Fisheries management report

Long term management strategies for the Western Rock Lobster fishery

(4 volumes)

A market-based economic assessment for the western rock lobster industry (May 1994) Volume 3

by Marec Pty Ltd

Fisheries management paper No. 69



Fisheries Department of Western Australia 108 Adelaide Terrace, East Perth 6004

October 1994

ISSN 0819-4327

The Western Australian lobster fishery is limited to a specific catch the sustainable catch. The pursuit of a catch in excess of the sustainable catch in the end is futile. Thus the opportunity for economic growth within the industry will be determined not through an increase in catch but through the increase in worth realised from the sustainable catch. The role of fishery's management is seen therefore as one which provides a structure that ensures the conservation of the fishery but at the same time acts to minimise the impediments preventing the industry (fishermen, processors and others) from optimising the worth of the catch.

Author

CONTENTS

	INODI		
1.	САТС	CH, PRODUCT AND MARKET OVERVIEW	3
	1.1	CATCH	3
	1.2	PRODUCTS AND MARKETS	5
		1.2.1 Live Lobster	7
		1.2.2 Frozen boiled lobster	9
		1.2.3 Frozen lobster tails	12
		1.2.4 Frozen whole raw lobster	14
2.	ECO	NOMIC OVERVIEW	16
	2.1	DETERMINING THE WORTH OF THE CATCH	
		2.1.1 The flow and composition of the catch	17
		2.1.2 How the catch is processed and sold	19
		2.1.3 Calculating the worth of the catch	23
		2.1.4 Maximising the worth of the catch	23
	2.2	EXTENDED SEASON COST	26
	2.3	NET ECONOMIC BENEFIT	
3.	ECO	NOMIC LIMITATIONS OF THE 1992/93 SEASON FISHERY MANAGEMEN	п
	STR	JCTURE	27
	3.1	A CATCH FLOW DETERMINED BY HOW FAST FISHERMEN	
		CAN EXPLOIT THE AVAILABLE STOCK	28
	3.2	A CATCH FLOW CONSTRAINED TO A PREDETERMINED PERIOD	
		(THE SEASON)	29
4.	SPE	CIFIC CONSEQUENCES OF THE 'RUSH TO FISH' BASED CATCH FLOW	· 30
	4.1	THE EXTRAORDINARY LOW WORTH OF THE DECEMBER CATCH	
		4.1.1 The disproportionately high catch	
		4.1.2 Low worth of products in December	
	4.2	THE LACK OF ACCESS TO THE MARKETS FROM 1ST JULY TO	•
		14TH NOVEMBER	36
		4.2.1 Live Lobster	37
		4.2.2 Frezen Lebeter	

	4.3 THE LIMITATION WHICH RESTRICTS THE INDUSTRY RESPONDING	
	TO MARKET OPPORTUNITIES AS THEY ARISE	41
	4.4 CONSIDERATIONS WITH RESPECT TO THE 1992/93 LOBSTER	
	CATCH	41
5.	REDUCING THE DECEMBER CATCH AND EXTENDING THE SEASON	42
•••	5.1 BEDUCING THE DECEMBER CATCH	
	5.1.1 Deferring the catch forward	42
	5 1 2 Catching prior to December	43
	5.1.3 Department of Fisheries estimates	43
	5.2 EXTENDING THE SEASON	44
6.	ESTIMATED ECONOMIC IMPACT ON THE 1992/93 SEASON OF A THEORETICAL REDUCTION IN THE DECEMBER CATCH AND AN EXTENSION OF THE	L
	FISHING SEASON	45
	6.1 1992/93 SEASON BASE MODEL	46
	6.2 ECONOMIC IMPACT OF REDUCING THE DECEMBER 1992 CATCH	47
	6.3 ECONOMIC IMPACT OF REDUCING THE DECEMBER 1992 CATCH	
	AND EXTENDING THE SEASON UNTIL THE 30TH SEPTEMBER	49
	6.3.1 Calculation of the change in the worth of the catch	49
	6.3.2 Extended season costs	51
	6.3.3 Summary of nett economic benefit	51
7.	THE INFLUENCE OF CATCH FLOW ON LIVE LOBSTER PRODUCTION	52
	7.1 INCREASING LIVE LOBSTER PRODUCTION	52
	7.2 HOW CATCH FLOW CAN INCREASE LIVE LOBSTER PRODUCTION	52
	7.2.1 Relationship between holding tank capacity and the 1992/93 season	
	catch profile	53
	7.2.2 Producing the entire catch as live	54
	7.2.3 Comments regarding practical limitations to live lobster production	55
8.	CHANGES TO THE WEIGHT AND COMPOSITION OF THE CATCH	57
		·
9.	ECONOMIC BENEFITS	59
	9.1 ECONOMIC BENEFITS TO THE WESTERN AUSTRALIAN	
	ROCK LOBSTER INDUSTRY	59

	9.1.1 Nett economic benefit of changing the catch flow	5
	9.1.2 Capital saving in holding tank construction	6
0.2		6
9.2		. 0
FINC	INGS AND CONSIDERATIONS	. 6
REQI	JIREMENTS OF A FISHERY MANAGEMENT SYSTEM	. 6
11.1	GENERAL	. 6
11.2	ANALYSIS OF FINDINGS	. 6
11.3	RECOMMENDATIONS WITH RESPECT TO A FISHERY	
,	MANAGEMENT SYSTEM	. 6
		,
PRO\	/ISIONS	. 7
12.1	RESEARCH AND FURTHER ASSESSMENT	. 7
12.1 12.2	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	.7 .7
12.1 12.2 DISC	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	.7 .7
12.1 12.2 DISC	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	.7 .7 .7
12.1 12.2 DISC	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	.7 .7 .7
12.1 12.2 DISC PEND	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7 . 7 . 7
12.1 12.2 DISC PEND	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY LAIMER	. 7 . 7 . 7
12.1 12.2 DISC PEND I	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7 . 7 . 7
12.1 12.2 DISC PEND I I	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7 . 7 . 7
12.1 12.2 DISC PEND I II	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY LAIMER	. 7 . 7 . 7
12.1 12.2 DISC PEND I II	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7 . 7 . 7
12.1 12.2 DISC PEND I II III	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY LAIMER ICES Explanation of the use of an economic model for the 1992/93 lobster season Department of Fisheries grade and catch estimates Converting catch grades to production grades	. 7 . 7
12.1 12.2 DISC PEND I II III	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY LAIMER	. 7 . 7 . 7
12.1 12.2 DISC PEND I II III	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY LAIMER ICES Explanation of the use of an economic model for the 1992/93 lobster season Department of Fisheries grade and catch estimates Converting catch grades to production grades	. 7
12.1 12.2 DISC PEND I II III	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7
12.1 12.2 DISC PEND I II III	RESEARCH AND FURTHER ASSESSMENT REQUIREMENTS FOR INDUSTRY	. 7

FOREWORD

Thirty years ago when frozen lobster tails were the only product produced from the Western Australian lobster catch they were sent by vessel to US agents to be held in store and then supplied to a market whose principal consumption period was in the spring and summer of the northern hemisphere. The skill of the agent was in matching the supply to the demand so that the market obtained continuity of supply without being oversupplied. The distribution objective was to optimise the return by understanding and responding to the needs of the market. Properly managed the supply of frozen lobster tails would last until production from the new season became available. If the market was in short supply by December exporters would air freight new season production of lobster tails to obtain the premium brought on by the short supply. The exporter would look forward to selling price improvements during the course of the year that would be more than sufficient to cover holding costs. There were exceptions to this when catch fluctuations and demand changes resulted in a shortage of supply with prices escalating too far and then when there were oversupply prices would collapse, invariably falling further than merited.

The lobster tail it should be noted was being consumed by a market that was not particularly pedantic about the size, colour or the condition of the lobster. Nor did it matter all that much when the catch was produced since it could be stored and distributed as required.

The emergence of a boiled lobster market in Japan brought with it very specific demands as to the condition, colour and size of the lobster. But the boiled lobster that has dominated lobster exports in the last ten years at least was delivered to the market in frozen form and could be stored so there was no particular demands on when the catch was actually produced. However, with this new market came a system of outright purchase where instead of the lobster industry responding to the consumption pattern of the market the product was being bought outright by importers who would in their own right deliver the product to the market just as the US agents may have done with lobster tails. The only difference with the boiled lobster distribution was that the importer should benefit from the gains made in distribution and not the producer.

It has only been since the emergence of the live lobster market that the lobster industry has seriously questioned the condition and timing of the catch. Live lobster not only demand a high quality lobster from the catch but the lobster market requires

supply a few days prior to consumption. The live product cannot be stored for any extended period and is normally consumed within a few days of arrival. If importers do not have supplies of Western Australian live lobster then demand is lost, either replaced by lobster from another source or by another product.

There is now a considerable level of support for understanding how the lobster markets behave and how the Western Australian lobster industry can present itself to best fit the requirements of the market. What it amounts to in effect is nothing more than a return to the principles that applied to the lobster tail market where the product was delivered as close as possible to the consumption pattern of the market. However, with live lobster beginning to dominate the economics of the lobster industry it is not simply a case of understanding the market and supplying the frozen product from storage, but ensuring that the catch is available so that the lobster industry can benefit from the highest value market.

It is useful to remember that thirty years ago there was one lobster export product and one market. Today there are four principal product types within which each size category can have a special market requirement, constituting in effect up to twentyeight sub-products (4 products x 7 size categories) that are sold to three or four main markets and a host of minor markets. The economic optimisation equation is now considerably more complex than it ever was, making it imperative that the managers and the processors and the industry generally, fully understand those factors that determine the economic destiny of the industry so that they can best act to obtain the maximum return from the catch. It is hoped that this report will make a useful contribution to that understanding.

INTRODUCTION

In October 1992 a special Sub-Committee of the Rock Lobster Industry Advisory Committee was set up to consider and evaluate future management strategies for the rock lobster fishery.

In May 1993 it was recorded that the Sub-Committee had identified two principal areas of investigation one of which being whether the present arrangement of the fishing season provides the potential for maximising the financial return to the industry. Pursuant to this the Director of Fisheries commissioned a marketing study that is the basis of this report. This study was commenced in early October 1993 and completed in May 1994.

This study looked at the market implications of fishery's management strategies. In particular it assesses how the existing management structure limits the potential for the lobster industry to maximise the financial return, and in so doing provides an insight into the characteristics and behaviour of the market.

It was an objective of the study to make findings and to deliver a suggested management structure based on those findings. This report contains those findings and the suggested management structure. In arriving at an appropriate structure, however, it became necessary to set certain ground rules. The determination of the structure is not constrained by external factors such as the cost of enforcement and the practical complexities of administration - these were matters for the Sub-Committee to consider in due course. Nor did it take account of the economics of catching lobster as this is the subject of another study. Furthermore it was thought prudent not to be constrained in the first instance by specific management options for to do so might inhibit the development of the optimum strategy. It was considered more appropriate that alternative strategies be developed subsequent to this report so that knowledge of those factors may help determine the optimum strategy.

The format of this report has been designed to first provide an explanation of the fundamental economics of the industry with respect to production and markets and then to use this understanding to explain the interaction between the market and the fishery. In particular, the report describes the products that are produced from the catch, their history and their production pattern through the course of a season. It described the factors that determine the worth of the catch and how these factors can be managed to optimise the worth of the catch. In particular it shows how the

catch flow, which is the weight, composition and timing of catch, is fundamental to the financial optimisation of the catch.

The study concentrated its evaluation on the 1992/93 season, this being the most recent full season on which to base an assessment. It derives a number of general findings that are supported by the outcome of the 1992/93 season. A financial computer model of the processing sector of the industry has been used to conduct the analysis and to examine within nominated constraints, the economic impact of an alternative catch flow.

This study has been based on a range of material derived from a number of relevant sources. The economic model of the 1992/93 season has been built on information supplied from some of those sources. The assistance of those who provided information is gratefully acknowledged as is the contribution of those who provided counselling from time to time on various matters relating to the lobster markets.

1. CATCH, PRODUCT AND MARKET OVERVIEW

The lobster catch, the products produced from the catch and the markets are the essential elements of this study. A general appreciation of these should prove valuable in understanding this report.

1.1 CATCH

The Western Australian lobster catch is based on the puerulus settlement that takes place approximately four years before the lobster reach a legally catchable size. The influence of a 'settlement' on the catch is mainly applicable to the second half of the season three years on and the first half of the season four years on. The 'settlement' can cause a season to season fluctuation in catch and at the same time can cause a change in the relationship of catches in the first half of the season to catches in the second half of the season. Furthermore the settlement can result in a variation in the grades of the lobster caught. A catch that results from a high settlement will have a higher content of the smaller size lobster whereas a catch resulting from a poor settlement will have a lower content of small lobster. While there can be some considerable fluctuation in catch weight between seasons, up to the 1992/93 season the pattern of catching within a season has remained fairly constant. This pattern may well change to some extent in the 93/94 season following the implementation of new management measures that should blunt the usual December catch and increase the catch between February and June.

