

INCIDENTAL ENTRAPMENTS OF CETACEANS, SHARKS AND MARINE TURTLES
IN INSHORE FISHING GEAR REPORTED DURING 1987 IN
NEWFOUNDLAND AND LABRADOR.

A PRELIMINARY REPORT SUBMITTED TO THE DEPARTMENT OF FISHERIES AND
OCEANS AND THE NEWFOUNDLAND AND LABRADOR DEPARTMENT OF FISHERIES.

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Jon Lien, Joanne Papineau, and Lisa Dugan
Whale Research Group, Newfoundland Institute for Cold Ocean
Science and Department of Psychology, Memorial University of
Newfoundland, St. John's, Newfoundland A1B 3X9

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SUMMARY

Throughout the fishing season of 1987 a program assisted fisherman that caught large whales and sharks incidentally in inshore fishing gear. Fishermen reported via a toll-free phone line and were given advice and assistance in releasing the animals and salvaging their fishing gear. Reports of these entrapments and reports of the accidental catches of smaller cetaceans and sharks as well as marine turtles and ice entrapped and stranded cetaceans are also summarized in this paper.

During 1987 a total of 44 humpback entrapments in fishing gear resulted in 7% whale mortality. Minke whales were less frequently caught (n = 12) but had higher mortality (75%) as a result of entrapment. Other species of cetaceans reported caught in fixed inshore fishing gear were harbour porpoise, white-beaked dolphins and fin whales.

Only 22 basking sharks were reported during 1987. Markets for basking sharks were erratic and probably account for the small number reported caught. A good market was found for porbeagle sharks. Several sharks of other species were also reported taken.

Fishermen also called to report leatherback turtles; only 4 were caught in gear but a total of 21 animals were sighted. A total of 9 cetacean strandings, 5 ice entrapments, many incidental captures of seals and several ocean sunfish were reported.

It is estimated that a total of 409 large whale and shark collisions occurred with inshore fishing gear during 1987. Gear losses as a result of these accidents are estimated at \$122,000.

Results of the program for 1987 are discussed in relation to the results obtained in previous years. The joint program of assistance to fishermen with whale and shark problems operated through Memorial University in cooperation with Fisheries and Oceans Canada and the Newfoundland Department of Fisheries is now 10 years old. A major review of the entrapment problem and the release assistance program by the cooperating agencies is requested.

INTRODUCTION

In 1978 Memorial University was contacted by fishermen in Trinity Bay for assistance in retrieving fleets of groundfish gillnets which held two humpback whales (*Megaptera novaeangliae*). The whales had been entrapped for three months. The fishermen had virtually extinguished in their own efforts to get the nets back and release the animals and exhausted contacts with agencies in looking for help. These whales were released by students and staff of Memorial University and their exposure to the problem of whale entrapment in inshore fishing gear was the basis for the organization of a whale research group at Memorial University of Newfoundland. Since 1978 the University, in cooperation with the Department of Fisheries and the Fishermens' Union, have offered a program of assistance to fishermen who inadvertently catch large whales and sharks.

Whale and shark collisions with inshore gear are not a new problem for inshore fishermen in Newfoundland and Labrador. There is much anecdotal and historical evidence indicating that inshore gear damage due to whales and sharks has always occurred at a low, irregular level. During the mid-seventies, however, there was a substantial increase in the amount of damage reported. Whales and sharks were more commonly entrapped in fishing gear made of much stronger modern materials (Lien 1980). Fishermen indicated whale problems were very serious (Lien 1980; Lien et al, 1983) and they have been quite vocal, especially during the years 1979-1980 when the problem peaked, in asking for assistance.

The number of whales, particularly humpbacks, sighted in inshore water of Newfoundland and Labrador has been negatively related to the immature capelin (*Mallotus villosus*) biomass offshore (Whitehead and Carscadden 1985). There are typically high, positive correlations between humpback whale sightings inshore and the number of collisions and entrapments which occur (Lien 1980).

With the recovery of collapsed capelin stocks in 1981 collision and entrapment damages due to whales declined but the numbers of entrapped humpback whales reported each year has remained substantial (from 26 - 52). It has been estimated that about 25% of collision damage fishermen experience is due to basking sharks (*Cetorhinus maximus*); their occurrence inshore in Newfoundland is closely tied to water temperatures (surface temperatures from 8 -12 C) (Lien and Fawcett 1985). Accidentally caught basking sharks are reported each year although numbers vary widely (from 17 - 147). Other cetacean species such as minke whales (*Balaenoptera acutorostrata*) (from 7 - 13 per year), fin whales (*Balaenoptera physalus*) (from 0 - 3 per year) are also reported in fishing gear with requests from fishermen for assistance.

When a collision does occur, the animal is sometimes caught in the gear; from 10 - 25% of collisions result in entrapment. Entrapment frequency following a collision varies with species and the type of gear involved. The trapped animal alive or dead, because of its size and weight, presents a difficult task for the inshore fishermen in retrieving his gear with a minimum of damage so fishing can be resumed. Because fishermen have difficulty coping with large whales and sharks, methods have been developed to aid them in releasing the animal and retrieving their gear (Lien 1980).

The purpose of the present report is to summarize services provided during 1987 to fishermen who called to report entrapped whales and sharks. As the program has now operated for ten years, a summary of entrapments which have occurred during that period and the entrapment assistance program are reviewed.

METHODS

Fishermen report whale and shark problems by a widely advertized toll-free phone line, to management officers of Fisheries and Oceans or the Newfoundland Department of Fisheries. In some cases entrapments and strandings are also reported to the Royal Canadian Mounted Police or the Canadian Coast Guard. On occasion dead whales that drift into communities or near fishing berths are reported through the Newfoundland Department of the Environment. All these agencies relay such calls to the University.

The Whale Research Group at Memorial University maintains a year-round capacity to respond to calls from any point in Newfoundland and Labrador. As required, help was sent to fishermen who requested assistance in removing animals from gear. Assistance was given by staff in St. John's or by other experts we notified around the island or in Labrador. In all cases assistance was given with 24 hours of the fishermen's request; usually the fishermen's problem or the stranding was dealt with in hours of receiving the report. In all cases where assistance was given a substantial effort was made to teach fishermen and local people skills in dealing with entrapped and stranded animals and release procedures. Detailed descriptions of methods are presented in Lien 1980; 1986 and Lien et al 1981.

RESULTS OF THE PROGRAM DURING 1987

Lists of cetaceans reported entrapped in fishing gear during 1987 are presented in Tables 1-4 and locations of these incidents are shown in Figures 1 and 2. Stranded cetaceans reported during 1987 are shown in Table 4 and occasions where cetaceans were reported trapped in ice are shown in Table 5. Lists of shark species caught are shown in Tables 6-8 and their locations shown in Figures 3 and 4. Marine turtle (Dermochelys coriacea) reports are shown in Table 9 and locations shown in Figure 5.

HUMPBACK WHALES

A total of 44 humpback whales were reported entrapped in inshore fishing gear (Table 1). Usually the call reporting the entrapment was received as soon as the fisherman discovered the problem. Often reports of the same entrapment were received from several individuals. Six animals (13.5%) that were reported entrapped towed at least part of the fishing gear off before complete release; three of these animals were later caught in another location and a complete ruined but the third release retrieved usable gear. It is possible that the remaining three animals that towed gear off were later reported and could be listed twice in Table 1, but we cannot be certain. Three humpbacks (6.8%) died as a result of entrapment.

Most entrapments occurred in June (36%) and July (39%) with some in May (9%) and August (16%). Most entrapments occurred in fleets of groundfish gillnets (42%), codtraps (33%) or salmon gillnets (17%). Several early entrapments were reported in fleets of lobster pots or lump gillnets.

Humpback whale entrapments occurred primarily on the NE Coast of Newfoundland (Figure 1) from La Scie on the Bay Verte Peninsula to Greenspond, Bonavista Bay. A second cluster of humpback entrapments occurred from Cape St. Marys to St. Shotts on the Avalon Peninsula.

MINKE WHALES

Twelve minke whales were reported entrapped in fishing gear during 1987 (Table 2). Most were caught in fleets of groundfish gillnets (42%) or codtraps (33%) in June (42%) or July (50%). Most minke whales (75%) died as a result of entrapment. Locations where minke whales were reported to us tended to be in Eastern Newfoundland around the Avalon Peninsula (Figure 2).

OTHER SPECIES OF CETACEANS

A total of 25 individuals of other species of cetaceans were reported (Table 3). Most were harbour porpoise (*Phocoena phocoena*); 1 white-beaked dolphin (*Lagenorhynchus albirostris*) and 1 fin whale were also reported entrapped. The number of harbour porpoise reported this year is somewhat inflated as for a brief period fishermen in St. Mary's Bay found a "market" for them. Fishermen use meat from 'puffin pigs' and they usually cause no damage to fishing gear so they are typically not reported as entrapped or a nuisance.

