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POSSIBLE CAUSES FOR DECLINE OF LOBSTER LANDINGS IN NORTHUMBERLAND STRAIT

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Background

Lobster landings in Northumberland Strait in the southern Gulf of St. Lawrence have been more than 1/3 of the annual landings for all of Canada from 1947 to 1960 (Fig. 1). Since then the Northumberland Strait landings have declined from a 10-year mean of 18 million lb in the 1950's to a mean of 9.7 million lb in the 10 years, 1967-76 (Fig. 1A). In the 1970's they amount to only about 1/4 of the total Canadian lobster landings.

The decline is not uniform throughout the Strait (Fig. 1B). In the central part of Northumberland Strait (areas B and C in Fig. 2) landings have decreased from a 10-year mean of 10.2 million lb in the 1950's to a mean of 2.7 million lb in the 10 years, 1967-76, or 26% of the 1950's landings. At the ends of the Strait (areas A and D in Fig. 2) landings have remained relatively stable.

Northumberland Strait Project

The Northumberland Strait Project, a joint Federal-Provincial-University study, was begun in 1975 to investigate the causes for the decline in lobster landings. It was to be a multidisciplinary study lasting several years.

The first phase was a synoptic survey in 1975 at 96 sampling stations throughout Northumberland Strait (Fig. 2). This was a baseline survey to be used in comparing future trends, and to set the framework for more specific testing of hypotheses about causes for the decline of lobster landings.

A number of reports have resulted from the 1975 survey. Amaratunga et al. (1976) discuss the background and scope of the survey. Stasko (1976) analyzes the trap catches of lobsters and crabs in relation to temperature, depth, and substrate type. Caddy et al. (1977) summarize the benthic data derived mostly from bottom grabs, beam trawls and scallop dredges. Stasko et al. (1977) summarize the commercial shellfish data mostly from the trapping survey. Some other reports, described below, are mostly data depositories. The three reports by van de Poll and McMullin (1975, 1976a,b) provide a physical description of the grab samples and sediment cores including some analyses of heavy metals (no anomalous concentrations were found). The two reports by Amaratunga (1976) and three by Linkletter (1976) classify and quantify the macrobenthic fauna, polychaetes, scallop shells, and incidental fish species collected at the 96 sampling stations.

These reports constitute only the first descriptive phase of the Northumberland Strait Project. The second phase, more specific testing of hypotheses about causes for the decline of lobster landings, has been postponed indefinitely.

The following sections summarize our present knowledge about the possible causes for the decline.

Overfishing

From 1947 to 1952 there was a rapid increase in lobster landings from areas B and C (Fig. 1B) in the central part of Northumberland Strait but not from areas A and D at the ends. In areas B and C, landings remained high until the early 1960's, then dropped to about 1/4 of the former levels. This may indicate overfishing in the 1950's, but needs to be examined in more detail. The report by Robinson (1979) addresses this question.

Sediment loading

Although no comparable measurements of suspended sediments are available for the 1950's compared to 1970's, several factors may have caused an increase in input of suspended sediments into Northumberland Strait. Road construction in P.E.I. was active in the 1950's and 1960's (De Belle 1971); new or cleared roadside ditches increase sediment input to streams (Saunders and Smith 1965). Harbour dredging in Northumberland Strait has averaged 141,000 m^3 yr^{-1} over the last 25 years. This has been estimated to be about 1/6 of the natural sedimentation (Bezanson and Kranck, pers. comm.). Dragging for scallops may also increase sediment loading. However, such dragging in Northumberland Strait did not increase dramatically until after the decline of lobster landings (Amaratunga et al. 1976).

The effect of suspended sediments on adult lobsters is not known, although lobsters in pounds are known to survive in very turbid water. Lobster larvae, however, can be killed by excessive suspended sediments (Cobb 1972).

Sediment loading in the middle compared to end areas of the Strait has not been measured. One might expect such loading to be greatest in the shallow and narrow sections of the Strait where tides are active (Kranck 1972) and dilution by clean water is least.

Sediment loading cannot be ruled out as a factor in the decline of lobsters. More work is needed on this.

Toxic chemicals

The input of toxic chemicals (insecticides, herbicides, industrial effluents, road salt activities, etc.) into Northumberland Strait has probably increased since the 1940's. Toxic effects of heavy metals and herbicides on lobsters have been demonstrated (McLeese 1976, Zitko et al. 1976). Chlorinated hydrocarbons and heavy metals can be expected to cause the greatest problems because of their long residual time in the environment. However, such toxic chemicals in the marine environment are expected to exist mostly adsorbed to particulate matter (D.J. Wildish, pers. comm.) and thus may be, in effect, removed from the water. Sediment samples in Northumberland Strait did not show any anomalous concentrations of heavy metals (van de Poll and McMullin 1976a). Concentration of chlorinated hydrocarbons in sediments and in lobsters have not been made in the Strait, but should be greatest in areas B and C where dilution by uncontaminated water is least.