The following is the graph of catches of western rock lobster per season since the the 1976/77 season:



The graph reveals the extent of season to season catch fluctuation that on some occasions has seen movement of up to 50% with movements between peaks and corresponding valleys of more than 50%.

A graph of the lobster season's monthly catch pattern for the last 11 years is provided in the following:



The graph shows a consistent pattern with a distinct catch peak in December, two lesser peaks in March and April and relatively low catches in the months of November and June. This pattern reflects what is termed the 'rush to fish' behaviour of fishermen that results from a management system that is based on input controls. The 'rush to fish' behaviour is the effect of fishermen catching as much as they can as soon as they can and if possible before anybody else does. The December peak catch reflects the availability of new lobster stock as a result of the November moult and as well, the vulnerability of the newly moulted white shell lobster (the 'whites') as they migrate from inshore reefs. The March and April peak results from the opening of the Abrolhos Island season and the availability of new lobster stocks on the coast as a result of a February moult. There are also moults at the end of May and August.

1.2 PRODUCTS AND MARKETS

Lobster markets consume lobster each day of each year. Some 80% of the product produced from the 1992/93 catch was frozen and hence could be bought and stored and supplied on any day. 20% of the catch was sold in live form and would have been consumed within a few days of arriving at its destination.

The lobster catch is converted into the following products and by-products:

Products -

Live lobster Boiled lobster - Frozen or chilled Frozen whole raw lobster Frozen lobster tails By products (from lobster tail processing) -Lobster heads Lobster meat Lobster paste

Almost the entire catch is processed for export markets however there is a small but growing domestic market. Frozen boiled lobster that fails to meet export requirements, but in all other respects are sound, represent the bulk of local market supply.



The following chart shows the history of lobster product production:

The diagram clearly shows the growth of boiled lobster production and the decline of lobster tail production. It also shows the sustained growth of live lobster production and particularly the

substantial increase in the 1992/93 season. Conclusions from this graph would be incomplete without showing the history of lobster production as measured by the

share of the catch since the above production figures were achieved against a widely fluctuating catch.



The following graph shows product catch share over the same eight seasons as that shown above:

The catch share graph suggests that the lobster tail decline may have only been arrested by virtue of the higher catches in the last two seasons. It also shows that live lobster and frozen whole raw lobster were the only products to substantially increase their 1992/93 season catch share.

Relative worth of lobster products

In terms of worth per grade per kilo of catch (refer definition Section 2.2.1) live lobster have in recent years been the industry's most valuable export lobster product however live lobster represented a relatively small proportion of the catch and only in the 1992/93 season did it reach 20% of the catch. In terms of gross worth boiled lobster with its larger share of the catch has been the industry's most valuable product.

At times the margin in favour of live lobster has been considerable although it can be said that at other times and depending upon market conditions size A frozen boiled red shell lobster could have replaced live lobster as the most valuable product.

There are two main markets for live lobster, the Japanese market and the Taiwanese market of which the Japanese market is the more valuable. The second most valuable product grade for grade has been small (size A) frozen boiled red coloured lobster that are bought almost exclusively by Japan. Frozen whole raw lobster is the

next most valuable product and competes at times against boiled lobster for Japan. Boiled lobster produced from white lobster ('pinks') and lobster tails for the US market have been the least valuable products. The worth of each product is described in Section 2.2.1.

1.2.1 Live lobster

Live lobster are normally prime quality vigorous lobster selected from the catch, held in specially designed holding tanks and then packed for air transport to their markets. On arrival at their destination the lobster are returned to holding tanks before being delivered to customers. In times of shortage there have been instances where the importers' customers have taken delivery of the insulated shipping containers direct from the consignment.

Live lobster are packed for export in polystyrene containers containing 8kg, 9kg or 10kg nett weight of lobster. Live lobster lose an estimated 5 - 6% of their catch weight before reaching the market.

Live lobster production has grown rapidly in recent years. The following is a graph of live lobster production and catch for the last eight seasons:



Note the steady growth in production that occurred 1991/92 up until the season despite fluctuating catches. The very rapid increase in the 1992/93 production was season due to a number of factors including a lower selling price, the expansion of the industry holding tank

capacity and the availability of air space. The rapid growth created a considerable amount of interest and undoubtedly influenced the very substantial expansion in holding tank capacity that took place prior to the commencement of the 1993/94 season. The following is a graph of the monthly production of live lobster relative to monthly catch for the 1992/93 season:



The production of live lobster from month to month during the course of the season is relatively steady compared to other lobster export products and under normal circumstances could be assumed to reflect the consumption pattern within the market. The production

was particularly strong in the last four months of the 1992/93 season and this may have been in part due to an increase in holding tank capacity as the season progressed although demand does normally increase during this time.

The following graph shows live lobster production each month for the last three seasons compared to the average monthly catch for the same three seasons:



The production graph illustrates a typical trend with production firm in December, declining in January and February then subject and to availability of suitable catch, increasing strongly to the end of the season.

Live lobster demonstrates its market strength in times of low catch when it can pay the price necessary to secure the high share of the catch that it needs to meet demand. Consider the following catch share graph that shows what percentage share of the monthly catch was used for live lobster production:



Note in particular the low catch share in December when the catch is at its peak and the relatively low catch share in March and April when the catch is at its next highest level. These months of low catch share should be contrasted with the very high catch share achieved in May and June when the catch is in decline but the demand is strong.

What this catch share demonstrates is the nature of the live product. It must be purchased for immediate consumption and hence importers cannot take advantage of peak catches to buy and if necessary store which they can with frozen lobster products.

Live lobster in the past has been supplied to markets in Japan and Taiwan. The size specifications and the economics of the two markets are very different. The Japanese prefer size A lobster and a reasonable content of size B lobster for which they are willing to pay a considerable premium compared to other live lobster markets. The Taiwan market takes grade A, B, C and a proportion of the remaining sizes. There is a new market emerging in mainland China that offers increased potential for live lobster growth. Furthermore the Chinese consumers are showing an interest in taking all sizes of lobster thus making more of the catch weight suitable for live lobster production.

Live lobster are sold outright to Japanese importers at prices quoted in Yen and sold outright to Taiwanese importers at prices quoted in US dollars.

1.2.2 Frozen boiled lobster

Boiled lobster are normally healthy lobster selected for processing with most appendages intact. They are normally drowned in fresh water and then boiled in a brine solution after which they are packed and frozen for export.

Boiled lobster are packed in cardboard cartons containing 10kg nett weight. Boiled lobster lose an estimated 8-10% of the catch weight before they reach the market.

This weight loss has considerable commercial significance in that it is responsible for converting a proportion of lobster that was size B at the time of catching into a higher valued size A boiled lobster.

The following graph shows the production of boiled lobster over eight seasons and the catch for the corresponding period:



Boiled lobster production has tended to follow the catch with the pattern notable exception of the 1992/93 season when boiled lobster markets were somewhat depressed.

Boiled lobster represented 42% of the 1992/93 season catch of 12 million kilos but its share of the catch peaked in the 1991/92 season when it represented nearly 60% of the catch.

The following graph shows the monthly production of export frozen boiled lobster and monthly catch for the 1992/93 season:



Note that most boiled lobster is produced in the month of December and the months of March and April which are also the high catch months. This is significant because the product is frozen and can be stored, permitting the buyer to take advantage of lower purchase prices that can be achieved when there

is excess product and reduced competition in high catch months.

The monthly catch share for boiled lobster is shown in the following:

The catch share for boiled lobster peaks in March as a result of the Japanese interest in small red lobster that are in abundance at that time. This comes as a



result of the opening of the Abrolhos season on 15th March and the coastal 'run' following the February moult. This pattern continues into April but not at the same rate with the bulk of the small lobster having been taken in the second half of March. The boiled lobster catch

share is also high in February because it is a low catch month and the Japanese have begun buying the red lobster that have just begun to emerge. The high catch share in December is mainly attributable to buying for the Taiwan market.

Boiled lobster are supplied to two main markets, Japan and Taiwan. The economics of the two markets and their preferences are entirely different with the Japanese preferring the small grade A red lobster for which they pay a premium, reluctantly taking a small percentage of grade B boiled lobster in the consignment. The Taiwanese are prepared to take grades A, B, C and some grade D boiled lobster however they do not compete with the Japanese for the red grade A lobster. They will also take the 'white' (in boiled terms referred to as 'pinks') lobster caught between late November and early January. The Japanese will consider purchasing grade A white lobster if the price is sufficiently discounted against the price of the same size red lobster. Normally the acceptable price difference is US\$4.00 to US\$5.00 per kilo or, in the domestic market, around 500 yen.

Whole boiled lobster are sold outright at prices expressed in US dollars.

1.2.3 Frozen lobster tails

Frozen lobster tails are produced from whole lobster. The head is removed during processing thus there is no need for the lobster to be intact when processed. As a result lobster that are not suitable for live or boiled production can be processed as

lobster tails. In general, lobster tails are produced because they are not suitable for live, boiled or whole raw lobster production or because the lobster are of larger size and not popular in other markets or because the processor considers that the US market will deliver a price that makes them more valuable than alternative product markets.

Frozen lobster tails at one time represented the entire catch. The catch share has dwindled and lobster tails now represent less than 30% of the catch and likely to decline further making the lobster tail market more volatile.

The following graph shows the production of lobster tails relative to catch for the last eight seasons:



The decline in lobster tail production is clearly apparent although it would appear to have stabilised over the last three years. This is based on higher catches and therefore may be shortlived.

The decline has been more pronounced for some grades than it would seem with the smaller sized lobster being diverted to the boiled and live markets leaving the lobster tail export shipments with a much higher content of larger size lobster. It has been the larger size lobster, damaged product and the 'whites' catch that has sustained supply to the lobster tail market.

Lobster tails are raw lobster with the heads removed. They are packed in cardboard cartons containing 25lb nett weight of lobster tails. The lobster loses about 60% of its catch weight during processing.

Monthly production of lobster tails and monthly catch is shown in the following graph:



The production of lobster tails broadly follows the catch graph. This can be explained in part by the fact that there is always some component of the lobster catch that because of damage to the lobster or because of the lack of demand for the larger sized lobster makes 'tailing' the only option.

In addition, there can be occasions where the processor prefers to produce lobster tails relative to some other products. In December for example, the high catch and the disinterest by some markets in the white lobster, means that the catch cannot be absorbed by other product markets without debasing the market by lowering the price and in such instances lobster tails can be considered to be a more profitable production option.

January is the second highest lobster tail production month despite the lower catch. This is due to the disinterest by the Japanese in the larger white lobster being caught at that time and a decline in demand by the Taiwanese.

The following graph shows the lobster tail catch share and the catch for each month of the 1992/93 season:



Note the high catch share in December which is the highest catch month. Note also the higher catch share in January which as explained is the month when the catch is of least interest to other markets. Were it not for the requirements of the live lobster market supplied from

a relatively small catch, January would easily be the lowest worth month.

Lobster tails are sold almost exclusively in the United States. They are distributed on a consignment basis through agents in the US who provide processors with an advance payment against the product shipped. The processor uses this advance payment to either pay or provide an advance to fishermen. Under the consignment system the lobster are not usually sold for two to three or more months after they are produced hence there is some difficulty at the time of production to assess the comparative worth of producing lobster tales relative to other products. The lobster tail market is considered to be a market of last resort since it can and does take product that is not required by other markets. It should be noted however that in the 1992/93 season the catch worth of lobster tails exceeded the catch worth of boiled lobster for the Taiwan market.

1.2.4 Frozen whole raw lobster

The development of a market for frozen whole raw lobster is said to have originated from the live lobster market with importers freezing those lobster that arrived at their destination in poor condition and then selling the frozen lobster to the restaurants that purchased live lobster. Frozen whole raw lobster can be used as a back up supply for restaurants on those occasions when live lobster is not available or it is used in other menu items that don't require live product. The following graph shows the production and catch over an eight season period:



The production increased significantly in the 1992/93 season but prior to that annual production had been somewhat erratic.

Frozen whole raw lobster are packed in cardboard cartons containing 10kg nett weight. In the 1992/93 season they accounted for around 8% of the catch.

Frozen whole raw lobster can lose an estimated 2-3% of their catch weight before reaching the market although some processors claim that there is no weight loss with the weight lost by the time the lobster catch is received at the factory being recovered during processing.

The following is a graph of the monthly production of whole raw lobster:



The majority of frozen whole raw lobster production takes place in the large catch months but particularly so in March and April when the lobster are red and of small grades that are more readily available at that time. This

would suggest that the Japanese market are the principal buyers. The relatively high December production of whole raw lobster could be explained by the fact that there was less competition for the catch in that month and there was an opportunity to buy in quantity without forcing prices up.

Purchasing of the majority of frozen product during peak catch times is a typical characteristic of the buying pattern of the lobster industry.

The monthly catch share graph is shown in the following:

Note the particularly high catch share in November. This may well give a distorted indication of the strength of demand since the November 1992 catch was the lowest for at least ten years.



Frozen whole raw lobster are sold outright to Japanese and Taiwanese importers at

prices that are quoted in US dollars.

