1977-021 14

Fishing Industry Research Trust Account

Report on a Continuing Project to be Completed on 31 March 1981.

By

Director, Department of Fisheries and Wildlife

On

A Study of the Fishery-Induced Mortality of Under-size Rock Lobsters.

FISHING INDUSTRY RESEARCH TRUST ACCOUNT
REPORT ON A CONTINUING PROJECT TO BE COMPLETED ON 31 MARCH, 1981.

N.B. No additional funds are requested since all expenditure to 31 March, 1981 has been approved.

1. Title of Proposal

A study of the fishery - induced mortality of under - size rock lobster.

2. Name of Applicant

The Director, Department of Fisheries and Wildlife, Western Australia.

3. Division, Department or Section

Fisheries Research Branch, Western Australian Marine Research Laboratories.

4. Proposal

To study present fishing methods as they relate to the handling of undersized western rock lobster, together with studies on the behaviour and population dynamics of undersized rock lobsters returned to the sea during fishing operations. Evaluation of the magnitude and relative importance of fishery-induced mortality of undersized rock lobsters and, if necessary, determination of the most suitable ways of reducing this mortality.

5. Name of Person responsible for Programme

D. A. Hancock, B.Sc., Ph.D., D.Sc. Chief Research Officer, Fisheries Research Branch, Department of Fisheries and Wildlife, W.A.

6. Qualifications of Staff Employed on Programme

Mr. R.S. Brown:	B.Sc. (Research Officer) $3\frac{1}{2}$ years experience with western rock lobsters.
Mr. J. Prince:	B.Sc. (Research)
Mr. J. Jerke:	Technical Officer

7. Objectives

To collect and analyse data on fishing practice as related to the handling of undersized western rock lobsters and to study their behaviour, survival rate and subsequent growth rates after being returned to the sea. The effect of fishing practice on the survival and subsequent growth rate of eff-bearing ("berried") rock lobsters will also be examined.

The rationale behind this approach to the problem is that previous work by R.G. Chittleborough has shown that juvenile western rock lobsters exhibit strong homing behaviour and, if displaced from their home reef, can travel long distances either back to the home reef or in an apparently random manner. This may increase the risk of predation of these animals. Handling practice is important in this regard as undersized animals are often not returned immediately to the area from which they were taken. Poor handling can also considerably retard the rate of growth of returned rock lobsters in increasing the degree of limb loss and may also affect the chances of successful hatching of eggs carried by "berried females.

8. Location of Operations

a)Base: Marine Research Laboratories, Waterman, W.A.

b)Area: Between Fremantle, Geraldton and the Abrolhos Islands.

9. Date Project Commenced

Staff appointed on 25th July, 1977.

10. Anticipated Completion Date

March 31, 1981.

11. Funds Requested

None.

12. Funds to be Provided by Applicant or Sought from other sources

None.

13. Co-operating Agencies and their Functions

None.

14. Is similar work being undertaken in Australia

No.

15. Plans for Reporting or Publishing Reports

Interim reports have been published in the Department of Fisheries and Wildlife publication F.I.N.S. (see copy attached).

The final report is currently being drafted and will be published in the Department's Report series. Suitable sections of the project will be published in a refereed journal. One section is currently in draft form.

16. Progress Report for the Research Project

Progress up to 15 December, 1980.

A detailed report of the year's work (1979/80) was submitted to the Western Fisheries Research Committee's Twentyfirst Annual Meeting (4 - 7 July, 1980).

a) All the field work for this programme was completed by 30 June, 1980. Some laboratory experiments are still in progress, but are expected to be finalized by mid-February, 1981.

b) All sections of the project are now being assembled and a draft of the final report is well underway.

c) Preliminary results:- It has been estimated that in the vicinity of 18 million undersize rock lobsters are handled by professional fishermen each year. There are six different catch sorting techniques used by the fishermen, some involving short exposure periods and others very long exposures as in the two examples below.

