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LOBSTER EXPLORATIONS ON CONTINENTAL SHELF AND SLOPE OFF NORTHEAST COAST OF THE UNITED STATES

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SUMMARY

Commercial quantities of American lobsters (Homarus americanus) were found in deep water as a result of explorations conducted by the U. S. Bureau of Commercial Fisheries on the continental shelf and slope off the northeastern portion of the United States in depths of 50 to 600 fathoms. Two areas were defined by the Bureau's exploratory research vessel Delaware in which sufficient numbers of lobsters were taken to indicate the feasibility of commercial-scale exploitation. Standard commercial trawling gear was used at all of the 211 stations covered in the investigation.

BACKGROUND

Experimental trawling on the continental shelf and along portions of the continental slope of the northeastern coast of the United States by government vessels dates back to the early 1800's. Records of lobsters taken from depths and regions other than those fished by commercial lobstermen are found among the data of these early explorations. In addition, information from the research of the Woods Hole Oceanographic Institution has contributed substantially to the store of knowledge available concerning those waters and the lobster resource (Schroeder 1955 and 1959).

Taking of deep-water lobsters incidental to groundfish trawling became increasingly commonplace, and, by 1947, approximately 85,000 pounds of lobsters were taken by trawlers in offshore waters between Barnegat Lightship and Winter Quarter Lightship alone (June and Reintjes 1957). Since 1947, a small Atlantic Coast fishery, specifically for deep-water lobsters, has slowly developed. Small and medium trawlers have utilized the lobster resource largely as an interim fishery in the summer months. Fishing efforts have been limited, for the most part, to depths of 65 to 70 fathoms in areas south of Cape Cod and in the vicinity of Hudson Canyon.

Late in 1954, a program of deep-water exploratory trawling along the edge of the continental shelf off the North and Middle Atlantic States was planned by the U. S. Bureau of Commercial Fisheries. Purpose of the exploratory program was to determine the extent of potential trawling grounds in depths exceeding those normally fished by commercial trawlers. The studies were originated as part of the Bureau's continuing effort to explore and develop the latent potentialities of offshore marine fishery resources and to encourage their utilization by the commercial fishing industry. Work was initiated on the program early in 1955 with the first cruise of the year of the Bureau's exploratory research vessel Delaware (Delaware Cruise No. 1-55, January 5-13, 1955). During this and the three cruises following, areas lying along the eastern and southern edges of Georges Bank were investigated (fig. 1). Included in the data resulting from the four cruises were indications of a potential commercial lobster resource in the deep waters explored.

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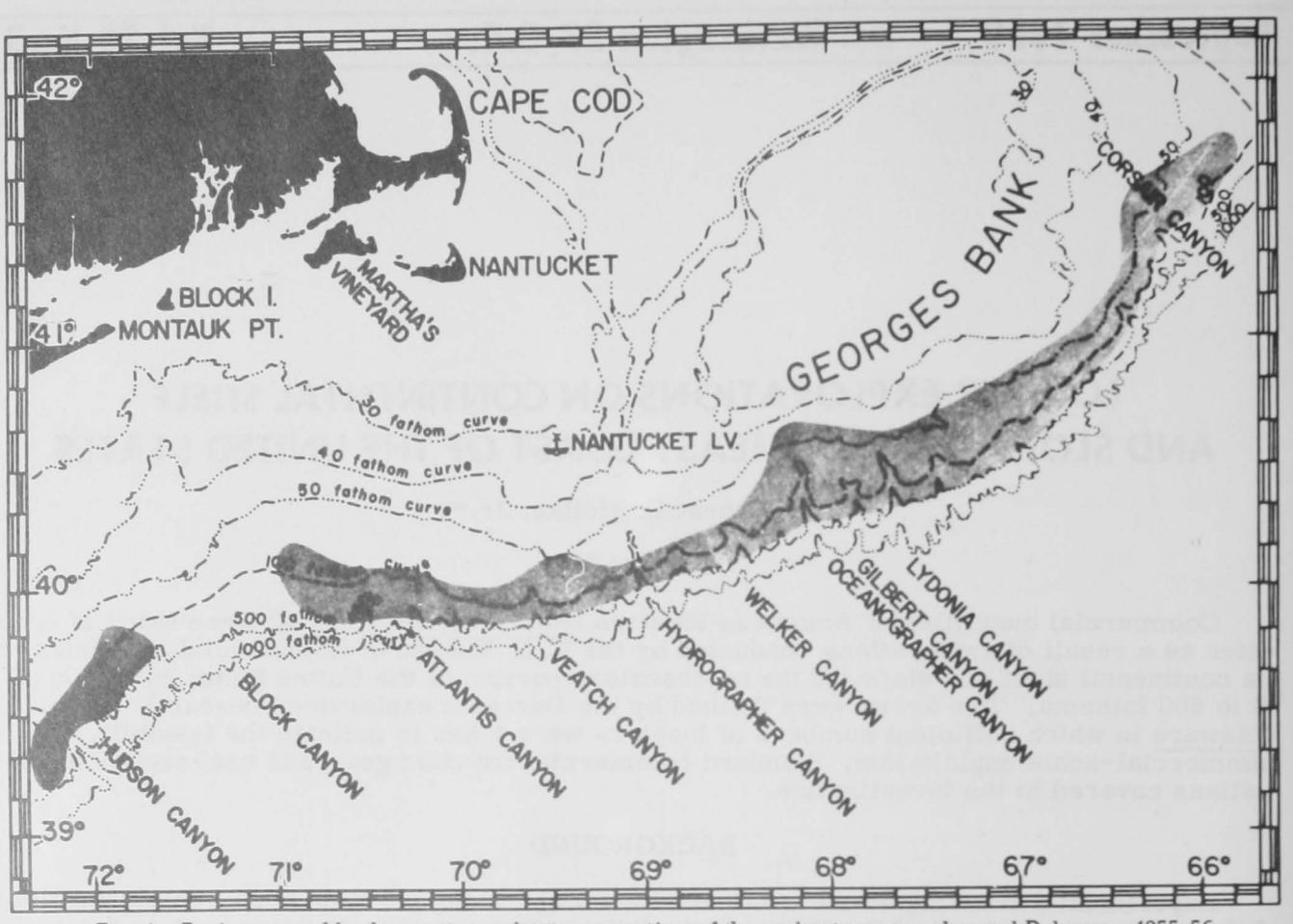

