



Australian Government

Department of the Environment

## Draft Recovery Plan for the Giant Freshwater Lobster (*Astacopsis gouldi*)



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April 2016

The Species Profile and Threats Database pages linked to this recovery plan is obtainable from:  
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

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# Table of Contents

<b>1 Summary .....</b>	<b>5</b>
<b>2 Introduction.....</b>	<b>7</b>
2.1 Conservation Status .....	8
2.2 Lobster Recovery Team .....	8
<b>3 Background.....</b>	<b>8</b>
<b>4 Threats.....</b>	<b>14</b>
4.1 Historical causes of decline .....	14
4.2 Current threatening processes .....	14
4.2.1 Habitat disturbance.....	14
4.2.2 Illegal fishing.....	15
4.2.3 Other potential threatening processes .....	16
4.2.4 Management approaches to managing threatening processes .....	16
<b>5 Populations under particular pressure .....</b>	<b>16</b>
<b>6 Objectives and strategies.....</b>	<b>17</b>
<b>7 Actions to achieve the specific objectives .....</b>	<b>17</b>
Strategy 1 – Increase the reservation status and improve the quality of key habitat for giant freshwater lobsters .....	18
Strategy 2 – Prevent or minimise the degradation of giant freshwater lobster habitat .....	19
Strategy 3 – Reduce the impacts of illegal fishing on giant freshwater lobsters .....	22
Strategy 4 – Conduct monitoring and research to increase understanding of giant freshwater lobster ecology and biology.....	23
Strategy 5 – Engage with the general public, local government and NGOs in developing and/or delivering conversation measures.....	24
<b>8 Duration and cost of the recovery process .....</b>	<b>26</b>
<b>9 Current management practices .....</b>	<b>27</b>
<b>10 Effects on other native species and biodiversity benefits.....</b>	<b>28</b>
<b>11 Social and economic considerations.....</b>	<b>28</b>
<b>12 Affected interests .....</b>	<b>28</b>
<b>13 Consultation.....</b>	<b>28</b>
<b>14 Organisations/persons involved in evaluating the performance of the plan.....</b>	<b>29</b>
<b>15 References .....</b>	<b>30</b>

## Tables and figures

<b>Table 1:</b> Conservation status of the giant freshwater lobster. ....	8
<b>Figure 1:</b> Definition of the stream classification system used within forest practices.....	11
<b>Table 2:</b> Current distribution of the giant freshwater lobster and key threats. ....	12
<b>Figure 2:</b> Modelled distribution of the giant freshwater lobster ( <i>Astacopsis gouldi</i> ) .....	14

# Acronyms

CBS	Clearfell, burn and sow
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Commonwealth)
DotE	Department of the Environment (Commonwealth)
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tasmania)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
FPA	Forest Practices Authority
FPP	Forest Practices Plan
FT	Forestry Tasmania
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IUCN	International Union for Conservation of Nature
LMRM Act	Living Marine Resources Management Act 1995 (Tasmania)
LRT	Lobster Recovery Team
MNES	Matter of National Environmental Significance
NGO	Non-government organisation
NVA	Natural Values Atlas (Tasmania)
REDMAP	Range Extension Database and Mapping Project
SAC	Scientific Advisory Committee (Tasmania)
SPRAT	Species Profile and Threats Database (Commonwealth)
TFGA	Tasmanian Farmers and Graziers Association
TSP Act	Threatened Species Protection Act 1995 (Tasmania)
TSSC	Threatened Species Scientific Committee (Commonwealth)
UTAS	University of Tasmania

# 1 Summary

## Giant Freshwater Lobster (*Astacopsis gouldi*)

<b>Family:</b>	Parastacidae
<b>IBRA Bioregion (ver. 7.0):</b>	Known: King; Furneaux; Tasmanian Northern Slopes; Ben Lomond  Translocated populations: Ben Lomond; Tasmanian South East  Possible: Tasmanian West; Tasmanian Northern Midlands; Tasmanian Central Highlands: Tasmanian South East
<b>Current status of taxon:</b>	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (C'th): Vulnerable  <i>Threatened Species Protection Act 1995</i> (Tas): Vulnerable  IUCN Red List of Threatened Species: Endangered
<b>Distribution and habitat:</b>	The giant freshwater lobster is endemic to rivers of northern Tasmania. This species requires well-shaded streams that have good water quality, low sediment levels, snags, pools and undercut banks (Gowns, 1995; Hamr, 1990a, 1990b; Lynch, 1967). The giant freshwater lobster requires a stable thermal regime of relatively low water temperature (TSS, 2006).

### Habitat critical for survival:

Habitat critical to the survival of the giant freshwater lobster is defined as:

- All areas currently occupied by the species throughout its geographical range (as shown in figure 2)
- All upstream reaches of occupied catchments.

### Recovery plan objectives:

The objectives of this recovery plan are to:

- Conserve, protect and manage identified key habitats to support increasing populations of lobsters, with a healthy demographic structure
- Address threats and improve habitat quality across the species' range

### Recovery team:

Recovery teams provide advice and assist in coordinating actions described in recovery plans. They include representatives from organisations with a direct interest in the recovery of the species, including those involved in funding and those participating in actions that support the recovery of the species. The Lobster Recovery Team has the responsibility of providing advice, and coordinating and directing the implementation of the recovery actions outlined in this recovery plan. The membership of the Lobster Recovery Team may include individuals with relevant responsibility and expertise from DotE and DPIPW, as well as experts from research institutions and consultancies, and private researchers; membership may change over time.

## Recovery strategies:

The strategies to achieve the plans' objectives are to:

- Increase the reservation status and improve the quality of identified key habitat for giant freshwater lobsters.
- Prevent or minimise the degradation of giant freshwater lobster habitat.
- Reduce the pressures of illegal fishing on giant freshwater lobsters.
- Conduct monitoring and research to increase understanding of giant freshwater lobster ecology and biology.
- Engage with the general public, local government and NGOs in developing and/or delivering conservation measures.

## Criteria for success:

This recovery plan will be deemed successful if, within 10 years, all of the following have been achieved:

- Population densities that are reflective of increasing numbers and a healthy demographic structure have been recorded at locations identified as key to the survival of the giant freshwater lobster.
- Key population sites are identified and monitored at least three times during the life of this plan.
- Illegal fishing has been significantly reduced, or limited to a point that it no longer threatens the species' survival.
- Appropriate measures have been put in place to manage key threats affecting lobster habitat in areas impacted by forestry, agriculture or urban development.
- Habitat quality has been maintained or improved in key locations.
- Reservation status has been improved, or habitat protections increased in key locations.
- Community awareness of, and participation in, lobster conservation has increased.

## Criteria for failure:

This recovery plan will be deemed to have failed if; within 10 years any of the following have occurred:

- Lobsters have become locally extinct from key locations in the wild, or population health in these locations has declined.
- Recruitment of juveniles has not been recorded, and a healthy demographic structure is lacking, at locations identified as key to the survival of the giant freshwater lobster.
- Regular monitoring has not been conducted and population trends have not been assessed.
- Illegal fishing pressure has not been reduced across the species' range.
- Key threats limiting population growth and recovery have not been appropriately mitigated.
- Habitat quality has declined in key locations.



## 2 Introduction

This document constitutes the 'Draft Recovery Plan for the Giant Freshwater Lobster (*Astacopsis gouldi*)'. The plan considers the conservation requirements of the species across its range and identifies the actions to be taken to ensure the species' long-term viability in nature, and the parties that will undertake those actions.

This recovery plan is a revision of the 2006 Recovery Plan for the Tasmanian Giant Freshwater Lobster (*Astacopsis gouldi*) (DPIW, 2006). The 2006 recovery plan was reviewed in 2015 by an expert panel that included representatives from DotE, DPIPWE, CSIRO, UTAS, FPA, Hydro Tasmania and independent researchers and species experts. This review acknowledged that while considerable progress had been made on implementing the 2006-2010 recovery plan, continued efforts were required to secure the future of the species. In particular a more targeted approach was needed with a focus on building upon the actions already undertaken and identifying the actions that would be likely to be the most effective in improving the species conservation status. Furthermore, the review concluded that a new recovery plan should be developed for the species that included actions such as the identification of key habitat that may benefit from greater protection and a shift in fisheries compliance activities to focus on illegal poaching, including greater collaboration with police. The 2006 recovery plan and the 2015 review of the recovery plan are available from:

<http://www.environment.gov.au/resource/giant-freshwater-lobster-astacopsis-gouldi-recovery-plan-2006-2010>

Threats to the giant freshwater lobster include illegal fishing pressure, large-scale habitat disturbance or loss, siltation of waterways, drought and climate change. However, the most significant threat currently impacting upon the species may be the land clearing and habitat disturbance in upstream reaches of catchments supporting lobster populations as increased siltation of waterways can have a considerable impact on the life cycle of lobsters, particularly affecting the species' juvenile life stage.

