South Australian Northern Zone Rock Lobster Fishery

Rebuilding and Sustainable Management

A report for NUFFIELD AUSTRALIA FARMING SCHOLARS

by Ben Tyley

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Foreword

Falling catch rates and a reducing total allowable catch has led to a reduction in viability for the northern zone rock lobster fishermen.

A period of poor recruitment of juvenile lobsters, and efficiency gains through new technologies, combined with fishermen travelling further, and fishing areas that were previously less exploited, has led to a reduction in the bio-mass.

The aim of my study is to analyze management plans and harvest strategies of some of the northern hemisphere lobster fisheries, by comparing the North American fishery that has stood the test of time and is at the moment having record catches, and the UK and Irish fisheries that are struggling to rebuild fish stocks.
Then through comparison of the management tools being used, some guidance on the way forward (or the measures not to take) can hopefully be integrated into the plan for the northern zone in South Australia.

Many fisheries around the world are facing similar stock number uncertainty, and while Australia is recognised as a world leader in fisheries management there are still many things to be learnt. Some of the projects happening in the northern hemisphere could be well adapted into the management plan here in Australia.

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To all the people who helped along the way, giving their time, knowledge and experiences, I can't thank you enough. You all helped to personalise the experience and turned it into something that couldn't be learnt from reading a report or doing a web search.

Most importantly, to my wife Kerry for allowing me to take on this incredible experience while leaving her behind to deal with everything, and my boys Damon and Jae, thanks for making it all possible.

Abbreviations

NZ – northern zone, Western Aust. border to the Murray River mouth

TAC – total allowable catch

USA – United StatesAmerica

UK – United Kingdom

ITQ - individual transferable quota

EU – European Union

Paurulas – just hatched lobster

Executive Summary

This study is for the purpose of rebuilding the lobster stocks and sustainably managing the future harvest of primarily the Northern Zone rock lobster fishery. Over the past 10 years the total catch of the zone has been steadily decreasing to the present all time low.

The industry has in this time had a complete change of management plans, going from input controls to output restrictions, in the form of individual transferable quota. Since the shift to quota management 7 years ago the total allowable catch has been annually reduced until 2009, hoping to leave more breeding stock in the sea.

The aim of my study has been to network with fishermen, fisheries managers and scientists from the northern hemisphere, where the lobster fishery has survived since the early 1800's, and in places like Nova Scotia which are having record catches.

Travelling through Maine and Canada's east coast where in excess of 25% of the worlds annual lobster catch is caught gave me the opportunity to meet and share knowledge with significant stake holders in the industry. The UK and Ireland also have a similar length history of lobster fishing, but their stock levels are significantly lower. This made for an interesting look at different methods of management and fisheries control.

One of the major differences between the North American fisheries and the South Australian fishery is the amount of scientific research being done. Canada and the U.S. have numerous research bodies and facilities, with the fishing industry and the community (through sponsorship) funding many of these.

One of the most encouraging projects that has just been started in Canada is the study of DNA profiles in lobster. The benefits of being able to trace where a lobster egg hatches, and the path the paurulas take before settling to the sea floor could be invaluable to rebuilding stock levels in lobster fisheries all around the world.

Significant change in the way forward could come in trap design. This is something that has not been changed in the northern zone since moving from input controls when a standard trap was necessary for management purposes. Now that quota management is in place a more efficient trap would mean less time the traps are in the water, therefore less by-catch and lower mortality rates of trapped lobster. This would result in lower running costs for fishermen and more fish being left in the sea.

Another key difference between our industries is public perception. The North American fisheries have strong community support and public understanding of the value of the fishing industry. They are using some brilliant educational and promotional tools that could be well utilized by the Australian industry, to give a better understanding of the fisherman's commitment to responsible stewardship of the marine resources.

After talking to lobster fishermen and fisheries managers in other sectors of the world, South Australia's rock lobster industry needs to better promote its self to the general public. It could be said much damage was done in the 60's and 70's with the style of fishing compared to the present. Awareness of the environment and marine eco system preservation is very much a part of today's fishing practice.

Although there is always room for improvement in management plans, the Northern Zones current plan is more detailed than any I saw in the Northern Hemisphere, which I found encouraging.