INCIDENTALLY CAUGHT SEALS

Reports of seals caught in fishing gear are now routinely transferred to the Seal Mammals Group in Fisheries and Oceans Science Branch in St. John's. Two reports are worth noting here as they occurred in the Gulf Region, which lies outside their mandate and could not be investigated.

Fishermen in the Woody Point, Bonne Bay area called to complain about an extensive harp seal (*Phoca groenlandica*) catch in groundfish gillnets. Estimates were from 8-15 young harps per 60-70 nets per day. The local spokesman suggested that each year for about 3 weeks in June over the past 3-4 years they had taken similar numbers.

In Old Fort, Quebec fishermen report a similar extensive catch. On-site discussions (in Sept., '87) with quite a number of fishermen from this community indicate that perhaps from 500-2000 mostly young harps are taken in the spring groundfish gillnet fishery.

CETACEAN STRANDINGS AND ICE ENTRAPMENTS

Nine reports of cetacean strandings (Table 4) including 2 sperm whale (*Physeter catodon*), 2 white-beaked dolphins, a Sowerby's beaked whale (*Mesoplodon bidens*) and 4 reports of very large whales, either fins or blues (*Balaenoptera musculus*). Large whales reported floating at sea can move considerable distances and we cannot be sure how many dead whales are involved in the 3 large whale reports where sea positions are given.

Ice entrapments occurred on the South Coast in Fortune Bay and in Placentia Bay. Five reports involving 27-32 individual animals of 4 cetacean species including minke, humpback, white-beaked dolphin and harbour porpoise were made during April.

BASKING SHARKS

Basking sharks reported caught in fishing gear during 1987 are presented in Table 5 and locations of these incidents are presented in Figure 3. Twenty-two basking sharks were caught in July (23%) and August (77%) primarily around the Avalon Peninsula. Most were caught in groundfish gillnets (59%) or codtraps (36%).

OTHER SPECIES OF SHARKS

Porbeagle sharks (*Lamna nasus*) caught and reported during 1987 are presented in Table 7 and locations of these catches are shown in Figure 4. Other species caught including Greenland (*Somniosus microcephalus*) and blue sharks (*Pionace glauca*) are shown in Table 8. A market of \$2.20/kg. was found for porbeagles in the St. John's area where most catches were reported. Dressed sharks which were sold (headoff/gutout) weighed from 98-161 kg. A market of \$.22/kg. for blues (headoff/gutout) enabled a few fishermen to sell these species as well.

MARINE TURTLES

Fishermen now use the toll-free phone line to report many kinds of animals they capture or to ask questions. Over the past several years leatherback turtles (*Dermodochelys coriacea*) have commonly been reported Geoff and Lien (1987).

Four leatherback turtles were caught in fishing gear during 1987; two of these animals did not survive the captivity (Table 9). Seventeen leatherbacks were sighted and reported primarily around the Burin Peninsula in August (Figure 5).

COST OF DAMAGES TO FISHING GEAR

From 1979-1985, each year cost of damages to fishing gear was monitored directly by having fishermen fill in damage report cards. Such monitoring depends on fishermen volunteering information. Submission of information does not result in any direct benefit to the informant and this tends to result in under-reporting. Fishermen who do report may expect some compensation or assistance as a result of their damage and such an expectation would tend to result in exaggerated reports. Beginning in 1986 cost of damages was estimated by using the number of entrapped humpbacks reported. A mean ratio of entrapment to collision frequency from 1979-1985 was 9.3 and an average cost of a collision was estimated to be around \$300 (Lien et al 1986).

Using this formula a total of 409 whale and shark collisions are estimated for 1987 at a cost of \$122,760.

RESULTS OF THE PROGRAM DURING THE PAST 10 YEARS

Humpback whale entrapments in fishing gear reported from 1978-1987 are presented in Table 12 and shown in Figure 6. Percentage mortality for humpbacks during this period is shown in Figure 7.

During the past 10 years humpback entrapment reports have varied from a low of 26 in 1984 to a high of 52 in 1985. The numbers of reported entrapments are believed to be quite representative from 1981 to 1987. By comparing reports to in situ interviews it appears that entrapments in these years are under-estimated in Newfoundland by about 10% (Lien et al 1981; 1982; 1983; 1984; 1985; 1986). During the first several years the program operated under-estimation was a much more serious problem. Most certainly the 1978 numbers seriously under-estimate the problem. Wide advertizing of the entrapment program began in 1979 but Lien (1980) estimated that under-reporting was from 20-50% which would mean 59-72 humpback entrapments occurred. In 1980, Lien (1980) estimated under-reporting from 10-25% so 67-76 humpback entrapments would be estimated. Under-reporting tendencies cannot be accurately estimated for Labrador.

Humpback mortality as a result of entrapment for this period is presented in Figure 7. Mortality was 50% in 1978 and fell to about 30% in 1979-1980. Mortality for the past three years of the entrapment program has been about 10%.

Minke whale entrapments from 1978-1987 are presented in Table 10. Entrapments of this whale are far more infrequent although this is a far more common animal than the humpback. Minke whale entrapments do not show a trend in frequency and mortality has not been consistently reduced.

Basking shark catches reported 1979-1987 are shown in Table 11. Catch per year ranges from 17-147 per year.

A summary of gear losses due to whales and sharks from 1979-1987 is presented in Table 12. Losses near \$400,000 per year occurred in 1979 and 1980. Losses from 1981-1985 have been under \$100,000. per year. In 1986-1987 gear losses have risen slightly. The actual cost of a collision includes both gear losses and down-time losses. Although down-time losses vary considerably it is estimated that such losses may be four times as much as gear losses themselves, especially for short season fisheries such as cod trapping (Lien 1980).

DISCUSSION

The whale and shark entrapment program was designed to assist fishermen in Newfoundland and Labrador in dealing with a serious problem which caused substantial financial loss and disruption in the inshore fishery in the period 1978-1980. When the program began, the humpback whale, then recognized in Canada as an endangered species, was thought to be primarily responsible for collision damage to inshore fishing gear: an endangered species making an absolute pest of itself. As humpback whales occurred inshore in far greater numbers in the late 1970's because of an offshore capelin stock collapse, it was believed a short-term program to deal with the problem for several years was necessary, until capelin stocks recovered (Lien and Merdsoy 1980).

From the outset, it was recognized that there would be little chance for a solution to the conservation aspects of whale/fishermen conflict unless a program could assist fishermen in minimizing their losses and fishermen perceived they were given fair and effective assistance. Without the cooperation of fishermen neither a conservation or a fisheries management program can work well. The biological basis for the increased numbers of whales inshore were widely explained in educational program (Lien 1986). To minimize financial losses markets were found for basking and porbeagle sharks which frequently caused damage fishermen attributed to whales. Damages to fishing gear were greatest when whales or sharks became entrapped in nets, as were down-time losses, so to minimize these costs methods to release live or dead animals from nets quickly with little additional insult to the fishing gear were developed and their use quickly became popular with fishermen.

However, entrapments of large whales and sharks in inshore fishing gear has remained reasonably high even after 1981 when capelin stocks recovered. While the problem with humpbacks has decreased and overall gear damages have decreased, the conflict inshore fishermen have with large whales and sharks remains significant. As the entrapment assistance program has operated in its present form for 10 years, it is an appropriate time for a basic review of the program.

FREQUENCY OF ENTRAPMENTS

Costs of whale and shark collisions to inshore fishermen were highest during 1979-1980 (Figure 13) and have declined since to about one-quarter of the damages experienced during those years. Reported entrapments of humpbacks, especially when considering the tendency for under-reporting during the programs early years, have not declined quite so dramatically. Minke whale entrapments show no clear trends over the decade. Reported entrapments of basking sharks show erratic variability caused by variation in ocean temperatures and markets for the

animals. The reality of the problem for the entrapment assistance program is that nearly the same number of animals were reported by phone with requests for help in 1987 (147) as were reported in the peak year of 1980 (149).

The predicted reduction of humpbacks inshore (Lien and Merdsoy 1980) has occurred with capelin stocks rebuilding offshore (Whitehead and Carscaden 1985) and the inshore numbers continue to be relatively low during 1987 (Lien and Hogan, unpublished data). However, 44 humpback entrapment calls were received during 1987 and gear damages of \$122,000. are estimated.

