IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Port Otago for resource consents to implement Project Next Generation.

STATEMENT OF EVIDENCE OF ROBERT STREET

1.0 INTRODUCTION

1.1 My name is Robert Street (BSc).

1.2 Retired Ministry of Agriculture and Fisheries Scientist, Director of Southern Shellfish Ltd with over 50 years practical and scientific work in Otago and Southland.

1.3 I wish to make the following key points in my submission as to the suitability of AO as the Dump site for Dredge spoils:

- *Impact of the discharge of spoil on the fish life at Dump site AO;*
- *The transport of sediments into coastal areas effecting rock lobster and Paua nursery habitat.*

2.0 CURRENT SYSTEM

2.1 The marine environment off the Otago coast is influenced markedly by the Southland Current. This current moves in a southerly direction down the Fiordland Coast, then through Foveaux Strait and to the south of Stewart Island, where it turns northward to flow up the Otago coast. Current systems serve to transport plankton, including the larval stages of many species, and also any fine sediment material with the flow.

2.2 There has been over the years a pattern of degradation on many beaches to the south of Otago Peninsula, and aggradation on beaches to the north.

2.3 While the general current direction is to the north, during periods of heavy seas from an easterly quarter there is a recognised inshore movement to the south. This feature is noted on marine charts as a guide to shipping.

2.4 That is during "heavy" weather conditions from the east, sediments will be transported inshore from offshore.

3.0 ROCK LOBSTER

3.1 The appendices to this statement describe many features of the rock lobster fishery in Otago, larval recruitment, habitats for the puerulus larvae and later juveniles, migrations etc, and the significance of Macrocystis kelp for rock lobster recruitment.

3.2 The main features of the early stages in the life cycle are summarized as follows:

1.1. From the hatching of eggs to the last larval stage, the puerulus that settle on the bottom takes about 18 months. Recruitment of larvae for the Otago fishery would therefore be from up current, probably Stewart Island and Fiordland.

1.2. To ensure better survival, puerulus larvae that settle require cover in fine crevices or marine growth, as do subsequent small rock lobsters. Any significant reduction in this habitat would adversely affect the numbers of juveniles and hence later recruitment into the fishery. One of the appendices describes habitat requirements for juvenile pincered lobsters in Scotland, and the situation is the same. It further emphasises the necessity to preserve habitats.

1.3. Periodically there are large migrations of immature rock lobsters from North Otago through South Otago to as far as Stewart Island, i.e. always in a southerly counter current direction. The proposed discharge area lies in the path of this migration route, and we don't know what impacts there will be.

1.4. Rock lobsters are mainly nocturnal feeders, leaving creviced cover in reef systems to forage on a variety of marine life. Any changes in normal shifting of bottom sediments that could result in the cover up of attached marine life would cause movement out of the area.

4.0 MACROCYSTIS KELP

4.1 The significance of Macrocystis kelp for rock lobster recruitment is discussed in one of the appendices. Macrocystis is common on reef bottom in the inshore areas of North Otago, and if the bottom has cover, small rock lobsters are present, with of course cyclic variations in their abundance. It is suggested that Macrocystis stipes (stem that supports fronds) may divert drifting puerulus larvae moving inshore, down to the

bottom, to find cover in crevices. It is also possible that larvae seek shelter within the kelp holdfast.

4.2 In California, Macrocystis kelp "forests" have been intensively studied and great emphasis is put on the need to preserve them. Macrocystis provides habitat for a variety of crustaceans, finfish and other species that are important as food or have a role in the ecosystem.

5.0 PAUA

5.1 One of the appendices describes paua habitat and reseeding trials at Papatowai in South Otago. Small paua require a habitat that provides cover, for protection from predators. The photos illustrate the under boulder habitat for small paua. Obviously, if such habitat is going to be covered up by deposits of sand, the fishery will suffer.

5.2 There is no commercial fishery for kina in Otago and only a minor customary and recreational one. As with paua, small animals seek cover in fine crevices.

6.0 POSSIBLE ADVERSE EFFECTS OF DISCHARGES

6.1 While the predominant current flow is to the north east, and it has been speculated that all sediments would be carried offshore, there is a back eddy north of the Otago Peninsula, with a southerly set in the tide flow, particularly during and after periods of easterly weather, hence aggregation of sand inshore does take place. This has been a natural sequence independent of any discharges.

6.2 My own diving observations over the period from the late 1950's to the early 1970's illustrate natural sand build up in several areas against the rocky shorelines near Purakanui, north of Dunedin. These areas were popular with divers targeting moki, paua and rock lobster, but by the 1970's the habitats were degraded. These observations were made right against the shoreline and do not relate to deeper water.

