to the correct salinity and sterilized by ultraviolet light. Inland oyster farms might use artificial sea water which would be filtered, purified, and recirculated to maintain a perfect environment.

Oysters and other molluscs are among the most efficient sources of animal food since they feed directly upon plants. Their growth is rapid if food supplies are adequate and environmental conditions are satisfactory. Furthermore, the product is nutritious, well accepted and easily marketed. The prospects of increasing production of shellfish are extremely good; much better than the prospects of increasing quantities of other marine fishery products. Surely "Farming of the Sea" which we hold to be the solution to the food supply problem of the future will begin with culture of oysters and clams.

Predictions presented here are based on incomplete evidence and some unproven assumptions, but with faith in the ability of American scientists and the resourcefulness of American industry. Present problems can be solved and the future can be bright, but only if we obtain the knowledge which will be needed in the future.

Industry's Appraisal Of The Future of the Oyster Industry

DAVID H. WALLACE
Oyster Institute of North America
Annapolis, Maryland

THOUGHTFUL LEADERS IN THE OYSTER INDUSTRY are seriously concerned with the future of their business. If our production continues to decline at the same rate as it has since 1954, less than 40,000,000 pounds will be made available to the consumer in 1970.

Some towns along the middle Atlantic Coast have become almost "ghost" towns already. More areas are feeling the pressure of a declining economy every day. The Eastern oyster, which was a staple part of the diet of our early settlers along the north and middle Atlantic Coast, is fast disappearing from the American scene.

Most of this discussion will be confined to the East coast from Maine to North Carolina, since in recent years this area has suffered the greatest losses of oysters and consequent decline in production.

Long Island, Delaware Bay and Chesapeake Bay have been recognized as the major oyster centers in the United States. Long Island was noted especially for its ability to grow excellent quality of oysters both for the half shell trade and the shucking industry, Delaware Bay produced excellent shucked oysters, but because of the vast acreage suitable for oysters, the Chesapeake yielded more than both of these plus all the other oyster areas in the United States.

The bulk of the oysters grown in these Eastern states, except Maryland, are cultivated on private grounds.

Since 1950 Long Island oystermen have sustained tremendous losses from hurricanes, starfish and drills, an unexplained mortality in 1953, and no commercial set until 1958. Delaware Bay growers in the same period have been

plagued with seed shortages, drills, and in 1957-60 almost complete destruction of all oysters by the new organism which has been discussed here by previous speakers.

In the Chesapeake Bay in Virginia production increased until 1959 as a result of increased farming in spite of great losses every year from *Dermocystidium* and drills. Since 1959 their catch has dropped drastically probably from the addition of "MSX" and this year from the damage of hurricane Donna as well.

In Maryland, a policy of planting shells on public beds, regardless of the time of spawning and setting, and regardless of whether the area planted obtained fairly regular sets, has resulted in depletion of most of the beds with a constantly declining yield. The only bright spot in this picture is the efforts of the present Commission in Maryland to plant the bulk of their cultch in high setting areas to grow seed and to foster and encourage oyster farming by private individuals.

Another factor, which should speed up Maryland's program of rehabilitation, is the utilization of dead reef shells as a sourch of cultch. The supply of such shells in Maryland waters appears to be vast indeed. If salinity actually proves to be a factor limiting the spread of "MSX," Maryland waters of lower salinity could well provide the "golden" future harvest for the middle Atlantic area.

In the last few years, certain East Coast oyster packers have sought sources of supply in the south, particularly in North Carolina, Alabama and Florida. A possible danger from this increased production pressure is that these public areas will be rapidly depleted too.

The south Atlantic and Gulf oystermen have benefitted from the misfortune of their East Coast friends by having an increased demand for their product. This excellent demand for Gulf oysters, coupled with abundant crops on the public grounds in Alabama, Mississippi, Louisiana and Texas, has enabled oystermen and packers in these states to have the best year in 1959-60 that they have enjoyed in the last fifteen to twenty five years.

It seems unlikely that this prosperity will continue indefinitely. Past history has shown that production from public bars in all of these states has been declining with intermittent upsurges while production has been increasing from private beds, particularly in Louisiana.

While our West Coast oyster industry is dependent on Japanese seed with the bulk of their seed supply from Japan, they have attained a relatively stable business and constant level of production. Even though plagued with industrial pollution in some of their major bays, beset with pests such as drills and ghost shrimp, and hampered by the lack of local seed, the Pacific growers have still been able to put most of the tidelands in the Pacific northwest into regular production and some growers are now using deep sea leases as well. However, the possibilities for expansion are limited by the bottoms available, at present prices of seed and selling prices of the product.

Aggressive merchandising and selling this season have already expanded the markets for Pacific oysters and at a higher price than ever before. In some ways the West Coast oystermen have the most promising future, so long as their source of seed remains stable and low priced Japanese imports of frozen oysters do not take over their markets.

The dismal prospects in the East have so discouraged some oyster growers and packers that they have liquidated their business. Others are debating

whether or not they should do the same thing before they dissipate their accumulated assets.

