Ensuring Fisheries Management Dysfunction: The Neglect of Science and Technology

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ABSTRACT

Significant problems exist in the management of marine fisheries in the United States. Although many factors impair the ability of management to effectively deal with resource problems, inappropriate and uncontrolled use of technology is perhaps the most insidious and most overlooked. Coming to terms with technology is a prerequisite for management and economic systems to function properly. Guiding and choosing appropriate technology to promote maximum resource utilization on a sustainable basis is the greatest challenge facing management in the future.

Introduction

It's that same old feeling of déjà vu all over again . . .

—Yogi Berra, Baseball Player and Philosopher

If marine fisheries management in the United States were to receive a report card, there is little doubt that a trip to the woodshed might be in order. The majority of marine fishery resources managed under the Magnuson Fishery and Conservation Act of 1976 (MFCMA) are presently either overfished or on the way to being so (Marine Fisheries Section, American Fisheries Society 1989). A recent review of the state of the U.S. fisheries (NOAA, NMFS 1989) noted severe resource problems (i.e., depressed and declining abundance levels, low catches, record-high fishing mortality rates, reduced catch per unit of effort, excess fishing capacity, illegal fishing practices, etc.) in the nation's fisheries off every coast of the United States. Whether it be New England groundfish, Atlantic swordfish, Gulf of Mexico red snapper, Pacific rockfishes, or Alaskan king crab, the optimism of rejuvenated stocks and unlimited economic opportunity engendered by passage of the MFCMA has yet to be realized. Success by management in curbing and/or preventing resource deterioration during the past decade has been elusive as the Holy Grail was to Percival of Arthurian legend. Given that overfishing and resource depletion are not new management problems (Russell 1931; Beverton and Holt 1957; Gulland 1974), why has U.S. fisheries management fared so poorly since 1977? Certainly, U.S. marine research scientists have been among the best and the brightest, and U.S. marine fishery managers among the ablest and most committed to resource conservation (Smith 1973). Scientists and managers alike have long known how susceptible fish stocks are to heavy fishing pressure. In fact, a major impetus for enacting MFCMA was the substantial reduction in Northwest Atlantic fish stocks (50% decline between 1963–1974) that resulted from the rapid expansion and extremely high fishing effort of distant water foreign fleets off the U.S. Atlantic coast during the 1960s and early 1970s (Brown and Halliday 1983; CEQ 1981; Clark and Brown 1977). With this experience fresh in mind, one would have thought that under MFCMA recurrence of overfishing would not be possible. What went wrong?

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Management's Shackles

Round up the usual suspects . . .

—Inspector Louis Renault, *Casablanca*

A litany of factors have traditionally been identified that constrain or inhibit effective fisheries management (Alverson 1972; Marine Fisheries Section, American Fisheries Society 1989; NOAA, NMFS 1986). Among the most widely cited are: (1) cumbersome and complex institutional arrangements for attaining management objectives; (2) scientific shortcomings regarding the adequacy, timeliness, applicability, interpretation, and predictive value of fisheries research information; (3) lack of sufficient funding and/or fiscal and programmatic accountability to insure that all requisite responsibilities of management can be accomplished; (4) confusion over the roles of scientists, managers, and administrators in the management process; (5) an almost religious dedication by decision makers to implement management actions only when scientific evidence is complete and unequivocal; and (6) lack of clarity and inconsistency

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in management objectives and policies (Gulland 1971; Larkin 1978; Royce 1989).

While we believe that all of these problems have impaired and continue to plague fisheries management, we are concerned that inappropriate and uncontrolled use of technology in fisheries is, by itself, bringing management to its knees. Furthermore, we believe that management dysfunction and failure are virtually ensured when technological developments and their implementation are neglected or ignored in designing and implementing fishery management programs. We contend that, by overlooking technology, fisheries management under MFCMA has not and cannot succeed.

Management's Quandary

Say it ain't so, Joe . . .

—Young boy to Shoeless Joe Jackson, a baseball player accused of purposefully losing 1919 World Series

It has become rather fashionable to describe the "fisheries problem" under MFCMA as ". . . too many fishermen; too few fish." Although many U.S. fishery resources are now at historically low levels, it is not strictly the number of fishermen that is the cause. Rather, it is the enhanced effectiveness of these fishermen, due to technological advancements, that is the heart of the problem. Since World War II, vast improvements in fishing vessel design, electronics, gear construction/materials, and processing equipment have all-too-frequently placed man, the predator, in disequilibrium with his prey, the fish stocks. Not only has technology markedly increased the fishing power of individual vessels, but it has been an inexorable force in fostering striking increases in both the number and size of fishing vessels. Technology has made fishing easier, safer, and more successful. This technology not only includes direct fishing aids such as LORAN navigation systems, net reels, and weatherfax machines, but also quality-of-life improvements such as cellular phones, refrigerators, and VCRs (Smolowitz and Serchuk 1988). In all but a few isolated cases, fisheries management has responded rather passively to the increased efficacy of the nation's fishing fleets, focusing instead on controlling the quantity and/or size composition of fishery landings.

