NORTHERN INLAND BIOREGION

ABOUT THE BIOREGION

The Northern Inland Bioregion, which encompasses 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 the damming of 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 also supported by the expanded food chain of native fish, and are thought to have increased significantly from their original billabong-based populations.

SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

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 previously 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.

The State Government recently funded a stock enhancement project at Lake Kununurra to create a recreational barramundi fishery in the region.

ECOSYSTEM MANAGEMENT

As one of the key ecosystem risks is the introduction of non-endemic species, the Department has an approval process in place for assessing proposals to translocate live non-endemic fish species into and within Western Australia, so as to minimise the environmental risks to freshwater ecosystems associated with this activity.

ECOSYSTEM BASED FISHERIES MANAGEMENT

Identification of Ecological Assets using the EBFM framework

The Department is now implementing an Ecosystem Based Fisheries Management (EBFM) framework (see How to Use section for more details). In terms of ecological assets, the Department has recognised the following for the Northern Inland Bioregion:

Ecosystem structure and biodiversity;

Captured fish species

Listed species (direct impact – capture or interaction);

The full set of ecological assets identified for ongoing monitoring are presented in Northern Inland Ecosystem Management Figure 1.

Risk Assessment of Regional Ecological Assets

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined Northern Inland Figure 1 are often made up of individual components at species or stock level. The risks to each of the individual stock or lower level components are mostly detailed in the individual fishery reports presented in this document. The following table (Northern Inland Ecosystem Management Table 1) provides an overview and cumulative assessment of the current risks to the ecological assets of the Northern Inland Bioregion, at a bioregional level and provides a mechanism for reporting on their status and the fisheries management arrangements that are being applied. These bioregional level risks are now used by the Department as a key input into the Department's Risk Register which, combined with an assessment of the economic and social values and risks associated with these assets, is integral for use in the annual planning cycle for assigning priorities for activities across all Divisions in this bioregion.

Summary of Monitoring and Assessment of Ecosystem Assets

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 Parks and Wildlife, and through involvement with local natural resource management councils. New aquaculture ventures are also subject to strict environmental evaluation under the Department's licensing and on-going arrangements, in conjunction with industry and TAFE.

NORTHERN INLAND ECOSYSTEM MANAGEMENT TABLE 1
RISK LEVELS FOR EACH ASSET.

Risk levels in this table are developed by combining the individual (lower level) elements that make up each of the higher level components. Low and Medium values are both considered to be acceptable levels of risk. High and Significant risks indicate that the asset is no longer in a condition that is considered appropriate and additional management actions are required. Where the value is followed by (non-fishing) this indicates that all, or the majority of the risk value, was not generated by fishing activities.

Ecosystem Structure and Biodiversity

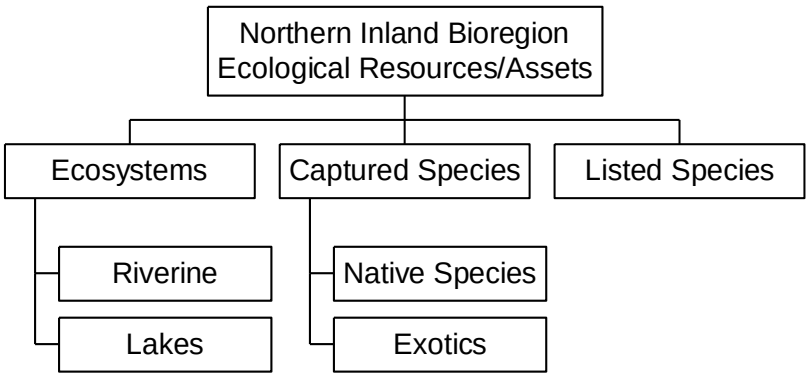
Ecosystem	Risk	Status and Current Activities
Ecosystems	LOW (non fishing)	Minimal threats and these would be due to non-fishing activities

Captured fish species

Fish species	Risk	Status and Current Activities
Finfish Native	LOW	The stocks of freshwater fish are not under any material threat

Listed species

Listed fish species	Species	Risk	Status and Current Activities
Listed Species	Crocodiles	LOW	A small number of crocodiles have been reported captured in nets in Lake Argyle. The numbers are small and would not affect these stocks.