2. ECONOMIC OVERVIEW

The economics of the lobster industry are based on the harvesting of a catch that is converted into final products of which around 98% are sold on the export markets. The export market income is delivered in foreign currency, the Yen and US\$, and converted to Australian \$'s at an exchange rate that is either the prevailing rate or some contracted rate.

The income derived from the market is used by the processing sector to meet production costs that includes the variable costs of processing labour, freight and packaging, the cost of fixed overheads and the cost of purchasing the lobster catch from fishermen. Nearly 80% of the income received is paid to the fishermen for the catch. For the 92/93 season, fishermen received an estimated 76% of the gross income from the sale of lobster products.

The income that remains after the deduction of variable expenses is referred to herein as the worth of the catch. In this study the determination of the worth of the catch is the principal method of analysis and comparison. This section defines and explains the factors which determine the worth of the catch and how the worth of the catch could be increased.

The non-variable costs of processing which are not included in the calculation of the worth of the catch are assumed to remain constant within the duration of the existing season. Non-variable costs for the purposes of this study will be referred to as fixed costs. Fixed costs become relevant to this study when they change as a result of a change in the duration of the season.

This study does not deal with the economics of catching including the costs associated with catching as a result of any change in the catch flow. This is dealt with in a separate study.

2.1 DETERMINING THE WORTH OF THE CATCH

There are two key economic factors that determine the worth of the catch. These are:

- The flow and composition of the catch
- How the catch is processed and sold

2.1.1 The flow and composition of the catch

The components of catch that determine its worth are the following:

- Catch weight
- The size (grade) of the lobster that make up the catch
- The colour of the lobster
- When the catch is taken
- The fitness of the catch for processing

Catch weight

The weight of catch is for all practical purposes fixed to a maximum in that the fishery should only deliver the sustainable catch.

The size (grade) of lobster caught

The size of lobster caught has important economic consequences. Different sizes of lobster can have a different worth and in general the smaller lobster have been worth more than larger lobster although in recent times the overall gap of worth between grades appears to have diminished. In the 1992/93 season there were some exceptions to the general rule that smaller sizes are more valuable than larger sizes.

The size A lobster is the premium product although a proportion of size B lobster in the catch can have a similar worth. This occurs with boiled lobster as a consequence of weight lost during boiling whereby the smaller size B lobster can become a size A boiled lobster. Furthermore the live lobster market will accept a reasonable proportion of size B lobster included with size A lobster for the one price. This point is particularly relevant when attempting to reconcile the grades of lobster that comprised the delivered catch versus the grades of lobster produced for export.

It has usually been the case in recent years that the higher the content of size A and then size B lobster in the catch the greater the worth of the catch.

The graph of estimated monthly lobster grade mix shows the percentage that each grade category or grade group represented of the monthly catch in the 1992/93



season. These figures are based on the grades of finished products and therefore do not reflect the grades of the delivered catch however they are useful in comparing grades from month to month.

The colour of the lobster

White shell lobster that are caught in the 'whites' run from late November to early January are considered by the Japanese to be an inferior product in their boiled form and worth considerably less than the red lobster. The Japanese discount the white boiled lobster ('pinks') by around US\$4.00 to US\$5.00 per kilo or 500 Yen and are willing to substitute the white lobster with red lobster that are imported from other countries.

The red shell lobster on the other hand is the premium product both in Japan and in other markets. The characteristic that appeals to both the Japanese and Taiwanese markets is the similarity in appearance between the Western Australian lobster and their own indigenous species.

When the catch is taken

When the catch is taken is important. The quantity, grade or size and colour of lobster caught can vary depending upon the timing. Ideally, the catch should be taken when it has its highest potential worth. Or, expressed another way, the catch should be taken in order to satisfy the immediate needs of the most valuable lobster product markets. To take more catch than required at any time by the most valuable lobster product markets places the industry at an economic disadvantage in that the catch must be processed and sold immediately and catch in excess of the immediate needs of the market can then be acquired by importers at low prices and sold cheaply or stored for later sale.

With respect to the timing of the catch the objective should be to deliver the weight of catch at those times when it is required in order to obtain the greatest worth from the market.

Fitness for use

The fitness of the catch for processing can have a significant bearing on the worth of the catch. The degree of fitness for processing of the catch can determine what products are processed and hence determine the worth of the catch. Lobster received in poor condition can mean that valuable products such as live lobster cannot be produced. This can result in a substantial reduction in the worth of the catch.

2.1.2 How the catch is processed and sold

The worth of the catch after receival by processors is determined by the following:

- The worth of each product type for each size (grade) category
- The mix of products produced and sold

The worth of each product type for each size

Each product type for each size has a worth. The greater the worth the more valuable the product. The definition of worth for the purposes of this report is the following:

The worth of a product type for each size

Worth is the value of the product after deducting from the sales income (converted to Australian currency), all variable costs (processing labour, packaging and freight) excepting the price paid to fishermen, and then converting the value so that it is expressed per one kilo of purchased or catch weight. For example, a worth of \$24 per kilo for size A boiled lobster means that one kilo of lobster purchased from a fisherman when processed and sold as size A boiled lobster would provide the processor with \$24 from which to meet overhead costs, pay the fisherman and retain any profit.

Different products and grades have a different worth at different times. The changing demand for certain products, the change of lobster colour, catch weight changes, all affect the worth of the product.

The factors that affect the worth of a lobster product are the following:

- Selling price
- Exchange rate
- Weight loss (otherwise known as yield or recovery)

• Variable processing costs - processing labour, packaging, freight, selling

Selling price

Selling prices for products can be negotiated in advance of production, at the time of production and after production has been completed. The price which is paid will depend among other things upon the availability of catch, the time of the year including the season in the consuming country and the proximity to festivals or special days.

Exchange rate

The sales income from the export sale of lobster products is normally received in foreign currency and needs to be converted into Australian currency either at the current rate of exchange or some contracted rate of exchange.

A change in the exchange rate will alter the worth of products. Exchange rates are outside the control of the processor.

Weight loss

All lobster products with the rare exception of whole raw lobster lose weight during production. A change in the weight loss will mean a change in the worth. A low yield will lower the worth whereas a high yield will increase the worth.

Variable costs

A change in the variable cost will alter the worth. A decline in variable cost will increase the worth whereas an increase in variable cost will reduce the worth.

The calculation of the worth of a product as defined above is an effective way of directly comparing the economic merits of different products.

Definition of catch weight and product weight

This report compares the worth of all products based on the worth of the product per kilo <u>catch weight.</u>

<u>Catch weight</u> is the weight of lobster paid for by the processor. <u>Catch weight</u> is used because it allows for the comparison of all products on the same basis.

<u>Product weight</u> is the weight of the finished product which in most cases is less than the catch weight. This is because most products lose weight in processing. Example. 100 kg of lobster tails would have been produced from 250 kg catch weight of lobster. In this case the catch weight would have been 250 kg and the product weight 100 kg.

The following is an example of the worth per kilo catch weight of different lobster products for one grade (size) of lobster:

TABLE OF PRODUCT WORTH G	RADE A LOBSTER (EXAMPLE ONLY)	
PRODUCT	WORTH / Kg CATCH WEIGHT	
LIVE LOBSTER	\$25.97 per kilo	
FROZEN BOILED LOBSTER	\$19.12 per kilo	
FROZEN WHOLE RAW LOBSTER	\$23.75 per kilo	
FROZEN LOBSTER TAILS	\$18.23 per kilo	

The mix of products produced and sold (product mix)

The second element that determines the worth of the catch is the product mix.

<u>The product mix</u> is the catch weight of lobster used to produce each product type for each grade. Product mix is expressed as a percentage of the total catch weight.

An example of a simple product mix table for one grade (size) of lobster is the following:

CASE 1TABLE OF PRODUCT MIX FOR	GRADE A LOBSTER
PRODUCT	% OF CATCH
LIVE LOBSTER	8%
FROZEN BOILED LOBSTER	51%
FROZEN WHOLE RAW LOBSTER	6%
FROZEN LOBSTER TAILS	35%

The example shows that 8% of the catch of that grade has been converted into live lobster, 51% of the catch of that grade has been converted into frozen boiled lobster, etc.

Based on the above example of product worth and product mix, the worth of the catch used to produce the products in the above example would have been \$19.63 per kilo catch weight.

It should be noted at this point the difference in worth that would result if there was a change in the product mix for the example grade used above. Take for example the following product mix:

CASE 2	TABLE OF PRODUCT MIX FOR GRADE A LOBSTER		
PRODUCT		% OF CATCH	
LIVE LOBST	ER	45%	
FROZEN BOILED LOBSTER		30%	
FROZEN WHOLE RAW LOBSTER		10%	
FROZEN LOBSTER TAILS		15%	

Using the same product worth as used in the previous example and using the revised percentage product mix in Case 2, the catch worth for that grade would be \$22.53 per kilo catch weight.

As will be noted from the above examples, the greater the percentage or content of the more valuable products produced and sold from the catch for that grade the higher the worth of the catch. The higher the percentage of low value products produced and sold from the catch for that grade the lower the worth of the catch.

Catch grade (size) mix

The third element that determines the worth of the catch is the catch grade (size) mix.

<u>The catch grade (size) mix</u> is the catch weight that is represented by each grade (size). Catch grade (size) mix is expressed as a percentage of the total catch weight.

An example of a simple catch grade (size) mix is as follows:

TABLE OF C	CATCH GRADE MIX	
GRADE	CATCH SHARE	
Size A	34%	
Size B	35%	
Size C	14%	
Size D	10%	
Size E	4%	
Size F	2%	
Size G	1%	

2.1.3 Calculating the worth of the catch

The worth of the catch per kilo is the worth for each grade (size) extended by the catch grade mix. The worth of the catch is the worth of the catch per kilo extended by the kilos of catch weight.

2.1.4 Maximising the worth of the catch

To maximise the worth of the catch requires the following:

- Delivering a catch that has the maximum potential worth
- Maximising the worth of each product type for each grade (size)
- Producing and selling the maximum weight of those lobster products with the greatest worth

Delivering a catch that has the maximum potential worth

In order to maximise the worth of the catch, the catch delivered to the processor should have the maximum potential worth. This requires the following:

- The catch should comprise the weight and composition required to meet the immediate needs of the most valuable lobster product markets
- Supplying as close as possible to meet the immediate needs of the most valuable lobster product markets
- Delivery of a catch that has the maximum fitness for processing

The weight and composition of the catch

The weight and composition of the catch is critical. There should be enough weight so that the demands of the most valuable lobster markets can be met. By not having the weight available to meet a demand for live lobster could well mean that the demand is lost. On the other hand to supply the catch in excess of the immediate needs of the most valuable product markets will result in catch being produced in lower value products. The composition of the catch is important. The most valuable lobster product markets may have a specific requirement for certain sizes of lobster which if not available in the desired weight could mean a loss of sale. The colour of the lobster is also important. White lobster relative to red lobster have a low worth, are significantly discounted by the Japanese market and can be substituted for by other suppliers of red lobster.

Supplying the catch as close as possible to the immediate needs of the most valuable lobster product markets

By supplying the catch as close as possible to the immediate needs of the most valuable lobster product markets means that priority is given to meeting the requirements of the high worth product markets and in so doing assists the processor to meet the fundamental objective of producing the maximum content of the most valuable products. Where live lobster is the most valuable product, which has often been the case, it means supplying to this market as and when the market requires production.

Delivery of a catch that has the maximum fitness for processing

The catch should be delivered so that it allows the processor the opportunity to produce the maximum desired weight of any product type. In effect it should be delivered so that if necessary the entire catch could be processed as live lobster for export. If the entire catch is suitable for live lobster production then it would be suitable for producing any lobster export product.

Maximising the worth of each product for each grade (size)

This may be achieved by carrying out the following:

Maximising the selling price of lobster products

The higher the selling price in Australian dollars the greater the worth of the product. The selling price of any one product and grade can vary depending upon: the skill of negotiation; when the product is sold; and the level of competition from other lobster product markets. When there is a high catch there is less product competition for the catch hence the prices could be expected to be lower. Prices usually firm as the season draws to a close and the catches are in decline. Prices generally decline when lobster are plentiful.

Producing lobster products for the lowest cost

The lower the cost to produce the product the greater the worth of the product.

This study is not directly concerned with processor efficiency and cost minimisation however it is relevant to this study to explain that one of the most significant factors influencing production cost is the weight of catch processed. Where spare capacity exists then the greater the catch weight processed the lower the production cost.

Producing and selling the maximum weight of the lobster products with the greatest worth

Having made each product for each size category worth as much as possible then the maximum worth for the catch is obtained by selling the highest content of lobster products with the greatest worth.

In order to achieve this objective there are a number of criteria that need to be satisfied, namely:

- The availability of the required weight and composition of lobster catch
- The fitness for use
- The capacity of the processing sector to produce the product

Availability of enough suitable product

(This subject has been previously considered under Section 2.1)

The quantity of product required and the size of the lobster required at any time varies depending on the market and the time of the year. In order to sell and produce the maximum weight of the most valuable product requires that the processor has received a catch comprising the requisite weight of lobster of the desired size and colour.

