

# SOUTHERN INLAND BIOREGION

## ABOUT THE BIOREGION

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

Across the remainder of the Southern Inland Bioregion, rivers flow primarily during the 3 months of winter rainfall, with very occasional summer flows from inland rain-bearing depressions resulting from decaying cyclones. Most large fresh water bodies are man-made irrigation, water supply or stock-feeding dams. There is a diverse variety of natural water bodies in this region ranging from numerous small springs and billabongs, up to Lake Jasper, the largest permanent freshwater Lake in the South West region, with 440 ha of open water up to 10 m deep. In combination these diverse natural and man-made permanent waterbodies provide valuable habitat for fish and freshwater crustaceans during the summer months. Some natural salt lakes also occur but these generally dry out over summer each year.

The few natural freshwater rivers and man-made lakes support a small native fish fauna and create an environment, particularly in forest areas, which is highly valued by the community for a variety of recreational pursuits.

## SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

While there are no commercial fisheries in the Southern Inland Bioregion, this area provides significant recreational fishing opportunities. The major species fished recreationally are native marron, trout (both rainbow and brown trout) stocked by the Department of Fisheries into public dams and rivers, and feral redfin perch, an introduced, self-perpetuating stock. The native freshwater cobbler is also taken in small numbers, as are the estuarine black bream which are artificially stocked into some inland impoundments that have become saline.

Aquaculture development in the Southern Inland Bioregion is dominated by the farm-dam production of yabbies, which can reach about 200 t annually depending on rainfall and market demand. Semi-intensive culture of marron in purpose-built pond systems provides around 60 t per year and has the potential to expand significantly.

Trout have historically been the mainstay of finfish aquaculture production in this region, originating from heat-tolerant stock maintained at the Department's Pemberton Freshwater Research Centre. Silver perch are also grown in purpose-built ponds to supply local markets.

## ECOSYSTEM MANAGEMENT

The conservation of the 13 species of freshwater native fish in freshwater ecosystems in the South-West of WA is a growing issue for the Department of Fisheries. Many of these species are endemic to WA, and are under pressure through increasing salinity, feral fish populations, infrastructure (bridges and dams) and adjacent land-use development.

The Department works with representatives from the Department of Water, the Department of Parks and Wildlife and other stakeholders, to facilitate information exchange and identify research projects and associated funding sources to mitigate environmental impacts and so better protect native fish species. This is being facilitated by the recent establishment of the Freshwater Ecosystem Working Group which aims to coordinate a whole-of-Government approach to the management of freshwater ecosystems in the State.

The Department undertakes a risk-based approach to managing the spread of feral fish in the bioregion. To support this, it has developed a community based reporting tool and education program to support its own routine surveillance activity. Information on aquatic pest distribution is used to prioritise management actions aimed at limiting the impact and preventing the spread of high risk pest fish within the State's freshwater ecosystems.

A key element of reducing the risk of feral fish is the approval process that the Department has 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 ecological values for the Southern Inland Bioregion:

- Ecosystem structure and biodiversity;
- Captured fish species
- Protected species (direct impact – capture or interaction);
- External Drivers

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

## Risk Assessment of Ecological Assets

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined 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 (Southern Inland Ecosystem Management Table 1) provides an overview and cumulative assessment of the current risks to the ecological assets of the Southern 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

Researchers from the Biodiversity and Biosecurity Branch are involved in several research projects related to freshwater biodiversity and conservation. One of these projects has been monitoring and assisting the restoration of hairy marron (freshwater crayfish) populations in the Margaret River. The critically endangered hairy marron (freshwater crayfish) is endemic to the Margaret River. However, the common, widespread smooth marron was accidentally introduced to the lower reaches of the river in the early 1980s. Over time, smooth marron have replaced hairy marron, first from the lower reaches (in the 1980s), then the middle reaches (in the 1990s) and at present hairy marron are only found in the upper reaches, but together with smooth marron.

Hairy crossed with smooth marron hybrids are common in the upper reaches of the Margaret River and the hybrids are fertile and appear to have similar ecological fitness. The displacement of hairy marron by smooth marron is most likely driven by hybridization of what appear to have been two geographically distinct species. Maintaining populations of hairy marron in the upper reaches of the Margaret River is

vital for the conservation of this species and will require ongoing removal of smooth marron and hybrids in combination with re-stocking pure hairy marron from the captive breeding program.

In 2005 The Department of Fisheries was successful in obtaining a grant from the SWCC (South West Catchments Council) to collect "hairy" marron from the wild and establish a breeding program to save this rare species from extinction. The Department has recently collaborated with the University of Western Australia to develop improved genetic tools to identify and characterise hairy marron to support further development of a controlled breeding program. This has resulted in production of genetically pure hairy marron and efforts are now underway to scale up production. Numbers of hairy marron in the Margaret River have declined significantly in recent years due to them being outcompeted by smooth marron and hybrids. As such the priority to ensure that this species does not become extinct is to establish a self-sustaining repository population that can be used to support any future Margaret River restocking program.

Most freshwater fish species are no longer present in large areas of their original range and some have been listed as critically endangered (e.g. Western trout minnow *Galaxias truttaceus hesperius*, and Margaret River marron *Cherax tenuimanus*). While others have been listed as vulnerable to extinction (e.g. Balston's pygmy perch *Nannatherina balstoni*). This has resulted in a reduced abundance and distribution of many species in lakes, rivers and streams in the southwest bioregion. Research is ongoing into establishing production of threatened native fish species to facilitate stock enhancement in priority waterbodies in the region.

Research and monitoring is also underway to support feral fish surveillance and management. The Department adopts a risk-based approach to managing the threats posed by non-native fish which are widespread in metropolitan waterbodies. Such research includes the evaluation and implementation of control mechanisms (e.g. trapping methods, barrier controls, poisoning) as well as developing methods to identify the diversity of fish species present in water bodies based on the DNA that they shed into their environment.