1. Catch directly sorted from the trap (9.3% of all fishermen)

Exposure (mins)	% of the undersize
15 - 30	98.5%
30 - 60	0.1%
60+	0%

2. Catch sorted after pulling a line of gear and then resetting it (8.0% of all fishermen)

Exposure (mins)	% of the undersize
0 - 15	56.9%
15 - 30	25.0%
30 - 60	16.0%
60+	1.2%

Using the results of the six sorting techniques and the percentage mortality for the various exposure periods given below, a preliminary figure of 6.5% mortality overall has been arrived at.

Results from rock lobster tagging trials.

Exposure (Mins)	% mortality	
	"Reds"	"Whites"
0	0	0
15	N/A	22.3
30	43.5	31.8
60	86.5	58.0
120	96.0	N/A

N/A = not available

The overall cost to the industry each season has been estimated to exceed $2.8 million, which would result in a $3,500 to $4,500 loss per boat, depending on the percentage of the catch coming from the 'shallows' area (0 - 20 fm) where the undersize rock lobsters are most abundant. Data analysis in this area is continuing.

d) An educational film is being produced by Development Education Services in conjunction with the Department of Fisheries and Wildlife, to demonstrate to fishermen how imperative it is for them to return their undersize animals to the water immediately.

The film was put to tender and two finalists were chosen to produce draft scripts, which were used

as the basis for the final selection. A variety of each tender's products were viewed to make the initial selection.

e) Talks to Professional Fishermen's Associations on the findings of the project have and will be given at many of the ports along the coast.

Research Proposals

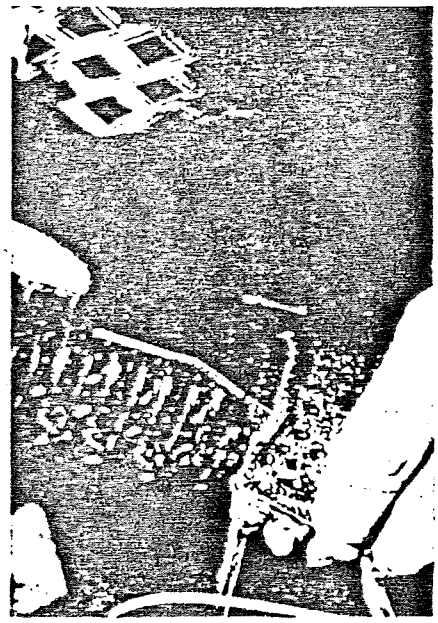
No further research is proposed and no further funding for the project will be required when the current grant expires on 31 March, 1981. The project is being written up for publication.

THE FATE OF UNDERSIZED ROCK LOBSTERS RETURNED TO THE SEA

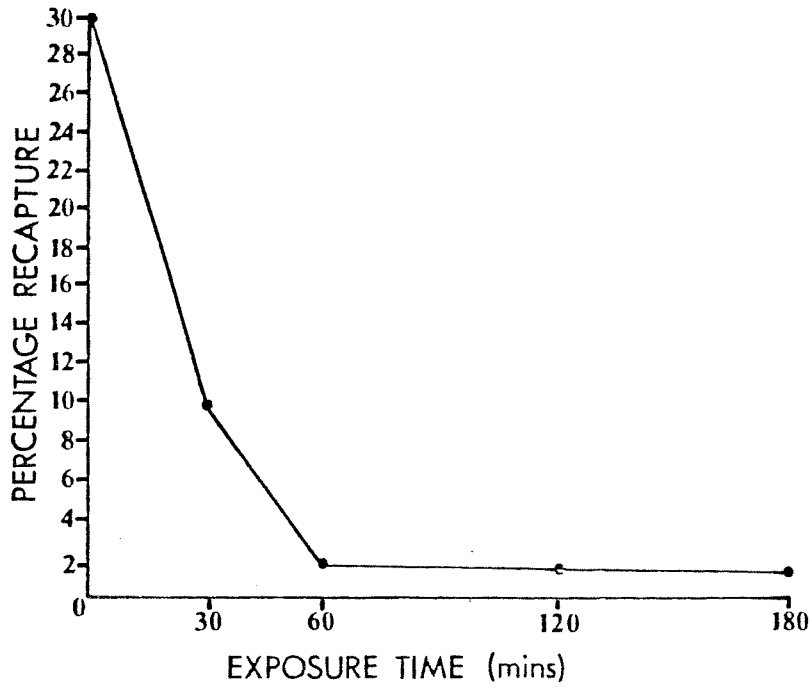
Over the years many professional fishermen have been concerned about what happened to the undersized rock lobsters that were thrown back into the sea. Did they live and grow to a size to be caught legally? Did they mature and produce young to replenish the stocks for future years? Or did they just die?