NORTHERN INLAND ECOSYSTEM MANAGEMENT FIGURE 1

Component tree showing the ecological assets identified and separately assessed for the Northern Inland Bioregion

FISHERIES
Lake Argyle Silver Cobbler Fishery Report: Statistics Only

J.I. Brown, S.J. Newman, G. Mitsopoulos, C. Skepper, A. Thomson and D. Wallis

Fishery Description

Commercial

The only commercial freshwater fishery in Western Australia is in the artificially created Lake Argyle in the north-eastern Kimberley. This gillnet fishery specifically targets silver cobbler (*Neoarius midgleyi*), with catches of barramundi (*Lates calcarifer)* not permitted.

Recreational

A small recreational and charter boat fishery exists in Lake Argyle and surrounding waters for silver cobbler and barramundi with fishing activities peaking during the dry season (winter months).

Boundaries

Commercial

The waters of the Lake Argyle Silver Cobbler Fishery (LASCF) include all waters of Lake Argyle between the dam wall and 16° 37' south latitude.

Recreational

In addition to the waters of Lake Argyle, recreational anglers can fish in all creeks and tributaries that feed into the Ord River and Lake Argyle.

Management arrangements

The LASCF is a limited entry fishery, with six Fishing Boat Licences permitted to operate in the Fishery. A licence condition restricts the net type permitted, with fishers permitted to use no more than 1,500 m of set nets at any one time and these nets must have a minimum mesh size of 159 mm and maximum net drop of 30 meshes.

In June 2012 the *Lake Argyle Fishery Notice 1994* was revoked and replaced with a new notice (Prohibition on Commercial Fishing (Lake Argyle) Order 2012) containing the management arrangements for the Fishery. The new notice retains the management arrangements that were in place under the previous notice. Under this Order the six Fishing Boat Licences listed are still prohibited from taking any fish whatsoever by means of nets during the period from 1 November to 31 December in any year. This seasonal closure is aimed at protecting silver cobbler during the spawning season. Additionally, at this time of the year water temperatures in the lake are high and would cause spoilage of fish in the nets. Commercial operators in the LASCF are not permitted to take barramundi at any time and all nets used by LASCF fishers must be suitably marked with licence identification.

In 2001, a voluntary industry Code of Practice was introduced to the LASCF, to enhance sustainable fishing practices and to reduce conflict with other stakeholder groups in Lake Argyle. The Code specifies the accepted means of operation in the Fishery and outlines contingency procedures for lost or abandoned fishing gear.

Furthermore, a Bycatch Action Plan has also been developed for the LASCF which aims to minimise the incidental capture of other species in Lake Argyle (including freshwater crocodiles, freshwater turtles, and birds) during commercial gillnetting operations. The Lake Argyle Silver Cobbler Fishery Bycatch Action Plan and Code of Practice were revised in 2010.

Landings and Effort

Commercial (season 2014): Not reported due to confidentiality provisions

Following the damming of the Ord River in 1971 and the creation of Lake Argyle, the commercial fishery first developed in 1979 with annual catches of silver cobbler landed up to 1984 being less than 41 t. From 1984 catches increased to reach an historical peak of 231 t in 2000 and then following reductions in effort, catches steadily declined to a low of <50 t in 2009. Catches from 2010 to 2013 then fluctuated between 67 t to 118 t (Lake Argyle Silver Cobbler Figure 1). In 2014, the catch of silver cobbler declined to be the second lowest level reported for the fishery since 1984 (actual figures cannot be reported due to confidentiality limitations).

The effort used in the fishery to assess stock status is currently being reviewed. Presently, nominal effort in this gillnet fishery is determined using block days fished with effort calculated as the effort associated with any catch of silver cobbler in the LASCF block. A more refined determination of targeted effort is difficult as fishing practices vary across the vessels in the fishery and are therefore not uniform. Additionally, reporting practices of effort and net lengths by some fishers are inconsistent across time. As such, block day is the only current reliable effort measure available.