### SOUTHERN 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
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SOUTHERN INLAND BIOREGION

Riverine Ecosystems	HIGH (non fishing)	The community structure of most river and lake systems in this bioregion are substantially altered from historical levels. A survey of the main areas has been completed through a state NRM funded project.
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**Captured fish species**

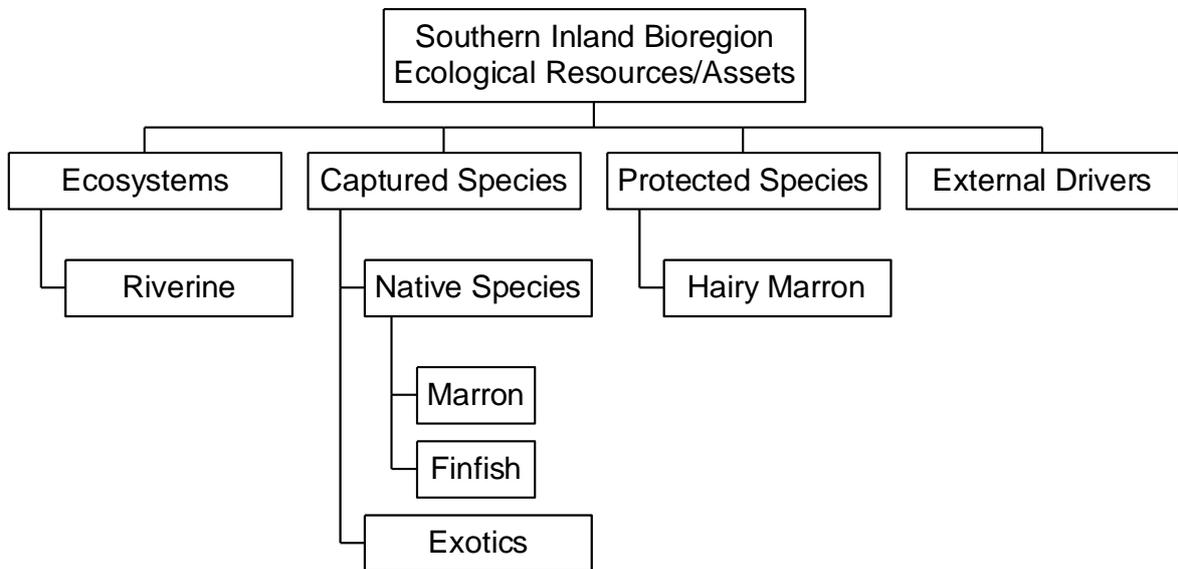
Fish species	Risk	Status and Current Activities
Finfish Native	HIGH (non-fishing)	The abundance and distribution of most native fish have been severely impacted due to reduced rainfall and land management practices. This has led to widespread fragmentation of native fish populations (i.e. regional extinctions, which without restocking will be permanent as there is no migration between lakes or catchments) and some species are already listed in danger of extinction
Crustaceans Native	MODERATE (non fishing)	The abundance of smooth marron has been monitored at regular intervals for a number of decades. The fishery arrangements have been through a number of significant updates to ensure that the catch is sustainable. The biggest threat to these stocks is from non-fishing causes.
Exotics (Stocked)	MODERATE	Trout have been stocked into a limited number of streams in WA for decades. The trout are produced from the Pemberton Hatchery and are heat tolerant.

**Protected species**

Protected fish species	Species	Risk	Status and Current Activities
Protected Species	Hairy Marron Western Minnow (non fishing)	SIGNIFICANT	There is a monitoring and restoration program for hairy marron and there is a captive breeding program for endangered finfish (see details below)

**External Drivers (non fishing)**

External Drivers	Risk	Status and Current Activities
Pests and Diseases	HIGH	A high number of exotic fish species have been released into the South West catchments. There is an assessment program underway to determine the extent of this and which of these events can be addressed by eradication.



**SOUTHERN INLAND ECOSYSTEM MANAGEMENT FIGURE 1**

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

# FISHERIES

## Licensed South-West Recreational Freshwater Angling Fishery Report: Statistics only

R. Duffy, N. Sumner and J. O'Malley

### Fishery Description

The South-West recreational freshwater fishery is primarily an angling fishery 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 were previously released in the South-West and now occur as self-breeding populations in most water bodies.

#### Governing legislation/fishing authority

Fish Resources Management Act 1994 and subsidiary legislation

Fish Resources Management Regulations 1995

Freshwater Recreational Fishing Licence

#### Consultation process

Meetings between the Department of Fisheries, Recfishwest and Freshwater fishers.

#### Boundaries

The South-West freshwater angling license authorises anglers to fish for freshwater finfish species in all inland waters of Western Australia south of 29° latitude (Greenough) and above the tidal influence including all lakes, dams, rivers and their tributaries.

#### Management arrangements

Access to this fishery is controlled by licenses, seasonal closures, fishing gear restrictions, minimum sizes, and bag limits. Licensed anglers may only use a single rod, reel and line or single handline when targeting these species.

To protect newly released trout, a closed season applies from 1 July to 31 August in rivers and dams in the south-west of the State, with the exception of the Murray, Blackwood, Donnelly and Warren Rivers and sections of the Serpentine River.

A combined daily bag limit of 4 applies to rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), together with a minimum legal size limit of 300 mm.

A daily bag limit of 30 applies to freshwater cobbler (*Tandanus bostocki*) when taken in the West Coast Bioregion. No minimum legal size limit applies to this species. No bag limit or size limit applies to redfin perch (*Perca fluviatilis*) and anglers are encouraged not to return any redfin to the water as this feral species negatively affects the marron fishery and predated actively on trout fry.

The trout stocking program administered by the Department of Fisheries in consultation with Recfishwest, focuses on public waters where trout have been stocked or been present since the 1930s. All trout stocked into public waters are produced at the Department of Fisheries, Pemberton

Freshwater Research Centre (PFRC).

### Landings and Effort

#### Commercial catch estimate (season 2011/12)

Not applicable

#### Recreational catch estimate (season 2011/12)

33,720 retained fish

Reporting of black bream has been dropped from this year's report due to difficulties in determining whether the catch originated from freshwater. An estimated total of 39,530 fish was landed in this fishery by recreational anglers in the 2011/12 season, including 27,765 retained fish and 11,765 captured and released fish. The estimated catch was composed of 10,000 rainbow trout, 1,700 brown trout, 27,000 redfin perch and 950 native freshwater cobbler (Freshwater Angling Figure 1).

The catch for the 2011/12 season varied for each species compared to the 2010/2011 season: redfin perch decreased by 40% from 44,600 fish; rainbow trout landings remained constant; brown trout increased 28% from 1,300; and landings of native catfish decreased 62% from 2,500 fish (Freshwater Angling Figure 1).

Estimates of fishing effort are based on telephone surveys of license holders. Total effort was estimated to be 19,253 days, slightly lower than in the previous reported season (22,000 days).

A catch rate of 3.64 fish of all species per day was estimated for the 2011/12 season similar to the previous season. This included 1.89 retained fish and 1.75 released fish per angler per fishing day.

