Northern Inland Bioregion

Lake Argyle

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ABOUT THE BIOREGION

The Northern Inland bioregion, encompassing the northern half of Western Australia, 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, which trap rainfall for water supply purposes and irrigation.

The only significant fishable water body in the region is Lake Argyle, created by damming the Ord River. The continuous release of water from the dam has resulted in the Ord River maintaining its freshwater fish populations year-round, as does the lake where some freshwater native fish populations have expanded. Populations of reptiles, such as the protected freshwater crocodile, are supported by the expanded food chain of native fish, and are thought to have expanded significantly from their original billabong-based populations.

The creation of Lake Argyle has produced a unique inland aquatic environment which is now home to various fishing and tourism-related activities. The lake supports the State's only commercial freshwater fishery – for the silver cobbler or catfish – together with a processing facility supplying predominantly Western Australian and interstate markets.

The lake and its associated river system also support recreational fishing for the freshwater component of the barramundi stock and cherabin (freshwater prawns).

Aquaculture development operations in the region have included the production of barramundi from a cage operation in Lake Argyle, and a small but growing pond production of redclaw crayfish in the Ord River irrigation system around Kununurra. Production of aquarium fish using bore water in the southern Gascoyne region is also being explored.

ENVIRONMENTAL MANAGEMENT

Regional Overview (Northern Inland)

The Department of Fisheries actively supports a number of studies into the native freshwater fish fauna and their habitats in northern river systems in conjunction with Murdoch University, the Department of Water and the Department of Environment and Conservation, and through involvement with local natural resource management councils. New aquaculture ventures are also subject to strict environmental evaluation under the Departmentís licensing and on-going arrangements, in conjunction with industry and TAFE.

A feral fish incursion response program is also in place to react to feral fish and/or non- endemic disease outbreaks where they occur.

The Ord River.

FISHERIES

Lake Argyle Silver Cobbler Fishery Status Report

S.J. Newman and C. Skepper
Management input from A. Bain

Fishery Description

The only commercial freshwater fishery in Western Australia is in Lake Argyle in the north-eastern Kimberley. This gillnet fishery specifically targets the silver cobbler or shovel-nosed catfish (*Arius midgleyi*).

Governing legislation/fishing authority

Commercial

Fisheries Notice no. 665 (Section 43 order)
Condition 55 on a Fishing Boat Licence

Recreational

Fish Resources Management Act 1994
Fish Resources Management Regulations 1995 and subsidiary legislation

Consultation process

Commercial

Meetings between the Department of Fisheries and industry

Recreational

Recreational Fishing Advisory Committee (RFAC)
East Kimberley Regional Recreational Fishing Advisory Committee (Kununurra)

Boundaries

The Lake Argyle Silver Cobbler Fishery (LASCF) is contained in the impounded waters of the Ord River at Lake Argyle.

Management arrangements

This fishery is managed by input controls in the form of a set of licensing conditions. It is a limited entry fishery.

For each licensee there is a gillnet length restriction of 1,500 metres and all nets must be suitably marked with licence identification. While there is no mesh size restriction, the fishers have adopted a code of practice that states that nets should have a mesh size not less than 6¼ inches (150 mm) and a drop length of 30 meshes.

All fishers are prohibited from taking any fish whatsoever by means of nets during the period from 1 November to 31 December in any year. Fishers in the LASCF are not permitted to take barramundi (*Lates calcarifer*).

Since 2000, operators have voluntarily reduced effort in the fishery and hence the levels of catch.

In response to concerns from charter operators, the general public and conservation groups, LASCF endorsement holders developed an industry code of practice to minimise the incidental capture of freshwater crocodiles. Implemented in 2001, the code specifies the accepted means of operation in the fishery and outlines contingency procedures for fishing gear that has been lost or abandoned.

Future management measures for this fishery include a review of the latent effort present within the fishery and a possible shift in the seasonal closures to better accommodate the wet-season breeding period for the target species.

Research summary

Data for assessing the status of the silver cobbler 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.

Retained Species

Commercial landings (season 2006): 78 tonnes

The target species in the fishery is the silver cobbler or shovel-nosed catfish. The fishery first developed in 1979, with increasing catches reported until 1988 (138 t). Catch levels then fluctuated between 90 t and 145 t until 1997 (Lake Argyle Silver Cobbler Figure 1), after which they increased to a peak of 231 t in 2000.

