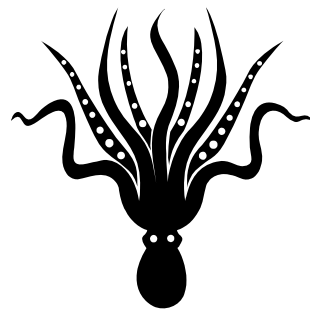


**SUBMISSION TO THE DEPARTMENT OF SUSTAINABILITY, ENVIRONMENT,  
WATER, POPULATION AND COMMUNITIES  
ON THE WESTERN AUSTRALIAN OCTOPUS FISHERIES**

*Against the Guidelines for the  
Ecologically Sustainable Management of Fisheries*



**Government of Western Australia  
Department of Fisheries**

**November 2010**



*Fish for the future*

**DEPARTMENT OF FISHERIES, WESTERN AUSTRALIA  
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## LIST OF ACRONYMS AND ABBREVIATIONS

AFZ	Australian Fishing Zone
CPU	Catch per unit
CPUE	Catch per unit of effort
CSLP	Cockburn Sound Line and Pot Managed Fishery
DoF	Western Australian Department of Fisheries
DevOF	Developmental Octopus Fishery
DSEWPaC	Australian Department of Sustainability, Environment, Water, Population and Communities
DEC	Western Australian Department of Environment and Conservation
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESD	Ecologically Sustainable Development
FBL	Fishing Boat Licence
FRDC	Fisheries Research and Development Corporation
GDP	Gross Domestic Product
GLM	Generalised Linear Model
L	Risk Likelihood
C	Risk Consequence
LED	Light Emitting Diode
SCPUE	Standardised catch per unit effort
SST	Sea Surface Temperatures
SOI	Southern Oscillation Index
WCRL	West Coast Rock Lobster
WCRLMF	West Coast Rock Lobster Managed Fishery

## 1. BACKGROUND

The purpose of this report is to update the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) on changes in the Western Australian Octopus fisheries comprising of the Developmental Octopus Fishery (DevOF) and the Cockburn Sound Line and Pot Managed Fishery (CSLP) since the submission made in November 2005 (**Attachment 1**) to enable the assessment of the octopus fishing component of these Fisheries against the *Guidelines for Ecologically Sustainable Management of Fisheries*, under Part 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In addition to describing changes to the management of the DevOF and CSLP since 2005 and further proposed changes, this new submission also covers the outcomes from a revised risk assessment undertaken through a risk review workshop.

### 1.2 Re- Assessment Process

A risk review assessment workshop, attended by the Western Australian Department of Fisheries' (DoF) management and research staff, and officer from the Western Australian Department of the Environment and Conservation (DEC) as well industry representatives was conducted on 25 August 2010.

Some questions about the risk assessment were also subsequently raised by DEC in response to receiving a draft copy of this report. After further meeting with a DEC officer, some additional explanatory information was then included in this final report.

The aim of the workshop was to revisit the risk ratings identified in the 2005 report and determine whether they were still relevant or required amendment. In addition, consideration was given to whether new risks existed. The workshop outcomes were sent to stakeholders for their comments in September 2010.

Copies of the related Octopus fisheries annual reports, to be published in the State of the Fisheries Report (2009/10) have also been included as attachments. This report also provides a time series for octopus catch in the West Coast Rock Lobster Managed Fishery.

### Contact

It is intended that this report should provide sufficient information for DSEWPAC to re-assess the fisheries against the guidelines for *Guidelines for the Ecologically Sustainable Management of Fisheries*, under Part 13 and 13A of the EPBC Act . However, should any further information regarding the contents of this report be required please contact one of the following people:

In regard to the Developmental Octopus Fishery:

- a) Michelle Coloper on (08) 9482 7359 or via email: [michelle.coloper@fish.wa.gov.au](mailto:michelle.coloper@fish.wa.gov.au)
- b) Ross Gould on (08) 9482 7378 or via email: [ross.gould@fish.wa.gov.au](mailto:ross.gould@fish.wa.gov.au)

In regard to the Cockburn Sound Line and Pot Managed Fishery:

Carli Telfer on (08) 9482 7256 or via email [carli.telfer@fish.wa.gov.au](mailto:carli.telfer@fish.wa.gov.au)

## **2. CURRENT STATUS**

### ***2.1 Developmental Octopus Fishery:***

In 2001 and 2002, eight exemptions were granted under the Developing New Fisheries policy that exempted operators to the fish trap prohibition legislation (notices). These exemptions were granted pursuant to section 7(3)(c) of the *Fish Resources Management Act 1994* (FRMA) and permitted the holder of the exemption (or their nominated operator) to access the DevOF by commercially fishing for octopus using traps.

The purpose of the exemptions was to allow for the-

- a) exploration and/or development of the octopus fishery and the fishing technology of that activity under the provision of Section 7(3)(c) of the FRMA; and
- b) collection of baseline data about octopus stocks within WA waters under a controlled management regime.

In 2005 the Department completed a review of the DevOF, which considered the progress made by all exemption holders. Those operators whose catch and effort records indicated a catch of less than 2000 kg of octopus during the initial three-year development period were refused a further exemption. As a result, two of the eight initial exemption holders were refused access to the DevOF at that time. A further exemption in the DevOF was revoked by DoF in 2009 for lack of use.

Currently, there are five exemptions permitted to access the DevOF. Four of the exemptions expire on 31 January 2011 and the remaining one on 31 January 2015. It is intended that the exemption will continue to be renewed until the fishery is moved to an interim managed fishery. Each exemption sets out the area in which the holder is permitted to fish. These areas were originally developed based on the historical fishing areas of each exemption holder and the area in which they applied for in their original submissions. Each exemption also sets out the number of unbaited, baited and trigger traps (that use LEDs and toy plastic crabs as lures) that each exemption holder is permitted to use. Trigger traps (a trap that has three openings) were approved for use in 2006 and research analysis shows these traps are approximately 10 times more efficient than a shelter trap.

It is expected that, unless replaced before then by managed fishery permits or revoked in response for a significant breach of exemption conditions, each exemption will be renewed on expiry.

A copy of each current exemption and associated map of the permitted fishing areas is provided at **Attachment 2 and 3**. **Attachment 4** provides a summary of the current exemption holders. Details of the type of traps used in the fishery are also included in **Attachment 5**.

In 2010 a new exemption was granted to one of the five holders to allow for the expansion of the scale of operation by increasing their permitted number of trigger traps. It also allowed for the nomination of other fishermen to fish the increased allocation on behalf of the exemption holder (**Attachment 5**). In approving this exemption the Department was cognisant that it was establishing a precedent and similar applications from the remaining exemption holders may be received.

Although the Department's Research Division has yet to identify the sustainable harvest level for the DevOF, it has advised, that based on the current knowledge of the stock, the DevOF could support an additional 18,000 trigger traps in total within the existing areas of exploitation. This conservative estimate of the sustainable harvest was the basis for approving the new revised exemption. Should the remaining exemption holders expand their fishing effort by using additional trigger traps the Department is confident that there would be no material risk to ecological sustainability. This is particularly so noting that recent reductions in number of fishing boats in the Western Rock Lobster Managed Fishery should result in a proportionate reduction in catch from that fishery and that fishing operations are currently only within a limited area of the range of the targeted octopus species in Western Australia.

DoF's current view is that any additional trigger traps will be allocated to the existing exemption holders in proportion to their history of fishing effort in the DevOF.

Further research being undertaken by the Department's Research Division (see **Attachment 6**) should eventually allow the development of more accurate estimates of the sustainable harvest levels and may support the use of additional traps and greater fishing effort.

Given the uncertainty about long-term sustainable harvest levels, it has been emphasised to exemption holders that they should not assume that they will also retain their current level of access in terms of traps numbers, areas of operation and fishing seasons. Similarly, given speculation that better estimates of the sustainable harvest level may be significantly greater than the existing level and that the fishery may be able to support more than 18,000 trigger pots, the existing exemption holders have also been advised that they should not assume they will retain exclusive access to the fishery.

## **2.2. Other Fishers with access to commercial octopus fishing through licence conditions:**

In addition to the five current exemption holders, there are three Fishing Boat Licences (FBLs) with a Condition that authorises the use of 100 baited octopus traps. Two of these FBL holders are restricted to fishing only within the waters of the West Coast Rock Lobster Managed Fishery (WCRLMF) and within the WCRL season.

The remaining FBL holder is restricted to fishing only within the waters of the WCRLMF and unlike other rock lobster licensees, is able to fish at any time. This FBL holder is also an exemption holder permitted to operate in the DevOF.

## **2.3 Cockburn Sound (Line and Pot) Managed Fishery**

There are 13 licenses the Cockburn Sound (Line and Pot) Fishery (CSLP) and all are able to use an unlimited number shelter traps to take octopus. However, in recent years only a limited number of licensees have focussed on trapping octopus. The fishery also takes fish and squid by line and is a fully managed fishery (see the Cockburn Sound [Line and Pot] Management Plan 1995).

In 2009 catch from the CSLP declined slightly, from 20 tonne to 17 tonne. The Catch per unit effort (CPUE) for octopus in the CSLP was 82 kg/day per tarp. CPUE has increased over time reflecting an increases in fishing efficiency, rather than abundance increases.