Fitness for use

(This subject has been previously considered under Section 2.1)

To produce the highest content of the most valuable products necessitates that the catch be fit for processing in the desired form. For example, where live lobster is the most valuable product and the weight required cannot be met, the loss of product due to the poor condition of the lobster prevents the processor from producing the maximum content of the most valuable product.

Processing capacity

In order to produce the maximum content of the most valuable products the processor must have the capacity necessary to produce the required weight. This has in the past been a constraint to the production of live lobster particularly during peak demand times when there may not have been enough holding tank capacity to meet the demand and the catch had to be processed in some other form. Furthermore, to increase the yield of live lobster from the catch the tanks need to have the capacity to be able to absorb peak daily catches that can be substantially greater than the average catch over a period.

The above illustrates that the achieving of an optimum product mix and a maximum worth is a dynamic calculation very time dependent and requiring a precise understanding of the market and when it consumes the lobster products.

2.2 EXTENDED SEASON COST

It is assumed that fixed costs remain the same within the duration of the existing season irrespective of any change to the flow of catch within that period. Any extension to the duration of the current season will result in an increase in some fixed costs less the effect of any cost savings or benefits which result from an extended season.

2.3 NETT ECONOMIC BENEFIT

The nett economic benefit for the purposes of this report is defined as follows: The nett economic benefit is the change in the worth of the catch adjusted by any consequential change in extended season cost.

3. ECONOMIC LIMITATIONS OF THE 1992/93 SEASON FISHERY MANAGEMENT STRUCTURE

The following analysis is based on the behaviour of the markets and the fishery up to the 92/93 season. There were significant management changes to the fishery for the 93/94 season that will alter the flow of catch and for the most part it will be necessary to wait and see the effects of the changes.

This study makes use of statistics and other information both actual and estimated that pertain to the 1992/93 lobster season. The 1992/93 season was chosen because it is the most recent and therefore the most likely to demonstrate the current behaviour of the market. The use of 1992/93 season statistics does not imply that the behaviour of the market in 1992/93 will be repeated in the future. The reason for considering the 1992/93 season is solely for the purpose of developing the underlying principle.

----- 0 ------

The lobster fishery is now managed by a system of input controls. For a given fishery stock, these controls that are essentially the number of fishing units (pots) and the period over which the pots can be used (the season) are the essential determinates of the flow of catch from the fishery to the processing sector. The flow of catch, its timing and its composition has a profound effect on the economics of the lobster industry.

The following catch flow factors in particular have limited the ability of the lobster industry to optimise the worth of its catch:

- A catch flow that is determined by the rate at which fishermen can exploit the available stock (the 'rush to fish')
- A catch flow that is constrained to a predetermined period (the season)

3.1 A CATCH FLOW DETERMINED BY HOW FAST FISHERMEN CAN EXPLOIT THE AVAILABLE STOCK

Under the present system of fishery management lobster fishermen have no choice but to catch as much of the available lobster stock in the fishery as soon as they can, irrespective of the requirements of the most valuable lobster product markets. If a fisherman doesn't take a fair share of the stock while it is available then other fishermen will take that share. This results in the aptly named 'rush to fish' practice of fishermen and takes place largely because there is no protection for a fisherman who might choose to defer fishing for whatever reason, including wanting to take advantage of a possible higher beach price later in the season.

Resultant catch flow

As a consequence of the 'rush to fish' the catch is taken when the lobster is available. Accordingly there are two distinct catch peaks that occur because of a flush of new lobster of legally catchable size recruited to the fishery as a result of the two main moults that take place during the season:

The 'whites' catch

There is a substantial catch in late November, December and early January following the new moult of lobster in November. This period is known as the 'whites' season because the bulk of lobster caught have a new white shell. At the moult the juvenile lobster grow some 4mm in their carapace length resulting in a substantial recruitment of new lobster of legally catchable size. In addition, as the newly moulted lobster begin their migration out to sea, they are hungry and particularly vulnerable to exploitation by fishermen. The 'whites' catch (November 15 to January 31) accounts for around 45% of the full season catch.

The March/April catch

There are two contributors to the March/April catch, namely:

The Abrolhos catch. The opening of the Abrolhos Island fishery in mid-March results in a peak catch of small red lobster in March and continuing into April.

The coastal catch. A moult in late February that produces primarily red shelled lobster results in increased catches from the coastal fishery in March and April.

These peak catch periods are evidenced in the following graph of monthly catches for the last eleven years:



The 'whites' catch is manifested in the December peak but in fact overlaps to November and January. The March/April peak is clearly identified.

3.2 A CATCH FLOW CONSTRAINED TO A PREDETERMINED PERIOD (THE SEASON)

Under the existing management system the season commences on 15th November and closes on 30th June. For the period from the 1st July to 14th November the reason is closed and no lobster are caught and processed. During this closed period the world lobster markets consume both live and frozen lobster products. Where this market cannot be satisfied by Western Australian suppliers, product is obtained from alternative suppliers. In the case of live lobster, supply is obtained mainly from New Zealand although other countries are understood to be now experimenting with this market. In the case of frozen lobster the Western Australian lobster can be purchased during the season and stored for later use but where not available could possibly be replaced by product from other countries including in particular Cuba and South Africa.

During the closed season for the Western Australian lobster fishery, markets that have a preference for Western Australian lobster can obtain supplies from other sources and the sale of products with a high worth are lost to the Western Australian industry.
4. SPECIFIC CONSEQUENCES OF THE 'RUSH TO FISH' BASED CATCH FLOW

The catch flow that is determined by the fishery stock and the 'rush to fish' has a significant bearing on the economics of the lobster industry.

The following is a graph of the estimated catch worth per kilo per month for the 1992/93 season. Refer Section 4.4 CONSIDERATIONS WITH RESPECT TO THE 1992/93 SEASON LOBSTER CATCH. The results are based on an economic model of the 1992/93 lobster season. Refer Appendix 1. EXPLANATION OF THE USE OF AN ECONOMIC MODEL FOR THE 1992/93 LOBSTER SEASON.



The following is the table of monthly estimated actual catch worth for the 1992/93 season used in the above graph:

TABLE	TABLE OF ESTIMATED MONTHLY CATCH WORTH (\$'s / kg catch)												
1992/93 SEASON BASE MODEL													
	Nov	Dec	Jan	Feb	Mar	Apr	Мау	Jun	Overall				
Catch worth per kilo	\$23.90	\$19.64	\$19.89	\$21.70	\$22.55	\$22.43	\$23.89	\$26.09 ·	\$21.56				
Catch ('000kg)	241	3,927	1,354	903	1,997	2,098	1,164	579	12,263				

This table shows that the highest catch but lowest catch worth month is December and the highest catch worth month is June which has the lowest monthly catch. The June catch was worth \$5.23 per kilo more in June than in December.

The important features of the catch worth table shown above are:

- The low worth of the very high December catch
- That despite the high worth of the catch at the end of the season the market is not supplied from 1st July through to the 14th November

Note also

- The increasing worth of the catch in the period February through to June.
- The relationship between high catch/low worth and low catch/high worth

The particular consequences of the 'rush to fish' based catch flow to be considered in detail are:

- 1. The low worth of the December catch
- 2. The lack of access to the market from 1st July to 14th November
- 3. The limitation which restricts the industry responding to market opportunities as they arise

4.1 THE EXTRAORDINARY LOW WORTH OF THE DECEMBER CATCH

Approximately one third of the season's catch is caught and sold in December at the lowest per kilo worth for the season. While consideration will be given to the December catch in this analysis the conclusions extend to the entire 'whites' catch which commences in November and abates in January.

The reasons for the low catch worth in December are:

4.1.1 The disproportionately high catch

In the 1992/93 season the December catch was 3.9 million kilos out of a 12.2 million kilo total catch or some 32%. On average it represented around 27% of the season catch and the 'whites' in total, which is the catch to the end of January, representing some 45% of the season's catch.

Due to the high catch the catch exceeds by a substantial margin the needs of the high worth product markets

The following table shows the estimated percentage that each product represented of the catch product mix for each month of the 1992/93 season:

	TABLE OF PRODUCT MIX PER MONTH1992/93 SEASON											
Product	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Overall			
Live Lobster	35%	8%	20%	23%	21%	22%	40%	5 6%	21%			
Boiled Lobster	36%	51%	30%	46%	51%	40%	34%	24%	43%			
Raw	19%	6%	4%	10%	9%	12%	10%	8%	8%			
Lobster Tails	10%	35%	45%	21%	19%	26%	16%	12%	28%			
	100%	100%	100%	100%	100%	100%	100%	100%	100%			

Considering the month of December in particular, the following table shows for each product its percentage share of the catch, the catch weight used to produce the product, the estimated product worth and the premium worth per kilo catch weight for each product for that month:

TABLE OF PRODUCT MIX PER MONTH, CATCH WEIGHT AND ESTIMATED WORTH DECEMBER 1992/93 SEASON

Product	Catch	Catch weight	Estimated worth	Premium*	
	. %	Kilo ('000)	\$/kilo catch	\$/kilo catch	
Live Lobster	8%	331	\$25.97	\$7.74	
Boiled Lobster	51%	1,988	\$19.12	\$0.89 [°]	
Raw	6%	217	\$23.75	\$5.52	
Lobster Tails	35%	1,390	\$18.23	\$0.00	

 Premium is the relative difference between the worth of products for the month with the lowest product lobster tails set to \$0.00 The table above illustrates the extent to which the December catch exceeds the requirements of the high worth product markets. It shows that only 8% or 331 thousand kilos of the December catch were used in production of the high worth live lobster and 6% in the production of high worth whole raw lobster whereas 86% or 3,378 thousand kilos was taken up in lobster tails and frozen boiled lobster that were the two lowest worth products in that month.

The high worth product's market needs in December accounted for only 548 thousand kilos from a catch of 3.9 million kilos.

By way of contrast compare the December figures with those for the month of June:

TABLE OF PRODUCT MIX PER MONTH, CATCH WEIGHT AND ESTIMATED WORTH JUNE 1992/93 SEASON Product Catch Catch weight Est worth Premium*

Product	Catch	Catch weight	Est worth	Premium*	
	%	Kilo ('000)	\$/kilo catch	\$/kilo catch	
Live Lobster	56%	323	\$28.89	\$7.19	
Boiled Lobster	23%	137	\$22.75	\$1.04	
Raw	8%	46	\$22.62	\$0.91	
Lobster Tails	13%	73	\$21.70	\$0.00	

* Premium is the relative difference between the worth of products for the month with the lowest product lobster tails set to \$0.00

From the above table it is noted that in June 56% or 323 thousand kilos of the catch was exported as high worth live lobster compared to 8% in December. All products except raw lobster increased in worth between December and June however the gap in worth between those products and live lobster while reduced remained significant.

Cash flow requirement

The high December catch places an inordinate cash flow pressure on processors to meet fishermen's weekly or fortnightly payments and in so doing forces processors to accept low selling prices. In the month of December 1992 processors would have needed to find around \$55 million to pay fishermen and another \$7 to \$8 million to meet other operating costs. The processing sector of the rock lobster industry has no external industry funding other than that which can be arranged through their own resources and accordingly is reliant on the processing and quick sale of lobster products to generate the funds to pay fishermen.

There is one further effect of this 'forced' selling and low prices in December and that is that it may well provide a bench mark that holds prices down for the remainder of the season particularly with respect to the Taiwanese boiled lobster market.

The fitness for processing of the catch is severely impaired

Daily peak catches during December can easily exceed on board holding tank capacities, the lobster is subjected to rougher handling, there are delays at receival depots and at factories and the weather conditions in December can be severe. Any lobster received in damaged condition can have restricted use and significantly reduced worth. A lobster with broken shell for example is not only unsuitable for live lobster production but could not be packed as whole raw or as frozen boiled lobster and its use would be limited to lobster tail production. During peak catch days in December and the 'whites' period generally, less than 20% of a fishermen's catch could be suitable for live lobster production.

4.1.2 Low worth of products in December

Products produced and sold in December have a lower worth than later in the season.

Consider the following graph that shows the worth of each product per month for the season. In this instance the worth of live and boiled lobster has been shown for both the Japanese and Taiwanese markets to illustrate the very pronounced worth increase in the Japanese products.



This graph depicts a number of fairly typical patterns: the increasing worth of live lobster for Japan as the season progresses; the rise in the worth of live lobster for Taiwan late in the season; and the increased worth of lobster tails as the season progressed. Particularly typical is the way in which the price of boiled lobster for Japan increased once the reds season commenced.

The reasons for the low worth of the catch in December 1992 are attributed to the following:

- The timing of the December catch
- The presence of a high proportion of white lobster in the December catch
- The reduced competition between markets for a share of the catch
- The effects of exchange rate movements

The timing of the December catch

All lobster products are sold to markets in the northern hemisphere where the seasons are opposite to those of the southern hemisphere and where for many of them December production arrives in the middle of their winter. In the case of the US lobster tail market the principal consumption is during the spring and summer in the period from March until July and is the reason why lobster tails have been sold on consignment into that market. A similar situation would appear to exist in other markets where the demand in December is not as strong as it is later in the year. The Japanese live lobster market that dominates the economics of the lobster industry typically pay higher prices as the season moves into their spring

and summer. This is also true to a lesser extent of the Taiwanese live lobster market. Lobster products bought in December, if they are to be held, have either to bear the cost of holding and finance or if they are bought for immediate consumption have to be bought at a sufficiently low price to encourage demand.

