 Other Biology							
Biology of bugs	Completed	■					
1.3 Stock Assessment							
Annual C&E Assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research Logbooks	Ongoing	■	■	■	■	■	
CAES returns	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Database maintenance	Ongoing	■	■	■	■	■	
Effort impact assessment (GIS)	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch	-						
BRD Implementation(grids)	Completed						Completed in 2004
BRD Implementation(secondary devices)	Under way	■	■				
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
Formal risk assessment	Periodic		■				Needed for next EPBC application
2.4 Oceanography	Not needed						
2.5 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 pearl 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 piggyback 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.

Pearl Oyster

Pearl Oyster Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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	Under way	■					
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	Under way	■	■				
Environmental impact/monitoring	Under way	■	■				
Site survey/food availability/density	Needed						
Site selection parameters	Needed						
EMS Template Pilot Project	Under way			■	■		
2.5 Oceanography							
NW Shelf study	Under way	■					
Kimberley inshore bio-oceanography	Completed						
80 Mile beach bio-oceanography	Completed						
2.6 Other Impacts on Fishery							None identified
3. Management Analysis							
3.1 Socio-economic							
Occupational Health & Safety							
Diver safety/farm profiles	Under way						To be completed In 2007/08
3.2 Resource Access (shares)							
3.3 Compliance							
Compliance evaluation							
3.4 Management Systems							
Statistics (value)							

Pearl Oyster Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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	Under way						To be completed In 2007/08
Hallmarking of pearls/nucleii		O	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	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	Under way	■					
Haplosporidian Project	Under way	■					
Cliona Management in wild stocks (FRDC)	Under way	■	■				Two years into study
Diagnostic test for OOD	Under way	■	■				
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 per cent 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.

Beche–de–mer

Beche-de-mer Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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		■	■	■	■	■	
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 Management Systems							
Statistics (value)							
Development of an interim management plan							
4. Industry Development							
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 (*P. latisulcatus*) and coral prawns (*various spp*.). 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.

Broome Prawn

Broome Prawn Trawl Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
King prawn biology	Completed						Completed in 1970s and 1980s
Coral prawn biology	Possible	O	O				
1.2 Other Biology							
1.3 Stock Assessment							
Lunar phase	Ongoing	■	■	■	■	■	
Delury depletion analysis	Ongoing	■	■	■	■	■	
Catch &effort stock assessment	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research logbooks	Ongoing	■	■	■	■	■	
CAES returns	Ongoing	■	■	■	■	■	
Processor returns	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)	Under way	■	■				
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
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	Under way	■					
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 (*P. merguiensis*), western king prawns (*P.latisulcatus*), brown tiger prawns (*P. esculentus*) and endeavour prawns (*Metapenaeus spp*.) 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 have actually fished in this fishery with a total of just 1000 to 1200 days being used.

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

Research data for monitoring this fishery are provided by Western Australian fishers' monthly returns and selected skippers filling in daily logbooks and by research logbooks collected by the Australian Fisheries Management Authority (AFMA) for NPF boats licensed to operate in the KPMF. 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).

Kimberley Prawn

Kimberly Prawn Trawl Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	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 1990s
Endeavour prawn biology	Possible						
1.2 Other Biology							
Biology of Squid	Possible						
1.3 Stock Assessment							
Catch & effort assessment	Ongoing	■	■	■	■	■	
Catch rainfall relationship	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
AFMA logbooks	Ongoing	■	■	■	■	■	
Research logbooks	Limited	■	■	■	■	■	Selected fishers only
CAES returns	Ongoing	■	■	■	■	■	
Processor returns	Ongoing	■	■	■	■	■	
Effort trends	Ongoing	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch							
BRD Implementation	Completed						Completed in 2004
Secondary BRDS	Ongoing						Partly implemented
Bycatch monitoring	Possible				■		Limited, review every 5 years
2.2 Listed Species							
Listed species interactions – logbooks/ CAES	To be developed	■	■	■	■	■	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)							
3.3 Compliance							
3.4 Management Systems							
Latent effort/effort trends	Ongoing	■	■	■	■	■	
Size management fish grounds	Under way	■	■				
4. Industry Development							
4.1 Production Technology							
4.2 Post-harvest							
4.3 Marketing							

North Coast – Nickol Bay Prawn

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 involves stock monitoring and assessment utilizing monthly return data provided by industry, information from boat skippers, and rainfall records. A few skippers are now 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.

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).

