

The famed explorer and oceanographer tells of the sea's riches and his approaching Odyssey aboard the 'Ben Franklin.'

## THE PROMISE OF THE UNDERWATER WORLD

By Jacques Piccard

The underwater world holds promise and importance for all of mankind. In my estimation, it is as vital to the Australian sheep rancher or European housewife as it is to the Gloucester fisherman or Louisiana wildcatter. The sea affects all our lives in a variety of ways, and better understanding of the seas and their mechanics can only make the lot of all mankind easier, more productive, and more satisfying.

The theme of my remarks, then, is to be the need, by whatever means you gentlemen of the Congress ultimately decide upon, for speeding the orderly exploitation and development of the riches of the Continental Shelf and the oceans, which, rather than separating the United States from its Asian, European, or African neighbors, rather provides a ready and convenient link with them.

The vastness of the subject almost makes it impossible to know where to begin. Allow me to start with some of the more familiar uses and products of the oceans and proceed to some of the more exotic, esoteric fields where today we are just piercing the surface, so to speak.

For as long as man has lived on the shores of the oceans, rivers and lakes, he has been nourished by the fish he has been able to lure, trap, snare, spear, or net from the beach or a boat. It is amazing to note that the methods of catching fish are practically the same today as they were in the earliest dawn of mankind, and certainly not much more sophisticated than those in the days 2,000 years ago when men drew their precious food from the Sea of Galilee in straining nets and bobbing boats.

The processing and marketing of seafood have developed along technological lines, but

we are still in the Dark Ages when considering the search for fish, knowledge of their habits, spawning grounds and their nutritional value. Recent developments have been made in the production of fish protein concentrate, thanks to great encouragement and financial support by the U.S. Government, and a great deal more must be done to produce and merchandise this dietary supplement for Americans and, perhaps more importantly, for those millions of undernourished people whose protein supply is inadequate.

Better organized fishing methods will not only increase the catches and yields of the commercial fisherman, but will also help guard against the annihilation and disappearance of certain species of food fish--a sad fact which has already seen the reduction to dangerous limits in some areas of halibut, salmon, lobster, and shrimp.

Finally, it should be mentioned that while every maritime nation of the world has shown substantial increases in fish production and consumption, the United States has been at a virtual standstill, with fish imports rising to the point where Americans now eat more imported fish than that caught and processed domestically. Surely this is an area which deserves more attention and support.

Linked to the food-from-the-sea activity is the problem of pollution of the sea. This is a thorny problem, but because it is man-made, it admits of a solution. We have already seen great quantities of shellfish from large areas declared unfit for human consumption because of polluted waters--in the Raritan Bay area of New Jersey, for example.

We must guard against increasing destruction of the species and upsetment of the marine environment too by dumping, radioactive

This article is nearly all of Dr. Piccard's testimony before a subcommittee of the House Committee on the Judiciary, July 24, 1968.

waste discharging, drainage from industrial plants and even the introduction of the heated water used for cooling powerplants to normally cool fish feeding grounds. A problem such as this which transcends State borders seems to call for the attention of, if not the regulation by the Federal Government.

My father once said that exploration is the sport of the scientist, and it is in exploration that much of oceanographic activity is found today.

Gentlemen, we are standing not at a single threshold, but before a long corridor marked by a series of doors. Behind each is a new and exciting field of opportunity awaiting the imaginative, the daring, the enterprising men who are blessed with both vision and the means to exploit these riches.

Besides food, the oceans contain, or more precisely, separate man from rich mineral deposits. One authority has calculated that the seas contain 30,000 trillion tons of chlorine--that is 30 followed by 15 zeros--2,000 trillion tons of magnesium, and similarly staggering quantities of sodium, sulphur, potassium, bromide, and carbon, and so on. The interesting point is that these minerals are not found only in minute quantities in the water itself. Off the California coast, phosphorous nodules resembling large pebbles are scattered around the seafloor at depths from 200 to 8,000 feet at least. Best known are the manganese deposits, confirmed to exist in the Atlantic, Pacific, and Indian Oceans.