This recovery plan sets out the research and management actions necessary to stop the decline, and support the recovery, of the giant freshwater lobster in Australia. The overarching objectives of this recovery plan are to:

- Conserve, protect and manage identified key habitats to support increasing populations of lobsters, with a healthy demographic structure
- Address threats and improve habitat quality across the species' range.

To achieve these objectives a range of strategies will be employed, including: reducing the impacts habitat degradation and illegal fishing; improving habitat quality and increasing habitat protection; increasing understanding of the species biology and ecology, and its ability to recovery from past threats; and promoting the giant freshwater lobster as a flagship species for healthy catchment management. In particular, it is believed that the species has a high probability of true recovery if the following three goals are achieved:

- Habitat protection is increased in key locations;
- Upstream land use activities are appropriately managed to prevent impacts on key downstream habitats; and
- Fishing ban enforcement activities are focussed on tackling poaching.

An accompanying Species Profile and Threats Database (SPRAT) page provides background information on the biology, population status and threats to the giant freshwater lobster. The SPRAT page is available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.

## 2.1 Conservation Status

The giant freshwater lobster is listed as threatened under both the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Tasmanian *Threatened Species Protection Act 1995* (refer to Table 1).

The giant freshwater lobster was transferred from the *Endangered Species Protection Act 1992* (ESP Act) to the Vulnerable list of the EPBC Act when it came into force in July 2000. For a species to be considered as Vulnerable under the ESP Act, the Minister must have been satisfied that the species was likely to become endangered within the next 25 years. Recommendations for listing species under the ESP Act were made to the Minister by the then Endangered Species Advisory Committee.

**Table 1:** Conservation status of the giant freshwater lobster.

Legislation	Conservation Status
Environment Protection and Biodiversity Conservation Act 1999 (C'th)	Vulnerable
Threatened Species Protection Act 1995 (Tas)	Vulnerable
IUCN Red List of Threatened Species (International)	Endangered

## 2.2 Lobster Recovery Team

The recovery program for the giant freshwater lobster will be coordinated by the Lobster Recovery Team (LRT) which was formed in 2015. The membership of the LRT may include individuals with relevant expertise from DotE and DPIPWE, as well as experts from research institutions, consultancies and individuals with relevant expertise; membership may change over time. The LRT will provide advice and assist in coordinating the recovery actions outlined in this recovery plan.

# 3 Background

## 3.1 Species description and distribution in Australia

The giant freshwater lobster is the world's largest freshwater crustacean. The species has been reported to attain weights of up to 6 kg, however in recent years the majority of the larger specimens recorded weigh between 2-3 kg. The species is slow-growing and long-lived. Colour varies considerably among individuals, with adults ranging from dark brown-green to black or blue. The species is spiny and has large distinct chelae (front pincers), walking legs, carapace and abdomen ending in a tail fan. Males have larger pincers than females. *Astacopsis gouldi* is the largest of the three *Astacopsis* species. Juvenile *A. gouldi* can be differentiated from the other two species (*A. franklinii* and *A. tricornis*) by the presence of a raised ridge in the middle of its forehead (rostrum).

The Tasmanian giant freshwater lobster is endemic to rivers, lakes and streams of northern Tasmania. Formerly, the species was distributed from the Arthur River in the west and eastwards across northern Tasmania, where it was found in all rivers flowing into Bass Strait, except for those of the Tamar catchment (Horwitz, 1994). Presently, the species distribution is more disjunct. Localised extinctions, or large declines in numbers, are thought to have occurred in the Welcome, Montagu, Rubicon, Don, Brid, Boobyalla, Pipers, Ringarooma, Duck, Little and Great Forester Rivers and Claytons Rivulet (Horwitz 1990, 1991, 1994; TSS, 2006). However, the species has been introduced into two catchments: the North Esk catchment (St Patricks River); and the Derwent catchment (Clyde River) (IFS



unpub. Data, cited in TSS, 2006), where its populations have become established. The species naturally occurs at altitudes below about 400 m, with most caught below 200 m (Horwitz, 1991, 1994). The estimated extent of occurrence of the giant freshwater lobster, based on catchments where the species is known to occur and historical reports of species presence, is approximately 10 700 km<sup>2</sup> (TSS 2006). Approximately 18% of the streams in which the species habitat is predicted to occur are protected in a formal reserve (Doran & Richardson, 2009).

## 3.2 Population trends

No data on population numbers are available for the giant freshwater lobster, however reports, largely based on anecdotal evidence, of localised extinctions and large declines in numbers due to fishing and/or habitat degradation were relatively common in the 1990s (e.g. Hamr, 1990a; Horwitz 1991, 1994; Maxwell et al., 1997). The structure of populations studied during this period indicated an absence of large individuals, particularly males, with very few lobsters of a size indicating sexual maturity being found (Gowns, 1995; Hamr, 1996; Lynch & Blühdorn, 1997). However, in recent years ongoing monitoring efforts have recorded larger specimens with increasing regularity (Doran et al., 2008). Whilst earlier records of the species had individuals weighing in at five kilograms or greater, by the late 1990s individuals weighing two or three kilograms were considered large (Doran et al., 2008). In January 1998 a fishing ban was imposed for the species, and there is some evidence of the benefits of this ban, with records of individuals weighing four kilograms and recaptures of marked individuals becoming increasingly common (Doran et al., 2008).

## 3.3 Biology and ecology

The giant freshwater lobster is a slow-growing crustacean, with females reaching sexual maturity at a carapace length of approximately 119 mm and weight of approximately 550 g, around 14 years, and males reaching sexual maturity at a carapace length of approximately 76 mm and weight of approximately 300 g, thought to be around nine years (Hamr, 1996). The species also has relatively low fecundity (TSS, 2006), with females mating and spawning biennially in autumn, after a summer moult (Hamr, 1990a 1992, 1996). Gestation takes about nine months, with females carrying the eggs on their tail through winter (TSS, 2006). The number of eggs produced by a female is proportional to its size, and egg counts range from 224–1300 per female (Hamr, 1996). After hatching in mid-summer, young lobsters stay attached to the female until autumn (Hamr, 1996). The species is long-lived and has been known to live up to 60 years of age (Bryant & Jackson, 1999).

The dispersal patterns and migratory activities of the giant freshwater lobster are largely unknown; however, the species generally appears to have two patterns in their movement and behaviour:

- residential periods, during which time animals may be inactive, or undertake small-scale movements, usually returning to a specific "home site"; and
- less common large-scale movements, after which the animal takes up residence in a new "home site" or pool, or returns to its initial "home site" (Webb & Richardson, 2004).

A study involving radio telemetry tracking of eight lobsters showed periods of inactivity lasting from 1-10 days, interspersed with movements involving travel over relatively large distances, including one lobster moving over 700 m in a single night and a total distance of 2.2 km recorded for one lobster over the five month study period (Webb & Richardson, 2004). This species is also known to walk over land (Horwitz, 1991).

The main food of the giant freshwater lobster is decaying wood and its associated microbes, though its diet varies with age, and they also eat leaves and animal flesh, including small fish, when available (Forteath, 1987; Hamr, 1996; Lynch, 1967).

Giant freshwater lobsters display differences in habitat preferences at different life stages. A study by Davies et al. (2006) found juvenile lobsters in streams at elevations ranging from 18-250 m ASL, channels ranging from 1-20 m bankfull width and catchments areas ranging in size from 0.4-240 km<sup>2</sup>. However, the study noted that densities were greatest in streams in catchments of intermediate size

(typically 2-30 km<sup>2</sup>) within channels of 1-3 m wetted widths at baseflow (Davies et al., 2006). Furthermore, juvenile abundance responded positively to lower levels of silt substrate (<2%) and higher proportions of moss cover (>10% stream bed area) and boulder substrate (10-30% stream bed area), while no juveniles were detected in streams with channel slopes >10%, silt substrate levels >5% and baseflow conductivities > 160 µS/cm (Davies et al., 2006). Optimal habitat for juvenile lobsters may be considered to include shallow areas of streams with minimal silt substrate, high proportions of moss and boulder cover, and meso-habitat features including large rocks, cavities and in-stream logs, while class 4 streams with substantial, sustained groundwater input may also provide suitable habitat conditions (Davies et al., 2006). Class 4 streams are defined within the Forest Practices Code as watercourses carrying water for part or all of the year for most years, they are differentiated from a drainage depression by: having a gravelly, pebbly, rocky or sandy bed; and/or an obvious gully; and/or a short steep section of stream bank adjacent to the watercourse bed (Davies et al., 2006). Conversely, preferred habitat for adult lobsters includes deeper pools often associated with snags (Webb, 2001).