Nickol Bay Prawn

Nickol Bay Prawn Trawl Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Banana prawn biology	Possible	O					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	O					Irregular catches
1.3 Stock Assessment							
Annual catch & effort assessment	Ongoing	■	■	■	■	■	Annual C&E assessment
Banana prawn catch vs rainfall relationship	Ongoing	■	■	■	■	■	
1.4 Fishery Monitoring							
Research logbooks	Limited	■	■	■	■	■	Selected fishers
CAES returns	Ongoing	■	■	■	■	■	
Processor returns	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)	Under way	■	■				
Bycatch monitoring	Periodic	O		■			Limited, Review every 5 years,
2.2 Listed Species							
Listed species interactions	Ongoing	■	■	■	■	■	Logbooks -EPBC requirement –not all fishers at present
2.3 Habitat							
Habitat/effort impacts	Ongoing	■	■	■	■	■	EPBC requirement
2.4 Ecosystem/Environment							
Formal risk assessment	Periodic		■				EPBC requirement
2.5 Oceanography	Not needed						None identified
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							
Size management areas and permanent closures							
375 Rule/Unitisation							
Gear development/changes	Ongoing	■	■	■	■	■	
Byproduct rules	Under way						

Nickol Bay Prawn Trawl Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 metres in depth. They have been fished commercially in WA since at least the mid-70s 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 two 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 1970s. 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.

North Coast Blue Swimmer Crab

North Coast BSC Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	■	■	■	■	■	
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 (or 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.

Northern Demersal Scalefish

NDSF Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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							
Annual catch & 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	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 onFishery	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 provided to industry and regional management.

Kimberley Gillnet and Barramundi

Kimberely Gillnet and Barramundi Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Giant threadfin biology	Under way						Finishing project
Blue threadfin biology	Under way						Finishing project
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
Pig-eye shark	Developing	O	O	O	O	O	Project identified – High risk
1.3 Stock Assessment							
Annual catch & 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		Periodic
Recreational creel	Periodic		O				Periodic
Charter boat catch & 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 introduced, the primary method employed in these fisheries was demersal longline in the WANCSF with a relatively small amount of pelagic gillnetting in the JANSF. Although these arrangements have yet to be finalised for the JANSF, once implemented, the total effort capacity of the fisheries will be reduced considerably and fishing effort will be re-targeted from longlining for K-selected demersal shark species (including sandbar, pigeye and lemon sharks) in the Pilbara towards gillnetting for more productive blacktip whaler stocks in the Kimberley. As fishers have so far been reluctant or unable to reconfigure vessels for gillnetting, there has been negligible effort in the fisheries since 2005. As the principal method and target species will be common to the WANCSF and JANSF under the new management arrangements, data from these fisheries are generally combined and the two regions considered as a single fishery for reporting purposes.

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 improved understanding of the fisheries and the biology of northern shark stocks generally. 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 and Heritage 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 in the northern shark fisheries is contingent on industry funding for a comprehensive observer program (notionally 30 per cent 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.

Northern Shark

Northern Shark Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Sandbar shark	Completed						
1.2 Other Biology							
2ary spp. reproduction	Ongoing	O	O	O	O		
2ary spp. age and growth	Ongoing	O	O	O	O		
1.3 Stock Assessment							
Sandbar demographic analysis	Completed						
Blacktip age structured	Unreliable	O	O	O	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	Ongoing	■	O	O	O		No reported fishing activity
Daily logbook development & analysis	Completed	■	O	O	O		No reported fishing activity
At sea observers	Ongoing but v. limited	O	O	O	O		No reported fishing activity
Landing inspections	Ongoing but v. limited	O	O	O	O		No reported fishing activity
VMS	Under way	O	O	O	O		No reported fishing activity
DNA fingerprinting	Completed for some spp.	O	O	O	O		
2. Habitat & Ecosystem							
2.1 Bycatch							
Elasmobranchs	Subject to industry funded observer program	O	O	O	O		No reported fishing activity
Teleosts		O	O	O	O		No reported fishing activity
2.2 Listed Species							
Grey nurse shark	Completed						No reported fishing activity
Sawfish	Subject to industry funded observer program	O	O	O	O		No reported fishing activity
Dolphins		O	O	O	O		No reported fishing activity
Turtles		O	O	O	O		No reported fishing activity
2.3 Habitat							
2.4 Ecosystem/Environment							
Trophic effects	Requires investigation						No reported fishing activity
Ghost fishing							No reported fishing activity
2.5 Oceanography							
2.6 Other impacts on fishery							