Owing to voluntary reductions in effort, catches declined in both 2001 and 2002. From 2003 to 2005, the level of catch has ranged from 131 to 165 t. In 2006, the catch dropped to 78 t and is below the target catch range for this fishery (Lake Argyle Silver Cobbler Figure 1).

Recreational catch: Not assessed

Limited data are currently available. The reported charter boat catch for Lake Argyle from 2002 to 2006 was less than 1 t of silver cobbler per annum.

Fishing effort/access level

Nominal effort in this gillnet fishery is calculated as the total number of fishing days by all boats multiplied by the average daily total net length fished per boat divided by 100 to give '100 m net days'.

During 2006, 3 vessels were active in the fishery, and generated an effort of 5,279 units (100 m net days). This level of effort is much lower than the 6,472 units reported in 2005 (Lake Argyle Silver Cobbler Figure 1).

Stock Assessment

Assessment complete: Yes

Breeding stock levels: Adequate

The catch rates achieved in the fishery from 2000 to 2002 were similar to those achieved in 1993 and 1994. The much higher catch rate achieved in the fishery in 2003 is similar to that reported in the fishery in 1990 (Lake Argyle Silver Cobbler

Figure 1). The factors contributing to the increase in CPUE in 2003 are not known.

The catch rate in 2004 declined to similar levels to those reported in the period from 2000 to 2002. The catch rate evident in the fishery in 2006 is the lowest recorded since 1979 and is similar to that recorded in 1998 and 1999 (Lake Argyle Silver Cobbler Figure 1). The fishery will be closely monitored over the next few years.

The catch and effort data provided by industry are used to develop stock assessment models for the fishery. The modelling approach used in the following assessment of the fishery requires a number of assumptions related to catchability and age and growth, and the available data are not sufficiently detailed to determine whether or not these assumptions are reasonable.

This 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.

The fishery was last formally assessed in 2001 when a process error model and an observational error model replaced the biomass dynamics model previously used. The results of this assessment work indicated that the stock was either fully fished or overfished. Both models indicated that the catch levels of 180 – 230 t reported by the fishery during the period 1998 – 2000 were unlikely to be sustainable.

The reduced effort applied by the fishery after 1999 has brought catches back into the acceptable range. These lower catches generated a slight upward trend in CPUE from 1999 to 2003, suggesting that stock abundance may be increasing (Lake Argyle Silver Cobbler Figure 1).

The simultaneous increase in catch and catch rate in 2003 may have reflected either the short-term use of a smaller mesh size within the fishery or an increase in recruitment. The reduced catch rate in 2006 now indicates that the catch rates have been declining since the relatively large catch of 2003.

The assessment completed in 2001 indicated that the fishery was probably over-exploited and the breeding stock may not have been sufficient to maintain existing recruitment to the fishery if fishing had continued at the catch levels seen during the years 1998 – 2000. The significant reductions in catch that occurred in 2001 and 2002 may have assisted in the recovery of the breeding stock.

The variable CPUE may be related to variations in recruitment strength that are unrelated to fishing. The declining catch rate since 2003 requires further investigation.

Non-Retained Species

Bycatch species impact: **Low**

Minimal fish bycatch occurs in this fishery as a result of the large mesh size used relative to the species present in the lake.

Protected species interaction: **Low**

There is an incidental capture of freshwater or Johnston's crocodiles (*Crocodylus johnstoni*) and some tortoises by the silver cobbler fishery in Lake Argyle. Although Lake Argyle is an artificially-created aquatic environment, it is now designated as a wetland of international importance under the Ramsar Convention.

While the crocodile population has probably increased in response to the creation of the dam in an otherwise arid environment, there are no assessments of the current size of the population, nor of the proportion of the population being captured incidentally by the fishery. In the absence of this information, but on the basis of the fishers' anecdotal information of low levels of capture, the incidental capture of crocodiles is considered to be of minimal ecological significance. In addition, fishers in Lake Argyle are also attempting to reduce the incidental capture of non-target species.

In 2005, LASCF endorsement holders' trialled the use of fish traps as a method of mitigating bycatch. Early indications suggest that this gear-type is ineffective for harvesting silver cobbler.

Ecosystem Effects

Food chain effects: **Not assessed**

Habitat effects: **Negligible**

The surface gillnets used in the fishery have minimal impact on the habitat.

