

NEW ZEALAND MARINE DEPARTMENT

FISHERIES TECHNICAL REPORT

No.16

**The Whaling Potential
of the
New Zealand Sub - Region**

D.E.GASKIN

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NEW ZEALAND SUB-REGION.

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SUMMARY

Whalebone and toothed whales occur in the New Zealand sub-region, which includes the Auckland, Campbell and Chatham Islands. At present no shore-based whaling stations are operating in the region, but formerly shore-stations have exploited right, humpback and sperm whale populations. The distribution, density and significance of the whale populations, within the New Zealand sub-region are discussed. The potential and economics of possible shore-based whaling stations, if established within the region, are forecast.

INTRODUCTION

The last New Zealand whaling station, at Tory Channel in the Marlborough Sounds, ceased operations in December 1964. The closure of this station brought to an end a tradition of shore whaling which had lasted since 1827. Sperm whaling ships watered and took on stores at Russell as early as 1792, but did not actually work up whales on shore. Right whaling operations began in 1827 in the Cook Strait area, and were so successful that in the two decades that followed, no less than 113 whaling "stations" opened around the coasts of New Zealand, the great majority on the east coasts of the North and South Islands (Dawbin, 1956; Rickard, 1965). Most of these consisted of a few ramshackle huts and one or two try-pots, and very few lasted for any length of time.

The ruthless exploitation of the right whales eventually killed the right whale industry, and most of the whaling sites were abandoned. A much smaller number of stations were in a suitable position to exploit the less profitable migration streams of humpback whales, but only Whangamumu (1912-1931) and Tory Channel (1914-1963) were able to make

a continuous success of the exploitation of this species. After 1955 a number of whaling companies worked for humpbacks out of a station on Great Barrier Island, but not with any continuous success.

A sharp decline in the numbers of humpback whales migrating through Cook Strait after 1961 forced Tory Channel whaling station to search for an alternative species of whale. Substantial concentrations of sperm whales were found in deep water south of Cape Palliser, and in 1963 and 1964 the station sought sperm whales. A special experimental licence was issued for the period January-April 1964. In December 1964, after a severe decline in the world market price of sperm whale oil, Tory Channel was forced to suspend operations. The situation equipment was later sold piecemeal and the whaling company went into liquidation.

Between 1962 and 1965 the New Zealand Marine Department conducted a survey of the whaling resources of the New Zealand sub-region, paying special attention to the areas within range of chasers operating out of the existing whaling station. The survey concentrated at all times on sperm whales, but detailed records were kept of all whales sighted, large or small.

The scientific results of this work are presently being published by the Fisheries Research Laboratory, Wellington, including information obtained from catches of sperm whales by the Tory Channel whaling station.

The purpose of this report is to outline and discuss the Cetacea found in the New Zealand sub-region from the point of view of basic resources, exploitation, economics and regulation.

POTENTIALLY USEFUL SPECIES OF CETACEANS
FOUND IN THE NEW ZEALAND SUB-REGION

For detailed descriptions and discussion of the species of Cetacea found in the New Zealand sub-region reference should be made to Oliver (1922 a, b) and more recently Gaskin and Cawthorn (in press 3). Not all the species of whales found in this area are of potential economic value, either because they are too rare, or are very irregular in appearance. Other species have been only dubiously identified.

The following list is not exhaustive, but covers all the species which could conceivably be of any interest commercially.

Mystacoceti - Whalebone whales

- | | | |
|----|--|--------------------------|
| *1 | <u>Eubalaena australis</u> (Desmoulins) | The southern right whale |
| *2 | <u>Balaenoptera musculus</u> (Linnaeus) | The blue whale |
| 3 | <u>Balaenoptera physalus</u> (Linnaeus) | The finback whale |
| 4 | <u>Balaenoptera borealis</u> Lesson | The sei whale |
| 5 | <u>Balaenoptera edeni</u> Anderson | Bryde's whale |
| 6 | <u>Balaenoptera acutorostrata</u> Lacepede | The minke whale |
| *7 | <u>Megaptera novaeangliae</u> (Borowski) | The humpback whale |

Odontoceti - Toothed whales

- | | | |
|----|-------------------------------------|---|
| 8 | <u>Physeter catodon</u> Linnaeus | The sperm whale |
| 9 | <u>Kogia breviceps</u> (Blainville) | Pigmy sperm whale |
| 10 | Ziphiidae - beaked whales | About eight species known in the New Zealand sub-region |
| 11 | <u>Orcinus orca</u> (Linnaeus) | The killer whale |
| 12 | <u>Pseudorca crassidens</u> (Owen) | The false killer whale |

*Capture prohibited by International Whaling Convention at time of writing.

