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# Lobster Distribution on the Scotian Shelf and Implications to the Jonah Crab Fisheries

by

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## Abstract

Lobster bycatch data from Department of Fisheries and Oceans Scotian Shelf groundfish trawl surveys (1970-1982) are analyzed for lobster distribution. Lobster catches were concentrated on the known commercial grounds of southwest Nova Scotia, Browns Bank, and Bay of Fundy. However, there were consistent but smaller catches on presently unexploited areas along the outer Shelf and upper slope from Browns Bank to southeast of Sable Island. Catches were greatest during the summer survey period (July) and lowest in the winter survey (March). Lobsters were not caught over the middle regions of the Shelf between the eastern coast of Nova Scotia and the outer Shelf.

The distribution of lobster bycatch corresponds closely to the warm slope water, but the lack of lobsters in the warm central Basin suggests other factors may influence distribution. The data suggest that no significant interactions are likely between the coastal and outer Shelf lobsters, outside of the southwest Nova Scotia Browns Bank region, and the lobster bycatches in the crab fishery will be generally small and restricted to the outer Shelf.



## Résumé

L'article qui suit contient une analyse des prises accidentelles de homard dans les relevés des poissons de fond au chalut effectués par le ministère des Pêches et des Océans sur le plateau Scotian en 1970-1982. Cette analyse avait pour objet de déterminer la distribution de l'espèce. Les prises de homard étaient concentrées sur les bancs commerciaux connus du sud-ouest de la Nouvelle-Ecosse, le banc Browns et la baie de Fundy. Cependant, des quantités plus faibles mais constantes ont été prises dans des régions actuellement inexploitées, sur le bord extérieur du plateau et à la partie supérieure de la pente, entre le banc Browns et le sud-est de l'île de Sable. Les prises ont été maximales lors du relevé d'été (juillet) et minimales dans le relevé d'hiver (mars). Aucun homard n'a été capturé au milieu du plateau, entre la côte est de la Nouvelle-Ecosse et le bord extérieur du plateau.

La distribution des prises accidentelles correspond étroitement à celle de l'eau de pente, chaude, mais l'absence de homards dans le bassin central, dont l'eau est également chaude, donne à penser que d'autres facteurs peuvent influencer leur distribution. Les données suggèrent qu'il n'y a probablement pas d'interactions significatives entre les homards de la côte et ceux de l'extérieur du plateau, en dehors de la région du banc Browns, au sud-ouest de la Nouvelle-Ecosse. En outre les prises accidentelles de homard dans la pêche des crabes seront généralement faibles et limitées au versant extérieur du plateau.

## Introduction

Little is known of the distribution of lobsters on the Scotian Shelf, outside of the narrow inshore fishery area, and the offshore fishing grounds in the vicinity of Browns Bank. Off southwest Nova Scotia the lobster fishery extends from the coast out to the deep water of the Gulf of Maine, a distance of >95 km. Along the eastern coast of Nova Scotia from Cape Sable Island to Cape Breton Island fishing is restricted to within 18 km from the coast (Lobster District 4B, mean 5.2 km, maximum 17 km; Lobster Districts 5-6, mean 3.1 km, maximum 17 km) (unpubl. data). Over most of the Shelf east of 65°30'W longitude no lobster fishing occurs.

Knowledge of lobster distribution is important to understanding stock relationships and the potential impact of various fisheries on them. A jonah crab fishery began in 1983 on the Scotian Shelf (Elner and Robichaud 1984). The crab fishermen reported lobster bycatches and requested permission to land these lobsters; however, without a knowledge of the abundance, the distribution, or the size frequency of lobsters on the Shelf, the effects of such a provision on existing lobster fisheries could not be estimated.

The data available on lobster distribution and numbers on the outer Shelf are from a series of offshore lobster trawl surveys in 1965 and 1966 (McKenzie 1966a, 1966b), larval distributional data from a 1976 survey (Stasko 1977), and a red crab trap survey in 1980-1981 (McElman and Elner 1982).

McKenzie (1966a, 1966b) reported low numbers of lobsters on the Scotian Shelf, compared to the known Georges Bank lobster grounds (Fig. 2). Small concentrations were found on Sable Island Bank and southeast of Browns-LaHave Banks; but it was concluded that trawl fishing for lobster, the only method in use for offshore lobster at the time, was uneconomical north of the Northeast Channel. The surveys were concentrated along the outer Shelf and upper slope with no tows taken over the middle or inner regions of the Shelf.

Data from U.S.A. groundfish surveys (1960-1980) presented by Fogarty et al. (1982) show low numbers of lobsters on the Scotian Shelf and in the Gulf of Maine from the early to mid 1960's and increasing numbers during a warming period in the Gulf of Maine in the late 1960's to late 1970's.

Data from the August 1976 SSIP survey (Stasko 1977) indicated larvae were present at 18 of the 76 stations sampled (Fig. 3). Larval catches occurred on Browns Bank and along the Shelf edge south of Baccaro and LaHave Banks, with smaller catches on LaHave and Western Banks, and in coastal regions of the Shelf.

The red crab trap surveys conducted by McElman and Elner (1982) and Stone and Bailey (1980) found no lobsters east of 65°W. The surveys occurred in July and October when lobsters have generally moved onto the Shelf (Uzmann et al. 1977) and were restricted to the slope region in water from 180 to 700 m. The small number of traps, the use of conical and snow crab traps, a short 18 h set period, and the large crab catch would likely reduce the chance of catching lobsters if present in the survey area.

The present paper examines lobster bycatch data from the Canadian groundfish surveys (1970-1982) for distribution and patterns in catches. Quantitative analysis and year-to-year comparison were not undertaken due to incomplete reporting of lobsters during the survey period.

## Methods

The data were collected and supplied by Marine Fish Division, Fisheries Research Branch, St. Andrews. A detailed description of survey methods can be found in Halliday and Kohler (1971).

At sample sites, chosen by a stratified random design, a standard 30 min tow at 3.5 kts was made with a "Yankee" 36 survey trawl with a small mesh codend liner and 16" rollers on the head rope. The sampling strata are given in Figure 4, and sample sites are given in Figures 5 - 10. Sampling intensity and station allocation within strata remained relatively constant with approximately one station/907 $km^2$ (Koeller 1980).

