shared by the NSF leadership, that the science adviser ought to be subordinate to the collection of Executive offices—such as the OMB, the National Security Council, and the Domestic Council—whose role is synthesizing "the big picture" of major issues and presenting him with tersely worded, multiple-choice policy recommendations. While this attitude doesn't rule out a science advisory council in the White House, it does mean that it isn't likely to have any more direct access to the President than do Stever and his staff.

One of the major weaknesses the critics see in the NSF's new advisory role is its low ranking in the federal pecking order (Cabinet officers outrank Stever). Lacking the implicit power of a White House office, NSF is viewed as less able to coordinate federal research programs and restrain the self-serving proclivities of larger agencies. Hornig, for instance, recalls the massive fish-kills along the Mississippi in the 1960's. They were ultimately traced to agricultural insecticides, but not before the old OST stepped into an argument between the Agriculture and Interior departments and brought its own expert opinions to bear. Hornig said he found it "hard to believe" that a science adviser outside the Executive Office would carry much weight in these circumstances.

Stever disagrees. When disagreements arise, he says, "We'll try mainly to shed more light on issues. Have we got all the facts? Are all the judgments in? There are cases when we should bring up the other side of issues."

Stever says that he has taken steps to strengthen the old Federal Council on Science and Technology (composed of R & D leaders in the agencies) so that it can deal with internecine problems. What the NSF's two policy units lack in political muscle among the agencies they hope to make up by a reputation for impartiality.

"So far we haven't come to a head-to-head crash," Stever says, "although on occasions agreement has been less than perfect."

Steering Clear of Weapons

Among the issues that the OEP and STPO have dealt with are relations between military and civilian weather satellite programs; the balance of nuclear versus coal research; and space programs in the post–space shuttle era.

For the most part, NSF officials believe that federal agencies are much better able to direct their own research programs today than they were a decade ago. With help from the science foundation, they say, OMB should be able to balance research priorities as well as it ever has, if not more adeptly.

In keeping with the view that agency research programs are now more self-sufficient than formerly, the NSF has waived the science adviser's role in a controversial area—the weapons systems—that traditionally occupied nearly half the old OST's time and effort. "We've chosen not to get involved in weapons," Drew says. "The Defense Department and the National Security Council are capable of assessing these things themselves. Review procedures have greatly changed and the NSC has new muscle."

The Killian panel disagreed, saying that even a strengthened technical staff in the NSC is "likely to be inadequate."

Stever said his communications with the Defense Department have mainly taken the form of an occasional letter to Malcolm R. Currie, the director of research and engineering, drawing attention to gaps in Currie's basic research programs. "That's one of my most important roles," he says. "Selling the agencies on stronger basic research roles."

One might easily conclude that the President's new science adviser is adopting a somewhat passive posture, but he insists it isn't true. "I can take the initiative when I get my ducks lined up," Stever says, and cites as a case in point a study of food supply problems undertaken jointly by Drew's policy office and the National Academy of Sciences.

Overall, Stever acknowledges that an office at 1600 Pennsylvania "might be a better address than 1800 G Street"—the NSF's location, a few blocks away. But the organization of the Executive Office is up to the President. "You can legislate away, but he can ignore it. The White House is his . . . and it's my job to get as much science and technology into the government with the structure we have."

—ROBERT GILLETTE

Law of the Sea: Fisheries Plight Poses Dilemma for United States

The third Law of the Sea conference, now in session in Caracas, Venezuela, finds the United States in a genuine dilemma where the regulation of fisheries is concerned. In the U.S. view, the tendency of some nations to act on their own to control fishing within a wide area off their coasts is a haphazard process inconsistent with a sound world order. The U.S. position is that fishery regulations should be established only pursuant to international agreement. Yet overfishing by foreign fleets has so reduced many fish stocks in waters adjacent to the United States that the U.S. government may have to take unilateral action to save the fish from commercial extinction. The fishing industry along the Atlantic Coast and in the Northwest is solidly behind legislation that would extend the U.S. jurisdiction over fisheries to 200 miles offshore.

The dilemma is heightened by the fact that the domestic tuna and shrimp industries, based largely in California and the Gulf states, fish off foreign coasts. And, while those fishing interests who are in favor of the 200-mile limit want very badly to stop or severely restrict foreign fishing off the U.S. coasts, they are leary of any legislative proposals that would make themselves subject to strong federal regulation and enforcement.

The fisheries problem being considered at the Law of the Sea conference is an extremely difficult one because it raises two diametrically opposed principles. On the one hand, there is the traditional principle that, outside such narrow territorial waters as coastal states may properly claim, fish of the high seas may be harvested by any vessel, regardless of its na-

tionality, which can catch them. On the other hand, there is the newer —and probably more politically compelling—idea that coastal nations should enjoy a preferential right to the fish stocks found in their adjacent waters.