Small headwater streams have been found to contain suitable habitat for juvenile lobsters, however the species has typically been detected in lower densities in these streams compared to larger, higher-order streams within the same drainage (Davies et al., 2006). However, there are some examples of high densities of juveniles being found in smaller headwater streams, such as Coopers Creek which has a catchment area of 40 ha (Davies et al., 2006), streams with sources rising adjacent to basalt-sedimentary geological contacts (Davies & Cook, unpublished data) and streams within the Flowerdale-Hebe River catchment (Walsh, pers comm., cited in Davies et al., 2006). Furthermore, densities of juvenile lobsters are also likely to be lower within heavily cleared and intensively managed areas typically found in the lower area of catchments compared to less modified areas within the same catchment (Davies et al., 2006).

### 3.4 Habitat critical to the survival of the giant freshwater lobster

On a regional scale, habitat for *A. gouldi* may be described as an intact system of densely canopied streams, of several stream sizes including small headwaters, flowing through a relatively undisturbed, forested catchment. On a local scale, excellent lobster habitat is comprised of streams containing snags, pools and undercut, but not eroding banks, with water of relatively low temperature, high dissolved oxygen, little sediment and bordered by intact riparian zones of native vegetation (Lynch & Blühdorn, 1997). Adult lobsters require still, deep pools containing submerged and decaying logs and undercut banks which provide shelter (Lynch, 1967; Hamr, 1990a). Smaller juveniles require shallow fast-flowing stream habitats (Hamr, 1990a) and favour habitats with large stable rocks or logs, not embedded in finer substrates, overlying coarser substrates and/or with a distinct cavity underneath (Davies & Cook, 2004).

Habitat critical to the survival of the giant freshwater lobster can be described as all areas currently occupied by the species throughout its geographical range and all upstream reaches of occupied catchments (which are vital to the maintenance of the areas where the species occurs, as included in EPBC regulation 7.09).

**Table 2:** Current distribution of the giant freshwater lobster and key threats.

	Distribution*	Tenure (Major land tenure, <i>other land tenure</i> )	Threats
<b>Known to occur</b>  (includes high quality habitat within the listed catchments)	<ul style="list-style-type: none"> <li>Black-Detention Catchment <ul style="list-style-type: none"> <li>- Black sub-catchment</li> <li>- Dip sub-catchment</li> <li>- Detention sub-catchment</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Timber Production Zone, <i>Private freehold (inc. agriculture)</i></li> <li>- Timber Production Zone, <i>Regional Reserve</i></li> <li>- Private freehold (inc. agriculture), <i>Timber Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> <li>- Poaching, heavy sedimentation</li> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Arthur Catchment <ul style="list-style-type: none"> <li>- Arthur sub-catchment</li> <li>- Frankland sub-catchment</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Timber Production Zone, <i>Regional Reserve</i></li> <li>- Regional Reserve, <i>Conservation Area, Future Potential Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, acid mine drainage</li> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Inglis-Flowerdale Catchment <ul style="list-style-type: none"> <li>- Inglis sub-catchment</li> <li>- Flowerdale sub-catchment</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Timber Production Zone</i></li> <li>- Private freehold (inc. agriculture), <i>Future Potential Production Zone, Timber Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> <li>- Poaching, heavy sedimentation</li> </ul>
AND			
<b>Likely to occur</b>  (Includes wider areas within the listed catchments, however densities are expected to be lower in areas of reduced habitat quality)	<ul style="list-style-type: none"> <li>Duck Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Timber Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Cam Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Timber Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Emu Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold</li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, mining (iron filing deposits)</li> </ul>
	<ul style="list-style-type: none"> <li>Blythe Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Timber Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Leven Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Regional Reserve</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Forth-Wilmot Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Hydro-electric dam</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, flow modification, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Mersey Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Hydro-electric dam</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, flow modification, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Rubicon Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture)</li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>
	<ul style="list-style-type: none"> <li>Pipers Catchment</li> </ul>	<ul style="list-style-type: none"> <li>- Private freehold (inc. agriculture), <i>Future Potential Production Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>- Poaching, heavy sedimentation</li> </ul>

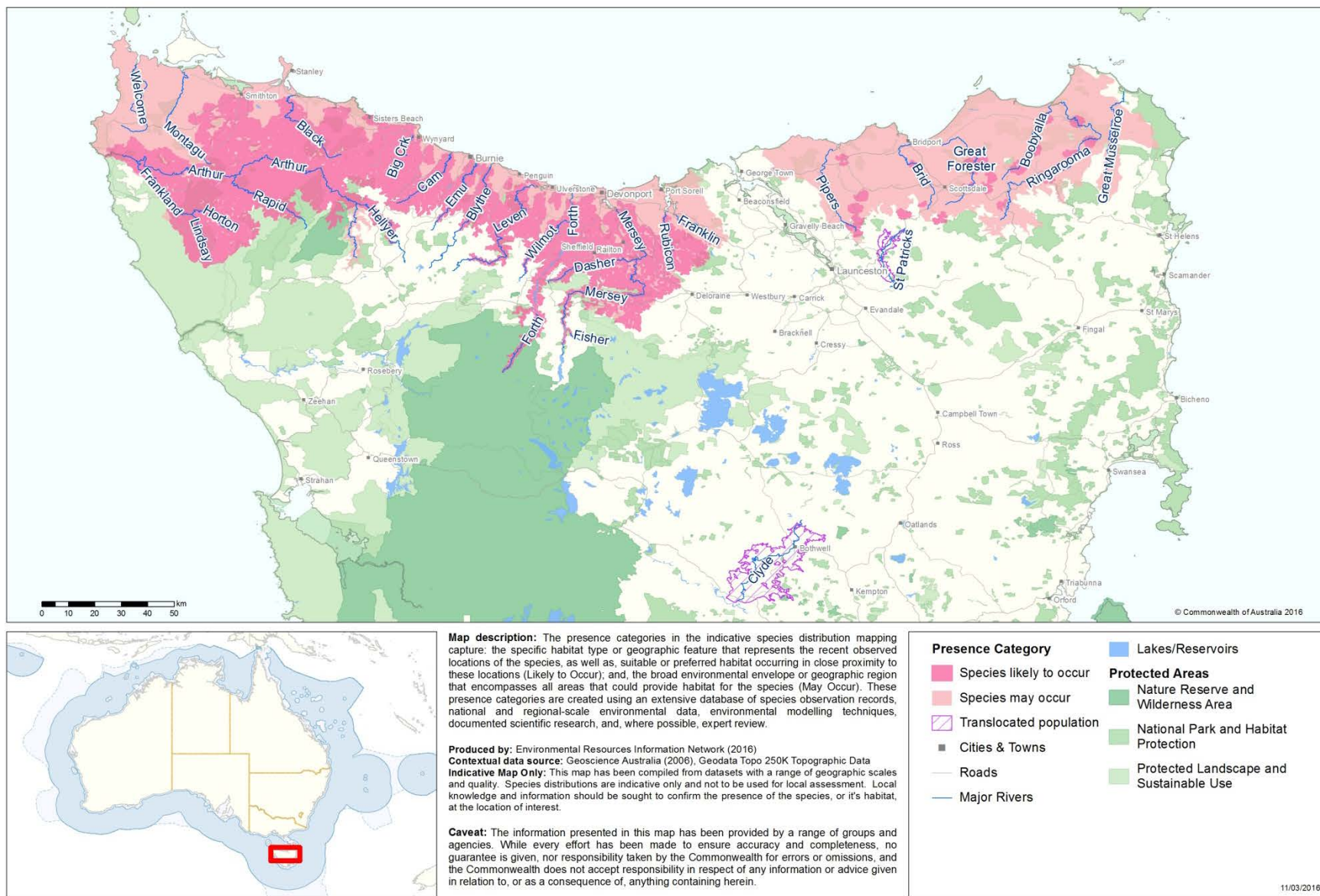
	Distribution*	Tenure (Major land tenure, <i>other land tenure</i> )	Threats
Known to occur AND Likely to occur	• Little Forester Catchment	- Private freehold (inc. agriculture)	- Poaching, heavy sedimentation
	• St. Patricks Catchment**	- Private freehold (inc. agriculture)	- Poaching, heavy sedimentation
	• Great Forester-Brid Catchment	- Private freehold (inc. agriculture), <i>Timber Production Zone</i>	- Poaching, heavy sedimentation
	• Boobyalla-Tomahawk Catchment	- Private freehold (inc. agriculture), <i>Regional Reserve, Future Potential Production Zone</i>	- Poaching, heavy sedimentation <i>Previous mining no longer an impact</i>
	• Ringarooma Catchment	- Private freehold, <i>Regional Reserve</i>	- Poaching, heavy sedimentation, mining
	• Clyde Catchment**	- Private freehold	- Heavy sedimentation
	• Welcome Catchment	- Private freehold (inc. agriculture)	- Poaching, heavy sedimentation
	• Montagu Catchment	- Private freehold (inc. agriculture), <i>Timber Production Zone</i>	- Poaching, heavy sedimentation
May occur	• Musselroe Catchment	- Private freehold (inc. agriculture), minimal use zone	- Unknown