- | | | |
|----|---------------------------------------|--------------------|
| 13 | <u>Globicephala melaena</u> (Traill) | The pilot whale |
| 14 | <u>Delphinus delphis</u> Linnaeus | The common dolphin |
| 15 | <u>Lagenorhynchus obscurus</u> (Gray) | The dusky dolphin |

DISCUSSION

I: SPECIFIC RESOURCES

1. Eubalaena australis (Desmoulins) The Southern Right Whale.

For a brief outline of the history of exploitation, life cycle and abundance of this species, see Gaskin (1964 c). Since the publication of this short paper a few more specimens have been recorded at various points along the New Zealand east coast, but the total number recorded has not yet reached double figures.

The southern right whale, which has the highest yield of edible oil of all the whalebone whales, has been protected by international convention since 1936. The uncontrolled exploitation in the last century and the early part of this century reduced the southern hemisphere population almost to extinction. At the present time the stocks in the South Atlantic (Elliott, 1953), the eastern South Pacific (Clarke, 1965) and the New Zealand sub-region appear to be recovering very slowly. In the future the stocks may recover to the point where commercial exploitation of a very limited nature may be permitted, but this is unlikely to be for some decades.

2. Balaenoptera musculus (Linnaeus) The Blue Whale

This species, the largest of all the whales, is now protected by international convention in the southern hemisphere. In the last decade catches by pelagic factory ships have reduced the numbers of the species to an alarmingly low level, and the blue whale is in very real danger of extinction.

Formerly the blue whale supported the southern whaling industry. In the 1930-31 Antarctic whaling season a total of 41 floating factories with 200 whale chasers killed 28,325 blue whales. In this season the species made up 75.6 per cent of the total catch. In the 1961-62 Antarctic whaling season 21 floating factories with 261 whale chasers took only 1,118 blue whales; 3.0 per

cent of the total catch. This decline in percentage of total catch represents a real decline in numbers. For further information see Brown (1963) and more recently the Fisheries Technical Paper No. 59 issued by F.A.O. in September 1965, and the final report (IWC/15/9) of the Committee of Three Scientists appointed by the International Whaling Commission to assess the Antarctic whale stocks, which was issued for the 15th meeting of the International Whaling Commission in 1962.

According to the best estimates available the total Antarctic population of blue whales is less than 2,000. The chance of the stock recovering enough in the next few decades to allow catches of even a few hundred each season is remote. To allow catches of 5,000 whales per year the stock will have to be left unmolested for about 65 years.

3. Balaenoptera physalus (Linnaeus) The Finback Whale

In the last two Antarctic whaling seasons the finback or fin whale has been replaced by the sei whale as the major fraction of the catch. The estimates of stock size in the F.A.O. Fisheries Technical Paper No. 59 mentioned in the last section show the total population of fin whales to be decreasing at an increasing rate. The species is not yet in danger of extinction, but the catches over many seasons in the Antarctic have so exceeded the sustainable yield of the population that it is rapidly being destroyed as an economically useful resource.

Despite the present low numbers, there is no overall protection for the species, and fin whales still pass parts of the New Zealand coast on their migrations. A whaling station operating in a suitable area, especially on the south coast of the South Island or on Stewart Island, could hope to supplement its catch of other species with small numbers of fin whales. It is very unlikely that enough now pass New Zealand each year to allow an industry to be based on this species alone.

Fin whales were seen by the Tory Channel whaling company passing up the north east coast of the South Island in small numbers (less than 20 all told) during February 1964.

4. Balaenoptera borealis Lesson The Sei Whale

This species, the smallest of the whalebone whales exploited by pelagic factory ships in the Antarctic,

also has the lowest yield of edible oil. The value of the species rests mainly on its high quality meat, which sells well on the Japanese market and gives good yields of by-products.

Migration streams of sei whales pass the coast of New Zealand to the east and west, usually staying some tens of miles from the coast. The whales are northbound in late summer and southbound in spring and for part of the year. During the winter, they may mingle with stocks of Bryde's whales also known to occur around New Zealand. In March 1964 the Soviet pelagic factory ship "Slava" made good catches of sei whales near Bank's Peninsula. It is estimated that about 60 whales were taken in this area, and more were seen further north which had eluded the Russian whale chasers.

Sei whales accounted for less than 2 per cent of the total New Zealand catch in 1963-64, but this was largely because the station was not permitted by law to process baleen whales during the peak period of sei whale occurrence in the Cook Strait area. At this time the station was operating on a special research licence for sperm whales only. Under other circumstances catches of this species might total 40-50 animals each season.

5. Balaenoptera edeni Anderson Bryde's Whale

This species is not known to make north-south migrations and from the Antarctic like its near relative the sei whale. The Marine Department whale survey confirmed the previously reported presence of this species in the Hauraki Gulf region (Dawbin, 1960) and showed that the range of the species extended at least from North Cape to East Cape. Many sightings were made in the vicinity of White Island in the Bay of Plenty, and to the north of Motiti Island in the same area. Trans-Tasman shipping reported baleen whales which may well have been this species in most months of the year in sub-tropical and temperate latitudes. The rate of recruitment into any exploited temperate or sub-tropical area is not known. Small numbers of Bryde's whale are usually taken off the coast of South Africa each season (International Whaling Statistics, 1965). The number has always been less than 100.