The heat generated by these conflicting principles is all the greater because nations whose fleets fish in distant waters—the Soviet Union and Japan are the leading examples—have expanded their catch much faster than have the nations whose fishermen are predominantly engaged in exploiting offshore stocks. The political problem is further aggravated by the poignant situation of most of the less developed countries. Because of lack of capital and expertise, they generally have not built modern fishing fleets capable of properly exploiting offshore fish stocks, even though many of the people of those nations suffer serious protein deficiency.

In the circumstances, the less developed countries are determined to keep the fish stocks from being depleted by foreign fleets. All but one of the 35 nations that have acted unilaterally to extend their territorial waters or to establish fisheries zones out beyond 12 miles of their coasts are developing nations (the exception is Iceland, which virtually lives from the sea).

The urgency of the fishery problem is evident from statistics kept by the Food and Agriculture Organization (FAO). In the early 1960's, there was much talk of "food from the sea" as an exciting and still greatly underutilized source of protein. At that time, FAO figures showing a steadily rising world catch provided grounds for optimism.

The world catch in 1950 came to 21 million metric tons; by 1960, the catch had risen to 40 million tons and, although the world's population was growing rapidly, the per capita consumption of fish was growing still faster. By 1970, the catch would be up to 70 million tons—amounting to 19 kilograms per capita, compared to the 8 kilograms per capita of two decades earlier. It looked as though the potential maximum sustainable yield of the world's ocean fisheries—estimated at about 100 million metric tons —would soon be attained. But, since 1970, the total catch has begun to decline. According to estimates made from FAO data by Lester R. Brown of the Overseas Development Council in Washington, D.C., the 1973 catch was 5 million tons less than the catch in 1970.

An American purse seiner off the northeast coast of the United States. The dip nets are being used to take bluefin tuna from the purse seine for tagging. Thousands of tuna may be caught in one setting of the purse seine.

At an earlier time, the immediate solution to increasing the productivity of many fisheries lay in technology—the introduction of better vessels and gear was usually followed by large increases in catches. But the vacuum-cleaner-like efficiency of modern fishing fleets has demonstrated that, for the long term, productivity will depend more on conservation than anything else.

Without effective conservation constraints, the fishing effort for desirable stocks tends to overshoot the level of highest sustainable yield. In some cases, the fishing pressure increases to such a point that a fishery virtually disappears as a commercial resource. The haddock fishery of Georges Bank is the leading case in point—it collapsed after a few years of intensive fishing, especially by the Soviet trawler fleet. At the moment, Alaska's Bristol Bay salmon fishery is in precipitous decline, in part because of poor spawning seasons, but also because much of the breeding population has been lost to the Japanese gill-netters on the high seas.

Fishery conservation is beset by a number of troublesome problems. One is that, for many species, the level of highest sustainable yield has not yet been determined, and the fixing of quotas is largely guesswork or trial and error. Similarly, in the case of wide-ranging pelagic species such as tuna, migratory patterns are often poorly understood unless large-scale and expensive tagging studies have been made over many years.

A second problem lies in the fact that international cooperation is not merely desirable but essential in the management of highly migratory species. For instance, tuna and swordfish may not remain long within the jurisdiction of any one nation, however wide the fishery zone established. To a lesser degree, the same is true of anadromous fish such as salmon, as the plight of the Bristol Bay fishery illustrates. Bottom fish are more amenable to management by individual nations, but they present special difficulties too. Various kinds of bottom fish tend to be intermixed, and a species that has been severely depleted may be taken by the same gear used to catch species that are in greater abundance.

Overriding all else in fishery conservation, however, is the largely political problem of establishing internationally agreed upon standards and enforcement mechanisms capable of preventing unbearable exploitation. Efforts to achieve this have been carried on, generally without much success, by a number of international fishery commissions. The imperiled status of the bluefin tuna in the Atlantic and the potential threat to the still apparently abundant yellowfin tuna fishery

Bisplinghoff to Resign

Raymond L. Bisplinghoff, the deputy director of the National Science Foundation since 1970, will leave Washington in October to become president of the University of Missouri's science and engineering campus at Rolla. Close associates say his resignation stems from a long standing desire to try his hand at a university presidency and reflects no unhappiness with NSF.

An aeronautical engineer who headed advanced research for the space agency in the early 1960s, Bisplinghoff spent 2 years as dean of engineering at MIT before moving to the science foundation. There he played a major role in organizing the NSF's new program of Research Applied to National Needs, in overhauling the NSF's educational programs, and setting up its new science policy units. In doing so, he became an important force in a fundamental and sometimes controversial shift within the agency toward applied research.—R.G.

in the Pacific illustrates how much remains to be accomplished.

As recently as the late 1950's, tuna were still being taken largely by the "live bait" technique—a hook and line method first developed by the Japanese centuries ago. In the 1960's, however, the purse seine came into extensive use and revolutionized tuna fishing (although many live-bait boats continue to operate today).