The continued fairly high level of humpback entrapments must be an interaction of several factors. Of course the level of effort in the inshore fishery is high. New fisheries, for instance for lumpfish (*Cyclopterus lumpus*), now account for some entrapments. Present prices for groundfish insure effort even when catches are somewhat smaller and perhaps prolong seasons.

A second factor is undoubtedly the sheer numbers of humpbacks which populate Newfoundland and Labrador waters. Recent population estimates of the Newfoundland and Labrador stock of NW Atlantic humpbacks by the mark-recapture method using fluke photographs yield estimate of about 3-4000 individuals (S. Katona, personal communication) and in Canada the Atlantic population has grown from the low numbers of animals (Mitchell 1974) estimated by researchers of the last decade because of differences in methodology and large confidence limits. But it is reasonable that protection has increased humpback numbers in waters off Newfoundland and Labrador and with more whales, especially humpbacks, collisions and entrapments will continue. Other ocean areas frequented by humpbacks, are now also experiencing problems catching them in fishing gear. Alaska caught 7 during 1987 (S. Baker; J.L. Sease, personal communications) and entrapments off New England have been at a low, regular rate for the past several years (S. Mayo, personal communication). Increasing numbers of whales returning to ocean areas now used for economic activities by man will inevitably come into conflict.

A third factor which results in the relatively high number of entrapments reported is due to the fishermen's willingness to call the entrapment program for assistance. Fishermen who have been surveyed (Lien et al 1983) have found the program useful in cutting their losses. Multiple calls reporting the same entrapment also reflect willingness to use the program. Thus we now hear about most entrapments. Variability in the markets for large sharks has also been such that fishermen who catch these animals can really only get the latest information from the entrapment program.

These factors together, and perhaps others, account for the present level of entrapments we hear about. Given the stability of reports from 1981 to the present the most reasonable prediction is that the entrapment problem will continue, with considerable variation, near the same level in the foreseeable future.

MORTALITY AS A RESULT OF ENTRAPMENT

An initial concern of the entrapment assistance program was the needless, often prolonged, deaths of endangered whales in fishing gear. Even if the view is taken that whales are now just "pests", fishermen or agencies that, in these times, abuse them would probably quickly find it difficult to sell their fish. A survey of nearly 7,000 Canadians found whales are the "most favorite" animal in Canada (Walters and Lien 1985) and similar trends are reported for England and the United States.

Luckily for all, a live whale in a net is a great benefit to the fishermen compared to a dead one. Although a live whale held in your damaged net is, understandably, much resented by a fisherman, that animal has caused less damage than a dead one, that has vented its full strength against the gear. If carefully approached and removed, live-released whales minimize fishermen's losses. Fishermen now widely understand and accept this (Lien 1983; Lien et al 1985b).

A key component effecting the mortality of entrapped whales is this understanding and assistance in effectively clearing the animal. Early calls about an entrapment incident with expert advice and assistance clearly minimize mortality.

However, another component in mortality is the behavior of the animal itself. Humpbacks, when entrapped, typically after an initial struggle become quiet, sometimes almost inert if held fast. They can then be safely and quickly removed from the gear. Mortality has dropped (Figure 7) from as high as 50% in this whale to 7% in 1987.

Minke whales typically appear to behave quite differently when entrapped. They are much smaller than humpbacks and may find it more difficult to carry entangled gear to the surface for breathing. They are much smoother with fewer bumps and knobs to catch on nets, less likely to be caught in a net collision. This may mean that minkes which are found entrapped are more seriously caught than the average humpback, which on occasion appears to be held by very minimal contact with the fishing gear. Also, commonly minkes continue struggling throughout an entrapment. Often, they struggle when nearly completely confined during a release procedure. Mortality in minkes has not been reduced as a result of the entrapment assistance program.

Basking and porbeagle sharks rarely are released alive after entrapment. They are much more difficult to release alive than dead from gear and because of markets which enable fishermen to recover some of their financial losses, there is no incentive to release them alive anyway. In 1987 one basking shark was released alive in Placentia Bay. A fisherman, celebrating both his birthday and twenty-fifth wedding anniversary, live-released a basking shark. We persuaded to tag it first for us! Few inshore fishermen can afford such costly celebrations too often.

Marine turtles when entrapped are released quite easily at sea. However, frequently they are towed into shore as a curiosity and mortality of entrapped turtles following these efforts to provide public viewing is quite high.

Thus entrapment assistance is a success in reducing entrapment mortality of humpback whales but has had little effect on mortality in other species.

ASSISTANCE TO FISHERMEN

The last systematic assessment of the feelings of fishermen about whale and shark damage and the entrapment assistance program was conducted in 1983 (Lien et al 1983). A survey was made of 43 fishermen's committees in areas that had experienced whale and shark problems and their views on the whale and shark problem and the entrapment program were solicited. Of 43 committees, 26 replied for a response rate of 62%. Results indicated that fishermen now ranked the whale and shark problem fairly low in their concerns about the fishery; it was less serious now than it had been. About 90% felt very positive about the entrapment assistance program; 80% felt there was a continuing need for the program; 70% rated it as valuable or excellent. Only 12% rated the codtrap depot program as useful. Compensation was commonly requested (62%) but 50% of the committees that replied felt insurance was important. About 70% of the committees requested that work continue on alarms or techniques which would prevent whale and shark collisions with fishing gear in the first place.

Since this survey, feedback from fishermen has been informal but quite uniformly positive. Entrapment assistance does save money (Lien 1980) but it is difficult to say honestly how much. Every year our impression has been that we have saved fishermen much more in direct gear damage than the program has cost to operate. More importantly, in some fisheries such as cod trapping, the entrapment assistance minimizes down-time losses and disposes of a vexing, emotional problem at very critical time of year.

ENVIRONMENTAL GROUP REACTIONS

Conservation concern for endangered whales has been an important factor in the initial design of the entrapment assistance program. Newfoundland's fisheries have for the past several decades been followed with interest by North American environmental groups. A focal group of animals for North American environmentalists have been marine mammals and many have followed the whale/fishermen conflict in Newfoundland with interest. Although no systematic reactions have been solicited, in general, very favorable reactions have been given to the entrapment assistance program and the work of Newfoundland's inshore fishermen in releasing whales.

RESEARCH VALUE OF THE ENTRAPMENT PROGRAM

There is a fundamental incompatibility between offering emergency assistance to fishermen with entrapped animals and scientific study of the animal trapped. Long-term monitoring of the entrapment problem is important documentation for fishery managers and this type of data does result from the assistance program. Other scientific work conducted in conjunction with the entrapment assistance program has generally focused on understanding the problem or solutions to it. A few basic scientific studies have been done which varied from ecological (Whitehead and Carrscaden 1985) to molecular genetics (Arnason et al 1987) and toxicological (Muir et al 1987), behavioral (Lien and Storey 1987), or on general cetacean biology or the biology of strandings of entrapments where animals died. In order to communicate with fishermen effectively basic educational studies have been done (Lien 1985; Walters and Lien 1985; Lien et al 1987). Much of the basic scientific and educational studies have been generated to serve the entrapment assistance program and improve it rather than use the assistance program to provide an opportunity to do research.

RECOMMENDATIONS

1. The incidental catch of harbour porpoise in Newfoundland and Labrador waters is suspicious, especially in St. Mary's Bay where, when a market briefly appears, fishermen start bringing many animals. Lien (1980), based on phone surveys over one summer estimated that "puffin pigs" were commonly taken. This by-catch has not been well examined and should be by systematic monitoring.

2. Leatherback turtles released and towed to a wharf for public display do not fare well. An educational program should be developed to prevent taking entrapped turtles home.

3. The entrapment assistance program is now 10 years old and should be reviewed by agencies that are responsible for it and those concerned with the problem. Responsible individuals and groups will be contacted and asked to respond to the following basic questions regarding the future of the program:

Is the program necessary?

Can the program be reduced in scope?

Are supplementary programs required?

Are there alternative programs required?

Are there specific goals or functions you or your agency would like changed?

Who should be responsible for the program?

Who should operate the program?

How should the program be funded?

What specific operational changes should be made to make the program more useful to you or your agency?