The presence of a high proportion of white lobster

The second reason for the low product worth in December is the presence of a high proportion of the commercially inferior white shell lobster. Japanese boiled lobster markets have very reduced interest in this product and at best will discount the price sharply, otherwise they might replace it with red shelled lobster from other sources.

The attitude of the Japanese to boiled lobster produced from the December 'whites' catch has important commercial significance as that market consumes mainly size A and a proportion of size B lobster and these account for some 82% of the December production. The Japanese attitude to white lobster is a significant contributing factor to the low worth of the December and January catch.

The reduced competition between markets for a share of the catch

The high catch means that markets are assured of supply and hence there is reduced competition for a share of the catch. Reduced competition could be expected to cause all prices to be less than they would be had there been greater competition.

The effect of exchange rate movements

The calculation of catch worth has been based on the average exchange rate for the season applied to each month. By applying the average exchange rate monthly distortions caused by exchange rate movements are removed.

4.2 THE LACK OF ACCESS TO THE MARKETS FROM 1ST JULY TO 14TH NOVEMBER

The Western Australian lobster season is closed from 1st July until 14th November of each year. During that time traditional markets for Western Australian rock lobster continue to consume live lobster and frozen boiled and whole raw lobster and where Western Australia lobster products are not available then the demand is satisfied as much as possible from other suppliers.

4.2.1 Live Lobster

The following graph is of Japanese live lobster import statistics showing the total weight of live lobster imported from Australia and New Zealand and the price paid in Yen. Australia and New Zealand represented more than 98% of the Japanese imports of spiny live lobster.



The graph shows that the Japanese market is an importer of live lobster throughout the year. The low level of imports in July through to September is not a reflection of demand but is due to the lack of available product. Live lobster demand in July and August in Japan is understood to be as high as in the months of May and June. This proposition would appear to be supported by the sharp increase in price during July and August. It therefore could be assumed that the weight of Western Australian live lobster exports in the month of June for example could be maintained in the months of July and August and even September if the Western Australian rock lobster season remained open and there was product available to export. The economics of supplying in these months are compelling. In June in the 1992/93 season, 54% of the catch was processed in live form and in that month the catch was estimated to be worth \$5.23 per kilo more than for the month of December. In particular live lobster sold to Japan in that June provided an estimated worth of \$30.31 per kilo and live lobster for Taiwan provided a catch worth of \$22.78 per kilo.

The following graph once again shows Japan live lobster import statistics, however in this instance imports from Australia and New Zealand have been separated:



It can be seen from the above graph that New Zealand dominates Japanese live lobster imports during the Western Australian off-season and accordingly take the benefit of the higher prices that are on offer at that time. It is also of interest to note that New Zealand remains a relatively strong supplier through November and December.

4.2.2 Frozen Lobster

Frozen boiled and frozen whole raw lobsters are consumed by the Japanese market all year round. During the period when the Western Australian lobster season is closed, Western Australian lobsters continue to be consumed. This is because the



product is bought during the season and stored for consumption when supply from Western Australia is no longer available. The principal frozen product is frozen boiled lobster that is consumed primarily at functions of which wedding functions are the principal event. A graph of Japanese wedding statistics as shown in the following reveals that the peak time for weddings in Japan is the months of October and November and to a lesser extent December which in terms of the production date coincides with the period that the Western Australian fishery is closed.

The graph also shows the Japanese imports of frozen lobster from Australia in the same year. While the import figures include frozen lobster from other states of Australia it is not likely to be sufficient to alter the conclusions that can be drawn. What the import statistics show is the import weight peaks in April reflecting production in Western Australia in February and March. From this peak the Japanese imports fall off quickly except for a small peak in August. These figures would suggest that any Western Australian frozen boiled lobster consumed in the months of October, November and December would have been bought and paid for as early as April or May.

Allowing for transportation and processing, it would take approximately six weeks from the time of catching to deliver the product to the market. This means that catch from the Western Australian fishery in July, August and September could meet the wedding demand in the months of October, November and December. By supplying in this manner there would be reduced holding costs and accordingly the industry may be able to negotiate a better price than otherwise possible.

There is however another aspect to the Japanese import statistics. By plotting the imports of Australian frozen lobster against the imports of the two major competing countries Cuba and South Africa it will be noted that the imports of Cuban and South African frozen lobster peak in the months of August through December when the supply from Australia has almost ceased.

During those months when the Australian production is high, the imports from Cuba and South Africa are very low suggesting that the Japanese market, given the choices, have a preference for the Australian product. The competing countries would appear to become active when Australia does not supply or when the supply from Australia is white lobster as in January. An examination of Japanese import prices during the same period shows that Cuba for example obtained a small price increase during the period as did South Africa until September 1992 when the price declined.



Note also that the price of South African frozen lobster actually exceeds the price of Australian frozen lobster for the months of August, September and October. The 1993 statistics that are not yet complete suggest a similar pattern except in this instance the frozen lobster from Cuba attained a superior price to Australia in the months of September and October.



Perhaps the overall conclusion is that major competitors have the potential to take advantage of the Japanese market at those times when the Australian supply is either virtually nonexistent, which is the period July through November or when the Western Australian production is most vulnerable which is during the 'whites' when the

Japanese market could substitute other supplier lobster for 'pink' western rock lobster.

4.3 THE LIMITATION WHICH RESTRICTS THE INDUSTRY RESPONDING TO MARKET OPPORTUNITIES AS THEY ARISE

The 'rush to fish' determines the flow of catch and once the flow is determined the ability of the industry to take advantage of market opportunities is limited. The result of the 'rush to fish' is to quickly exhaust fishery stocks until the weight of catches decline. This effect is particularly evident in the months of May and June. At those times market opportunities cannot be fully realised because there is not enough weight of catch of the required composition remaining in the fishery to meet the demand.

4.4 CONSIDERATIONS WITH RESPECT TO THE 1992/93 SEASON LOBSTER CATCH

The 1992/93 season catch was 12.3 million kilos, the equal second highest ever recorded and 1.7 million kilos above the 10.6 million kilo average for the last ten seasons. The white's catch was 5.5 million kilos and was the third highest recorded in the last ten seasons.

This high catch could have had some influence on the catch worth calculations as referred to in Section 4. These affects are considered to be the following

Total catch

It has been explained that the high catch in the 1992/93 season exceeded the needs of the high worth product markets, resulting in a higher content of lower worth products thus lowering the worth of the catch. A higher catch was seen to reduce the level of market competition for catch and could have resulted in lower prices.

A lower catch could have resulted in an increase in the catch share of high value products, creating an environment for higher prices and accordingly could increase the worth of the catch. Any increase in the worth of the catch could reduce the potential benefit resulting from a redistribution of the catch.

White's catch

The white's catch in the 1992/93 season well exceeded the requirements of the high worth product markets at that time and as a consequence resulted in a higher content of low value products and possibly lower selling prices due to reduced competition and overall a reduction in the overall worth of the catch per kilo at that time.

A lower white's catch might have been expected to result in a higher content of the more valuable products, an increase in prices resulting from increased competition and an overall increase in the worth of the white's catch. This could reduce the difference between the worth of the catch in the white's and the worth of the catch in the other months.

SUMMARY

While the 1992/93 catch may have influenced the calculation of the worth of the catch it was not seen to change the fundamental principal being derived from the analysis. What it might have influenced was the order of benefit which might have been derived from a redistribution of a smaller catch.

5. REDUCING THE DECEMBER CATCH AND EXTENDING THE SEASON

5.1 REDUCING THE DECEMBER CATCH

A reduction in the December catch is now seen to be an economic imperative for the lobster industry in that it reduces the content of white lobster from the fishery and reduces the problems created by the very large catch and at the same time allows that weight of the sustainable catch that was saved in December to be available to be caught at a time when it would have a greater worth.

Reducing the catch however is not simply a case of taking less lobster for the month. One reason for the high catch in December is the fact that the lobster are newly moulted and very vulnerable to trapping. In December the lobster are said to have a high catchability. If the lobster are not caught in December and are redistributed to other months their catchability could be expected to decline which would mean that the cost of catching would increase. This factor will be dealt with in a separate study dealing with the economics of catching.

It will be recalled that the worth of the catch as delivered to processors is determined by the following factors:

- Catch weight
- Catch grades
- Lobster colour
- Fitness for use
- Timing of the catch

Changing the catch flow such as reducing the December catch will result in a change in some or all of the above factors and therefore a change in the worth of the catch. The extent of the change in catch worth resulting from a December reduction in catch will depend upon the method used to reduce the December catch.

There are two ways of reducing the December catch, namely:

5.1.1 Deferring the catch forward

By effectively deferring part of the December catch forward the deferred catch becomes subject to mortalities, growth and colour change. These changes represent both positive and negative economic factors the nett effect of which depends upon the economics prevailing in the particular year. No assessment has been made as to the effects of a deferment of the December catch.

5.1.2 Catching prior to December

The alternative that provides potentially the greatest economic benefit is to reduce the December catch by taking the lobster in July, August and September by allowing a catch of undersize lobster during that time. This lobster caught in July, August and September would be red shell and premium products for the market yet they would be the same lobster that in the November moult would otherwise have changed to legal size white size A and B lobster with a lower worth. It will be recalled that a boiled red size A lobster sells for approximately US\$4.00 to US\$5.00 more than the a size A boiled white lobster. Japanese live lobster prices also normally firm when the red lobster become available. Reducing the December catch by catching prior to December has the following advantages:

- The 75mm lobsters are smaller than size A, have a red shell and therefore could be considered by the Japanese market to be a premium product.
- The lobster are caught prior to incurring any mortality whereas if they were left in the fishery until November/December there would be losses.
- The lobster are caught at an appropriate time being available to meet the demands of the live lobster market which in the existing season structure is lost to the Western Australian lobster industry. Catching in July through September would also result in the availability of frozen red boiled lobster to meet the function market that peaks in October and November.

Whereas reducing the December catch by leaving lobster in the fishery in December is subject to some economic uncertainty, there would appear to be little doubt as to the significant economic benefit of taking the catch prior to December.

5.1.3 Department of Fisheries estimates

The Department of Fisheries Marine Research Laboratories were asked to provide estimates of the impact in terms of catch and grades of catching undersize lobster prior to December in order to reduce the December catch. The monthly catch flow projections and grades used for the example contained in Section 6 of this report have been based on the Department of Fisheries estimates of catch grades that could result from a catch reduction of 2 million kilos in December, the season extended until the 30th September and the taking of 75mm lobster during the period from 1st July to 30th September. The Department of Fisheries figures together with the explanation relevant to the figures is provided in Appendix 2. Note should be taken of the statement attached to the figures and in particular to the reference that the figures are a first draft and represent a rough approximation. Department scientists have suggested that a more comprehensive study of the size content and weight of catch be undertaken at a later time. No account has yet been taken of the effect of the catch flow change resulting from the December reduction on the composition of the catch in future seasons and no attempt has been made to ensure that egg production is either maintained or enhanced to achieve the conservation objective set by the RLIAC.

5.2 EXTENDING THE SEASON

An extension of the season would require processors to maintain a range of services and facilities during the additional time the season remained open. Maintaining these facilities would result in an increase in fixed costs. These costs include:

- Electricity
- Fuel and oil
- Telephone
- Repairs and maintenance
- Wages and salaries
- Inspection

Cost savings or benefits resulting from an extended season are the following:

- Lower interest costs
- Increased utilisation of holding tanks
- Efficiency gains from the possible retention of processing staff on a permanent basis
- Providing continuity of supply to the live lobster market

6. ESTIMATED ECONOMIC IMPACT ON THE 1992/93 SEASON OF A THEORETICAL REDUCTION IN THE DECEMBER 1992 CATCH AND AN EXTENSION OF THE FISHING SEASON

To support the proposition that a change in the catch flow can change the worth of the catch, an analysis has been undertaken using a computer model that has been developed to reflect as far as possible the economic circumstances that prevailed during the course of the 1992/93 season. (With respect to the limitations and other aspects of the Model and an explanation for the data used, please refer to Appendix 1. EXPLANATION OF THE USE OF AN ECONOMIC MODEL FOR THE 1992/93 SEASON.)

The analysis will consider change to the two principal features that affect catch flow:

- A reduction in the December catch
- The extension of the season to 30th September

Using the 1992/93 season as a base the model has then been adjusted to reduce the December catch and to allocate the reduced catch to the months of July, August and September. By comparing the worth of the catch as shown in the base model and the worth of the catch after adjusting for the December reduction and extended season, the gain in worth can be determined. The results of this assessment are intended to show that for the 1992/93 season:

- there would have been an economic benefit to be gained from changing the catch flow to meet the demands of higher worth products; and
- to provide an indication of the magnitude of the economic benefit of changing the catch flow

With respect to the results of the Model please note:

- 1. The results derived from this computer model are based on a range of assumptions and suppositions and additional work will be required to refine and validate the results.
- 2. The results are produced entirely subject to verification and confirmation and further consideration of the monthly catch grades by the Department of Fisheries. Refer page 61 Item 5.