Northern Shark Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
Illegal, Unreported and Unregulated (IUU) fishing		O	O	O	O		Critical
Indigenous fishing		O	O	O	O		Requires investigation
3. Management Analysis							
3.1 Socio-economic							
Dependence on fins	Ongoing	O	O	O	O		NPOA requirement
Mercury and other toxins		O	O	O	O		Requires investigation
3.2 Resource Access (shares)							
Indigenous fishing	Low priority	O	O	O	O		NPOA requirement Low Priority
3.3 Compliance							
Catch under-reporting		O	O	O	O		There has allegedly been recent unreported fishing activity
Illegal, Unreported and Unregulated (IUU) fishing		O	O	O	O		Critical
3.4 Management Systems							
Pilbara closure			O	O	O		Requires investigation
Effort reduction & zoning			O	O	O		
4. Industry Development							
4.1 Production Technology							
4.2 Post-harvest							
4.3 Marketing							
Full utilisation (dependence on fins)	Ongoing	O	O	O	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 blue-spot emperor, threadfin bream, flagfish, red snapper, red emperor, scarlet perch, goldband snapper, spangled emperor, frypan snapper and Rankin cod. The trap fishery targets six of the above species listed (blue-spot, red and spangled emperor, red and goldband snapper 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 to1999, 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. This is combined with age composition data within a simulation stock assessment model at three-yearly intervals to generate the level of spawning biomass remaining for the key indicator species.

An observer program commenced in 2004 in the trawl fishery to improve estimates of the quantity of bycatch, especially protected species. In addition, an FRDC-funded bycatch mitigation project is nearing completion. This is investigating the use of acoustic pingers and separation grids to reduce the catch of dolphins and turtles.

Pilbara Demersal

Pilbara Demersal Finfish Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis	Pilbara red emperor						
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Red emperor	Completed						
Goldband snapper	-						Gap
Rankin cod	Completed						
Bluespot emperor	Completed						
Flagfish	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 catch & effort assessment	Ongoing	■	■	■	■	■	
Age-structured models	Periodic			■			
1.4 Fishery Monitoring							
Commercial catch and effort	Ongoing	■	■	■	■	■	
VMS	Ongoing	■	■	■	■	■	
Voluntary logbook (trawl)	Ongoing	■	■	■	■	■	
Age composition for							
-Red emperor	Periodic	■					
-Goldband snapper	Periodic				■		
-Rankin cod	Periodic		■				
-Bluespot emperor	Periodic			■			
-Flagfish	Completed						
-Rosy threadfin bream	Completed						
2.1 Bycatch	Under way	■	■	■	■		
2.2 Listed Species							
Dolphins (moderate risk), turtles (low risk). Sygnathids (low risk), sea snakes (low risk), sea horses (low risk). Sawfish (moderate risk)	Under way	■					
Mitigation - acoustic pingers	Completed						
- selection grids	Under way	■					
2.3 Habitat (low risk)							
Survival of benthos	Work Completed in 90s						Managed by restricting areas of operation.
2.4 Ecosystem/Environment							Low risk

Pilbara Demersal Finfish Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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		■	■	■	■	■	
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 log book 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.

Mackerel

Mackerel Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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						Needed for IFM - Gascoyne
1.3 Stock Assessment							
Annual catch &effort 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 catch & effort	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 shark losses	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						Needed for IFM. Also for IMP?
Monitoring of shares	Ongoing	■	■	■	■		Needed for IFM/IMP
Review of IMP	Upcoming		■	■			Current Plan ends 2009 and need review of data requirement and assessment of Plan
3.3 Compliance							
Monitoring of vessel activities	Ongoing	■	■	■	■		Using VMS
Quota compliance	Ongoing	■	■	■	■		
3.4 Management Systems							
Assessment of IMP	Proposed						And how fits with IFM

Mackerel Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 affect 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 that can have any significant physical interaction with the marine habitat.

Trawling in deep waters 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.

South Coast Biodiversity Issues

South Coast Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
1.2 Other Biology							
1.3 Stock Assessment							
1.4 Fishery Monitoring							
2. Habitat & Ecosystem							
2.1 Bycatch							
2.2 Listed Species							
Seabirds							Study to mitigate seabird interactions with purse seine fishing. (see above)
Australian sea lions - foraging ecology and fishery interaction	Under way	■					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
2.4 Ecosystem/Environment							
Introduced Marine Pests	Ongoing	■					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 (*Haliotis laevigata*), brownlip abalone (*H. cornicopora*) and Roe's abalone (*H. roei*), 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, a growth experiment for this species is planned for in Windy Harbour in 2007 to assist in determining whether the increased catches are sustainable.

