

useful but still undeveloped compounds. This screening program requires the development of standard testing techniques which may be modified and augmented as our knowledge and needs increase.

The potential hazard of pesticide use has been clearly shown by laboratory observations but with few exceptions we are still unaware of the magnitude of their danger to our natural resources under field conditions. Therefore, a second objective of our expanding field program is the comparison of the acute and residual toxicities of these chemicals under a variety of field conditions with the relative toxic levels that were determined in laboratory tests.

Detailed studies are required to show how the persistence of chemicals in the environment may be affected by weather conditions, amount of ground cover, drainage patterns, and soil structure. Projects are also being designed to determine if some of the more important pesticides may be concentrated or biologically magnified in the estuarine food web. There is laboratory evidence that man's food supply may be contaminated even in areas where chemical contamination levels are extremely low.

Finally, it is proposed that teams of observers be trained to make appropriate before and after studies of large scale pest control programs to determine when and under what condition there may be significant danger to our natural resources. These teams will be concerned also with the monitoring of estuarine environments supporting important commercial fisheries. We are hopeful that technically and economically reasonable bio-assay methods will be developed so that we can maintain a continuing vigilance over the estuarine habitat.

Shellfish Advisory Service — Cooperation With the Industry

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MOLLUSK SHELLFISH at the present time account for more than 12 per cent of the total landed value of our domestic commercial fisheries. In cold cash this represents about 45 million dollars. They are therefore of major importance to our United States fisheries economy and of direct concern to us in the Bureau of Commercial Fisheries which, in cooperation with the research and management agencies of the maritime states, is charged with the conservation and wise management of these important natural resources. While all of us should be, and no doubt are, consumers of this fine food, we should be vitally aware also of the significant place members of the shellfish industry, with their background of experience, have in this discussion. This makes a quartet of forces, state and federal research, state and industry management, that must work together in complete harmony to stabilize and increase production, to improve quality, to stimulate consumer demand, and as a result to develop and maintain a healthy shellfish industry.

These statements imply that there are conditions under par in this industry. This is unfortunately so. The list of problems is long and I shall not enumerate them at this time. Dr. J. L. McHugh, Assistant Director for Biological Research of the U.S. Bureau of Commercial Fisheries, in his speech entitled "Research and the Oyster Industry" told the members of the Oyster Growers and Dealers

Association of North America that there is a large fund of knowledge available to draw upon, but generally unutilized by industry, state legislators, and some state management agencies.

This again is unfortunate. Therefore I should like to point out briefly and for background the historical picture of production of oysters and clams in the United States over the past 80 years. I draw once more on Dr. McHugh (1963) who illustrated this graphically in a prepared statement presented in a public hearing to the Subcommittee on Fisheries and Conservation, Committee on Merchant Marine and Fisheries, U.S. House of Representatives.

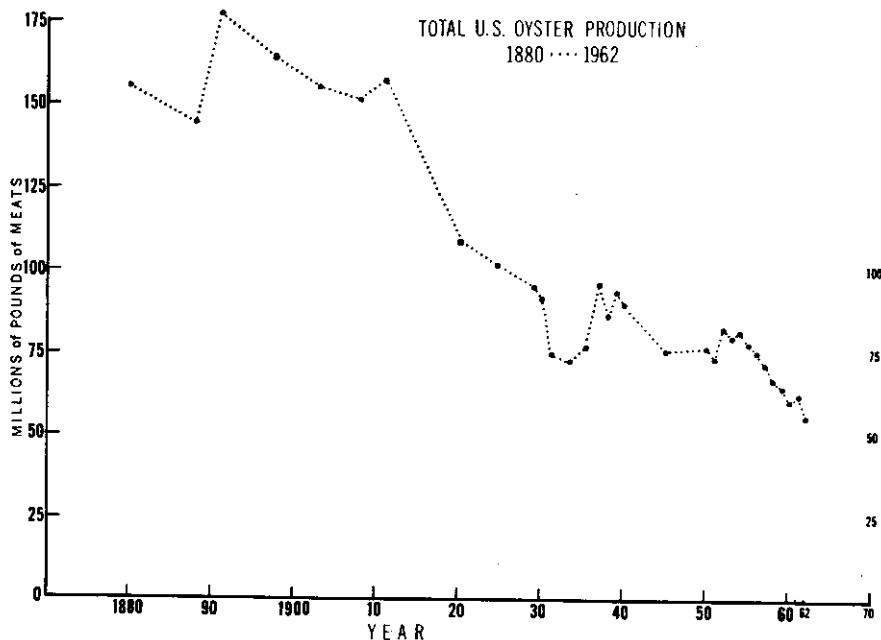


FIG. 1. Total U.S. oyster production 1880-1962.