The national effect of this essentially laissez-faire policy is startling. Since enactment of MFCMA in 1976, the number of U.S. fishing vessels has increased from 17,000 to 38,000 (U.S. Department of Commerce 1988a), while the overall tonnage of the fleet has approximately quadrupled. The actual fishing power of the fleet has presumably increased by a much larger amount. In the New England groundfish fishery, where the number of otter trawl vessels doubled from 825 in 1977 to 1620 in 1983 (NOAA, NMFS 1989) and the number of nominal days fished between 1977–1985 increased by 82% (Northeast Fisheries Center, National Marine Fisheries Service 1987), total potential fishing power is probably higher now than at any time in the past (including the heyday of the foreign fisheries). Given this impressive harvesting capability, it is disconcerting to see the recent poor performance record of the fishery. In 1987, the average daily catch rate per vessel of all marketable species combined was only 5,500 pounds (U.S. Department of Commerce 1988b). By comparison, during 1935–1960 when annual groundfish effort (measured in total days fished) was about one-third of the present level and catchability was much lower, daily catch rates of haddock alone were 12,000 pounds!

Some might argue that the lower catch rates do not matter, that fishermen are still making money, and that things will improve on their own accord. Others suggest that reduced stock abundance levels are not due to legal fishing activities but are the result of pollution, the greenhouse effect, sunspot cycles, illegal catches, and so forth. Irrespective of current economic conditions or the proximate/ultimate causes affecting resource status, there is growing concern that recovery from overfishing is needed (Marine Fisheries Section, American Fisheries Society 1989). Few now doubt that our fishing fleets, equipped with increasingly sophisticated technology, are capable of taking virtually the last fish in the ocean.

Management's Burden

Now, here, you see, it takes all the running you can do, to keep in the same place.
If you want to get somewhere else, you must run at least twice as fast as that . . .

—The Red Queen, *Through the Looking Glass*

Typically, in a regime of uncontrolled technology, fisheries management will attempt to restrict nominal fishing effort (i.e., the number of vessels or number of days fished) and/or total landings. This is easier said than done, even when resource levels are high. For example, if the total biomass of finfish and squids (excluding menhaden) off the northeastern United States (Gulf of Maine to Cape Hatteras) was presently at the long-term equilibrium level, maximum sustainable fishery yields (MSY) of about 900,000 metric tons might be possible (Brown et al. 1976). Since present fishing effort is far beyond the level at which MSY is attained, effort would have to be significantly reduced (perhaps by 20–50%) to take advantage of the ecosystem's potential. However, current biomass in the region is well below that necessary to produce MSY. In fact, because biomass is so low, recent annual catches have only been about 325,000 metric tons (i.e., one-third of the MSY level) and even these catches are greater than what the stocks can presently sustain (Anthony 1988).

What's a manager to do? One approach might be to freeze the fleet at current levels, both in numbers and technology, and allow each vessel to fish some fraction of its average fishing days until the stocks recover. Another approach might be to allow the fleet to suffer an economic collapse that affects say, 75% of the vessels, thereby quickly reducing fishing effort. This might be facilitated, in part, by closing vast areas of the ocean to fishing. Of course, the hard facts of life are that none of these approaches are probably appropriate or acceptable.

Management's Options

Tomorrow is another day . . .

—Scarlett O'Hara, *Gone With the Wind*

There is a farm story that makes an excellent point which might be wisely applied to the U.S. fishing industry. At a recent meeting of vegetable growers, an Indiana farmer related how his father was encouraged by the government and banks to expand his family farm shortly after World War II. The family increased their acreage from 150 to 1,500 acres, increased their capital investment in buildings and machinery, hired additional help, and very efficiently mass produced crops sold to middlemen. The entire family worked long hours, were in debt up to their eyeballs, experienced labor and machinery problems, and didn't like farming anymore. When the son took over the farm, he decided to rescale the operations. He reduced the farm to 25 acres, replaced his machinery with smaller equipment, let the hired help go, paid off his debts, and planted a variety of crops which he directly marketed. While gross income fell dramatically, the farm's net income rose significantly. While all family members still worked hard, they now had time for vacations and most importantly enjoyed farming once again.

The concept used by this farmer is known as downsizing. Fundamentally, it entails reducing inputs to keep costs down and applying appropriate technology to maximize profits. Could the fishing industry downsize? We believe the answer is yes, if everyone involved does it together and "ownership" of fishery resources is vested with the public. Fishermen are forced onto the innovation treadmill by the common property nature of fishery resources (Graham 1943). The industry needs to get off the treadmill, not only until fish stocks recover, but until we learn how to enhance the productivity of the ocean (Smolowitz and Serchuk 1988). In the interim, for many individual fishing vessels to remain economically viable, the entire industry must downsize. This requires that an appropriate fishing unit be selected that will equilibrate effective fishing effort with existing (or desired) resource abundance levels, producing a situation where fishery yields are sustainable but no incentive exists for new entrants into the fishery. This approach goes beyond dollars and cents. One can make good money bull-raking clams, but how many people want to do it?