The modern purse seiner may be a vessel of 1000-ton capacity that costs more than $3 million—and, more than likely, it is American, for the tuna industry is one part of the world fishing industry that Americans dominate. The vessel's huge net will be, say, 3600 feet long and 600 feet deep, and will weigh many tons. The use of so large and heavy a net was made possible only by the introduction of the "power block." Suspended from a boom at the aft end of the ship, this roller-like device is used in retrieving the net.

In a successful set of a large purse seine an entire school of tuna may be caught. Late last year, the *Royal Pacific*, operating out of San Diego, claimed a new industry record when in a single setting of its purse seine it took 10,000 yellowfins of 40 to 70 pounds each, this catch totaling some 350 tons. Catches of 150 tons in a single set are common, and, for the crews of the superseiners, not altogether welcome. The emptying of the net may take 6 hours or more, so long that many of the tuna may die and spoil before they can be placed in the refrigerated hold.

The stock of Atlantic bluefins is in such trouble that the U.S. National Marine Fisheries Service recently announced an emergency research and management program in an effort to save it. Aided by aircraft that spot the fish feeding at the surface, American purse seiners have taken the highly vulnerable school tuna with ruthless efficiency. At the same time, Japanese boats have been catching many of the giant bluefins—the spawning population on which perpetuation of the species depends—by using advanced long-line fishing methods that even include the retrieval from central computers of detailed information about the conditions under which previous catches were made.

For several years now there has been an International Commission for the Conservation of Atlantic Tunas, but this body is yet to recommend to its member governments any specific measures for the protection of the bluefin. In the Pacific, the Inter-American Tropical Tuna Commission, responsible for a conservation zone running from northern Mexico to Chile and extending westward perhaps a third of the way to the Hawaiian Islands, has established a quota for yellowfins. Yet, even here, there is a real question how effective its regulations ultimately will prove.

This year, for instance, an "over catch" already has occurred because the member nations failed to agree on the quota in time to notify the fishing fleet before the tuna season began. Moreover, the quota consists essentially of a limit on the total catch, with only a very small part of it specifically reserved for a few nations such as Mexico and Costa Rica.

This free-for-all, grab-what-you-can system favors the U.S. tuna fleet because it represents more than three-fourths of the total capability of all vessels engaged in the fishery. The American fleet, much too large in relation to the allowed yellowfin catch, is sure to resist any further reservation of fish to foreign fleets unless the overall quota is increased, as it repeatedly has been in the past.

In its current negotiating position at Caracas as to what kind of regime is in order for the control and management of fisheries, the United States seeks to reconcile the highly divergent interests at play, domestic and foreign. The U.S. position has been based on the "species approach," by which fishery regimes would be based on the biological and economic facts that pertain to particular fish stocks; this is in contrast to a zonal approach whereby coastal nations would each exercise control over all stocks within a wide zone offshore.

A New U.S. Position

On 11 July, however, Ambassador John R. Stevenson, head of the U.S. delegation at the Law of the Sea conference, announced that the United States would accept the concept of national "economic zones" extending offshore up to 200 miles. This represented a concession to the developing nations as well as to a major part of the U.S. fishing industry, but it by no means represented a total abandonment of the species approach. That approach is retained in the exceptions and provisos accompanying the U.S. position. These are as follows:

- Highly migratory stocks such as tuna would not be subject to management by coastal nations, but, rather, would be managed by international bodies (as they are now, after a fashion).
- Anadromous stocks such as salmon would be managed by the coastal nations in whose rivers and streams the fish reproduce. The jurisdiction of the "host" nations over these stocks would not be limited by any geographic zone but would extend to the full migratory range of the fish. Also, the host nations alone would harvest the fish, because it is these nations that can best determine the condition of the stocks and have to bear the cost of maintaining suitable habitat for the annual spawning runs.
- The principle of "full utilization" would be observed. Coastal nations would enjoy a preferential right to harvest stocks (nonmigratory stocks

excepted) within their economic zones; but, to the extent that their catch will fall short of the highest sustainable yield, other nations must be allowed to take the surplus.

- Fishery regulations promulgated by coastal nations for their economic zones could be challenged by other nations and made subject to compulsory dispute settlement or arbitration.

According to Ambassador Stevenson, an international consensus has developed in support of coastal nations' claiming a 12-mile territorial sea and broad economic jurisdiction beyond 12 miles. The newly modified U.S. position reflects that consensus but is still far from the position of those developing nations which, by extending their territorial sea from 50 to 200 miles offshore, have asserted not a limited or conditional economic claim to the waters in question but rather a claim of full national sovereignty. In their numerous seizures of American tuna boats in recent years, Ecuador and Peru have alleged that, by fishing within 200 miles of their coasts, those vessels were intruders—in the same sense that a Russian trawler that violates the U.S. 3-mile territorial limit is regarded by Americans as an intruder.