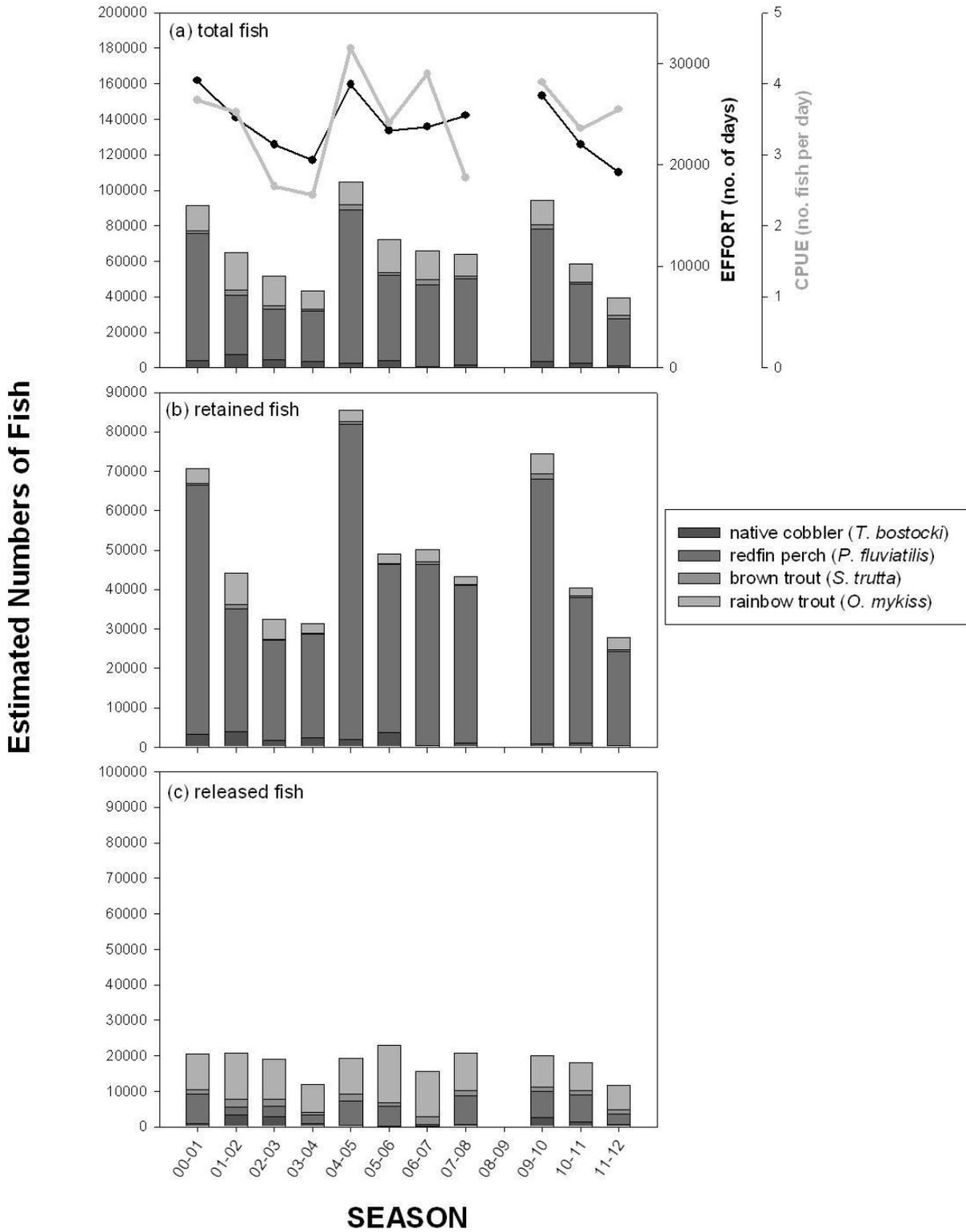
The stock levels of both rainbow and brown trout as indicated by catch rates and catches, have remained reasonably stable over the past ten years (Freshwater Angling Figure 1). Both species of trout display little or no breeding in local waters and the fishery is supported through the stocking of fry, yearling and ex-broodstock trout by the Department of Fisheries. Red-fin perch breed in all waters, and often dominate the biomass where introduced. The cause of the reduction in redfin catches is unclear, but may be related to a reduction in suitable habitat due to reduced rainfall. Catch of cobbler showed an even greater decrease.

### Fishery Governance

Target catch (or effort) range Not applicable

Current fishing (or effort) level Not applicable

New management initiatives (2011/12) Nil



**FRESH WATER ANGLING FIGURE 1**

Estimates of the development of (a) total catch, effort and CPUE; (b) total numbers of fishes retained; and (c) total numbers of fishes released, by species in the South-West freshwater angling fishery since the 2000-01 season.

# Licensed Recreational Marron Fishery Report

R. Duffy, N. Sumner and J. O'Malley

## Main Features

Status		Current Landings	
Stock level	Acceptable	Commercial	nil
Fishing level	Acceptable	Recreational catch estimate	78,130 marron

## Fishery Description

Marron are endemic to Western Australia and are the third largest crayfish in the world. Recreational fishing occurs in freshwater dams and rivers throughout the southern part of the State extending from as far north as Geraldton, to Esperance in the east. Fishers may only use legal scoop nets, drop nets or snares to take marron.

### Governing legislation/fishing authority

Fish Resources Management Act 1994 and subsidiary legislation

Fish Resources Management Regulations 1995

Marron Recreational Fishing Licence

### Consultation process

Meetings between the Department of Fisheries, Recfishwest and freshwater fishers.

### Boundaries

The recreational marron fishery extends from the Hutt River north of Geraldton to waters near Esperance. The fishery operates in freshwater dams and rivers, although drinking water supply dams servicing the Perth metropolitan area and south-west regional centres are closed to the public by the Water Corporation.

### Management arrangements

This fishery is managed through input controls of licences, closed seasons and gear restrictions, and the output controls of size and bag limits (see <http://www.fish.wa.gov.au/>).

All marron fishers require a special marron recreational fishing licence. For the 2012 season, licensed fishers were permitted to fish for marron from 8th January to 5th February 2012. Three types of legal gear exist; scoop nets, drop nets and snares. In most waters there is a minimum size of 80 mm carapace length and for the 2012 season, the bag limit was reduced from 10 marron per day to 8 marron per day. The possession limit was decreased from 20 marron to 16 marron. The exception to these reductions were Harvey Dam, Waroona Dam and Hutt River which are managed as snare only 'Trophy Waters' with a minimum legal size of 90 mm carapace length and a daily bag and possession limit of 5 marron.

