

man's return to the sea

**An address by
Athelstan Spilhaus, Ph. D.
December, 1971**

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The Sea Grant College episode began at Woods Hole, where I did a great deal of my oceanographic work. A National Academy of Science Committee met in the late 20's and early 30's and felt they needed an institution for marine science, and Woods Hole was created. That institution got into marine science and meteorology. Prior to that, oceanography was in the expedition stage. The bathythermograph, I think, could be credited with taking oceanography out of the expedition stage into the synoptic stage. The next step was to take it into the engineering stage, to manipulate and use the ocean.

In 1957 the National Academy of Science started another committee -- the National Academy of Science Committee, which is still in being. When it was formed with Harrison Brown as chairman, the committee determined its main purpose was to get congressmen to be able to at least pronounce the word *oceanography*. We succeeded in that. I paraphrased the first report of the Academy in *Turn to the Sea*. We had a bathyscaphe that would go down about 10,000 feet at the time. To visit the other five per cent, we maintained that we should have a bathyscaphe that would go down 18,000 feet, which would be adequate to cover

95 per cent of the ocean's bottom. To visit the other five per cent, we would need a stronger bathyscaphe that could withstand the pressures of the deepest ocean trench. We envisioned these deeper-diving, manned vehicles would resemble a lobster, moving horizontally and vertically at any depth and crawling along the bottom. The vehicles were expected to have mechanical arms like claws remotely controlled by a man in his pressure-tight shell. His eyes would be extended by television pickups. Two years later, in 1960, Jacques Piccard and Lt. Donald Walsh descended to 36,000 feet. And now, we have innumerable varieties of little submarines, all searching frantically with their lobster-like claws for a job to do.

In 1961 it fell my lot to take over this National Academy Committee, and again we searched for the next thing to do. We decided that once we had obtained a healthy backing for marine science, we would then draw marine science out of its laboratories and put it to work in ocean engineering. This we set out to do.

During that time, I was continually thinking about how we could pull the science out. It was painfully evident at that time -- and unfortunately, the situation has not changed -- that our merchant marine was down the drain. We were about *sixteenth* in the world fisheries, with Peru at the top, and I personally could not understand why the most advanced technological nation in the world was not, at this stage, in the business of exploiting the sea. I still do not understand it. We still have a lot to do. These remarks had been made at a national fisheries meeting in Minneapolis. I was lambasting and lamenting the fact of our disaster in the merchant marine. U.S. labor laws have prevented this nation's merchant fleet from offering service comparable to European service in attracting passengers. Someone had the brilliant idea of building the *Savannah*.

But it does not cure labor problems to fire boilers with nuclear power instead of coal, and that is why the *Savannah* is now idle. Our only real strength in the ocean was in the Navy which had tremendous strength but was not being translated into total sea power involving both military, commercial, economic, recreational and all the other strengths which the ocean can give a nation.

We have not done anything about our merchant ships or much about our fishing. *Fishing in the United States, compared to world performance, is in a disastrous condition.* And, of course, the reason is that we want to give our fishermen and our seamen the conditions at sea that are comparable to the conditions of workers on land. That is quite right and as it should be. But we can not do that and compete with other nations.

Sea Grant College Idea

One point I made was this: "*Why can't we do to the oceans what they did a hundred years ago in land grant institutions devoted to agriculture and mechanical engineering?*" The important thing was the parallel between the phrases, "Land Grant Colleges" and "Sea Grant Colleges." That was in September 1963, when the idea was actually born. Considerable interest was aroused, and one day I received a call from Senator Claiborne Pell of Rhode Island who told me of his interest in the Sea Grant Program. Of course his interest and assistance became of the utmost importance.

In October 1965 we had a meeting of approximately 250 governmental and university representatives, and we sold the idea of the Sea Grant College. This was apparent because in September 1966 President Johnson signed the bill which was not expected to pass so quickly. A hundred years earlier, the Land Grant bill, had been vetoed by President Buchanan and subsequently signed by Lincoln -- I believe. Sea Grant was to

be administered by the National Science Foundation. I was then asked by the director of the Foundation, Lee Haywood, to suggest someone to direct the Sea Grant Program. My suggestion, of course, was Robert Abel, who was then serving on the Interagency Committee on Oceanography, and he accepted.