\* *known to occur* consists of all locations where the species has been sighted since 1990, this includes biologically important areas where the species is known to breed, feed or forage. Habitat typically includes areas with low to no sedimentation, no flow modifications and intact riparian vegetation which can allow for the recruitment of in-stream woody debris.

\* *likely to occur* consists of areas where the species or species' habitat is likely to occur, such as locations adjacent to known distribution polygons or locations where the species has been previously sighted. Habitat may exhibit some reduction in the quality of riparian vegetation and an increase in sedimentation impacts.

\* *may occur* consists of areas where the species or species' habitat may occur, such as historic locations or anecdotal sightings. Habitat may be significantly compromised.

\*\* Note: individuals have been introduced into this catchment and have subsequently established, this catchment is not a part of the species historic 'natural' range.



**Figure 2:** Modelled distribution of the giant freshwater lobster (*Astacopsis gouldi*).

## 4 Threats

### 4.1 Historical causes of decline

The principal threats affecting giant freshwater lobsters in past decades were fishing pressure and habitat disturbance (Lynch, 1967; Hamr, 1990b; Horwitz, 1994; Grouns, 1995; Lynch & Blühdorn, 1997), with relatively common reports of localised extinctions and large declines in numbers attributed to these threatening processes (Hamr, 1990a; Horwitz, 1991, 1994; Maxwell et al., 1997). Many of the streams inhabited by the species have been subject to disturbance from agricultural, forestry and urban activities and much of the floodplain riparian area within its range has been heavily modified (Jackson & Blühdorn, 1999). With expansion of roading, primarily a result of forestry activities, many of the species' upland refuges have become more easily accessed for fishing (TSS, 2006).

The recolonisation of impacted streams appears to be very slow (e.g. Maxwell et al., 1997), indicating that dispersal is naturally slow or that the animals available for such migrations may no longer be plentiful. The species' slow growth and relatively low fecundity compounds the problems facing recruitment into impacted areas (TSS, 2006).

### 4.2 Current threatening processes

Current, ongoing threats to the species include illegal fishing pressure (the species is easily caught), large-scale habitat disturbance, including siltation of waterways and modifications to flow regimes. Other threats include drought and climate change.

#### 4.2.1 *Habitat disturbance*

Habitat disturbance includes the removal or destruction of riparian vegetation, bank erosion, removal of snags, channelisation, siltation, nutrification, toxic chemical inputs, instream barriers to movement such as culverts and farm dams, and alterations to stream flow and thermal regime (TSS, 2006).

In forestry areas, riparian and aquatic habitats are affected by activities such as road construction, logging and the establishment and subsequent harvesting of plantation timber (TSS, 2006). Continuing effects include loss of canopy cover, increased runoff, sedimentation, and changes in hydrology (TSS, 2006), all of which result in impacts to stream flows, geomorphology, nutrient dynamics, carbon budgets and in-stream habitat (Thompson et al., 2009). It is known that increased siltation and turbidity places increased stress on the giant freshwater lobster's ability to transpire oxygen through the gills (Eastman & Eastman, 2007). These threats have been known to occur in every catchment (Jackson & Blühdorn, 1999), however the impacts on stream condition can vary in relation to the location, extent and duration of forestry operations within a catchment (Smith et al., 2009; Johnson & Host, 2010).

A recent study by Davies et al. (2016) has shown that the impacts of upstream forestry operations in Tasmania can extend downstream by up to 10 km and effect stream condition in mid-river reaches in catchments with non-basaltic geologies. The study also found that higher percentages of land area under clearfell, burn and sow (CBS) forestry operations were associated with lower densities of juvenile lobsters, though the results were only marginally statistically significant, perhaps due to small sample sizes (Davies et al., 2016). The Forest Practices Code provides protection for headwater streams in small catchments (<50 ha) in the form of machinery exclusion areas that apply to 10 m streamside buffers, however until recently harvesting and burning were permitted up to the stream edge in these areas (Davies et al., 2016). Davies et al. (2016) recommend that forestry management practices include measures to minimise downstream impacts in areas that support optimal habitat for both juvenile and adult lobsters. The Tasmanian Forest Practices System has recently introduced measures to increase protections of headwater streams identified as 'high sensitivity' (FPA, 2010), however the effectiveness of these measures has yet to be assessed.

In agricultural areas, lobster populations may be affected by general stream degradation caused by the clearing of riparian vegetation, removal of snags, extensive modification of stream channels (including dam construction), access by stock, water abstraction and inflows of agricultural chemicals and



nutrients. The overall result of these practices has been probable local extinctions of lobsters from some river reaches, especially in floodplain and estuarine areas (Horwitz, 1994).

### *Sedimentation of waterways*

Sedimentation of waterways, particularly in the headwaters of occupied river reaches, poses a potentially significant threat to the survival of giant freshwater lobsters. Headwaters have been recognised as important sources of downstream sediment, nutrient, carbon and water budgets, and, as they can constitute a significant portion of a catchment (up to 70%), appropriate management of these areas can help to control downstream impacts (Davies et al., 2016). Channel morphology, riparian structure and in-stream macro-invertebrate community composition can all display signs of modification in response to increases in sediment transported from headwater tributaries (Gregory et al., 1991; Gomi et al., 2002). Increased sediment levels arising from agricultural and forestry related land-uses have also been correlated with decreased abundances of lobsters (Walsh and Nash, 2002).

Davies et al. (2016) found that, in a number of forestry areas within Tasmania, increases in the percent of land under CBS operations were related to increasing levels of in-channel fine sediments and decreasing numbers of juvenile lobsters. The authors attributed the increases in fine sediment loads to a combination of recent and historical CBS operations, and associated roading which was found to be a significant contributor to these impacts (Davies et al., 2016). Hardwood plantation operations in upstream reaches of study catchments were also associated with increases in in-stream fine sediment loads, and with increased unsealed roading activities, though the effects were less pronounced than in CBS operations (Davies et al., 2016). Sediment depositions arising from upstream forestry operations were observed to impact in-stream habitat for considerable distances downstream (up to 10 km) and a clear positive relationship between the percentage of upstream land under historical CBS operation and fine sediment loads in mid-catchment reaches was identified (Davies et al., 2016).

In agricultural areas, the clearance of riparian vegetation can result in elevated sediment loads entering waterways as vegetation removal often causes the destabilisation of stream-banks, while bank erosion can result in the direct loss of burrowing habitat (Horwitz, 1994). The clearance of riparian vegetation can also result in increased water temperatures as canopy shading is reduced allowing more light to reach the water (Horwitz, 1994). Pesticide use resulting from agricultural activities, and point-source increases in effluent and nutrient discharge, may also impact water quality (Horwitz, 1994).

### *Modifications to water flow*

In forestry areas, hydrology and flow dynamics within headwater streams immediately downstream of land clearing activities typically show signs of modification (Davies & Nelson, 1994; Grouns & Davis, 1994). Impacts of forestry operations on hydrological processes can include reductions in base flows and increases in high flows and flow flashiness, all of which can effect bank stability, channel morphology and stream heterogeneity (McIntosh, 2004).

In agricultural areas, land conversion and crop intensification coupled with rising temperatures have led to increased water extraction rates for irrigation purposes in some areas. Such practices exacerbate impacts already faced by aquatic species, including freshwater crayfish, as development may also result in a loss of connectivity between areas of suitable habitat (Richman et al., 2015). Within Australia climate-mediated threats, including impacts on water temperature and availability, are putting the conservation status of two-thirds of all freshwater crayfish species at risk (Richman et al., 2015).