While vessel size was previously a the limiting factor in the number of octopus pots a licensee could operate in the CSLP (there is a maximum boat size limit of 5.5m stated in the plan) this is less so now as currently only 2 vessels are shorter than this length and there are 5 vessels between 5.5m and 6.5m, and 4 boats between 6.5m – 7.6m operating in the fishery. Two licensees in the CSLP also hold an exemption that permits the use of a vessel of 9.8 and 9.9 metres, respectively to operate a maximum of 5000 octopus pots

The table below shows that number of vessels active in both the pot and line methods within the fishery over the last 4 years.

**Figure 1 – Vessels operating in the Cockburn Sound Line and Pot Fishery 2006-10**

	2009	2008	2007	2006
Number of vessels reporting OCTOPUS catch greater than 200kg/year in Cockburn Sound Line and Pot Fishery	4	4	4	6
Number of vessels reporting FINFISH/SQUID catch greater than 200kg/year in Cockburn Sound Line and Pot Fishery	3	3	3	6
Total Number of vessels with octopus and/or finfish/squid catch greater than 200kg	5	7	7	8

The CSLP differs from the DOF as it has a limited amount of octopus 'ground' and research has raised concerns that, within the CSLP increases in octopus trapping effort may cause localised depletions and impact on the sustainability. Accordingly a very precautionary approach is being taken to managing the octopus fishing component of the CSLP.

The size ratio octopus caught in Cockburn Sound varies throughout the year with the October to March period seeing a large number (50-70% of catch) of small (<400gm) octopus caught with less than 15% of catch being large (>800gm). However during the June to August period, there is a significant shift in the ratio with the majority of octopus caught either large or medium size.

## ***2.4 West Coast Rock Lobster Managed Fishery***

The take of octopus in the WCRL fishery was dealt with in the Department's 2007 ESD submission for the WCRL. With effort reductions in the order of 70% since 2007 there has been a similar reduction in octopus catch in the WCRLMF. With a significant reduction of licensees and boats operating in the WCRLMF, the impact on octopus stocks is considered unlikely to return to previous levels. More details of this fisheries historic catch is in **Attachment 8**.

## ***2.5 Recreational Octopus Fishing***

The current Statewide recreational bag limit for octopus is 15, with a boat possession limit of 30.

According to the previous National Recreational and Indigenous survey undertaken in 2000-01, recreational fishers retained and estimated total weight of 8 tonnes of octopus in Cockburn Sound.

Fisheries Research Report 177 "*A 12-month survey of recreational boat-based fishing between Augusta and Kalbarri on the West Coast of Western Australia during 2005-06*" (N.R. Sumner, P.C. Williamson, S.J. Blight and D.J. Gaughan) estimated the retained total West Coast (Augusta to Kalbarri) recreational catch of *octopus spp.* 2005-06 to be 679 octopus (approximately 480 kg). This catch estimation has reduced to less than half of the previously recorded catch of 1,433 octopus (estimated 1 tonne total weight) by recreational fishers in 1996-97.

# **3. PROPOSED MANAGEMENT CHANGES:**

## ***3.1 Developmental Octopus Fishery***

The operators in the DevOF have now been operating for eight years with some making significant investments. Given the extended term of their involvement, they are obviously eager to progress to a more formal management arrangement. DoF agrees that continuing to manage the DevOF by way of exemption is not and appropriate long-term strategy and accepts that operators with a long-term

commitment to the DevOF should be recognised with a more permanent, transferable authorisation. The original DevOF exemptions were granted under section 7(3)(c) of the *FRMA*. However, since then, it is considered that operators have entered a more established phase of ongoing operations and the fishery has progressed from its previous exploratory and developmental stage.

It is expected that, subject to the approval of the Minister for Fisheries and a satisfactory outcome from a subsequent consultation process, the DevOF is expected to move to an Interim Managed Fishery in the near future. Noting four of the five current exemptions will expire on 31 January 2011, new replacement exemptions will need to be issued to allow continued operation in the DevOF until an Interim Management Plan is in force.

It is intended that those operators who hold a FBL and fish for octopus through a licence condition will also be granted permits in the interim managed fishery.

Significant key elements of the proposed Interim Management Plan include:

- a) Access initially being limited to existing DevOF exemption holders or FBL holders with a conditions permitting commercial octopus fishing.
- b) A general provision regarding entry criteria to allow for the expansion of the fishery (should research data support extra effort).
- c) Standardisation of fishing gear covering all types of existing fishing gear.
- d) Up to 18,000 trigger traps allocated according to the exemption holders' proportionate history of fishing effort in the DevOF:
- e) Zoning consistent with the rock lobster fishery zones.
- f) Fishing permitted in all waters off the WA Coast with the exception of the following:
  - I. all marine parks, marine reserves and fish habitat protection areas;
  - II. all waters of the Abrolhos Islands;
  - III. all the Waters of Shark Bay;
  - IV. all the Waters of Exmouth Gulf;
  - V. the waters of all estuaries;
  - VI. any waters permanently closed to commercial rock lobster fishing;
  - VII. all the waters of the Cockburn Sound Line and Pot Fishery; and
  - VIII. all the waters of Geographe Bay.

Some existing Notices and Orders may need to be amended to close some areas to commercial octopus fishing.

The proposed closures are designed to avoid conflict with conservation, recreational fishing and other commercial fishing sectors. Once more is know about the stock distribution and biology further seasonal or spatial closures designed to protect egg carrying female octopus or otherwise reduce stock sustainability risks may be considered.

### **3.2 Cockburn Line and Pot Managed Fishery**

It is recognised that management of the CSLP needs to be amended to cap octopus trapping at a sustainable level. Options being considered include:

- a) incorporating the Cockburn Sound Line and Pot Managed Fishery and assigning a sustainable number of traps to a Cockburn Sound Zone of the Octopus Managed Fishery; and
- b) imposing a sustainable octopus trap number limit on the CSLP with octopus with transferable octopus trap entitlement equitably shared between licensees;

It is intended these and options will be further developed in liaison with CSLP licensees during 2011 with the objective of ensuring that sustainable effort limits are placed on octopus fishing within CSLP.

### **3.3 Recreational Octopus Fishing**

There is currently no restriction on the materials used by recreational fishers to fish for octopus. In the past using old car tyres and other waste objects as octopus traps has at times resulted in an undesirable visual impact on the marine environment. In some smaller coastal towns recreational octopus fishers are also known to have left homemade traps permanently set, only pulling them on annual holiday visits.

It is considered the opportunity should be taken to regulate the materials that may be used by recreational fishers to trap octopus through the octopus interim management plan. This may encourage the use of more expensive purpose made commercial traps, which should, in turn, discourage the abandonment of home made traps on the seabed and the permanent setting of traps. Use of one or more standard designs with know fishing efficiency should also assist in estimating the impacts of recreational fishing effort. There has already been some take up of the commercial trigger traps by recreational fishers interested in increasing their catching efficiency.

## **4. RISK RATING RE-ASSESSMENT**

The risk ratings of all risks identified in the 2005 risk assessment were re-assessed at the August 2010 workshop. All fishing practices, the fisheries management and other relevant external influences were taken into account at the reassessment workshop. Attendance at the review workshop included octopus fishers, exemption holders, Department's research and management staff, a representative from Recfishwest, representatives from the WA Fishing Industry Council and a representative from the WA Department of the Environment and Conservation. Draft copies of this report were also distributed to all attendees and other stakeholders prior to submission to DSEWPAC.

## 5. ERA RISK RATINGS

### 5.1 Assessment Process

The risk assessment process considers the range of potential consequences of an issue/activity and how likely those consequences are to occur. The combination of the level of consequence and the likelihood is used to produce an estimated level of risk associated with the particular hazardous event/issue in question.

**Table 1: Risk Assessment Ranking Matrix**

LIKELIHOOD	CONSEQUENCES					
	Negligible C0	Minor C1	Moderate C2	Severe C3	Major C4	Catastrophic C5
Remote L1	0	1	1	1	1	1
Rare L2	0	1	1	1	2	2
Unlikely L3	0	1	1	2	2	3
Possible L4	0	1	2	2	3	4
Occasional L5	0	1	2	3	4	4
Likely L6	0	1	2	3	4	4

An estimate of the consequence level for each issue ranges between zero and five, with zero being negligible and five being catastrophic / irreversible. The likelihood of a consequence actually occurring should be assigned to one of six levels from remote to likely. From these two figures (consequence and likelihood), the overall risk value is calculated. Finally, each issue is assigned a Risk Ranking within one of five categories: Extreme, High, Moderate, Low and Negligible, based on the risk value (see Table 2).

**TABLE 2: Risk Ranking and Management Response**

RISK	Rank	Likely Management Response	Reporting
Negligible	0	Nil	Short justification only
Low	1	None specific	Full justification needed
Moderate	2	Specific management needed	Full performance report
High	3	Possible increases to management activities needed	Full performance report
Extreme	4	Likely additional management activities needed	Full performance report

**A further note regarding the impact of the take of female octopuses on long term sustainability**

Following the risk review workshop DEC raised questions about the impact of taking female octopuses on the long term sustainability of the fishery.