Introduction

Fishing for rock lobster in South Australia began in the early 1900's, and in August 1967, following 12 months of investigation by a government committee, it was decided that a boat and trap limit would be imposed on each of the fishing zones (northern and southern) and that no new licences would be issued into the fishery.

The northern zone fishery has progressively reduced the potential fishing effort since 1968 with adjustments to the number of traps and the number of days allowed to be fished during the season (1 Nov- 31 May) where previously the fishery was managed by input controls.
In 2003 the industry moved away from input control management into an individual transferable quota management system. The season remains the same and no new licences or traps have been allowed into the fishery.

Since the change to quota management, each year the total allowable catch has been reduced to try and stop the downward trend in catch rates, which peaked in 1992 at just over 1200 tonnes, but had a long term average between 850-900 tonnes. Since the early 2000's the catch rate has been steadily declining to the current level of 310 tonnes.

The decline in the fishery has been blamed on a number of factors, rangeing from changing environmental conditions, the improvements in technology of fishing equipment, bigger and faster boats fishing grounds further away (that in the past were left alone), the higher value of licences and equipment (driving fishermen to work harder to reduce their debts), and, probably the most important, a factor that fishermen have at the moment very little control over is a period of poor recruitment of juvenile lobsters into the fishery.

The current challenge of turning this fishery around, back to the vibrant industry of the 90's is a job that the current management is struggling to achieve. A better understanding of where the juvenile lobsters are coming from so that the stock of breeding adults can be better managed is necessary.

I have been involved in the Northern Zone Rock Lobster fishery for the past 21 years, starting my career as a fisherman in the family business at the age of 19 after finishing a mechanics apprenticeship. Since then I have taken over the family business and have been actively

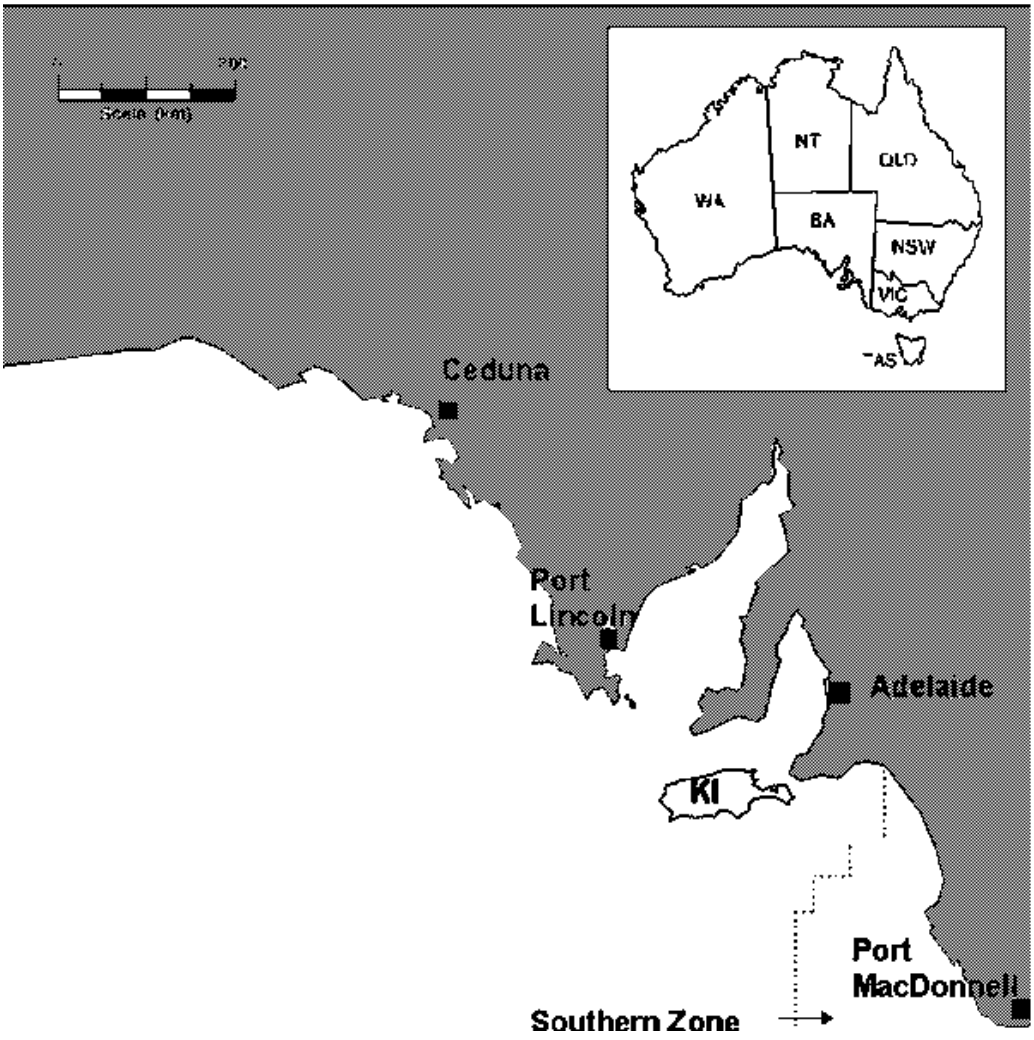
involved in industry associations and management committees, placing a great emphasis on the long term sustainability of the fishery.