REFERENCES

- Arnason, U., P. Alderdice, J. Lien and B. Widegren (1987) Highly repetitive DNA in the baleen whale genera *Balaenoptera* and *Megaptera*. ms.
- Breeck, K. and J. Lien (1987) Cetacean strandings in Newfoundland and Labrador and geomagnetic characteristics of stranding locations. North Atlantic Marine Mammal Association Proceedings of Meetings, March 1987 (Abstract only) 19.
- Dix, L., J. Lien, D.E. Sergeant (1986) A North Sea Beaked Whale, *Mesoplodon bidens*, in Conception Bay, Newfoundland. Canadian Field-Naturalist 100 (3) 389-391.
- Geoff, G. and J. Lien (1987) Leatherback turtles (*Dermochelys coriacea*) in cold water off Newfoundland and Labrador. The Canadian Field-Naturalist, In Press.
- Lien, J. (1980) Whale collisions with fishing gear in Newfoundland. Final Report to Fisheries and Oceans Canada, 316 pp.
- Lien, J. and B. Merdsoy (1980) The humpback is not over the hump. Natural History, June, 46-49.
- Lien, J. and D. Aldrich (1982) Damage to inshore fishing gear in Newfoundland and Labrador by sharks and whales during 1981. CAFSAC WP/82104, 46 pp.
- Lien, J., J. Dong, L. Baraff, J. Harvey, K. Chu (1982) Whale entrapments in inshore fishing gear during 1982. A preliminary report to Fisheries and Oceans Canada, 26 pp.
- Lien, J., S. Staniforth, L. Fawcett, R. Vaughan, J. Dong (1983) Whale and shark entrapments in inshore fishing gear during 1983. Report to Fisheries and Oceans Canada, 21 pp.
- Lien, J., L. Dix, E. Lee, H. Walter (1984) Whale and shark entrapments in inshore fishing gear during 1984. Report to Fisheries and Oceans Canada, 21 pp.
- Lien, J., H. Walter, C. Harvey-Clark (1985) Whale and shark entrapments in inshore fishing gear during 1985. Report to Fisheries and Oceans Canada, 22 pp.
- Lien, J. and L. Fawcett (1985) Distribution of basking sharks, *Cetorhinus maximus*, incidentally caught in inshore fishing gear in Newfoundland. Canadian Field-Naturalist, 100 (2) 246-252.
- Lien, J., K. Breeck, D. Pinsent, H. Walter (1986) Whale and shark entrapments in inshore fishing gear during 1986: A preliminary report to Fisheries and Oceans Canada, 33 pp.

- Lien, J. (1986) Teaching fishermen about whales. *Whalewatcher: Journal of the American Cetacean Society*, 20 (1), 2-7.
- Lien, J., J. Dodd, H. Walter and B. Brown (1987) Can we teach everybody to feel the same way about whales? Seventh Biennial Conference on the Biology of Marine Mammals, Miami, Fla. (Abstract only).
- Lien, J., G.B. Stenson, S. Booth, P. Jones and R. Sears (1987b) Ice entrapments of blue whales (*Balaenoptera musculus*) in Newfoundland and Labrador (1978-1987). *North Atlantic Marine Mammal Association Proceedings of Meetings, March 1987*, (Abstract only), 20.
- Lien, J., A. Storey (1987) Vocalizations of humpback whales when they're all alone. Seventh Biennial Conference on the Biology of Marine Mammals, Miami, Fla. (Abstract only).
- Mitchell, E. (1974) Present status of Northwest Atlantic fin and other whale stocks. In W.E. Schevill (Ed.) *The Whale Problem, A Status Report*, Harvard University Press, Cambridge, 108-169.
- Muir, D.C.G., R. Wagemann, N.P. Grift, R.J. Norstrom, M. Simon and J. Lien (1987) Organochlorine and heavy metal contaminants in white-beaked dolphin (*Lagenorhynchus albirostris*) and pilot whale (*Globicephala melaena*) from Newfoundland, Canada. *Archives of Environmental Contamination and Toxicology*, In Press.
- Walters, H. and J. Lien (1985) Attitudes of Canadian students and teachers towards the marine environment and marine education. In J. Lien and R. Graham (eds.) *Marine Parks and Conservation: Challenge and Promise, Vol. 1*, National and Provincial Parks Association of Canada, Toronto, pp. 187-205.
- Whitehead, H. and J.E. Carscadden (1985) Predicting inshore whale abundance - whales and capelin off the Newfoundland coast. *Can. J. Fish. Aquat. Sci.* 42 (5), 976-981.

TABLES AND FIGURES

Table 1: Humpback whales (*Megaptera novaeangliae*) reported entrapped in fishing gear during 1987

Date	Place	Gear	Outcome
12 May	Pt. Saunders	lobster pots & gillnets	Released alive
21	Cape Broyle	Salmon net	Released alive
21	Pt. Saunders	gillnets	Released alive
29	St. Brides, P.B.	gillnets	Self release
2 June	St. Brides, P.B.	gillnets	Towed gear off
4	Little Hr., P.B.	codtrap	Released alive
8	St. Brides, P.B.	gillnets	Released alive
14	Greenspond, B.B.	codtrap	Self release
15	Greenspond, B.B.	salmon nets	Self release
16	Greenspond, B.B.	codtrap	Self release
17	Duntara, B.B.	codtrap	Self release
20	Peter's River	codtrap	Released alive
22	Witless Bay	codtrap	Self release
22	Bay de Verde	codtrap	Dead. Examined by Lien
22	Eddies Cove, GNP	lumpnets	Released alive
23	Valleyfield, B.B.	lumpnets	Released alive
28	La Scie	salmon net	Whale towed gear off
28	Snooks Arm	salmon net	Released alive
29	Snooks Arm	salmon net	Self release
30	Green Is. Cove, GNP	codtrap	Released alive
3 July	St. Anthony	gillnets	Whale towed gear off
4	Herring Neck, NDB	codtrap	Dead. Examined by Lien

5	Torbay	codtrap	Self release
9	Twillingate	gillnets	Whale towed gear off
9	Ladle Cv., NDB	gillnets	Released alive
9	Fogo, Fogo Is.	codtrap	Released alive
14	Musgrave Harbor	gillnets	Whale released alive
15	Musgrave Harbor	gillnets	Released alive
15	Shoe Cove, Green Bay	salmon net	Whale towed gear off
16	Twillingate, NWI	gillnets	Whale towed gear off
19	Bonavista, B.B.	gillnets	Self release
20	Merritts Hr., NDB	codtrap	Released alive
20	Main Brook, GDP	codtrap	Released dead
22	St. Brides, P.B.	gillnets	Whale towed gear off
26	Twillingate	gillnets	Whale towed gear off
29	Goose Cove, GDP	salmon nets	Released alive
31	Joe Batts Arms	gillnets	Released alive
1 August	Exploits Is., NDB	codtrap	Released alive
4	Battle Hr., Lab	salmon net	Released alive
7	Bonavista	gillnet	Released alive
9	Shoe Cove, Green Bay	codtrap	Released alive
19	Greenspond, B.B.	gillnet	Released alive
22	Burin	gillnet	Released alive
28	Straits of Belle Isle	gillnet	Released alive

Table 2: Minke whales (*Balanenoptera acutorostrata*)
reported entrapped on fishing gear during 1987.

Date	Place	Gear		Outcome
15 June	Britanna, T.B.	codtrap	7.4m	Dead
17	Wesleyville	salmon net	9.2m	Released dead
19	North Boat Hr.	lump nets	?	Animal towed nets off
23	Tors Cove	capelin trap	?	Entrapped several hours - self release
26	Point Verde, P.B.	gillnets	7m	Dead
3 July	Emerald Isle, T.B.	gillnets	24'	Dead
4	Schnde Bay	codtrap	7m	Dead
12	Joe Batts Arm	codtrap	est. 6.5- 7.5m	Dead
14	Brigus, C.B.	gillnets	5.5m	Released alive
22	Lawn	codtrap	7m	Dead
27	Admirals Cove	?	7.9m	Dead
1 Aug.	St. Brides, P.B.	gillnets	4.9m	Dead

Table 3: Misc. species of cetaceans reported caught in fishing gear during 1987.