Fig. 1 - Region covered by deep-water exploratory operations of the exploratory research vessel Delaware, 1955-56.

OPERATIONAL PROGRAM

The favorable results of the 1955 cruises indicated that, with further exploration and with the development of modern methods of keeping lobsters alive and of shipboard vacuum-packing and freezing of lobster tails, the existing small fishery for deep-water lobsters could be expanded to the point where it would become a larger specialized segment of the domestic fishing industry. The Bureau, therefore, planned a follow-up program to investigate more thoroughly the deep-water lobster resource. Included in the program were exploratory, technological, biological, and marketing studies. Four lobster cruises were scheduled for the Delaware for 1956. These were designed to: (1) complement the lobster data obtained during the preceding explorations by providing more detailed coverage of the areas where the best lobster catches had been made; (2) supplement previous explorations by extending the investigation farther south; (3) tag lobsters to determine, if possible, the relationship of the deep-water population to other lobster populations; and (4) investigate methods of handling and preserving lobsters and lobster meat aboard ship and ashore.

By October 1956, with the completion of the last scheduled lobster cruise for that year, the accomplishments of the over-all program included the following: (1) the lobster population along some 300 miles of the continental slope had been sampled and two areas showing definite promise of potential commercial concentrations of lobsters had been found; (2) a total of 2,406 live lobsters in good condition and suitable for tagging had been tagged in cooperation with the Marine Fisheries Department of the Commonwealth of Massachusetts and released in the area of capture, and a few tagged lobsters had been retaken; (3) an additional 526 lobsters, chiefly females with eggs, had been kept alive in tanks of circulating sea-water

and turned over to the marine fisheries departments of the states of Massachusetts and Rhode Island for tagging and release in selected inshore areas; and (4) studies of techniques for handling fresh, frozen, and, cooked lobster meat aboard ship and inshore installations had been made, and freezer-storage and taste-panel tests for the evaluation of the palatability of lobster meat after extended storage had been conducted by the Bureau's technological laboratories (Peters and Slavin, 1956, 1958; Pottinger 1950; Slavin and Peters 1956, 1958). In addition, tests to determine consumer acceptance of the meat of lobsters from deep water were completed in some of the New England area's leading restaurants and dining rooms.

Fig. 2 - M/V Delaware, exploratory research vessel of the Bureau's Exploratory Fishing and Gear Research Base, Gloucester, Mass.

EXPLORATORY VESSEL, GEAR, AND EQUIPMENT

The M/V Delaware is a conventional side-rigged North Atlantic otter trawler of steel construction with modifications for research work (fig. 2). The vessel's over-all length is 147.5 feet, its beam is 25 feet, its draft 14 feet 8 inches, and its displacement weight 518 tons. It has a cruising range of 8,000 nautical miles. There are accommodations available for 23 men, although the normal complement during exploratory fishing consists of 13 officers and crew members plus from 1 to 3 specialists.