It is acknowledged that by removing female octopuses from the population through commercial fishing, those females are prevented from ever contributing to recruitment. This is a product of the semelparous life history of the species, where females have a singular breeding event and die shortly after their eggs hatch. However, regardless of this, it is considered that, the present or foreseeable numbers of females caught in the W.A. commercial octopus fishery, are unlikely to create any significant sustainability risk for the following reasons:

:

- *Octopus tetricus* is year round breeder, thus ensuring a constant supply of recruits.
- *O. tetricus* is fast growing and has a short life span, leading to high generational turnover rates within a year.
- *O. tetricus* is a merobenthic species with hundreds of thousands of eggs in each clutch, allowing for large scale dispersal of paralarvae into fished and unfished zones.
- Present catches in the W.A. octopus fishery constitute <0.03% of the global annual catch of octopus and is distributed in over 1000 km of coastline. In a global context, this is considered an extremely underutilised resource and an exploratory fishing effort.
- The plastic life history and strong population scale responses to environmental influences, makes octopus one of the most ecologically opportunistic taxa in the marine environment, for its size.
- Initial analysis of catch data shows that sex ratios are not greatly biased for females and are lower than those in many other large-scale octopus fisheries.

To ensure that the fishery is developed in an ecologically sustainable manner the DoF has initiated a detailed research project on the population dynamics of *Octopus tetricus*. This research will address the following:

- Seasonal variation in the age and growth of the population;
- Influence of environmental factors on reproductive scheduling;
- Spatial and temporal variation in catch composition; and
- Potential harvest levels.

The information obtained from this research will be facilitated in the management of the fishery.

## 5.2 Revised (Current) Risk Ratings

Risks for retained and non-retained by-catch from unbaited octopus pots

Species	2005 Risk	2010 Risk	Summary/Justification
<b>Retained Species</b>			
Common Perth Octopus- <i>Octopus tetricus</i>	Low	L4 C2 Moderate	Target species. Taken at low levels compared to Western Rock Lobster Managed Fishery. Effective and potential future effort level has increased since 2005
White-striped octopus- <i>Octopus ornatus</i>	Low	L4 C2 Moderate	Species caught in tropical waters (around Kalbarri) Effective and potential future effort level has increased since 2005
Maori octopus- <i>Octopus maorum</i>	Low	L4 C2 Moderate	Species caught in southern waters (around Esperance) Effective and potential effort level has increased since 2005
<b>Non Retained Species</b>			
Blue Ringed Octopus <i>Hapalochlaena sp.</i>	Negligible	L3 C0 Negligible	This species is caught in very low numbers and immediately returned to the water unharmed.
Baby and Juvenile Octopus	Negligible	L3 C0 Negligible	Taken in relatively small numbers and ones of marketable size are retained
Eels	Negligible	L2 C0 Negligible	Taken in extremely small numbers and are immediately returned to the water unharmed
Shell sp; Live specimen shells, pip and razor shells	Negligible	L5 C0 Negligible	Taken in extremely small numbers and are immediately returned to the water unharmed
Mussels	Negligible	L5 C0 Negligible	Immediately returned to the water unharmed
Crabs incl. Blue Swimmer Crabs <i>Portunus pelgagocus</i>	Negligible	L5 C1 Minor	Taken in moderate numbers but generally immediately returned to the water unharmed (some may have minor loss of limbs).

Samd Crabs <i>Ovaplipes australiensis</i> Spider Crabs			
Eggs-Octopus, cuttlefish and squid	Low	L5 C1 Minor	Occasional egg laden octopus trapped while a low occurrence in brooding octopus may be vulnerable while seeking a replacement brooding refuge. As fishery has expanded there has been some increase in trapping of brooding females. Capture pattern is being monitored to see if spatial and/or seasonal closures may be appropriate to protect brooding females.
Seagrass	Negligible	L5 C0 Negligible	Dead leaves swept into pots
Algae	Negligible	L5 C0 Negligible	Already dead or detached, drifts into pot ropes
Starfish	Previously not assessed	L5 C0 Negligible	Not previously assessed. Occasional capture. Taken in extremely small numbers and are immediately returned to the water unharmed.
Non-retained Species-Protected			
Syngnathids	Negligible	L5 C1 Minor	Are occasionally pulled up on the ropes but all are returned live into the water. Insignificant catch level but increase in fishing effort has increased likelihood of capture since last assessment.
<b>Interaction but not captured-protected species</b>			
Turtles; Flatback- <i>Natator depressus</i> Green- <i>Chelonia mydas</i> Hawkesbill-	Negligible	L2 C2 Moderate	Could possibly be entangled in the ropes, but there have been no reports of entanglement in octopus fishing gear. Fishery will adopt code of practice that is used in West Coast Rock Lobster to minimise risk of turtle and whale entanglement. Increase in fishing effort and move to fishing in deeper waters has increased risk of entanglements since last assessment

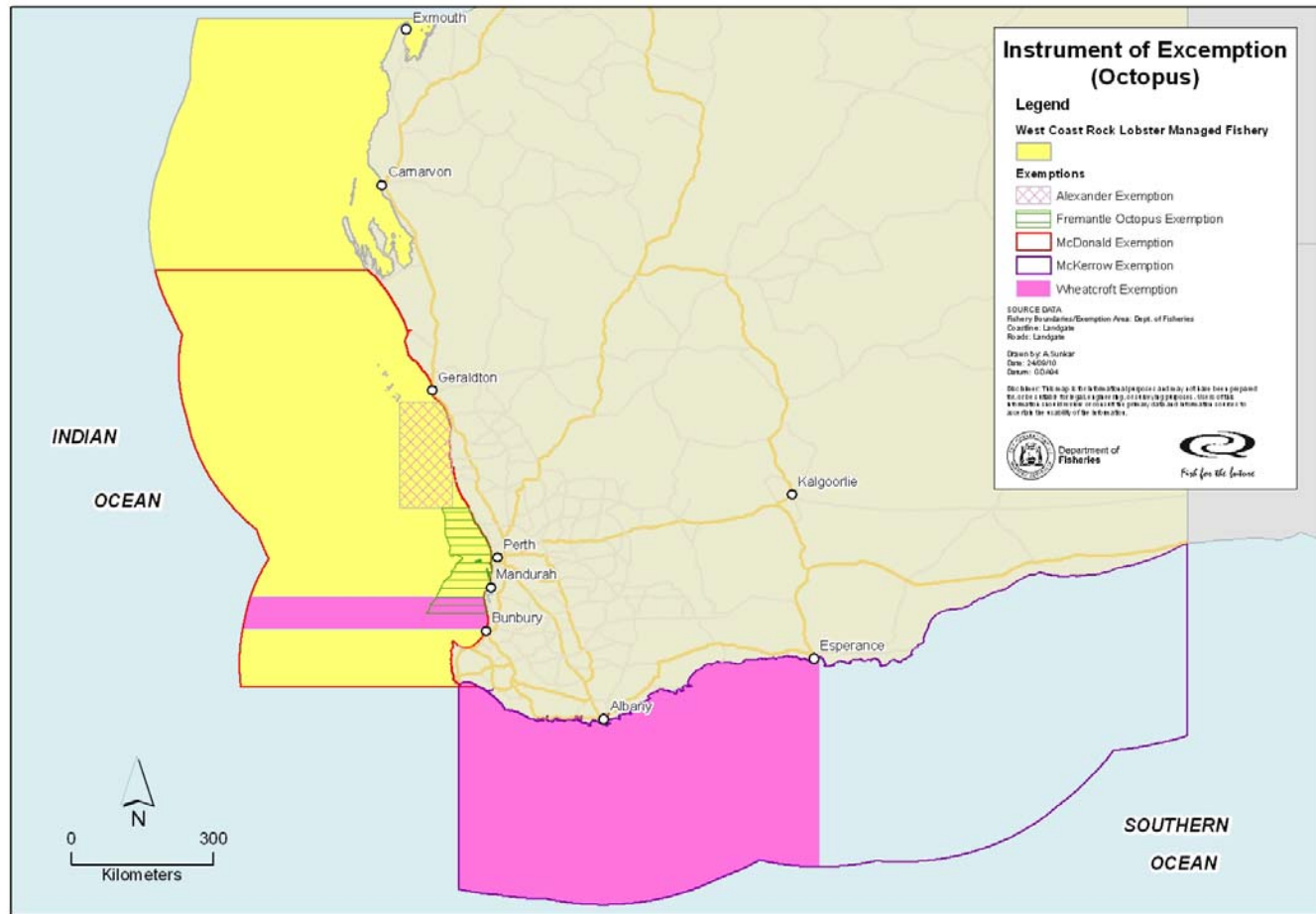
<i>Eretmochylis imbricata</i> Leatherback- <i>Dermochelyles coriacea</i> Loggerhead- <i>Carretta caretta</i>			
Whales; Humpback- <i>Magaptera novaeangliae</i> Southern Right Whale- <i>Eubalaena australis</i>	Negligible	L5 C1 Minor	There has been one report of a Southern Right Whale entangled in octopus fishing gear in Warnbro Sound in August 1994. The entanglement occurred after the gear was dislodged from the bottom through inexperienced human interference, the whale disentangled itself and escaped unharmed. To reduce the risks the Fishery is moving to adopt the Code of Practise used in the West Coast Rock Lobster Managed Fishery. Likelihood has increased since the last assessment due to increased fishing effort, moves to fishing in deeper water and increased whale numbers.
Dolphins	Negligible	L2 C1 Minor	There have been no reports of entanglement of dolphins in the octopus fishing gear. Occasionally taking octopus from pots but no evidence of habitual behaviour. Likelihood has increased since the last assessment due to increased fishing effort.
Dugongs- <i>Dugong dugon</i>	Negligible	L1 C0 Negligible	There have been no reports of entanglement of dugongs in the octopus fishing gear.
Sea lions	Negligible	L1 C0 Negligible	There have been no reports of entanglement of sea lions in the octopus fishing gear. Occasionally reported taking octopus from pots but no evidence of habitual behaviour.
Seabirds (incl. penguins)	Negligible	L1 C0 Negligible	There have been no reports of entanglement of seabirds in the octopus fishing gear.