Date	Location	Species	Gear Involved	Comments
15 June	Torbay	Harbor porpoise (Phocoena phocoena)	Salmon net	Dead
17	Kelly's Is. C.B.	Harbor Porpoise	Groundfish Gillnet	5 released 7 dead
23	St. Brides, P.B.	Harbor porpoise	Groundfish Gillnets	3 dead Examined by J. Bratty
July	Branch	Harbor porpoise	Groundfish Gillnets	Total of 8 animals collected by fish plant.
21 Aug.	Frenchman's Cove, F.B.	White-beaked dolphin (Lagenorhynchus albirostris)	Groundfish Gillnet	Dead
25	Frenchman's Cove, F.B.	Fin (Balaenoptera physalus)	Groundfish Gillnet	14.4m Dead - Examined by Lien & Bose

Table 4: Cetaceans reported stranded during 1987 (to Sept. 31)

Date	Location	Species	Sex	Length
11 June	Red Harbor, P.B.	Sperm (Physeter catadon)	Male	15m - Examined by Lien & Mate
8 July	Penguin Is. W.	Sperm	Male	13.2m - Examined by Lien
3 Aug	SE St. Anthony (50°42N; 54°07W)	Fin or Blue	?	est. 20-24m
11	New Ferolle	?	?	12-14m
27	Frenchman's Cove, F.B.	White-beaked dolphin (Lagenorhynchus albirostris)	Female	?
28	48°41'N; 52°17'W	?	?	"large" (maybe same as 3 August report)
14 Sept	50°15'N; 54°03W	?	?	Very large (maybe same as & 28 Aug animal)
14	Lewisport	White-beaked dolphin	?	3 animals pulled alive from beaches
19	Norris Arm, NDB	Sowerby's beaked whale (Mesoplodon bidens)		4.8m - Examined by Lien

Table 5: Ice Entrapments of cetaceans reported during 1987

Date	Place	N	Spp	Outcome
2 Apr	Marystown	1	Minke (<i>Balaenoptera acutorostrata</i>)	Stayed in ice 3-4 days. last seen alive - probably left when ice receded.
3	Little St. Lawrence	15-20	Hr. Porpoise (<i>Phocoena phocoena</i>)	Trapped 24 hrs. last seen alive.
8	Lawn, P.B.	8-12	White-beaked dolphin (<i>Lagenorhynchus albirostris</i>)	Disappeared as ice receded. 4 found dead on 12 July.
22	Little Bay East, F.B.	2-3	White-beaked dolphin	Disappeared as ice receded
22	Bay L'Argent	1	Humpback (<i>Megeptera novaeangliae</i>)	Disappeared as ice receded

Table 6: Basking sharks (*Cetorhinus maximus*)
reported caught in fishing gear during 1987.

Date	Location	Length	Sex	Gear
13 July	Hearts Delight, T.B.	est 6.8m	Male	codtrap
14	Lower Is. Cove, C.B.	est 7.4m	Female	codtrap
14	Upper Is. Cove, C.B.	est 8m	Male	groundfish gillnets
29	Parker's Cove, P.B.	est 8-9.2m	Male	groundfish gillnets
31	Fairhaven, P.B.	est. 5.5- 6m	Male	(tagged & released)
1 Aug	Portugal Cove, C.B.	?	?	codtrap
1	Bauline, C.B.	?	?	codtrap
1	Bay Bulls	?	?	gillnets
1	Bauline South	?	?	gillnets
1	Port-aux-Basque	?	?	gillnets
2	Bauline, C.B.	?	?	codtrap
3	St. Bernard's, F.B.	est 8.3- 8.6m	Male	gillnets
4	Bauline South	?	?	gillnets
4	Holyrood, C.B.	3.8m	Male	jigger
6	Bauline, C.B.	8.4m	Male	codtrap
8	Portugal Cove, C.B.	?	?	codtrap
13	Quirpon	est. 9.2m	Male	codtrap
17	Greens Pond, B.B.	5.6m	Female	groundfish gillnets
20	Fogo, Fogo Is.	est. 3.7m	?	gillnets
26	St. Bernard's, F.B.	?	?	groundfish gillnets

27	Virgin Arm, NDB	est. 4.9m	Female	gillnets
27	Bridgeport, NDB	est. 8.6- 9.2m	Male	gillnets

Table 7: Porbeagle sharks (*Lamna nasus*) reported caught during 1987.

Date	Location	Length	Sex	Gear Involved
26 June	Port Kerwin	2.2m	Female	Groundfish gillnet
7 July	Fairhaven, P.B.	2.6m	Male	Codtrap
30	Torbay	?	?	Codtrap
3 Aug.	Little Bay	?	?	Gillnet
4	Bauline, C.B.	?	?	Groundfish gillnet
4	Flatrock	?	?	Groundfish gillnet
1st week	Parkers Cove, P.B.	?	?	2 porbeagles in gillnets
13	Port au Port Penn.	est 2m	?	gillnets
10 Sept	Bauline, C.B.	?	?	2 porbeagles in gillnets
18	Fox Hr., P.B.	2.4m	Male	Groundfish gillnets
20	Bauline, C.B.	?	?	3 porbeagles in gillnets

Table 8: Misc. species of sharks reported entrapped during 1987.

Date	Location	Species	Details
26 May	Couch	Greenland (Somniosus microcephalus)	6m animal, in groundfish gillnets.
21 July	Lawn	Blue (Prionace glanca)	In groundfish gillnets.
28	Bell Is., C.B.	Blue	Schools of blues visible from cliffs - several caught.
28 Aug.	St. Brides, P.B.	Blue	4 animals in groundfish gillnets
1 Sept.	Grand Beach, F.B.	Blue	Est. 2m long animal in groundfish gillnets.

Table 9: Leatherback Turtles (*Dermochelys coriacea*) reported sighted or entrapped in fishing gear during 1987.

Date	Location	Comments
10 June	Hermitage	Sighting of turtle
22 July	Hermitage	Dead turtle in trawl - disposal of at sea, not examined.
10 Aug	Shoe Cove, Green Bay	Caught in gillnets - released alive
17-21	Lord's Cove, P.B.	8 turtles sighted during week
20-28	Old Fort Bay, P.Q.	4 leatherbacks sighted
21	St. Lawrence	Leatherback (est. 1000 lb.) caught in groundfish gillnet -released alive
23	Garnish, F.B.	Large turtle sighted
12 Sept	Logy Bay	Turtle approached boat
14	Long Harbor, P.B.	Turtle (est. 6 ft. long) approached boat
16	Fox Harbor, P.B.	Turtle sighted
18	Fox Harbor, P.B.	Turtle caught in gillnet and towed to wharf, examined by Geoff, Stenson, Chatman & Lien. Died. Female

Table 10: Minke whale (*Balanenoptera acuterostrata*) entrapments in inshore fishing gear reported throughout Newfoundland and Labrador estimated numbers of entrapments, and mortality as a result of entrapment. (1978-1987)

<u>Year</u>	<u>N Reported</u>	<u>% Mortality</u>	<u>N Entrapments estimated</u>
1978	5	100	?
1979	10	90	13
1980	12	75	15
1981	11	72	12
1982	9	44	10
1983	11	36	12
1984	8	75	9
1985	9	77	10
1986	7	42	8
1987	12	75	13

Table 11: Number of basking sharks (Cetorhinus maximus) caught per year (1979-1987)

Year	N of Animals
1979	5
1980	65
1981	125
1982	35
1983	147
1984	39
1985	39
1986	17
1987	22

Table 12

Year	N Reported Humpback Entrapments	N Reported Collisions	Estimated (1) N Humpback Entrapments	Reported on Estimated Gear Losses (in \$)
1979	47	441	72	384,000
1980	51	813	76	381,000
1981	31	238	34	80,000
1982	35	174	38	71,000
1983	35	387	38	67,000
1984	26	268	29	82,000
1985	52	255	57	68,000
1986	34	316*(2)	37	95,000(3)
1987	43	399*(2)	47	120,000(3)

Table 12: Reported and estimated humpback whale entrapments and fishing gear damage (1979-1987). (1) Estimated figures are the actual reported values corrected for a tendency founder-report incidences (Lien et al. 1981). Data for 1979-1980 is from Lien, 1980; data from 1981-1986 if from Lien et al, 1981; 1982; 1983; 1984; 1985; 1986. 1987 details from this report. (2) In 1986 reports of collisions were no longer tallied. Estimated frequency of collisions was estimated from by an average ration (1979-1985) of 9.3 collisions per humpback entrapment. (3) Cost per accident was estimated at \$300.00 per collision.