A report by the National Water Commission (2012), which assessed water stress in Australian catchments and aquifers, found that while Tasmanian river basins are generally less impacted than other catchments across Australia, some river basins (such as the Mersey and Pipers–Ringarooma river basins) are heavily impacted by hydro-electric schemes and, to a lesser degree, by water extraction for irrigated agriculture and urban water use (NWC, 2012).

The giant freshwater lobster is also threatened by reduced flows in streams and rivers associated with drought conditions (DotE, 2015). Anecdotal reports indicate that low environmental flows caused the death of giant freshwater lobsters in several catchments in the north-west and north-east of Tasmania in 2006–2007 (DotE, 2015). Of particular concern is a lack of contingency planning by authorities in

preparation for reduced environmental flows in areas utilised by land owners for irrigation of crops (Eastman & Eastman, 2007).

#### **4.2.2 Illegal fishing**

Fishing of the giant freshwater lobster was prohibited, through an amendment to the *Inland Fisheries Act (1995)*, on 1 January 1998; however, the impacts of ongoing illegal fishing continue to threaten the species. The full implications of fishing on the population dynamics of the species are not well understood, although population surveys indicate that past fishing pressure has had a significant impact on lobster populations. Fishing pressure targets mainly adult and large sub-adult members of the population. Given the slow growth rate of the species, and the significant time lags in the reappearance of full sized adults following past recreational fishing pressure, illegal fishing has the potential to significantly threaten lobster populations,

A degree of fishing activity is known to be continuing despite now being illegal. This is evidenced by prosecutions, the presence of bait lines and anecdotal reports. Annual reports from the Inland Fisheries Service (IFS) provide details on the compliance activities undertaken jointly by the IFS, Tasmanian Police and the Tasmanian Parks and Wildlife Service in relation to illegal fishing activities (IFS 2016). Investigations and/or prosecutions relating to offences involving giant freshwater lobsters are occurring on a regular basis, with most convictions relating to the take of a protected fish or possession of the giant freshwater lobster, and penalties generally involving the issuing of fines (IFS 2016). Reports indicate that compliance activities often occur in remote areas and many prosecutions are associated with joint charges being laid for offences involving firearms, ammunitions, drugs and drug-related materials (IFS 2016). The amount of illegal fishing that may be going undetected is currently unknown.

#### **4.2.3 Other potential threatening processes**

1. Climate change is a significant overarching threat that may result in altered stream flows, stream temperatures and changes to catchment vegetation (DotE, 2015). Such habitat disturbance may affect the entire local lobster population, not just large individuals (TSS, 2006).

#### **4.2.4 Management approaches to managing threatening processes**

Given the nature of the threats that are impacting upon lobster survival, researchers are increasingly identifying the need for catchment-level management approaches to address both direct and indirect (e.g. downstream) impacts. Davies et al. (2006) highlight the need to consider catchment-scale management to secure the future of the species, with an emphasis on the protection of lobsters in higher order streams to address the cumulative impacts of modified land-use (including forestry and agriculture), point source pollution and illegal fishing. Minimising the impacts of land-use activities on downstream reaches that support optimal habitat for both juvenile and adult lobsters is of particular importance (Davies et al., 2006). Research indicates that optimal habitat includes, but is not limited to, class 4 streams such as Coopers Creek, where groundwater inputs strongly supplement baseflows (Davies et al., 2006). Davies et al. (2016) also recommend a holistic approach to river and catchment management to address the relationship between catchment-wide activities and localised impacts, including the potential for upper catchment disturbances to result in flow-on effect to downstream habitats. Barmuta (2011), in relation to forest practices in particular, also discusses the need for management of freshwater systems to incorporate both broad landscape-scale and fine-scale planning in order conserve these ecosystems and the values they support.

## **5 Populations under particular pressure**

The actions described in this recovery plan are designed to provide ongoing protection for giant freshwater lobsters throughout their range.

Giant freshwater lobsters have a restricted distribution and have experienced reductions in the number of mature individuals, extent of occurrence and area and quality of habitat, all of which present significant challenges for their recovery and exert strong pressures on their survival in the wild. Given these challenges all populations of giant freshwater lobsters require protective measures.

## 6 Objectives and strategies

The objectives of this recovery plan are to:

- Conserve, protect and manage identified key habitats to support increasing populations of lobsters, with a healthy demographic structure.
- Address threats and improve habitat quality across the species' range.

The strategies to achieve the plans' objectives are to:

- Increase the reservation status and improve the quality of identified key habitat for the giant freshwater lobster.
- Prevent or minimise the degradation of giant freshwater lobster habitat.
- Reduce the impacts of illegal fishing on giant freshwater lobsters.
- Conduct monitoring and research to increase understanding of giant freshwater lobster ecology and biology.
- Engage with the general public, local government and NGOs in developing and/or delivering conversation measures.

## 7 Actions to achieve the specific objectives

Actions identified for the recovery of the giant freshwater lobster are described below. It should be noted that some of the objectives are long-term and may not be achieved prior to the scheduled five-year review of the recovery plan. Priorities assigned to actions should be interpreted as follows:

<b>Priority 1:</b>	Taking prompt action is necessary to mitigate the key threats to the giant freshwater lobster and also provide valuable information to help identify long-term population trends.
<b>Priority 2:</b>	Action would provide a more informed basis for the long-term management and recovery of the giant freshwater lobster.
<b>Priority 3:</b>	Action is desirable, but not critical to the recovery of the giant freshwater lobster or assessment of trends in that recovery.

## Strategy 1 – Increase the reservation status and improve the quality of key habitat for the giant freshwater lobster.

### Research/information actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>1a</b>	Assess the effectiveness of current management provisions for lobster conservation.	2	<ul style="list-style-type: none"> <li>Current management provisions for the conservation of the giant freshwater lobster are assessed to evaluate their effectiveness, including management relating to: <ul style="list-style-type: none"> <li>Water planning.</li> <li>Agricultural development.</li> <li>Forestry operations.</li> <li>Conservation covenants.</li> </ul> </li> </ul>	<b>DPIPWE</b> FPA Tasmanian Irrigation TFGA	
<b>1b</b>	Identify priority sub-catchments for improved habitat protection to support and maintain healthy lobster populations.	1	<ul style="list-style-type: none"> <li>Population survey data is overlaid with habitat quality data to identify pristine or 'high quality' sub-catchments which support healthy lobster populations.</li> <li>Sub-catchments are ranked in terms of population and habitat health and priority sub-catchments are identified for potential increased habitat protections.</li> <li>Where information is available, priority sub-catchments are selected to maximise genetic diversity.</li> </ul>	<b>DotE</b> <b>DPIPWE</b> Research community	

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>1c</b>	Increase the total area of giant freshwater lobster habitat that is reserved.	1	<ul style="list-style-type: none"> <li>Opportunities to incorporate priority sub-catchments, as identified under action 1b, or portions thereof into public or private reserve systems are explored.</li> <li>The total area of giant freshwater lobster habitat that is protected under regional, State, National or private reserves systems increases.</li> </ul>	<b>DPIPWE</b> DotE	

<b>1d</b>	Implement mechanisms for protecting lobster habitat on private land in priority areas.	1	<ul style="list-style-type: none"> <li>Mechanisms for protecting lobster habitat and enhancing riparian restoration on private land, such as conservation covenants or other landholder incentives, are identified and promoted.</li> <li>Implementation of identified mechanisms focuses on increasing participation in the north-east</li> </ul>	<b>DPIPWE</b> NRM bodies
<b>1e</b>	Reduce the impacts of acid mine drainage on lobster habitat.	2	<ul style="list-style-type: none"> <li>Areas where acid mine drainage, arising as a legacy impact from disused mine sites, overlaps with lobster habitat are identified.</li> <li>Technologies under development for the amelioration of acid mine drainage are investigated for potential use in habitat rehabilitation.</li> </ul>	<b>DPIPWE</b> Research community

## Strategy 2 – Prevent or minimise the degradation of giant freshwater lobster habitat

### Research/information actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>2a</b>	Inform agricultural communities about lobster conservation.	2	<ul style="list-style-type: none"> <li>Informative material on giant freshwater lobsters and best practice management for their conservation is provided to agricultural communities within the species distribution.</li> </ul>	<b>DPIPWE</b> TFGA NRM bodies	
<b>2b</b>	Review and where required update methods for assessing habitat suitability to incorporate maintenance of upstream habitat values for protection of downstream habitat quality.	1	<ul style="list-style-type: none"> <li>Methods for categorising the suitability of habitat for the giant freshwater lobster are analysed to determine their effectiveness at protecting habitat upstream of priority sub-catchments (as identified under action 1b).</li> <li>Options for increasing the habitat suitability rating in headwaters above priority sub-catchments are investigated, including potential refinement of watercourse definitions, and a suitable method for conferring increased protection is identified.</li> <li>The FPA's Threatened Fauna Advisor and Giant Freshwater Crayfish Habitat Suitability Map are updated to incorporate the preferred method for improving upstream habitat management in priority sub-catchments.</li> </ul>	<b>FPA</b> <b>DPIPWE</b> Research community	

- DPIPWE's formal advice on the management and maintenance of giant freshwater lobster habitat is updated as required.