Winter (March) and summer (July) surveys were conducted 1970-1982, and fall (October) surveys 1978-1982. During 1978-1981 comparative surveys using two vessels were made; sample site locations are given for only one of the vessels, but catches are shown for both vessels. Data are pooled by 4-8 yr periods since catches are generally low and the year-to-year variation is high. In the early years, and to a lesser extent in recent years, all lobsters caught were not recorded; and since some catches are generally low (1-3/tow), the failure to report even a single lobster can have a major impact on the data.

## Results and Discussion

The sample sites and lobster catches from the Marine Fish Division groundfish surveys are given in Figures 5-10.

Lobsters were most consistently caught in the shallower areas of the Bay of Fundy, the Grand Manan area, and on or near

the outer banks of the Scotian Shelf west of Sable Island. Lobsters were generally not caught in the larger area between the Shelf edge and the inshore limit of the survey area (50 fathom inshore contour).

The distribution of lobsters along the outer Shelf is similar to that found by McKenzie (1966a, 1966b) and also corresponds closely to the distribution of larval stages reported by Stasko (1977).

McKenzie (1966a, 1966b) reported the largest catches in areas with bottom temperatures of >5°C and suggested that the distribution of lobsters along the slope was influenced by bottom temperature. Over the Shelf area north and east of Sable Island (Banquereau Bank), the bottom temperature rarely exceeds 5°C (McLellan 1954) and this is unfavorable for lobster habitation. This is supported by the absence of lobsters in the surveys of this area. Warm slope water (>7°C) occurs year round along the upper slope south of Sable Island with large intrusions into the Gulf of Maine through the Northeast Channel and into the deep central basins of the central Shelf (LaHave and Emerald Basins). The warmer water extends over the outer Shelf in summer and fall with maximum temperature on Sable Island Bank (15°C) and Browns Bank (10°C). East of Cape Sable Island the warm water does not extend to the coastal region but is separated by a band of cooler water. West of Cape Sable Island warmer water extends from the coast to the deep areas of the Gulf of Maine in summer and fall. The warm water areas of the outer Shelf and Gulf of Maine correspond to the regions of lobster bycatch in the trawl surveys and the offshore lobster fishing grounds. The absence of lobsters from the deep basins of the central Shelf where favorable temperatures appear to exist suggests that other factors such as bottom type, food, or current patterns may play an important role in determining lobster distribution.

Recent tagging work in the Browns Bank (unpubl. data) area indicate that lobsters move from deep water (275-450 m) in winter to shallower areas on the Shelf (70-150 m) in summer. American trawl survey data also show higher catch rates on the Banks during fall surveys and in deep water during spring surveys (unpubl. data). The movement onto the Shelf follows the warming trend of bottom water temperatures (Uzmann et al. 1977).

The lower lobster catch rates of the Canadian winter groundfish surveys are likely due to the movement of lobsters off the Shelf into deeper water, though the continued presence of lobsters in shallow areas of Browns Bank (Fig. 5-6) suggests that this movement is not universal. The scarcity of lobsters during fall surveys does not correspond with U.S.A. survey data or the results of fall trap surveys (Pezzack 1983), which found large numbers on western Browns Bank.

Recent data from lobsters tagged in both deep (400 m) and shallow (110 m) water southeast of Browns Bank indicate a seasonal movement of lobsters from deep water southeast of the Bank to the northeast along the Shelf edge, with crab fishermen recovering tagged lobsters along the Shelf south of LaHave Bank. These returns suggest that the lobsters along the edge of the southern Scotian Shelf may represent a single stock. No tag data exist to postulate their relationship to the lobsters in the Sable Island Bank region, though distance would most likely preclude the possibility of regular seasonal movements between these areas.

The distance from shore (130-220 km), the absence of lobsters on the middle Shelf, and the lack of direct surface water currents for larval transport from the Shelf edge to coastal areas (Bumpus and Lauzier 1965) suggest that a major interaction between the lobsters of the outer Shelf and the inshore eastern shore of Nova Scotia is unlikely.

The implication of this to the lobster bycatch by crab fishermen is that large lobster catches will only occur on the outer banks well away from coastal areas, and that any lobsters caught will likely have no effect on the depressed inshore lobster fishery along the eastern shore of Nova Scotia.

## Acknowledgements

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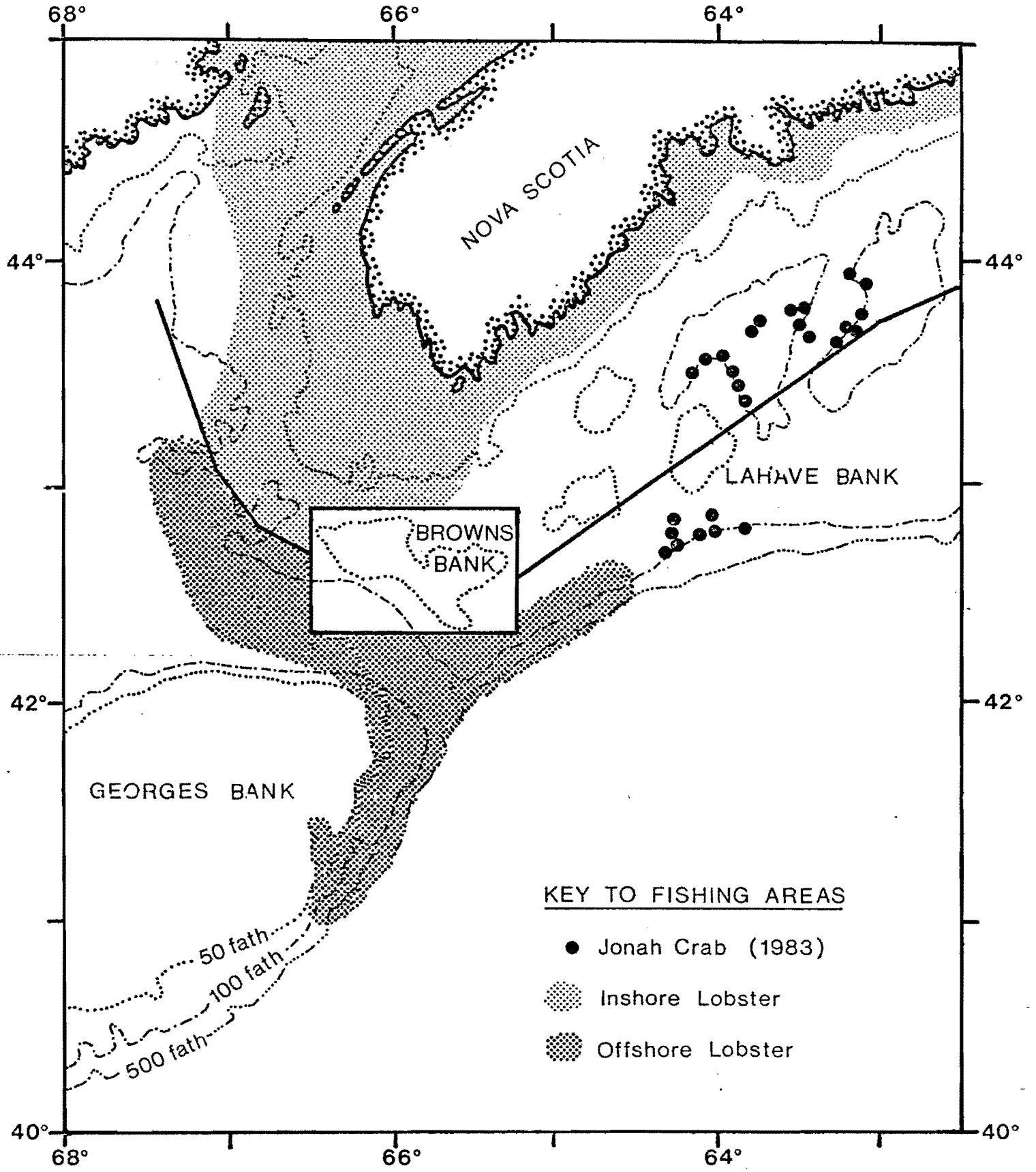