South Coast Abalone

South Coast Abalone Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Roe's biology	Completed						Sufficient for management
Growth rate of green lip abalone – spatial, juveniles (hatchery)	Under way	■					
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						
Brown lip growth	Proposed	O	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	Under way	■	■	■	■	■	
1.4 Fishery Monitoring							
Catch statistics (wildstock)	Ongoing	■	■	■	■	■	
Commercial length frequency monitoring	Ongoing	■	■	■	■	■	
Research monitoring and recruitment sites	Ongoing	■	■	■	■	■	
Industry video monitoring sites	Under way	■	■	■			
2. Habitat & Ecosystem							
2.1 Oceanography/shelf – bathymetric survey							
2.2 Site survey/food availability/density							
2.3 Environmental assessment for export - DEH	Ongoing	■	■	■	■	■	
2.4 Remote sensing							
2.5 External Threats, pollution, bio-invasion, red tides, contaminants							
2.6 Abalone habitat assessment	Proposed	O	O				

South Coast Abalone Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
3. Management Analysis							
3.1 Socio-economic							
Public awareness / interest groups							
Biological training / scientific methods							
3.2 Resource Access (shares)							
3.3 Compliance							
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)	Under way	■	■				
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 (*Jasus edwardsii*) and western rock lobsters (*Panulirus cygnus*) as well as deep sea crab species including giant crabs (*Pseudocarcinus gigas*), crystal crabs (*Chaceon bicolor*) and champagne crabs (*Hypothalassia acerba*).

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.

South Coast Crustacean

South Coast Crustacean Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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						
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	-						
Finfish 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						

South Coast Crustacean Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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-1980s, 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.

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 using 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.

Some information on bycatch levels and composition will be required to meet the future requirements of the EPBC assessments.

South Coast Trawl

South Coast Trawl Fishery Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Scallop biology	Completed						Completed in 1980s
1.2 Other Biology							
Recruitment dynamics	Possible						
Other fish species biology	Possible						
1.3 Stock Assessment							
Catch &effort 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	Under way	■					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							
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 1970s. 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.

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

South Coast Estuarine

South Coast Estuarine Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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 catch & effort trends	Ongoing	■	■	■	■		CAES data & angler logbooks
1.4 Fishery Monitoring							
CAES	Ongoing	■	■	■	■		
Commercial daily logbook	Developing	■	■	■	■		Draft trialled in 2006/07
Creel survey	Periodic						None proposed in 5 years.
Recreational angler logbook	Ongoing	■	■	■	■		RAP
Fishing tournament & club records	Developing	O	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	Proposed	O	O	O			UWA study under way - ecological flow requirements for Wilson Inlet. Proposal (UWA & DoF) – flow effects on bream reproduction & early life history.
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							Bream
							Pallinup & other closures
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.

South Coast Purse Seine

South Coast Purse Seine Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	■	■	■	■	■	
2. Habitat & Ecosystem							
2.1 Bycatch (Low Risk)							Low Risk
See 2.2							Medium risk, can involve listed species
2.2 Listed Species							Low risk
Some interactions with e.g. seabirds	Under way	■					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						Low value, small scale
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 principally divided into two 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 per cent) in the temperate demersal gillnet and longline fisheries is from demersal gillnets.

These fisheries target a variety of shark species but scalefish (teleosts) account for between 15 and 20 per cent of fishery landings. Target species vary by zone, with primary targets being the sandbar shark (*Carcharhinus plumbeus*) in the WCDGDLF, dusky sharks (*C. 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 fisheries' target shark stocks over the period 1993-2005. These have provided extensive information on the biology and stock status of these species.

Current Research Focus

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

Temperate Demersal Gillnet and Longline Fisheries

DGLL Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Gummy shark	Reproduction completed						Age & growth incomplete
Whiskery shark	Completed						
Dusky shark	Completed						
Sandbar shark	Completed						
Wobbegongs	Completed						
Pencil	Completed						
1.2 Other Biology							
2ary spp. reproduction	Ongoing	O	O	O	O		
2ary spp. age and growth	Ongoing	O	O	O	O		
Grey nurse movements/habitat use	Completed						
1.3 Stock Assessment							
Gummy age structured	Completed	O	O	O	O		Model and age structure require updating
Whiskery age structured	Completed	O	O	O	O		Age structure requires updating
Dusky demographic analysis	Completed	O	O	O	O		Fishing mortality rates require updating
Sandbar demographic analysis	Completed			O	O		Fishing mortality rates will require updating in 2008/09
1.4 Fishery Monitoring							
CAES analyses	Ongoing	■	■	■	■	■	Probable DEH requirement
Daily logbook development & analysis	Ongoing	■	■	■	■	■	Probable DEH requirement
At-sea observers	Ongoing but v. limited	■	■	■	■	■	Probable DEH requirement
VMS		■	■	■	■	■	
DNA fingerprinting	Completed for some spp.	O	O	O	O		
2. Habitat & Ecosystem							
2.1 Bycatch							
Elasmobranchs	Completed						
Teleosts	Completed						
2.2 Listed Species							
Grey nurse shark	Completed						
White shark	Completed						
Pinnipeds	Completed						
Dolphins	Completed						
Turtles	Completed						
2.3 Habitat							