<b>Risks associated with ecological impacts on the generally ecosystem (CSLP – Cockburn Sound (Line and Pot) Managed Fishery, DevOF – Developmental Octopus Fishery)</b>			
Issue	2005 Risk	2010 Risk	Summary/Justification
<b>Impact from addition/movement of biological material</b>			
Provisioning	Negligible	L6 C1 Minor	There is only a very small amount of baited pots in the DevOF that are being trialled. This is a small-scale fishery and the impact to the ecosystem from baited pots is insignificant. Likelihood has increased since the last assessment due to increased fishing effort
<b>Impact from removal of/damage to organisms</b>			
Loss of octopus fishing gear	Low	L6 C1 Minor	There have been octopus pots lost at sea, including tyres that were used early in the CSLP, that have not been found. Lost traps may provide a habitat for octopus to live in. Likelihood has increased since the last assessment due to increased fishing effort and deeper water single trap fishing.
Ghost fishing	Low	L1 C0 Negligible	All pots used at this stage in the fisheries are unbaited. There is no ghost fishing associated with the fishing gear because the animals can move in and out of the pots at their own will. These pots create a habitat for the octopus.
Line entanglements	Low	L1 C0 Negligible	There have been no reported entanglements from lost octopus gear.
Visual pollution	Low	L6C1 Minor	Losses of octopus pots and tyre traps (used early in the CSLP) have possibly created visual pollution by washing up onto beaches and abandoned on bottom. Use of more costly trigger traps has increased motivation to retrieve any lost traps. Risk off lines being cut by commercial shipping is likely to increase with increased trap numbers.

Impact to benthic biota:	Low	L5 C1 Minor	The octopus pots that are currently used in these fisheries are lightweight and have only a minor disturbance on the on benthic biota. Increased fishing effort has increased likelihood of impact.
Sand	Low	L5 C0 Negligible	A limited amount of sand and associated biota is washed into pots through disturbance via storms and animals moving in and out of the pots.
Seagrass	Low	L5 C0 Negligible	Seagrass found in the pots is already dead. There is a small amount of drag when the pots are lifted although it creates little disturbance. The pots are left to soak for approximately 7 days, which could possibly hinder the photosynthesis of seagrass the pot is directly sitting on.
Reef	Low	L2 C0 Negligible	The traps are not cumbersome nor are they a large size so there would be only minor damage to reef if a pot was set. There is a chance that damage may occur if the pots were set on soft corals.
Impacts to fishing trophic level.	Low	L4 C2 Moderate	As the DevOF and the CSLP are small-scale fisheries the take of octopus is a relatively small portion of the biomass in these areas. Secondary food chain effects are likely to be minimal in these fisheries. Increased fishing effort will have increased likelihood of impact on trophic levels.
<b>Water quality</b>			
Debris	Negligible	L4 C1 Minor	<p>Waste disposal bins are located at all points where commercial boats tie up. Fishers are highly aware of the impacts of discarded waste and the public perception and sensitivity to waste disposal.</p> <p>With increased fishing effort and fishing activities, there is considered to be a minor risk of gear loss and other debris adversely effecting water quality.</p>

Oil & Fuel Spills	Negligible	L5 C1 Minor	Likely that some minor accidental spill may eventually occur through a boating accident. Increased fishing effort will have increased likelihood of fishing boat accidents involving oil and fuel spills.
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### Attachment 3 Developmental Fishery Maps



## **Attachment 5 - Summary of Existing Exemptions**

### **A. Existing Operators in the Developing Octopus Fishery**

The current five Exemptions expire on 31 January 2011.

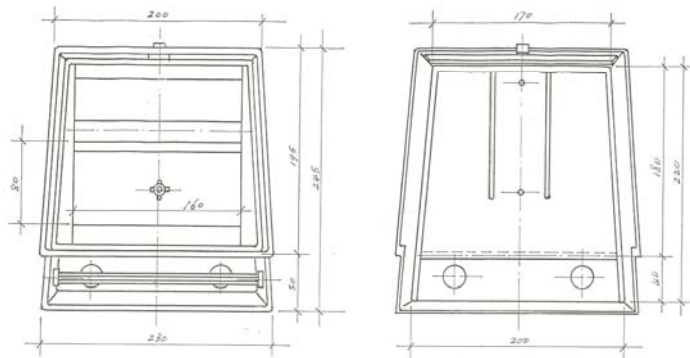
<b>Exemption Holder</b>	<b>Area</b>	<b>FBL</b>	<b>LFB</b>
Fremantle Octopus	31° S to 33° S and to the 300 metre isobath	1306	A062
Mr J & Ms E Macdonald	26° 30' S to 34° 24' S (to the AFZ)	2044	G414
RL & MA Alexander	east of 114° E and west of 115°E and between 29° S and 31° S	1123	G298
McKerrow Holdings	East of 115° 08' E off the south coast (to the AFZ)	1125	F189
T Wheatcroft	1. East of 115° 08' E and west of 122° E on the south coast; and 2. North of 33° 18' S and south of 32° 41' S.	1047	A117

### **B. Historical Gear and Existing Allocation Per Exemption in the Developing Octopus Fishery**

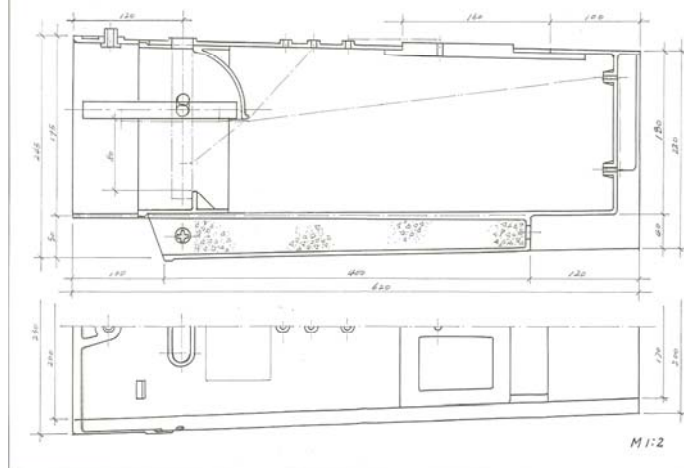
<b>Exemption Holder</b>	<b>Shelter Traps</b>	<b>Baited Traps</b>	<b>Trigger Traps</b>
Fremantle Octopus <sup>1</sup>	12,000 (6000)	100 (0)	1,000 (6,610)
Mr J & Ms E Macdonald	12,000	400	100
RL & MA Alexander	12,000	200	0
McKerrow Holdings	5,000	0	0
T Wheatcroft	10,000	0	0
<b>TOTAL CAPACITY</b>	<b>51,000</b>	<b>700</b>	<b>1,100</b>

<sup>1</sup> Trap allocation shown in brackets has recently been granted to Fremantle Octopus.