Figure 1. Approximate distribution of Canadian inshore and offshore lobster fishing, and the location of crab fishing sites in 1982.

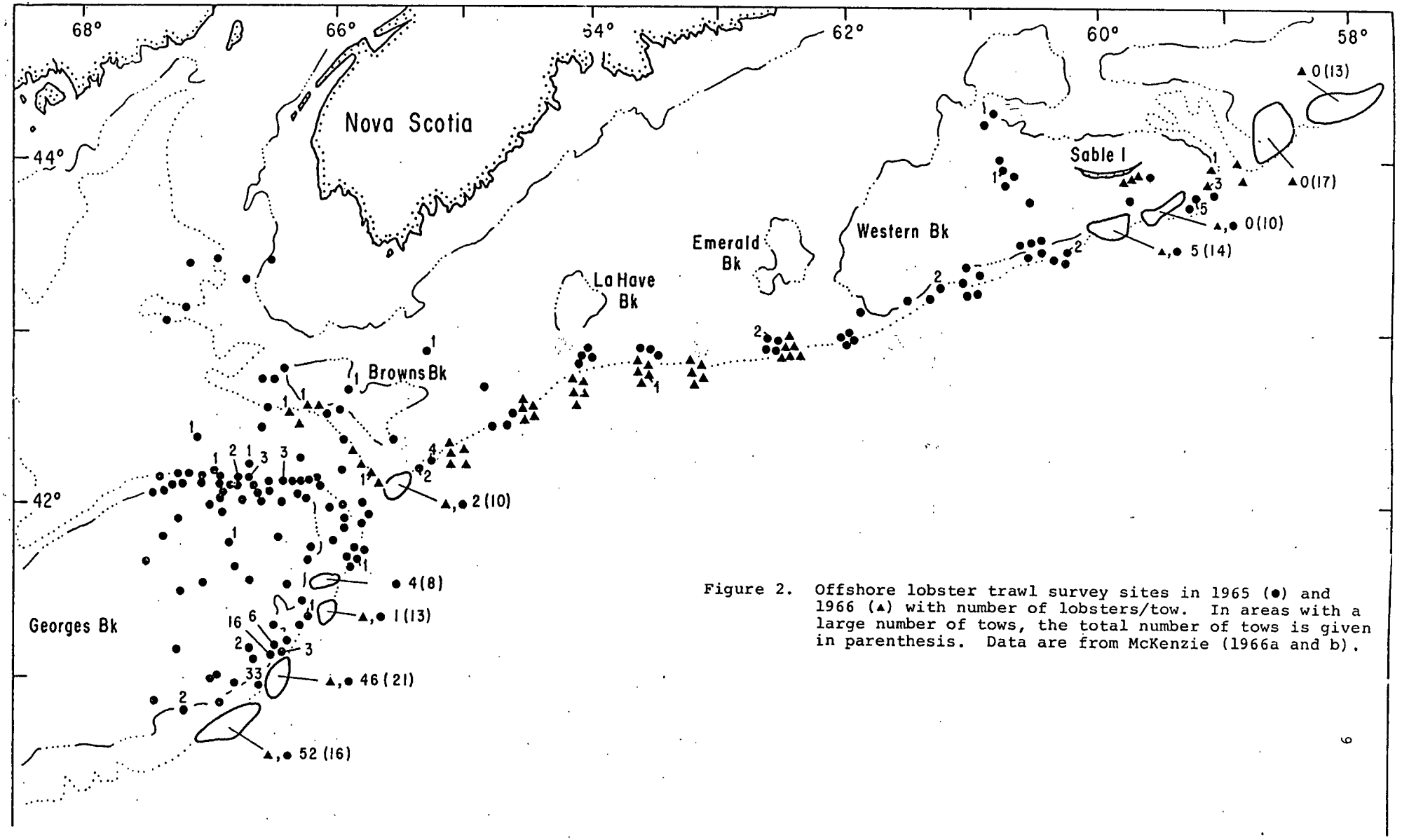


Figure 2. Offshore lobster trawl survey sites in 1965 (●) and 1966 (▲) with number of lobsters/tow. In areas with a large number of tows, the total number of tows is given in parenthesis. Data are from McKenzie (1966a and b).