The New Zealand whaling companies which operated out of Great Barrier Island in the 1950s took small numbers of this

species. A study of the catch statistics suggests that the numbers of this species available to the chasers declined very rapidly after only a few seasons, indicating a very small population with a low level of recruitment from outside the area. However, this may be an erroneous impression. The whaling station at Great Barrier Island relied mainly on humpback whales. Bryde's whales, with their low oil yield, would certainly have been ignored in favour of the former. Periods when the station chasers would have been prepared to take Bryde's whales may not have coincided with their greatest abundance. During 1963 whale surveys four whales of this species were marked; three near Great Barrier Island and one near Motiti Island.

6. Balaenoptera acutorostrata Lacepede The Minke Whale

This species is one of the smallest of the whale bone whales* and its appearance around the coast of New Zealand is uncertain and irregular. There is a possibility that some Minke whales recorded on the coast of New Zealand may belong to another species or subspecies, B. bonaerensis Burmeister, which differs from the Minke whale in lacking a white patch on the outer surface of the pectoral flipper.

The population dynamics of this species have been studied by Jonsgaard (1962) on the coast of Norway, and by Sergeant (1963) on the coast of Newfoundland. It is conjectural whether these results are applicable to the species or subspecies found in the southern hemisphere.

The oil yield from this species is almost negligible by modern commercial standards, but the Minke is taken in the northern hemisphere for its meat. There are no available estimates of the size of the Minke whale population in the southern hemisphere. Several hundred animals of this species were taken by the Soviet pelagic factory ships in the Antarctic between 1957 and 1961,** but the data does not yet appear to have been published. No estimate can be made of the numbers of Minke whales which a small-whale industry based in New Zealand might expect to take in a season.

* With the exception of the rare Pigmy Right Whale.

** See table 1 in the appendix.

7. Megaptera novaeangliae (Borowski) The Humpback Whale

This whale is now fully protected from exploitation in the southern hemisphere by international convention. The decline of the humpback population in the New Zealand sub-region has been fully documented by Chittleborough (1965). The numbers have been reduced to such a low level that it is calculated that the species in this area will have to be left unmolested for at least 38 years if the population is to recover to the level required for the maximum sustainable yield. This is an optimistic value; the best estimate is in fact 65 years (Chittleborough, *ibid.*). It can thus be seen that there is no possibility of commercial operations being reopened on humpback whales within the lifetime of most interested operators.

There is a wealth of literature on this species in the New Zealand and Australian sub-regions. Reference should be made to Chittleborough (1953, 1954, 1955a, b, 1958a, b, c, 1959a, b, c, 1960a, b, c, 1962, 1963, 1965) and Dawbin (1956a, b, 1959, 1960, 1964, 1966).

8. Physeter catodon Linnaeus The Sperm Whale

The sperm whale is almost certainly the most common large whale in the New Zealand sub-region, and the species has been studied in detail in this area (Gaskin, 1963, 1964a, b, 1965, in preparation₁, in prep.₂, in prep.₃; Gaskin and Cawthorn, in press₁, in press₂).

Results of the parts of this research which have been completed can be briefly summarised as follows.

The feeding habits of the sperm whales in the Cook Strait region were examined in detail. Quantitative estimates showed that commercial species of fish, such as groper Polyprion oxygeneios (Bloch and Schneider) and ling Genypterus blacodes (Block and Schneider) formed only about 30 per cent of the stomach contents by weight. The sperm whales appeared to be feeding in considerable quantities on a squid Moroteuthis sp. (probably ingens Smith), not previously known to occur in the Cook Strait region. Examination of the mandibles of squid found in the stomachs showed that the whales were also feeding heavily on other species of the family Onychoteuthidae and the common arrow squid Nototodarus sloani (Gray). For detailed results, see Gaskin and Cawthorn (in press 1 and in press 2).

9. Kogia breviceps (Blainville) The Pigmy Sperm Whale

Nowhere in the world is this species taken in commercial quantities. The pigmy sperm whale is a small animal, reaching a maximum length of less than fifteen feet, and little is known of its habits. For a brief summary of the distribution in the New Zealand sub-region see Dell (1960) and Gaskin (1966).

It is probable that a small-whale industry based in New Zealand would take a few specimens of the pigmy sperm whale over a number of seasons. From the number of stranding on the coast of this country the species may actually be more common than is presently supposed.