# Trigger Trap as Used By Fremantle Octopus Pty Ltd

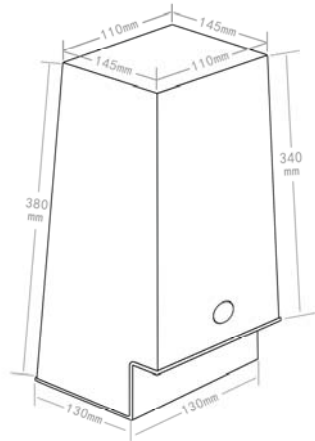


M 1:2



M 1:2

## Some Types of Shelter Traps Used



a) Purpose Made Traps Used by Fremantle Octopus Pty Ltd



b) Two Entrance Poly Pipe and Concrete Trap



c) Older style Single Entrance Trap

## Attachment 6 FRDC Research Project

### Administrative Summary

#### Project Title

Innovative development of the Octopus tetricus fishery in Western Australia

### Project Description

#### Challenge

Optimise resource access, resource allocation and opportunities for each sector of the fishing industry, within a rights-based framework	20.00%
Maintain and improve the management and use of aquatic natural resources to ensure their sustainability	80.00%
Respond to, and take advantage of, increased demand for seafood and for recreational and customary fishing experiences	0.00%
Increase community and consumer support for the benefits of the three main sectors of the fishing industry	0.00%
Develop people who will help the fishing industry to meet its future needs	0.00%

#### National Research Priority

An environmentally sustainable Australia.	90.00%
Promoting and maintaining good health.	10.00%

#### Rural Research Priority

Productivity and Adding Value	40.00%
Supply Chain and Markets	30.00%
Natural Resource Management	30.00%

#### Species

OCTOPUS Octopodidae spp

#### Background

The Department of Fisheries, Western Australia, implemented a developmental strategy for octopus in the late 1990s, issuing 6 exemption licenses to investigate the possibility of developing an octopus fishery. This was the culmination of a strategy beginning with research conducted by Japanese vessels in the early 1980s. Rules governing octopus fishing gear are however, restrictive in nature, stipulating that the method used must not produce by-catch, or be in competition with other fisheries that used baited pots. Consequently, most vessels have been restricted to using unbaited shelter pots, set along a longline, and requiring substantial soak times (20 - 40 days) as they are passive habitat traps. However sections of the developing octopus industry have developed a baited trap that is octopus specific, can be set and hauled in a much shorter soak-period (4 - 8 days), has 5-10 times higher CPUE per pot, and can be deployed in previously inaccessible habitat. This innovation has provided the impetus for the Department, in conjunction with the octopus industry, to implement an adaptive management strategy to develop the fishery. This strategy was developed jointly with WAFIC, management, and research providers over the last 2 years, with the decision given to approve effort expansions in the fishery alongside a 3 year R&D project to examine potential harvests. Overall, the developmental nature of this project ensures it falls squarely within FRDC challenge 1, To Maintain and improve the management

and use of aquatic natural resources to ensure their sustainability. Cephalopod fishery development is underway in other states (NSW and Tasmania) and this project is related to a current proposal before FRDC to investigate the age determination, growth and reproductive biology of commercially important octopus and cuttlefish species in NSW. It is likely that there will be an exchange of information beneficial to both projects.

### **Consultation**

This project concept has been discussed and approved by the WAFRAB, who gave it a high priority in their evaluation of proposed FRDC projects for the 2010 funding round. It was discussed and developed at a meeting of Industry, management, and research at WAFIC in August 2009. Formal support has been given by the main octopus industry player (Occotechnologies Pty Ltd), who are providing substantial in-kind and cash contributions to the project (see letter of support for more details). The project has also been discussed and approved by the Department of Fisheries, who are also contributing significant in-kind support.

### **Need**

The octopus fishery is a new fishery in Western Australia that has shown innovation in pot design and fishing practice to negate bycatch of other species, but commercial scale development has been impeded by lack of relevant information. An average of 140 tonnes of octopus are caught as by-catch every year by the Western Rock Lobster Fishery, however estimates are that these account for only 10% of octopus that actually predate on lobster in lobster traps, the remaining 90% evade capture. Annual landings from octopus developing fisheries have increased drastically from 1t in 1999 to 30 tonnes in 2008, and this expansion has been mirrored by a 200% increase in value from ~\$4/kg in 2002 to \$12/kg in 2008. Industry would like to see an expansion of effort within the fishery, particularly within areas fished by the rock lobster fishery, because the new LED trigger pots have enabled octopus-specific targeting of previously inaccessible habitat. However, so far the Department of Fisheries has resisted calls for a major expansion of the octopus fishery due to the paucity of stock assessment and biological information. Thus there is an urgent need to undertake innovative research and assessment of the Octopus cf. tetricus, fishery to guide Departmental policy to ensure any future expansion of the fishery occurs in a controlled and sustainable manner.

### **Objectives**

- 1 Determine fishing efficiency of octopus trigger pots
- 2
- 3 Estimate potential harvest from octopus fisheries
- 4 Calculate the effects of fishing closures on octopus predation rates on rock lobsters

## **Outputs & Extension**

Dissemination, Extension, and Commercialisation Plan

1. A non-technical description of the project and its results for public dissemination
2. Establishment of an octopus research capacity to fill the needs of the industry and Government
3. Scientific papers describing the project and its results
4. Establishment of an Octopus developmental group to facilitate the commercial expansion of the fishery if viability is demonstrated

Outputs will take the form of a formal assessment of the developmental octopus fishery, its biology and economics, the potential harvest for Octopus tetricus, spatial and temporal catch targets, a detailed effort control management plan to minimize the risk of unsustainable fishing to the environment and existing stocks. These will be linked to a detailed commercialisation plan that includes the establishment of fishing boundaries and catch targets if the viability of an expanded fishery is demonstrated.

Communication objectives

1. Provide to industry, government and community groups an evaluation of key biological and harvest strategy outcomes
2. Communicate to industry, community and Government, the methodology enabling viable development and management of Octopus tetricus stocks

The communication objectives will be facilitated by the project advisory committee, which will meet 1- 2 times a year. The main annual forum for communication will be the bi-annual project progress meetings

held at the Western Australian Fisheries and Marine Research laboratories, in which research findings are disseminated to stakeholders. This first of these is planned early in 2010. A presentation will also be given at the Australian Society for Fish Biology annual meeting and International Symposiums where appropriate.

#### Target Audience

1. Commercial fisheries advisory committees and industry
2. Environmental managers
3. Scientists
4. International community and conservation groups
5. Local, State, and Commonwealth Governments

The specific target audiences are the octopus industry, managers and policy officers in the Department of Fisheries, the Australia-wide Fisheries and Aquaculture Research Institutions.

#### Key Messages

1. The main findings regarding the viability and scale of a fishery for *Octopus tetricus*.
2. Management strategies to implement the research findings.
3. Pathways to adoption of results, principally the establishment of a formally managed octopus fishery with appropriate policies on license imitations, effort, and catch controls

The project will deliver original scientific knowledge on the biology, fishery and environmental effects on stocks of *Octopus tetricus* in WA, as well as applied scientific knowledge on area-specific catch and effort targets that will facilitate the transfer and dissemination of the outcomes of this project into a formally managed fishery.

#### Communication Methods

1. A report detailing the key findings, in a form appropriate for industry advisory committees and environmental managers will be prepared and presented to all stakeholders
2. A presentation will also be given at appropriate National and International Symposiums.
3. An account of the outputs of the study will be published in appropriate local magazines, e.g. Western Fisheries
4. Scientific manuscripts published in international journals

#### Action plan

Project is the undertaken over 3 years

#### During project Method 1:

Research results from the project will be reported as they become available to industry advisory committees and managers. 1 - 2 meetings of the advisory group will be held annually, with all results being reported to appropriate bodies.

Responsibility: Principal Investigator

Completion 30/12/2013

#### During project Method 2:

Articles will be published in local magazines i.e. Western Fisheries.

Responsibility: Principal Investigator

Completion: 30/12/2013

#### After Project Method

Advice will be given to Department of Fisheries Managers on objectives and targets for the Octopus fishery under a formal management plan.

#### Intellectual Property

Published, widely disseminated and promoted, and/or training and extension provided. Relates mainly to outputs that will be available in the public domain.

#### Planned Outcomes and Benefits

- 1) Increased knowledge of octopus stocks

The expansion of biological and ecological knowledge of octopus stocks will benefit the Western Australian community who expected all sustainable fisheries to be predicated on sound biological principles. The immediate beneficiaries of this research will be the octopus licence holders and octopus fishermen. The methods and procedures developed will also have a benefit to other octopus fisheries,

however due to species differences the biological data is not likely to be as transferable.

## 2) An expanded octopus fishery (100 to 300+ tonnes)

An expanded octopus fishery of 300 tonnes will result in GDP increase of around 300%, from the current GDP of 1.2 million to around 3.6 million, which will directly benefit the commercial fishing industry and seafood exporters. Complete success of achievement of this research will yield a cost saving per kg and increase in profitability if markets are simultaneously increased and continuity of supply can be maintained. Lower costs are more likely achieved by gear efficiencies and boat management, both of which will be addressed by this research.

## 3) Formal management of the Western Australian Octopus fishery

The data will reduce the risk of managing the Fishery and give security to the licence holders and fisherman when used to set management goals. Management practices of when to fish in conjunction with market demand will not only improve the sustainability of the Fishery it will improve and stabilise the market pricing. Formal management of the fishery will define the objectives and limitations of octopus fishing and provide security to the WA Government that a fishery is managed on sustainability principles, as well as explicit recognition of the cost, values, and benefits of an octopus fishery license, providing certainty to stakeholders.