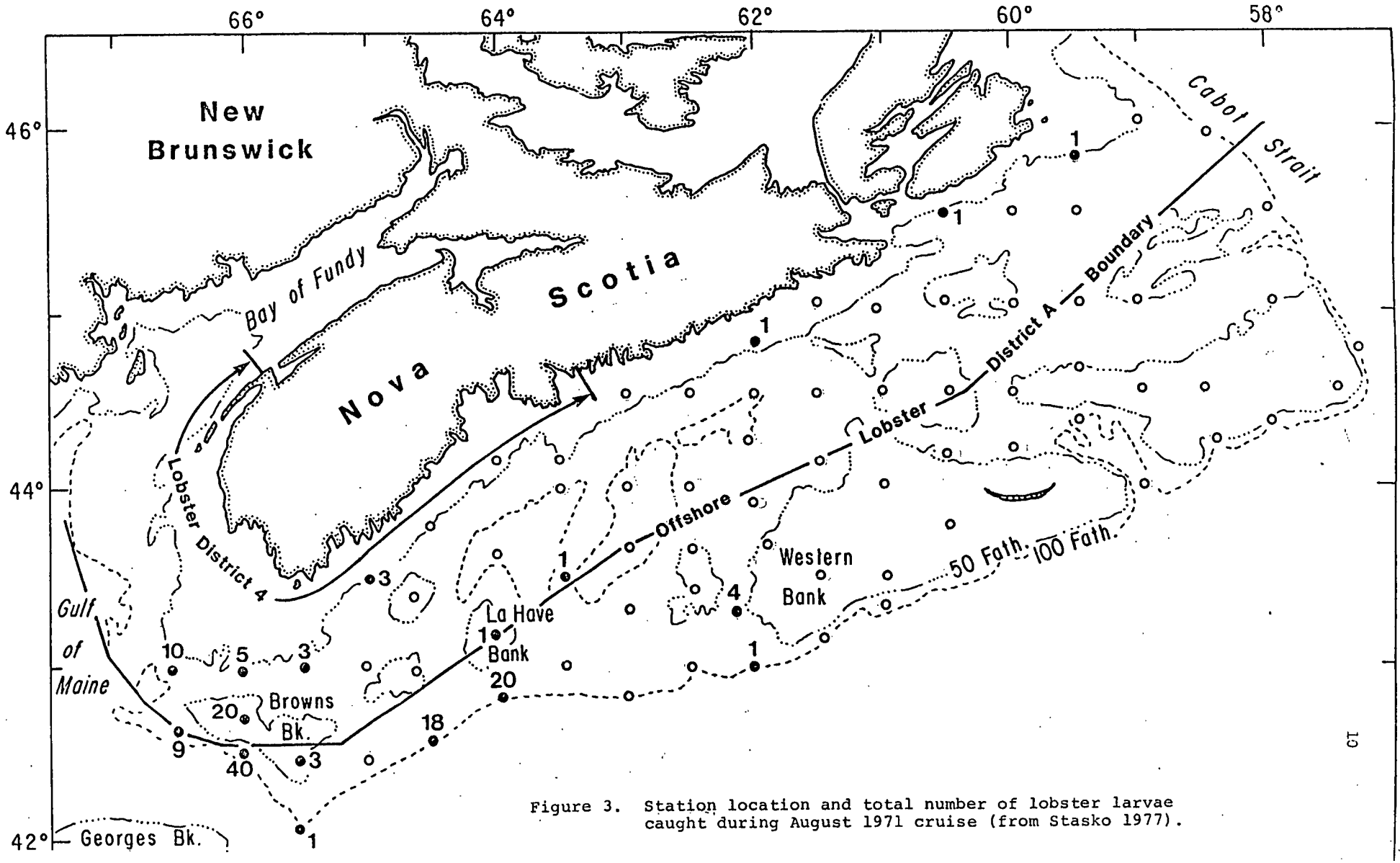


Figure 3. Station location and total number of lobster larvae caught during August 1971 cruise (from Stasko 1977).