## Research summary

Detailed research on the marron stocks in south-west rivers has been undertaken since the 1970s. Current research involves the annual scientific monitoring of stock levels before the summer fishing season, surveys of catches taken by recreational licence holders and biological characteristics (growth, size-at-maturity, fecundity etc) of key marron populations in different catchments. These data enable trends in stock levels to be monitored and recommendations to be made for adjustments to fishery management when necessary. The following status report is based on these research findings.

## Retained Species

**Commercial landings:** Nil

**Recreational catch estimate (season 2012)**

**78,130 marron**

The total marron catch for the 2012 season was estimated at approximately  $78,130 \pm 1,365$  standard error (SE) marron (See Fig. 1). This is similar to the previous seasons catch (2011:  $74,400 \pm 7,100$  marron) despite the decrease in bag and possession limits due to limited rainfalls. Reduced rainfall can increase catches through reduced volumes of water concentrating marron and resulting in increased susceptibility to capture. This is reflected in an increase of the mean number of animals caught per day from 3.6 marron per fisher per day in 2011 to 4.6 marron per fisher per day in 2012. The catch per unit effort was higher in rivers (5.10 marron/day) than in dams (3.22 marron/day) (Figure 1b). The catch for 2012 is below the target catch range (see Fishery Governance below).

Total effort for the 2012 season was estimated from phone surveys at around 16,900 days, much lower than the previous season of 21,500 days. The number of participating fishers increased to 9,900 from the approximately 8800 participants in 2009, 2010 and 2011. The average number of fishing days per fishermen was 2.99 days in 2012, similar to 2009 (2.9 days) and 2010 (2.93 days) but less than the 3.6 days per fisherman in 2011.

There was no change in the proportion of total effort in dams from 25% last year. Of the remaining 75% of effort directed at rivers, it was widely spread among the rivers in the South-West. The Blackwood River (~18%) is the most popular site, followed by the Warren River (~13% effort). The Murray,

Preston, Collie, Deep and Donnelly rivers all received similar amount of effort of between 6 and 9%.

## Stock Assessment

**Assessment complete:** Yes

**Assessment Method and level:**

**Level 4 - Fishery Independent Direct Survey**

**Breeding stock levels:** Acceptable

Fishery-dependent catch and effort data (e.g. CPUE as determined by logbook or phone survey) can be poor indicators of true stock abundance especially in heavily managed fisheries (i.e. those with seasons, bag limits, size limits and gear restrictions) like the Recreational Marron Fishery. In 2006 a new stock assessment program using traps was initiated that provided fishery-independent data on relative abundance and average size (mm Orbital Carapace Length [OCL]) of marron in three dams (Waroona Dam, Wellington Dam, Harvey Dam) and eight rivers (Shannon, Warren, Donnelly, Blackwood, Preston, Collie, Murray and Moore River). These three dams and eight rivers account for more than 75% of the total fishing effort of the Recreational Marron Fishery (see Fig. 2a).

The annual fishery-independent survey provides vital data for monitoring trends in stocks, evaluating the performance of changes in management on stocks and will allow for recommendations to be made for adjustments to the management of the fishery when necessary.

Relative abundance and size of marron varies greatly spatially among the surveyed rivers and dams (Fig. 3). Size of animals in most locations has stayed relatively stable. However, the mean size in Moore river has been decreasing since a peak in 2009 and recorded the lowest mean size since initiation of the stock assessment survey in 2006 (Fig 3).

Marron abundance in Waroona Dam and Wellington dam was at the lowest levels yet measured during the fishery independent stock assessment. Both dams have exhibited a general decrease in CPUE since initiation of surveys. Donnelly, Blackwood, Murray and Moore rivers all showed a decrease in abundance to the lowest levels since the survey began in 2006. Of concern is that these declines coincide with a period of decreasing rainfall, about which, little can be done.

In addition to data on abundance and size, the annual fishery independent survey also provides information on size-at-maturity and fecundity for each of the rivers and dams. From the locations surveyed, the current breeding stock levels appear adequate (based on typical size-at-maturity). Size-at-maturity, i.e. size at which 50% of the females are mature, seems to be below the minimum legal size of 80 mm Rostrum Carapace Length (RCL) for the majority of marron stocks in the south-west. Present size restrictions seem to adequately protect the majority of the female breeding stocks. A larger minimum legal size of 90 mm RCL has been introduced to protect the breeding stocks and these water bodies are managed as 'Trophy' waters.

A tagging program may be incorporated in the annual fishery-independent stock assessment, to obtain information on growth and mortality of marron in the different rivers and dams and to aid with abundance calculations.

## Non-Retained Species

**Bycatch species impact:** Negligible

The marron fishery does capture small quantities of non-target species, principally gilgies (*Cherax quinquecarinatus*, *C. crassimanus*) and koonacs (*C. plebejus*, *C. glaber*). Although little is known about their biology, the impact of the marron fishery on these species is thought to be low as gilgies and koonacs are smaller than marron and are not targeted by marroners.

**Protected species interaction:** Negligible

A second type of marron has been identified ('Hairy' marron) which is threatened mainly by the extension in range of the more common 'Smooth' marron, which is the basis of the recreational marron fishery. In late 2002, recreational marron fishing upstream of Ten Mile Brook Junction (including all its tributaries) on the Margaret River was prohibited to remove the impacts of fishing on the remaining 'Hairy' marron stocks. However, illegal fishing is still reported in this reach of the Margaret River. A recovery plan, developed jointly between the Department of Fisheries, the Department of Environment and Conservation, and other stakeholders on the recovery team is underway for the 'Hairy' marron.

## Ecosystem Effects

**Food chain effects** Low

The removal of legal-sized marron from freshwater rivers is unlikely to have a significant effect, noting that the bulk of the marron biomass is below legal size and that marron of all sizes have similar food and habitat requirements. Marron taken from man-made dams are already living in highly modified habitats, as such their removal does not significantly impact on natural freshwater ecosystem function.

**Habitat effects** Negligible

The impact of this fishery on the aquatic habitat is negligible. The major effects are litter in surrounding areas and the trampling of areas of riparian vegetation by marroners and subsequent bank erosion.

## Social Effects

The marron fishery is an iconic fishery and a major recreational activity in regional areas of the south-west of the State. The effect of rainfall on the availability of marron habitat is expected to increase awareness of changes in climate patterns in the South-West.