Standard No. 41 nets (Knake 1956, 1958) were used during the lobster operations with bracket-hung trawl doors measuring 4 feet 6 inches by 10 feet 6 inches. Extra shoes were added, increasing the weight of each door to 1,440 pounds, to enable them to tend bottom more effectively during deep-water drags. Both round and trawl-plane floats of cast aluminum alloy were used on the headrope; and, during all but 25 of the 211 drags, 45 feet of 16- to 18-inch rollers were rigged on the footrope.

In exploratory fishing, more gear damage is normally expected than in regular commercial fishing owing to general unfamiliarity with bottom topography and the location of snags and obstructions in the areas fished during exploratory operations. Gear damage during the present lobster explorations, however, was light and no greater than would be expected from a comparable amount of commercial fishing on known grounds. No damage was incurred during 189 of the 211 drags, 23 of which were made with chain gear rather than roller gear. Roller gear was used routinely during the explorations because, although chain gear may possibly fish more effectively than roller gear for some fish and shellfish, there is a greater possibility of damaging or losing the chain-rigged net.

EXPLORATORY COVERAGE

The 1955 explorations were conducted in an area along the outer edge of Georges Bank, between 41°45' N. lat., 65°53' W. long., and 39°55' N. lat., 69°53' W. long. The 1956 explorations supplemented those of 1955 in areas requiring more complete coverage, expanded the explorations in the vicinity of Veatch and Lydonia Canyons, and extended the range of the explorations westward as far as 72°17' W. long. (at 39°14' N. lat.). The areas are shown in figure 1.

Trawling in 1955 was conducted in depths ranging from 50 to 420 fathoms and in 1956 from 62 to 600 fathoms, with the majority of the drags in depths ranging from 100 to 300 fathoms. The combined areas trawled during the investigation aggregated approximately 350 miles long and from 5 to 15 miles wide on the edge of the continental shelf and slope between Northeast Peak on Georges Bank and the southern side of Hudson Canyon. Coverage, except in an area approximately 15 to 20 miles long near Block Canyon, was reasonably complete (fig. 1).[1/]

1/ In December 1958, five drags were made to spot check the areas from which the best catches of lobsters had been taken during the 1956 explorations. One of these drags was made west of Lydonia Canyon, and the other four were made near Veatch Canyon. Catches resulting were similar to those made earlier in the same areas.

Fig. 3 - Deep-water lobster catch taken during lobster explorations and typical of catches made in productive areas.

FISHING RESULTS

Best fishing during the 1955-56 explorations was experienced in two areas on the southern edge of Georges Bank: The area between Veatch and Hydrographer Canyons; and an area lying immediately east of Lydonia Canyon (fig. 1).

The first of these areas, between Veatch and Hydrographer Canyons, covers a linear distance of approximately 15 miles between 69°12' W. long., and 69°32' W. long. Fishing rates are shown in figure 4. Best fishing was found between 150 and 250 fathoms. The best single drag in this area resulted in 860 pounds of lobsters (215 individuals) in 100 minutes of fishing time.

The second area, lying immediately east of Lydonia Canyon, extends for a distance of approximately 53 miles between 66°30' W. long., and 67°40' W. long. Fishing rates in this, the largest and most productive ground fished, are depicted in figure 5. Although several good catches were obtained in both deeper and shallower waters adjacent to the area of greatest production, best fishing was again found between 150 and 250 fathoms. The best drag in this area resulted in an estimated 1,240 pounds of lobsters (177 individuals) in 95 minutes fishing time.

