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Economic Benefits from Oceanographic Research

The United States has been experiencing a steady drain on its gold reserves while tending to become a have-not nation with respect to raw materials. A future crisis in our gold reserves might be averted by negative measures, such as restrictions on travel and on imports. Or it can be prevented in more imaginative ways. One of these is through exploitation of the resources of oceans.

In this context, the special report of the Committee on Oceanography of the National Academy of Sciences–National Research Council, "Economic Benefits from Oceanographic Research" (*Science*, 25 Dec. 1964), seems particularly valuable.

The committee has addressed itself to evaluation of the financial effects of expenditures on research in oceanography. It has attempted to determine what a 10-year research program might mean to the economic well-being of the United States. For this purpose the group considered a variety of items, some of which (food, minerals, shipping) could contribute directly to our balance of trade, others of which (long-range weather forecasting, for example), could contribute to our comfort and internal efficiency. The committee estimated that a continuing investment of about $165 million a year for oceanographic research would be an essential factor in bringing about savings of nearly $3 billion a year, plus annual increases of almost the same amount in annual production. Ten to 15 years would be needed to achieve these gains, and expenditures other than those for research would be required.

The opportunities and problems are indicated by statistics on the performance of our fishing fleet. In 1949, domestic production and imports of edible fish were 3305 and 715 million pounds, respectively; in 1962, the figures were 2535 and 2070 million pounds (1150 and 940 million kilograms). In 1962 these imports cost more than $300 million, representing a sizable drain on our gold reserves. Research on the ecology and biology of the organisms supporting marine fisheries is of direct value; it can provide the basis for more efficient catching operations. The total problem, of course, requires more than research; it requires a modern, coordinated, aggressive fishing fleet with an efficiency comparable with that of the Russian fleet.

Of great possible economic significance are materials on the deep-sea floor. Among these are manganese nodules (nominally worth $45 to $100 a ton), which contain not only manganese but other elements such as copper, cobalt, nickel, molybdenum, vanadium, zinc, and zirconium. The report estimates total reserves of these nodules at 10^{12} tons. To put a price on these reserves would be meaningless, but it is clear that a resource of fantastic magnitude is involved. To exploit this resource will require better knowledge of the distribution of the nodules and of their composition as a function of the ocean region in which they occur. It will also require initiative in the development of practical harvesting techniques.

That the continental shelves are rich in oil, gas, and sulfur is well known. In addition there are potentially valuable mineral concentrations which have received little attention, including placer deposits of drowned beaches. Diamond-bearing gravels off the coast of southwest Africa are an example. Recently, substantial quantities of gold-bearing sands have been found in sea areas off Alaska. Tin ores have been found off Malaysia, and magnetite-rich sands are being mined near Japan.

In attempting to evaluate the monetary significance of oceanographic research, the committee has rendered a public service, for it has directed attention to a vast reservoir of economic resources and opportunity.—PHILIP H. ABELSON