It is estimated that professional fishermen handle over 20 million undersize rock lobsters every season. An increase in the death rate of these animals of only 2 or 3 per cent above the natural level could result in a loss to the industry of over $1 000 000 a year. Therefore it was of vital importance to the industry to see just what was happening to these young animals.

In order to do this the Fisheries Industry Research Trust Account (FIRTA) gave a three year grant to the Department of Fisheries and Wildlife so that a Research Officer and a Technical Officer could be employed to find out if indeed there was a problem and if so what could be done about it.



Rock lobster with plastic tag.



Graph showing recapture of tagged—exposed rock lobsters.

The Research Officer, Rhys Brown's first task was to find out just how the rock lobsters were being handled by the fishermen. He and his Technical Officer, Jerry Jerke, went out with many of them to see what they did with the undersized animals. Their observations told him that:

(a) nearly 60 per cent of fishermen sorted their catch as soon as it was pulled, and,

(b) just over 40 per cent did not sort their catch until all the pots in a line had been pulled or until the "caca" box* was full.

Those fishermen who sorted the catch straight away kept the undersize rock lobsters out of the water from 5 to 10 minutes while the fishermen who sorted the animals after a line was pulled or the caca box filled kept the animals out of water for 25 to 40 minutes and up to nearly two hours in some cases.

What effect did this exposure have on survival?

Trials to see just what happened to these animals were carried out at sea in conditions which were as similar to those of a commercial rock lobster fisherman's operation as possible. Two thousand five hundred rock lobsters were caught, and tagged over a 15 day period. Each day the animals were divided into 5 groups and kept out of the water for different lengths of time before being put back.

* "Caca" box is the box in which rock lobsters are kept that are not obviously of legal size or undersize and therefore require precise measurement. The word "caca" is thought to originate from the supposed resemblance between undersize rock lobsters and cockroaches. "Caca" is thought to be a corruption of the Spanish word *Cucaracha*.

Group 1 was put straight back after tagging, group 2 was left for 30 minutes and then put back, group 3 left for an hour, group 4 for 2 hours and group 5 for 3 hours.

The idea was to see how many animals would be caught again by fishermen over the season. These results would give a fairly accurate idea of the death rate of the animals.

The results of the experiments were pretty conclusive. They showed that of the animals that were out of the water only a very short time (approximately 5 minutes) nearly 30 per cent were caught again. Only about 10 per cent of the animals that were left out for 30 minutes were re-caught and of those that were left out longer very few were caught again (see graph).

It is obvious from these figures that if you keep juvenile rock lobsters out of water for more than 30 minutes two thirds more will die than if they are put back immediately. Since 40 per cent of the catch of undersized animals is treated in this way this *must* result in a huge loss to the industry, not only in terms of money but in potential breeding animals.

Why don't juvenile rock lobsters which have been exposed for a period of time survive when put back into the water?

The reason why these animals do not survive has not been fully worked out. However, research has shown that the animals are in a very much weaker condition after exposure to the drying effects of wind and sun. As the animals dry out so do the gills. This means that the respiratory surface of the gills is reduced and the animal does not get enough oxygen. Interesting to note also is the fact that the body weight of a rock lobster goes down quite quickly as it dries out. This means the "blood" will become thicker and move more slowly round the body of the animal, so once again the oxygen supply to the vital organs will be reduced.

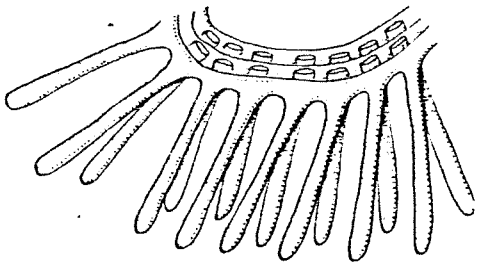


Diagram of part of a normal unexposed rock lobster gill.