3. The results calculated for the 1992/93 season are not intended to suggest that the change in the worth of the catch would be repeated in any other season.

6.1 1992/93 SEASON BASE MODEL

The base model for the 1992/93 season provides the following table of estimated catch worth each month and for the season:

TABLE	TABLE OF ESTIMATED MONTHLY CATCH WORTH (\$'s / kg catch)												
	1992/93 SEASON BASE MODEL												
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Overall				
Catch worth per kilo	\$23.90	\$19.64	\$19.89	\$21.70	\$22.55	\$22.43	\$23.89	\$26.09	\$21.56				
Catch ('000kg)	241	3,927	1,354	903	1,997	2,098	1,164	579	12,263				

The overall worth for the catch using the base model was \$21.56 per kilo.

The following is the 1992/93 base model graph of worth and catch that was used in Section 4:



6.2 ECONOMIC IMPACT OF REDUCING THE DECEMBER 1992 CATCH

The following are the principal adjustments that have been made to the 1992/93 season base model:

- The December 1992 catch is reduced by 2 million kilos from 3,926,993 kg to 1,926,993 kg.
- The December 1992 production maintains the production of live lobster and whole raw lobster at the levels of the **base model**, that is, the reduction of 2 million kilos is taken primarily from boiled lobster and lobster tail production.
- The reduced December catch **has not been** re-allocated. The object of this example is to show only the effect of reducing the December catch.

 Estimated December Product Mix (1992/93 season)											
Product	Catch share %	Catch share %									
	Initial	After adj'ment									
Live lobster	8%	17%									
Boiled lobster	51%	16%									
Whole raw lobster	6%	11%									
Lobster tails	35%	56%									

Having reduced the December catch and changed the parameters as described the resultant catch worth and catch graph would be as follows:



Page 48 of 71

This graph shows the relative catch profile as a result of the December catch reduction and the revised monthly worth of the catch as a result of the change in catch.

The following is the table of estimated catch worth and catch each month and for the season:

TABLE	OF EST	ΓΙΜΑΤΙ	ED MO	NTHL	Y CAT	CH WC	ORTH (\$'s / kg	catch)	
1	992/93 SE			ECEMB	ER CAT	CH RED		Refer text		
· · · · · · · · · · · · · · · · · · ·	Nov	Dec	Jan	Feb	Mar	Apr	Мау	Jun	Overall	
Catch worth per kilo	\$23.88	\$20.37	\$20.01	\$21.72	\$22.40	\$22.40	\$23.59	\$24.84	\$21.95	
Catch ('000kg)	241	1,927	1,354	903	1,997	2,098	1,164	579	10,263	

The worth of the December 1992 catch after reducing it by 2,000,000 kilos is \$20.37 per kilo. The catch reduction therefore has resulted in an increase of \$0.73 per kilo for the remaining December catch. On a December catch of 1,926,993 kg this would amount to an increase in worth of approximately \$1.4 million.

The economics of reducing the December catch and increasing the worth of December catch cannot be considered in isolation. What also needs to be considered at the same time is what is done with the excess catch. To apply the excess catch to any other month of the existing season could increase its worth but is not likely to achieve any significant gain because it might simply create an excess of product in that particular month thereby reducing the catch worth of that month.

If however the excess catch is applied outside the existing season then the economic benefits can be substantial.

6.3 ECONOMIC IMPACT OF REDUCING THE DECEMBER 1992 CATCH AND EXTENDING THE SEASON UNTIL 30TH SEPTEMBER

The economic impact of both reducing the December 1992 catch as described above and allocating the catch outside the existing season is considered in this example.

6.3.1 Calculation of the change in the worth of the catch

The principal parameters on which the analysis is conducted are the following:

The December 1992 catch is reduced by 2 million kilos.

The December 1992 production maintains the production of live lobster and whole raw lobster at the levels of the base model, that is, the reduction of 2 million kilos is taken from boiled lobster and lobster tail production.

The season is extended to the end of September.

The 2 million kilos taken from December is applied equally to the months of July, August and September.

All recoveries and cost factors are maintained for the extended season.

The selling prices for the period March to September are those applicable to May 1993.

The product mix for the extended months is the same as that applying in June 1993.

The catch lobster sizes that are expected to have resulted from the change in catch flow are those provided by the Department of Fisheries. (Refer Appendix 2 for details and Appendix 1 Item 5 for a further explanation relating to these figures .)

The method used to convert Department of Fisheries catch grades to production grades is explained in Appendix 3.

No account has been taken of the economic impact of a change in catchability of the catch as a result of the change in the catch flow.

No account has been taken of the effect of a catch flow change on the catch in subsequent seasons.

The minimum catch size for lobster from July to September is 75mm.

Based on the parameters above the product worth and catch graph would be as follows:



The graph shows that the worth increased in July, August and September due to the maintenence of the June product mix and the high content of size A lobster.

The following is the table of estimated catch worth and catch each month and for the season as shown in the above graph:

TABLE OF ESTIMATED MONTHLY CATCH-WORTH (\$'s / kg catch)													
1992/93 SEAS	1992/93 SEASON WITH DECEMBER CATCH REDUCED AND SEASON EXTENDED Refer text												
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Overall	
WORTH/ kilo	\$24.51	\$20.67	\$20.14	\$22.03	\$22.63	\$22.48	\$24.13	\$26.36	\$26.34	\$26.34	\$26.92	\$22.97	
CATCH ('000kg)	241	1,927	1,354	903	1,997	2,098	_1,164	579	667	667	667	12,264	

The overall catch worth as a result of extending the 1992/93 season and reducing the December catch, is \$22.97 per kilo of catch. This compares to an overall catch worth in the base model of \$21.56 per kilo of catch. The difference of \$1.41 per kilo

is the increase in the worth of the catch. On the 1992/93 season catch of 12.3 million kilos the increase in catch worth would have been \$17.3 million.

6.3.2 Extended season costs

An extension of the season represents an increase in the fixed costs which were not included in the above calculation of catch worth less cost savings and benefits of an extended season. Refer Section 5.2.

The additional fixed cost to the industry of extending the 1992/93 season by three months is difficult to ascertain as the fixed cost increases for different processors could vary significantly. The fixed cost increase for the industry for extending the 1992/93 season for three months is estimated to be approximately \$2.5 to \$3.5 million which has to be offset by the benefits detailed in Section 5.2. The nett effect is indeterminate depending upon the circumstances of the processing organisations and on the value placed on the provision of market continuity and other factors.

6.3.3 Summary of nett economic benefit

The nett economic benefit in the 1992/93 season based on the above calculations is the increased worth of \$17.3 million as calculated less say \$3.0 million to allow for the nett cost effect of extending the season. No account has been taken of any increase in the cost of catching. This matter is the subject of a separate study.

The nett economic benefit as shown is an indicative figure only. The sole purpose in calculating it was to show that for the 1992/93 season with a hypothetical catch flow that the worth of the catch could increase. It should be noted that:

1. The catch flow that was used was hypothetical and there is no reason to assume that it would be achieved in practice.

2. That the nett economic benefit resulted from the 1992/93 season model based on parameters used in the model and applying in the 1992/93 season and there is no reason why it should be repeated in any other season.

3. The calculation did not seek to optimise the economic benefit.

7. THE INFLUENCE OF CATCH FLOW ON LIVE LOBSTER PRODUCTION

Export live lobster has in recent years begun to have a significant impact on the economics of the lobster industry. This section lists those factors that determine the yield of live lobster and how they are affected by a change in catch flow.

7.1 INCREASING LIVE LOBSTER PRODUCTION

Factors which could contribute to an increase in live lobster exports:

- Extending the period over which live lobster are supplied to the market
- Matching the catch flow to consumption
- Increasing the percentage of the catch that is fit for use as live lobster
- Increasing the shore based holding tank capacity
- Increasing the holding tank capacity at the port of destination
- Increasing the availability of air space
- Increasing the overall level of live lobster exports through the growth of existing markets and the development of new markets

7.2 HOW CATCH FLOW CAN INCREASE LIVE LOBSTER PRODUCTION

A change in catch flow could:

- Result in supply to the market during that period which is the current off-season and thereby gain access to a market which otherwise would have been satisfied by alternative lobster suppliers or substitute products
- Provide access to additional shore based holding tank capacity through the utilisation of idle holding tank capacity

- Provide access to air space which is currently not now utilised for live lobster production
- Provide access to additional port of destination holding tank capacity for the same reasons as explained above
- Reduce catch peaks which would permit lobster to be caught at other more desirable times and reduce the extent of product damage thereby increasing the proportion of lobster suitable for live lobster production

7.2.1 Relationship between holding tank capacity and the 1992/93 season catch profile

The following graph shows the catch profile relative to holding tank capacity. The tank capacity is set at 200 tonnes which is the estimated tank gross holding capacity at the commencement of the 1993/94 season. The tank holding capacity is based on an effective use of tank capacity of 45%, a product holding time in the tanks of 3 days and a live lobster weight loss of 5%.



It is noted that in the months of May and June the holding tank capacity exceeds the catch and in the months of July through October the capacity is unused while in the months of December, March and April there is a considerable weight of catch beyond the holding tank capacity.

It should be noted that the catch profile as shown above indicates the total catch and does not show the weight of catch suitable for live lobster production.

7.2.2 Producing the entire catch as live

A graph of the relationship between the 1992/93 season catch flow and holding tank capacity sufficient to produce the entire catch as live is shown in the following graph:



The amount of holding tank capacity required to ensure that the entire catch flow produced was as live lobster based on the parameters used above for tank utilisation, holding time and weight loss is 800

tonnes.

7.2.3 Comments regarding practical limitations to live lobster production

The following graph has been constructed to allow the production of 60% of the catch as live lobster. It shows the 1992/93 season catch, the estimated amount of tank capacity required to produce 60% of the catch as live and it shows the monthly production of live lobster that would result. It is based on the parameter used above, that is 45% tank capacity utilisation, 5% weight loss and a set of fitness for use parameters adjusted to produce the 60% catch share of live lobster.



It is noted from the above graph that the production of 60% of the catch as live lobster based on the 1992/93 catch flow results in distinct production peaks in December and March/April but with a declining production in May and June which might be presumed to be the peak consumption period in the northern hemisphere. The decline in May and June is due to the reducing catch as the 'rush to fish' reduces the available stock.

In order to produce 60% of the catch as live lobster it required that there was a minimum per month of nearly 60% of the catch being received in condition fit for use in live lobster production. This is because the peak catch have a very substantial influence on the overall catch average hence to achieve a high yield of live lobster from the catch the quality of the peak catches must be near to the catch share being sought.

To receive almost 60% of the peak catch in December which is fit for use would require a substantial improvement in what seems to be the current industry performance in that month. The high catch which can exceed on board holding tanks and the hot weather conditions work against industry realising such a high level of fitness for use. A similar position may apply to the Abrolhos' although the weather conditions would be more favourable and the industry is making changes to its transportation methods, it may still be difficult to produce around 60% of the catch in March in condition suitable for live lobster.

It will be noted that the monthly production pattern which shows a peak in December and peaks in March and April. This pattern does not match the normal consumption pattern and it would appear that in order to sell to this pattern the processors could have to deal in spot markets and probably agree to selling price reductions to induce the market to accept the peak live lobster production levels. Furthermore to achieve this production level it would be necessary to have sufficient air space available to transport the production from peak catches and there would need to be sufficient holding capacity at the destination to hold the peak production on arrival.

It would seem apparent that the extension of the season, the reduction in the December catch and the spread of catch to better match the market demand would increase the production potential of live lobster both in terms of what the market would accept and in terms of the capacity of the industry to deliver the weight.

8. CHANGES TO THE WEIGHT AND COMPOSITION OF THE CATCH

A change in the catch flow could cause a change in the weight and/or composition of the catch compared to what it would have been had the catch been taken under the system of input controls that prevailed in the 1992/93 season. The weight and/or composition of the catch that would have resulted from the input controls as they applied for the 1992/93 season is referred to herein as the **base catch**. The weight of the catch is the gross catch weight and the composition of the catch refers to the configuration of sizes and the colour of the lobster that comprises the catch. A change in the base catch as a result of a redistribution of the catch could result in an increase or a decrease in the worth of the catch compared to what it may have been if the base catch had not changed.

This study has been conducted to assess whether there may be the potential for deriving an increased worth from the lobster catch by changing the flow of the catch and hence the flow of products to the market. The calculations used in Section 6.3 of this report were for a specific case being based on the reduction of the December 1992 catch by 50% and the reduced catch spread equally over each of the three months of an extended season. These calculations relied on preliminary research data (subject to qualification and review) which suggested that the particular redistribution of the catch could be achieved for that year. The information, details of which are provided in Appendix II was for the 1992/93 year only with no assessment of the effect on future years or on breeding stock. The research results were also qualified in other respects as noted in Appendix II.