## Economic Effects

The value of the 2012 season recreational marron catch could not be calculated as no data on the size of marron captured by recreational fishers was collected. In the past, this data was collected as part of the Marron logbook program, however, this program ceased operation in 2008. Since then, the marron logbook program was combined with the Research

Angler Program logbook (RAP logbook). Too few records of marron catches (size and abundance) have been captured by this logbook on which to base economic calculations. The estimated 25,700 days of marroning in regional locations is likely to have provided a significant economic boost to regional towns in the South-West.

## Fishery Governance

### Target catch (or effort) range

**96,000-136,000 marron**

In 2006, the Recreational Freshwater Fisheries Stakeholder Subcommittee (RFFSS) proposed that, based on the available research data and the knowledge of the marron fishery, the fishery be managed to a maximum target catch of between 96,000-136,000 marron. Effort has steadily increased since 2003 with a proportionate increase in catch. In 2007 the marron season was increased from 16 to 23 days. The season was increased to 29 days in 2009 with fixed dates whereas previously seasons varied each year to match with lunar cycles. Assuming relatively stable marron abundance, a limited growth in the fishery is allowed while maintaining catches at a sustainable level. Variations in marron abundance (fishery independent surveys) and marron catches (phone survey) will be monitored to determine the impact of the changes in season length and increase in legal minimum size.

### Current fishing (or effort) level                      **Acceptable**

Fishing effort has been low under current management arrangements. Since 2003 when the reduced 16 day season was introduced effort (fishing days) dropped considerably from ~40,000 fishing days (2000-2002) to ~11,000 fishing

days (2003-2006). The season length was extended from 16 to 23 days in 2007 and a significant increase in effort from ~11,000 (2003-2006) to ~17,000 fishing days (2007-2008) was observed. The effort for 2011 was 21,500 fishing days with a 29 day season.

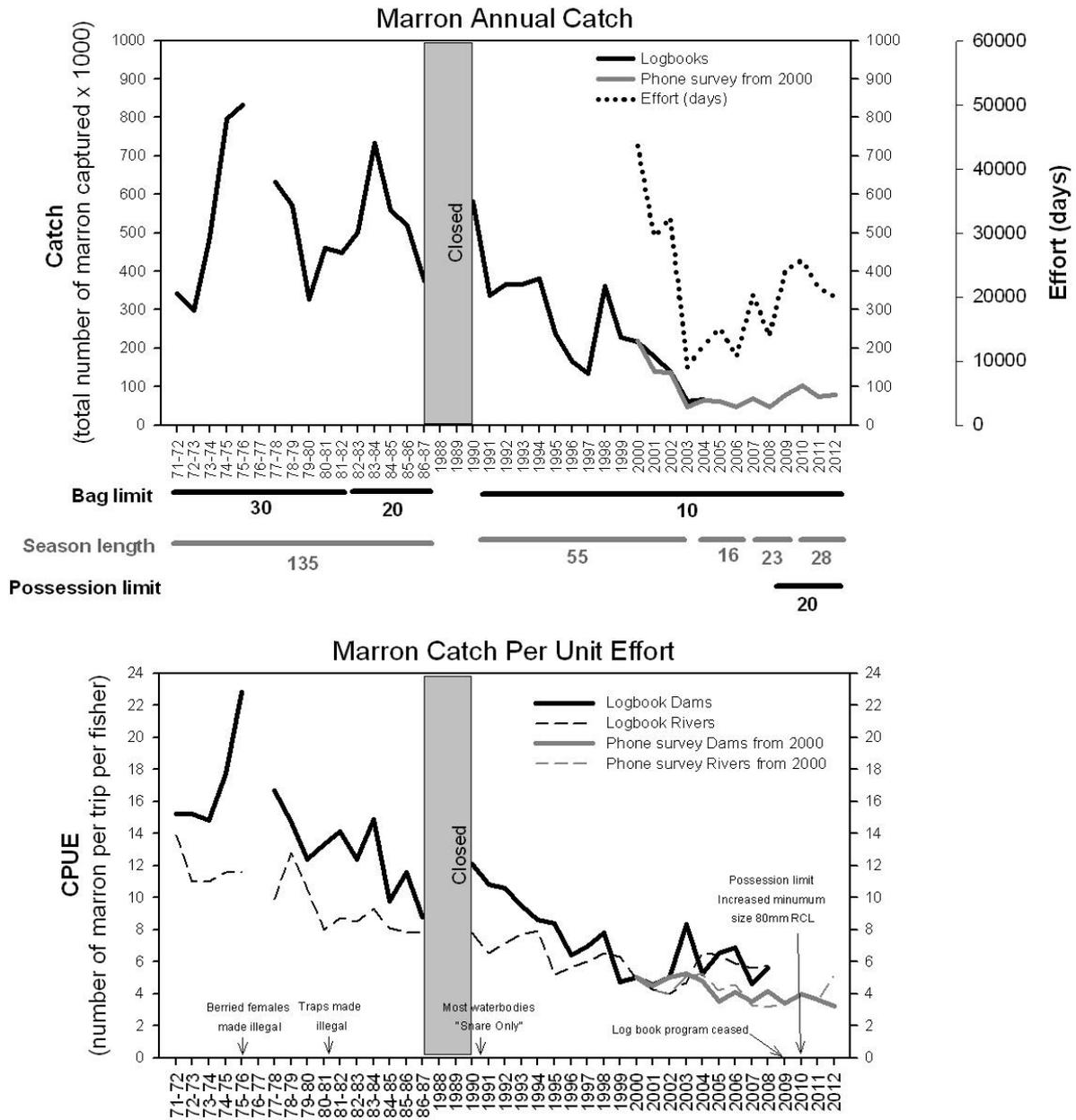
### New management initiatives (2013/14)

For 2013 the marron season started on 08 January and ran for a 28 day period until 05 February. Fisheries managers and scientists will continue to monitor the impact of changing rainfall patterns in the South-West on marron populations. As a result of this monitoring and discussions with stakeholder groups, it was decided a precautionary approach would be taken and the 2012 daily bag limit would be reduced from 10 to 8 animals per licensed fisherman. The reduced limit will be maintained due to a reduced CPUE during the 2012 fishery independent surveys.