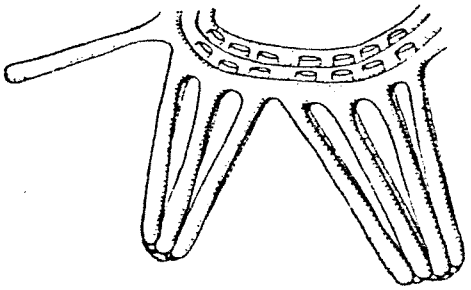


Diagram of part of a rock lobster gill which has been exposed to the drying action of wind and sun.

Once this animal is put back into the water in the weakened state it would find it more difficult to get away from a predator, such as an octopus, than normal. As a result more undersize rock lobsters that are thrown back after being exposed for a long time will be killed than those that are thrown back immediately.

Experiments have also shown that the more damage an animal receives out of the water the slower it grows. This is due to limb loss and possibly exposure and stress. The slower the animal grows the longer it stays as a juvenile and the more likely it is to be preyed upon and eaten before a fisherman has a chance to include it in his catch or before it has bred.

Rhys Brown is now looking in more detail at the survival rates of juvenile rock lobsters that have been exposed between 0 minutes and 30 minutes as the death rates of the animals increase dramatically over this time period. Results from this work should be available later this year.

Exposure of females carrying eggs

In 1979 experiments were carried out to see what effect exposure had on rock lobster eggs. Fishermen are required to return females carrying eggs to the water. The majority do this as soon as possible, however, some fishermen do not sort their catch straight away while others put the females back into the pots and wait until the eggs are released. This may result in a female being hauled to the surface two or three times while she is carrying eggs.

Exposure and stress on the females for any length of time could affect development of the eggs and many may die. Further work on this problem is in progress.

Transporting rock lobsters from their place of capture

Rock lobsters have definite "homes". They do not simply range around the sea floor at random. The animals hide in holes to escape predation. Experiments have shown that they do not move far from these homes. A juvenile rock lobster, male or female, will only move about 15 metres from its "home" and this becomes its home range.

If a juvenile is caught in a pot and dropped back outside its home territory it becomes disoriented and moves around more than usual trying to find its way back. The more active it is the more energy it uses and so it has to feed more often. Animals dropped back into areas where there are large numbers of resident animals will be driven out.

Rhys Brown's research shows that there is no significant difference between the number of animals caught which have been moved (displaced) and those that have been put back in their home territory.

Even though the likelihood of their being caught by predators increases as they move about randomly trying to find their old home, it is possible these rock lobsters are caught more easily in pots because they are more hungry and need to feed often.

Work is still in progress to see what happens when undersize rock lobsters caught in reef areas are dropped into water where the sea floor is sandy. (continued on page 12)

Researchers measuring and tagging rock lobsters.

How to reduce the death rate of juvenile rock lobsters from exposure and displacement

Three methods which could help overcome the high death rate of juvenile rock lobsters from exposure and possibly displacement are under study:

1. Co-operation from *all* fishermen in sorting their catch continuously as soon as it is hauled out of the water.
2. Rigging up some kind of spray system in the "caca" box to keep the animals wet.
3. The development of pots with a different type of escape gap, such as a round one, which would possibly cut down the number of juveniles being caught.

It is of benefit to the rock lobster industry as a whole that the undersized animals are handled correctly. Many fishermen say it takes longer to sort rock lobsters as they go. But observations and careful timing have shown that the time difference between the fishermen who sort continuously and the ones that sort at the end of a line or when the "caca" box is full is minimal and certainly not worth taking into consideration when looking at the benefits to the industry of preventing high death rates of the juveniles.

Results from Rhys Brown's work now without a doubt that if animals are put back within half an hour of being caught their chances of survival, while better than those left out longer, are not particularly good. However, if the animals are put back in under 15 minutes and preferably straight away, the chances of survival are very much better. In other words *those fishermen who do not sort their catch continuously while pulling their gear are exposing their undersize animals far too long.* Much of the research has been completed and some of the questions asked by the industry concerning the fate of the undersized rock lobsters have been answered. It is now up to the industry as a whole to put this knowledge into practice and in doing so save itself millions of dollars in lost production.

