development of high volume unloading techniques.

4. Considering techniques for sorting and otherwise handling diverse small fish ashore.
5. Working with industry to modify existing flesh-bone separators for use with local species: i.e., whiting (silver hake).
6. Have developed contract with Connecticut College for economic evaluation of mixed species parameters.
7. Through marketing and liaison channels have worked to alert producers and processors of plans, progress, and potentials.
8. Have active plans for marketing survey to determine the potential markets in animal feeding (zoological parks, aquariums, seaquariums, and related).
9. Pilot studies initiated on use of containers for preservation of fish.
10. Looking at methods of skinning dogfish shark.

THE FUTURE

It is generally agreed that most Northwest Atlantic finfish stocks are now exploited near or beyond their capacity. It would appear that if any are not, the momentum built up in the present fisheries will almost certainly absorb readily available "surplus" within the next several years. It appears to follow that any new potential to support growth or maintenance of fishery production will probably come from "underdeveloped" resources. In most cases the exploitation of these requires a comparatively high input of risk, fishing and processing technology, and marketing. These must be blended into a coordinated effort; it is this approach in spirit which dominates the New England Fisheries Development Program.

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MFR PAPER 1101

Riddle of Bering Sea Soundings Resolved

FELIX FAVORITE

ABSTRACT—Although a Soviet map and Japanese nautical chart show isolated soundings in excess of 300 m on the Bering Sea shelf about 160 km northwest of St. Matthew Island, evidence indicates that actual depths are less than 200 m and no conspicuous depression of the sea floor exists in that area.

Almost a decade ago, when writing an article on the oceanography of the Bering Sea basin (Favorite, 1966), I was surprised to discover the paucity of soundings on the broad continental shelf in the eastern part of the sea indicated on U.S. nautical charts. After consulting several Federal agencies and oceanographic groups and not discovering any conclusive evidence to the contrary, I accepted the existence of a depression in excess of 300 m northwest of St. Matthew Island as shown on one panel of a large map of the USSR (Fig. 1) printed by the Omsk Cartographic Plant, Main Administration of Geodesy and Cartography, (27 June, 1955, 3,000 copies) that I had acquired. Recent extensive exploitation of fish stocks in the Bering Sea by foreign mothership fleets (total fish catch per year in the Bering Sea exceeds the total catch per year of all U.S. fisheries) prompted renewed interest in environmental conditions over the continental shelf, and further evidence that such a depression does not exist has been obtained.

The eastern Bering Sea shelf, which extends over 600 km seaward of the west coast of Alaska, is not only the widest in the world but generally devoid of bathymetric irregularities. The gentle seaward slope, interrupted only by several isolated island groups, is so slight that if sea level were reduced and man were able to walk on the shelf, the terrain would appear flat in all directions. Ice cover during winter lowers water temperatures to nearly $-2°C$. In spring, extensive runoff from coastal rivers and increased insolation increases the stability of the surface layer and retards the penetration of summer heating into the water column, resulting in an annual range of temperatures at depths greater than 75 m of only a few degrees. In the area between St. Matthew and St. Lawrence Islands, negative temperatures can occur year round; thus, evidence of a depression of the sea floor in excess of 300 m as shown in the Soviet map implied the existence of not only an unusual bathymetric feature, but also an area of year-round temperatures near the ice point ($-2°C$), a rather unique, isolated, benthic environment.

For nearly 200 years man has tra-

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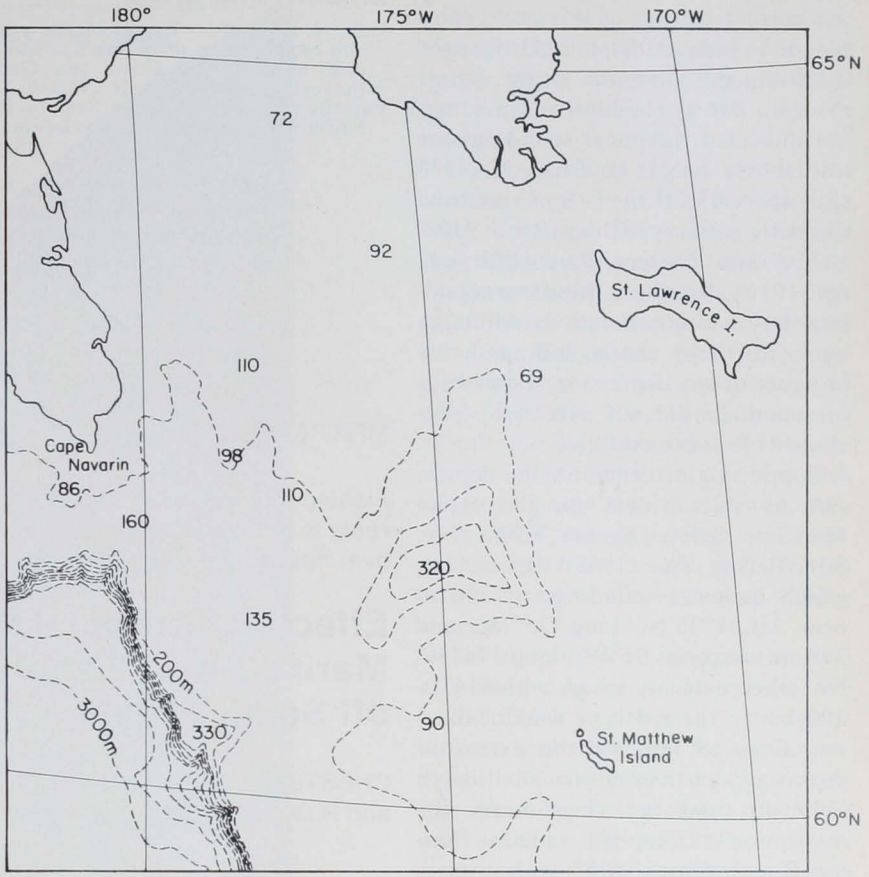
Figure 1.—Bathymetry and individual soundings (m) as indicated on a portion of a Soviet map constructed in 1951-52 and printed in 1953 showing detailed contours of a depression northwest of St. Matthew Island.