Section 6.3 deals with one specific change in catch flow to demonstrate that within the conditions that applied in that example that a theoretical change in the catch flow could increase the worth of the catch.

This study makes the assumption that the catch flow could change in any way as required to increase the worth of the catch but does not take into consideration the effect of any change to the base catch other than for the example used in Section 6.3.

A change in the base catch, could enhance any perceived benefit from a redistribution of the catch or it could detract from any perceived benefit derived from the redistribution of the catch.

If it should be shown (Refer Section 12.1) that any change in the catch flow would cause a change in the base catch then this change to the base catch would have to be taken into consideration when assessing the worth of the catch resulting from a redistribution of the catch.

Based on 1992/93 season model used herein, changes to the base catch resulting from a redistribution of the catch which could alter the worth of the catch are the following:

1. An increase or decrease in the weight of the catch

and/or

2. A change in the proportion of each size of lobster which makes up the catch.

and/or

3. A change in the weight ratio of white shell lobster to red shell lobster

The above changes are the imposed changes resulting from a change in the catch flow and specifically exclude changes brought about through a change in the catching practises of fishermen.

9. ECONOMIC BENEFITS

In this study the logic had been developed to explain why a change in the catch flow could increase the worth of the catch. To illustrate this a comparative example based on the 1992/93 season has been used to show that a theoretical change in the catch flow resulted in an increase in the worth of the catch. The purpose of the example was solely to demonstrate the theory. There was no suggestion that the particular catch flow used would be produced in practice nor was there any attempt to optimise the benefit.

The economics of the 1992/93 season were in fact dominated by live lobster with its premium worth and increasing catch share during the course of the season. Whether this particular set of economics will be maintained or improved in future years is not known.

The economic benefit that the industry derives in any future season as a result of a change in catch flow will depend upon the economic circumstances of that season and how the industry utilises those circumstances for its benefit. The primary objective of this study is to show that there could be benefits and to suggest a framework which could provide the potential for deriving the optimum economic benefit.

It is not the intent of this study to justify a change in the catch flow by claiming a specific economic benefit but to show by analysis the potential for deriving economic benefit.

This assessment of economic outcomes assumes that the catch flow can be shifted without suffering any deterioration in the base catch as described in Section 8 above.

The type of economic benefits that could be delivered through a change in the catch flow as proposed herein are the following:

9.1 ECONOMIC BENEFIT TO THE WESTERN AUSTRALIAN LOBSTER INDUSTRY

The potential economic benefits to the Western Australian lobster industry would be provided from the following sources.

9.1.1 Nett economic benefit resulting from a change in catch flow

This is any nett economic benefit resulting from a change to the catch flow which resulted from the production of a higher content of the more valuable product as compared to what the worth of the catch would have been if constrained by the fishery management structure which applied in the 1992/93 season.

In addition, the redistribution of the catch might be expected to result in increased competition for the catch during what were peak catch times resulting in higher selling price and hence an increase product worth as a result of a catch flow change.

It has also been explained that a change in catch flow could increase the potential to produce live lobster over and above that which could be produced from the 1992/93 catch flow. This potential for an increase in catch share of live lobster is an additional economic benefit in favour of changing the catch flow providing that live lobster has a greater worth than other lobster products which would otherwise have been produced from the catch.

Should the desirable demand for live lobster increase to where it represents some 60 - 70% of the catch then the findings suggest that there could be, depending upon the relative worth of live lobster, a further increase in the economic benefit resulting from a management system which will permit the catch flow to shift to meet the demand.

9.1.2 Capital saving in holding tank construction

The holding tank capacity could be effectively increased by approximately 40% if the season is extended until the end of September.

9.2 ECONOMIC BENEFIT TO AUSTRALIA

The additional sales income produced from a change in catch flow and in turn from catch optimisation is received in foreign currency. The increased sales income not only increases foreign currency received into Australia but also increases the amount of money that is spent on Australian services such as transport, packaging materials, etc. Thus when considering the economic benefit of a change in catch flow it is necessary to consider not just the benefit to the lobster industry of an increase in worth but also the benefit to the Australian economy.

The benefit to the Australian economy is the increased amount spent on goods and services over that which would otherwise have been spent on the same goods and services had there been no change in lobster exports. Thus it might be expected

that some portion of the increased expenditure on processing, packaging and freight as shown above would benefit the Australian economy although the actual amount is not known.

10. FINDINGS AND CONSIDERATIONS

The following represent the principal findings of this study together with relevant considerations and are provided subject to the assumptions contained in Section 8 and the provisions contained in Section 12:

- Based on the 1992/93 season model the white's catch as reflected in the month of December has an extraordinary low worth yet it represented some 45% of the seasons catch.
- The market for the high worth live lobster was not catered for in the period July to November 14th of the 1992/93 season and possibly at other times when there may have been insufficient catch to meet demand.
- The input control system of management as it applied in the 1992/93 season together with its season closure effectively predetermined the catch flow irrespective of the needs of the market.

Other findings are as follows:

- The worth of a lobster product can change at any time.
- It is theoretically possible at any time for any lobster export product for any size to have a greater worth than any other lobster export product for that same size although in practice certain export products have generally had a greater worth than other export products within specific size categories.
- Live lobster, or any lobster product, does not have to be the product with the highest worth at all times or any particular time for it to be relevant to the maximisation of the worth of the catch. It's relevance depends upon its relative worth within any catch size category and whether it is choice of processing in this product form or some other product form which has a lower worth.
- Live lobster in the 1992/93 season in general provided a higher worth per catch kilo for any size category than alternative products. Small frozen boiled red lobster have in general been the second most valuable product and from time to time although not necessarily in the 1992/93 season have provided a higher worth than live lobster for the same size category.
- To maximise the worth of the season's catch it is necessary to produce the maximum weight of those products with the highest worth.
- To produce the maximum weight of the products with the highest worth it is necessary to deliver a catch at the time when it has the highest potential worth.
- It is not possible to accurately predetermine the catch flow that provides the maximum worth for the catch although there are some changes to the 1992/93 season catch flow that could be expected to provide important benefits.
- Up until the 1991/92 season around 90% of lobster products have been produced primarily in frozen form and therefore if required could be stored and consumed at a later time.
- Live lobster production at present is normally not stored for any length of time and is understood to be consumed a short time after receival.

- The characteristics of live lobster and the live lobster market and the economic importance of live lobster in recent times has placed a much greater emphasis on when the catch is delivered from the fishery.
- The catch flow pattern of the type that occurred in the 1992/93 season is not conducive to producing a high content of live lobster from the catch.
- A strong Japanese demand for live lobster appears to exist in the months of July to September when the Western Australian fishery is closed and this demand is now being partially met by New Zealand exporters.
- The taking of that quantity of undersize red lobster in the period from the May which otherwise would become white size lobster in the following whites season would seem to be an effective way to reduce the whites catch and at the same time replace that catch with a more valuable lobster.
- Extending the season results in an increase in some fixed costs. For the 1992/93 season these have been broadly estimated at \$2.5 million to \$3.5 million. Offsetting these are the benefits of lower interest rates, increased utilisation of holding tanks, market continuity for live lobster and the advantage of maintaining processing staff on a permanent basis.
- Extending the season may result in an additional catching costs. This is the subject of a separate study and has not been taken into consideration in this study.
- The 'rush to fish' results in a depleted catch in May and June and as a result the lobster industry may not be taking full advantage of market opportunities at that time.

Further findings with regard to the 1992/93 season model:

• The December 1992 peak catch substantially exceeded the requirements of the most valuable lobster product markets at that time and accordingly resulted in the production of a large content of the lowest worth products.

- The white lobster that represented the bulk of the very large December 1992 catch and to a lesser extent the November 1992 and January 1993 catch, were commercially inferior to red lobster.
- The large December 1992 catch is understood to have placed cash flow pressure on the processing sector. Catch flow pressure may result in weaker processors liquidating product at less than optimum levels to obtain funds to pay fishermen.
- In general the high worth of the catch in the month of June 1993 resulted from a high proportion of live lobster obtained from a relatively low catch and from a higher product selling price at that time.
11. REQUIREMENTS OF A FISHERY MANAGEMENT SYSTEM

11.1 GENERAL

Historically lobster products irrespective of their relative worth have been frozen allowing them to be stored and distributed at some later time. While this had disadvantages in that the production would have to be undertaken and committed well ahead of consumption it allowed the catch to be taken as available and accordingly there was little impetus for a change in the catch flow.

The situation has now changed. The characteristics of live lobster and the live lobster market and the economic importance of live lobster in recent times has placed a much greater emphasis on when the catch is delivered from the fishery.

In has been shown from this study that a change in catch flow could offer opportunities to increase the worth of the catch. This section explains those changes so that industry can assess their relative merit.

The assessments contained herein have been based solely on an analysis of the market and in particular how it applied in the 1992/93 season. It is recognised that there are many other factors which need to be considered with respect to changing the industry catch flow and these may well preclude or alter the form of their adoption.

11.2 ANALYSIS OF FINDINGS

The analysis of the 1992/93 season has shown three important outcomes:

- The extraordinary low worth of the white's catch. As this represented some 45% of the 1992/93 season catch it has an important consequence for the overall catch worth.
- The industry being unable to supply the live lobster markets after the end of June and until the 15th November and possibly at other times when there may have been insufficient catch to meet demand.
- The rush to fish behaviour of fishermen effectively predetermines the catch flow irrespective of the needs of the market.

These three outcomes resulted primarily from the catch flow imposed by the input control system of fishery management and the season duration as it was arranged for the 1992/93 season.

Bearing in mind that the lobster industry is dealing with a fixed catch (the sustainable catch) the industry as reflected in the 1992/93 season had a substantial portion of the catch which had a low worth. If this low worth catch could have been redistributed to higher worth products including in particular the live lobster market during an extended season then it is reasonable to conclude that the worth of the catch would have increased although the amount of increase would depend on the cost of redistribution.

To redistribute the catch it is first necessary to extend the season for as long as justifiable but perhaps at least until the end of September thus giving the industry as much access as possible to the live lobster market. It would be prudent however that if the season was to be extended that there be a staged introduction so that the market and other implications could be fully tested.

At the same time it would be necessary to provide the mechanism for the redistribution of the lobster stock so that there would be stock available to the extended season to take advantage of market opportunities.

It has been assumed in this study that the redistribution of the stock does not detract from the base catch. Refer Section 8. If it did then this would need to be taken into account as an offset against the benefits of a stock redistribution. One possible method that would appear to be effective in redistributing the white's catch to the extended season is allowing the catching of undersize lobster which otherwise would have become catchable size white lobster after the following November moult. If this method is practical it would appear to have considerable advantage of providing a pool of lobster for catching in the winter period including during an extended season and depending upon the weight of undersize lobster caught during that time, it would reduce the white's catch accordingly. Furthermore it would replace the lower worth white lobster by what have been higher worth red lobster.

Having provided an extended season and the mechanism for the redistribution of the stock the remaining requirement is to provide a system which ensures that fishermen can take the catch to meet the needs of the high worth product markets. This

mechanism is likely to be either a system based on output controls or a system based on input controls, depending upon suitablility.

The extent to which the season can be extended will need to be determined by others. The need to extend the season is largely driven by the needs of the live lobster market and the aim would be to provide access to live lobster over as long a period as possible. It should be noted however that the prospect of taking undersize small red lobster for production as frozen boiled may be an inducement to take catch in an extended season. There is, however, a cost of extending the season - the increase in processor cost and possibly a cost of catching (the subject of a separate study) and the lobster industry will need to assess the benefits against the cost.

It should be carefully noted that the determination of what the fishery management system should provide to assist the market is being influenced by those factors which determine the recent economics of the industry. In particular it is being influenced by what has been the high worth of live lobster and the growing catch share of live lobster. Because of the recent economics, the management system that seeks to increase the worth of the catch is one that among other things provides maximum exposure to the live lobster market. While the importance of live lobster is illustrated in the 1992/93 season example the industry would need to consider the future of the live lobster market since it plays an important although not exclusive role in the relative worth of live lobster and any decline in its share of the catch then the potential economic benefit in favour of the recommendations with respect to the management system provided herein could decline.

11.3 RECOMMENDATIONS WITH RESPECT TO A FISHERY MANAGEMENT SYSTEM

It is recommended that subject to Section 8 and Section 12 of this report that to assist in overcoming catch worth limitations as reflected from the 1992/93 season model, that provided there has been no change in the market and economic characteristics in all respects from that applicable to the 1992/93 season model as explained herein and that there are the same catch worth limitations which were exhibited in the 1992/93 season model as contained herein, that consideration be given to a fishery management system which would include:

- Extending the duration of the season for as long a period as is considered reasonable but possibly to the end of September. And that there be a staged implementation of the extended season to fully test the market and the overall viability of the proposed extension.
- Providing an effective mechanism to reduce the whites lobster catch by an appropriate weight and make lobster stock available to the winter period until the duration of the extended season (subject to the requirements of Section 8) and in that respect to give consideration to the catching of undersize lobster which otherwise would become white size lobster at the following November moult.
- Providing the mechanism to allow fishermen the potential to take the catch to meet the needs of the high worth product markets.