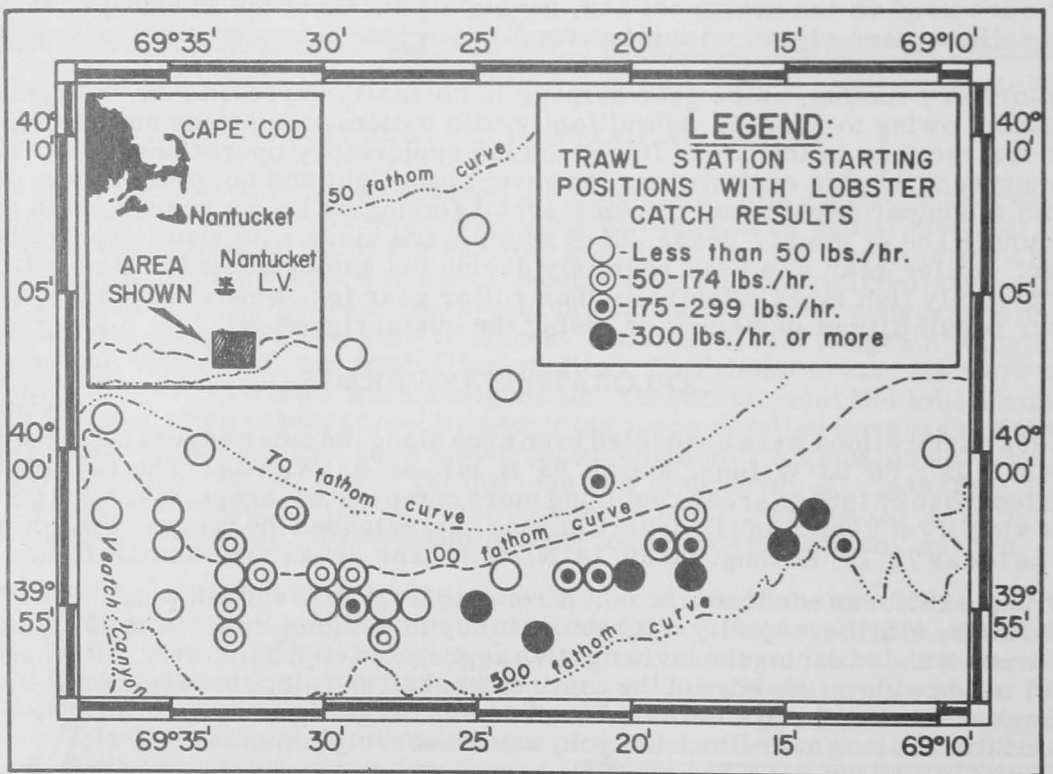

Fig. 4 - Results of exploratory trawling in the area between Veatch and Hydrographer Canyons--one of the most productive areas fished.