Social Effects

During 2006, 3 vessels fished in the LASCF with an average crew level of 2 people per vessel, indicating that 6 people were directly employed in the fishery. Additional employment occurs in the fish processing and distribution networks used by the LASCF.

Economic Effects

Estimated annual value (to fishers) for year 2006: **$207,000**

The LASCF landed a total of 78 t of fish in 2006 for a catch value of over $207,000. This estimate is based on the landed weight of silver cobbler recorded in the Department of Fisheries' CAES system and the 2005 average price per kilogram of whole weight of silver cobbler as supplied by fish processors.

Fishery Governance

Target catch range: **95 – 155 tonnes**

The target catch range under the current management regime is in the range of 95 – 155 t of silver cobbler. This range has been derived by applying an autoregressive moving average control quality procedure to the annual catches from 1990 to 2002. The confidence intervals are obtained by estimating the variation of the observations compared with the variation of the predictions using the 13 years of catch data.

The catches from 1998 to 2000 exceeded this range (Lake Argyle Silver Cobbler Figure 1) and were driven by the utilisation of latent effort. The 2001 and 2002 catches were within the target catch range as a result of voluntary decreases in effort in this fishery. The catch in the fishery in 2004 and 2005 has been within the target catch range. The 2006 catch is below the target range, due to a reduced level of effort in the fishery.

Current fishing (or effort) level: Acceptable

The 2006 level of catch and effort was much lower than in previous years. This low catch is likely to assist the breeding stock in recovering. As such, the current level of catch and effort is considered acceptable. However, the declining catch rates in the fishery that are evident from 2003 to the present requires close monitoring.

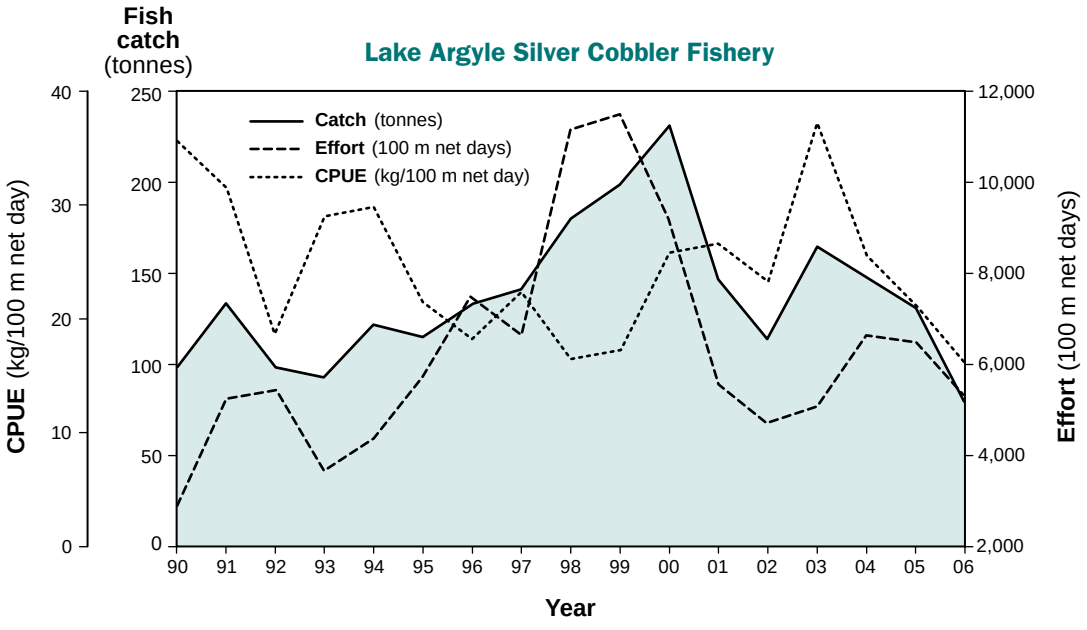
New management initiatives (2006/07)

The 2007 annual management meeting for the fishery is expected to focus on bycatch issues, particularly in relation to interactions with protected species. It is expected that this meeting will lead to new management initiatives for the fishery, including formalisation of current industry codes of practice and possibly further trialling of alternative gear-types.

External Factors

The variations in catch and catch rate seen from year-to-year are possibly related in part to the unknown catchability dynamics, recruitment levels and demographic characteristics of the silver cobbler – each of which may be affected by variations in environmental conditions within the Lake Argyle system.