DGLL Fishery Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
2.4 Ecosystem/Environment							
Trophic effects	Require investigation	O	O	O	O		
Ghost fishing		O	O	O	O		
2.5 Oceanography							
2.6 Other impacts on fishery							
Catch by Commonwealth fisheries	Ongoing	■	■	■	■	■	
Bycatch in Commonwealth fisheries	Partly completed for SWTBF	O	O	O	O		
Illegal, Unreported and Unregulated (IUU) fishing	Ongoing	O	O	O	O		
Indigenous fishing	Low priority	O	O	O	O		
3. Management Analysis							
3.1 Socio-economic							
Mercury and other toxins	Requires investigation						
3.2 Resource Access (shares)							
Indigenous fishing	Low priority						NPOA requirement
IFM teleost spp.	Low priority						
Areas of conflict with rec. fishers	Low priority	O	O	O	O		
3.3 Compliance							
Dusky shark max. size	Ongoing	O	O	O	O		
Gear prohibitions/restrictions	Ongoing	O	O	O	O		
Time gear unit usage	Ongoing	O	O	O	O		
Seasonal closure	Ongoing	O	O	O	O		
3.4 Management Systems							
Dusky shark max. size	Ongoing	■	■	■	■		
Gear prohibitions/restrictions	Ongoing	■	■	■	■	■	
Time gear unit usage	Ongoing	■	■	■	■	■	
Seasonal closure	Ongoing	■	■	■	■	■	
Catch and effort triggers	Ongoing	■	■	■	■	■	
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 1940s. 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 mainly assessed using CAES 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 use the limited fishery data currently available. The age structure of the recreational fishery is being sampled to provide input for the model. Recruitment data collected since 1995 is being re-examined – there is recent evidence of intra-annual pulses of juvenile settlement related to oceanography that may explain total annual variation. Potential nursery signatures in otoliths are being examined to better determine sources of recruitment to each region.

Australian Herring

Aust. Herring Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Australian herring	Complete						
1.2 Other Biology	Not needed						
1.3 Stock Assessment							
CAES data	Ongoing	■	■	■	■		
Age-based model (herring)	Under way	■	O	O	O		Otoliths being collected, Update existing model
1.4 Fishery Monitoring							
CAES	Ongoing	■	■	■	■		Minimal Swan R. & Hardy Inlet data, no Leschenault data.
Creel survey	Periodic						Need boat & shore-based data from west & south coasts
Angler daily logbook	Developing	O	O	O	O		Research Angler Program (RAP)
Juvenile recruitment index	Under way	■	■	■	■		
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 1930s. 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.

WA Salmon

SW and SC Salmon Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	O			ESD requirement. Logistically difficult due to low & infrequent catches
Observer program	Under way	■	■				ESD requirement. Logistically difficult due to low & infrequent catches.
Creel survey	Periodic						Need shore-based data from west & south coasts. None proposed in 5 years.
Recreational angler logbooks	Under way	■	■	■	■		Research Angler Program (RAP)
Juvenile recruitment index	Under way	■	■	■	■		
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 – Biodiversity Issues

Description and Scope of Issues

The northern inland bioregion, encompassing the northern half of the state, is predominantly a desert area, with few permanent water bodies. As a result of occasional summer cyclones, the various river systems flow at flood levels for short periods before drying out to residual waterholes. The only exceptions to this are man-made dams that trap rainfall for water supply purposes and irrigation.

Influences on freshwater bodies and habitats in the northern inland bioregion are largely terrestrial and outside the control of Fisheries legislation. While fishing activities in this region do not cause any significant environmental impact, the Department has supported a number of studies into the native fish fauna and their habitats in northern river systems.

In Lake Argyle, the development of the barramundi aquaculture industry is subject to environmental management under the Department's licensing arrangements. Monitoring to ensure maintenance of water and benthic quality standards is undertaken by the industry, and research has been carried out by the Department to assess the nutrient dynamics and carrying capacity of the lake in relation to barramundi. Water quality standards are set in consultation with the Water Corporation, Water and Rivers Commission and the Department for Environmental Protection.

Current Research Focus

Under development

Northern Inland – Barramundi Aquaculture Research Plan

Description and Scope of Fishery

Barramundi (*Lates calcarifer*) is a native diadromous fish species from the Indo-Pacific region. In Western Australia they are farmed in cages in coastal embayments, cages in irrigation reservoirs and also in freshwater recirculation systems. Barramundi are produced in a range of sizes for plate (400 g), banquet (1000 g) and fillet (> 2500 g) markets. Barramundi production has increased rapidly over the past few years to become the majority of aquaculture finfish production in Western Australia. This has occurred mainly due to expansion of both the number of operators and the scale of some operations.

