first form of exploitation of fish oils. We cannot undertake this work without unduly dissipating our research effort. We feel it to be more fitting for us to continue our emphasis on the more basic research. We will, of course, do all in our power to assist the industry in establishing commercially feasible fractionation processes.

Exploratory Fishing For Sardine-Like Fishes in the Gulf of Mexico

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Introduction

It is convenient, for present purposes, to recognize two fundamental regions in the marine environment, namely, the benthic or bottom region, and the pelagic region comprising everything above the bottom. Each division contains its own unique fauna and, as far as fisheries are concerned, poses its own specific problems.

Present knowledge of bottom fishery resources is fairly well advanced as compared to the pelagic. Modern otter trawling methods have undergone a progressive evolution and now occupy a place of prominence in world fisheries. In the Gulf of Mexico shrimp and ground-fish trawl fisheries are major components of the industry. In addition, oyster, scallop and clam fisheries, and to a large extent, the blue crab fishery are all dependent upon benthic stocks and bottom gear.

Regarding the pelagic division, however, knowledge is less complete. This area may be subdivided into a surface layer and a midwater region, again for convenience.

Most pelagic fisheries now existent depend upon the fauna of the surface layer. In the Gulf purse seining, gill netting, trammel netting, and some beach seining have been carried out in the bays and along the coast line. Menhaden, mullet and Spanish mackerel have been among the principal species sought to date. Sporadic observations of additional life in the surface layer have been made throughout the years on a subjective and more or less hit or miss basis by persons primarily engaged in other pursuits. Lack of adequate gear and methods of coping with the smaller school fish often reported and a lack of market have combined with a low level of interest to prevent progress in this field. The accumulative impact of the reports has, however, resulted in increasing interest in the past few years.

Recent Interest in Pelagic Fisheries

With the increase in overhead and other expense associated with the complexity of large, modern, refrigerated menhaden vessels and gear, this fishery has become interested in increasing its operations, presently occupying the factory equipment for only a few months of the year, to a full time basis. They have, thus, recently been seeking information on school fishes other than menhaden for reduction use in the off season.

Another industry segment, the so-called "Industrial Fish" fishery, has also recently become interested in the school fish potentials in the Gulf. Originating primarily as a trawl fishery, this operation has undergone a tremendous growth since 1952 with several plants set up in Louisiana, Mississippi and neighboring states for the production of canned pet food and, more recently, high quality, vitamin enriched meals.

Advances in the field of marine electronic devices since the war have opened the midwater reaches to observation, and recorded indications of fish schools have caused some interest in this area as a possible commercial fishery site. In contrast to the surface school fisheries, which depend primarily upon visual observation, hence are restricted to the relatively shallow layer herein designated "surface," modern depth recorders and scanning devices make it possible to "pick up" schools beyond the reach of visual observations. Thus, a region many times the volume of either surface or bottom regions is theoretically opened up. The major difficulties in utilizing the area involve methodology, efficiency of present gear, plus an almost complete lack of knowledge of the species of school-fishes involved or their available quantity.

Thus, in the pelagic fisheries alone there is a basic schism which will necessarily involve two types of operation—surface and midwater. It is with these two areas and the problems of pelagic fishing that the *M/V Oregon* is presently devoting the principal portion of her operational time.

Oregon Activities

Close to a year ago, the *M/V Oregon* temporarily reduced her bottom explorations in order to devote near-maximum effort to the problems of pelagic fishery development. This investigation of midwater and surface school fish potentials was brought about by industry interest, regular and frequent sightings of schools by Fish and Wildlife and commercial vessels in the Gulf and the encouragement voiced in a recommendation by the Gulf States Marine Fisheries Commission. At the outset the following definite objectives were decided upon:

1) Identification of school fish species.
2) Development of efficient methods of fishing and fishing gear.
3) Determination of geographic range and seasonal availability.
4) Determination of available quantity.

The project started off on schedule with a preliminary survey of the potential primarily in the eastern portion of the Gulf where interest was keenest. Principal gear used was a forty foot modified British Columbia midwater trawl of small mesh nylon webbing. This proved an excellent sampling device in most instances for schools picked up on the echo recorder. School samples were obtained over the area investigated, the principal school components have been identified, and a small reference collection has been built up of sardine-like fish species encountered. While main reliance during the survey was placed on detection of midwater schools by electronic means, a constant bridge watch of professional personnel and vessel crew was kept and observations of surface schools were made. The work is presently at a stage where the schools are known qualitatively with fair assurance of completeness, a start has been initiated at correlating fish species with the shape of schools as portrayed by

echograph tracings, and indications of a definite commercial-type potential have been found. Sampling activities pointed to the occurrence of at least six midwater species of fish in the Gulf in possible commercial quantities which are either not used at all, or are little used at present. They include:

1) Razor bellies *(Harengula p. pensacolae)*
2) Cigarfish or scad *(Decapterus punctatus)*
3) & 4) Anchovies (*Anchoa hepsetus* & *A. mitchelli*)
5) Round herring *(Etrumeus sadina)*
6) Thread herring *(Opisthonema oglinum)*

In addition, Spanish sardines *(Sardinella anchovia)* are seasonally abundant along the west coast of Florida. Chub mackerel *(Pneumatophorus colias)* and butterfish *(Poronotus sp.)* may also prove to be of commercial abundance.

The relatively large number of species encountered, each with its own behavior pattern, characteristic habitat, etc., has made necessary an exploratory attack utilizing a variety of gear types. It has also become evident that a project division into surface schools and midwater school-fish projects would facilitate investigation. For this reason the *George M. Bowers* is now in the Gulf primarily to aid in the surface school program. A California lampara and a West African purse lampara modification are now available for use with the *Bowers*. An hydraulic net gurdy has been installed on her afterdeck, and a west coast type, 20-foot seine skiff has been built for the operation. At present the *Bowers* is engaged in preliminary gear trials. The surface school investigation is providing an example of cooperation between industry and the Fish and Wildlife Service. A lampara operation, recently instigated by a local "industrial fish" concern, has been cooperating closely with our own. This operation is providing encouraging evidence that the lampara may be useful gear in the Gulf as well as on the west coast. The crew has all observed commercial operations in California and their net, approximately 350 fathoms, is cut and hung after California practice. So far, in spite of the invariable difficulties incident to a new method, considerable success has been met with on several menhaden sets in the bay. One desirable feature of the method is that large shrimp boats can be utilized with minimum change over.

The *Oregon* will devote the principal portion of her exploratory time to midwater school-fish work. Plans have been drawn up calling for the use of larger midwater trawls of 100-125 feet square opening and gear modifications which we believe will increase efficiency. The recent acquisition of a telemeter is also an important step in this program. The telemeter is an electronic pressure sensitive unit which enables the vessel operator to tell by a glance at a bridge dial the position of his net. The instrument has been recently perfected by the Seattle Exploratory Fishing Section and is in limited commercial production. With this instrument to enable more precise location of the net in relation to echograph-located schools plus constant modification of gear and methodology, more thorough coverage—seasonal and geographic, and with further experience and observations of fish school behavior a more closely delimited idea of the availability of Gulf midwater school fishes to commercial-type operations will be obtained. A new fishery in the Gulf could well result. Towards this end, the cooperation of the Technological and Biological branches has been elicited as well as the efforts of the Exploratory Fishing and Gear Research Branch.