Project No.: 2010/200      Application Reference: HA007

## Methods

### Objective 1. Determine fishing efficiency of octopus trigger pots

Trigger pots are an octopus-specific fishing trap designed around a trap-door mechanism, which is triggered by the octopus after it has entered the pot. The pot was developed by the industry specifically for the WA species "Octopus tetricus", and fishery development will be primarily based on these pots due to their ability to be set in rocky reef and other complex habitats not amenable to fishing by traditional unbaited shelter pots set on longlines. Fishing efficiency of these pots will be determined from monthly sampling over a 24 month period. A custom designed daily catch and effort logbook will record accurate estimates of effort (no. of pots set, no. of days soaked), catch (numbers and kilograms of octopus), and catch per unit effort (CPUE) in numbers and kg per pot. The logbook will also provide spatial information in the form of GPS locations of fishing. These variables will be combined to predict average annual catches per pot, and determine potential harvests arising from various pot allocations in the fishery. The catchability coefficient and exploitation rate / fishing mortality will be determined from a Leslie-DeLury depletion model. Knowledge of the exploitation rate will facilitate management by effort controls. The semelparous life-cycle of *O. tetricus* lends itself to a depletion analysis because the population recruits, breeds, and dies within a year to 18 months, and for this reason, per-recruit models and in-season Leslie-DeLury depletion models have been the most common methods used to assess cephalopod stocks (Pierce and Guerra, 1994). Preliminary examination of the CPUE gained from the daily catch and effort logbook show steady declines in CPUE over the main growing and fishing period leading up to spawning (March to August), which confirms that this methodology will be applicable to *Octopus tetricus*. Additional spatial information will be obtained from different populations between Esperance and Lancelin. Care will be taken to ensure that growth rate and natural mortality parameters are accounted for in the depletion analysis, and there have been many adjustments to the original Leslie-DeLury depletion models to account for this added complexity (Hendrickson and Hart, 2006).

### Objective 2. The potential harvest from octopus fisheries

Diverse efforts have been made to assess octopus and cephalopod stocks in general, however the documented evidence shows a consistent interaction between cephalopod life cycles and environmental variability, which is often extreme (Boyle and Rodhouse, 2005). Thus it has proved difficult to establish reliable stock assessment methodology; consequently a range of methods for estimating potential harvest will be tested.

### Method 1 – Direct survey

The direct survey method will involve two components. The first component shall be exploratory fishing to determine spatial extent of potential habitat. The second component will be a dedicated stock survey in key area's to estimate biomass using a stratified sampling approach. Because CPUE is known to vary seasonally, adjustments for this seasonal variation will be made to ensure an unbiased biomass estimate. These adjustments will be estimated using GLMs (Generalized Linear Models).

Exploratory fishing will be undertaken by up to 10 vessels utilizing an exploratory effort quota (5000 pots; 500 to 600 pots per vessel). The vessels will primarily target a 500km stretch of coast between Greenhead and Busselton, with additional surveys in the Esperance region, initially for 12 to 18 months. Fine-scale catch, effort, size, and GPS information will be collected from daily logbooks and compiled to obtain a broad understanding of stock distribution and abundance. Information will also be compiled

from the lobster fishery, where fishers record by-catch of octopus, and quantity of dead lobster in the pots, which is an index of octopus predation. The lobster fishery encompasses an 800km stretch of coast and spatial maps of both octopus by-catch and octopus predation index should identify the major octopus stocks and habitats.

Following this a dedicated stock survey of key octopus habitat will be undertaken using a commercial vessel. This survey will target octopus habitat in a defined spatial area over a depth gradient and the CPUE / abundance data (adjusted for seasonal variability, area fished, and other effects where necessary) will be scaled by total habitat area to arrive at a total biomass estimate. Estimates for the entire fishery can then be obtained, and while they will not represent a total coverage for the potential fishery, they will be an indicative estimate, most likely to be conservative as it is unlikely the entire stock distribution will be sampled.

Once a biomass estimate is known, estimates of biologically sustainable catch can be obtained using reference point analysis, where the limit reference point is  $F_{limit} = M$ , and the target reference point is  $F = 0.75 F_{limit}$ . Estimates of  $M$  will be obtained empirically using a number of established methods based on maximum age, length and age-composition data. Length and age-composition data will be obtained as part of information collected for Method 2.

Various models of the stocks will be developed using biological, catch and effort data for *Octopus tetricus* and used to produce estimates of sustainable harvest. The models will be tested on the Cockburn Sound octopus fishery, which has 5 years of daily logbook fishing data, and will have 8 years data by the end of the project. Monthly sampling for gonad development, fecundity, growth and length-weight relationships will provide the biological data. A minimum of 200 – 300 animals per month per location will be sampled. The industry practice is to separate the arms/legs from the head immediately upon capture. The heads contain all the biological information, including the stylets. Stylets are reduced internal shells found in the mantle, and have been successfully used to age octopus in Tasmania in the same manner that otoliths are used for finfish. Samples will be chilled and return to the laboratory for processing of length, weight, sex, reproductive development, and age. From these data estimates will be made of size-weight relationships, age, growth rates, size and weight at sexual maturity, and if possible, size-fecundity relationships. Preliminary sampling has shown that trigger pots are occasionally pulled up with entire egg masses. In these instances, the eggs will be counted, and the animals, if present will be measured. These egg counts will be compared with residual gonad weight to determine what % of the total egg production they are likely to represent.

A range of models will be tested depending on the nature and quality of data. Optimally, a size-structure population model will be developed using standard techniques, i.e. Equations and code will be used to construct a representation of stock dynamics using catch history, CPUE history, demographic parameters (growth, mortality, fecundity), length-weight relationships, size-frequency, and abundance indices where available. For example, it may be possible to construct a suitable abundance index using research surveys on octopus bycatch in the lobster fishery. Per-recruit models that account for semelparity and post-spawning mortality rate will also be investigated for their suitability. Biological reference points (e.g.  $F_{limit}$ ,  $F_{0.1}$ ,  $B_0$ ) will be calculated from the outputs of these models.

#### Method 3 – empirical modeling of the effects of environment

The difficulties of population modeling with data from short-lived species such as *Octopus tetricus* and tight responsiveness of the population changes to environmental variables in many cephalopod stocks has resulted in research to relate stock abundance to environmental variables using empirical models. Predictive models of future catches have been developed for many squid species and these have been based on easily quantifiable variables such as SST (Boyle and Rodhouse, 2006). Empirical modeling will be undertaken for the *O. tetricus* fishery by correlating historical spatio-temporal trends in abundance indices and with environmental variables such as SST and SOI, to evaluate any environmental relationships with stock abundance.

#### Objective 3. Octopus predation rates on western rock lobster

Under new management rules, the western rock lobster fishery now operates, on average, a 4 day fishing, 3 day closure (Fri-Sun) weekly harvest cycle. Daily research logbooks capture an index of octopus predation in the lobster pots (# of dead lobster found; number of octopus found) and this allows for a direct comparison of different soak periods on octopus predation rates. Data collected by DoF staff in conjunction with commercial rock lobster fishers on the relationship between soak days and lobster mortality will be examined in four depth ranges (0-10, 10-20, 20-30 and 40+ fm) at numerous locations between Fremantle and Kalbarri for months from November to June. Expected coverage is approx. 20% of the fleet, around 100-150 vessels. Data will be analysed by a Generalised Linear Model, taking into account soak period, spatial, seasonal, moon phase, vessel, and other possible factors and their effects.

**Performance Indicators**

1. Accurate estimates of pot efficiency and catchability coefficients's for octopus tripper pots
2. Octopus stock biomass and sustainable harvest estimates
3. Octopus predation rate estimates on lobsters

**Related Projects and Research Capability**

The Department of Fisheries has already supervised 2 honours projects on octopus biology, developed a trial octopus logbook, and is initiating trials to develop octopus culture techniques. Its major research and aquarium facilities at the Fisheries and Marine Research Laboratories in Hillarys and Waterman's Bay make it the pre-eminent Fisheries Research provider in WA.

This project is related to two current proposals before FRDC to investigate the "Age determination, growth and reproductive biology of commercially important octopus and cuttlefish species in NSW", and "Development of octopus aquaculture" by Dr Sagiv Kolkovski of the Department of Fisheries, WA. These projects will exchange information beneficial to all projects.

Dr Anthony Hart is the Principal Research Scientist in the Mollusc Fisheries section of Department of Fisheries. He has 20 years experience as a Fisheries Research Scientist, specialises in mollusc fisheries stocks and has authored or co-authored final reports from seven major FRDC funded projects.

## Attachment 7 Extract from 2009/10 State of the Fisheries Status Report

A. Hart and D. Murphy

Management input from R. Gould and M. Coloper

### Main Features

#### Status

Stock level - Acceptable

Fishing level – Acceptable

#### Current Landings

Commercial – Statewide – 71 tonnes

Recreational – Statewide (2001 estimate) - 17 tonnes

### Fishery Description

The octopus fishery in Western Australia primarily targets *Octopus cf. tetricus*, with occasional bycatch of *O. ornatus* and *O. cyanea* in the northern parts of the fishery, and *O. maorum* in the southern and deeper sectors.

Fishing activities targeting octopus in Western Australia can be divided in four main categories. The West Coast Rock Lobster Managed Fishery (WCRLMF) harvests octopus as a by-product, and currently accounts for the majority of total octopus landings. The Cockburn Sound (Line and Pot) Managed Fishery (CSLPF), uses unbaited or passive (shelter) octopus pots; the Developmental Octopus Fishery (DevOF) uses both passive shelter pots and active (trigger pots) traps to selectively harvest octopus. Recreational octopus fishing consists of by-catch from recreational lobster and crab pots, and targeted octopus fishing, mostly by SCUBA divers. In addition to these 4 main sectors, numerous trawl and trap fisheries land small amounts of octopus as a by-product.