7.0 ALTERNATIVES

7.1 The Port Otago proposal to deepen the channel and port environs has to proceed, however, as there are significant fisheries for all user groups which could possibly be adversely effected, any viable alternative discharge sites would be preferable.

7.2 It has been suggested that the dredged material could be deposited in the upper Harbour extending out from Portsmouth Drive, i.e. a continuation of earlier re-claimation that now accommodates retail outlets and industrial buildings.

7.3 This proposal has much merit as reclaimed land and a sandy shoreline resulting could be used for recreational purposes and create bird roosting habitats. Over time, additional sandy habitat created could aid fisheries recruitment.

Mr Robert Street
18th April 2011

SUPPORTING APPENDIX DOCUMENTS

Rock Lobster Population Monitoring In Otago

For the last seven years, the Otago Rock Lobster Liaison Committee has been undertaking a monitoring programme on the fishery, looking mainly at variations in recruitment, the size and age of rock lobsters, migrations and how all these factors have affected landings. The work has been carried out by sampling pot catches, diving observations and counts including video recording, and tagging. Fisheries consultant, Bob Street, outlines the aims and results of some of this work, and stresses the need for continued monitoring, especially focused on the abundance of pre-recruits.

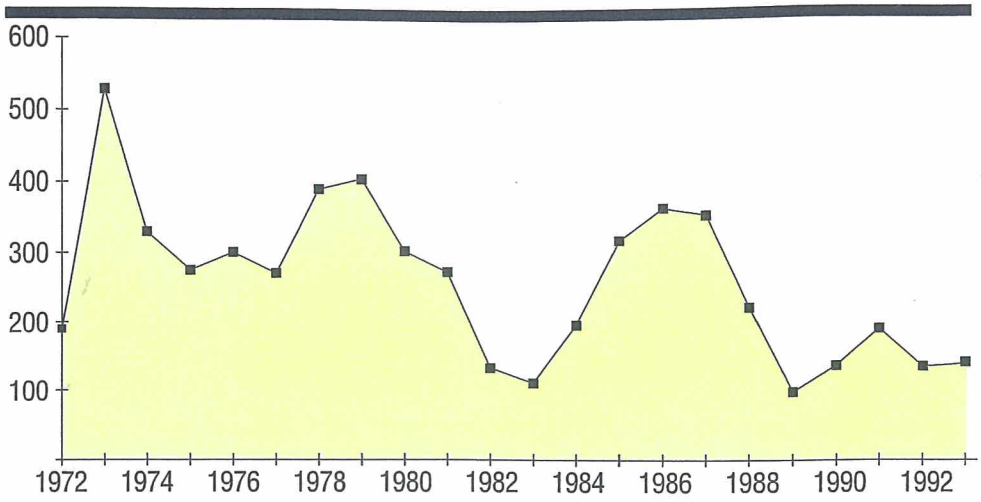


Figure 1 — Otago Rock Lobster Landings.