I think we should be very proud of what has been done under the Sea Grant College Act; however, we should examine what has not been done.

We are still trying to give our fishermen and our seamen conditions at sea comparable to those of our workers on land. That is as it should be. But we cannot do that and compete with other nations. The only way we can possibly compete at sea is to make technological over-leaps with automated vessels. We must use our technology to build fishing boats, factories and processing plants that will outfish the Japanese or the Russians.

Recently I met with General Magnuson and George Miller from California, and we discussed aquaculture and the production of proteins from the sea. Someone said, "The scientists have studied and don't agree; they don't agree within a hundred times of the possible productivity of the sea." They use this disagreement as a reason for not trying aquaculture. I told them that there had been no studies on productivity of the land -- people just started farming, growing things, hybridizing plants and increasing yields. *Why then are we sitting around studying the productivity of the sea? Why don't we go out and try aquaculture* and determine the yields and see how we can increase those yields? Very often, art precedes the science, and we do not wait for the science to tell us everything before we do things. Science and the art of engineering and farming go together. Sometimes one leaps ahead of the other. That is the way it should be and in this case, where the complex relations of the

food chain in the sea are seldom understood, I think we had better let the art jump ahead. When studies are carried too far, they become the leisure of the theoried class.

The Language Barrier on Pollution

There has been much talk concerning pollution, but when we talk about pollution we had better watch our language. We speak of consumers, yet nobody really consumes anything. One of the reasons that we have waste and pollution is because we think of people as consumers. We do not consume anything, neither in our cities nor in our bodies. We use materials and we have a so-called waste, which is exactly the same as the substance we take in; we simply convert it. There is no waste. *Waste is a useful substance that we have not yet had the wit to use.* As to excrement in water, we should note that some bottom fish depend on a rain of detritus for their food, well-being and nourishment. I have mentioned that lobsters wax fat at sewer outfalls. And man's excrement, if it is in the right amount of water, is just detritus of another form. There is no reason why the proper amount of man's excrement in water should not be beneficial to certain fishes in that water.

Eutrophication has become a bad word. This is a very curious thing. The definition of eutrophication is "well-nourished." In fact, eutrophication has now become a symbol of pollution. But it is not bad; it simply means well-nourished. We do not want our waters to be the opposite of eutrophication. We do not want dystrophy, which is the word for under-nourished. So we must watch our language.

We talk about *waste heat*. Heat is a form of energy, the basic currency of all civilization. Waste heat is simply some of that basic currency of energy that we happen to waste. We must not stop building power plants because of

the waste heat, but we must encourage scientists and engineers to determine a way in which we can use this low grade heat to our advantage. There are many experiments in progress concerned with the use of this so-called waste heat.

Sewers are a prime concern today. Communities cannot exist without them. This means that people have to crowd into cities because the umbilical lines for sewers, highways and other conveniences, are so costly that they cannot spread across the lands. In the olden days people had individual wells and septic tanks. *Septic* tank is a curious word, too, because it came from an *anti-septic* tank. Currently it is called a septic tank which connotes the idea of *sepsis* which is quite wrong. I am quite sure -- in a not too distant future when we learn that we have to put our wastes back onto the land or in measured quantities as nourishment into the sea -- that we will get back to some form of antiseptic tanks for the handling, sterilization and conversion of this waste material into use material.

I think that there is a false idea of what pollution is. When you put a little of something into water, air, or land, it is not necessarily a pollutant. But if we have no natural dust in the air we get no rainfall. There would be no nuclei for condensation. In other words, *there is a right amount of pollution in all media*, and our studies in science and engineering and the control of our industries must define the right amount. Pollution occurs only when we have too much of something.

A very important idea has been mentioned by some -- the competitive advantage of being dirty. When a new federal agency enters the pollution discussion, the rhetoric on pollution in our bays is more heated than the water. This kind of thing is not good. I think the role of the federal government is to make sure that the competitive advantage of being dirty is removed.