#### Governing legislation/fishing authority

Cockburn Sound (Line and Pot) Management Plan 1995

Instrument of Exemption (Section 7(3)(c) of the *Fish Resources Management Act 1994*)

West Coast Lobster Management Plan 1993

#### Consultation process

Meetings between the Department of Fisheries and industry

Developing Fisheries Advisory Committee

#### Boundaries

Recreational octopus fishing is permitted to operate throughout Western Australian waters, with the exception of reserves and sanctuaries. Each commercial fishing sector is limited spatially to the boundaries inherent in their legislative instruments. Octopus caught in the WCRLMF are restricted to the boundaries of that fishery (between latitude 21° 44' S and 34° 24' S). Octopus catch in the CSLPF is limited to Cockburn Sound. Octopus caught in the DevOF are limited to the boundaries of the developmental fishery, which is an area bounded by Coral Bay in the north and Esperance in the south. Within this area however, spatial separation of the DevOF “Exemption holders” ensures they are each restricted to a section of the coast that excludes the others.

## Management arrangements

The keeping of octopus as a by-product in the WCRLMF is permitted without catch restrictions or size-limits, however the catch rate of octopus within the fishery is monitored as a performance indicator to ensure it is maintained within historical levels (see WCRLMF status report). The CSLPF is managed through input controls in the form of limited entry and gear restrictions, with a permitted maximum number of octopus pots allowable under the license conditions. The DevOF is also managed through limited entry (currently only 5 exemption holders) and limits on octopus pot allocation specific for passive (shelter) and active (trigger) octopus traps. Effort is also spatially controlled, with each exemption holder allocated a specific area of coast.

The current recreational bag limit for octopus is 15 octopus, with a boat possession limit of 30 octopus. The *Recreational Fishing (Permitted Fishing Methods) Notice (527)* currently permits recreational fishers to use unbaited octopus traps when fishing from a boat (note that recreational fishers cannot dive from shore using traps to take octopus). However, the *Fish Traps Prohibition Notice 1994 (677)* prohibits all persons from taking fish by means of fish traps, with the exception of those persons that hold a recreational fishing licence and are using a rock lobster trap.

A comprehensive Ecologically Sustainable Development assessment of this fishery has also been undertaken to identify any potential sustainability risks requiring direct management. Boxed text in this status report provides the annual assessment of performance for this issue.

## Research summary

Current research is focused on reporting of annual catch and effort statistics from commercial fisheries, reported on a monthly basis. A daily catch and effort logbook for the DevOF was implemented in 2003 and gradually introduced to the DevOF between 2003 and 2007. The logbook provides details of the octopus fishing operations such as the depth, habitat, pot types used and soak times (the period of time pots remain in the water until next pull). Details on catch include catch size categories and estimates of undersize catch. The location of the fishing gear is recorded with a GPS position to enable a more precise spatial breakdown of fishing activities and the identification of fishing zones. In 2008 and 2009, two student projects investigating aspects of biology and ecology of *Octopus cf. tetricus* were also completed.

The department has also successfully obtained a research grant from the Fisheries Research and Development Corporation for a project titled “Innovative development of the *Octopus tetricus* fishery in Western Australia”. Results from this project will inform industry and management on the viability of an expanded DevOF.

## Retained Species

<b>Commercial landings (season 2009): weight)</b>	<b>71 tonnes (live</b>
<b>Recreational catch estimate (season 2001): weight)</b>	<b>17 tonnes (live</b>

## Landings

**Commercial.** In 2009 the total commercial octopus catch was 71 t live weight, a decrease of 37% over last years catch of 112 t, mainly due to the lower effort and therefore lower catch, from the WCRLMF (Octopus Figure 1).

On a sector-specific level, octopus catch from the WCRLMF declined from 68 to 31 tonnes; catch from the CSLP also declined slightly, from 20 to 17 t, while the catch from the DevOF remained steady at 21 tonnes (Octopus Figure 1).

The developing octopus fishery (DevOF) has steadily risen from 4% of the total catch in 2001 to 30% in 2009 (Octopus Table 1). At the same time, share of catch from the lobster fishery has declined from 86% to 44%, primarily as a result of effort reductions.

**Recreational.** No annual estimate of recreational catch exists for octopus. In 2001, the national recreational and indigenous fishing survey<sup>2</sup> estimated a total catch of 25,600 octopus in WA. Using an average weight of 0.7 kg, this amounts to a total catch 17 tonnes.

## Fishing effort/access level

**Commercial:** Fishing effort in the commercial octopus fishery is measured as the amount of days fishing in which octopus was caught. Total octopus effort in the WCRLMF in 2009 was 18,300 days, a 38% reduction from 29,400 days in 2008 (Octopus Table 1). Days fished in the CSLP and DevOF were 208 and 217 respectively, a decrease of 6% and 10% from 2009 (Octopus Table 1). Overall there has been a decline in octopus effort from early 2000s (2001 to 2006) compared to the late 2000s (2006 to 2009).

## Stock Assessment

<b>Assessment complete:</b>	<b>Preliminary</b>
<b>Assessment method:</b>	<b>Catch rate</b>
<b>Breeding stock levels:</b>	<b>Adequate</b>

**Catch per unit effort:** The catch per unit effort (CPUE) from the three main sectors (WCRLMF, CSLP, DevOF) are the principal indicator of abundance of octopus.

The CPUE for octopus from the WCRL was 1.7 kg/day, which was a decline from the 2008 estimate of 2.3 kg/day (Octopus Figure 2). Otherwise it has been fairly stable between 2001 and 2008, varying between 2.3 and 2.9 kg/day.

The CPUE for octopus in the CSLP and DevOF sectors was 82 and 99 kg/day respectively. CPUE has increased over time in both these sectors, from 30 kg/day in 2001 (Octopus Figure 2). This pattern is assumed to reflect increases in fishing efficiency, rather than abundance increases, primarily as a result of the developmental nature of these sectors.

A standardised CPUE analysis for the CSLP and DevOF was also undertaken, based on daily catch and effort logbook data, and more precise estimates of effort. This methodology is still under development, however preliminary trends have been estimated and are compared with the raw CPUE.

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<sup>2</sup> Henry, G.W. and Lyle, J.M. (eds). 2003. *The national recreational and indigenous fishing survey*. FRDC project no. 99/158. NSW Fisheries Final Report Series No. 48.

SCPUE for shelter pots has shown a slight increasing trend between 2005 and 2009, but has been stable around 0.09 kg/pot in the last two years (Octopus Figure 3). SCPUE for trigger pots is only available for 2008 and 2009, but also shows a stable level, around 0.9 kg/pot. Overall, there is about a 10-fold difference in catching efficiency of the two pot types.

*The initial performance measures for the fishery relate to breeding stock maintenance as indicated by catches remaining in the range 50 – 250 t and catch rate remaining above 70 kg/ day in the CSLP and DevOF sectors. Both the catch and catch rate measure was met.*

*Target catch ranges and performance indicators will be reviewed as more information becomes available*

## **Non-Retained Species**

**Bycatch species impact:** **Negligible**

For the WCRLMF, octopi are themselves bycatch. The selective method of fishing used for the CSLP and DevOF results in a minimal level of bycatch of other species.

**Protected species interaction:** **Negligible**

There are currently no protected species known to be taken in this fishery.

## **Ecosystem Effects**

**Food chain effects:** **Negligible**

This fishery harvests only a small amount of octopus per annum. The effect from this harvesting on the rest of the ecosystem, given that the catch is spread over a wide region, would be insignificant.

**Habitat effects:** **Negligible**

Rock lobster potting in the WCRLMF occurs primarily on sand areas around robust limestone reef habitats covered with coralline and macro-algae, and these habitats are considered resistant to lobster potting due to their regular exposure to high-energy swell and winter storms. In the CSLP and DevOF, octopus-specific pots are set in similar areas, and rather than impacting on existing habitat, actually provide habitat and shelter for the octopus.

## **Social Effects**

Each octopus fishing vessel employs between 2 and 3 people, with octopus catch in 2009 being landed by 240 vessels, although the vast majority of these landings were small (< 100 kg), as they were by-catch in the WCRLMF. Only 11 vessels landed greater than 500 kg. There is also a substantial processing and value-added component to the octopus catch with factories in Fremantle and Geraldton.

## **Economic Effects**

**Estimated annual value (to fishers)**

**for year 2009:** **\$710,000**

The estimated annual value for 2009 was \$710,000 based on an average product price of

\$13/kg (head off) or \$10/kg live weight. This is a beach price value and supports a substantial processing and value-adding sector.