There have been significant reductions in the amount of fishing effort, but an accurate and effective way of measuring or enhancing recruitment, is still a major challenge.

Many fisheries around the world are struggling with similar issues and are tackling them in a variety of different ways, some of which could be applied quite well to the N.Z. fishery.

My aims throughout this study have been to open some lines of communication with fishing industries around the northern hemisphere and compare the research and ways of management that they are employing, as well as sharing the knowledge of successes and failures through the different management plans, harvest strategies and stock enhancement projects.

NORTHERN ZONE



The Northern Zone is the area between the Western Australian boarder and the mouth of the Murray River. It encompasses approximately 3700 klm's of coastline and extends from the low water mark out to 200 nautical miles.

The fishing method used for rock lobster in South Australia generally consists of a single trap style fishing, where each trap has its own rope and set of floats on the surface. Traps are individually set on rock or reef, and commonly spread over large areas, rangeing from hard along the shore out to the continental shelf. As opposed to the Canadian style of fishing where a string of up to 20 traps are connected together and set off in lines, with a set of floats at the end.

The placement of the traps on the sea floor is much more critical in the South Australian fishery, as our lobster tend not to walk across the sand/mud to get to the trap, where as the North American lobster is quite happy in the mud.

The Life Cycle of Southern Rock Lobster

Mating between lobsters occurs between the months of April to July, shortly after the female has moulted, with most eggs hatching between September and October. The female carries the fertilised eggs externally under her tail for 4-6 months before hatching, and a large female can carry up to 400 000 eggs.

Rock lobsters have among the longest larval development known for any marine creature, developing through 14 moult stages. After hatching the Naupliosoma larvae leave the female as free swimming plankton, they migrate towards the surface where they moult into a phyllosoma larva. Phyllosoma larva disperses widely with the ocean currents and has been located hundreds of kilometres offshore. This phase of the life cycle lasts between 9 and 20 months, before they change into transparent puerulus, resembling miniature lobsters in shape. The puerulus still live in the plankton, moving up and down in the water column on a daily cycle, coming up near the surface at night and swimming deeper during the day, until they settle to the sea floor. After settlement they develop pigment and moult into bottom dwelling lobster, taking approximately 7 years to reach maturity (depending on location).

Photo's Dept. Primary Industry, Fisheries Research Branch Queenscliff. Vic

Photo B Tyley

Northern Hemisphere Fisheries

Although the American and European lobster are a different species to the lobster caught in the northern zone, the fisheries have a lot of similarities, in regard to how fishermen act and think. Fisheries managers are faced with similar challenges of increasing pressure on fish stocks due to the increasing efficiency of the fishing fleet, and the unpredictability of the climate, which determines where the juveniles travel throughout their evolution into lobsters before they settle on to the sea floor.

The most common management tool that isn't being used in South Australia which I came across was the V notching of female lobsters with eggs. A notch approximately 5mm deep is cut into one of the tail fins so that if that lobster is caught again after she has released her eggs she is protected from being able to be sold until the notch has grown out. This usually takes 2 to 3 malts, allowing time for her to breed again and hopefully be notched again when she next is carrying eggs. Egg bearing females are protected but the V notching is voluntary, although all females that have been notched are protected by law. This is a way of ensuring a good population of fertile females remain in the bio-mass. Although the program is voluntary the general consensus is that the majority of fishermen are participating, seeing that it's for the greater benefit of the fish stocks. The record keeping in this regard could be a little better, with not many fishermen having in depth log book data. The numbers of fish actually caught (size, undersize, spawning) or numbers of V notched released are not recorded accurately, with all catch data coming from the processors in the form of number of pounds landed.