Oyster Production

Oyster production on the Atlantic Coast in all sections has declined (Fig. 1). It is, however, the marked drop in the Chesapeake Bay yield that influences most seriously the total U.S. picture. The oyster culture in Maryland is still a relatively primitive one using antiquated tools and restrictive laws which limit modernization and expansion. In Virginia some progress has been made in improving culture methods, but restrictive legislation limiting expansion to submarginal areas compounds the problem of efficient cultivation and the control of predators and disease. In the states on the Gulf of Mexico production is low but relatively stable, although problems similar to those mentioned above exist here. On the Pacific Coast production has increased only after drastically altering the culture by importing seed from Japan on an annual

basis. The local West Coast oyster, *Ostrea lurida* or Olympia, accounts for a small part only of this production. At one time eastern oysters, *Crassostrea virginica*, were shipped in car loads to the West Coast where they were simply held in storage in local waters. The eastern oyster did not respond in sufficient amount to any natural culture of seed in western waters. The practice of shipping fully grown oysters to the West Coast still is being done, but on a very limited scale, as one may easily realize after examining the curves of the decline of the Atlantic Coast oyster harvest. Oyster production regionally is summarized in Fig. 2.

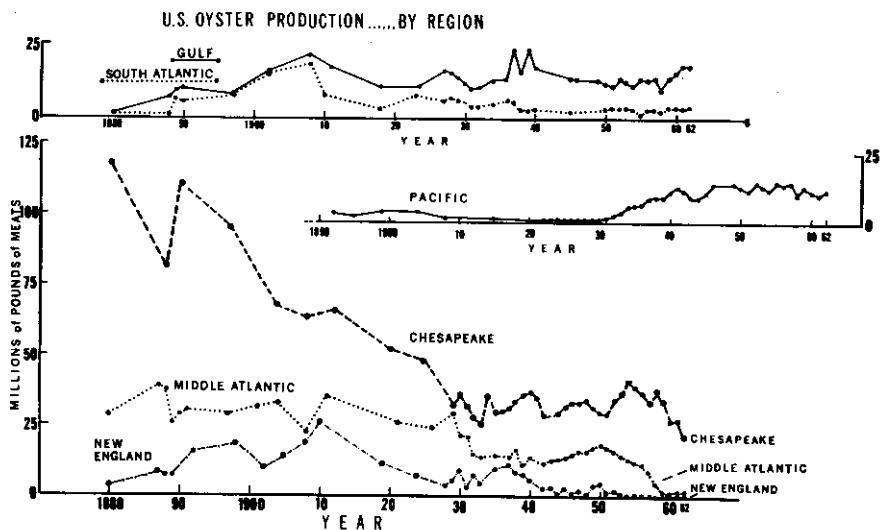


FIG. 2. U.S. oyster production by region.

Clam Production

Viewed as a whole, the clam industry in the United States appears to be in good condition, with a total annual production reaching 50 million pounds, as shown in Fig. 3. This figure, however, is derived from a number of different species and genera, all but one of which have shown a decline of considerable proportion. The surf or sea clam, *Spisula solidissima*, the fishery of which is primarily located off the New Jersey coast, has shown a phenomenal growth to offset the losses in production in the other clams. The soft clam, *Mya arenaria*, in serious decline in the New England states, has been exploited heavily in Maryland over the past ten years. The soft clam harvest in Maryland for 1962 was 7 million pounds, which is an increase from practically nothing during this period. This spectacular production increase was made possible by an abundance of clams and by the recent invention of an escalator clam dredge. Nevertheless, the Maryland production is limited by difficulty in marketing this newly exploited Chesapeake Bay resource.