Techniques for breeding, feeding and farming barramundi were developed by researchers in Queensland in the late 1980s and early 1990s. In the late 1990s the Department of Fisheries undertook an industry development plan for Lake Argyle, which was identified earlier as a key site for potential large-scale barramundi production. In the early 2000's the Department of Fisheries provided support for the expansion of an existing small-scale operation in Lake Argyle to become the third largest barramundi farm in Australia, through the assistance in development, implementation, conduct and reporting of its environmental monitoring program and also through close involvement of the Department of Fisheries Research Division in providing technical advice. In early 2004, following large flooding events at Lake Argyle, the farm succumbed to a disease outbreak that resulted in major losses and ultimately resulted in the closure of the company in 2005. Farming at Lake Argyle since has only continued on a small scale. New developments in sea-cage farming in the Dampier Archipelago are also progressing, with an operator installing salmon-farming style technology and steel nets to farm barramundi. This operation is commencing its expansion phase.

Current Research Objectives

- Improvement of production efficiency by better feed management through refinement of bio-energetic growth and feed-utilisation models.
- Assessment of new raw materials for use in barramundi diets to reduce reliance on imported fishmeal and fish oils.
- Assessment of environmental impacts and identification of new and more sensitive methods of assessment.
- Assessment of potential cage-aquaculture sites for hydrodynamics and environmental carrying capacities.
- Development of diagnostic methods and management protocols to manage disease outbreaks.

Barramundi Farming

Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Growth	Being Revised	■	■	■	O	O	Major external projects include components examining the influence of temperatures > 29°C on fish growth and also include the development and refinement of growth models.
Reproduction	Completed						Completed in QLD
Diet	Being Revised	■	■	■	O	O	Major externally funded projects include components examining a range of feed design, raw material use and feed management issues to improve feed resource sustainability.
1.2 Other Biology							
Reproduction in WA	Required		O	O	O		Limited success in spawning of local fish and development of a reliable hatchery in WA needs investigation.
Genetic selection	Required	O	O	O	O	O	Selection programs are required to improve stock performance. Industry directed programs have already been planned and some progress made, but major R&D initiatives in this area are still to be undertaken.
1.3 Stock Assessment	Completed						Assessment of genetic pools of barramundi stocks completed and show that WA (Kimberley) fish are not genetically distinct from others throughout NT and western QLD.
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	Required	■	■	■	■	O	
2.5 Oceanography	Not needed						
2.6 Other Impacts on Fishery	Not needed						
3. Management Analysis							
3.1 Socio-economic	Possible	O	O				
3.2 Resource Access (shares)	Not needed						
3.3 Compliance	Ongoing	O	O	O	O	O	
3.4 Management Systems	Required	O	O	O	O	O	Licensing and policy development required to facilitate a more streamlined processing of applications. Identification of appropriate sea-cage sites in Kimberley required to underpin resource allocation and environmental management.

Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
4. Industry Development							
4.1 Production Technology	Required	■	■	■	O	O	Ongoing. Major improvements have been made over the past decade, but ongoing research and development is required to optimise sustainability and economic viability as market volume grows.
4.2 Post-harvest	Required	O	O	O	O	O	Some issues identified and resolutions to some problems defined but require some of these require broader extension and commercial application. Other issues still remain to be resolved.
4.3 Marketing	Possible	O	O	O	O	O	Development of an industry marketing strategy is required.

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 behaviour 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.

Lake Argyle Freshwater Catfish

Lake Argyle Silver Cobbler Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Silver Cobbler	Developing	O	O	O	O	O	Project identified
1.2 Other Biology							
1.3 Stock Assessment							
Annual catch & effort assessment	Ongoing	■	■	■	■	■	Ongoing
1.4 Fishery Monitoring							
Commercial catch & effort	Ongoing	■	■	■	■	■	Ongoing
Commercial monitoring	Proposed	O	O	O	O	O	??
Charter boat catch & effort	Ongoing	■	■	■	■	■	Ongoing
2. Habitat & Ecosystem							
2.1 Bycatch	Developing		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							

North Inland – Recreational Redclaw Fishery

Description and Scope of Issues

A population of redclaw crayfish (*Cherax quadricarinatus*) exists in Lake Kununurra in the East Kimberley region of Western Australia. Redclaw crayfish are a feral species within the Ord River catchment and this population is believed to have been present in the lake for the last 6-7 years.