During 2014, only one vessel was active in the fishery. The level of effort reported is the lowest level reported for the fishery since 1983. There is considerable latent effort available in the LASCF with 5 licences choosing not to operate in the fishery in 2014. Participation in the fishery can be variable as a result of the availability of fishers (i.e. active in other fisheries/industries) and market demand.

The overall catch in 2014 was lower than 2013 and the second lowest since 1984. The historically low catch level can be attributed to the lower effort expended in the fishery, with only one licensee actively fishing in 2014. In recent years (2004 to 2013), two to four licensees have actively fished Lake Argyle each year. The level of catch in the fishery at present is a reflection of the variable level of effort expended.

Since 2000, the catch per unit effort (CPUE) has been fairly constant indicating a long-term stable trend in the biomass of

silver cobbler in Lake Argyle (Lake Argyle Silver Cobbler Figure 1).

This fishery requires further monitoring of the population dynamics (growth, longevity and mortality) of silver cobbler to confirm stock status.

Recreational: **Charter <1 tonne**

Limited data are currently available on recreational fishing in this region. The reported charter boat catch for Lake Argyle from 2002 to 2014 was less than 1 t of silver cobbler per annum. There are no data available on general angling catches. There are no minimum legal size limits for silver cobbler, although, fishers are restricted to a mixed species bag limit of four freshwater fish per day.

Fishery Governance

Commercial
Target commercial catch range: **93-180 tonnes**

The target commercial catch range is calculated based on catch information from 1990 – 1998, a period during which the fishery was stable and levels of exploitation were considered to have been sustainable. The target catch range for silver cobbler has recently been revised to be consistent with the reference points and control rules adopted for other fisheries. This catch range previously represented a confidence interval calculated using time series analyses (statistical control charting) of annual catch for the fishery. In contrast, the current approach specifies this range as the values within the minimum and maximum catches observed during the reference period. The revised target catch range (93 – 180 t) is similar to that previously used (90 – 155 t).

Current Fishing (or Effort) Level **Acceptable**

The level of catch in the fishery in 2014 is below the acceptable catch range. This level of catch is, however, considered acceptable as the effort in the fishery is historically low. In addition, the catch rate since 2000 has been at a relatively high and stable level. The lower levels of catch in the fishery in recent years are likely to have allowed the stock to increase in size, thus resulting in the observed high catch rates. A review of the catch reference points will need to be undertaken if effort in the fishery continues to remain at low levels.

New management initiatives (2014/15)

The next management review for the Fishery is scheduled for 2016/2017.

The LASCF underwent MSC pre-assessment in 2014. Outcomes from the pre-assessment are currently under review.

External Factors

A number of external factors may impact on silver cobbler biomass.