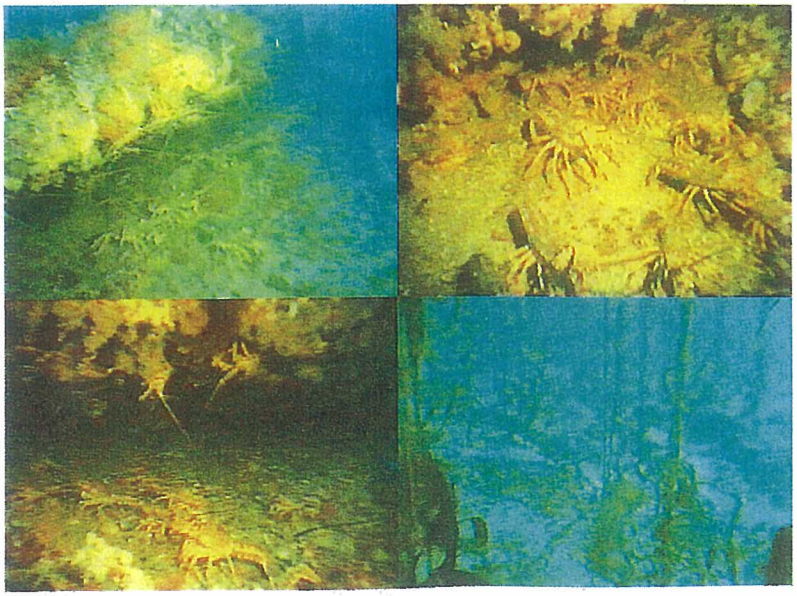
Landings

Rock lobster landings in Otago have shown a pronounced cyclic pattern over the years. Figure 1. Landings since 1990 have been controlled by quotas, hence the levelling out from thereon does not necessarily reflect a trend of declining stock. The number of boats operating has also been reduced since the introduction of quotas. However the declines in landings which troughed in 1983 and 1989, do indicate temporary recruitment failure, and undersized rock lobsters in the pots in the preceding years. Also dive observations confirmed that the numbers of rock lobsters one year away from legal size were also low. However in 1983, both pot catches and dive sampling showed good numbers of undersized rock lobsters to be present. Subsequently catches rose significantly until 1986, and then declined again to a low of under 100 tonnes in 1989. In 1989 good numbers of 2 year old rock lobsters were observed, and in 1990. very large numbers of rock lobsters one year away from legal size were present both in pots and on the bottom. Catches rose sharply in 1991, although quotas checked them.

Underwater counts in 1990 showed particularly large aggregations of mainly 3 and to a lesser extent 4 year old rock lobsters in North Otago. In one sampling area it was estimated that approximately 14,000 juveniles were seen in a 25 minute dive period along the reef sampled, with the same overall density being present either side of the start and end point of the dive. These observations were recorded on video tape and represent the largest continuous masses of rock lobsters I have seen in nearly four decades of diving. Other sampling areas in North Otago showed very good although not as concentrated populations of the same size groups.

Rock lobster catches were very good along the south-east coast in the winter - late spring months of 1993, with a large migration taking place. There was a strong 6 year old class in this migration, which was foreshadowed by the strong 3 year old class in 1990. It is obvious that the situation in North Otago in sampling sites in 1990 was general over a wide area along the south-east coast.

The Otago fishery is very dependent on one or two year classes, and also vulnerable in years immediately after large emigrations.



In these pictures reproduced from video film, can be seen: 1, 2 & 3 – *Congregations of mainly 3-4 year old lobsters beneath undercut ledges, North Otago;* 4 – *Macrocystis kelp stipites.*

Habitat for Larval Settlement and Post Larval Development

Monitoring of larval settlement rates and subsequent year class strengths to determine both short and long term trends in the fishery is a vital part of rock lobster research. There are no oceanographic conditions which influence larval survival and drift into settlement areas are not clearly understood. Obviously the nature of the inshore habitat and the amount of shelter available for the puerulus larvae at and after settlement is very important for their survival. For settlement and subsequent early juvenile stages, most bottom living species have specific habitat requirements. For example paua larvae settle on rock surfaces encrusted with coralline algae, and the young seek shelter under boulders, oyster larvae adhere to clean shell surfaces, and scallop and mussel larvae settle on algae and animal life such as hydroids and polyzoa (small tufty colonial animals), also man-made fibres, a characteristic which is used to collect spat for enhancement schemes.

Top — *Macrocystis kelp.*
Bottom — *Macrocystis holdfast. Possible habitat for recently settled rock lobster larvae.*

Shellfish enhancement schemes revolve around improving larval settlement rates and survival by increasing the amount of settlement surface over what is provided in nature. While deliberately increasing the amount of habitat for rock lobster larvae and juveniles has not been carried out on a commercial scale, man-made structures such as rock breakwaters that proved shelter in crevices, and wharves that provide shelter and shade for many plant and animal communities have incidently achieved this purpose.

For the first year of their life in particular, juvenile rock lobsters remain hidden in fine crevices and amongst marine growth. Quantitative sampling during this period is desirable, and the habitat should be clearly defined. The settlement rates of puerulus larvae in collectors have been very low at the sites in Otago and the east coast of Stewart Island in comparison to those on the east coast of the North Island. Does this mean that very few puerulus are settling, or is there an abundance of natural shelter for them?