One of the biggest lessons I think Australian fisheries can take from the North American fisheries is changing the public image of the fishing industry. Their fisheries seem to be highly valued by the community and the general public are well educated about the benefits the industry brings to the community as a whole. A great example of this is the Gulf Science Centre in Portland, which is a privately run facility that is funded mainly through sponsorship from the fishing industry, the general community, and a small amount of government funding for specific projects. It has a hands on educational section that every year 5/6 student in the state of Maine goes through and learns about the sustainable way fisheries are being managed, and the benefits the fishing industry brings to the whole community. There is also a scientific section and a section for developing more environmentally friendly fishing equipment. The centre also provides training in the use of these developments to fishermen.

If the Australian fishing community could educate the general population here in a similar way, it would help to dispel some of the "myths" associated with the fishing industry over-

exploiting the marine environment. By raising the public image of the industry and making the community aware that fishermen are responsible custodians of the resource, I feel some of the negative image could be removed.

Raising public awareness and having a cleaner public image would give the fishing industry a higher standing when it comes to dealing with the many forms of bureaucracy which become involved in management issues, and opens the door to working together to solve some of the challenges in managing the whole marine environment.

Eco Friendly

The North American fishermen have been extremely pro-active in the implementation of sinking rope leading up to their buoys. The benefits of not having rope floating on the surface greatly reduce the chances of entanglement of marine animals, such as whales and dolphins, and of other vessels using the waterways. Another innovation that is being widely used is the use of biodegradable clips to hold escape panels closed on one end of the trap. If the trap becomes irretrievable the clips rust away, opening one end of the trap, thereby making it free for animals to walk/swim straight through, and eliminating any ghost fishing of lost gear.

The trap design being used all over North America and most of Europe is vastly different to the traps being used in the South Australian nz. A long rectangular trap with multiple entries and separate parlours to provide separation between larger and smaller animals has proven to be much more efficient than the traditional wooden slat trap or the bee hive design.
It will be well worth exploring the different designs in the nz fishery, not just for the better efficiency (which seems a strange way to go about preserving stocks), but the less time the traps are in the water means lower costs for fishermen, with the added advantages of less by-catch, lower mortality rates caused by predators of the lobster caught in the traps, and a lower amount of undersize and spawning females being removed from their habitat and relocated when returned to the sea.



North American wire and wooden traps with compartments. *South Aust. Trap.*
Note the multiple side entrances and lift up door compared to the single neck entry/exit. Also the clips holding the end wire panel, and there are soft wooden slats that biodegrade quickly opening the sides of the trap if it becomes irretrievable.
Photo's B Tyley

Another innovation has been pioneered by a processing company in Canada, for storing live lobster for extended periods. This allows control over the flow of product into the market place, resulting in less price fluctuation.

The lobster are placed into individual trays stacked on racks in a refrigerated environment, then a stream of cold water is run over the animals flowing through the trays. This induces a state of hibernation, so there is no need to feed the lobster and weight loss is minimal. Also numbers of mortality are low because there is no interaction between the animals. While this is of no real benefit to stock numbers, if a processors operating costs and mortalities are down, and their profits up, that should equate to a better price the fisherman receives for their product.

The specifics of temperature control and water flow rates for this operation are closely guarded, but the benefits being achieved make further investigation of the process attractive for the nz fishery, where the price has considerable fluctuations during the season.

Management Plans

The basic management plans found in the North American lobster fisheries have not changed much since their inception in the early 1900's.

Seasons are still the same and were based on when the fishermen could go to sea due to weather conditions and ice, more than any other reason.

The fishery in Maine still has no limited entry and a 12 month open season, while the fishery on the east coast of Canada has capped licence numbers, and has been divided into 41 fishing zones. Each fishing zone has its own management plan, with variations on size limits, season length, and opening/closing of seasons.

