laboratory trawler has been equipped with four different shrimp nets. One of these is a regular 65′ shrimp trawl as used on this coast in the commercial fishery. A second 65′ net is identical in all respects with the first except that it has a Guthrie culling bag, developed on the east coast, instead of the regular sack. Two other nets are used. These are of a type developed locally within the last two years and are known as "Kite Nets." They are totally unlike the ordinary shrimp trawl inasmuch as they have no lead lines, no cork lines, and no bottom. These nets in operation have proved to be excellent over rough, soft, or grassy bottom, consistently producing catches where nets of the regular pattern cannot be used. They have another advantage, the difference in construction causing them to act as culling nets, greatly reducing the percentage of fish in the catch.

Of the two nets of this type which are being used, one is equipped with the ordinary sack, the other with the Guthrie culling bag mentioned above.

This part of the program will be carried on under actual fishing conditions, the laboratory boat operating at the same time, in the same area, under the same conditions, as the commercial shrimping fleet. Its purposes are as follows:

1. To determine the species of fish taken in the commercial shrimping operations and the ratio in numbers, size, and poundage of these species to the amount of marketable shrimp obtained.
2. To determine the actual ratio of the various sizes of shrimp during the various seasons to the marketable shrimp.
3. To determine the ratio of the poundage in unusable shrimp and fish to the poundage of shrimp produced for market.
4. To determine the amount of trout and redfish, if any, taken in commercial operations.

In connection with this part of the investigation, meal and oil analyses of the various species will be made, and it is hoped also that it will be possible, a little later, to conduct some experiments as to the possibility of utilizing the scrap fish for canning.

The Florida Mullet Research Program

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IN A NATION ranking second in the world in the production of fish, Florida is among the leading states. Only California, Massachusetts and Virginia landed greater quantities of fish in 1945 (Anderson and Power, 1949). Of the food fish caught in Florida, the mullet is the leading species.

Two varieties of mullet are recognized by the industry. These are the striped mullet (*Mugil cephalus*) and the silver mullet (*M. curema*). Of these the former is caught in greater quantities. Two other species may possibly occur in the commercial catches but they are of negligible importance. These are *M. lisa* and *M. trichodon*.

No continuous record is available of the amount of mullet landed in Florida. Federal government statistics for the State are available for some years (Table 1) but statistical surveys have been made by the United States Bureau of Fish and its successor, the United States Fish and Wildlife Service, only at relatively long intervals, as funds were available. Florida State law has required statistical reports from the fishing industry since 1933, but even since then there is not

TABLE 1

LANDINGS OF MULLET IN FLORIDA FOR VARIOUS YEARS
REPORT OF U.S. FISH AND WILDLIFE SERVICE

YEAR	LANDINGS IN POUNDS WEST COAST	WHOLE STATE
1890	15,555,964	
1897	15,574,455	
1902	26,309,800	
1908	16,144,600	
1918	26,380,059	
1923	28,454,464	34,652,664
1932		21,141,449
1934		23,966,300
1937		27,679,600
1938		28,593,900
1940		31,877,100
1945	26,715,600	34,527,900

a continuous record of mullet figures available. (Table 2). The State has never had adequate machinery to collect complete fishery statistics, and the figures obtained are recognized to be incomplete. It is therefore impossible to determine from the landings whether the mullet fishery is declining. Taken at face value the figures available would indicate that it is not. Opinions expressed by those connected with the industry are contradictory, although the general consensus is that the abundance of mullet is less than previously. Certainly in some areas fishing is poorer than it was, and there is evidence that the maintainance of the level of mullet landings has been due to increased fishing intensity and efficiency of the gear. A decrease in the average size of the mullet has also been reported from certain areas in Florida, notably along the north Gulf coast, west of St. Marks.

Due to a lack of research, the basic facts which are necessary for an evaluation of the economic and biological status of the mullet fishery are not available to guide its proper management. The program at present being undertaken by the Marine Laboratory of the University of Miami for the Florida State Board of Conservation is designed to provide these facts.

Among the first tasks is to attempt to secure better landing statistics, since a proper evaluation of the present condition of the fishery and its future trends

TABLE 2

LANDINGS OF MULLET IN FLORIDA, 1933 - 1948.
REPORTS OF FLORIDA STATE BOARD OF CONSERVATION.

YEAR	SILVER MULLET	STRIPED MULLET	TOTAL
1933		33,915,350	*33,915,350
1934		33,915,350	*33,915,350
1935		26,163,452	*26,163,452
1936		26.163,452	*26,163,452
1937			no record
1938		24,516,620	24,516,620
1939		32,921,522	32,921,522
1940		33,718,807	33,718,807
1941	167,772	39,399,504	39,567,276
1942	666,828	55,766.115	56,432.943
1943	733,818	55,952 367	56,686,185
1944	14,533	39,657.603	39,672,136
1945	28,238	34,562,063	34,590,301
1946		36,889,793	36,889 793
1947	24,873	28,530,058	28,554,931
1948	8,890	35,662,695	35,671,585

*Average of two years.

cannot be made without trustworthy figures. The industry must first of all be made aware of the need for such figures, since its cooperation is essential to the success of a statistical system. A start has been made in this educational program by the publication of a bulletin explaining the need and function of fishery statistics. (Idyll, 1949a). We must now proceed to gather as accurate data as is possible. The influence on increased fishing intensity and gear efficiency will be studied in conjunction with the total landings.