Toxic chemicals are unlikely to be a major factor in the decline of lobsters, but may be a contributing factor.

Canso Causeway

In 1954 construction of the Canso Causeway blocked the net southerly flow of water from the Gulf of St. Lawrence through the Canso Strait (Buckley et al. 1974; McCracken 1979). Drinkwater (pers. comm.) has calculated the maximum possible resultant change on the flow at Cape Tormentine, the most constricted part of Northumberland Strait, as being 5 cm/sec (= 4.3 km/day or 0.1 knots). This calculation is based on spring-tide conditions and assumes that all the former flow through Canso was derived from Northumberland Strait and that after 1974 any waters blocked by the Canso Causeway will not flow toward Cabot Strait. It is unlikely that the above extreme assumptions are valid. Thus, the actual changes in net flow past Cape Tormentine, the area of greatest effect, should be considerably less than 0.1 knots. By contrast, in the same area wind-driven residual currents can reach 2 knots (Farquharson 1959). Easterly bottom residual currents have been inferred by Lauzier (1965).

If the causeway had an effect on lobster production in the Gulf, one might expect to see the greatest changes closest to the causeway in the restricted waters of Georges Bay. In fact, a comparison of landings in Pictou and Antigonish Counties shows that the more distant Pictou County has experienced a drastic decline in lobster landings since the mid 1950's while landings in Antigonish County, adjacent to the Strait of Canso, do not show any large decline (Iles 1975).

Thus, it is extremely unlikely that the Canso Causeway has had any effect on lobster production in Northumberland Strait.

Other Factors

Changes in climate, if such had occurred, should have affected the end as well as middle areas of Northumberland Strait, and thus cannot explain the decline of lobsters in the middle areas only.

Any detrimental effects of other fisheries, such as irish moss raking (Scarratt 1973) and groundfish dragging, should be greatest in the end areas where these fisheries are more intensive, and not in the middle areas. As mentioned earlier, scallop dragging did not become significant until after the lobster catches had declined (Amaratunga et al. 1976).

Conclusions

Our experimental work to date has not identified any one single factor as the cause for the decline in landings in the central part of the Northumberland Strait in the 1960's. However, we conclude that the most probable cause for the decline of lobster landings was overfishing in the 1950's. Increased sediment loading and presence of toxic chemicals may have been contributing factors. It is unlikely that construction of the Canso Causeway was instrumental in the decline.

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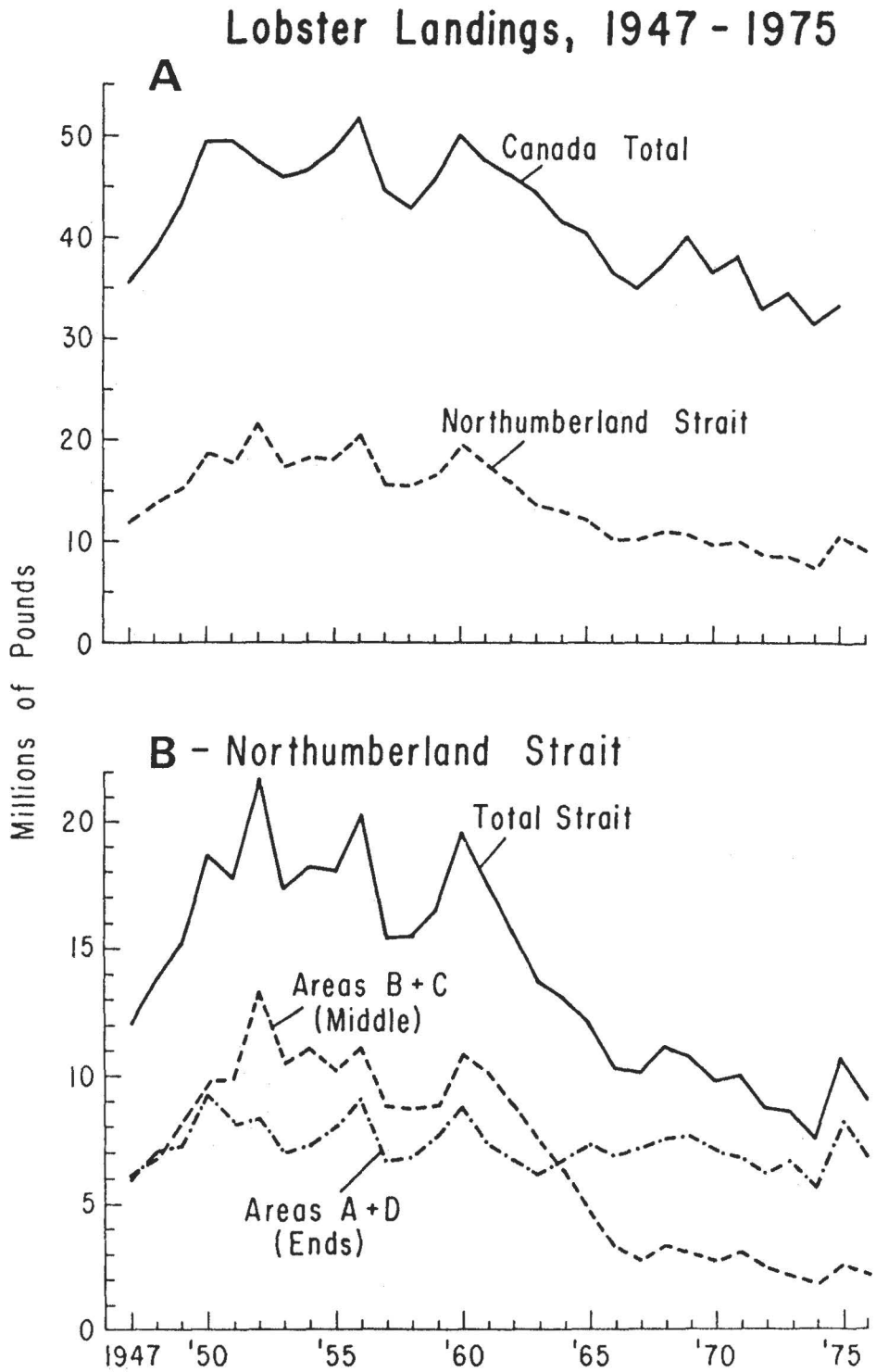

