SCIENTIFIC FISHERIES WORK IN MARYLAND

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It is a very distinct pleasure for me, sailing with you on this historic bay, to take part in your program and, especially, to discuss before you some of the more important scientific work we are attempting in the fisheries at Maryland's new laboratory on Solomons Island. As director of the Conservation Department's researches, I feel happy over the opportunity I have to work in this very rich, and in many ways nearly virgin region. Opportunities for applied science could barely be better elsewhere than in the Chesapeake bay country.

It is quite commonly held that poets, above all other classes of men, are able, intuitively of course, to picture the hidden, the unknown. When words were given to that well-known jazz song "Sailing Down the Chesapeake Bay" several years ago to the effect that "Every fish and worm begins to wriggle and squirm, when the propeller begins to do the corkscrew turn," the scientists had barely started to explore animal responses and the average man hardly dreamed that at each rotation of the paddle-wheels of a ship, like this we are on, thousands upon thousands of oysters and other mollusks respond by closing their shells and that even greater numbers of crustacea and true fishes become alert and start to hie themselves to safety, while incalculable billions of micro-organisms receive the impulse and set up responses. Today, oysters, for instance, have been electrically contacted and their most secret native activities explored as they have written their own records with kymographic apparatus. Tagged crabs and fishes have yielded much information about their daily life, breeding grounds, longevity, and there has accrued from such efforts valuable knowledge upon which to formulate sound policies for real conservation. Today it is generally recognized that the sea is no longer a "barren vastness," but instead a fertile valley seething with life, in the main uncharted.

When Gray wrote in his celebrated Elegy "Full many a gem of purest ray serene, The dark unfathomed caves of ocean bear," men had not learned to extract iodine, a gem among the elements and a most important therapeutic agent, from sea-weed. Indeed, it was years and years later when this very body of water here began to produce the quantities of oysters Commissioner Earle has referred to, upwards of 20,000,000 bushels in a single year. But it is improbable that Gray had either iodine or oysters in mind when he penned his immortal verses. I like to think he had in mind that

wealth of inorganic and planctonic matter which underlie all life in the water, and with which the Chesapeake is so richly supplied.

I shall not attempt to glorify the State of Maryland before this group, though I confess that it is difficult to refrain from just that when I look toward this west bank and beyond, over fertile agricultural plains and valleys to wooded hills and smoothly chiseled but green mountains, with a thrifty city or town located here and there in the distance, all connected directly to historic Baltimore by fine highways. The Bay here, its banks frequently indented by lovely, broad, salt water rivers, speaks more eloquently for itself than I possibly could. The Eastern Shore you see there, bathed by both ocean and bay, is virtually a garden set in lovely long-needled pine, richly productive of vegetables and truck crops which afford the happiest of homes and family life. Surely Byron could have had that land in mind when he in effect asked in his Bride of Abydos,

> "Know ye the land of the cedar and pine
> Where the flowers ever blossom, the beams ever shine;
> Where the light wings of zephyr, oppressed with perfume,
> Wax faint o'er the gardens of roses in their bloom?
> Where the peach and the melon are fairest of fruit,
> And the voice of the mocking bird never grows mute;
> Where the tints of the earth, and the hues of the sky,
> In color, though varied, in beauty they vie?
> Know ye the land of the cedar and vine,
> Where the flowers ever blossom and the beams ever shine?"

At our new laboratory, a fine brick structure located on a commanding site facing the Patuxent and the Chesapeake, equipped with modern devices and the necessary supplies for the work at hand, we have many and varied problems to attack. In common with the pioneering tendency of all American settlers, early Maryland citizens used wild forms without restraint and a kindly Nature replenished them unfailingly until the on-rush of machines. The Chesapeake stood up until some forty-odd years ago, when depletion of our seafoods set in. The oyster, to cite one case, dropped in production from 17,000,000 bushels in 1885 to 2,000,000 bushels in 1925, or to one-eighth of its one-time abundance, and this at a time when production had increased in most every type of husbandry. It became our problem then to discover, if possible, the causes of such depletion and to work out a procedure whereby it not only could be checked but restoration could be effected.

Oystermen rather generally held that the waters of the state were "dead"; that the oyster beds had been adversely affected by some agency, such as oil, exhaust gas or changes of a physical nature; and that the days of oystering were numbered. Our first step, in attacking this problem, was to make a general survey of the physical condition of the water and to note the biotic relationships. After

several summers sufficient data accrued to make comparisons with records made by that early Johns Hopkins University scholar, Dr. W. K. Brooks (1880-1890), and with the findings of Lt. Richardson, a graduate of the Naval Academy who became interested in biology and did work in our Tangier sound during the eighties. Records of salinity, alkalinity, temperature, and biological forms (numerically), showed no appreciable change in the intervening years except for oysters. In other words, the waters of Maryland, with very minor exceptions, are today as potentially productive of oysters as they were in the days of greatest abundance.