Fishers head and gut the silver cobbler for transport to Perth markets in order to reduce freight costs, thus it is difficult to cost-effectively sample the size and age composition of the catch. The remote location of this fishery also means that it is a costly exercise to use observers to gain a better understanding of the catchability of this species.



LAKE ARGYLE SILVER COBBLER FIGURE 1

The annual catch, effort and catch per unit effort (CPUE, kg/100 m net day) for the Lake Argyle Silver Cobbler Fishery over the period from 1990 to 2006.

AQUACULTURE

Regional Research and Development Overview

During 2006/07, Department of Fisheries' research and regional services staff in the Northern Inland bioregion continued to assist a variety of mainly Indigenous proponents with interest in inland aquaculture species including barramundi (*Lates calcarifer*), cherabin (*Macrobrachium rosenbergii*) and live-bait fish.

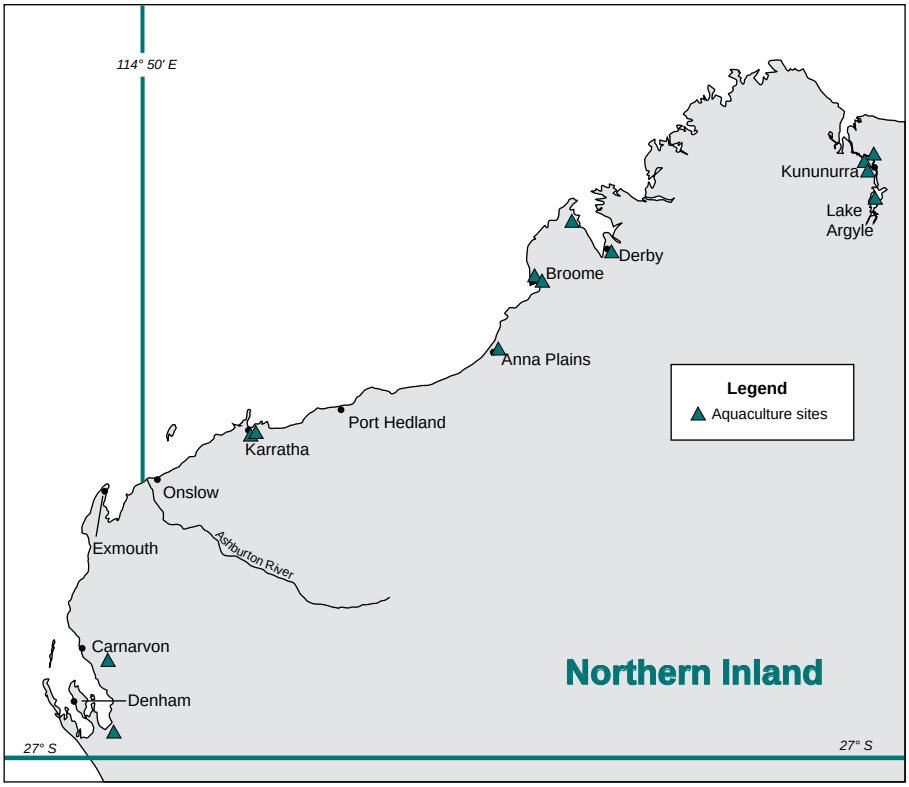
The Department was involved in assessing a range of potential sites in areas occupied by local indigenous communities interested in aquaculture projects. Staff have progressed the issuance of an aquaculture lease area in Lake Argyle for the Mirriuwung Gajjerong Aboriginal Corporation, in accordance with requirements for the Ord Stage II final agreement.

Progress has also been made on developing an indigenous model farm for the aquaculture of barramundi and redclaw crayfish near Kununurra, with commissioning of the site expected in 2007/08. A proposed prawn farm in the Wyndham area remains under consideration.

Research and regional services staff from the Department of Fisheries have also been assisting the Department of Planning and Infrastructure in identifying a new land-based aquaculture area for Lake Argyle to support the mid- to long-term expansion of aquaculture in the lake.

2 large externally-funded research projects have helped underpin the sustainability of barramundi aquaculture development in the Kimberley. These projects have been funded from the Fisheries Research and Development Corporation (FRDC), Sustainable Regions Program and the Australian Centre for International Agricultural Research.