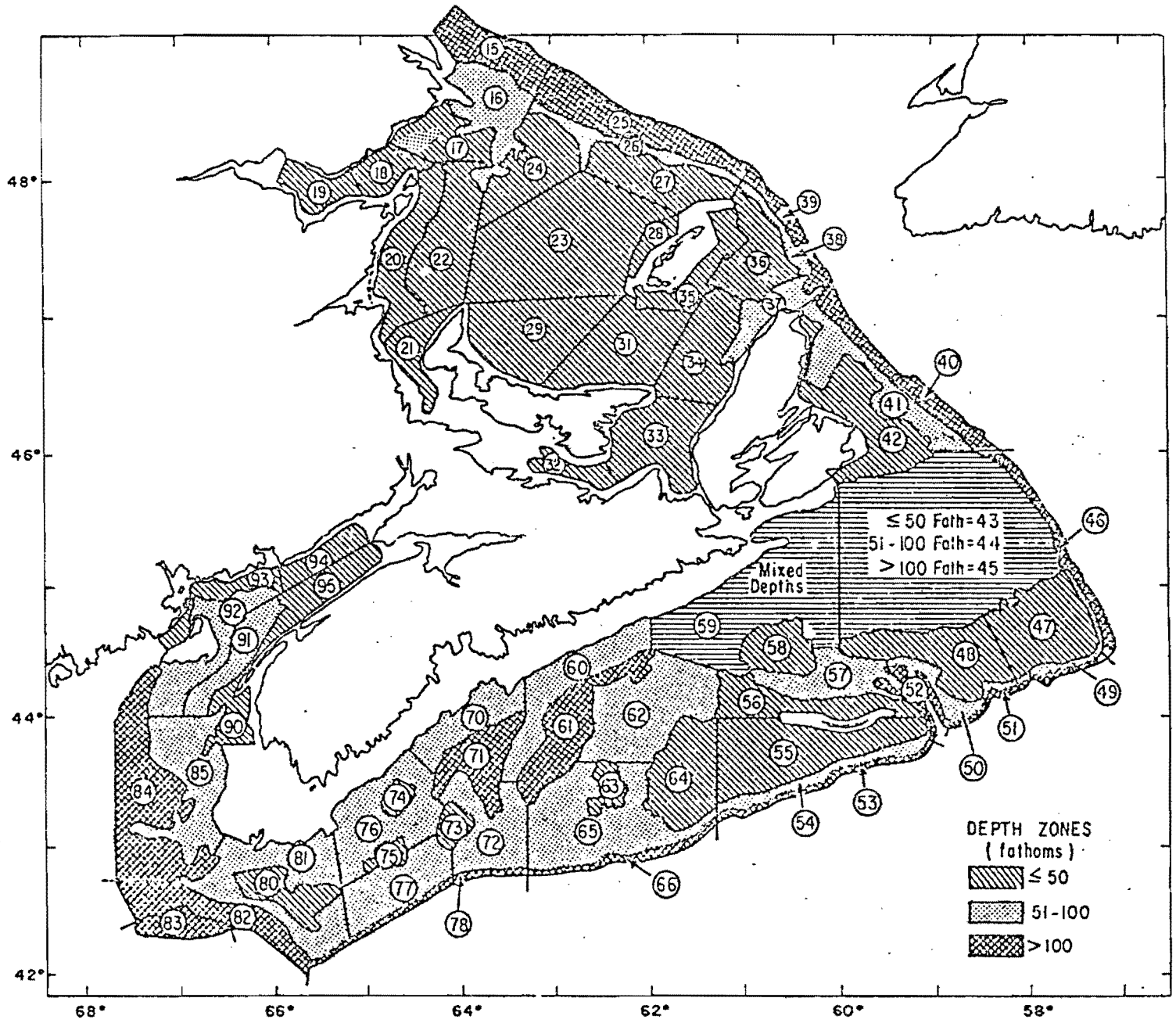


Figure 4. Stratification and numbering system of NAFO Divisions 4TVWX.

# MARINE FISH CRUISE STATIONS

## 1970-77 WINTER CRUISES

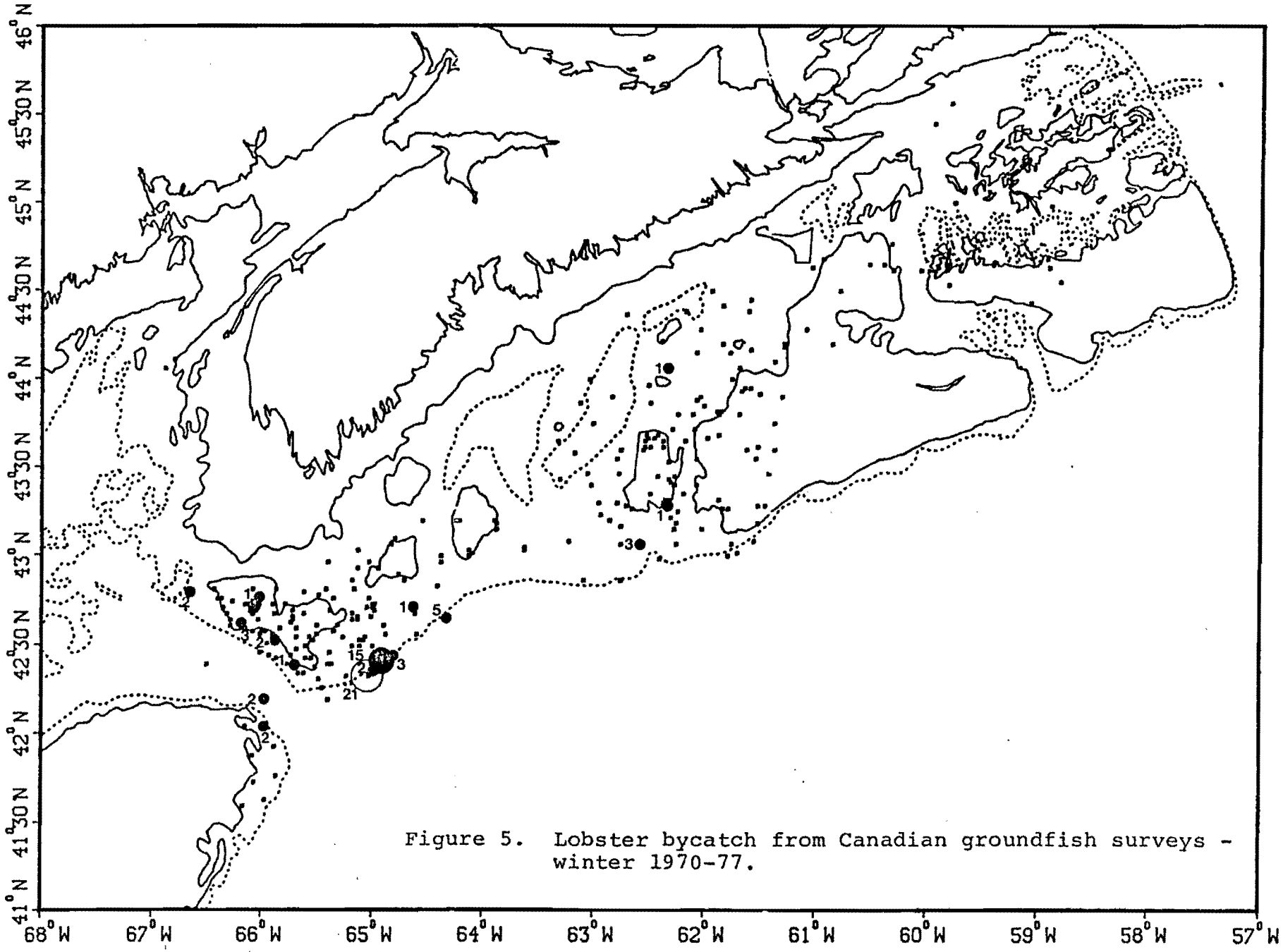


Figure 5. Lobster bycatch from Canadian groundfish surveys - winter 1970-77.