An exemption was issued by the Department of Fisheries to allow a twelve-month trapping trial to be done in Lake Kununurra. The trial was conducted in collaboration with the East Kimberley Region Recreational Fisheries Advisory Committee and the East Kimberley Sport and Game Fishing Club to (1) determine most effective trapping method (maximise red claw catch) and (2) determine least disruptive trapping method (minimise bycatch especially protected animals like turtles and crocodiles). The results indicate that the best redclaw trap is the commercially available opera-house trap. Provided that the entrance gap was restricted by a metal or plastic ring not greater than 70 mm in diameter, interaction with protected reptiles, mainly turtles, and Johnson's freshwater crocodile, did not occur.

The Minister has approved the drafting of legislation that would allow the use of such traps to catch feral redclaw in Lake Kunnunura. This new recreational fishery is expected to be introduced in 2007.

Current Research Focus

- General biology (reproduction, growth etc) of redclaw in Lake Kunnunura
- Effects of redclaw on native organisms, especially Macrobranchium
- Distribution and abundance of redclaw in 1) Lake Kunnunura, 2) Ord river and 3) other northern river systems
- Monitoring recreational fishery

Recreational Redclaw

Northern Inland Recreational Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Redclaw	Developing	■					Some basic biology research to be done in collaboration with Murdoch University and UWA.
1.2 Other Biology							
Macrobranchium	None						Limited information on basic biology, distribution, abundance and interaction with redclaw.
Native fish	Limited						Limited information on interaction redclaw with native (recreational/ commercial) fish.
1.3 Stock Assessment							
Redclaw	None						Basic stock assessment needs to be developed.
Macrobranchium	None						Basic stock assessment needs to be developed.
1.4 Fishery Monitoring							
Redclaw	None						Basic assessment of the recreational redclaw fishery needs to be developed.
Macrobranchium	None						Basic assessment of the re recreational macrobranchium take needs to be developed.
2. Habitat & Ecosystem							
2.1 Bycatch	Completed						Bycatch study redclaw traps has been completed, joint effort local RFAC and DoF.
2.2 Listed Species	Low risk						Freshwater turtles and crocodiles
2.3 Habitat	Low risk						
2.4 Ecosystem/Environment	High risk						Impact of feral redclaw on native fish and macrobranchium potentially highly threatening
2.5 Oceanography	N/a						
2.6 Other impacts on fishery							
3. Management Analysis							
3.1 Socio-economic							
Social assessment	None						
Economic analysis	None						
3.2 Resource Access (shares)							
Detailed determination of access shares	N/A						
Monitoring of shares	N/A						
3.3 Compliance							
Validation of catch records	N/A						

Northern Inland Recreational Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
3.4 Management Systems	N/A						
4. Industry Development							
4.1 Production Technology	None						
4.2 Post-harvest	None						
4.3 Marketing	None						

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 southwest 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 per cent) and crustacean species (100 per cent) 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 that may affect 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 under way.

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.

Southern Inland Biodiversity Issues

Southern Inland Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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	O	■	■	■	Replacement of gambusia with native fish for mosquito control as an alternative to chemical spraying.
Restocking natural wetlands	Ongoing	O	O	■	■	■	Restocking critically endangered native fish to prevent extinction.
1.3 Stock Assessment							
Native fish distribution	Ongoing	■	■	■	■	■	Identification of species of conservation concern.
	Ongoing	O	■	■	■	■	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	O	■	■	■	■	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.
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							
Monitoring of shares							
3.3 Compliance							
Validation of catch records							
3.4 Management Systems							

Southern Inland Biodiversity Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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						

Southern Inland – Marron Aquaculture

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 1970s. 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 1980s. 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.

Marron Farming

Marron Farming Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Growth	Ongoing	■	■	■	■	■	Monitoring of genetic improvement
Reproduction	Ongoing	■	■				There appears to be variation in reproduction variation among some river lines.
Diet	Possible					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)	Under way	.	■	■	■	■	Margaret river marron Captive breeding program (to new Biodiversity program)
Stock enhancement (Margaret River marron)	Future				■	■	Margaret river marron (to new Biodiversity program)
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	Under way	■	■	■	■	■	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 1980s, validated in 2000-05 FRDC project
4.2 Post-harvest							
Post-harvest handling							11% mortality in purging systems requires investigation
4.3 Marketing	Not needed						

Southern Inland – Ornamental Fish Aquaculture

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 conducted small scale holding of south-west native fish at PFRC in the early 1990s, but has had no dedicated research program in this area. 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.

Current Research Objectives

- Production techniques for pygmy perch for restocking water bodies and replacement of *Gambusia* for mosquito control.