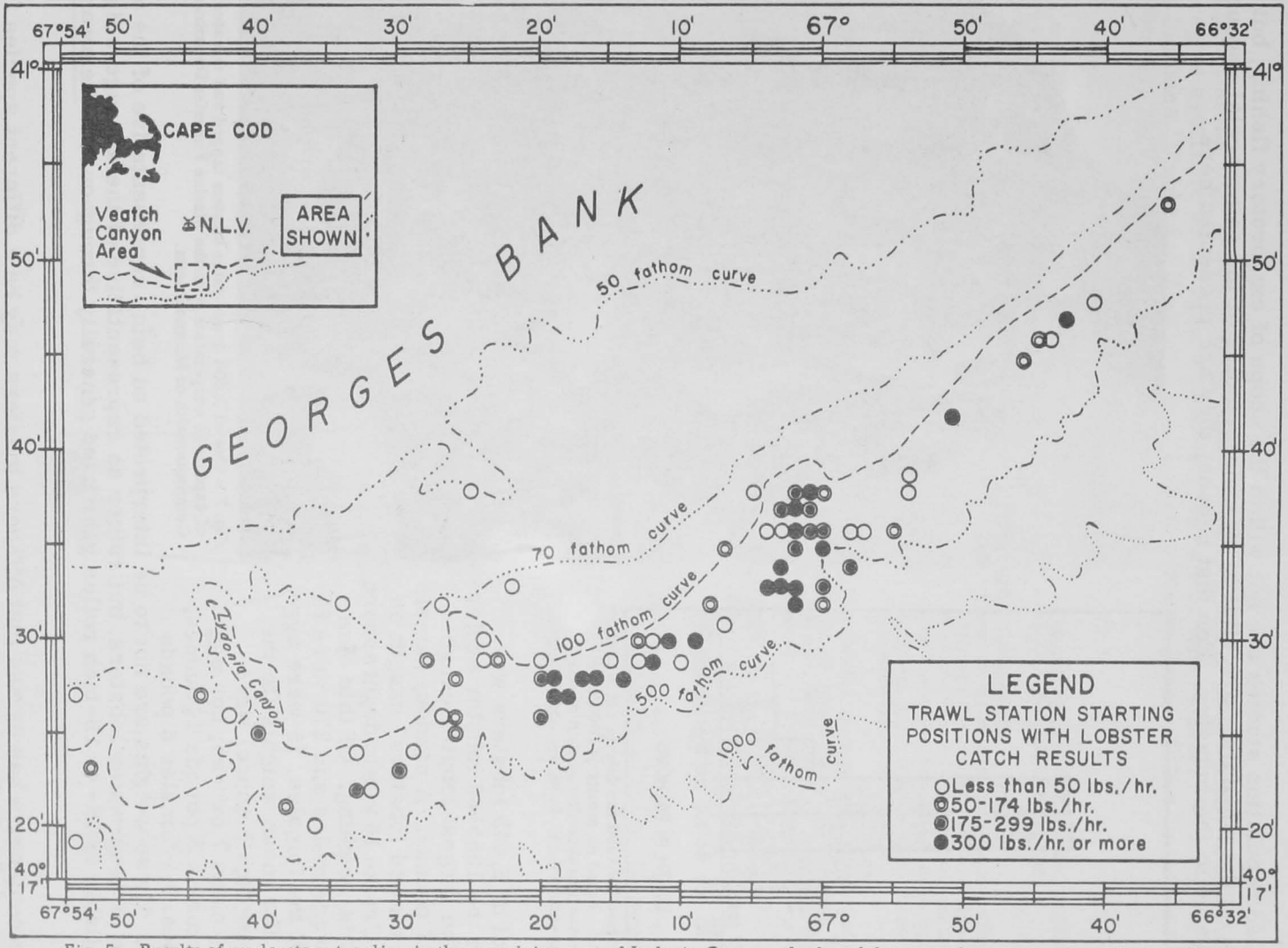

Fig. 5 - Results of exploratory trawling in the area lying east of Lydonia Canyon, the best lobster-producing area found in the 1955-56 explorations.

Throughout the 1955-56 explorations, the 150- to 250-fathom depths were the most productive (fig. 6). In most cases, catch rates decreased on either side of those depths.

NATURE OF DEEP-WATER POPULATION

Detailed population studies are not within the scope of exploratory fishing, but a few observations on the population are vital to an understanding of the commercial resource and its potential value to the industry. For that reason, they are presented here.

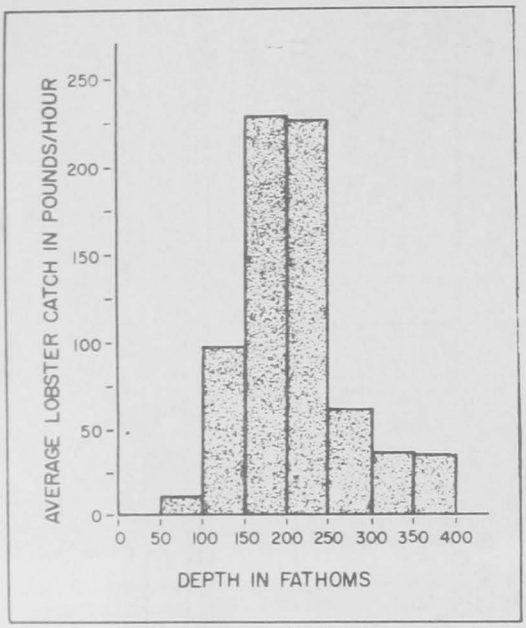

Fig. 6 - Relation between the lobster catch and depths fished. Based on results of 200 drags. Depth indicated was recorded at start of drag. Within-drag variations in depth are not indicated.

Fig. 7 - One of 2,406 deep-water lobsters tagged and released in the area of capture in cooperation with the Marine Fisheries Department of the Commonwealth of Massachusetts.

A total of 5,445 lobsters was counted in the 1955-56 lobster explorations. The largest lobster caught weighed 27 pounds. A random sample of 381 "2-clawed lobsters" caught on Delaware Cruise 16 was brought ashore for accurate weighing. Of this number, 111 were males and 270 were females. Of the females, 71 were egg-bearing. The mean weights (to the nearest one-eighth ounce) were: Males, 5 pounds 7 ounces; non egg-bearing females 5 pounds $1\frac{1}{2}$ ounces; and egg-bearing females 6 pounds $1\frac{1}{8}$ ounces. These weights are not to be interpreted as being representative of the average population of deep-water lobsters, but rather as representative of the average weight of lobsters available to 16- to 18-inch roller gear used generally throughout the Delaware investigation.

Some conjecture has arisen that offshore lobsters may be a different species from the inshore lobsters. This, as yet, has not been demonstrated. The number of returns from the tagged deep-water lobsters has been limited, and no positive conclusions can be drawn. In general, the results indicate only that the tagged lobsters tend to remain near areas where they were originally caught, tagged and released.

The deep-water population is probably unique in one way; it may possibly be one of the few natural American lobster populations that has not been subjected to heavy modification by man.

APPENDIX

A detailed fishing log, showing geographic position, depth, date, catch, and related data for each drag is available as an appendix to the reprint of this article. Write for Separate No. 598, which includes "Table 1--Fishing Log--Lobster Drags made off the Northeast Coast of the United States, M/V Delaware, 1955-56."

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