# MARINE FISH CRUISE STATIONS

## 1978-82 WINTER CRUISES

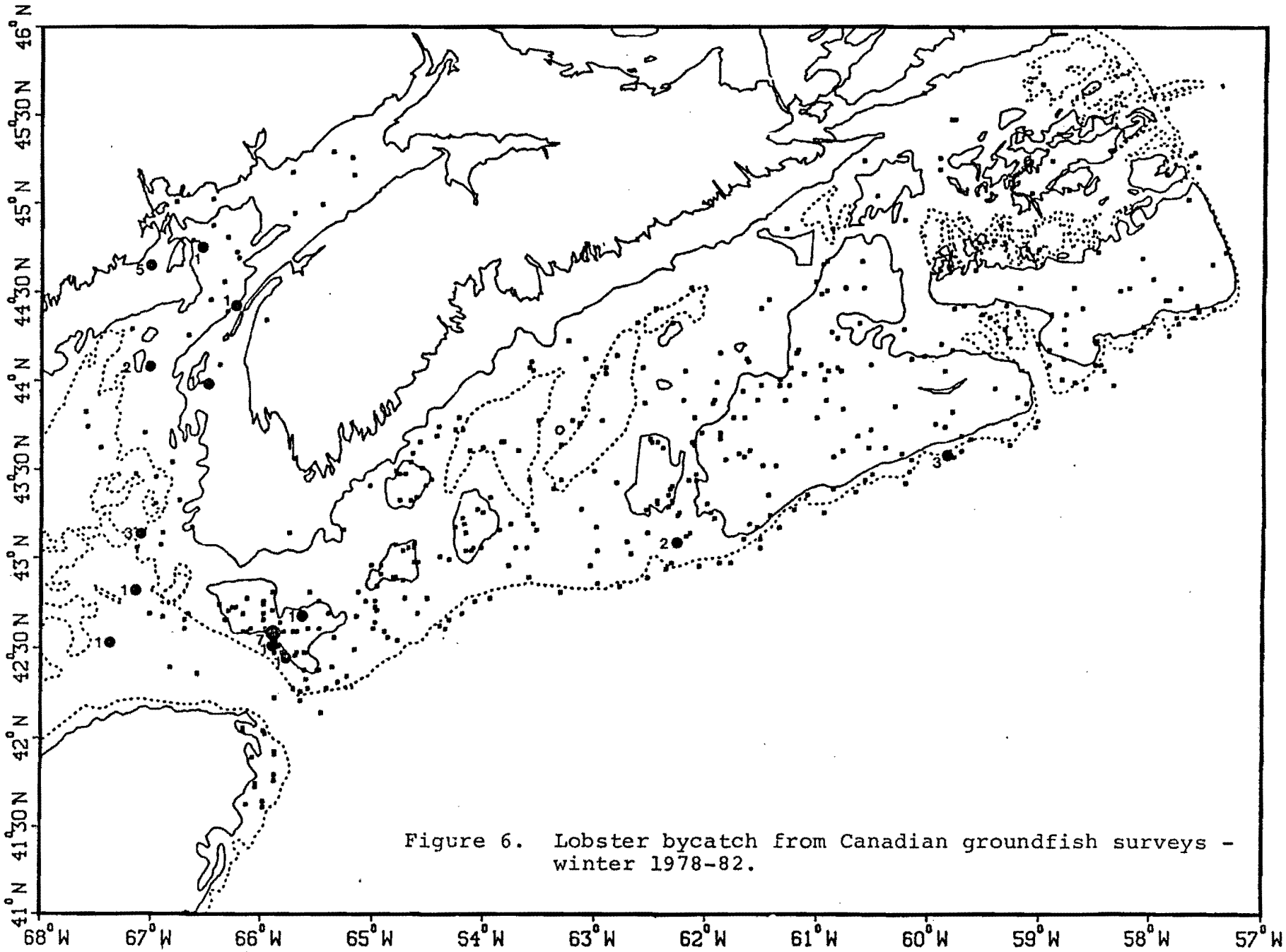


Figure 6. Lobster bycatch from Canadian groundfish surveys - winter 1978-82.

# MARINE FISH CRUISE STATIONS

## 1970-73 SUMMER CRUISES

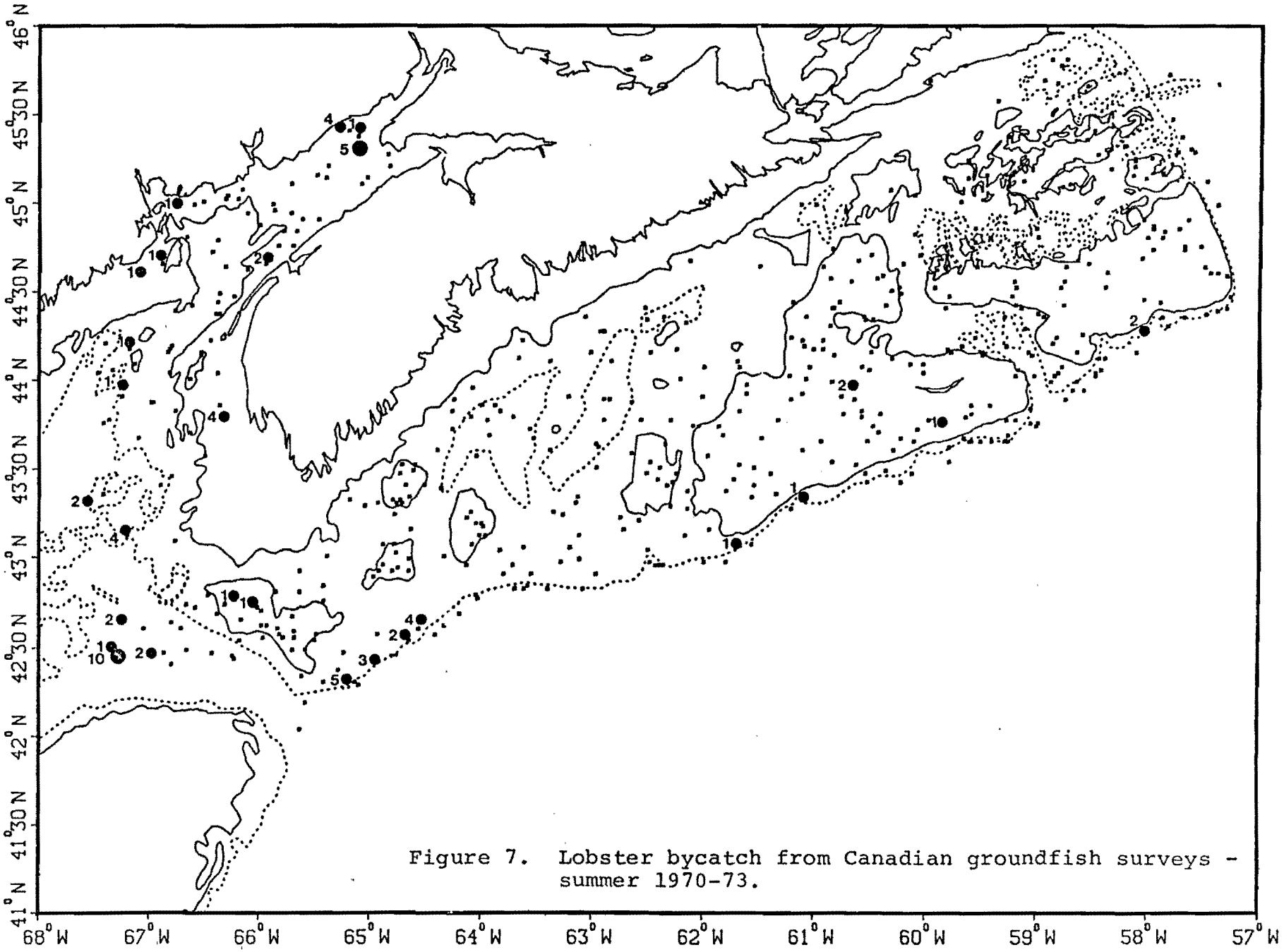


Figure 7. Lobster bycatch from Canadian groundfish surveys - summer 1970-73.