10. Family Ziphiidae Beaked whales

This group of whales is dealt with collectively because of the complexity of their systematics. The species can only be separated by someone with experience in the group and some training in cetacean taxonomy. About eight species are known from the New Zealand sub-region, although virtually nothing is known of their distribution and population size. The beaked whales are taken commercially in small numbers on the coasts of Japan and the U.S.A. They have a small yield of oil and meat similar in type to that of the sperm whale. A record by Oliver (1922b) of a school of 25 Mesoplodon stranded at the Chatham Islands and a more recent record by Gaskin (1964a) demonstrate that at certain times of year beaked whales accumulate in substantial schools of several dozens of animals near the coast in this area. A small-whale industry based in New Zealand would almost certainly take several species during operations.

11. Orcinus orca (Linnaeus) The Killer Whale

The killer whale appears to occur in the Bay of Plenty all the year round (Gaskin and Cawthorn, in press 3.) In the same bulletin sightings of this species reported in 1963 and 1964 are plotted and listed. There is not enough information available to postulate migration patterns around New Zealand, although seasonal movements probably occur. Migrations of killer whales have been recorded off the west coast of the U.S.A. (Norris and Prescott, 1961).

Schools seen near the North Island coast usually consist of small males and females, often with calves, accompanied by one or two large males, the latter recognised by their very tall dorsal fins. Further

south, especially around the South Island, schools composed almost entirely of large males are seen. The oil yield of even a large killer whale is very small, usually less than one ton, and the smaller females, which are frequently little more than 10 feet in length, give much less. The meat is dark, like that of the sperm whale.

12. Pseudorca crassidens (Owen) The False Killer Whale

The false killer is one of the most gregarious of all Cetacea, travelling in schools which are frequently many hundreds strong. In common with the pilot whale and beaked whales this species is known locally as a "Blackfish", and there are several records of large schools stranding around the New Zealand coast (Gaskin and Cawthorn, in press 3, but the movements of the species are irregular and nothing is known of the distribution. The average size of false killer whales is less than 10 ft; they are of no interest to standard whaling operations.

13. Globicephala melaena (Traill) The Pilot Whale

This whale, which reaches a maximum size of about 20 ft, is probably the commonest cetacean of moderate size around New Zealand. It is hunted extensively on the coast of Newfoundland for its meat, which is sold to the province's mink farms. The oil yield is quite high, considering the small size of the animal.

A large number of strandings has been recorded in New Zealand, often of schools numbering many scores. Large concentrations also occur, possibly seasonally, to the south of Campbell Island (Gaskin and Cawthorn, in press - 3). The pilot whales around the North Island appear to be a different colour phase, subspecies or species to those found in the far south of the sub-region.

The records for New Zealand suggest a seasonal movement such as has been reported for the coast of Newfoundland pilot whale population (Sergeant, 1962). The species appears to be most common in the vicinity of the coast of Northland. A small-whale industry, using suitable methods, would probably be able to take large numbers in good years. The appearance of the species in any locality seems irregular, but fishermen only rarely reported sightings of pilot whales to the Marine Department whale survey because they were of no economic importance at the time.

14. Delphinus delphis Linnaeus The Common Dolphin

The most frequently observed dolphin in New Zealand waters, this species occurs in substantial numbers around the North Island, especially on the Wairarapa, Bay of Plenty and Northland coasts. In the summer months, apparently when temperature conditions are most favourable, very large aggregations, hundreds and sometimes thousands strong, gather between Cape Palliser and Cape Kidnappers. In other months of the year these aggregations break up into much smaller schools, usually composed of 100 animals or less. For much of the year common dolphins may be semi-resident in quite small areas. Around the South Island this species gives way on the east coast to the next species, Lagenorhynchus obscurus (Gray) and on the west coast to the cowfish or bottle-nosed dolphin Tursiops truncatus (Montague). The very small Cephalorhynchus hectori (Van Beneden) is quite common very close to shore around the east and west coasts of the South Island, and in Cook Strait. However, it is a shy animal which does not readily approach boats and is frequently overlooked.

Several species of dolphins are exploited commercially off Cape Hatteras in the U.S.A., in Japan, and in the Black Sea by both the U.S.S.R. and Turkey. Recently the U.S.S.R. has announced that the capture of dolphins has been discontinued since research work on the animals over the last few years has shown they may be the next most intelligent species to man. Although large resources of D. delphis certainly occur off the east coast of the North Island, there is no doubt that any attempt to exploit them for oil or meat would lead to a violent and sustained public outcry.

15. Lagenorhynchus obscurus (Gray) The Dusky Dolphin

This species differs in the shape of the head and in colour pattern from the last species. Little is known of its movements and distribution except that it is a "cold-water" dolphin. In winter it is observed in large numbers in Hawke Bay and in much smaller numbers as far north as Whitianga. In summer the main concentrations of the species appear to lie off the east coast of the South Island, and it then replaces the common dolphin as the most common cetacean in Cook Strait.