We have many people who are "doom-ers," the non-doers. I am afraid that we have very many "doomers" among our ranks of science. We have a scientist who warned us all that we were going to run out of oxygen, the biggest nonsense coming from a scientist that you can imagine, but it made the headlines. We have other very distinguished scientists who are "doomers", who say "stop doing everything you are doing; stop building power plants; stop doing this and that." Recently one of my great friends, and a fine scientist, said that when the problems of aquaculture are introduced, we should stop aquaculture projects until we can lick the pollution problems. I am afraid I do not agree with that at all. We can do both.

Population and Pollution

I noticed one thing in *Texas and the Gulf of Mexico*, a fine compilation of information on marine resources, indeed, on the oceans and waters of anywhere. One fact expressed is that *more than half of the state's population lives within 100 miles of the coast*. That is a demographic fact. By the year 2000 it is estimated that more than 12 million Texans will live on the coastal zone, the population equivalent to the entire state in 1970. That is probably a pretty accurate extrapolation of the present state of affairs. But if we are really going into the business of engineering ecologies for the quality we demand of the environment in the future, should we assume that there is nothing we can do about man's disasterous over-population of the earth? This is the real disease that is causing all our pollution problems, which are merely symptoms of man. I am not going to give you a lecture on birth control; this is only one part of population control. But I do remember once I was at a dinner meeting after which a lot of people were sitting on the platform. They had a speaker talking about birth control. My neighbor on

the platform was Father Flynn, the distinguished president of St. Thomas College in St. Paul. The speaker was an absolute genius at taking a very exciting subject and making it unutterably dull. Father Flynn fell asleep and, so that his parishioners would not see him, I tried to keep him awake. I said, "Father Flynn, what do you think about birth control?" He looked up at the speaker and said, "I'd be for it, if it could be retroactive." Well, the fact is that it cannot be retroactive. We look forward to the time when we can have a sensible population control in our country and in the world, and we feel obligated, in the meantime, to do the best we can, using all the science, technology, social sciences and all the associated arts. This does not mean we must stop doing things for people because they cause a little pollution.

The first Industrial Revolution ennobled man by giving him power to use, instead of using his own muscles or the muscles of animals. Of course, with this marvelous boon to man came the filth and the smoke which was regarded then as the symbol of progress. People accepted those things with side effects because the benefits were so great. *You might say we invented air pollution with the Industrial Revolution.* It brought manufactured things for people, permitting them to have many things by mass production that they had never had before. The more things put into people's hands for use, the more they have to throw away. So we invented the solid waste problem program. Then, of course, the next part of that marvelous technological revolution was the Chemical Revolution where we found out how to tailor-make chemicals, so that we could, for example, synthesize pesticides, herbicides, fertilizers which led to the great abundance of food that we enjoy in the United States. Of course, these were things that killed selectively, things that were in eminent order to man. And, so in a way, by the use or overuse of these things, we have now invented what we call the *eutrophication* problem.

But there is no sensible person, I am sure, who thinks we should go back. No sensible person believes that we are not living in greater ease than the disease of a century ago because of these marvelous things.

Industry is always the scapegoat for pollution, but when we blame industry for pollution, we forget something. It is traditionally the job of industry in the United States to produce things for people to use, and then it is traditionally the job of a public sector to take these materials after use and dispose of them. Disposition is greatly practiced by most municipalities, by means of putting it into the sea; diluting it; grinding it fine; rolling it up; spreading it around in hopes that the taxpayers will not notice it. It is really the public sector who has failed miserably to keep up with the private industry that produces things. I suggest that it is very much like the lazy housewife who was asked what she did with her garbage. She replied that she merely kicked it around until it got lost. That is what we have been doing with our wastes for centuries. The removal of wastes is really the basis for sanitary engineering -- carrying it away; building longer sewers; bigger garbage scows.