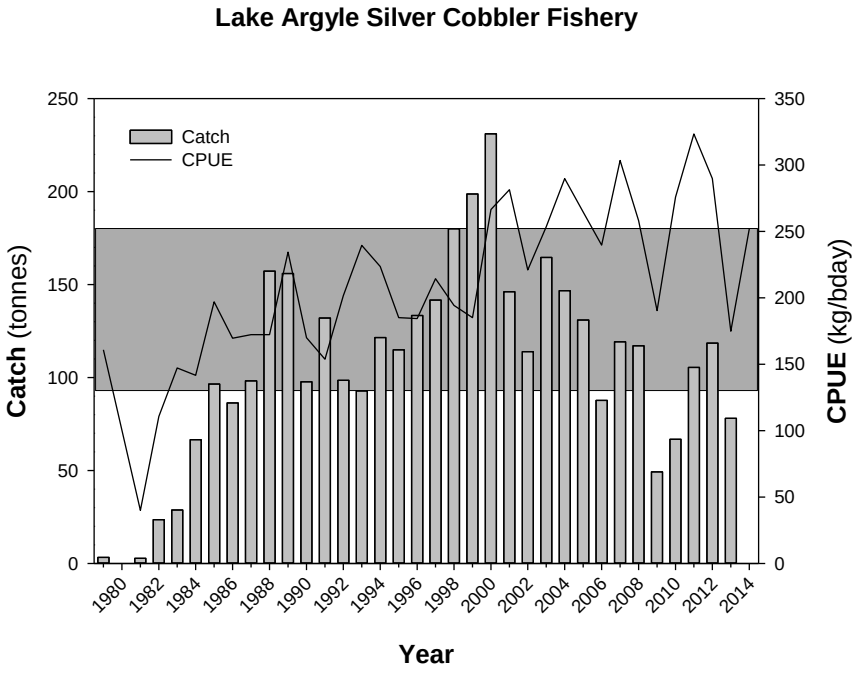
The introduced cane toad (*Rhinella marina*) was first observed in Lake Argyle in 2009 (Somaweera *et al*. 2011).This pest species is highly toxic to a number of native species, although a recent study determined the likely impact to the silver cobbler population in Lake Arygle to be minimal due to the ability of the fish to learn avoidance behaviour of egg and tadpole consumption in a laboratory study (Somaweera *et al*. 2011). However, the impact of cane toad consumption by prey and predators of silver cobbler may still influence their biomass.

Since the creation of Lake Argyle, the population of the freshwater crocodile (*Crocodylus johnsoni*) has increased to more than 30,000 (Webb Pty Ltd 1989; WMI 2005, 2009). The population status of freshwater crocodiles is also likely to impact silver cobbler biomass in the form of predation levels as well as competition for food.

In Lake Argyle, stratification resulting in low oxygen levels typically occurs during the silver cobbler spawning period, possibly impacting recruitment levels particularly given the species low fecundity and high parental care.

There may also be a risk to the silver cobbler stock by the disease caused by the bacterium *Edwardsiella ictaluri*. This bacterium has impacted freshwater catfish aquaculture industries in the USA and Asia. In Australia, this disease has been detected in captive native catfish species but has yet to be detected in wild populations.

Barramundi aquaculture in Lake Argyle is likely to indirectly provide some additional (waste) food utilized by the silver cobbler and its prey species. Although there may be some negative impacts on environmental conditions due to the decomposition of food waste and excrement.



LAKE ARGYLE SILVER COBBLER FIGURE 1

The annual catch and catch per unit effort (CPUE, kg/block day) for silver cobbler in the Lake Argyle Silver Cobbler Fishery over the period from 1979 to 2014. Note, the 2014 catch is not reported due to confidentiality limitations. The upper and lower bounds of the target commercial catch range are shown by the shaded catch area between 93 and 180 tonnes.

AQUACULTURE

Regional Research and Development Overview

There is one current licence to produce barramundi in Lake Argyle; the licence holder has secured tenure over a land based area to support its proposed aquaculture activities and has started operations.

COMPLIANCE AND 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.

The compliance effort for this area primarily focuses on the commercial Silver Cobbler fishery in Lake Argyle, as well as aquaculture lease inspections and licence compliance.

The Ord and Fitzroy rivers are two of the State's largest river systems. They are highly valued by visiting and local fishers. Both river systems are relatively easy to access and are focal points for fishers pursuing barramundi. A large number of campers also access the northern inland rivers during the peak tourism period of May to October. Compliance and education for the freshwater systems in the Northern Inland bioregion therefore continues to focus on these river systems. Officers pay particular attention to the catch of any protected sawfish species, rules regarding barramundi, illegal fishing gear and localised impacts of fishers.

Given the presence of red claw in Lake Kununurra, time is also dedicated to translocation inspections of non-endemic freshwater species and continued monitoring of these and other introduced fish species in northern inland waters.

The Community Education Officer develops programs and coordinates the delivery of educational activities to a range of targeted audiences. They reach a wide range of people including school aged children and retirees, who come north to escape the cold and throw a line.