II: THE WHALING POTENTIAL OF SPECIFIC LOCALITIES WITHIN THE NEW ZEALAND SUB REGION

1. The Subantarctic - Auckland Islands and Campbell Island

An established whaling station on either island might still be able to pay its way, like the enterprises on the island of South Georgia. However the cetacean resources of the Southern Ocean are declining rapidly. The whaling stations on South Georgia were established at a time when immense profits were to be made from the Antarctic, which is not the case today. Also, the South Georgia stations were used as support bases for the lucrative pelagic whaling expeditions sent out by the United Kingdom and Norway. This meant that whale oil extracted at South Georgia could be sent to Europe on transport which would be taking the pelagic whaling produce there in any case.

The cost of establishing a whaling station on Auckland or Campbell Islands would be quite prohibitive, and the cost of supplying such a base and shipping back the products would be completely uneconomic under present Southern Ocean whaling conditions.

2. The Chatham Islands

The 1962-5 Marine Department whale resources survey did not cover the Chatham Islands. Surveying in this direction was limited to one flight made in indifferent weather conditions.

However the configuration of the coastal shelf, the latitude and old whaling ship records (R. Richards, in litt) suggest that a whaling industry of suitable characteristics could be established at the Chatham Islands. Such an industry could work either on large whales or smaller species. There is every likelihood that a shore based small-whale fishery working at the right season would be able to catch substantial numbers of pilot, false killer, killer and beaked whales. The catch could probably be supplemented with minke and even sei whales.

A large-whale industry would almost certainly catch considerable numbers of sperm whales. This catch could probably be supplemented with catches of sei whales and a smaller number of fin whales.

For a discussion of the problems involved in setting up such an industry at the Chatham Islands, see section III.

3. Northland

Even in the short period that the Marine Department whale survey worked off the coast of Northland in 1963 numbers of sperm whales and Bryde's whales were seen. A number of very good sheltered harbours are sited within range of the North Cape sperm whale grounds. It is probable (from lighthouse keeper's sighting records of the Marine Department), that chasers working around the west side of the Cape in the spring and autumn could supplement the sperm whale catch with migrating fin and sei whales.

The prospect for a small-whale fishery would have to be investigated in more detail. Although pilot whales occur in considerable numbers at certain times of year, especially from July to November, records for other small whales are scanty, and the period of apparent maximum occurrence of pilot whales coincides with the worst weather at sea in the area.

4. Hauraki Gulf

No sperm whale grounds lie within range of the established whaling station site on Great Barrier Island. The population of Bryde's whales which occurs in this area is suspected to be semi-resident and probably quite small, or at least with low recruitment from outside areas. The humpback migration stream which used to sustain the whaling station is no longer a resource, and other baleen whales do not seem to migrate inside the Barrier Islands. A good whale feeding area was plotted to the south of Little Barrier Island, and the frequent occurrence of Bryde's whales in this region, only a few hours from Auckland harbour, may give an erroneous impression of the numbers of whales in the Hauraki Gulf area.

Sightings of whales and dolphins have been collected for the author by the Marine Department launch m.v. "Ocean Star" for over three years. The results hold out no hope for a small-whale industry within the Hauraki Gulf-Firth of Thames area. Sighting frequencies of pilot, killer and other small whales were very low.

5. West Coast of the North Island, North of Cape Egmont

Strandings and sightings indicate substantial numbers of sperm whales in the Tasman Sea, together with numbers of sei and/or Bryde's whales. Most of the sperm whale records are from the Kaipara coast. There is little information on this area, but there is no potential site for a whaling station on this coast.

6. Bay of Plenty

Sperm whales are apparently present near East Cape in some numbers, but eight cruises through the Bay of Plenty, four in perfect whaling weather, failed to reveal any sperm whales further west, especially near the coast of the Coromandel Peninsula and Mayor Island. Bryde's whales occur in some numbers, but the caution expressed concerning the stock size in the Hauraki Gulf also applies to this area.

Smaller whales, especially killer and beaked whales, are plentiful near White and Motiti Islands, and false killer and/or pilot whales are frequently reported near Mount Maunganui and in Tauranga harbour.

Whale survey operations around East Cape were frequently hampered by high seas and strong winds, even in mid-summer.

7. East Coast of the North Island, East Cape to Cape Palliser

There are very few localities south of Gisborne which are even remotely suitable for siting a large-whale station. Even on the north east coast, localities such as Tokomaru Bay and Tolaga Bay are badly exposed in certain winds. Hawke Bay is too shallow for sperm whales, although they are seen inside the tip of Mahia Peninsula very occasionally, and most of the bay is badly exposed to southerly conditions. A station on the Wairarapa coast is out of the question, even at Castlepoint, since the anchorage can be used only by very small vessels under certain weather conditions. This is unfortunate, as the concentrations of sperm whales appear to be greater towards Cape Palliser than further north. However this may be an erroneous impression gained from incomplete records. Sei whales are known to migrate north and south off this coast, but usually some miles off shore.