## External Factors

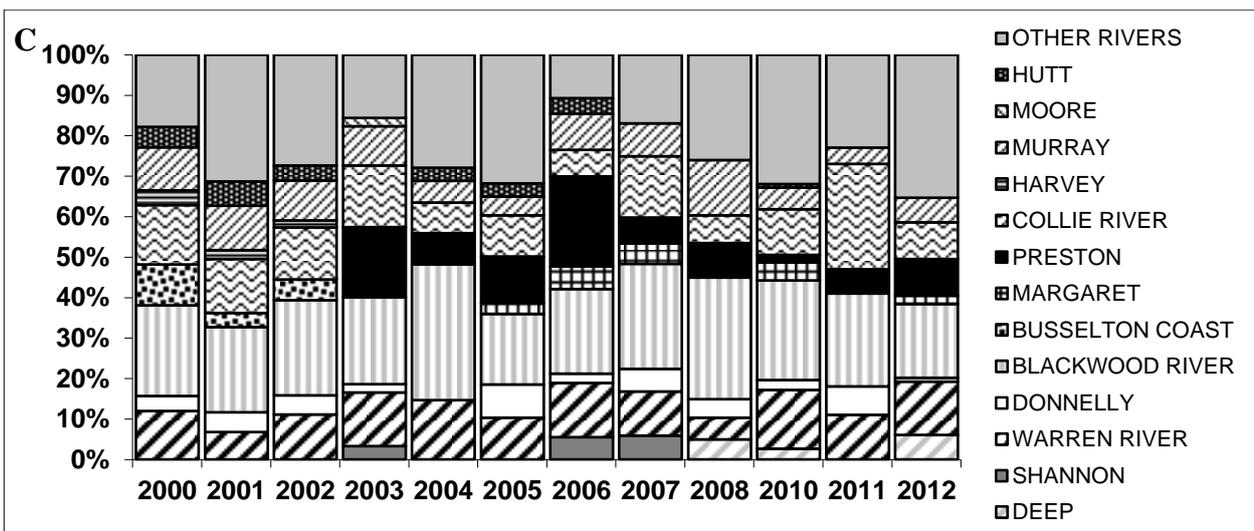
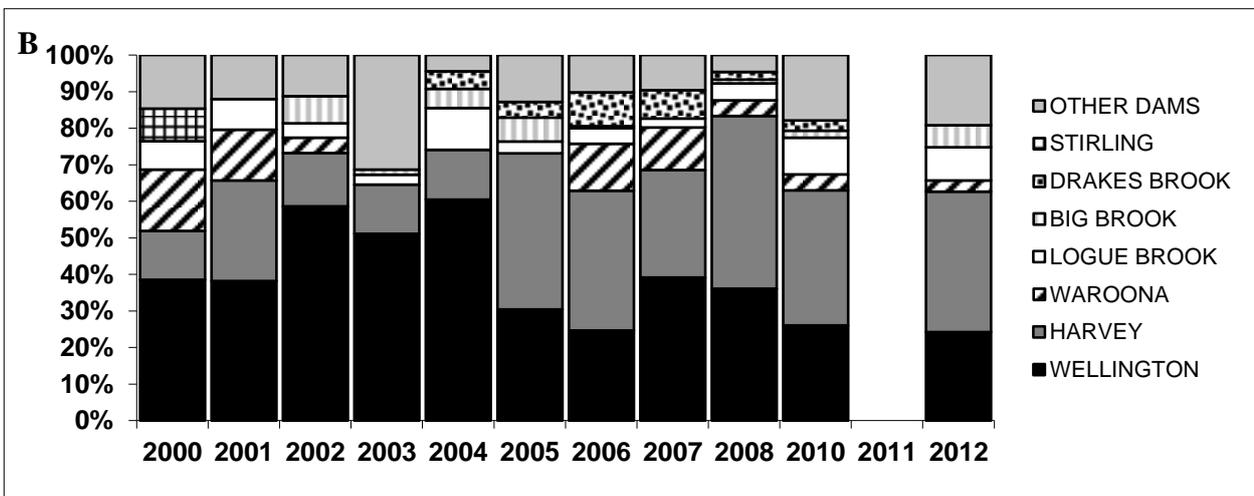
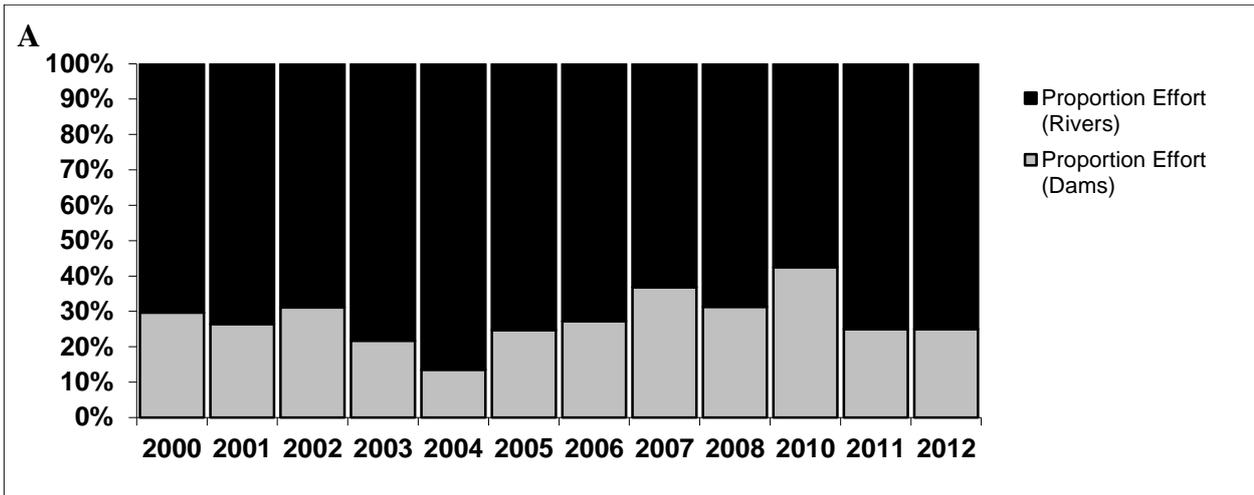
Winter rainfall plays a major role in marron reproduction, growth and survival. Rainfall increases the quality of areas for marron by transporting leaf-litter into streams (providing food sources for marron growth and reproduction) and by maintaining water volume and quality. A second major issue in this fishery is access to irrigation dams. The Water Corporation closed access to Stirling Dam in 2001 and Logue Brook Dam in 2008 to divert water to the metropolitan water supply.

The Department of Fisheries has developed a memorandum of understanding (MOU) for working 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.