With the knowledge that the Bay, so depleted, is capable of producing as many oysters as it ever did, our problem became one of determining the best method for restoration. Seed oysters were the big problem. How could spat, recently attached oysters, be secured? A series of experiments was set up on the same oyster bed, using shells, pebbles, brickbats, glass and various woods, to ascertain the most efficient oyster gathering materials, taking into consideration cost and availability and power to attract oyster larvae. Oyster shells proved by far to be the best cultch material, exceeding in potentialities the concreted water-proof paper developed by the U. S. Bureau of Fisheries.

Having established that the Bay could be made to produce, and knowing the most effective material for oyster cultch, there remained for us the problem of choosing from the vast areas of depleted oyster bottoms those most rapidly developable. The microscope came into play and all those where no oyster larvae were found (oyster larvae, microscopic in size, swim around in these waters for fifteen to seventeen days, depending upon the temperature) were discarded as far as immediate use was concerned. Only bars where sufficient larvae appeared to assure a "catch" were recommended to Commissioner Earle's department for intensive shell planting. However, full approval was not given any area unless it had been tested out by experiments in shell planting in which wire baskets carrying sixty shells each were used. If sufficient larvae appeared in the water over a given area, and if experimentally planted shells followed up with a catch of young oysters ("spat"), then the area was recommended for development in a big way to the Conservation authorities, who in the meantime had developed a substantial policy for acquiring and planting shells. At present approximately 1,000,000 bushels of shells are being returned to the bottoms annually. The department no longer needs the microscope while choosing areas to be planted. Experience has established that only those sections are developable over or around which sufficient brood stock may be found. Totally barren areas, no matter how productive they may have been once upon a time, are not used.

Our force at Solomons Island working on the oyster problem are attempting experimental work toward the end of developing from

certain barren bottoms, very specially chosen, oyster seed areas. As previously pointed out, the problem of securing seed for private plantings on leased bottoms is our biggest one. Without pointing out the details here, I might say that this investigation, now in its third year, is very promising and we hope soon to have a fine oyster seed bed in the Honga river, the center of our activity.

During the past month we have been experimenting with the breeding habits of the Japanese oyster, *O. gigas,* in an effort to determine whether or not it will cross-breed with the native species *O. virginica.* As you may know, this species from the Orient grows very rapidly, has a fishy smell, is unpleasing to the taste and, with a darkly fringed mantle, is unsightly. We find, in common with experience elsewhere, that it does readily hybridize with the local form. While the poor qualities of this foreign oyster are not so pronounced when it is processed and canned, and it would offer little competition to the east coast oyster when sold fresh, as the bulk of our oysters are sold, it is my opinion that a genuine "yellow peril" would face us if plantings of this species were made in the Chesapeake. In Willipa bay, on the Pacific coast, great quantities of Japanese seed oysters are now being used and, I hear, without bad consequences, since in those waters the temperatures do not rise to a point within its breeding temperature range. This means, of course, that the alien species does not spawn and, therefore, does not mix with the forms native there. Generally speaking, this condition holds in northern waters, here in the East. However, the situation is quite different in the Chesapeake, and southward to the Gulf states, where temperature ranges are around the optimum for Japanese oyster spawning. It is my firm opinion that it would be a very, very big mistake to release Japanse oysters, experimentally or otherwise, along the east coast, not only because of the possibilities of establishing an inferior product, which might readily absorb or replace the native form, but with it accidentally establish a new enemy to do a damage to our water life the equal of or even in greater proportions than that now being done by the Oriental peach moth or the Japanese beetle within our confines.

Crabs, fin-fish, and terrapin likewise have had their ups and downs in the Chesapeake, and they offer problems in many cases not yet attacked scientifically. Just now the Laboratory is busy studying the biology of the blue-crab, a native of this region, which probably will add upward of $2,000,000 in wealth this year to the Chesapeake bay country. This denizen, though having been used for decades, has been so little studied that we do not yet know even its life history, except by inference. Soft crabs are known to all, yet we are unable to tell you how many times a crab molts and becomes soft.

Crabs begin their life in the bay near the ocean. Tiny forms, totally unlike the adult crab, they grow and molt, grow and molt, passing through two distinct larval types of development, the Zoea

and the Megalops, and then for a full year grow and molt in crab form to reach maturity, about fourteen months being required in all. After a few growth stages have passed they start their migration up the bay and reach our shores when they are about one-fourth of an inch in width. Continuing their growing and molting, they reach their adulthood in this section and, taking a leaf from near by Elkton's Maryland's and America's celebrated Gretna Green record, they start their nuptial activities. When crabs mate the male is in the hard shell state and the female in the soft shell state. The male clasps the female just before she molts and swims to a favorable shedding ground, a shallow, grassy, warm area, where she is released to discard her shell. Immediately after becoming soft, the male clasps her and mating takes place and continues for ten or twelve hours, at which time the female's shell has begun to harden again. August and September are the months in which these activities take place for the most part. After mating the female slowly works her way to Virginia waters to overwinter and to lay her eggs during the early summer to follow.