versed this area while engaged in various fishing activities, yet published soundings are still quite sparse. Captain James Cook, during a search for a Northwest Passage, is credited with being the first to sail along the eastern Bering Sea coast. He accomplished this in 1778, almost 50 years after I. Fedorov transited the Bering Strait and discovered that North America was separated from Asia by only about 100 km. During the mid-19th century, numerous New England whaling vessels sailed through the shallow strait, which was surveyed during a cruise of the USCS *Yukon* in 1880 and shown to have a maximum depth of about 50 m (Dall, 1882). Although soundings and construction of bathymetric charts of U.S. coastal waters have been carried out historically by the extant U.S. Coast and Geodetic Survey, extensive soundings in the southeastern Bering Sea were obtained by the U.S. Fish Commission's steamer *Albatross* at the end of the last century; and, in order to make these data available quickly to fishermen, the Commission actually published a chart—U.S. Commission of Fish and Fisheries Chart No. 1, Alaska Region (Rathbun, 1894). The edge of the continental shelf (100 fathom line) was indicated well west of St. Matthew Island, but only a few soundings were indicated in that area.

Surprisingly, little new information in the area northwest of St. Matthew Island is afforded even on present day U.S. nautical charts. The charts available to me in 1965 have been revised and therefore not retained, but an indication of the data available at that time can be made. U.S. Hydrographic Office Chart No. 0068, Bering Sea and Strait (14th ed., Sept. 1943; rev. Aug. 1950) indicates two isolated soundings (Fig. 2) of 40 and 42 ftm (73 and 77 m) near lat.61°35′N, long.175°W and 174°W, respectively,