It is difficult for planters in parts of Long Island, in Delaware Bay and in the lower Chesapeake to be optimistic about the forseeable future. Unless the cause of the mortality in the latter areas can be determined immediately and methods developed for controlling it, the possibilities for profitable oyster culture are few indeed. Biologists estimate that from five to fifteen years probably will be needed to carry out all the studies necessary. Obviously, if the "MSX" killer continues the devastation at the present intensity, results at the end of five to fifteen years will be too late to benefit present oystermen. It is an enigma that the oyster, which has been studied more than any other marine species, would be the commercial species which would be ravished by a malady unfamiliar to the biologists.

What are the future alternatives facing the eastern grower? As mentioned before, he may go bankrupt and out of business anyway. A second possibility, if he can obtain sufficient financial resources, would be to embark on a program of oyster culture in ponds under completely controlled conditions and greatly improved methods of cultures. The obvious drawback to pond culture now is that adequate technical data are not available to insure the success of this type of enterprise on a commercial basis. Legislation to expedite the development of a research program to answer some of these questions in this approach failed to pass the last Congress, and there is no assurance it will obtain support in the coming Congress. Greater efficiency and improved techniques by growers is a possible approach which could be productive.

A third alternative, which would disregard existing growers, is the fullest possible utilization of the dwindling areas, where losses have not been sustained. The fourth approach is the immediate introduction of another species of oyster which might be resistant to presently known destructive parasites and which would thrive in the environment prevailing in the middle Atlantic area.

One such species would be *Ostrea gigas* which was introduced to the Pacific northwest and has acclimated itself there. Factors favoring planting this species are its rapid growth rate, high reproductive capacity, and ready availability of large quantities of seed. Another possibility is the planting of one or the other species of oysters native to European countries. The flat European oyster, *Ostrea edulis*, grown for several generations at the U. S. Fisheries Laboratory at Milford, has already been planted in the waters of Maine. From a planting of only one bushel, a bed of oysters has accumulated there. Furthermore, oysters of this species have been found fifty miles from the original experimental planting.

It cannot be emphasized too strongly the seriousness of the present situation. United States production has dropped to one half what it was fifty years ago. I repeat again, if the present trend continues, production will be 40,000,000 pounds or less by 1970. That is only one third of the catch just after the turn of the century. On the other hand, in the other major oyster producing country —Japan—oyster production has been increasing at a startling rate. In 1954 their yield was 28,800,000 pounds, in 1960—estimated 40,000,000 pounds and probably at least 50,000,000 pounds by 1970.

Our biologists and administrators are too complacent about their own little niches of interest. We have to have some fresh, forward thinking if we are to save our third most valuable fishery. Research along old traditional lines is

great and much scientific knowledge has been accumulated for posterity and for our scientists in the future. But, I think our biologists and administrators must be realists. We have a dying industry, which cannot wait ten to fifteen years. We need new ideas and action now! If you will, we need courageous leadership willing to strike out before all the facts are in, to try, yes, even to fail; but in failing to point the way for progress and success.

Possibly all of us are guilty sometime of seeking our own personal security first. It is perfectly natural to be cautious before acting. But, security is a nebulous thing and sometimes can be attained only by striking out from the old paths.

Today, large quantities of oysters are being canned in Japan and sold in American markets. Others are being frozen for export to the United States. Plans are developing for other Japanese firms to do the same thing. With present United States scarcity and high prices there can be little objection to these imports if they are grown and packed under sanitary conditions comparable to our own. This is only another reason why we must move swiftly, if our industry is to survive. While the East Coast industry struggles to survive Gulf and Pacific oyster growers can anticipate a period of prosperity for the immediate future, if they can only maintain production at the same rate. I predict that within the next five years a substantial number of packers in the East will, from necessity, be selling frozen oysters from Japan, and another group trying to grow some foreign species in their waters.

Only those who are adjusted or who can adjust to their environment survive in nature. Approximately the same laws seem to prevail in an economic struggle for survival. Many oystermen, shuckers, packers, boatmen, etc. have already lost out. Of those remaining, only the people who are able to modify their operations to the new circumstances can be expected to survive the natural catastrophies which have befallen them. And our oystermen, biologists and administrators, who are unable to take a forward view, will lose out to the flooding tide of disaster. I appeal to those here, who are considered leaders in science and industry, to drop complacency, forget personal differences, if they exist, and unite in the restoration and development of a sick fishery.

TRENDS IN OYSTER PRODUCTION IN U. S. AND JAPAN

Year	JAPAN Pounds	U. S. Pounds
1954	29,823,750	81,922,000
1955	31,873,725	77,515,000
1956	36,962,250	75,134,000
1957	41,027,250	71,658,000
1958	44,312,710	66,396,000
1959	46,000,000[1]	63,000,000[2]
1960	48,000,000[1]	59,000,000[2]

[1]Preliminary Estimate—Japanese Ministry of Agriculture and Forestry
[2]Our estimates