## On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>2c</b>	Habitat managers and regulators work cooperatively to identify and implement methods for strengthening habitat protections, or reducing forestry impacts, in upstream reaches of priority sub-catchments.	1	<ul style="list-style-type: none"> <li>• The recommendations of Davies et al (2016), that forestry management practices include measures to minimise downstream impacts in areas that support optimal habitat for both juvenile and adult lobsters, are considered.</li> <li>• Various methods are investigated for increasing habitat protection, or reducing adverse impacts, in upstream reaches of priority sub-catchments.</li> <li>• Habitat managers and regulators work together to identify the most appropriate method for increasing protections, or improving management, in upstream reaches of priority sub-catchments.</li> <li>• The chosen method is implemented by regulators.</li> </ul>	<b>DotE</b> <b>DPIPWE</b> <b>FPA</b> Research community	
<b>2d</b>	Undertake monitoring of forestry industry compliance with lobster management prescriptions.	3	<ul style="list-style-type: none"> <li>• Regular monitoring is undertaken to ensure management prescriptions for the protection of giant freshwater lobster habitat are being correctly and effectively implemented.</li> <li>• Compliance with management prescriptions is evaluated.</li> <li>• Monitoring results are used to inform adaptive management of the prescriptions to improve implementation and incorporate any new recommendations/prescriptions.</li> </ul>	<b>FPA</b>	
<b>2e</b>	Investigate options for sediment control.	1	<ul style="list-style-type: none"> <li>• The effectiveness of various methods of controlling erosion and reducing sediment inputs into streams are investigated for different habitat types.</li> <li>• Appropriate erosion and sediment controls measures are implemented in priority sub-catchments.</li> </ul>	<b>FPA</b> <b>DPIPWE</b> Research community	



<b>2f</b>	Establish a demonstration site to display lobster habitat rehabilitation in agricultural areas.	3	<ul style="list-style-type: none"> <li>• A suitable location for establishing a demonstration site is identified.</li> <li>• A demonstration site showcasing methods of rehabilitating and managing habitat for the conservation of the giant freshwater lobster is established.</li> </ul>	NRM bodies
<b>2g</b>	Ensure that water management planning incorporates the water requirements of the giant freshwater lobster.	1	<ul style="list-style-type: none"> <li>• Water managers in catchments housing lobsters are aware of the water requirements of the species.</li> <li>• The water requirements of lobsters are incorporated in water management planning processes and environmental flow assessments.</li> <li>• Appropriate mechanisms are in place to control illegal water extraction across the species range.</li> <li>• Appropriate mechanisms are in place to ensure that the impacts of dam construction on lobsters are minimised.</li> </ul>	<b>DPIPWE</b>
<b>2h</b>	Ensure culvert designs allow for movement of giant freshwater lobsters	3	<ul style="list-style-type: none"> <li>• Information on minimal-impact culvert designs, as described in the FPA Fauna Technical Note No.15, is disseminated to local councils, landholders and other relevant stakeholders within the giant freshwater lobster's distribution.</li> <li>• Culvert designs which allow for the movement of giant freshwater lobsters are used for stream crossings within the species range.</li> </ul>	<b>DPIPWE</b> FPA NRM bodies Local councils Private landholders

## Strategy 3 – Reduce the impacts of illegal fishing on the giant freshwater lobster.

### Research/administration actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>3a</b>	Increase awareness of the fishing ban, methods for identifying lobsters and avenues for reporting breaches of the ban.	3	<ul style="list-style-type: none"> <li>The IFS website is updated to incorporate new information on the lobster and provide links to other relevant websites.</li> <li>An education and awareness program is undertaken to inform the public about the fishing ban and encourage reporting of any fishing breaches to IFS or Bushwatch.</li> <li>Existing brochures detailing how to recognise giant freshwater lobsters and gain the evidence required to prosecute illegal fishers/poachers are reprinted and distributed to all staff involved with compliance and enforcement activities.</li> <li>Enforcement staff are informed of the benefits that the fishing ban is already having on lobster populations to highlight the importance of enforcing the ban.</li> </ul>	IFS DPIPWE PWS Tasmanian police Bushwatch	

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>3b</b>	Enforce the full ban on fishing of giant freshwater lobsters.	2	<ul style="list-style-type: none"> <li>An appropriate level of enforcement of the fishing ban is undertaken, with a focus on: <ul style="list-style-type: none"> <li>Joint collaboration between IFS and PWS compliance officers and Tasmanian police;</li> <li>Targeting poachers;</li> <li>Preventing illegal trade.</li> </ul> </li> </ul>	IFS PWS DPIPWE Tasmanian police	

## Strategy 4 – Conduct monitoring and research to increase understanding of giant freshwater lobster ecology and biology.

### Research/information actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>4a</b>	Increase understanding of genetic connectivity between lobster populations and develop effective population estimates.	1	<ul style="list-style-type: none"> <li>Genomic research to assess population structure and genetic relationships within and between populations, and increase understanding of movements within the meta-population is undertaken.</li> <li>Results are analysed to estimate effective population size and survivorship of young.</li> <li>Research is linked to the ongoing surveys of tagged individuals (as undertaken in action 4d).</li> </ul>	<b>CSIRO</b> Research community	
<b>4b</b>	Determine phylogeny of the giant freshwater lobster at the species level.	2	<ul style="list-style-type: none"> <li>Genetic studies are undertaken to determine whether or not the two known colour morphs for the species represent different subspecies.</li> <li>Surveys are designed, and permits are obtained, to allow for the collection of samples to be used in genetic analysis.</li> </ul>	<b>CSIRO</b> Research community	
<b>4c</b>	Collate and analyse existing population data to inform ongoing monitoring strategy.	1	<ul style="list-style-type: none"> <li>All existing population data is collated, standardised and analysed to assess population trends, where possible.</li> <li>Results of the data analysis are used to inform monitoring of the giant freshwater lobster.</li> </ul>	<b>DPIPWE</b>	

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>4d</b>	Conduct regular monitoring at long-term study sites to determine the reproductive	1	<ul style="list-style-type: none"> <li>Regular monitoring of long-term study populations occurs every three years at minimum, but with greater frequency where possible.</li> <li>Age and size classes, moult patterns, reproduction and growth dynamics are</li> </ul>	<b>DPIPWE</b> NRM bodies Research community	

	ecology and habitat use of recovering lobster populations.		<p>determined for all monitored populations.</p> <ul style="list-style-type: none"> <li>Understanding of the recovery trajectory of monitored populations is increased.</li> <li>The behaviour and ecological roles, of lobsters in an un-fished population is assessed.</li> <li>The &gt;500 presently tagged animals are used to increase understanding of local population dynamics.</li> </ul>	
<b>4e</b>	Conduct ongoing monitoring at other sites across the species range.	2	<ul style="list-style-type: none"> <li>A representative selection of study sites are nominated for ongoing monitoring of giant freshwater lobster populations.</li> <li>Nominated sites focus on the inclusion of major catchments in the north-east of Tasmania.</li> <li>Nominated sites are surveyed every three years using a standardised surveying protocol and survey effort.</li> </ul>	<b>DPIPWE</b> NRM bodies Research community
<b>4f</b>	Maintain a database for population, habitat and distributional data.	1	<ul style="list-style-type: none"> <li>National Values Atlas (Tas) and Protected Matters Search Tool (C'th) databases are maintained and updated on a regular basis.</li> <li>Databases effectively capture population, habitat and distributional information for the species.</li> </ul>	<b>DPIPWE</b> <b>DotE</b>

## Strategy 5 – Engage with the general public, local government and NGOs in developing and/or delivering conversation measures.