Activities during 2013/14

During 2013/14, Fisheries and Marine Officers (FMOs) recorded 1,026 hours of active compliance patrol time in the Northern Inland bioregion (Northern Inland Compliance Figure 1).

Across the Northern Inland bioregion, personal contact was made with 3312 fishers and non-fishers 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 localised complaints regarding illegal fishing activities.

Compliance and education was also undertaken in the Lake Argyle area, where FMOs inspected commercial silver cobbler fishers to ensure that compliance with management, protected species interaction and environmental objectives were being met. These inspections resulted in 4 infringement warnings being issued.

Education activities for the 2013/14 period included the delivery of school incursions and excursions, school holiday programs, community presentations and regional events such as fishing competitions and agricultural shows. An increased emphasis has been placed on developing materials that focus on local issues and their dissemination through regional brochure stockists and local publications.

Initiatives in 2013/14

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

The Departments Northern Region Mobile Patrol will focus on compliance and education of recreational fishers. A large portion of the mobile patrols time will be spent ensuring that fishers are aware of, and comply with, bag, size and possession limits relating to barramundi, which is one of the States iconic fisheries that is primarily inland based.

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

District FMOs will continue to work closely with other government agencies to facilitate the transfer of intelligence information and respond to compliance situations.

Given the large expanse of these inland waters the community education program will focus on other methods of delivery rather than direct contact. Initiatives such as local media releases, advertising in fishing magazines and websites and signage are planned for these areas. Presentations on the recreational fishing rules will also be delivered to target audiences such as interstate tourists where recreational fishing rules for barramundi and legal/illegal gear differs between the states.

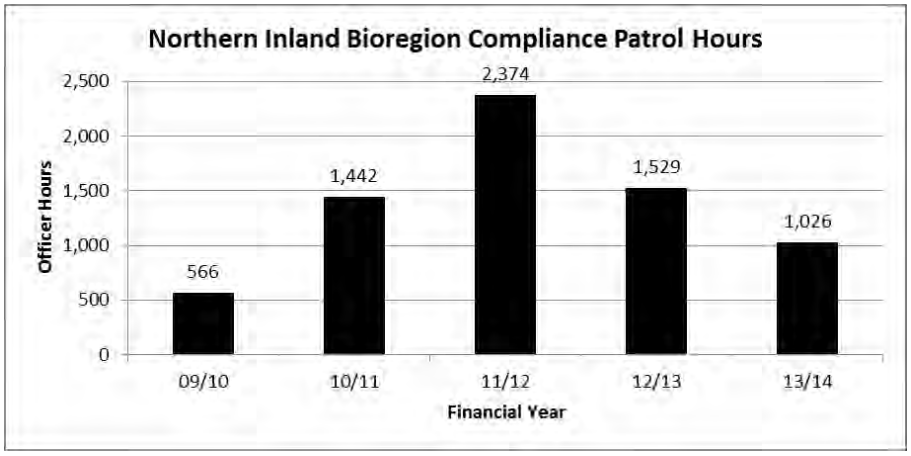
NORTHERN INLAND COMPLIANCE TABLE 1

This table gives a summary of compliance and educative contacts and detected offences within the Northern Inland bioregion during the 2013/14 financial year.

PATROL HOURS DELIVERED TO THE BIOREGION	1,026 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY[1]	
Field contacts by Fisheries & Marine Officers	10
Infringement warnings	4
Infringement notices	0
Prosecutions	0
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY	
Field contacts by Fisheries & Marine Officers	2,277
Infringement warnings	4
Infringement notices	8
Prosecutions	0
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY	
Field contacts by Fisheries & Marine Officers	1,025
Fishwatch reports[2]	N/A

[1]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.

[2] 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, Gascoyne Coast and West Coast bioregion totals.



NORTHERN INLAND COMPLIANCE FIGURE 1

This figure gives the "On Patrol" officer hours showing the level of compliance patrol activity delivered to the Northern Inland bioregion over the previous five years. The 2013/14 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.