Ornamental Fish Farming

Ornamental Fish Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Introduced Ornamental fish							
Growth	Completed						
Reproduction	Completed						
Diet	Completed						
Native Ornamental fish							
Growth	Ongoing	■	■	■	■	■	Production for restocking water bodies & replacement of Gambusia for mosquito control (to new Biodiversity program).
Reproduction	Ongoing	■	■	■	■	■	Production for restocking water bodies & replacement of Gambusia for mosquito control (to new Biodiversity program).
Diet	Possible			O			
1.2 Other Biology							
Introduced Ornamental fish							
Improved varieties	Possible			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						
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				
Native ornamental fish	Possible			O			
3.2 Resource Access (shares)	Not needed						
3.3 Compliance	Possible						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	O	

Ornamental Fish Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
Native ornamental fish	Possible				O	O	
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		

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 licence, seasonal closures, minimum sizes, and bag limits. People under 16 years of age are not required to hold a licence 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 Research Angler Program (RAP)
- Diet of trout (brown and rainbow), redfin and freshwater cobbler
- Growth and mortality of stocked trout

Recreational Freshwater Angling

Southern Inland recreational Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural 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.
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	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	needed						Determine off-set loss of dams by Water Corporation
Economic Analysis	needed						Determine off-set loss 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						

Southern Inland recreational Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
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 freshwater 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 season. A large number of recreational marron licences are sold annually. For the 2005 season, a total of 20,075 licences were sold, including umbrella licences (13,035).

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 trialled 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

- Improve annual stock assessment
- Develop of 0+ abundance method
- Develop of long-term tagging program
- Trial large-scale artificial habitat to improve production and fishery in dams
- Improve logbook survey
- Develop prediction model based on stock assessment, recruitment and environment

Recreational Marron Fishery

Southern Inland recreational Fisheries Research Projects	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (gowth, reproduction, diet, natural 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 of 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

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 1980s. In the early 1990s Department of Fisheries researchers in Western Australia developed extension material to facilitate the adoption of this technology by local farmers. In the mid 1990s 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

Silver Perch Farming

Silver Perch Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Growth	Completed						Completed in NSW
Reproduction	Completed						Completed in NSW
Diet	Completed						Completed in NSW
1.2 Other Biology							
Reproduction in WA	Ongoing		■	■	■	■	Troubleshooting/problem solving for industry hatcheries to prevent spawning failures.
1.3 Stock Assessment	Not needed						
1.4 Fishery Monitoring	Not needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not needed						
	Not needed						
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						

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 southwest 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 1800s 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 per cent decline in egg viability of brown trout needs to be identified.
- Improved production of triploids by pressure shock.
- Control of inbreeding in PFRC population.

Trout Farming

Trout Farming Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Growth	Completed						
Reproduction	Completed						
Diet	Completed	O					Nutrition of trout is well understood. Some potential for work on replacement of fishmeal in trout feeds.
Temperature tolerance	Current	O	■	■	■	■	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% needs to be 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	O	■	■	■	■	1). Selective breeding for heat tolerance & growth 2). Control of inbreeding in PFRC population
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	Possible						Economics of trout production in WA are unknown
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	Under way	■	■				ADU/TAFE FRDC project
4.2 Post-harvest	Possible						
4.3 Marketing	Possible						

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 southwest. 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.

Major Research Objectives

- Eradication of feral yabby populations within the marron region.

Yabby Farming

Yabby Farming Research Project	Research Status	2007/08	2008/09	2009/10	2010/11	2011/12	Comments
1. Retained Species Stock Analysis							
1.1 Basic Biology of Indicator Species (growth, reproduction, diet, natural mortality)							
Growth	Completed						
Reproduction	Completed						
Diet	Possible					O	Basic diet developed, but nutritional requirements are still unknown.
Genetic improvement	Completed						
1.2 Stock Assessment	Not Needed						
1.3 Fishery Monitoring	Not Needed						
2. Habitat & Ecosystem							
2.1 Bycatch	Not Needed						
2.2 Listed Species	Not Needed						
2.3 Habitat	Completed						
							Completed in 1990s
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 1990s
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 1990s 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 metres long. 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 of 2004.

Specimen Shell Managed Fishery

Description and Scope of Fishery

The SSMF operates in the shallow waters around the entire Western Australian coastline. The fishery is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. Up to 550 different species, including various cowries, cones, murexes and volutes, are collected by hand by divers operating from small boats. There are 33 licences with no more licences to be issued to the fishery; only six of these are active divers. The actual locations where collections occur form only an extremely small proportion of the coastline making the risk to these species negligible.

Current Research Focus

Nil