The possibility of the existence of more than one population of mullet in Florida is a second problem which we are concerned with. It may be that the mullet caught in the southern part of the State are distinct from those north of Tampa, for example, and these, in turn, distinct from the mullet of the northwest coast. On the contrary, it is quite possible that all the populations intermingle, moving from one area to another. The management practice will differ, depending on which of these two situations prevails. For example, if the northwestern populations are distinct from the others, perhaps the prevalent smaller average size in this region is a racial character. If the populations mix, this small size may indicate an over-intensive fishery or one which is operating with nets with too small a mesh. The implications to regulation are obvious.

This problem is being attacked by the most direct method, namely, by tagging. For the present, morphometric racial analysis is not being carried out. The tags being used are the Petersen or button tags. We have released 772 tagged mullet up to the present time, at 10 different places on the Florida coast from Naples to Destin. The tags have already shown us that the summer populations of mullet do not move far, since the great majority of tags put on in July and August were recovered near the place where the fish were released. Returns from our October tagging are starting to come in and we will have a clearer picture of the mullet movements as we continue the experiment.

The intensity of fishing is another aspect of the mullet problem and again our tagging is giving us some information. A high intensity is indicated by our returns from some regions (Table 3). Over 40 per cent of the tagged fish have been recaptured from the Apalachicola tagging and high returns are shown for other areas.

No exact information is available as to the size and age at maturity of the mullet constituting the commercial catch. Returning to the smaller average size of mullet caught on the Florida coast from Pensacola to St. Marks, an important question arises as to whether these fish are younger than those larger individuals caught in the rest of the state. The age composition of the catch is

TABLE 3
RECOVERIES OF TAGGED MULLET

DATE TAGGED	PLACE TAGGED	NO. TAGGED	NO. RECOVERED	PERCENTAGE RECOVERED
7-16-49	Cedar Key	80	7	9.7
7-18-49	Steinhatchee	84	3	3.6
7-20-49	St. Marks	87	12	13.8
7-22-49	Apalachicola	100	42	42.0
7-23-49	Port St. Joe	41	3	7.3
7-24-49	Destin	64	23	35.9
8-22-49	Punta Gorda	100	27	27.0
8-28-49	Naples	41	0	0
8-29-49	Cortez	51	12	23.5
10-25-49	Steinhatchee	83	4	4.8
11-9-49	Homassassa	42	0	0
		773	133	17.2

likewise important in estimating the future abundance of the mullet. The age of many fish can be determined by the markings on the scales, which are caused by different growth rates at different times of the year. It has been widely stated that the scales of fish inhabiting tropical waters do not have these markings. We have collected large numbers of scales from Florida mullet, both from the commercial catches and from tagged fish. A study of these scales is under way to discover whether age can be determined from them. Marks are present and we have hope that we may be able to relate these to the age of the fish.

The size at maturity of the mullet is not well known and this basic information is being obtained. This phase of the investigation, as well as that dealing with the size of mullet caught in various net mesh sizes, is reported in another paper.

Different types of gear used in the mullet fishery are being studied. One report on this has been issued (Idyll, 1949b).

Finally, the gaps in our knowledge concerning the spawning and early life history of the mullet are being filled in as quickly as possible. The results of all these studies should provide the basis for an intelligent management of the mullet fishery, whose objective would be the stabilization of a high level of steady production.

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Gear Studies In The Florida Mullet Fishery

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DURING THE PAST YEAR the Marine Laboratory of the University of Miami has carried on a study of the Florida mullet fishery. This research was undertaken because of persistent reports that striped mullet, *Mugil cephalus,* were becoming increasingly scarce, and fear was felt that the industry would continue to decline unless some corrective measures were taken. Investigations of fishing methods and gear and studies of the life history of the mullet have accordingly been carried out.

Fishermen and fish dealers, in an effort to explain the causes of the decline, have condemned practically all methods of fishing for mullet on one ground or another. Studies of various methods used in the fishery have been made, with the charges against them in view.

The use of the gill net appears to be criticized less than any other. This net is selective in the size of fish it takes, since fish too small to be gilled pass through it, while fish too large to force their heads into the meshes usually are able to back away and avoid being caught. This type of net is probably the least efficient, especially when used simply as a gill net and not employed as a seine. The only criticism made against gill nets is that so many of them are in constant use that mullet have no chance to occupy an area without being disturbed. In some areas along the coast so many fishermen are active that all available fishing grounds appear to be occupied almost every day or night, and