## Fishery Governance

**Target catch range:** 50 – 250 tonnes

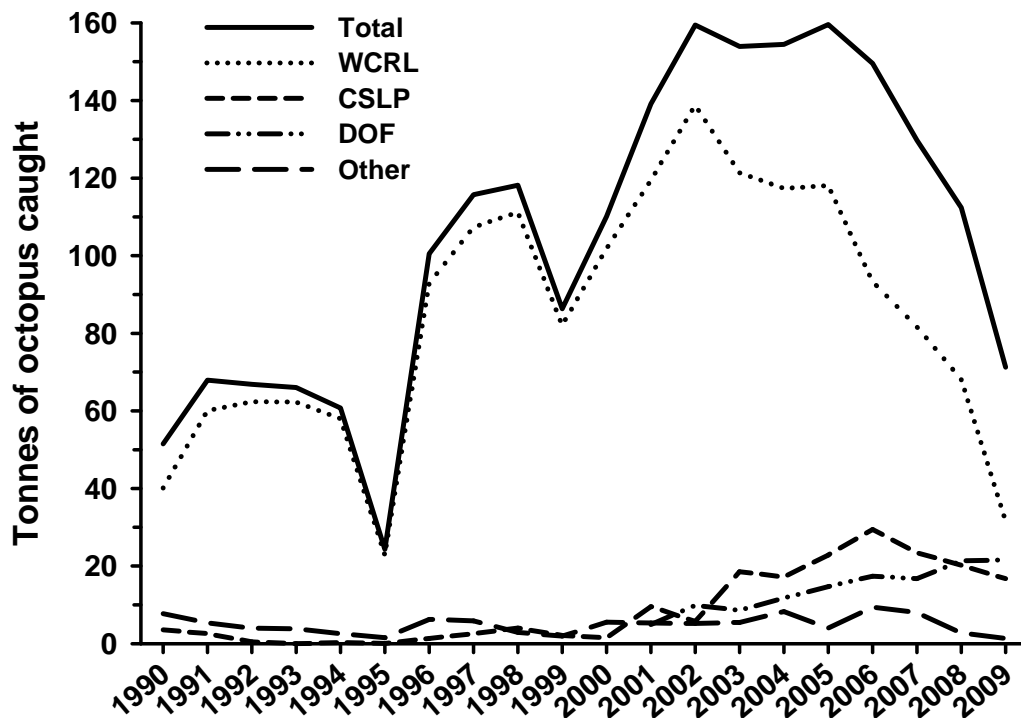
This is a preliminary target range due to the developing nature of the fishery. Current fishing level of 88 tonnes is within the target range.

### New management initiatives (2009/10)

Progress on the movement of the DevOF into an interim managed octopus fishery was made in 2009/10. It is likely that this will be gazetted in 2010/2011. Pot allocations are likely to be based on an initial exemption granted to a license holder to expand its scale of operation by allowing other fishes to fish on that company’s behalf using an increased number of trigger traps. The need to extend this exemption was in part due to the lack of a formal legislated management structure for the fishery.

## External Factors

Cephalopods in general, including octopus, are known to be subject to large environmentally-driven fluctuations in abundance. If the fishery expands to reach a catch level approaching maximum possible yields, this year-to-year variability in abundance may prove a significant issue for the fishery.



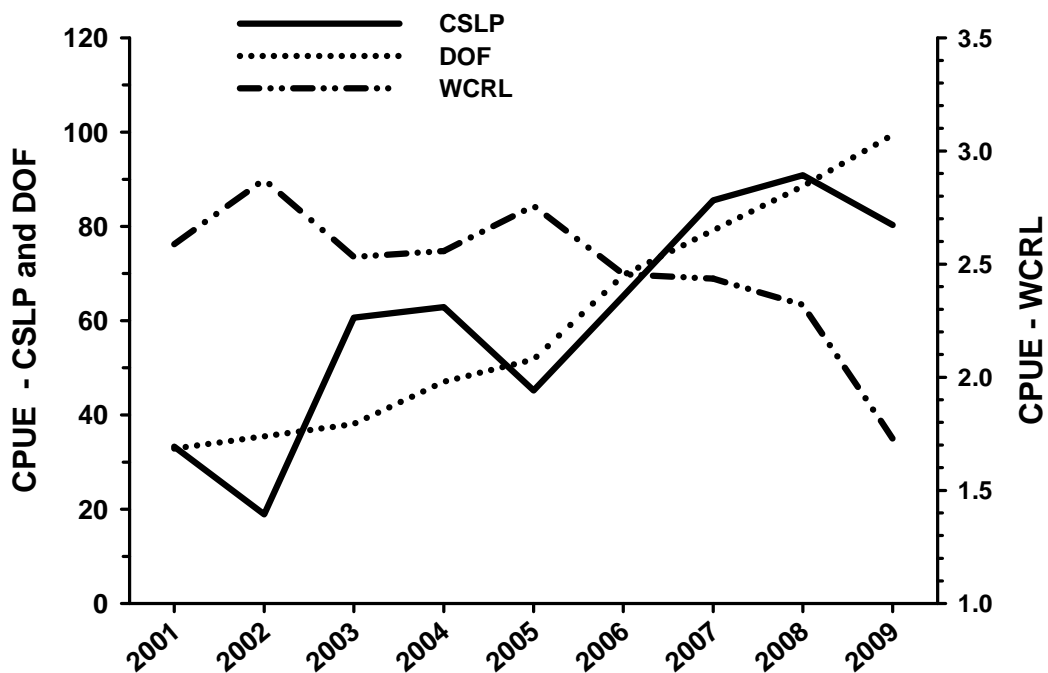
**OCTOPUS FIGURE 1**

Commercial catch (t) of octopus in Western Australia since 1990. Catch is divided between the main sectors – WCRL (West Coast Rock Lobster Fishery), CSLP (Cockburn Sound Line and Pot), DevOF (Developing Octopus Fishery) and Other, which is by-catch from trawl and miscellaneous pot fisheries

**OCTOPUS TABLE 1**

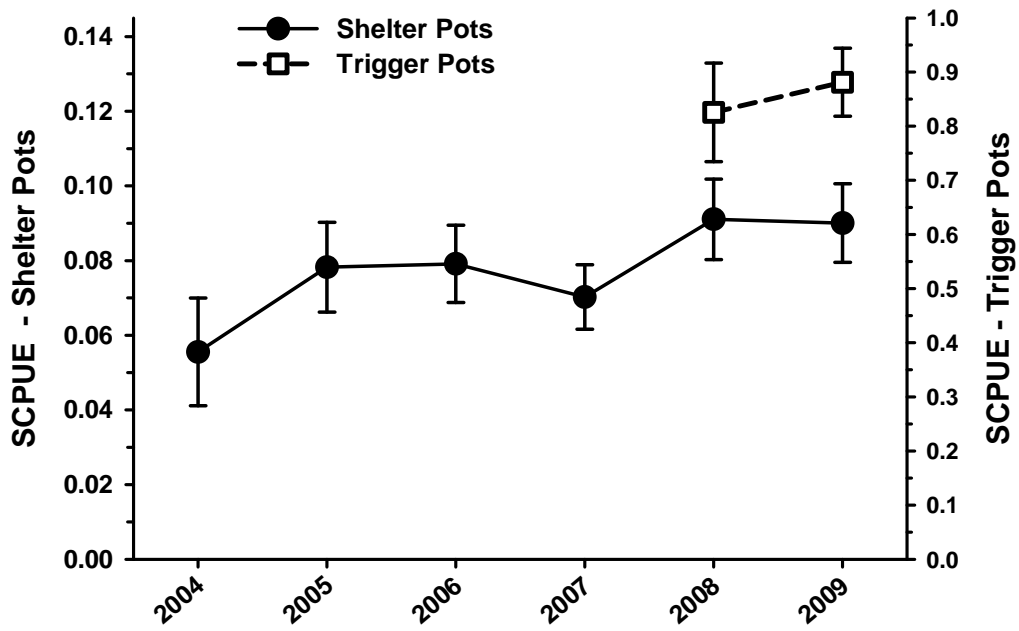
Percentage of octopus catch and total days fished from different sectors of the fishery. – WCRLMF (West Coast Rock Lobster Fishery), CSLP (Cockburn Sound Line and Pot), DevOF (Developing Octopus Fishery) and Other, which is by-catch from trawl and miscellaneous pot fisheries

Year	WCRL	CSLP	DevOF	Other	WCRL	CSLP	DevOF
	Percentage of total catch				Effort (total days fished)		
2001	86	6.9	3.5	3.8	46,100	287	149
2002	87	3.6	6.2	3.2	48,300	300	278
2003	79	12.1	5.6	3.6	47,900	306	225
2004	76	11.1	7.6	5.3	45,900	273	249
2005	74	14.3	9.2	2.5	42,800	505	284
2006	62	19.7	11.6	6.3	38,000	451	250
2007	63	18.1	12.9	6.1	33,500	274	211
2008	61	18.0	19.0	2.4	29,400	222	241
2009	44	23.5	30.3	1.8	18,300	208	217



**OCTOPUS FIGURE 2**

Catch per unit effort (CPUE) in kg/day of Octopus in the three main sectors – WCRL (West Coast Rock Lobster Fishery), CSLP (Cockburn Sound Line and Pot), DevOF (Developing Octopus Fishery).



**OCTOPUS FIGURE 3**

Standardised catch per unit effort (SCPUE) ( $\pm 95\%$  CL) in kg/pot of Octopus in the CSLP (left axis) and DevOF (right axis) sectors. Trends are for two pot types – passive shelter pots, and active trigger pots.

***Appendix 8 Cockburn Sound Line and Pot Management Plan***