Nearly 75% of the world's blue-crab supply comes from the Chesapeake. Virginia and Maryland possess this resource in common and the problem is a bit confounded by the fact that there exists a lack of accord among their fishermen, as well as the conservationists, relative to vital points in crab life. Virginia just recently permitted the capture of egg bearing crabs, and has permitted from the first dredging of crabs, largely mated females, during the winter season when they are in the stupor of hibernation. Maryland lays down laws that permit of unrestricted fishing except for lower size limit and winter operations. Neither state has a crab sanctuary. Our work indicates fully that both states need crab reserves and that they should be chosen from the most valuable crab fishing grounds known.

Crab studies will be continued at the Laboratory another year in the hope that the full life history of the species, *Callinectes sapidus,* may be known both through rearing them in holding tanks and through observations made in their habitat. Mr. George Beaven, a graduate student at the University of Maryland, will continue this work with me.

Our laboratory building has space for some fifty-odd workers. It has running salt and fresh water in every room, and it is supplied with gas, compressed air and electricity. It has three working floors in it and its furniture was specially made by the Kewaunee people to serve specific purposes. There are six combined office-research rooms, bio-physics and bio-chemistry rooms, a general laboratory for thirty-six persons, a small research laboratory for eight persons, a combined aquarium and museum room, library, lecture room, and rest rooms. The basement floor has a photographic and a dark room, engine room (six electrically driven machines), two store-

rooms, janitor room, dining room, kitchen and pantry or refrigeration room. In fact, the physical plant is just about as complete and satisfactory as those of us who have been working at Solomons island could anticipate, and we are very grateful to the Governor of Maryland and the Commissioner of Conservation for their interest and support in this connection. We trust that we may justify their confidence in making available such quarters for our work.

I would like to go further in telling of Maryland's new laboratory and state that I feel that its mission will be only partially fulfilled if it should deal strictly with research problems, whether pure or applied if there really is a line of demarcation between the two. The serious decline in output of seafoods already referred to would not have taken place, I feel, had the men of the industry and their leaders known long ago the causes of depletion and remedies for them. It is true that they have seemed blind to their faults in some cases, and that they have shown resistance to efforts at rehabilitation on occasions; but are not such attitudes due to lack of information whether here or elsewhere? Indeed, I feel that a very considerable part of this new work should center around the dissemination of knowledge. It is not a hard matter in many cases to unearth new facts, but it may be extremely difficult to put the information into use. There is no better place in our land to illustrate this principle than in your work, members of the Society, for with you science is years and years ahead of practice, as you well know and further realize from the papers at each annual convention.

In connection with our educational program, as well as in research, we have been fortunate in that the University of Maryland, which joined with the Conservation Department over a decade ago in fostering the Chesapeake work, Goucher College, St. John's College, the Johns Hopkins University and Washington College, old and leading colleges in the state, are cooperating in the management and development of the laboratory. These institutions assign members of their staffs to our work and we in turn grant full privileges for their students and staff alike, as far as space permits, without cost. Regular classes are held in the building for which credit, graduate and undergraduate, is given at the University of Maryland. Special emphasis in all this work is placed on local forms and problems. Next year we hope to institute a course in the biology of our more important water forms and offer in it an opportunity for the high school teacher to thoroughly familiarize himself with the conservation of Maryland's water heritage, hoping in turn that this information may be passed on to all parts of the state, city and county alike, so that our citizens may not only take interest in restored productivity but that they may have a genuine pride in a seafood output exceeding by far that grown at the peak of "wild fruit" production. Such a development would bring to this small commonwealth an added increment in wealth sufficient to afford a fine liveli-

hood for more than one hundred thousand people. Such vast possibilities made possible the establishment of our new laboratory. They inspire those of us who are directly responsible for its conduct. We hope to be productive.

Discussion

MR. FOLLETT (Michigan): Were these Japanese oysters planted?

DR. TRUITT (Maryland): We were very careful not to plant them. We held them in salt water tanks in the laboratory and then turned that salt water out on the ground so that no eggs could escape. We take every precaution in that respect, and we hope that others who have them in tanks in New Jersey, New York and Connecticut, will be as careful in that respect.

DR. EMMELINE MOORE (New York): They have been released on the west coast, have they not?

DR. TRUITT: Yes, on the Pacific coast. They bring them across from Japan in shiploads and sell them to planters on the west coast, but the water is so cold that they do not propagate. Incidentally we are not only afraid of the Japanese oyster on the ground that it might eliminate our oyster, or at least weaken its quality, but also that through it some pest might be introduced.

MR. O'MALLEY (Washington, D. C.): The Japanese oyster has spawned on the Pacific coast because they have been picked up by Doctor Hopkins, who has a laboratory at Olympia, near Shelton, Washington, and at Willapa Harbour and Pedilla bay in Puget sound.

DR. TRUITT: I am glad to be corrected by Commissioner O'Malley, but I believe one of your government publications said they did not spawn on the west coast.

MR. O'MALLEY: I know that Doctor Hopkins recently found that they do spawn. I think we were among the first to advise the oyster people on the east coast not to introduce them.

MR. EARLE (Maryland): I might say that on the advice of the United States Bureau of Fisheries we have taken steps to warn everybody concerned in Maryland against the Japanese oyster. We are doing our best to keep them out of the waters of Maryland.