Fig. 1. Annual lobster landings in millions of pounds from 1947 to 1975 for a) Canada and b) Northumberland Strait (to 1976).

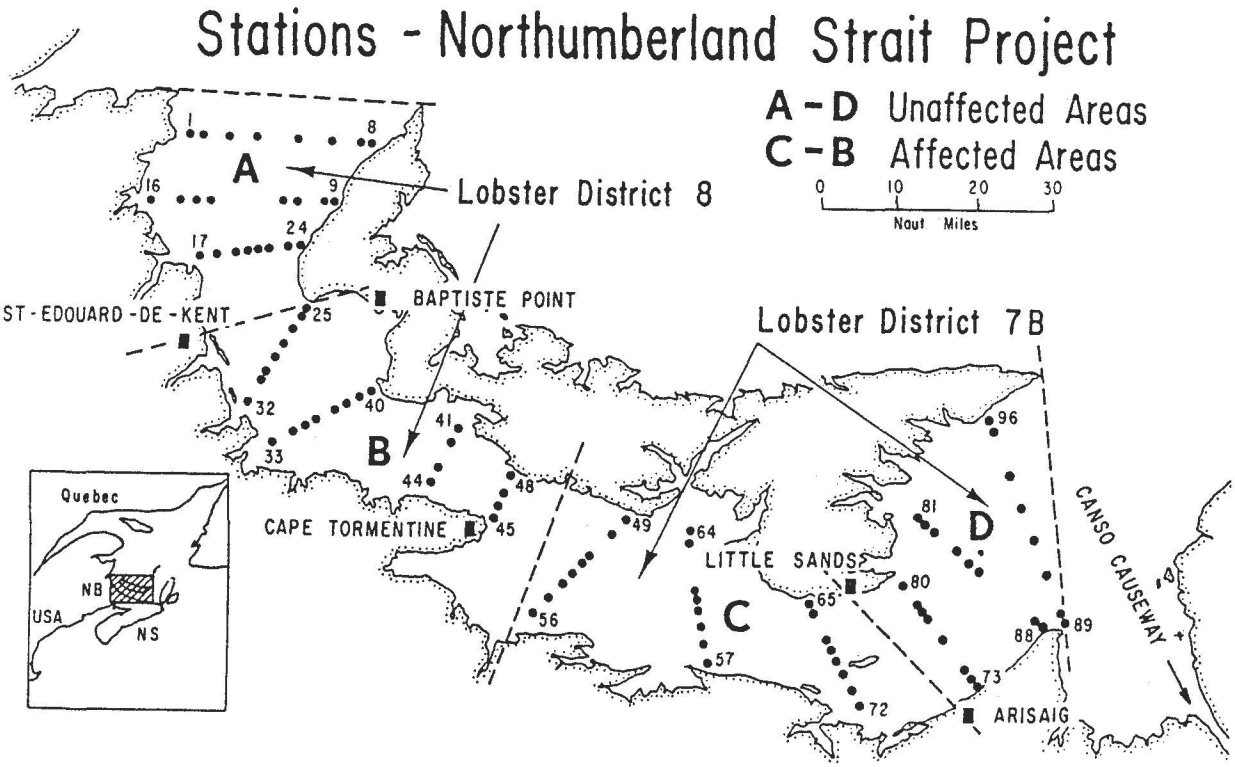

Fig. 2. Map of Northumberland Strait showing areas of stable lobster landings (A and D, unaffected areas) and declining lobster landings (B and C, affected areas). The 96 locations (solid circles) are sampling stations used in the 1975 Northumberland Strait Project.