Major issues resolved include the development of disease management strategies to limit spread of diseases in Lake Argyle; the development of techniques to reduce and remove 'muddy' flavour taint in fish farmed in Lake Argyle; the development of a national testing centre for flavour taint issues; and the refinement of a production and feed management model. This model is being further refined in work at the WA Fisheries and Marine Research Laboratories, at Hillarys in Perth.



NORTHERN INLAND BIOREGION FIGURE 1
Map showing the major licensed aquaculture sites of the Northern Inland bioregion.

Barramundi Farming Status Report

C. Lawrence and S. How

Industry Description

Production methods

Barramundi (*Lates calcarifer*) can be farmed in cages in lakes or coastal areas, in inland saline ponds, or in intensive recirculating culture systems using fresh water, inland saline water or seawater. In Western Australia the majority of barramundi production is from fresh water, particularly using cages or intensive recirculating systems.

Production areas

Barramundi is currently produced in cages in Lake Argyle or intensively in recirculating systems in the southern half of the state.

Management arrangements

An aquaculture licence from the Department of Fisheries is required to undertake barramundi farming. A water quality monitoring program that is to the satisfaction of the Department of Environment and Conservation must also be developed and maintained.

Aquaculture Production

Production current year (2005/06): 18 tonnes

Number of producers for year 2005/06: 13

In comparison to 2004/05, this represents a decrease of 3 productive farms.

Production projection next year (2006/07): 20 tonnes

Barramundi production in 2005/06 decreased by 93% compared to the previous year, with a corresponding decrease in value of 87% due to a return to more realistic prices per kilogram. This decrease in production can be attributed to 4 farms ceasing production since 2003/04. (Barramundi Farming Figure 1).

Future production levels may be affected by:

- appropriate management during periodic fluctuations in water quality in Lake Argyle;
- intense competition (particularly from Northern Territory and Queensland farms) that can depress market prices; and
- development of new farms.

Ecosystem Effects

With correct management, barramundi farming is considered to present a moderate risk to the environment. Even within protected coastal areas and lakes, cages can be operated with low environmental impact if they are appropriately located in deeper water with adequate current flow to remove nutrients.

Native fish present around the cages can also be expected to consume a significant amount of waste material (uneaten feed and faeces), thus reducing the overall impact on the environment. Monitoring of the major farm in Lake Argyle in 2002/03, as part of the requirements of the Department of Environment and Conservation, indicated minimal environmental impact.

Land-based farms producing more than 1 t of fish are required to minimise their environmental impact and are subject to discharge licensing, which includes monitoring of water quality.

Social Effects

While this industry has the potential to become a valuable source of regional employment and local tourism opportunities at Lake Argyle, production has decreased considerably over the past year.