# MARINE FISH CRUISE STATIONS

## 1974-77 SUMMER CRUISES

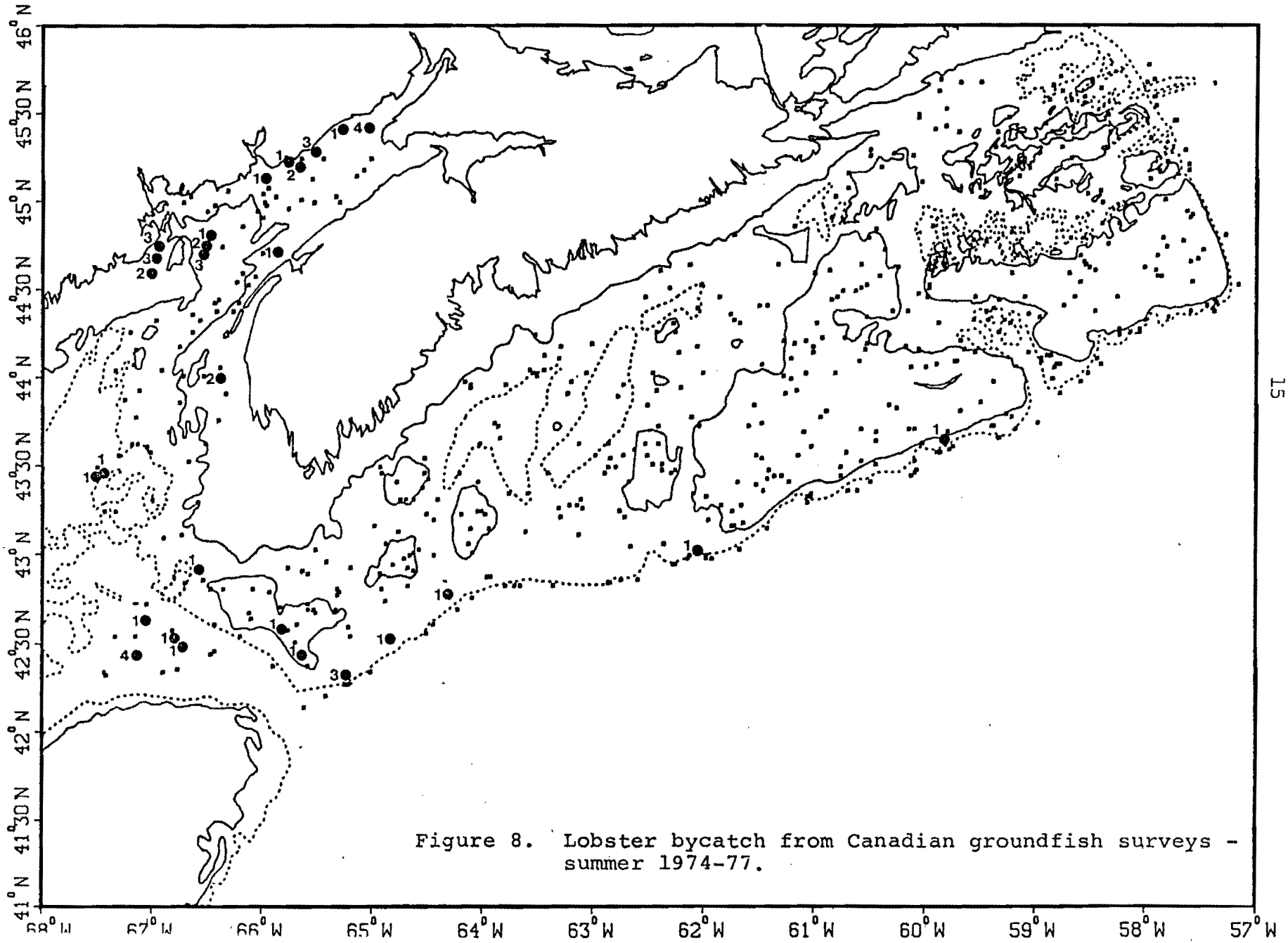


Figure 8. Lobster bycatch from Canadian groundfish surveys - summer 1974-77.