The management rules are mainly driven by the fishing industry, and although the scientific community make recommendations, the majority of licence holders need to agree before anything can change. The number of fishermen and the amount of community support for the industry makes for a strong political force, so the government is reluctant to force change.

Some of the fishing zones in Canada have been broken into smaller management areas, where the fishermen have had to choose which area they want to fish in and then are locked into that area. As a result of this some areas are having faster progress with management changes,

resulting in legal size increases allowing more females to reach maturity and be V notched before being caught again.

The smaller management areas take away some of the challenges in getting a consensus with a large group of spread out stakeholders, but without the knowledge of where the paurulas are travelling to and from, the conservation efforts of one area might only be benefiting another area further down the coast.

One area of New Brunswick engineered a scheme to receive dollar for dollar funding from the state government, for a buyback of licences to reduce fishing effort. Government funded 50% and offered a low interest loan for 50%. The ultimate aim was to remove 10% of the traps in the water. Every licence holder sold 20% of their traps to the scheme at market value, and then had the opportunity to buy 10% back from the pool that had been acquired. This raised the money to pay back the loan and didn't cost the fishermen anything. They still had the money from the 10% of the traps forfeited to the buy back, so that could finance them to buy out retiring fisherman's licences, and build back up to their original trap number without having an actual cost to their business.

The Irish lobster fishery has a similar management plan to the state of Maine. They have a minimum size limit (Maine also has a maximum size limit); egg bearing and V notched females are protected. Their season is open for 12 months of the year and anyone with a registered boat can obtain a licence to catch lobster. There is concern about the rising effort rate, but under the current management arrangements there is no way to cap the catch or the effort. The industry has developed a more in-depth plan with the help of Dr. Oliver Tully, Irelands head crustacean scientist, based at the Marine Institute in Galway, and the staff of Bord Iascigh Mhara (Irish Sea Fisheries Board) and has driven the process of implementation, but the process has stalled at the government level, with government saying they do not have the man power or resources to implement the administration side of the plan.

However with the approaching introduction of marine parks around the Irish coast line the fishing industry needs to meet certain criteria to be allowed to keep fishing within the park areas. Hopefully this will drive the process forward for them.

In Ireland as with the UK, once outside the 6 mile coastal limit the fisheries are governed by the rules of the EU. The management plans of EU fisheries are not a focus of this study.

Stock Enhancement through Hatcheries

Pictou Nova Scotia.

The lobster hatchery in Pictou is a fairly simple set up, comprising a series of small tanks in a shed on the water's edge. There is a small area for public education about the industry and the benefits of the hatchery, but the main focus is on getting more juvenile lobsters into the environment. They have a staff of 3, a scientist, a biologist and a university grad student. The grad student is funded by government, but the rest of the costs are met by the fishing industry and community sponsorship.

Egg bearing females are caught in the wild and supplied to the hatchery by fishermen, where they are stored in a holding tank of water chilled to 4-5 degrees C. They remain there in a semi dormant state until the hatchery is ready for the eggs to hatch. Then after placing them in a hatching tank where the water is slowly warmed to 18-20 degrees C, the eggs will slowly start to hatch, taking between 10 and 14 days. The water flowing through the hatching tank exits over a high division in the tank, then through a sieve catching the newly hatched paurulas with minimum effort. From here the paurulas go into their own tank and for the first 3 days just float around, during which time they are fed on brine shrimp flakes. On day 4 they start to swim for themselves so their diet changes to live brine shrimp. Their development is quite fast and by day14 they have grown to a length of approximately 25mm, and are ready for release into the wild. The release is done by volunteer fishermen transporting them in tanks of water to suitable settlement grounds. Then using a 100mm flexible hose they are pumped to the sea floor. This system gives the juvenile lobster a lot better chance of survival than hatching in the wild, as all preditators are removed during the most vulnerable stages of their life and they are guaranteed to settle in a suitable habitat.

While there is no practical way of tracking the animals from this stage (too small to tag and too expensive to micro chip) the general consensus from diver observations is very positive. This particular hatchery has only been running for 4 years, so the first released lobsters are still 2-3 years away from legal catchable size. Considering that the survival rate for lobsters hatched in the wild is thought to be less than 1%, by the end of this summer the Pictou hatchery hopes to reach in excess of 300 thousand juvenile lobsters released into the wild.