While sufficient quantities of these various elements are obtainable on land, their exploitation from the seabed will receive low priority. When poorer strata are mined on land, raising production costs there, greater attention can be expected for offshore mining development. Such was the case in the petroleum industry, which is by far the leading developer of offshore resources.

Today some 70 countries are involved in the quest for oil and gas beneath the Continental Shelf. Twenty countries are producing these products, by recent estimate.

Like every general statistic about the seas the figures regarding petroleum production and reserves defy the imagination. About one-fifth of the world's total known oil reserves of 425 billion barrels is found off-

shore. Currently about  $5\frac{1}{2}$  million barrels are produced each day from wells sunk offshore. This is about 16 percent of the world total. In another 10 years perhaps 33 percent will come from offshore--all this to meet a demand which is increasing at a rate of 7 percent a year. No need to belabor the importance of offshore oil and gas production. It is, after all, the very *raison d'etre* of the legislation you are considering.

We must also acknowledge, too, that the water-starved areas of the globe see in the salty surface of the oceans, their first source of potable water, as desalinization techniques grow and hold out promise of abundant fresh water everywhere in the world. If we could theoretically separate all the minerals from all the water in the oceans, we would have, on one hand, enough salts to fill a freight train stretching back and forth between the earth and the sun 300,000 times and, on the other, about 1,500,000 trillion tons of fresh water. I apologize for having to resort to these big numbers, but I know you gentlemen want to know the facts.

We are only beginning to fully appreciate the preeminent role of the oceans in the origin and influence of weather. If man is to accurately predict the weather, to guard against destructive waves, prepare for hurricanes and typhoons, and some day exercise a degree of control over the elements, he must learn a great deal more of the dynamics that go on where sea meets sky, and the massive movements of ocean waters from one region to another.

While these remarks have dealt with, let us say, peaceful or materially productive uses of the seas, we cannot overlook the strategic importance of the undersea world in defensive and possibly offensive warfare. Greater knowledge of the terrain, not only along the Continental Shelves, but in mid-ocean as well, is needed to assure the safe transit of military submarines. And we must understand the acoustic phenomenon better if effective defense measures are to be prepared.

The very immensity of the seas, which, as you know, cover about 70 percent of the earth's surface, makes a concise and specific summary of ocean-related activities difficult, if not impossible. Likewise, the fledgling efforts of governments and private industry are as diverse as the problems and challenges themselves.

Many, many American industrial firms have been attracted beyond the water's edge, so to speak. And they have invested sizable sums of their own money in the oceanography market. I would like to take just a minute to describe one of these programs, the oceanographic activities in which I am presently engaged with the Grumman Aircraft Engineering Corp. in Bethpage, N.Y.

Already a leader in the design and construction of military and private aircraft and sophisticated space vehicles, Grumman in 1965 appraised the oceanographic field and, rightly, I believe, saw there great potential.

In order to contribute to solving these problems of offshore mining, fish study, national defense, and the study of basic physical phenomena, it was decided to turn the vast engineering talent of the company to the development of a submersible vehicle, a work submarine which could bring man into the undersea environment to observe and perform useful tasks there.

About this time I became an exclusive consultant to Grumman, and after several studies, it was decided to build a mesoscaph or middle-depth submarine (from the Greek words for "middle"-"meso" and "ship"-"scaph"). It was to be based on a design I had prepared for an earlier submarine, the first mesoscaph, the "Auguste Piccard," named for my father.

Subsequently, the PX-15, as the Grumman submersible was called, was built in Switzerland at the same factory which constructed the first vessel. In about 1 year the PX-15 was practically fully completed. In early March it was partially disassembled--to allow it to pass by railroad through our Swiss tunnels to Antwerp, where it was loaded on a merchant ship and transported to the Grumman facility in West Palm Beach, Fla.