# MARINE FISH CRUISE STATIONS

## 1978-82 SUMMER CRUISES

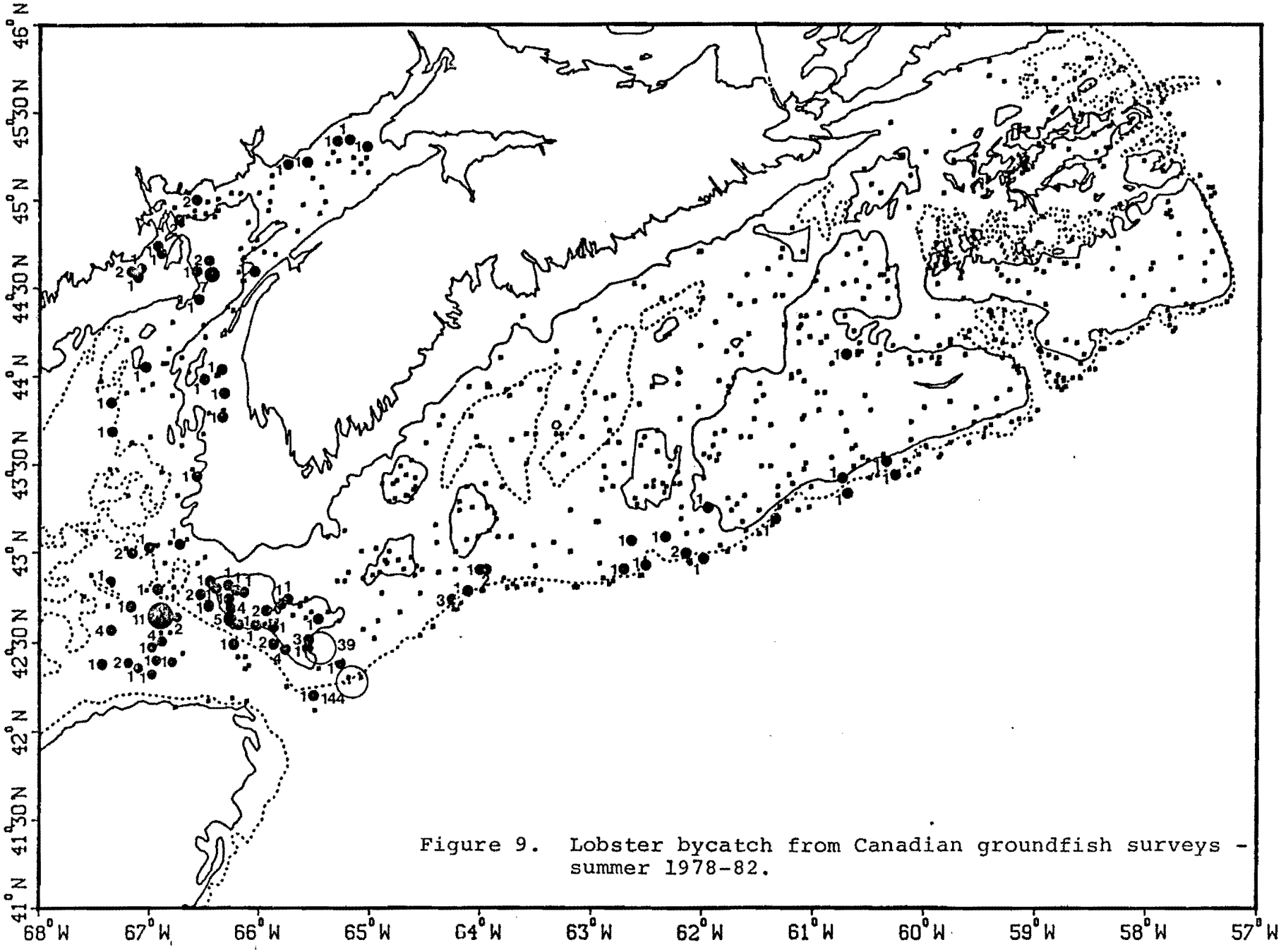


Figure 9. Lobster bycatch from Canadian groundfish surveys - summer 1978-82.

# MARINE FISH CRUISE STATIONS

## 1978-82 FALL CRUISES

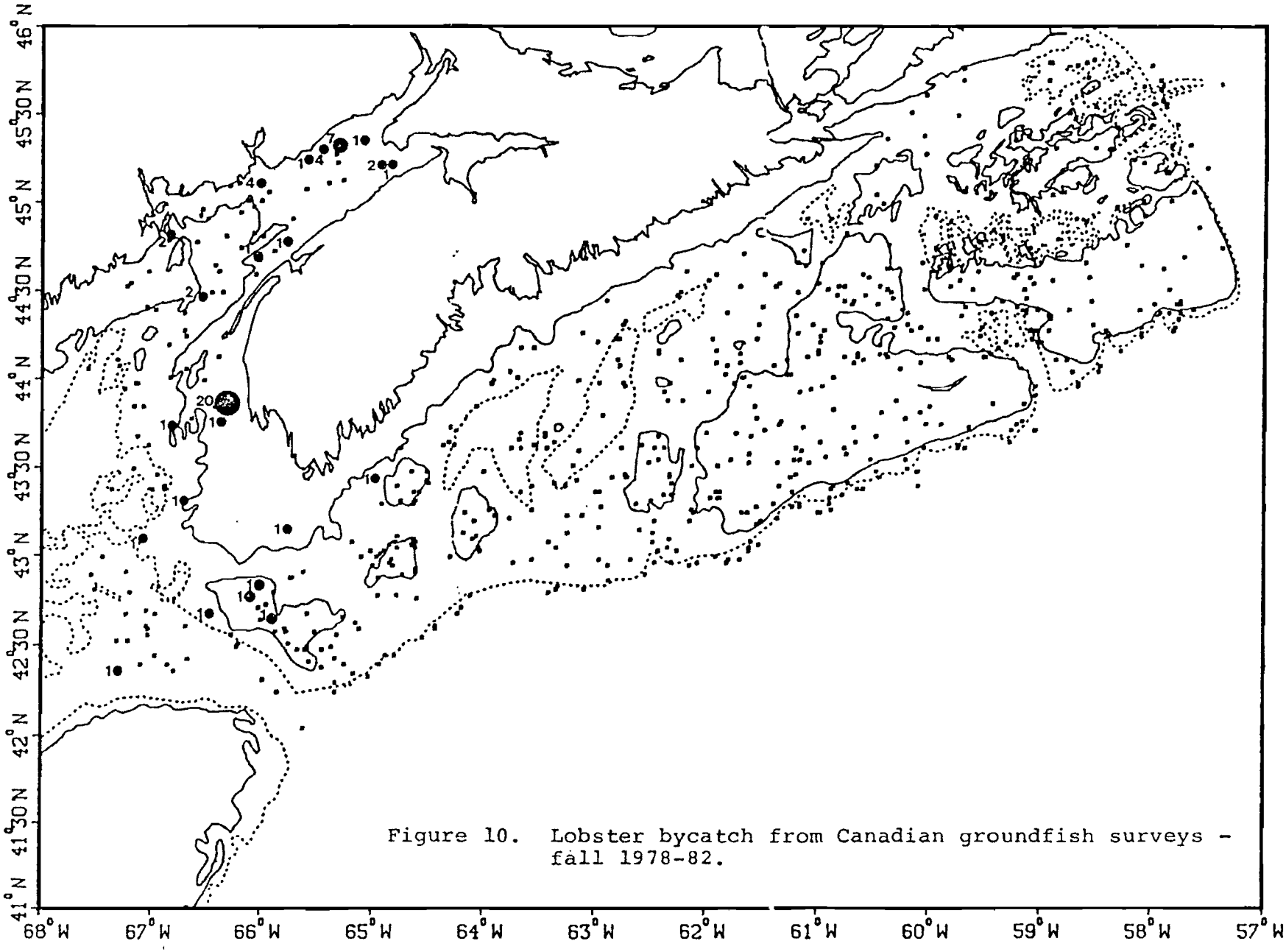


Figure 10. Lobster bycatch from Canadian groundfish surveys - fall 1978-82.