The hatchery I visited in Padstow, Cornwall is a similar set up, run by sponsorship and money generated through their visitor centre. Here there is a lot more emphasis on educating the public and raising the profile of responsible fishing practices. Just under 47 thousand people visited the hatchery in the 09/10 financial year. While the numbers of juveniles being released

is significantly lower (11056 in 09/10) there is a bigger emphasise going into researching different grow-out techniques and on research projects in conjunction with universities, one of which is examining the effects of climate change on lobster.

The hatchery work here is very labour intensive compared to the Pictou hatchery. The juveniles are caught out of the hatchery tanks with a fine net and then placed into individual compartments in the grow-out tanks. This means each one has to be fed and its compartment cleaned, but it has the advantage of better analysis of amounts of feed needed and growth rates on different diets.

The catch and release methods of the breeding stock and juveniles is the same in all the hatcheries I visited, and most of the time the females were released back to the ocean, depending on the dinner menu of the hatchery workers.

Science

The study of lobsters in the northern hemisphere has been ongoing for hundreds of years. The understanding of the life cycle, the social structure at mating time, the places they prefer to live at certain times of the year and the biology of the animals has been studied in depth by quite a number of world renowned scientists and many grad students.

They have done tagging programs, inserted tracking devices under the shell and followed them around using hydro phonic equipment on working lobster boats, with each animal tag having an individual call signal. Under-water bottom surveys have been carried out, along with low tide onshore monitoring of rock pools and rocky shoreline, counting the numbers of newly settled lobsters in known settlement areas. Surveys of the deeper waters are carried out using remote control submarines searching for areas where the big breeders like to live.

Many of the projects are carried out by non government funded facilities like the Lobster Conservatory in Maine, where fishermen and the community fund the running of the centre and donate their time and effort to keeping it running.

A tool that can be extremely useful when it comes to making decisions about managing a fishery is using science from a number of different research facilities, considering that the results of some studies tend to be in favour of those paying the bills. A system where all science is government funded tends to sometimes overlook the fisherman’s interests.

Photo B Tyley

This photo shows an old "lobster pound" that has been donated to the Lobster Conservatory in Friendship Maine. Here scientist Diane Cowan studies the lifecycles of lobster in a semi natural setting. The gates to the pound are open allowing movement in and out, but a wall across the gateway stops the water from completely draining at low tide.

The project that created the most interest for me is just starting in Canada, at the Atlantic Veterinary Collage Lobster Science Centre. There they are doing studies into the blood protein levels to find the ultimate time to harvest, just before the lobster malts when the shell is at its hardest and the body full of meat. There is also work being done to tell how far away from spawning the mature females are, which stage of malt they are in and the general health of the animal. All of this information can be gained from a drop of blood, taken by the fisherman while at sea. The test can be done on board the boat by placing the blood on a slide then into a viewer, with different colours coming up in the viewer depending on the state of the lobster's health and condition. There are also tests being developed for the changing fat and starch content in the meat.

The object of the study is to harvest when the lobster is in its peak condition and gain market advantage.

Currently the work is being carried out by scientists doing trips with the fishermen, until the system is perfected and rolled out for all of industry to be involved in. While the scientists are carrying out this work they are also taking a small cutting off of one of the small fins under the tail. These samples are being stored in vials and catalogued with all the relevant data such as position caught, date, depth, size, sex, malt state and any body damage.

This is the first stage of building a DNA data base on lobster families. One of the aims of this study is to identify genetic markers in lobster that will be able to be traced up and down the coast. This will reveal where a lobster's mother lives and where the egg hatched before drifting in the currents and finally settling to the sea floor.

This kind of information will be one of the best tools available for managing and rebuilding lobster stocks. The lack of information about where the paurulas travel between hatching and settlement, is the biggest challenge of lobster fisheries management the world over.

With this information breeding stocks in certain areas will be able to be protected and ensure that a steady flow of eggs enter the fishery each year.

The collecting of the tissue sample is very simple, and by having the fishermen doing it while they are at work is very cost effective. The DNA testing technology is becoming cheaper all the time and there is an opportunity to involve university students in this part of the project. So for a relatively small cost to industry, the benefits of a project similar to this across Southern Australia could help restore lobster stocks to much higher levels than are currently being experienced.