Macrocystis Kelp as a Nursery Habitat

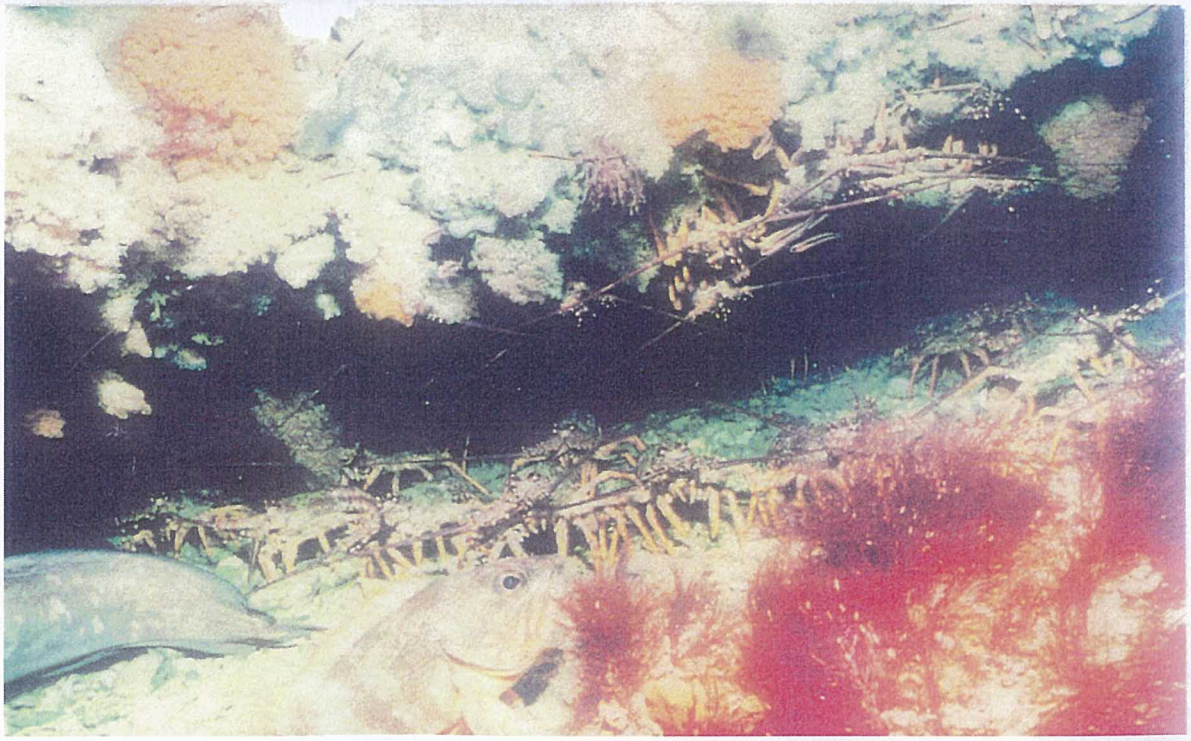
Along the east coast of the South Island, the floating bladder kelp *Macrocystis pyrifera* grows profusely, forming in places dense masses out to depths of about 20 metres, usually on coasts with a northerly aspect protected from big southerly swells. Macrocystis beds become less common north of Cook Strait. The attachment holdfasts of Macrocystis have a labyrinth of holds with shelter for marine life such as recently settled rock lobster larvae. Examination of these holdfasts in February 1994 showed they provided shelter for crabs, small shellfish and worms, and these observations will now be concentrated on the winter and early spring months, the main period for puerulus settlement on the south-east coast of the South Island. In Chile, Macrocystis holdfasts have an important role in providing shelter for small sea urchins (kina), which are an important fishery in the area.

It is pertinent that small rock lobsters 2, 3 and 4 year olds in particular occur near or amongst Macrocystis beds. The stipites growing to the surface may divert larvae drifting inshore to shelter in the holdfasts, just as mussel longlines have collected larvae in Marlborough.

There is a large area of Macrocystis in Otago with many hundreds of thousands of individual plants, so it will be a painstaking job examining the holdfasts. The assessment will be carried out by underwater observation and possibly a hand suction pump will be used.

