per cent algin, less than one per cent mannitol, 4 per cent fucoidin, and no laminarin. The algin content is an average for a considerable part of the year, actual figures having ranged from 13 per cent to 23 per cent. The others are reported on one sample of a fixed Sargassum. Fat content was about one eighth of one per cent, proteins 4 per cent.

Algin is the important constituent in this study. In the United States alone, several million pounds are used yearly and the demand is growing. Alginic acid is used in the manufacture of fibers, thickeners, protective colloids, and in insulating materials. The sodium salt, usually called Algin, and the calcium salt have been used in the production of textiles, plastics, transparent paper, cosmetics, films and coatings, ice cream, salad creams, custards, jams, sauces and jellies, and as an emulsifier in pharmaceutical, medical, and surgical preparations. Other uses are being frequently reported. Fucoidin has no known use at present but it may prove similar to agar. The protein and fat in Sargassum are of little value, as such. But Sargassum, dried and washed free of some of the salt, can be used as a cattle feed and has been reported to have a fairly high digestibility factor.

Dried Sargassum can be used as a fertilizer material. The minerals extracted during the production of algin can be recombined with the spent weed and this used as a fertilizer. Properly prepared Gulf Weed is a good mulching material, since the colloidal materials present will hold large amounts of moisture.

In any discussion of ways for increasing the available foodstuffs, consideration should be given to the fermentable sugars obtainable from Sargassum. As with such sugars from other sources, the extract of the Sargassum can be used as a liquid on which to grow high-protein yeast. This yeast can be dried and used as a protein supplement in human nutrition. Since the sugar solution can be obtained before extraction of the algin, it is possible to obtain two products from the same lot of Sargassum.

From the 90,000 tons of Sargassum which Parr has calculated is present in the Gulf of Mexico, and estimating that this quantity will produce 12 or 13,000 tons dried, recovery of 15 per cent algin would produce close to 2,000 tons of this material, or about four million pounds. Of course, it would not be possible to harvest all the weed in the Gulf, but if it is true that the supply there is replenished by fresh weed floating in from the Atlantic, it is possible that somewhere near the tip of Florida there is a good place for collecting Sargassum in large quantities. There might also be such a place near Nassau. The process of extraction and purification is neither difficult nor expensive, and it is probable that a worthwhile industry can be built up on this one seaweed.

The Place of Systematics in Commercial Fisheries Research

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Before discussing the part played by systematics in fisheries research, a few words should be said about the modern concept of, and approach to, systematics, especially in what concerns the study of fishes.

In the "old days," from about the time of Linnaeus until very recently, the practice of taxonomy consisted in the morphological study of single or, at the most, very few individuals collected by miscellaneous persons. In most instances, these specimens were not even accompanied by a locality label. Few, if any, natural history notes were taken in those days. In other words, an "ichthyologist" was an individual who studied the morphology of a dead, sometimes not too well preserved, fish, published a very brief description of it, and that was that. If the locality was given at all, it was usually expressed as "Alantic Ocean," "North America," "West Indies," etc. The discovery of geographical variation brought about the necessity of more precise locality indications, but not until recently did the necessity of knowing the precise locality become apparent through refined racial studies.

For obvious reasons, the practice of establishing species on single or few individuals from single localities was also shown to be highly inaccurate when geographical variation was brought to light. Many of the previously described species considered as "good" for many years have been, and are continuously being found to be, mere local variations of a single species, often not even with a subspecific value.

Analytical keys designed for the rapid and practical identification of species were also based on single individuals, with almost complete negligence of ontogenetic and geographical variation. The result has been that at present most of the keys written up to some years ago are (as they were then) of little, if any, value. A good example of this is found in Jordan and Evermann's "Fishes of North and Middle America," in which most of the keys to species are based on single individuals and not even the length of the specimens is given.

In recent times, most taxonomists have realized the necessity of studying series of individuals, containing as many age groups as possible, in interpreting a species or group of species. But a mere study of morphological characters is not enough. Taxonomists are also interested in the relationship between species and groups of species. This leads to the establishment of basic factors in interpreting their phylogeny and origin, and the speciational processes through which the species came about, i.e., their evolution.