Photo B Tyley
Scientists from the Atlantic Veterinary Collage Lobster Science Centre doing on board monitoring.

The way forward

- Public perception of the whole fishing industry in Australia needs a facelift.

Australia has some of the best fishing practices in the world, and although there is always room for improvement, the management plans already in place are a long way infront of most of our competitors on the world market.

The industry needs to be more self promotional, and to realise that no one is going to tell a good news story for us. There is a lot of misinformation and distorted facts about fish stock

numbers and fishing practices that are very outdated, and the fishing industry needs to set the story straight.

Facilities like the Gulf Science Centre and the Cornwall Lobster Hatchery are doing a brilliant job of telling good news stories about the industry, and they are driven by people that realise the economic value to the whole community of the fishermen.

If some of the fisheries training facilities here in Australia could tailor an informative, educational and hands on promotional package aimed at senior primary school children, showcasing some of the well managed and sustainable fisheries, then take the package on a tour around the schools, you would be educating the target audience as well as their parents, when the kids go home and talk about what they learnt at school today. An added benefit could also be that when people know that a product is coming from an eco-friendly supply, that product will have buyer preference.

- The trap design used in the nz needs to be reviewed.

The efficiencies that could be gained for the fisherman, as well as the benefits for the whole marine eco-system are too large to be ignored. Having the traps in the water for less time can only have positive effects for all aspects of the fishery. The only down side I can find is the change it will have on catch per unit effort statistics, but that can be rectified by the fishermen continuing to use the same 3 standard research traps that they have been using previously. This would mean that all previous data collected would still be relevant and the ongoing studies would not have to change.

- The DNA work being done in Canada has the potential to be a significant help in tracking where our paurulas are coming from.

Being able to monitor and protect an area of breeding stock will help guarantee the sustainability of the fishery well into the future.

Also with the oncoming implementation of marine protected areas in the waters around the South Australian coast, this information could provide a good guide for the areas to be protected.

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Plain English Compendium Summary

Project Title:	Northern Zone Rock Lobster Fishery Rebuilding and Sustainable Management
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Objectives	To investigate management plans and harvest strategies of northern hemisphere lobster fisheries, compare research projects and technology advances in fisheries that have been active for a much longer period of time than the northern zone.
Background	The rock lobster fishery in the northern zone of South Australia has been experiencing declining catch rates since the end of the 1990's. Various reasons have been blamed for the decline, including environmental conditions and human influences. Since the inception of management in the fishery in 1967 the plan has been constantly evolving, with the biggest change coming in 2003. This saw the removal of input restrictions and a shift to individual transferable quotas. During the period of quota management the total allowable catch has been annually decreased to an all time low of the current 310 tonnes. At its peak in the mid 90's the industry was catching just over 1200 tonnes annually. For the fishermen to remain viable in the long term both the stock numbers need to increase, the fishermen need to become more efficient and market stability needs to be achieved .
Research	Fisheries managers, research facilities, hatcheries, fisheries departments, and many fishermen were visited along the east coast of the U.S.A., Canada, Ireland and the UK. Various different management plans were researched along with the differing results of each plan.
Outcomes	Fisheries management is not a black and white issue. There are many factors that cannot be controlled when dealing with a wild creature in its natural environment. Environmental conditions play a big part in the activities of lobster, so a cautious approach is needed when making changes to long term management plans. -The most encouraging research project being undertaken is the DNA profiling in Canada. The establishment of a data base linking lobster family's and being able to trace where eggs are laid compared to where the paurulas settle on the ocean floor will go a long way in protecting breeding stocks. -The blood protein work also being done in Canada will be quite valuable in terms of delivering the best possible quality product on to the market. -A large emphasis is being placed on public education and awareness of the positive work being done by the fishing industry in terms of eco-friendly fishing practices and having a minimum impact on the environment. -efficiencies in trap design will help the profitability of the fisherman, as well as have a positive effect on the marine eco-system.
Implications	The northern zone still has a long way to go in terms of rebuilding catch rates to historic levels, but after looking at the management of other fisheries I believe it is well on the right track. With the implementation of some of the previously mentioned research programs and efficiencies in trap design, the full recovery of the resource could come about in a shorter time frame and with less financial pain to the fishermen.