Kaeos and associate
Elzerina provide
initial good cover
for puerulus larvae

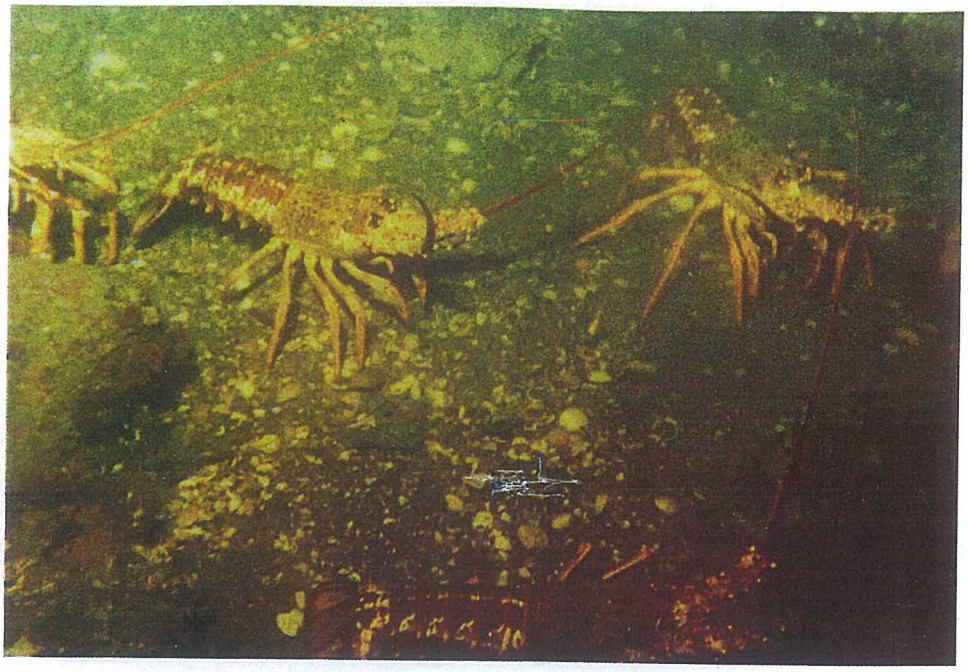
Puerulus and
post puerulus
larvae North Ot



Rock lobsters
beneath undercu
ledge North Ots

Rock Lobster Migrations In Southern New Zealand

The fact that Rock Lobster migrate has been well known and observed for many decades but the exact reason why and to what extent still remains unclear. Current moves to refine management techniques depend very much on a greater understanding of Rock Lobster movements and migrations. One time MAF Fisheries scientist and now Fisheries Consultant, Bob Street describes the Southern migrations and the studies currently under way.



Above — *Migrating rock lobsters.*

1993 Migrations In Otago

In late September 1993 it was apparent that a large migration of rock lobsters was taking place southwards past the Otago Peninsula. Inshore trawlers working in North Otago were catching rock lobsters just after pot catches had declined sharply on the outer edges of the rough bottom to the south-east of Moeraki. This was followed several days later by large numbers in pots set off the Otago Peninsula, with catches of up to 2 tonne a day, some individual pots having 60kg. At the same time, and after the run in pots was over, trawlers working in depths between 40 and 65 metres to the south as far as Nugget Point and beyond were catching up to 60kg for a two hour tow. These boats had earlier reached their quotas by potting, so the rock lobsters were released, still in a lively condition. The rock lobsters were present over a wide area, so while targeting for finfish species, it was not possible to completely avoid them.

By mid-October, pot catches off the Otago Peninsula had declined markedly, but trawlers were still catching up to 60kg a tow from mid-October to early November.

When large scale directional movements of this type appear to be taking place, it is important to carry out tagging, so that the ultimate destination of the migration can be established. Approximately 500 rock lobsters were tagged in October, both pot caught on rough bottom off the Otago Peninsula, and trawl caught on sand bottom of north of Nugget Point.

By mid-November, most fishers in Otago, eastern Southland and at Stewart Island had filled their quotas, so relatively few of the tagged rock lobsters were able to be recaptured. From early to mid-November 3 that were tagged 16km north of Nugget Point had been retaken 40km south at Long Point in the Southern Zone Fishery Cray 8, confirming the southerly movement of the migration.

Size Of Migrating Rock Lobster

The size composition of pot caught rock lobsters sampled in the 1993 migration is shown in Figure 1. A wide size range comprising year classes mainly between 4 and 9 years was present. All females in the sample were immature, both pot and trawl fishers reporting only occasional mature specimens in their catches.

Previous Studies On Migrations In Otago

Migrations of rock lobsters from North Otago southwards past the Otago Peninsula occur frequently.

During these periods fishers observe sharp changes in pot catches from one area to another, and rock lobsters are