### Research/information actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>5a</b>	Apply a principle of adaptive management to all aspects of recovery plan implementation	1	<ul style="list-style-type: none"> <li>An overarching principal of adaptive management is used to guide recovery plan implementation and enable the identification of new threats, refocus priorities appropriately and recognise when certain actions are no longer relevant to the species recovery.</li> </ul>	<b>DPIPWE</b> <b>DotE</b>	

## On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>5b</b>	Promote lobsters as a flagship species for good catchment management.	2	<ul style="list-style-type: none"> <li>Giant freshwater lobsters are the focus point for a variety of audio/visual material encouraging healthy catchment management across their range.</li> <li>Particular attention is given to promoting the species as a flagship in the north-east.</li> <li>Informative material on lobster ecology and conservation, including fact sheets, colour brochures, posters and stickers, is updated and distributed to schools, local land care groups and other relevant stakeholders.</li> </ul>	<b>NRM bodies</b> DPIPWE	-
<b>5c</b>	Investigate options to display giant freshwater lobsters to increase public awareness.	2	<ul style="list-style-type: none"> <li>Opportunities to display lobsters in major accredited public institutions for the purpose of raising public awareness are investigated.</li> <li>Policy is developed to inform any potential future display of lobsters.</li> </ul>	<b>DPIPWE</b>	
<b>5d</b>	Options for reintroduction, translocation and re-wilding of lobsters are investigated and, where appropriate, implemented.	2	<ul style="list-style-type: none"> <li>A translocation strategy, informed by the outcomes of strategy 5, which considers population distribution and genetic characteristics, is developed.</li> <li>Potential reintroductions, translocations and re-wilding of lobsters into areas where previous habitat impacts have been removed are considered.</li> <li>All reintroduction, translocation or re-wilding activities undertaken are compliant with IUCN, state and Commonwealth guidelines.</li> </ul>	<b>DPIPWE</b> DotE	

## 8 Duration and cost of the recovery process

It is anticipated that the recovery process will not be achieved prior to the scheduled five year review of the recovery plan. The *Draft Recovery Plan for the Giant Freshwater Lobster (Astacopsis gouldi)* (2016) will therefore remain in place until such time as the populations of the giant freshwater lobster have improved to the point at which they no longer meet threatened species status under the EPBC Act.

It is expected that state and Commonwealth agencies will use this plan to prioritise actions to protect the species and enhance their recovery, and that projects will be undertaken according to agency priorities and available resources. In order to maximise the conservation outcomes and cost effectiveness of this plan, it is intended that the recovery actions proposed complement, where possible, those of other protected matters.

**Table 3:** Summary of high priority recovery actions and estimated costs in (\$000's) for the first five years of implementation (these estimated costs do not take into account inflation over time).

Action	Cost					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Identify priority sub-catchments for improved habitat protection to support and maintain healthy lobster populations						
Increase the total area of giant freshwater lobster habitat that is reserved						
Implement mechanisms for protecting lobster habitat on private land in priority areas						
Review and where required update methods for assessing habitat suitability to incorporate maintenance of upstream habitat values for protection of downstream habitat quality						
Habitat managers and regulators work cooperatively to identify and implement methods for strengthening habitat protections, or reducing forestry impacts, in upstream reaches of priority sub-catchments						
Investigate options for sediment control						
Ensure that water management planning incorporates the water requirements of giant freshwater lobsters						
Increase understanding of genetic connectivity between lobster populations and develop effective population estimates						
Collate and analyse existing population data to inform ongoing monitoring strategy						
Conduct regular monitoring at long-term study sites to determine the reproductive ecology and habitat use of recovering lobster populations						
<b>TOTAL</b>						



## 9 Current management practices

As the giant freshwater lobster is protected under the EPBC Act, it is an offence to kill, injure, take, trade, keep, or move any individual without a permit in Commonwealth areas and Commonwealth waters. In addition, all listed threatened species are considered matters of national environmental significance (MNES), and any action that may have an impact on MNES must be referred to the Minister of the Environment for approval. The Department of the Environment, as the Australian Government department responsible for administering the EPBC Act, maintains a suite of interactive tools that allow users to search, find and generate reports on information and data describing MNES, including the giant freshwater lobster.

The giant freshwater lobster is also protected across its range in Tasmania. Under the Tasmanian *Threatened Species Protection Act 1995* it is an offence to knowingly take, trade in, keep or process any listed species without a permit. Management of the giant freshwater lobster is primarily the responsibility of the Inland Fisheries Service (Tasmania) under the provisions of the *Inland Fisheries Act 1995*, and the Department of Primary Industries, Parks, Water and Environment (Tasmania) under the *Threatened Species Protection Act 1995*. Since January 1998 giant freshwater lobsters have been a 'protected fish' under the *Inland Fisheries Act 1995*, prohibiting fishing for the species. Previous fisheries regulations allowed a recreational fishery for the lobster during the angling season, with original regulation allowing a bag limit of 12 lobsters a day, a minimum size of 130 mm carapace length, and no taking of females in berry (Hamr, 1990b). From the 1993-94 season, the taking of all females was prohibited and a bag limit of three males per day applied. Six catchments, including the Hellyer, Inglis, Duck, Emu, Mersey and Great Forester were closed to the taking of freshwater lobster (Inland Fisheries Commission 1993a, b). In addition, taking of any freshwater crayfish (i.e. including the two other species of *Astacopsis*) was prohibited under Inland Fisheries regulations in 2000.

Management of the species in relation to forest practices is subject to the provisions of the Forest Practices Code (FPB, 2000). A Forest Practices Plan (FPP) must be prepared for any forest clearing on non-vulnerable land that is in excess of 1 hectare or 100 tonnes of timber per year upon any one property, even if no commercial wood is produced (FPB, 2002). On vulnerable land, a FPP is required for any clearing, unless that clearing is undertaken to protect public safety or maintain existing infrastructure and does not exceed 1 hectare or 5 tonnes of timber per property per year. FPPs are subject to specific management prescriptions for threatened species, which are delivered via the *Threatened Fauna Adviser* decision support system (FPB, 2001). The intent of these recommendations is to enhance the standard provisions of the Forest Practices Code according to the needs of threatened species. Areas reserved for threatened species purposes become vulnerable land upon expiry of the FPP. No further clearing or harvesting is permitted on such vulnerable land retained for the conservation of threatened species, such as the giant freshwater lobster (*Forest Practices Act 1985*).

Guidelines are available with recommended management practices for works in waterways (Gallagher, 2003) and to protect and rehabilitate riparian zones on agricultural land (Munks, 1996; Hamlet, 2002).

## 10 Effects on other native species and biodiversity benefits

By managing northern Tasmanian freshwater ecosystems for the benefit of giant freshwater lobsters, many other native aquatic fauna will also benefit. The FPA's Biodiversity Values Database lists a number of other threatened species that occur in lobster habitats, including hydrobiid snails and four species of burrowing crayfish. Because of the linkages between riparian and in-stream ecosystems, the protection of riparian zones will benefit riparian and in-stream fauna. Functional, intact riparian zones are directly related to high in-stream biodiversity (Boulton & Brock, 1999) and contribute to the floristic diversity of off-reserve areas. Benefits can be effectively achieved by measures to raise awareness of freshwater environments and their conservation management requirements, and by encouraging implementation of management through private and community projects, private land conservation agreements, and forest and agricultural industry management prescriptions and codes of practice.

## 11 Social and economic considerations

Habitat degradation threatens the giant freshwater lobster and may largely exclude the species from areas, perhaps traditionally utilised for feeding or spawning, where they were historically much more abundant. Due to their distribution in rivers across northern Tasmania, often in close proximity to forestry or agricultural land uses, giant freshwater lobster populations could be adversely affected by habitat degradation arising from anthropogenic activities in these regions. As habitats critical to the survival of the species are identified, there is potential for developments to be restricted under the EPBC Act assessment and approval process. Any measures to assist recovery of this species that involve restrictions on the use of riparian land may result in economic impacts to affected industries.

Conversely, increased protection of lobster habitat is expected to result in significant improvements in water quality which are likely to be economically and socially advantageous. For example, improved water quality can significantly reduce the costs associated with water treatment processes and is also likely to convey positive social benefits in terms of increased recreational and aesthetic values. Increased public awareness of the lobster and its undisturbed forest habitat may bring social and economic advantages through tourism. State government support for protection of lobster habitat on private land may also be available.