FISHERIES ACT PENALTIES RAISED

During the recent new year celebrations many aspects of the past decade were reviewed in the media. One constant topic of discussion was the rate of inflation experienced in the 1970s and fishermen would not need reminding that costs and charges increased dramatically in that period.

In one area, however, "costs" did not keep pace with inflationary trends: penalties for offences against the Fisheries Act had not been generally reviewed for many years. In fact, many penalties had remained unaltered since the mid-1960s.

During these years, many fishermen enjoyed large increases in prices received for their catch. For example rock lobster prices rose from less than $2.00 per kg in 1970 to over $6.00 per kg at present. With the deterrent effect of penalties eroded by inflation, a situation existed in which unscrupulous members of the fishing industry were tempted to break the law in the expectation of high returns for their misdeeds if they avoided apprehension.

Recent amendments to the Fisheries Act are designed to ensure that penalties imposed under the Act are set at levels which will deter the potential lawbreaker, thereby protecting the future of the State's valuable fishing industry.

A comparison between the old penalties and the new (applicable from December 14, 1979) appears below and it can be seen that substantial increases have been made.

Whilst those who choose to break the law will now need to take account of these amendments, the vast majority of law-abiding fishermen can take comfort from the fact that this particular "cost" increase will not affect their incomes, no matter what rate of inflation prevails in the 1980s.

Offence	Old Penalty ($) Min.	Old Penalty ($) Max.	New Penalty ($) Min.	New Penalty ($) Max.
Contravention of notice restricting use of gear, areas fished etc:				
First offence (rock lobster)	200	400	200	750
First offence (other fish)	20	100	50	250
Subsequent offences (rock lobster)	400	1 000	750	1 500
Subsequent offences (other fish)	50	200	250	750
Contravention of license condition:				
First offence	200	400	500	1 000
Subsequent offences	400	1 000	1 000	2 500
Continuing offences (per day)	....	20	....	50
Undersize fish:				
First offence (*rock lobster)	40	100	50	250
First offence (other fish)	20	40	50	100
Second offence (*rock lobster)	200	400	250	500
Subsequent offences (*rock lobster)	400	1 000	500	1 500
Subsequent offences (other fish)	40	100	100	750
Unlicensed processing	2 000	4 000	2 000	10 000
Continuing offences (per day)	....	200	....	500
Obstruction or assault of Inspectors †	100	400	100	1 000

* Higher penalties apply if the number of undersize rock lobster exceeds one-twentieth of the total in possession at the time of the offence.

† Also liable to six months imprisonment.

ROCK LOBSTER BOAT LIST– AN APOLOGY

A number of rock lobster boat owners have drawn to the Department's attention certain errors and ommissions in the list of rock lobster boats and their pot and zone entitlements published in the last edition of F.I.N.S. (volume 12 number 3).

Any inconvenience caused by such errors is regretted. It is anticipated that a revised and accurate list will be made available for publication in a later edition of F.I.N.S. during 1980. Meanwhile, any enquiries concerning the entitlements of specific vessels should be addressed to the Head Office of the Department of Fisheries and Wildlife.