Information on small whales off the east coast north of Cape Palliser is presently limited. Routine collection of data during 1967 by boats in Hawke Bay has been arranged in conjunction with the Marineland of New Zealand at Napier. Killer whales are common around Cape Kidnappers and pilot whales and/or false killer whales are recorded within the bay in the winter and spring months.

8. Cook Strait

The survival of the Tory Channel whaling station in Cook Strait for so many years was due entirely to the migration stream of humpback whales which passed through the Strait on their way to the breeding grounds in the

tropics. The Tory Channel whaling station is not in a suitable position to work on the substantial sperm whale stocks which occur around Cape Palliser and along the Hikurangi Trench down to the Kaikoura Peninsula. While the whale chaser was able to work the area, much time was wasted in the long steam out to the best grounds, and more in the long towing time back to the station with the deadwhales. The numbers of baleen whales other than humpback whales passing through the narrow part of the Strait is not sufficient to sustain operations without substantial catches of sperm whales.

9. North Canterbury Coast

What are apparently the best sperm whale grounds close to New Zealand are located to the east of Kaikoura Peninsula. The best catches by the Tory Channel whaling station were made in this area. The whales taken were almost all large males.

A study of the sperm whale population in this area over a period of two years suggested that catches of up to 500 sperm whales could be taken each season; providing there was no regular interference with the recruitment of whales into the area by pelagic factory ships making large catches between the New Zealand coast and the Chatham Islands. However to take such numbers would require a higher level of efficiency in operation on the whaling grounds than was evident with the Tory Channel whale chaser Orca.

Factors operating against the company were as follows: 1) the established site at Tory Channel was too far from the best whaling grounds; 2) the chaser was slow by modern standards; 3) the company did not initially work the best whaling season in this particular area (since information on this was not available when operations began); 4) the size of the whaling grounds was really too big to be covered adequately by a single chaser; 5) even when whales were encountered in large numbers the chaser could only catch as many as it could tow back in a reasonable time (a maximum of 5); 6) since the chaser was not equipped with asdic considerable effort was expended chasing solitary "shy" animals.

The problem of re-siting the Tory Channel whaling station was considered at one time, but the project was shelved at an early stage because of the prohibitive cost. Since the station has now been broken up the problem would be of siting a new whaling station on the coast. There

are only two possible general localities; Kaikoura and Bank's Peninsula. While the Kaikoura Peninsula has the advantage of being close to the largest known seasonal concentration of sperm whales off the coast, it has the disadvantages of exposure to bad weather and no deep water access for ships of even moderate size. Unless a radically new method of hauling the whales ashore was devised, improvement of the anchorage for use by a whaling station would probably necessitate blasting out part of the reef. Considerable numbers of local residents would probably oppose the siting of a whaling station so close to the township, although it would have an obvious tourist attraction.

A number of inlets on Bank's Peninsula would be suitable sites for a whaling station, and the number of property owners affected would be much smaller than at Kaikoura. A small company with two modern chasers of the Japanese or Soviet pattern would be able to work both the Kaikoura ground, the Canterbury Bight and the Chatham Rise, all of which are potentially excellent sperm whaling areas. Catches could be supplemented by fin and sei whales passing the coast in late summer. Large catches of sei whales were made by the factory ship Slava in this area in March 1964. Small-whale prospects are also good.

10. South Canterbury Coast

Although sperm whales occur off this coast and migrating schools of baleen whales have been recorded, there are virtually no suitable sites for whaling operations between the Otago Peninsula and Bank's Peninsula.

11. Otago Southland and Stewart Island

Large catches of sperm whales were made by whaling ships off the Otago Peninsula and Stewart Island in the last century. The Marine Department whale survey did not cover this area intensively, and no information on whaling possibilities is presently available.

12. Westland and Fiordland

A station worked for sperm whales out of Preservation Inlet in the last century with considerable success. Considerable catches of sperm whales could probably still be made, supplemented by fin and sei whales, but the most important considerations in the whaling potential of the area are the relatively short period of good whaling weather and the extreme isolation of the best whaling sites from civilization. Transport costs would be very high for products to be sold in New Zealand. Possibly a shipping company could be persuaded to send a vessel into the fiord in which the station was sited to pick up oil or other products directly for export.

III: THE ECONOMICS OF WHALING IN THE NEW ZEALAND SUB-REGION AND SUITABLE METHODS OF EXPLOITATION

1. Operations for large Whales-sperm, fin and sei

No whaling station in New Zealand waters could hope to operate on baleen whales (fin and sei) alone. Although numbers of both these species pass the coast of New Zealand to east and west, little is known in detail of their movements, and the number available to any particular shore station would probably be small. The distribution of sperm whales is much better known, and the available quantities in certain areas are large enough to support whaling enterprises.