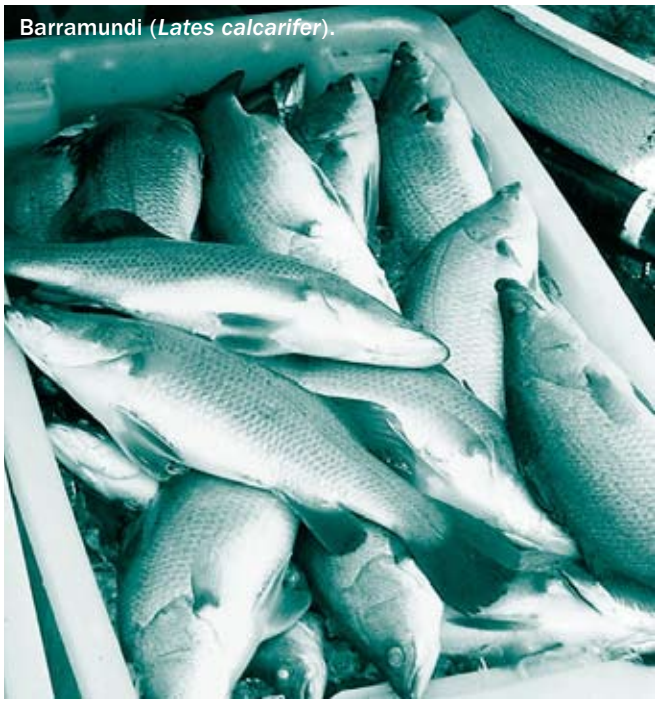
Economic Effects

Estimated annual value (to producers) for year 2005/06: $0.2 million

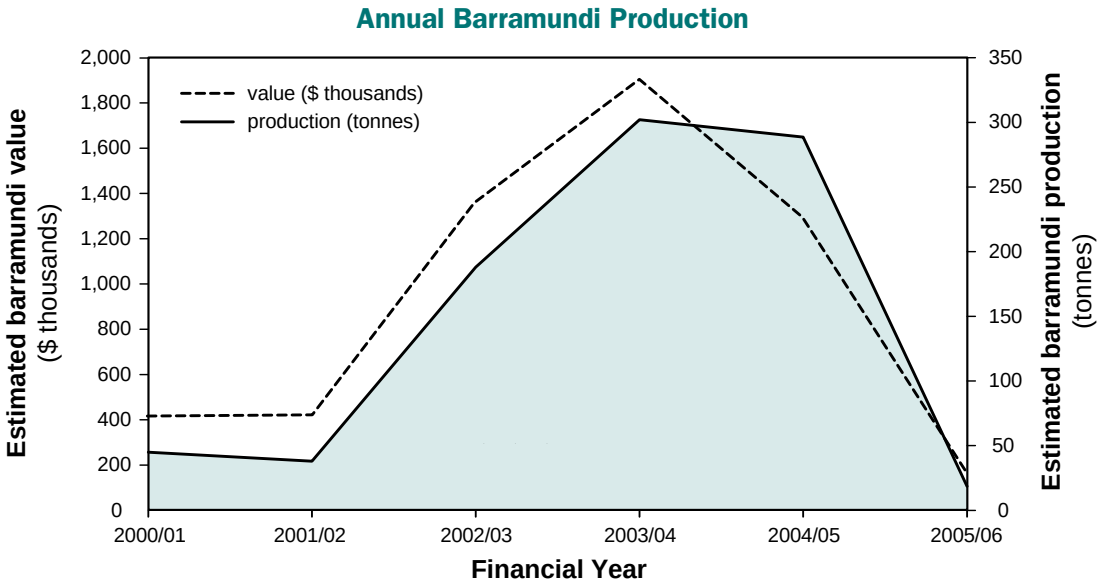
The value of barramundi production decreased by 87% in 2005/06.

External Factors

To compete with imported product, and farms in the Northern Territory and Queensland, WA producers will need to implement marketing strategies that emphasise the benefits of local produce.



Barramundi (*Lates calcarifer*).



BARRAMUNDI FARMING FIGURE 1
Estimated barramundi production and value from 2000/01 to 2005/06.

COMPLIANCE & COMMUNITY EDUCATION

The Northern Inland bioregion includes the freshwater rivers, lakes, billabongs and wetlands primarily located in the Kimberley. Commercial fishing is permitted in Lake Argyle (man-made lake) and in the tidal area of the mouth of the lower Ord River.

Compliance and education for the freshwater systems in the North Inland bioregion focuses on:

- habitat protection;
- translocation inspections of non-endemic freshwater species;
- protected species interaction;
- monitoring of introduced fish species;
- aquaculture lease and licence compliance;
- localised depletion of barramundi as a target recreational species;
- cherabin catches; and
- impact of the commercial fishery in Lake Argyle.

Patrols continue to focus on the Fitzroy and Ord Rivers, due to the large number of campers and fishers accessing the inland Kimberley rivers during the peak tourism period of May to October and the area-specific barramundi size and possession limit legislation. Both the Fitzroy River and the Ord River are identified as major breeding areas for barramundi.

Officers pay particular attention to catch of any protected sawfish species, disused recreational fishing gear and localised impacts of fishers.

Activities during 2005/06

During 2005/06, Fisheries and Marine Officers (FMOs) recorded 416 hours of active compliance patrol time in the Northern Inland bioregion – a decrease compared to the previous year but aligned with historic levels of patrol activity (Northern Inland Compliance Figure 1).

Across the Northern Inland bioregion, personal contact was made with 1,708 contacts across the commercial, recreational and other sectors (Northern Inland Compliance Table 1). FMOs focused on freshwater fishing compliance in areas of known high visitation or local complaints regarding non-compliant netting.