TOTAL U.S. CLAM PRODUCTION
1889 1962

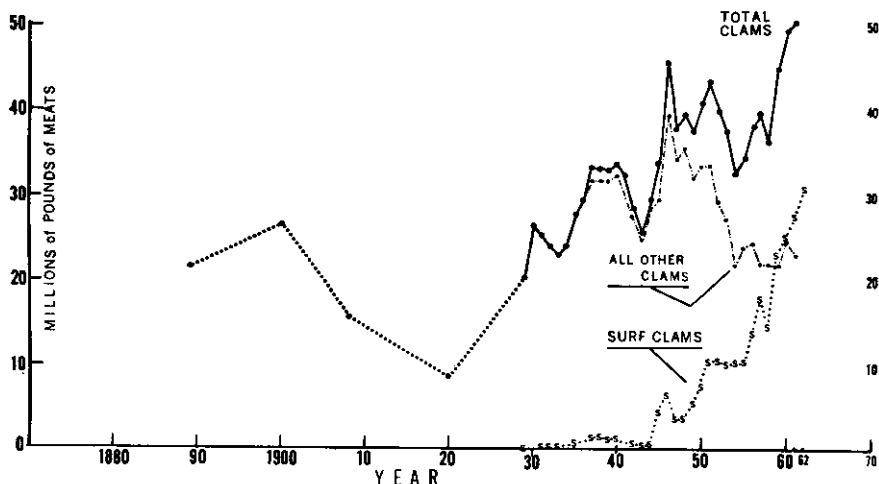


FIG. 3. Total U.S. clam production 1889-1962.

Why Is Production Declining?

Production of oysters and clams, and perhaps scallops, is declining for many of the same reasons: predation by drills, crabs, fish, and starfish, among other predators; overfishing when the wild stock is not inventoried and managed within the sustainable yields; pollution and other human activities producing formidable complications to the maintenance of these important commercial shellfish resources; and unrealistic legislation which hampers the exercise of our most precious prerogative of free enterprise and healthy competition.

The Bureau of Commercial Fisheries is conducting research on many of these problems. State and university research laboratories also are studying these local adverse conditions. The shellfish industry in many areas is helping to solve some of its own ailments, mostly in the field of gear improvement. All this effort, however, is accumulating information in an isolated way. We know a great deal about many of these problems but we have not applied this knowledge effectively to general shellfish culture and management. Our methods of communication have not bridged the gap between knowledge and application. The Bureau of Commercial Fisheries has a legal responsibility for correcting some of this lapse. We have not done very much of this in the past except as the researchers attempt to pass their information back to the industry that needs it. This apparently has not been direct or positive enough to produce the desired improvements. The breakdown in communication has in part caused this enigma but steps are being taken to fill this need.

Shellfish Advisory Service

Dr. McHugh, in his speech to the Oyster Growers and Dealers Association in 1962, said that the Bureau was considering the organization of a Shellfish Extension Service. This service would work closely with industry, state sci-

entists, and state administrators to interpret and utilize the scientific knowledge available, and to improve the basic knowledge on which to plan further improvements. Another task to be undertaken was the analysis of the shellfish laws that have outgrown their usefulness and actually hinder progress in management. In July, 1963, Dr. McHugh again addressed the same organization, but at this time he announced the installation of the Shellfish Advisory Service, generally following the plan proposed the previous year. He stated as he announced the new service that, "The shellfish industry has been profitable in the past and it still can be profitable if we put the combined knowledge and experience [of science and industry] to work".

He asked the question, "What are the principal requirements?" to make this work, and proposed the following: (1) a reliable supply of seed oysters developed to resist local ailments; (2) freedom from the vicissitudes of nature such as extremes of temperature and salinity, freshets, storms, siltation, disease, predators, and pests; (3) freedom from interference by man, such as over-exploitation, channel dredging, construction of dams and other barriers; filling of marshlands, pesticide spraying, water pollution, and the like.

There has been only token improvement, if any, in dealing with these principal problems of the shellfish industry, especially on the Atlantic Coast where major production has existed. In fact, space restrictions increase as pollution of growing areas expands. The laws requiring this are direct and necessary to protect human health. Other shellfish laws, however, impose restrictions that decrease the efficiency and increase the cost of a shellfish harvest. Something is lacking in the regulations and management programs when the decline in production persists. This and the lack of good communication between science and industry inhibits the progressive use of our accumulated knowledge.

The U.S. Bureau of Commercial Fisheries' plan to meet this need is the installation of the Shellfish Advisory Service to help assemble the facts and consolidate them into a comprehensive program of cooperation to help rehabilitate the shellfish industry and change the direction of the current production curve.

Its staff will be expanded and service agents as they are available and trained will eventually be placed in the principal shellfish centers to aid and advise on area problems. Success of this experiment hinges on the extent to which cooperation develops among all responsible shellfish groups.

REFERENCES

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- 1963 (a) Statement before the Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, United States House of Representatives, Washington, D.C. October 2, 1963. (The illustrations used in this paper have been taken from this reference.)