## 12 Affected interests

Organisations with an interest in the actions proposed in this plan include Australian and state governments agencies, particularly those with environmental and fisheries concerns; forestry operators; recreational fishers; local Indigenous communities; researchers; tourism operators; conservation groups; wildlife interest groups; and proponents of urban or other development in the vicinity of important lobster habitat. This list, however, should not be considered exhaustive, as there may be other interest groups that would like to be included in the future or need to be considered when specialised tasks are required in the recovery process.

## 13 Consultation

The *Draft Recovery Plan for the Giant Freshwater Lobster (Astacopsis gouldi)* (2016) has been developed through extensive consultation with a broad range of stakeholders. The consultation process included a workshop in Tasmania that brought together key species experts and conservation managers, from a range of different organizations, to categorize ongoing threats to the species and identify knowledge gaps and potential management options. Workshop participants included representatives from DotE, DPIPWE, CSIRO, FPA, IFS, Hydro Tasmania, researchers from UTAS, other species experts and local community groups. During the drafting process DotE continued to work closely with key stakeholders.

# 14 Organisations/persons involved in evaluating the performance of the plan

This plan should be reviewed no later than five years from when it was endorsed and made publically available. The review will determine the performance of the plan and assess:

- whether the plan continues unchanged, is varied to remove completed actions, or varied to include new conservation priorities
- whether a recovery plan is no longer necessary for the species as either conservation advice will suffice, or the species is removed from the threatened species list.

As part of this review, the listing status of the species will be assessed against the EPBC Act species listing criteria.

The review will be coordinated by DotE in association with relevant Australian and state government agencies and key stakeholder groups such as non-governmental organisations, local community groups and scientific research organisations.

Key stakeholders who may be involved in the review of the performance of the *Recovery Plan for the Giant Freshwater Lobster (Astacopsis gouldi)*, include organisations likely to be affected by the actions proposed in this plan and are expected to include:

## **Australian Government**

Department of the Environment

Commonwealth Scientific and Industrial Research Organisation

## **State/territory governments**

Department of Primary Industries, Parks, Water and Environment (Tas)

Inland Fisheries Service (Tas)

Forestry Tasmania (Tas)

Forest Practices Authority (Tas)

Hydro Tasmania (Tas)

Local government across the species range

## **Non-government organisations**

Natural resource management bodies across the species range

Conservation groups

Local communities

Universities and other research organisations

Recreational fishers and associations

# 15 References

Boulton AJ and Brock MA (1999). Australian Freshwater Ecology: Processes and Management. Gleneagles Publishing, Glen Osmond South Australia.

Bryant SL and Jackson JE (1999). Tasmania's Threatened Fauna Handbook: what, where and how to protect Tasmania's threatened animals. Threatened Species Unit, Parks and Wildlife Service, Hobart.

Davies PE and Cook LSJ (2004). Juvenile *Astacopsis gouldi* in headwater streams –relative abundance and habitat. Report to Forest Practices Board. Freshwater Systems consulting, Hobart.

Davies PE, Cook LSJ, Mallick SA and Munks SA (2016). Relating upstream forest management to stream ecosystem condition in middle catchment reaches in Tasmania. *Forest Ecology and Management* 362, 142-155.

Davies PE and Nelson M (1994). Relationships between riparian buffer widths and the effects of logging on stream habitat, invertebrate community composition and fish abundance. *Australian Journal of Marine and Freshwater Restoration* 45, 1289–1305.

Forteath N (1987). The aquaculture potential of the giant freshwater crayfish *Astacopsis gouldi*. School of Applied Science, Tasmanian State Institute of Technology, Launceston.

Forest Practices Board (FPB) (2000). Forest Practices Code. Forest Practices Board, Hobart, Tasmania

Forest Practices Board (FPB) (2001). Threatened Fauna Adviser (revised version), Expert System Program. Forest Practices Board, Hobart.

Forest Practices Board (FPB) (2002). Information sheet Land clearing: changes to legislation. Forest Practices Board, Hobart, Tasmania.

Gallagher S (2003). Waterways and Wetlands Works Manual: Environmental best practice guidelines for undertaking works in waterways and wetlands in Tasmania. Department Primary Industries, Water and Environment, Tasmania and the Local Government Association of Tasmania.

Growns IO (1995). *Astacopsis gouldi* in streams of the Gog Range, northern Tasmania: the effects of catchment disturbance. *Papers and Proceedings of the Royal Society of Tasmania* 129, 1-6.

Growns IO and Davis JA (1994a). Effects of forestry activities (clearfelling) on stream macroinvertebrate fauna in South-Western Australia. *Australian Journal of Marine and Freshwater Restoration* 45, 963-975.

Hamlet AG (ed) (2002). Soil Management - A Guide for Tasmanian Farmers. First edition, Department of Primary Industries, Water and Environment, Tasmania, Australia.

Hamr P (1990a). Comparative reproductive biology of the Tasmanian freshwater crayfishes *Astacopsis gouldi* Clark, *Astacopsis franklinii* Gray, and *Parastacoides tasmanicus* Clark (Decapoda: Parastacidae). Unpublished PhD Thesis, Department of Zoology, University of Tasmania.

Hamr P (1990b). Rare and endangered: Tasmanian giant freshwater lobster. *Australian Natural History* 23, 362.

Hamr P (1992). A revision of the Tasmanian freshwater crayfish genus *Astacopsis* Huxley (Decapoda: Parastacidae) a freshwater crayfish from Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 126, 91-94.

Hamr P (1996). A Giant's Tale: the life history of *Astacopsis gouldi* (Decapoda: Parastacidae). Freshwater Crayfish XI, Lakehead University, Ontario, Canada.

Horwitz P (1990). Conservation status of Australian freshwater Crustacea. Australian National Parks and Wildlife Service Report Series no. 14, Canberra.

- Horwitz P (1991). On the distribution and exploitation of the Tasmanian giant freshwater lobster *Astacopsis gouldi* Clark. Centre for Environmental Studies, University of Tasmania, Hobart.
- Horwitz P (1994). The distribution and conservation status of the Tasmanian giant freshwater lobster *Astacopsis gouldi* Clark (Decapoda: Parastacidae). *Biological Conservation* 69, 199-206.
- Inland Fisheries Commission (1993a). Changes to freshwater crayfish regulations. *Inland Fisheries Commission Newsletter* 22(2), 6.
- Inland Fisheries Commission (1993b). Fishing Code: Season '93 - '94. Inland Fisheries Commission, Hobart, Tasmania.
- Inland Fisheries Service (IFS) (2016). *Annual Reports*. Inland Fisheries Service, Hobart, Tasmania. Available on the Internet at: <http://www.ifs.tas.gov.au/publications/annual-reports>
- Johnson LB and Host GE (2010). Recent developments in landscape approaches for the study of aquatic ecosystems. *Journal of the North American Benthological Society* 29, 41–66.
- Lynch DD (1967). A synopsis of biological data of the giant freshwater crayfish *Astacopsis gouldi* Clark 1936. Inland Fisheries Commission, Hobart.
- Lynch T and Blühdorn DR (1997). Reservation assessment and habitat requirements of the giant Tasmanian freshwater lobster, *Astacopsis gouldi*. Report to the Tasmanian RFA Environment and Heritage Technical Committee, Hobart.
- McIntosh PD (2004). New guidelines for the protection of Class 4 streams. Forest Practices Board, Hobart, Australia.
- Munks SA (ed) (1996). A Guide to Riparian Vegetation and its Management. Department of Primary Industry and Fisheries, Tasmania, Australia.
- National Water Commission (NWC) (2012). Assessing water stress in Australian catchments and aquifers. A report to the Australian Government. National Water Commission, Canberra.
- Richman NI et al. (2015). Multiple drivers of decline in the global status of freshwater crayfish (Decapoda: Astacidea). *Philosophical Transactions of the Royal Society B* 370, 20140060. Available on the Internet at: <http://dx.doi.org/10.1098/rstb.2014.0060>.
- Thompson RM, Phillips NR and Townsend CR (2009). Biological consequences of clear-cut logging around streams – moderating effects of management. *Forest Ecology and Management* 257, 931-940.
- Threatened Species Section (TSS) (2006). *National Recovery Plan for the Tasmanian Giant Freshwater Lobster (Astacopsis gouldi)*. Hobart, Tasmania: Department of Primary Industries and Water. Available on the Internet at: <http://www.environment.gov.au/biodiversity/threatened/publications/a-gouldi.html>.
- Webb M and Richardson A (2004). A radio telemetry study of movement in the Giant Tasmanian Freshwater Crayfish, *Astacopsis gouldi*. *Freshwater Crayfish* 14, 197-204.