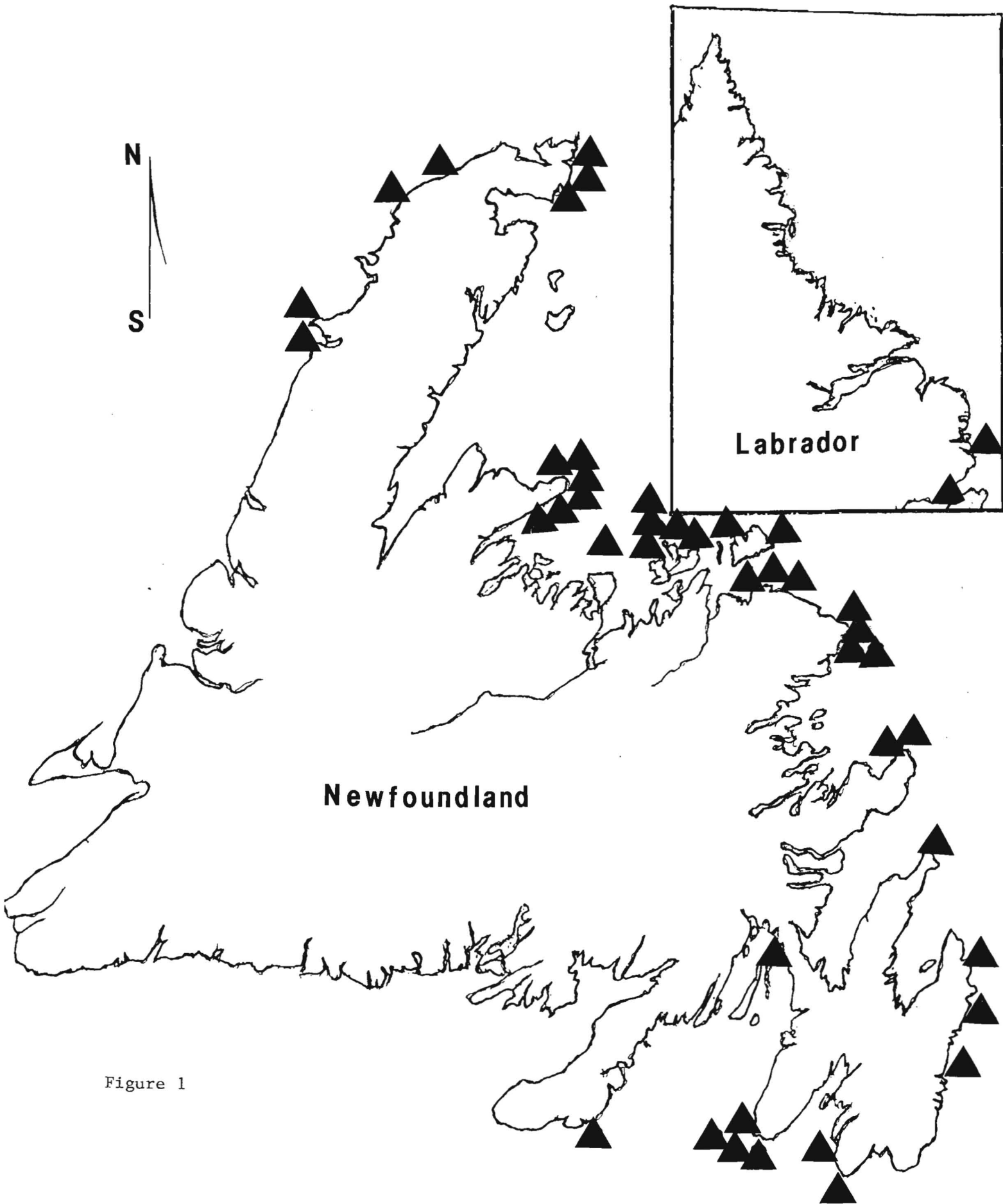


Figure 1

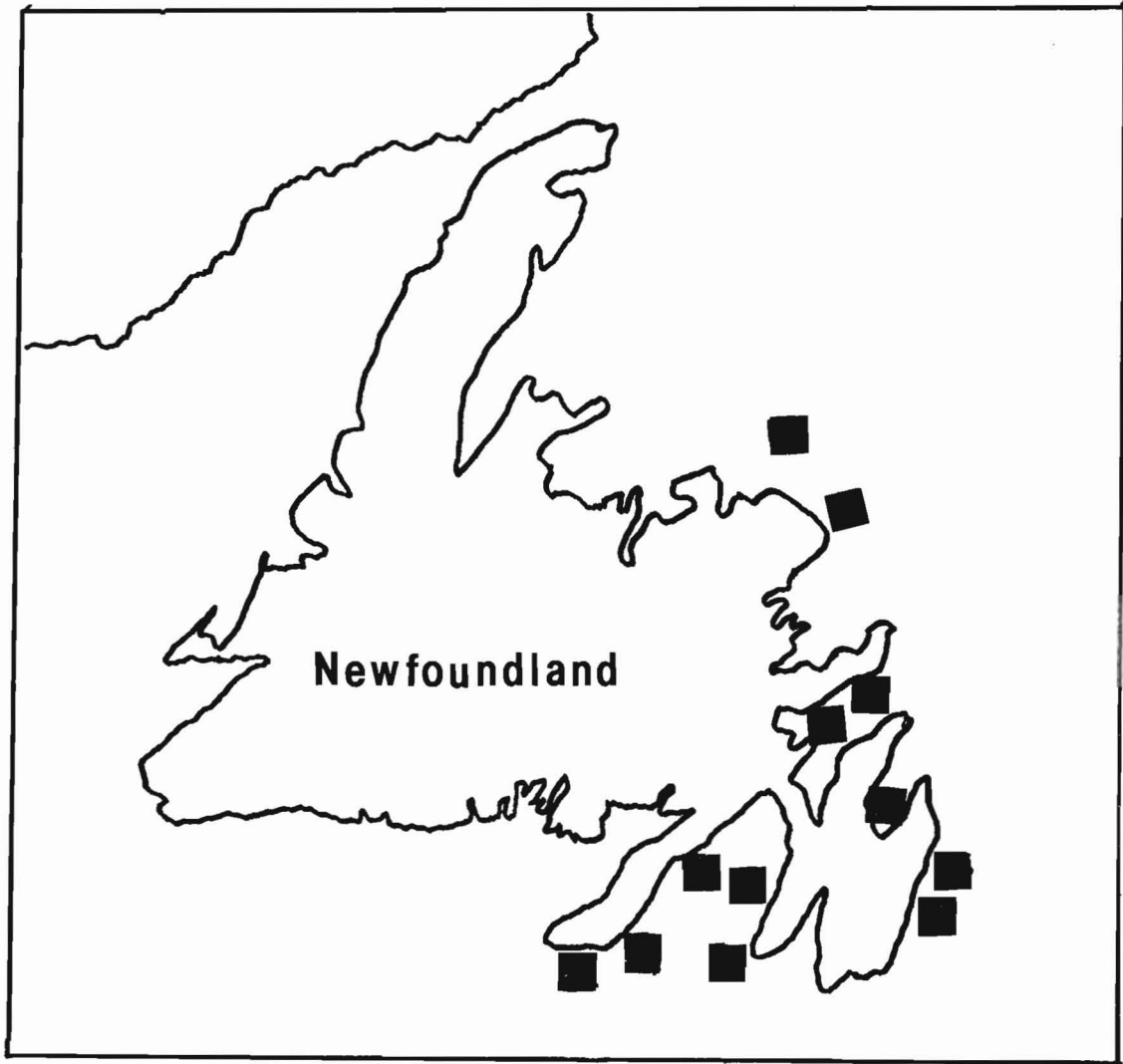


Figure 2