To set up a large-whale industry in New Zealand at the present time would be a difficult undertaking. The capital cost of establishing a viable station with two chasers of modern design could probably not be ~~done for~~ much less than a quarter of a million pounds; this estimate including running costs for only a very short time. It would be advisable for the company to have a side operation of some kind, such as a meal plant that could work on fish, to keep money coming in while the whaling gear and vessels were overhauled in the four month close season. It is noteworthy that experimental operations in the Southern Ocean, using the same vessels for both whaling and fishing (with beam trawls) were not successful. The crew apparently had their attention continually divided and ended up being not very good at either whaling or fishing.

To succeed in the New Zealand sub-region at the present time an enterprise must have the following conditions satisfied: 1) there must be a good supply of whales for the eight month period taken as the whaling season; 2) there must be a ready market for the products; 3) the financial structure of the company must be sound, as periods of bad weather and no whaling must be anticipated and a drop in the world market price of whale oil is a frequent occurrence; 4) the quality of the whale oil must match certain specifications; so the appointment of an experienced station manager/engineer is essential; and 5) at least some of the chaser crew should have had previous whaling experience.

A whaling company with a relatively small amount of capital might succeed in buying two obsolete chasers and still make the operation pay, providing they did not have a run of mechanical trouble such as plagued the Orca during its first season. However no company could hope to succeed for long without the conditions listed above being fulfilled.

The fact that the bulk of a large-whale catch would consist of sperm whales raises a number of difficult problems. Baleen whale oil and sperm whale oil cannot be mixed, so the plant has to be cleaned out between operations if the catch is of both types of whale. There is presently no ready market for sperm whale meat in New Zealand, even as pet food; its dark colour and heavy texture are a sales disadvantage. Any fresh baleen whale meat could be easily sold.

In the last few years the price of sperm whale oil has fluctuated from nearly £90 per ton to a record low of barely £40 per ton. While the price is currently once again high, there is no guarantee that it will remain so. The price of baleen whale oil fluctuates from about £65-80 per ton, but the product usually finds a ready market both locally and overseas. Yields of oil from sperm whales taken by Tory Channel varied from 4 to 8 tons. The yield from fin whales would be higher. Sei whales would normally be taken for their meat.

Experienced personnel are essential to success on the whaling grounds. A whale chaser is actually working on whales for only a small fraction of its total operational time each month, and it must carry out the task of hunting, killing, securing and flagging whales with the utmost precision. Navigation must be of a high order, since much time can be wasted trying to find flagged whales in poor weather conditions. Since weather conditions change very rapidly off the New Zealand coast, even in summer, the station must be sited so that a change of sea or wind does not prevent the chasers bringing whales to the wharf. It has been indicated in the previous section that the best sites for large-whale industries are almost certainly Bank's Peninsula and the east coast of Northland. In the case of the latter area further surveying would be required before operations began, and this work would need to be carried out by trained and experienced whaling scientists or industry personnel. Such a survey should last for at least the summer months and preferably for a whole year.

The same conditions would apply to the Chatham Islands, the only other area where a large-whale industry would have a good chance of success. However a company working there would run into the same problems of communication and transport which mitigate against a large-whale industry in Fiordland or on Stewart Island. Unless enough local labour could be obtained, the company would probably have to pay high wages and recreational leave expenses to retain staff.

2. Operations for small whales - Beaked whales, pilots and minke.

Small whales have been hunted off the coasts of Norway (Jonsgaard, 1951) and Newfoundland (Sergeant, 1962) for many years with varying success. No such enterprise has ever been conducted in New Zealand, but in some areas, of which the Chatham Islands and Stewart Island are two examples, operations might be profitable under certain conditions.

These can be defined as follows: 1) the catching operations should be by the most efficient method which can be employed under local conditions; 2) a market for the meat must be available, preferably local (in Newfoundland the pilot whale meat is sold to the milkfarms); 3) the vessels used should work at the lowest possible cost. The latter is more critical in small-whale operations than in large-whale operations, as the "yield per strike" is much less in the former. It is a great advantage to have a high promontory from which observers with binoculars can spot for whales. Boys could be employed at little cost in vacations to spot the schools of pilot or other whales as they moved into the catching area. These schools are much easier objects to see than whale spouts, and can be picked up at distances of several miles even in moderate seas.

It is useful to have small whale operations conducted in conjunction with other enterprises, such as fishing. Then, if a school is sighted while a number of men are carrying out a shore task, such as net-mending, crews are immediately available to put to sea. Since the financial yield per catch is relatively small in small-whale operations, it is usually too expensive to have a permanent crew on paid standby. In fact this kind of operation seems to be more successful as a community or co-operative venture rather than in the form of a company enterprise.