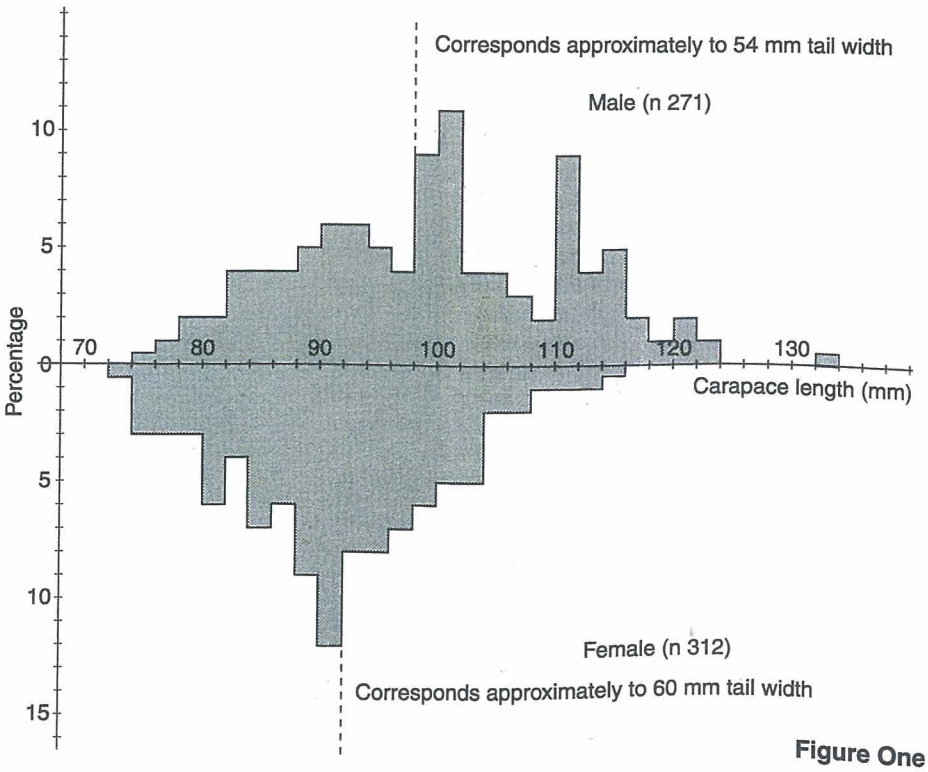


Figure One

trawled on sand bottom following declines in pot catches on rough bottom. Tagging experiments have confirmed these migrations (Street 1969, 1971, 1973, 1986 unpublished).

The most significant of these migrations off the Otago coast occurred in September and October 1970. A large mass of rock lobsters moved south past the Otago Peninsula over sand bottom, at speeds of up to 6km a day. Trawlers made substantial landings at the time, following the migration progressively southwards. Tagged rock lobsters were recaptured from as far south as Lords River, Stewart Island, 240km south of the release point off the Otago Peninsula. No tagged rock lobsters were recaptured the following year, but the type of tag used at the time did not have good retention over the moult.

1993 Migrations In Southland

In eastern Southland, including Foveaux Strait and Stewart Island, fishers experienced very good catches in the spring to early summer months of 1993, most reaching their quotas early. This also occurred in Western Foveaux Strait and southern Fiordland. As in Otago, the pattern of pot fishing, along with significant numbers being taken in some trawl catches, gave an indication that migrations were taking place. However runs in Southland were also occurring at the same time as in Otago, so it was not necessarily the same continuous mass that was contributing to the run.

To gain some more information on migrations, eight fishermen working representative areas in Southland have been tagging and releasing rock lobsters, usually males and immature females that were considered to be "run fish". By early 1994, about 1700 will have been tagged.

Previous Studies On Migrations In Southland

There have been numerous tagging experiments carried out in Southland over the last two decades. (Annala and Bycroft 1983, McKoy 1983, Street 1969, 1973, 1980 and 1990).

These studies show that large numbers of immature females and males of similar size, periodically migrate southwards down the east coast, and northwards up the west coast and from the Snares Is. That is against the direction of flow of the Southland Current. The intensity of these migrations varies in different years. The migrations from Foveaux Strait, Stewart Island, the Snares Is. and southern Fiordland contribute significantly to the populations in northern Fiordland and South Westland. As in Otago, migration speeds of up to 7km a day have been recorded.