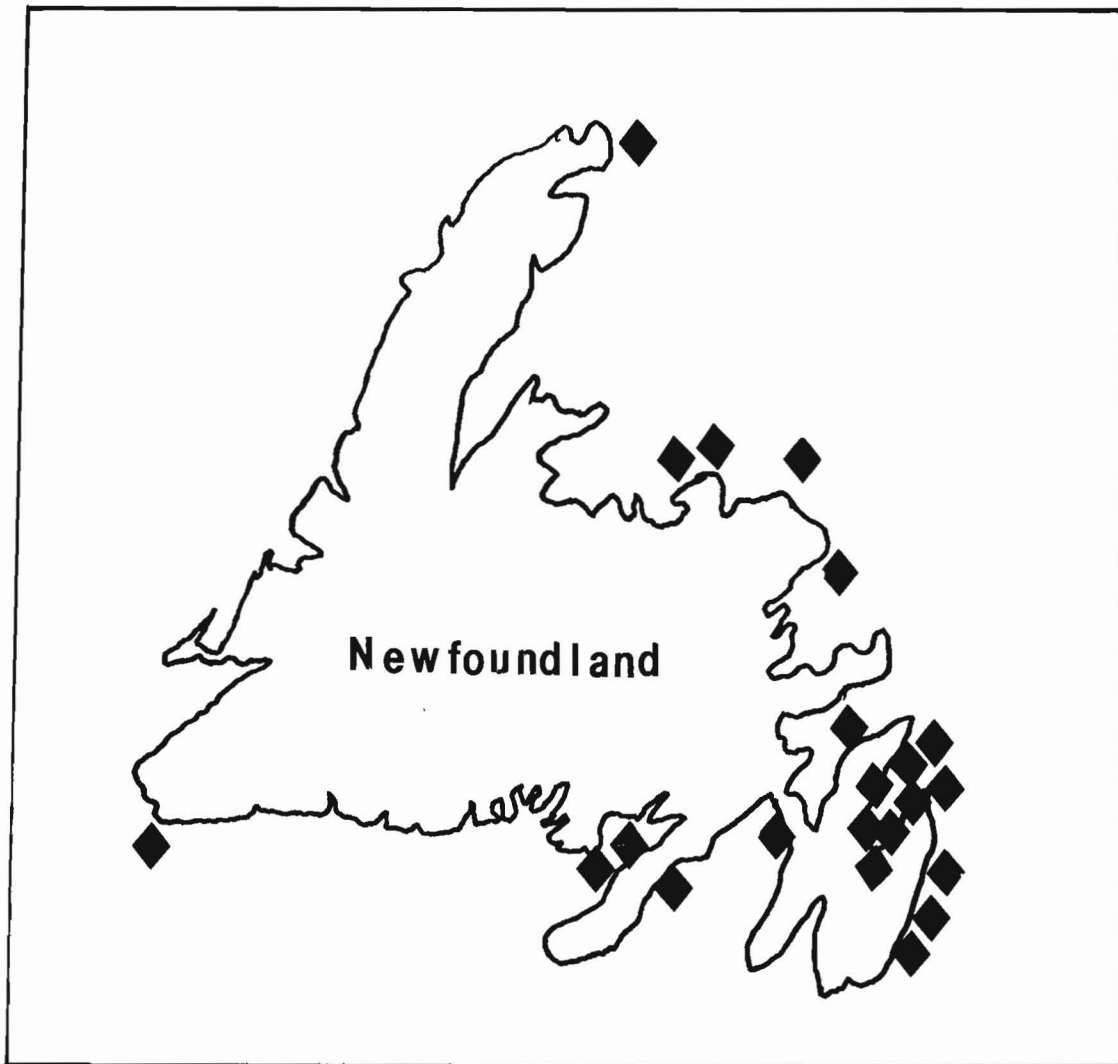


Figure 3

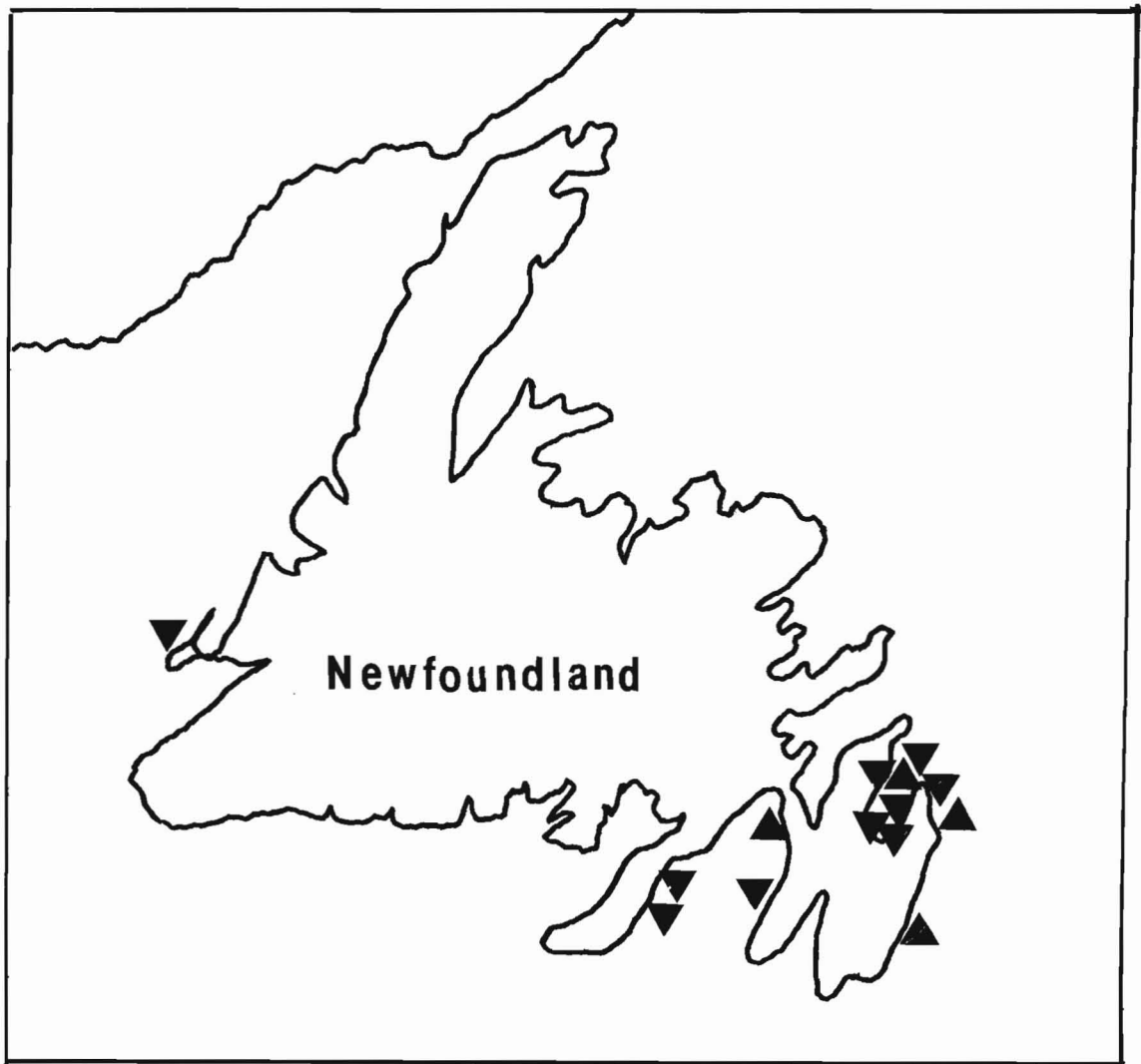


Figure 4

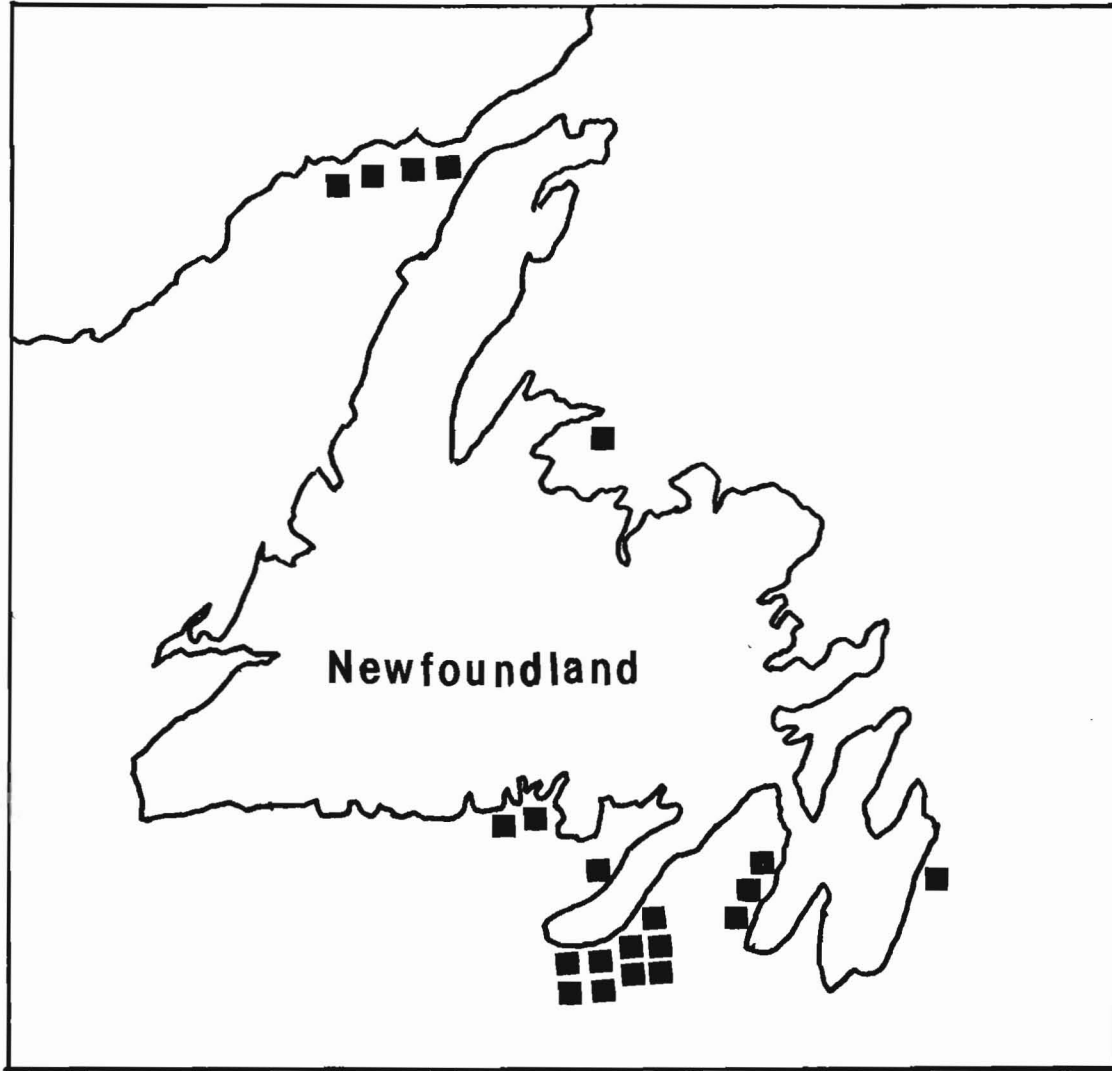