Obviously, much hard negotiating lies ahead at Caracas not only on fishery questions but on the whole range of issues with which the Law of the Sea conference is concerned, including the important question of international management of the deep seabed. The most that is expected of the Caracas meeting is that it will advance negotiations enough for them to be successfully completed at a follow-up conference next year in Vienna. The United States has proposed that any fishery regime accepted as part of a Law of the Sea agreement be implemented immediately, without waiting several years for formal ratification by the signatory nations.

U.S. fishing interests along the Atlantic Coast and in the Northwest are convinced that the Law of the Sea conference will not bring them timely relief from foreign fishing pressures. These interests, together with some environmental groups and sportsmen's organizations, are demanding early passage of S. 1988, a bill introduced last year by Senator Warren G. Magnuson (D–Wash.).

This measure would extend the contiguous fisheries zone of the United States from its present outer limit of 12 miles to 200 miles, far enough out to take in most of the U.S. continental shelf waters inhabited by commercially important species of bottom fish. As in the U.S. proposal at Caracas, U.S. jurisdiction over anadromous fish would be coterminous with the range of the species, however.

The proposed act would cease to be in effect as soon as a Law of the Sea treaty went into force, and its sponsors have emphasized its interim character. Nevertheless, officials of the Department of State have said that the bill is seriously prejudicial to the U.S. negotiating position and that, if enacted, it could destroy the Law of the Sea conference. This objection to the bill seems much more substantial than the one raised by the American tuna interests who fish off Latin America and Africa and by the U.S. shrimpers who fish off Mexico and Brazil. These distant-waters fishing interests probably will have to cope with increasing jurisdictional claims and regulation by the developing nations whatever Congress or the Law of the Sea conference may do.

If the 200-mile-limit bill begins moving toward congressional passage, it will not be before the end of the Caracas meeting, and then perhaps only if little progress has been made toward a Law of the Sea agreement. The bill may or may not be reported soon by the Senate Commerce Committee, which Magnuson chairs, but, in the event that it is, it will then go to the Committee on Foreign Relations for up to 60 days. In the House of Representatives, John Dingell (D–Mich.), chairman of the fisheries and wildlife subcommittee, will await the outcome of the Caracas conference before taking any major actions.

Clearly, there is no easy escape for the United States from the fisheries management dilemma. If the course of international negotiations is patiently pursued, additional fish stocks may be lost before any workable international agreements are reached. If, on the other hand, unilateral action is taken to ban or limit foreign fishing in offshore waters, the establishment of fishery regimes that do not depend on gunboat diplomacy for their enforcement could be made more difficult still.

Perhaps the best thing Congress can do is to bide its time for now, but be ready to act if the Caracas and Vienna conferences fail to produce an agreement. In such an eventuality, Congress would seem justified in enacting an amended version of S. 1988 that would include management provisions applying to American as well as foreign fishermen. Although American fishing interests have contended that the 200-mile-limit proposal and the management issue should be kept separate, the combining of the two might be more consistent with the aims of emergency interim legislation aimed at conserving international fishery resources.

—LUTHER J. CARTER

APPOINTMENTS

. . . **Joseph L. Wolfson**, acting dean of arts and sciences, Saskatchewan, to dean of science, Carleton University. . . . **Paul H. Silverman**, acting vice president for research, University of New Mexico, to vice president for research and graduate affairs at the university. . . . **John F. McCarthy, Jr.**, professor of aeronautics and astronautics, Massachusetts Institute of Technology, to director, Center for Space Research, MIT. . . . **Marvin Goldman**, acting director, Radiobiology Laboratory, University of California, Davis, to director of the laboratory. . . . **Michael J. Harrison**, professor of physics, Michigan State University, to dean, Lyman Briggs College at the university. . . . **George W. Wheeler**, chief, advanced research and development branch, high energy physics program, Division of Physical Research, U.S. Atomic Energy Commission, to dean of science, Herbert H. Lehman College, City University of New York. . . . **Richard Berendzen**, associate professor of astronomy, Boston University, to dean, College of Arts and Sciences, American University. . . . **Philip Nanzetta**, associate professor of mathematics, St. Mary's College of Maryland, to dean, Faculty of Natural Sciences and Mathematics, Stockton State College. . . . **May Brodbeck**, dean, Graduate School, University of Minnesota, to vice president for academic affairs, University of Iowa. . . . **Merwyn A. Landay**, chairman, periodontology department, Temple University, to dean, School of Dentistry, University of Louisville. . . . **John R. Beljan**, associate dean for medical education, University of California, Davis, to dean, School of Medicine, Wright State University. . . . **Raymond J. Steimel**, professor of psychology, Catholic University, to dean, School of Education at the university.