A New Revolution

I have been talking about the next *Industrial Revolution*. People realize that they need these things that ease their lives, and they want a clean environment as well. We can develop a mirror image of that industry which will take the things after use, and hopefully, reprocess them so that we can close the cycle in the manufacture of things for man. This cycle leads to a lot of basic research. It leads to a new economic theory of what we might call *thermodynamic thrift*. Because as we reprocess wastes we must make sure that we recycle them in such a way that we use

the minimum of energy, otherwise the very fact of recycling physical wastes will create an even greater growth in capital per capital amount of energy, which is not desirable in the long run. We have to think of relatively clean air and clean water as a commodity, and we have to allow the price of these things to float up under the supply and demand situations. We cannot go along with these vocal politicians who are not getting themselves elected on the basis that a clean environment is going to be a political gift. It is not going to be a political gift. It is going to cost us a great deal in taxes or we are going to do it through an industry that can employ more people. Either way, it is just a question of how we pay for it, not whether we pay for it. *I think if we charge for clean water what it really costs to supply it, we would get a feedback from the people who waste their water. As soon as we give things away, we reduce the feedback from the people.*

The power question is similar. Power plants have two governmental controls. One is the Federal Power Commission which tells them what to do with rates. The other is an Environmental Protection Agency that says, "put million-dollar scrubbers in every one of your chimneys and clean up that mess." Well, we cannot hold the price down and clean up at the same time. *Power ought to be allowed to float up to its cost.* And then, as a matter of fact, people might be a little more sparing of their power, and this, in the long-run, is a good thing.

The proper use of water and air by man or by any other organism or the organism that we call a city is such that it dirties that water and air. When we breathe air, we use the oxygen and turn it into carbon dioxide. That is a form of dirtying the air. The sole purpose of water, the universal solvent, is to carry poisons both out of our bodies and/or out of our plants and cities. Therefore, by the very use of these two fundamental things to our living, we

must dirty the environment. We must continually dirty it. I hope that what we can do is to use technology to sterilize or sanitize the old traditional way of doing things without creating such mistakes as the invention of the flush toilet. This device is really one of the worst inventions on earth since it dirties so much water with solvent organic matter. You know, of course, that an Indian on a subsistence level in India, can live on the amount of organic matter and water we would use to take it away in one day. He can grow soybeans on that and live. That is a pretty shocking thing.

A Diet for Poisons

We hear of a great deal about poisons. There was something in the literature that struck me as very important. It concerns fish poison scares that ruin the market for our shellfish and other fish. We are all aware of how cranberries have been dumped and tuna has been seized. These things are done in a very unscientific way. Certain levels are set regarding the amount of this particular poison in a particular product, such as swordfish, and the poison content may not exceed that amount. I do not agree with that. First of all, we do not generally have the knowledge of *how much of this poison our body can tolerate*. We do not have the second fact either, and that is *how fast our bodies eliminate the poison*. Some of this information is known for mercury. I think there is a 70-day residence time in the body, and I think there is some idea of the level of tolerance. If you do not eat tuna three times a day, seven days a week, you can actually eliminate most of the poison, and you will get a steady state of mercury level in your body which is below the tolerance of your body. In reference to the woman who died from swordfish: she was on a diet of nothing but swordfish for a year. This does not make sense. Naturally you will die. It becomes a pollutant because there is too much of it. I

suggest the more intelligent way would be in utilizing these combinations of talents, such as we have in the Sea Grant Program, in learning to live with poisons from here on out. We should design a *diet for poisons*. It is necessary to determine if a substance like swordfish has a certain amount of poison and how much, so that a reasonable diet can be set up. We need to learn to live with poisons not fight them.

A National Goal

One thing that we do not have yet in the Sea Grant Program is a focus on *the proper use of the sea*. We take its resources to enjoy, to live in, to occupy, but we have not yet made this a *national goal*. We are still whittling at it. The most successful Sea Grant Programs are at the land grant colleges because they have the traditions of the land grant program. They can immediately translate that tradition into Sea Grant. The other day, I came to a railroad crossing. One gate on the outside was up; the other gate on the other side was down. There were eight tracks in-between. I thought, "What do you do? Do you go across and open the other gate? Do you wait and not take the chance of getting hit?" I waited and a railroad man came along, and I asked, "What goes on here? You've got one gate up and one gate down." He said, "Yes, I'm half expecting a train." We are half expecting to do something in the sea, but we are not getting to it. We need to raise our sights to a national goal in the proper use of the sea.