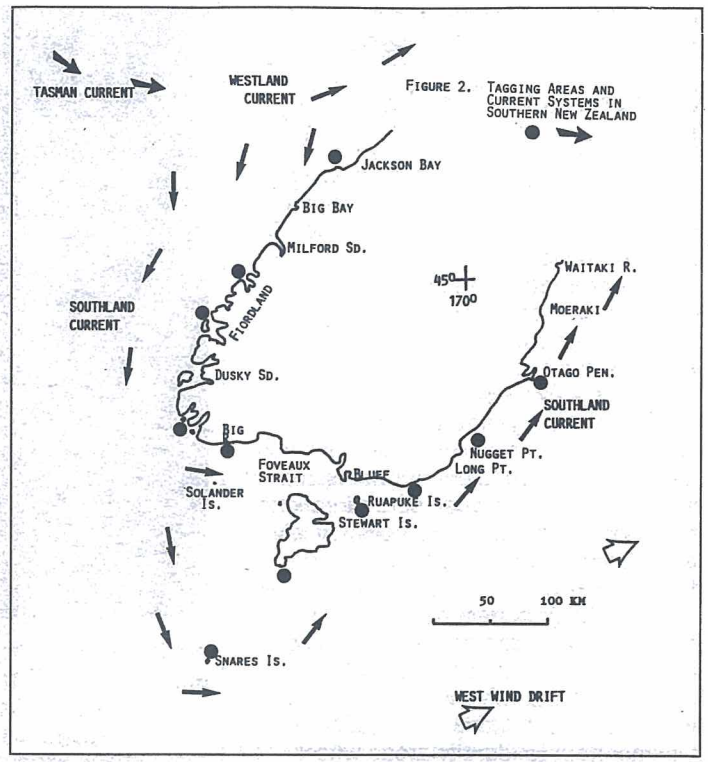


FIGURE 2. TAGGING AREAS AND CURRENT SYSTEMS IN SOUTHERN NEW ZEALAND

Importance Of Current System

The Tasman Current is of sub-tropical origin, and has a general west to east movement across the Tasman Sea. Off the coast of South Westland it divides, one branch flowing northward as the Westland Current, and the other southward as the Southland Current. The Southland Current flows through Foveaux Strait, and to the south of Stewart Island where it turns eastwards across the Snares shelf, and then moves in a northeasterly direction up the east coast of the South Island (Figure 2).

Off the south and south-east coast of the South Island the inshore water is cooled by mixing with sub antarctic West Wind Drift Current water, so that temperatures are 2-3 degrees C lower than in comparable latitudes on the west coast. Apart from influencing marine life by varying the water temperature, currents have other major impacts on fisheries. They serve to transport plankton, including the larval stages of many species down current, and provide a cue for the migrations that occur with some species against the direction of current flow. For example the New Zealand short finned eel, when approaching maturity, migrates from fresh water against the current flow across the Tasman Sea to spawning grounds in the Coral Sea east of northern Australia, and the current transports back the elvers.

Reason For Migrations

The movement patterns on the large scale exhibited in southern New Zealand contrast with the situation further north in New Zealand, with red rock lobsters, and in southern Australia and in southern Africa, where movements are limited.

It is probably because of the larger size at which female rock lobsters mature off the south-east and south coast of the South Island. Migration against the

current flow (contranatent movement), may be to counteract larval drift.

Objectives Of Further Tagging

There are three broad objectives in carrying out tagging work. 1. Group; 2. Fishing intensity from recapture rate; 3. Migration patterns.

While considerable information is available on these topics, more is required, particularly on fishing intensity and migrations.

There is a cyclic pattern with rock lobster catches, yearly differences in landing being due mainly to variations in the levels of recruitment of undersized stock from the previous year, migrations into or out of the area and how actively rock lobsters feed and hence trap in different years.

An important aspect of research is to monitor year class strengths and potential recruitment of undersized rock lobsters into the fishery, to determine how catches are going to be sustained. It is important to identify areas where large numbers of juveniles have traditionally occurred, and have an understanding of migration patterns from such areas. Obviously the rates of initial larval settlement in these areas, and subsequent year class strengths will influence catches further up current if migrations do take place.

A large scale exodus of rock lobsters from an area will obviously significantly deplete stocks in that area, and future catches will have to rely on local larval settlement and subsequent build up of the stock as well as any migration into the area. For example a tagging experiment carried out off Big River in southern Fiordland in 1984 showed a mass migration out of the area in 1985, with tag returns being made progressively northwards with time to as far as north of Jackson Bay. Tag returns were made up until 1988, but there were no recoveries in the tagging area after 1985, indicating that a mass exodus out of the area occurred (Street 1990).

Congregation of mainly 3 year old rock lobsters in North Otago.

Monitoring Programme On Fishery

Monitoring of the rock lobster population is being carried out in several representative areas by the writer. These assessments will be presented in future articles.

As well as sampling of pot catches, underwater assessments are being made, with sizes and numbers being recorded, supplemented by video recordings. Underwater video recording of rock lobster populations is an important aspect of the work.

In 1990 I observed very large numbers of predominantly 3 year old rock lobsters on the bottom in several of the sampling sites in North Otago. This strong year class was followed through the fishery in subsequent years. In the 1993 run along the whole south-east coast, there was a strong 6 year old class. This suggests that the large numbers of 3 year olds observed in the North Otago sampling sites in 1990 were general over a wide area. It emphasises the need for a continuation of and expansion of the monitoring work.