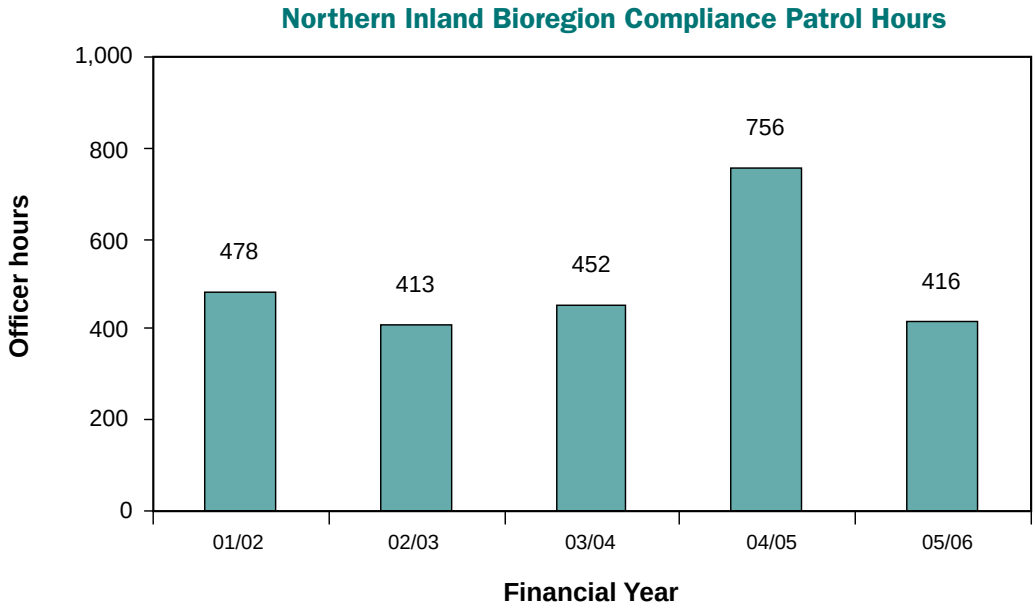
Compliance and education was also undertaken in the Lake Argyle area, where FMOs inspected commercial silver cobbler fishers and aquaculture sites to ensure that compliance with management, protected species interaction and environmental objectives were being met.

Initiatives in 2006/07

Compliance service delivery will continue to target any areas of complaint and high levels of recreational fishing pressure. These locations are reviewed during annual risk-assessment processes.

Compliance activities relating to the only freshwater commercial fishery, which targets the Lake Argyle silver cobbler, will continue. The small number of operators is scrutinised to ensure that high levels of compliance and community confidence are maintained.

Improved levels of engagement with children in regional towns and remote Aboriginal communities are planned, through fishing clinics and school presentations promoting ‘fish for the future’ messages.



NORTHERN INLAND COMPLIANCE FIGURE 1

This figure gives 'On Patrol' officer hours showing the level of compliance patrol activity delivered to the Northern Inland bioregion over the previous 5 years. The 2005/06 total gives the patrol hours in the bioregion that resulted in the contacts detailed in Table 1. The totals exclude time spent on other compliance related tasks, e.g. travel time between patrol areas, preparation and planning time.

NORTHERN INLAND COMPLIANCE TABLE 1

This table gives a summary of compliance and educative contacts and detected offences within the Northern Inland bioregion during the 2005/06 financial year.

PATROL HOURS DELIVERED TO THE BIOREGION	416 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY*	
Field contacts by Fisheries & Marine Officers	11
District Office contacts	16
Infringement warnings	0
Infringement notices	0
Prosecutions	0
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY	
Field contacts by Fisheries & Marine Officers	468
District Office contacts	39
Infringement warnings	1
Infringement notices	2
Prosecutions	1
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY*	
Field contacts by Fisheries & Marine Officers	1,229
District Office contacts	0
Fishwatch reports**	Not recorded

* Contacts are classified according to the specific fishery, which is usually clearly delineated as being either commercial or recreational. The "other fishing-related contacts with the community" category is used where multiple fisheries are contacted and it is not possible to accurately classify the contacts into one specific fishery – typically, the majority of contacts are these contacts are recreational in nature (e.g. personal contacts in marine parks), but contacts made in relation to fish kills, shark patrols and inspections of commercial fish wholesale and retail premises, etc, are also included in this category.

** Fishwatch calls relating to the Northern Inland bioregion are not recorded, as the service provider reporting mechanism only details calls referred to district offices. Calls relating to the Northern Inland bioregion will be included in both the North Coast and Gascoyne Coast bioregion totals.