Several methods can be used for catching small whales. When a few whales of moderate size are sighted, such as a school of four or five killer whales, harpooning either by hand or by shoulder gun is appropriate. The boats for such operations need not be particularly fast, in fact almost any small fishing boat can be used, slightly modified to take running and towing lines.

When large schools of false killer or pilot whales are encountered, direct harpooning at sea is a wasteful method, as the schools quickly scatter, and the great majority of the potential catch escapes. Under these conditions the Newfoundland technique is to use several boats to drive the whales into a shelving sandy bay until they strand. Men on shore then kill them with rifles, pistols and hand lances. The whales are usually easily driven by slapping the water behind them with oars. Once the animals are in the bay it is common practice to harpoon a few leaders to start a panic

among the school. Under conditions of stress the animals strand themselves more rapidly.

If the topography of a small inlet is suitable, the animals can be encircled with a heavy fibre net and towed ashore between two or more boats. The Japanese use heavy nets slung between boats to take small whales and dolphins at sea.

IV: EXTERNAL INFLUENCES : THE EFFECT OF THE SOUTHERN OCEAN WHALING INDUSTRY ON ANY NEW ZEALAND ENTERPRISE

In the last decade there has been a progressive decline in viability of the Southern Ocean pelagic whaling industry. This may soon alter. For the first time the operating nations have agreed on a B.W.U. quota which is compatible with scientific evidence on the catch level that the surviving stocks can tolerate. Although they have not yet been able to agree how this quota should be split among the expeditions, a working agreement will probably be reached.

Had the Southern Ocean pelagic whaling industry continued to hunt the baleen whales to the point of economic extinction, it is likely that the expeditions would have reached the point of diminishing returns before they had drastically reduced the populations of sperm whales in the temperate regions. Since 1962 there has been a growing tendency for sperm whales to be taken by pelagic factory ships on their way to and from the baleen whale grounds in the Southern Ocean. A continuance of this trend at an accelerating rate would eventually seriously affect such shore stations as Saldanha Bay, Durban, Callao, the Azores, Albany and a hypothetical New Zealand station. If the factory ships were withdrawn from the Southern Ocean before this point was reached then the shore stations would be free to work on temperate sperm whale stocks without fear of competition.

It is difficult to assess the pattern of whale exploitation over the next few years. Probably the catches of sperm whales will continue to increase, but at a slower rate as the overall factory ship effort is reduced. The partial agreement on baleen whale exploitation will probably mean that the fin and sei whales will be saved from economic extinction, and that Southern Ocean whaling will continue for at least another five to six years, although the number of expeditions will be steadily reduced. With the pattern of diminishing economic returns developing in this industry, even for the Japanese (and probably the Russians), it is doubtful that any new factory ships will be built specifically for whaling.

Probably the best that can be said is that any New Zealand whaling station set up on a firm financial and technical basis could survive on sperm whale catches alone over the next decade, providing there was not a recession in the price of sperm whale oil again and a local reliable market could be found for the meat products.

An industry based on small species of whales would not be affected by the trends in the catch pattern of the pelagic whaling industry, but the prices offered for oil would be governed by the same factors of supply and demand operating for sperm and baleen whale oil.

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APPENDIXTABLE 1. CATCHES OF LARGE WHALES IN THE ANTACTIC IN THE LAST 10 YEARS (1955-1965) BY SPECIES

Season	Blue	Fin	Hump- back	Sei	Minke	Right	Sperm	Total
1954-55	2,176	28,624	495	569	-	-	5,790	37,654
1955-56	1,614	27,958	1,432	560	42	-	6,974	38,580
1956-57	1,512	27,757	679	1,692	46	-	4,429	36,115
1957-58	1,690	27,473	396	3,309	493	-	6,535	39,896
1958-59	1,192	27,128	2,394	2,421	103	-	5,652	38,890
1959-60	1,239	27,575	1,338	4,309	204	-	4,227	38,892
1960-61	1,744	28,761	718	5,102	162	2	4,800	41,289
1961-62	1,118	27,099	309	5,196	2	1	4,829	38,554
1962-63	947	18,668	270	5,503	-	-	4,771	30,159
1963-64	112	14,422	2	8,695	-	-	6,711	29,942
1964-65	20	7,811	-	20,380	-	-	4,352	32,563

Interpretation: The decline in catches of blue, fin and humpback whales represent real declines in the numbers of whales of these species available to be taken. The increase in the catches of sei whales show the expeditions turning more and more to this species as the numbers of blue and fin decline. The decrease in the catches of minke whales reflect a decline in interest in this species. Catches of sperm whales by pelagic factory ships are not truly reflected in this table, which contains only records of sperm killed south of latitude 40°S. Catches of sperm whales north of this latitude have increased rapidly since 1960-61.

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