Family	Scientific Name	Common Name
CHEILODACTYLIDAE	*Cheilodactylus gibbosus*	Crested Morwong
MUGILIDAE	*Aldrichetta forsteri*	Yellow-eye Mullet
	Mugil cephalus	Sea Mullet
SPHYRAENIDAE	*Sphyraena obtusata*	Striped Sea Pike
ODACIDAE	*Neoodax balteatus*	Rock Whiting
	Neoodax semifasciatus	Weedy Whiting
	Olisthops cyanomelas	Herring Cale
	Omobranchus germaini	Germain's Blenny
	Pictiblennius tasmanianus	Blenny
CLINIDAE	*Cristiceps australis*	Crested Weedfish
CALLIONYMIDAE	*Callionymus goodladi*	Goodlad's Dragonet
	Callionymus papilio	Painted Stinkfish
	Dactylopus dactylopus	Fingered Dragonet
GOBIIDAE	*Amoya bifrenatus*	Bridled Goby
	Favonigobius lateralis	Long-finned Goby
	Favonigobius suppositus	South-west Goby
	Pseudogobius olorum	Blue-spot Goby
	Tridentiger trigonocephalus	Japanese Goby
SCOMBRIDAE	*Thunnus albacares*	Yellow-fin Tuna
BOTHIDAE	*Pseudorhombus jenynsii*	Small-toothed Flounder
PLEURONECTIDAE	*Ammotretis elongatus*	Elongate Flounder
CYNOGLOSSIDAE	*Cynoglossus maculipinnis*	Tongue Sole
MONACANTHIDAE	*Bigener brownii*	Spiny-tailed Leatherjacket
	Chaetoderma penicilligera	Weedy Leatherjacket
	Eubalichthys mosaicus	Mosaic Leatherjacket
	Meuschenia freycineti	Six-spined Leatherjacket
	Monacanthus chinensis	Fan-bellied Leatherjacket
	Scobinichthys granulatus	Rough Leatherjacket
OSTRACIONTIDAE	*Anoplocapros lenticularis*	White-barred Boxfish
	Aracana aurita	Shaw's Boxfish
TETRAODONTIDAE	*Arothron hispidus*	Lined Pufferfish
	Contusus richei	Prickly Toadfish
	Lagocephalus sceleratus	North-west Blowfish
	Torquigener pleurogramma	Common Blowfish
DIODONTIDAE	*Atopomycterus nicthemerus*	Globe Fish

SPAWNING ROCK LOBSTERS– THE INDUSTRY'S FUTURE

It has been brought to the attention of Fisheries Inspectors that rock lobster fishermen are taking spawners and placing them in pots in shallow water until they have shed their eggs. This practice must stop or the industry will suffer.

Spawning female rock lobsters are a very vulnerable link in the life cycle of the Western Rock Lobster. It is estimated that fishermen up and down the coast handled around four hundred and thirty four thousand spawning females between December 1978 and February 1979.

If only a small percentage of these animals are handled incorrectly the number of young rock lobsters produced could be drastically reduced. Ultimately this would lead to a reduction in catch rates.

Exposing spawning females to the drying action of sun and wind, together with excessive handling, will cause the female rock lobster a lot of stress. This stress will affect the eggs and they may hatch prematurely or fail to develop and then die. In addition, females in captivity are known to strip off their own eggs. The females themselves can also be severely affected by exposure and many will die or not grow very well.

Some spawners which have been hauled up from about 25 fathoms of water are taken to holding pots in about 8 fathoms of water. They are often kept on the deck of the boat for about 60 minutes or more while being transported from their place of capture to the holding pots. A very high egg loss could be expected under these conditions.

Certain conservation regulations put on the industry by the Department of Fisheries and Wildlife are specifically designed to minimise losses of young rock lobsters. Fishermen are required to return spawning females to the water immediately so their eggs will have the best chance to develop fully and so contribute to the next generation of rock lobsters. Fishermen who flaunt these regulations and keep spawning females in pots until they have spawned will not only reduce the potential catch of the industry as a whole but also eventually reduce their own catch.

(See also p. 10 The Fate of Undersized Rock Lobsters Returned to the Sea.)

FEES FOR LIMITED ENTRY FISHERIES

Following a review of fees payable under Section 3H of the Fisheries Regulations, the Minister for Fisheries and Wildlife has approved the following fees for licenses to engage in limited entry fisheries.

Rock Lobster Fishery

Zone A—$4.30 per pot
Zone B—$4.30 per pot
Zone C—$4.30 per pot
Zone D—$4.30 per pot
Zone E—$2.50 per pot

Prawn Fishery

Shark Bay—$1 800 per boat
Exmouth Gulf—$1 800 per boat
Nickol Bay—$200 per boat

Australian Salmon Fishery

South Coast—$80 per team
South West Coast—$40 per team

Abalone Fishery

Zone 1—$200 per diver
Zone 2—$200 per diver
Zone 3—$100 per diver