Figure 5

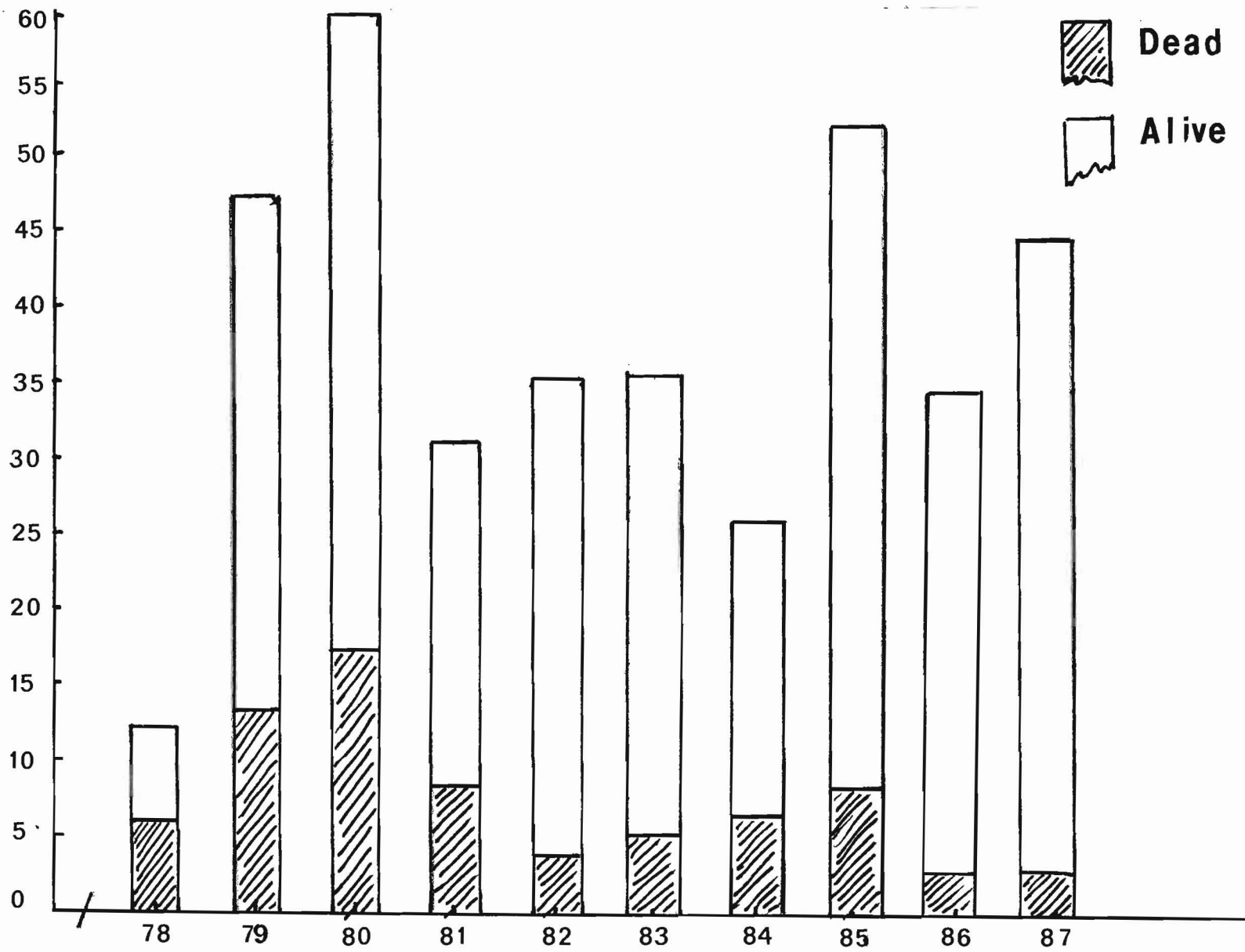


Figure 6

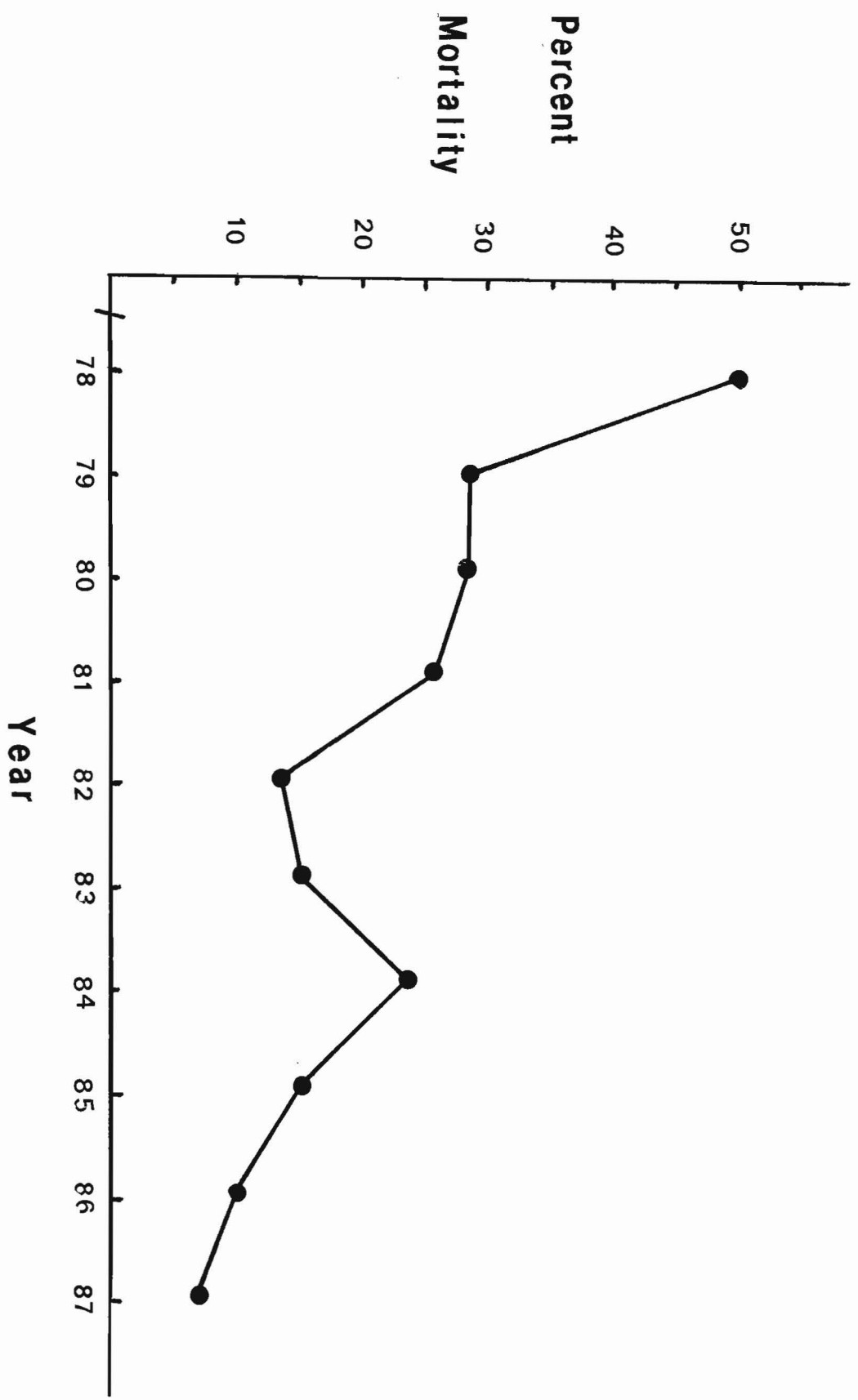


Figure 7