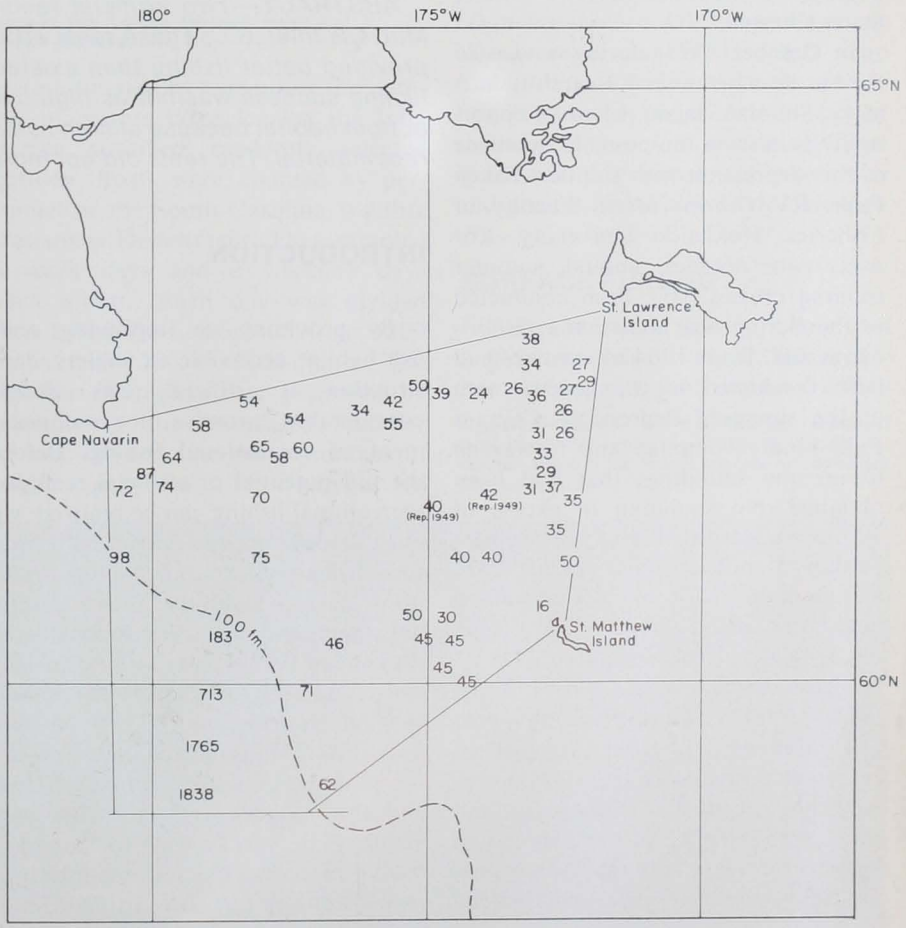


Figure 2.—Bathymetry and individual soundings (ftm) as indicated on a portion of H.O. Chart 0068 (14th ed; rev. Aug. 1950). Present day charts show no additional soundings.

with the notation "Rep (1949)." On the current edition of this chart (now No. 68—14th ed., Sept. 1943; Revised 4/28/69), the notation is no longer evident, but no additional soundings are indicated. Identical soundings are also shown on H. O. Chart No. 523 (Revised 11/12/73), U.S. Coast and Geodetic Survey Chart No. 9302, Bering Sea, Eastern Part (17th ed., rev. 1956) also shows these two soundings but without notation. Although none of these charts indicated the presence of any depression, the paucity of soundings did not necessarily preclude its possible existence.

Supporting evidence for the depression is still evident on the Japan Maritime Safety Agency Chart No. 804, Bering Sea, (1938, Rev. 1972), which indicates soundings of 320 m near lat.61°35'N, long.175°W, and 318 m near lat.61°W, long.174°W. No other data are given within 150-200 km to the north or west of these soundings to indicate the extent of depths greater than normal shelf depth (200 m), and the chart bears the inscription "Compiled chiefly from the British Chart, 1937 with corrections from the U.S.S.R. and United States Charts."

In October 1973, during a visit to the Far Seas Fisheries Research Laboratory, Shimizu, Japan, I had an opportunity to discuss the possible existence of this depression with Captain Takeji Fujii, RV *Oshoro Maru*, Faculty of Fisheries, Hokkaido University. For over two decades annual summer training cruises have been conducted in the Bering Sea aboard the *Oshoro Maru* and, from 1964-68, cruises had been conducted in the general area of the supposed depression. Captain Fujii kindly compiled and forwarded to me the soundings that had been obtained. No sounding in excess of 100 m was recorded, and two are particularly significant: on 3 August 1967 a sounding of 76 m was obtained near lat.61°33'N, long. 173°50'W; and, on 4 August 1968 a sounding of 91 m was obtained near lat.61°31'N, long.175°00'W. Thus, it would appear that another riddle of the sea has been resolved, particularly, in view of the fact that recent Soviet maps do not show any evidence of the depression. However, a potentially interesting fishing ground has been eliminated.

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MFR PAPER 1102

Fishing intensity over artificial reefs is thousands of times that over natural habitat.

Effects of Artificial Reefs on a Marine Sport Fishery off South Carolina

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ABSTRACT—Two artificial reefs created recreational reef fisheries off Murrells Inlet, S.C. These reefs attracted additional anglers to the area and provided better fishing than existed before the reefs were built. However, fishing success was not as high over the artificial reef as over nearby live bottom habitat because of high fishing intensity on the small area covered by reef material. The reefs did not increase surface fishing success.

INTRODUCTION

By providing or improving reef-fish habitat accessible to anglers, construction of artificial reefs affords considerable promise for enhancement of recreational fishing. Before the full potential of artificial reefs for recreational fishing can be realized, we must determine their impact on fishing success and effort. Several investigations have considered these effects, but their findings were inconclusive (Buchanan, 1972; Elser, 1960; Turner, Ebert, and Given, 1964; Wickham, Watson, and Ogren, 1973). The purpose of this study, which encompassed the summer (June-September) of 1972 and the summer and fall (June-November) of 1973, was to compare fishing success, species composition, and fishing effort on artificial and natural habitats off Murrells Inlet, S.C. Results of the survey in the summer and fall of 1973 are presented and compared with results from the 1972 survey reported by Buchanan (1973).

There are two artificial reefs located off Murrells Inlet: Paradise Artificial Reef, begun in 1963 and located 3 miles from the Inlet; and Pawleys Island Artificial Reef, begun in early summer of 1973 and located 5 miles from the Inlet (Fig. 1). Paradise Artificial Reef, the larger of the two, is composed of several thousand car tires and four vessels. Pawleys Island Artificial Reef consists only of two landing craft. The reefs, together, cover about 0.01 square mile and protrude 1 to 10 feet above the bottom. The reefs are rich with sessile and motile invertebrates such as tunicates, barnacles, oysters, sponges, hydroids, sea urchins,