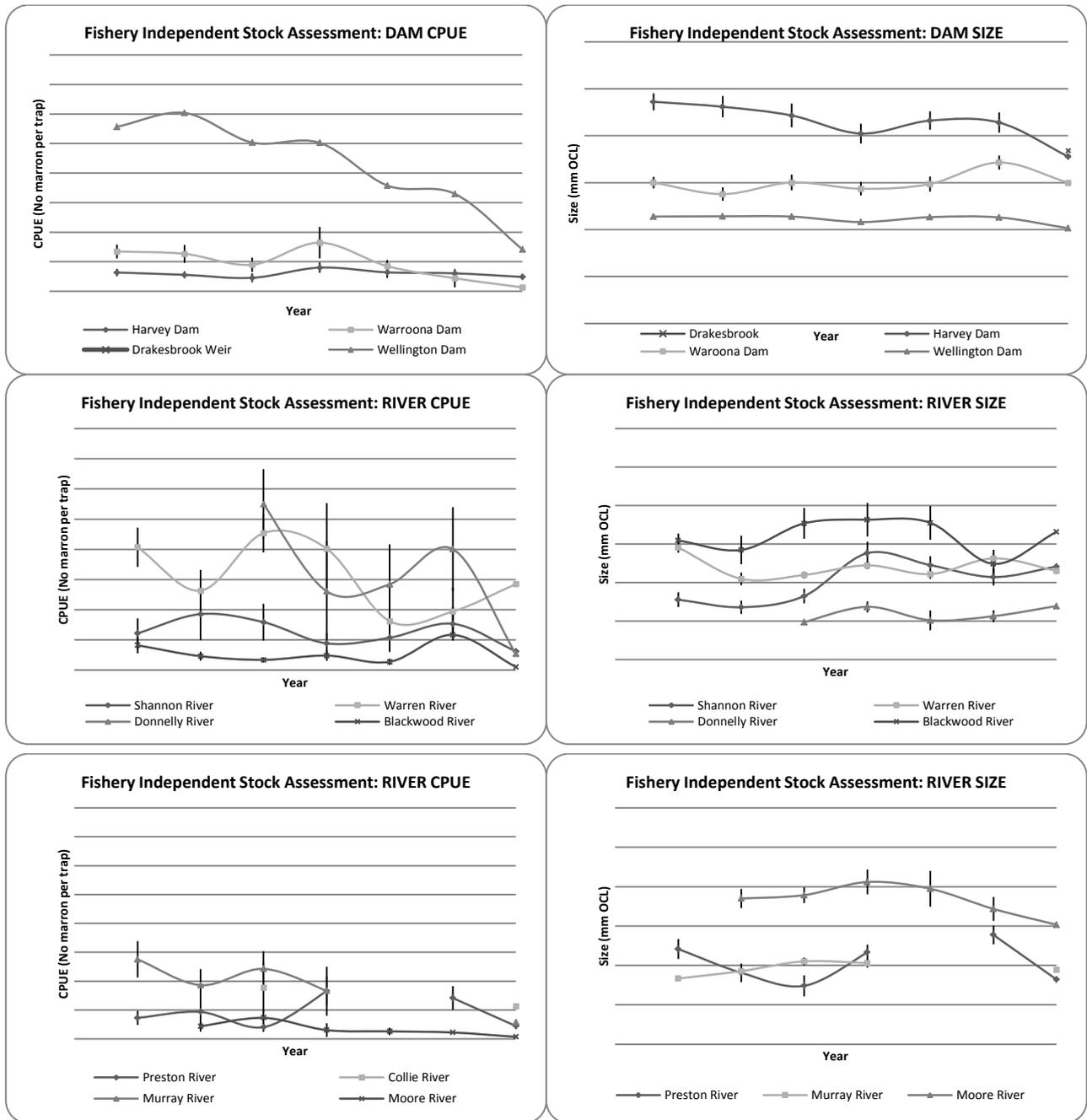
**RECREATIONAL MARRON FIGURE 1**

The estimated total catch (a) and catch per unit effort (b) of the recreational marron fishery between 1971 and 2011.



**RECREATIONAL MARRON FIGURE 2**

The distribution of effort over (a) rivers and dams, (b) among dams and (c) among rivers of the recreational marron fishery between 2000 and 2011. An exact breakdown of fishing effort for dams was not possible due to changes to licensing.



**RECREATIONAL MARRON FIGURE 3**

The relative abundance (CPUE) and size (mm OCL) of marron in four dams and eight rivers as determined by the fishery-independent stock assessment. Note: Values may be missing for a year if the site was not able to be sampled.

# AQUACULTURE

## Regional Research and Development Overview

Previous research undertaken at the Pemberton Freshwater Research Centre focused on marron husbandry and selective breeding research. Current research is focusing on captive breeding programs for conserving endangered marron and native fish.

The Pemberton Freshwater Research Centre continues to be the only major supplier of trout fingerlings to the aquaculture industry and for recreational fisheries restocking. Future research in this area will focus on improving the efficacy of triploidy induction in the Pemberton trout line. The production of infertile triploid trout is considered an

important mechanism to prevent establishment and spread of stocked trout which also has potential benefits for aquaculture (eg increased growth rates). A new collaborative project with the University of British Columbia is underway which aims to understand the genetic basis for the high thermal tolerance of the selectively bred Pemberton trout line. This line is considered internationally significant and is potentially important in understanding thermal tolerance in trout. This has potential implications for future aquaculture and restocking programs worldwide, especially in areas affected by climate change.

## COMPLIANCE AND COMMUNITY EDUCATION

Fisheries and Marine Officers (FMOs) based in Geraldton, Dongara, Jurien, Lancelin, Hillarys, Fremantle, Rockingham, Mandurah, Bunbury, Busselton, Albany and Esperance conduct recreational fishing compliance and education activities in the Southern Inland bioregion.

The highest risk of non-compliance in the Southern Inland bioregion is within the recreational Marron fishery. The Marron season lasts for just 28 days annually (8 January to 5 February) and intelligence information shows there is a risk of illegal fishing during the closed season. This illegal fishing is usually higher during the period from September to December, after the winter rains and prior to the season opening.

During the open Marron season additional resourcing is provided to Compliance efforts in the Marron fishery. Strategic rostering practices ensure that available staff from neighbouring Districts contributes to operational needs in providing a high profile and professional presence. This presence is designed to provide education, licence inspections, size and bag limit inspections, and patrols of waterways to ensure no illegal gear is being used in the taking of Marron.