Divergence in morphology, the basis for taxonomy, also means divergence in ecology, physiology and behavior. In many instances this latter type of divergence many be better marked and more important than mere morphological divergence. So-called physiological and ecological species are good proof of this. The importance of incorporating such disciplines as ecology and physiology becomes apparent in the difficulty that frequently arises in interpreting certain forms known to be morphologically affected by certain environmental factors, namely, temperature, salinity, turbidity, etc. The effect of temperature on the size and number of vertebrae in fishes is well known, as well as that of salinity on size and coloration. There are many problems of species interpretation which can be solved only through experimental ecology in the field as well as in the laboratory, in order to establish definitely whether presumably distinct forms are truly separate genetic entities or mere ecotypes of one single form.

The fishery biologist is interested in learning about the habits and distribution of fishes (their life histories) for the practical purposes of commercial exploitation and conservation. But in order to do the job right he must be sure of the taxonomic entities with which he is working, since, as already pointed out, even in the lowest taxonomic ranks (subspecies, races, populations) great divergence in habits may be observed. It is the job of the systematist to provide the fishery biologist with this information.

It has been said earlier in this paper that modern taxonomy is concerned with *series* rather than with single individuals, and it is a well known fact that fishery biology is even more concerned with series of individuals—in fact with populations. It becomes apparent, then, that the fishery biologist can provide invaluable information to the taxonomist, not only by supplying him with large series of specimens, but by learning about their habits and distribution which are factors that have been found to be basic in the accurate interpretation of a taxonomic entity. At the same time, the fishery biologist will benefit by the accurate taxonomic interpretation based on the information supplied by him.

Poor work on the part of systematists in the early days of fishery biology brought about the development of so-called "racial studies" in the field of that discipline, in order to obtain a better interpretation of populations below the species level. Great improvements in taxonomic methods resulted and these have been incorporated to the practice of modern taxonomy in many branches of zoology. At present, with the improvements and refinements available in systematic ichthyology, racial studies should be left to the taxonomist, releasing in this manner the fishery biologist to his more important duties of investigating the other phases of the biology of fishes.

Fishery biology and taxonomy are mutually complementary. Basic training in systematics is as important to the fishery biologist as basic training in the general biology of fishes is to the systematist. Fishery biologists and taxonomists have usually worked independently and have regarded each other as separate and inferior castes. It is necessary to realize that these two branches of ichthyology have a great deal in common and are dependent on each other.

The Effects of Underwater Seismographic Exploration

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THE PROBLEM of the lethal effect of underwater explosions to aquatic life has been accentuated by the necessity of the employment of this means of searching for oil deposits. These phenomena are paralleled by war use of underwater explosions for the destruction of enemy submarines.

The necessary employment of this technique in the onshore and offshore waters of the State of Louisiana caused deep alarm among those citizens who were concerned with five major marine enterprises, viz., recreational fishing, commercial fishing, the oyster industry, the shrimp industry and the crab fishery, both hardshell and softshell.

It was imperative that a sound basis be established that the use of these seismographic techniques would not seriously impair such aquatic resources.

Therefore, three series of controlled experiments were devised and executed to ascertain in what manner these highly important marine resources of Louisiana would be affected by the use of submerged explosive charges in exploration.

The problem proved to be extremely complicated.

The first series of experiments was executed in duplicate and involved the discharge of a top shot of 800 pounds of the explosive seismographically used which deviated less than 4 per cent from the impact of trinitrotoluol. Graded lesser charges were subsequently used. Shrimp (*Penaeus setiferus*), fish, croakers, (*Micropogon undulatus*) and oysters (*Ostrea virginica*) were used, the experimental animals being placed in carefully constructed cages at intervals of 50, 100, 150, 200, 300 and 400 feet. The most careful consultation was conducted with physicists to establish that these confining cages, constructed with extremely small slats, could not possibly cushion any explosive impact. As already stated, this series was fired in duplicate.

It was revealed that these relatively enormous charges, far in excess of anything normally employed, left completely unharmed shrimp at 50 feet, oysters