Page 69 of 71

12. PROVISIONS

12.1 RESEARCH AND FURTHER ASSESSMENT

The items referred to in 11.3 for inclusion in the fishery management system have been prepared solely on the basis of an assessment of the economics of lobster markets. It is therefore would be necessary that the Department of Fisheries lobster research group to assess each of the items and any relevant findings with respect to the following:

1. Redistribution of catch.

Ascertain how and to what extent the redistribution of the catch could change the base catch. Refer Section 8. This would need to be made known to industry for them to assess the feasibility of redistributing the catch. Furthermore to ascertain whether the catch can be redistributed without jeopardising the fishery in any way.

2. Extension of the season

Whether there is any limit on the extent to which the season could be extended without jeopardising the potential of the fishery in any way.

3. Taking of undersize lobster

Whether the taking of undersize lobster as described herein would be effective in reducing the white's catch and could be achieved without jeopardising the fishery in any way.

4. Any other outcome

Whether any of the findings, items or any other material in this report either singularly or collectively for any reason whatsoever is/are seen to be disadvantageous to the fishery and/or either inhibit or preclude their adoption.]

12.2 REQUIREMENT FOR INDUSTRY

It is recommended that the lobster industry including any party likely to be affected in any way by the items for inclusion in the fishery management systems should fully scrutinise the structure as listed in Section 11.3 to satisfy themselves as to their reasonability.

13 DISCLAIMER

This Report contains information, assessment and comment believed to be accurate and reliable but which cannot however be guaranteed. No warranty of accuracy or reliability is given and no responsibility arising in any other way for errors and omissions (including responsibility to any person by reason of negligence) is accepted by Marec Pty Ltd or any director or employee or associate of the company.

APPENDIX I

Explanation of the use of an economic model for the 1992/93 lobster season

i

EXPLANATION OF THE USE OF AN ECONOMIC MODEL FOR THE 1992/93 LOBSTER SEASON

In carrying out this study use has been made of an economic model for the 1992/93 season for the following purpose:

To show that there is a considerable disparity between the worth of the catch from month to month during the lobster season

To support the assertion that the current catch flow from the fishery is not the optimum

To demonstrate how by changing the catch flow, including extending the season, the worth of the catch could be increased

There are limitations in the use of an economic computer model however it is considered that the information to be gained from using the model in this study is necessary in meeting the objective of the study. It is believed that the model is sufficiently reliable for the purposes intended however it is essential that in using this report and the results it contains that the readers are aware of why the model is being used and what are the principal limitations in the use of the model.

The limitations of the model and other considerations are as follows:

1. The model is intended to provide support to the general findings of this study. It interprets the economics of the industry only to the extent of demonstrating as far as possible the general findings.

2. That the model is only applicable for the intended purpose. The results should not be used in any other context.

4. The model calculations have been based in part on preliminary catch grade estimates supplied by the Department of Fisheries and adjusted to reflect production grades. The monthly catch grades as supplied are subject to a number of important limitations and will need to be verified to confirm the results contained in the Model. Refer specifically to Appendix II page iv item 5 'Catch grades as a result of catch flow changes'.

ii

5. The model has been developed to demonstrate relative values and comparisons between certain options thereby permitting a degree of approximation which would not be possible had the model been used in other forms of analysis.

6. Selling prices used in the model have been supplied in confidence and therefore cannot be revealed. The methodology used in the model is the property of Marec Pty Ltd and is proprietary to that organisation and cannot be included in this report.

7. The model makes use of variables which are based in part on data supplied as actual and accepted as such without verification. The model also includes estimates and assumptions that cannot necessarily be verified but are considered to be reasonable for the purpose intended.

8. The factors that influenced the economics of the lobster industry in the 1992/93 season can be expected to be different in any future year.

9. The model does not attempt to reverse the effect of foreign currency movements during the 1992/93 season. Refer also Appendix I page iv item 2.

10. No account is taken of different exchange rates relating to the difference in timing in the flow of US dollar advances against lobster tail production and the flow of sales proceeds. This difference is not considered material to the result.

11. The model takes no account of the economic effects of a change in catchability of the lobster as a result of a redistribution of catch.

12. The overall results from the model would appear to be consistent with the estimated final outcomes of the 1992/93 season.

With respect to the data used in the model the following information is provided:

1. Selling prices

<u>(</u>;;

Selling prices are based on the monthly average prices provided from certain processors. The prices used have been supplied in confidence. In the case of US lobster tail market the prices used for any one month in the model are the average selling prices two months in advance. This has been done to provide some measure

of offset for the time delays associated with transport and selling of lobster tails on consignment.

2. Exchange rates

The monthly exchange rate for the conversion of sales income in Yen and US dollars is the average exchange rate for the season. The average exchange rate is calculated by first converting the monthly sales income in Yen and US dollars at the official monthly mid-rates of exchange and then calculating the average exchange rates for both currencies. The average rate of exchange has been used to avoid the effect on the product worth calculation of month to month exchange rate fluctuations.

3. Catch weight

The monthly catch quantities are the industry catch figures as supplied by the Department of Fisheries.

4. Sizes (grades) of lobster

The grades of monthly lobster production have been calculated from actual production figures provided by the Department of Fisheries.

5. Catch grades as a result of catch flow changes

Grades of lobster caught each month as a result of a theoretical change to the catch flow of the 1992/93 season that were used in the example contained in Section 6 of this report were based on the estimated monthly catch grades supplied by the Department of Fisheries and which are provided in Appendix II.

The information supplied by the Department of Fisheries is preliminary only and represents a "first draft" and a "rough approximation" which was all that could be achieved in the time provided. An explanation is provided with the figures provided in Appendix II and should be read and understood. In addition to the information contained therein it should be noted that no account has yet been taken of the effect of the catch flow change resulting from the December reduction and the extended season on the quantity and composition of the catch in future seasons.

The results produced from the Economic Model are entirely subject to verification and further consideration by the Department of Fisheries of the monthly catch grades as supplied.

iv

Fisheries management papers

No.1	The Report of the Southern Western Australian Shark Working Group. Chairman P. Millington (1986).
No.2	The report of the Fish Farming Legislative Review Committee. Chairman P.Rogers (1986).
No.3	Management Measures for the Shark Bay Snapper 1987 Season. P. Millington (1986)
No.4	The Esperance Rock Lobster Working Group. Chairman A. Pallot (1986).
No.5	The Windy Harbour - Augusta Rock Lobster Working Group. Interim Report by the Chairman A. Pallot (1986).
No.6	The King George Sound Purse Seine Fishery Working Group. Chairman R. Brown (1986).
No.7	Management Measures for the Cockburn Sound Mussel Fishery. H. Brayford (1986).
No.8	Report of the Rock Lobster Industry Advisory meeting of 27 January 1987 . Chairman B. Bowen (1987).
No.9	Western Rock Lobster Industry Compensation Study. Arthur Young Services (1987).
No.10	Further Options for Management of the Shark Bay Snapper Fishery. P. Millington (1987).
· No.11	The Shark Bay Scallop Fishery. L. Joll (1987).
No.12	Report of the Rock Lobster Industry Advisory Committee to the Hon Minister for Fisheries 24 September 1987. (1987)
No.13	A Development Plan for the South Coast Inshore Trawl Fishery. (1987)
No.14	Draft Management Plan for the Perth Metropolitan Purse Seine Fishery. P. Millington (1987).
No.15	Draft management plan, Control of barramundi gillnet fishing in the Kimberley. R. S. Brown (1988).
No.16	The South West Trawl Fishery Draft Management Plan. P. Millington (1988).
No.17	The final report of the pearling industry review committee . F.J. Malone, D.A. Hancock, B. Jeffriess (1988).
No.18	Policy for Freshwater Aquaculture in Western Australia. (1988)
No.19	Sport Fishing for Marron in Western Australia - Management for the Future. (1988)
No.20	The Offshore Constitutional Settlement, Western Australia 1988.
No.21	Commercial fishing licensing in Western Australia. (1989)
No.22	Economics and marketing of Western Australian pilchards. SCP Fisheries Consultants Pty Ltd (1988).
No.23	Management of the south-west inshore trawl fishery. N.Moore (1989)
No.24	Management of the Perth metropolitan purse-seine fishery. Noel Moore (1989).
No.25	Rock Lobster Industry Advisory Committee report to the Minister for Fisheries November 1988. (1989)
No.26	A report on marron fishing in Western Australia. Chairman Doug Wenn MLC (1989).
No.27	A review of the Shark Bay pearling industry. Dr. D.A.Hancock, Ph.D, D.Sc (1989).
No.28	Southern demersal gillnet and longline fishery. (1989)
No.29	Distribution and marketing of Western Australian rock lobster. P. Monaghan (1989).
No.30	Foreign investment in the rock lobster industry. (1989)
No.31	Rock Lobster Industry Advisory Committee report to the Hon Minister for Fisheries September 1989. (1989)
No.32	Fishing Licences as security for loans. P. Rogers (1989)
No.33	Guidelines for by-laws for those Abrolhos Islands set aside for fisheries purposes. N. Moore (1989).
No.34	The future for recreational fishing - issues for community discussion. Recreational Fishing Advisory Committee (1990).
No.35	Future policy for charter fishing operations in Western Australia. P. Millington (1990).
No.36	Long term management measures for the Cockburn Sound restricted entry fishery. P. Millington (1990).
No.37	Western rock lobster industry marketing report 1989/90 season. MAREC Pty Ltd (1990).
No.38	The economic impact of recreational fishing in Western Australia. R.K. Lindner, P.B. McLeod (1991).
No.39	Establishment of a registry to record charges against fishing licences when used as security for loans.P. Rogers. (1991)
No.40	The future for Recreational Fishing - Forum Proceedings. Recreational Fishing Advisory Committee (1991)
No.41	The future for Recreational Fishing - The Final Report of the Recreational Fishing Advisory Committee. Recreational Fishing Advisory Committee (1991).
No.42	Appendix to the final report of the Recreational Fishing Advisory Committee. (1991)
No.43	A discussion of options for effort reduction. Southern Gillnet and Demersal Longline Fishery Manage- ment Advisory Committee (1991).
No.44	A study into the feasability of establishing a system for the buy-back of salmon fishing authorisations and related endorsements. (1991)

- No.45 Draft Management Plan, Kimberley Prawn Fishery. (1991)
- No.46 Rock Lobster Industry Advisory Committee, Chairman's report to the Minister (1992)
- No.47 Long term management measures for the Cockburn Sound restricted entry fishery. Summary of submissions and final recommendations for management. P. Millington (1992).
- No.48 Pearl oyster fishery policy guidelines (Western Australian Pearling Act 1990). Western Australian Fisheries Joint Authority (1992).
- No.49 Management plan, Kimberley prawn fishery. (1992)
- No.50 Draft management plan, South West beach seine fishery. D.A. Hall (1993).
- No.51 The west coast shark fishery, draft management plan. D.A. Hall (1993).
- No.52 Review of bag and size limit proposals for Western Australian recreational fishers. F.B. Prokop (May 1993).
- No.53 Rock Lobster Industry Advisory Committee, Chairman's report to the Minister for Fisheries. (May 1993)
- No.54 Rock Lobster Industry Advisory Committee, Management proposals for 1993/94 and 1994/95 western rock lobster season (July 1993).
- No.55 Rock Lobster Industry Advisory Committee, Chairman's report to the Minister for Fisheries on management proposals for 1993/94 and 1994/95 western rock lobster seasons (September 1993).
- No.56 Review of recreational gill, haul and cast netting in Western Australia. F. B. Prokop (October 1993).
- No.57 Management arrangements for the southern demersal gillnet and demersal longline fishery 1994/95 season. (October 1993).
- No.58 The introduction and translocation of fish, crustaceans and molluscs in Western Australia. C. Lawrence (October 1993).
- No.59 Proceedings of the charter boat management workshop (held as part of the 1st National Fisheries Manager Conference). A. E. Magee & F. B. Prokop (November 1993).
- No.60 Bag and size limit information from around Australia (Regulations as at September 1993) F. B. Prokop (January 1993).
- No.62 Management arrangements for specimen shell collection in Western Australia. (J. Barrington, G. Stewart) (June 1994)
- **No.63** Management of the marine aquarium fish fishery. J. Barrington (June 1994)
- No.64 The Warnbro Sound crab fishery draft management plan. (Fiona Crowe) (June 1994)
- No.65 Commercial fishing licensing in Western Australia. Kerrie Naughton. (August 1994) (in press)
- No.66 Future management of recreational gill, haul and cast netting in Western Australia and summary of submissions to the netting review. F.B. Prokop, L.M. Adams (September 1994)
- No.67 Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Evaluation of management options Volume 1. Bernard K. Bowen (September 1994)
- No.68 Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Economic efficiency of alternative input and output based management systems in the western rock lobster fishery, Volume 2. R.K. Lindner (September 1994)
- No.69 Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) A market-based economic assessment for the western rock lobster industry, Volume 3. Marec Pty Ltd (September 1994)
- No.70 Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Law enforcement considerations, Volume 4. Neil McLaughlan (September 1994)