In poor years we should never presume that the fishery is on a continuous decline. Assessments of the numbers of pre-recruits should always be made. Of interest is the fact that landings in the north-west Atlantic lobster fisheries have in recent years been 50% above what they were in the 1970s, and the same thing has happened in the United Kingdom. Scientists cannot clearly explain this situation, but cyclic changes in environmental conditions that affect lobsters, particularly when they are in the larval stages are the most likely reason. Lobster populations in both areas have been fished for about 150 years, and many times this century great concern about the fisheries has been expressed after a few bad years.

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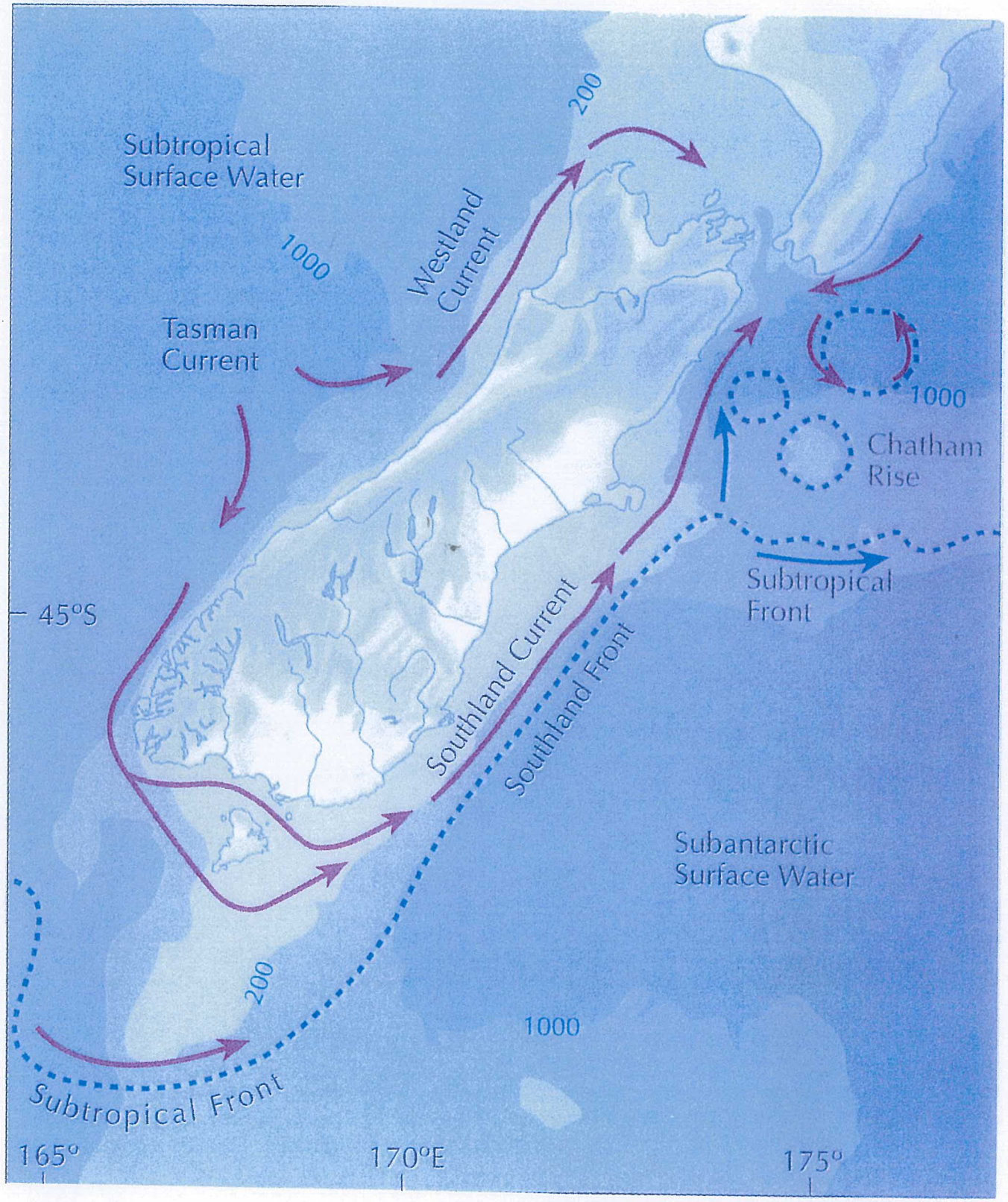
Subtropical
Surface Water
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