FMO'S frequently engage joint patrol/operation initiatives with police to investigate the theft of marron from private properties and licensed aquaculture sites.

Dams and catchment areas once open to Marroning are being closed by the Water Corporation, which presents further challenges to ensure compliance in these areas. A number of Water Corporation Rangers have been authorized as honorary FMO's to assist with the compliance of illegal fishing on Water Corporation dams. Some DPaW officers have also been authorized as honorary FMO's and play an important role in the Marron compliance throughout the South West.

The other main fishery in the Southern Inland bioregion is the recreational trout fishery. The Compliance and Education focus in this fishery is to ensure compliance with bag limits, that fishers hold a current recreational freshwater fishing licence, and that line fishing does not occur during the closed season (1 July – 31 August).

Compliance patrols for the other recreational fisheries in these inland areas, as well as inspections of fish wholesale and retail premises form part of the compliance activities conducted by FMO'S in the Southern Inland bioregion.

Commercial fishing activity in rivers is included in the Southern Inland bioregion and some compliance patrols target fishing activity in the West Coast and South Coast estuarine fisheries. The compliance effort in these fisheries focuses mainly on closed waters, setting times, net lengths and licensing.

### Activities during 2011/12

During 2011/2012, FMO'S delivered 2232 compliance patrol hours to the Southern Inland bioregion (Southern Inland Compliance Table 1) – which is a marginal decrease from the 2283 compliance hours delivered in the previous year.

Officers conducted patrols throughout the bioregion in vehicles, dinghies and canoes, making 3515 field contacts with recreational fishers and 110 contacts with commercial operators. This is an increase of 28% for recreational contacts and 83% increase contact with commercial industry.

There were 117 infringement warnings and 60 infringement notices issued with a further 66 prosecutions for recreational offences.

The marron fishery continues to be the major focus for the compliance and education program in this bioregion. The compliance activities for the 2012 season included a pre-season operation which specifically targeted 'Out of Season' fishing activities. A number of people were found to be illegally fishing out of season and faced prosecution. The second phase of the operation included a high-profile presence during the Marron season which targeted both highly frequented and less frequented Marron fishing locations.

Aquaculture compliance activities (classified as 'commercial' In Table 1) are also a focus in the Southern Inland bioregion for FMO'S. Activities mainly involve inspection of aquaculture facilities, oversight of broodstock collection to ensure compliance with exemption conditions, and inspection

## SOUTHERN INLAND BIOREGION

of proposed aquaculture sites to ensure that the harvesting does not affect the wild stocks in WA waters. FMO'S continue to work closely with police to investigate theft from farm dams.

Freshwater fishing attracted a higher focus towards the end of the Freshwater Ban period, there were few contacts made and no offences detected.

### Initiatives for 2012/13

Compliance operations will again pay close attention to 'Out of Season' Marron fishing with both covert and overt patrols already planned.

A high-profile professional presence is again planned for the Marron season but in addition there are likely to be covert operations.

FMO'S are committed to maintaining Joint patrols and partnerships with external stakeholders. The joint patrols have been included in the operational plans for the coming

peak Marron fishing times.

Theft of Marron from dams on private property and aquaculture facilities remains a focus of joint agency collaboration in the sharing of intelligence information and resource sharing.

Freshwater fishing is purposely targeted towards the end of the Freshwater Fishing ban. Heavy rains and muddied waters are expected to see a decrease in activity but early results have seen some offending already.

Community Education activities will target recreational fishers prior to the start of the Marron fishery and the delivery of fisheries programs to school children and the public. The awareness of freshwater biodiversity and the threat posed by introduced species will also be promoted. The Community Education Team will maintain partnerships with natural resource management groups and the community to enable a holistic approach to catchment management and issues facing the sustainability of freshwater species.

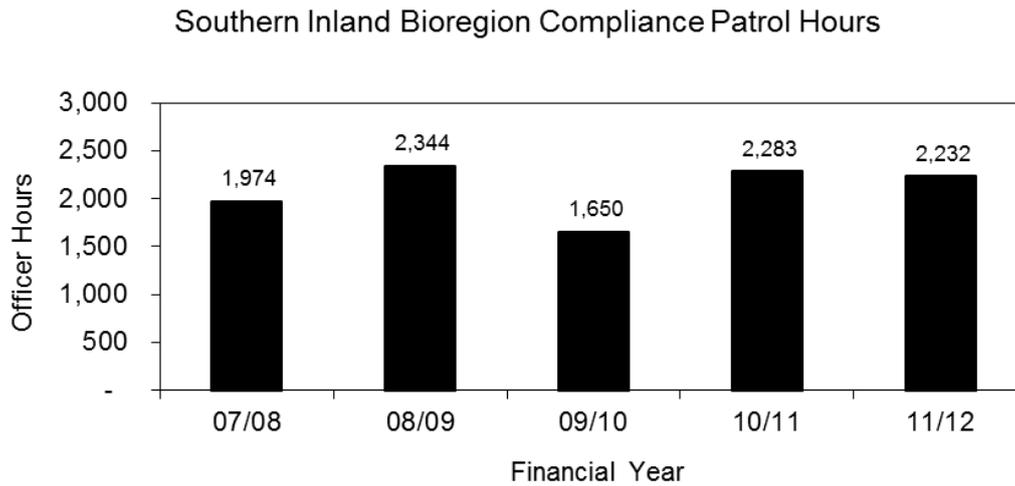
## SOUTHERN INLAND COMPLIANCE TABLE 1

This table gives a summary of compliance and educative contacts and detected offences within the Southern Inland bioregion during the 2011/12 financial year.

PATROL HOURS DELIVERED TO THE BIOREGION	2,232 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY	
Field contacts by Fisheries & Marine Officers	110
Infringement warnings	11
Infringement notices	3
Prosecutions	28
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY	
Field contacts by Fisheries & Marine Officers	3,515
Infringement warnings	117
Infringement notices	60
Prosecutions	66
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY*	
Field contacts by Fisheries & Marine Officers	1,541
Fishwatch reports**	N/A

\* 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 protected areas), 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 reported for this Bioregion are reported in either West Coast or South Coast Bioregional summaries. It is not possible to distinguish between calls relating to Inland Bioregions.

**SOUTHERN INLAND COMPLIANCE FIGURE 1**

In this figure, "On Patrol" Officer Hours shows the level of compliance patrol activity delivered to the Southern Inland bioregion over the previous five years. The 2011/12 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.