Grumman engineers and several of my staff have been engaged since April in the final outfitting of this unique research submarine. The vehicle is built of high-strength steel and is about 50 feet long and about 130 tons in weight, making it the largest research submarine in the world. It can dive to 4,500 feet before collapsing, but we shall limit its operation to 2,000 feet. The live support system can sustain six men for 6 weeks, giving us a great deal more submerged endurance than any other research vehicle.

And 29 portholes, a closed-circuit television system as well as fixed external cameras and recording devices assure that we can observe and document the underwater secrets we uncover.

The various unique features of the Grumman-Piccard PX-15 admirably suit it for our first major undertaking, a kind of undersea adventure, with "science nonfiction" objectives.

Early next year the submarine with six men, including myself, on board will submerge off the Florida coast and drift in mid-water at depths of 300 to 2,000 feet, propelled northward for 4 to 6 weeks only by the current of the Gulf Stream.

The scientists will conduct a series of long- and short-duration experiments concerning the mysterious Deep Scattering Layer, which "tricks" navigators by sending back false echoes on their fathometers and has implications in fish-feeding and marine-life cycles, on bottom topography, acoustics, marine biology, and fish habits, as well as analysis of the water's chemical properties, temperature, and speed.

The program is to be a cooperative enterprise with the U.S. Naval Oceanographic Office providing the all-important surface support ship (to give us navigational information) and two of the scientific observers on board the submarine.

When the Gulf Stream Drift Mission is terminated, probably 1,000 miles later off the coast of Massachusetts, the people at Grumman will make the submersible available on a lease basis to those who can best utilize its special depth, endurance, and large payload capabilities.

Just 2 weeks ago here in Washington, at a convention, we announced that the PX-15 henceforth will be known as the Ben Franklin, honoring your early American scientist-statesman, the man who first recognized the practical advantages of knowing and defining the limits of the Gulf Stream.

Franklin, as head of the U.S. Post Office, learned that British mail packets sailing from England, took 2 or 3 weeks longer to cross the Atlantic than Nantucket whalers returning from Europe. A conversation with some of the Yankee skippers brought the fact that they

avoided the Gulf Stream while the English "bucked" the current much of the way.

Franklin then asked several of the New England whalers to make temperature readings throughout the North Atlantic and from these reports he charted the first map of the Gulf Stream. He turned it over to the British General Post Office, and we can assume that a substantial decrease in the London-to-Philadelphia mailing time followed shortly.

Just this week at the West Palm Beach facility we will begin dockside tests of the Ben Franklin, and on August 21 we will hold the formal christening ceremonies.

This Grumman program will involve more than \$4 million of company funds, and it is just one of many pioneering efforts, some supported wholly or in part by Federal money, others purely company sponsored.

The important point, however, is that basic research into the workings of the world beneath the waves is moving forward. The Naval Oceanographic Office and the Office of Naval Research are spearheading this assault on the unknown, and scientists the world over acknowledge the preeminent position these agencies along with ESSA, the Bureau of Commercial Fisheries, and others occupy in the advancement of man's understanding of the oceans.



#### DO YOU KNOW?

Fish have "nurseries." These are the estuaries, which are among the world's most productive areas and include the bays, sounds, and nearshore areas that surround our coasts.

It is to these nutrient-rich waters that the "baby" salmon, shad, pompano, shrimp, and other important food fishes come to feed and grow until they have passed their "adolescent" stages and are ready to move into deeper water as adults.

Estuaries provide essential living space for more than 70 kinds of fish and shellfish that contribute 3 billion pounds, or two-thirds, of the total U. S. commercial fishing catch. Seven of the ten species most in demand, including shrimp, our most valuable fishery, and menhaden, our largest fishery, must have suitable estuarine nurseries.

Pollution of estuarine areas by chemical and human wastes, pesticides, and dredging and filling reduces important nursery areas. The result is a decrease in the commercial catch and less food for our growing population.

The estuaries are the "fishbasket" of our nation. It is vital that the best possible use be made of them for the benefit of all. BCF works with other government agencies to foster multiple use of these estuaries--but still protect those valuable natural resources.

--Catherine Criscione