How might fisheries downsizing be done? We offer several illustrations of where fishing power of an operating unit might be limited using one or more controls on the vessel, its gear, or the crew. It should be recognized that we are not advocating downsizing (which some consider regressive) as the optimal control strategy, but as an interim measure until fish stocks are rebuilt. Downsizing may be inevitable, however, if fisheries continue to be managed in their present fashion (i.e., ignoring technology).

In the New England groundfishery, controls on gear alone might suffice. For example, the largest otter trawl net could be a Yankee 36 trawl with no extension, possessing 6-inch mesh forward, a 6-inch square mesh cod end, and no heavy rollers or rock-hopper gear. The officially sanctioned net would be specified in complete detail to prevent uncertified changes. The idea is not to make every fisherman equal but to make fishing success dependent on individual skill, not technology. The highliner may then be the most knowledgeable fisherman, not the one who can cheat the best or buy the latest and most expensive equipment. Dependence on knowledge and skill is a form of self-regulation that would limit entry.

Another alternative, albeit one much more radical, is to eliminate the use of bottom trawls. In 1893, Captain Collins of the U.S. Fish Commission loaned an otter trawl he obtained in Europe to a Cape Cod fisherman for an experiment. We propose (with tongue in cheek) that the experiment be declared a failure and that, beginning in 1993, the practice of bottom trawling be banned. Although this suggestion seems outrageous, the fact of the matter is that we do not necessarily know the most appropriate method to harvest groundfish. The problems we face today, however, suggest that trawling is not it. Recent studies indicate that fish escaping through the meshes of the cod end of a trawl suffer high mortality. The long-term effects on the ecosystem and habitat of trawling activities are still unknown, after more than a century of claims and counter-claims concerning the "destructive" nature of bottom trawls.

In gill-net fisheries, we suggest that consideration be given to returning to cotton nets, limiting the overall size of nets, and requiring fishing vessels to remain attached to their gear. This would substantially reduce the fishing power of a gill-netter, make it more difficult to make a profit, and discourage new entrants. This is the point! If the industry doesn't take the lead in examining such approaches, concerns over marine mammal entanglement, plastics, pollution, "ghost-fishing," recreational access, and destructive fishing will put gill nets in museums. This is not a diatribe against profits but the realization that some of the potential earnings need to be plowed back into the resource right off the top.

In the Northwest Atlantic sea scallop fishery where fishing effort in 1988 was a record high (Serchuk and Wigley 1988), a slightly different set of controls might be employed. Most vessels in the fishery presently tow two large dredges (i.e., ≥15-foot wide and weighing several tons) and shuck scallops at sea with shucking power a function of crew size (which is typically between 9 and 11 men). To cap both fishing and shucking power, vessels could be limited to only one 15-foot dredge (or sweep), not exceeding 1,000 pounds in weight, and a maximum crew size of four. While these suggestions sound Ludditean, the present fishing power of the scallop fleet is perhaps an order of magnitude larger than the resource can sustain in the long run.

Before making technological decisions, a choice may also be required as to whether we wish to have the fishing equivalent of a few big agribusinesses or lots of small farmers. In a common property environment, it is unlikely that a mix of the two can successfully coexist without significant government intervention and cost. In the scenarios provided above, we have tacitly assumed continuation of open-access fishery policies (e.g., the status quo) which tend to favor many small operators over a few large ones.

Finally, as we enter the 21st century, environmental concerns (i.e., global warming) and finite supplies of petroleum and other fossil fuels will require the expansion and reintroduction of more passive fishing techniques. Such techniques are energy efficient, relatively non-polluting, and can be expedited near major urban centers of consumption. The latter will eliminate the additional energy load needed to freeze and otherwise process seafood.

Management's Challenge

Be not deceived; God is not mocked:
for whatsoever a man soweth, that shall he also reap.
—*The Bible*, Galatians 6:7

Guiding and choosing appropriate technology to promote maximum resource utilization on a sustainable basis is the greatest challenge that management faces in the future. The current picture is one of high tech fisheries and low tech management (Smolowitz and Serchuk 1988). In a competitive world, economic survival depends on growth and making the most of what we have. It is essential that management direct its efforts into augmenting fishery resources, utilizing existing harvests more efficiently, and identifying and implementing more energy-efficient and conservation-based harvesting practices and technologies. Managers, scientists, and industry need to cooperate vigorously in this task. Recognizing the impacts of technology on fisheries development and fisheries management is a first step. Much remains to be accomplished, however, to insure that our actions will provide a legacy for tomorrow's fisheries and not an epitaph. Robert Rodale, a leading proponent of regenerative agriculture states the task as follows (Rodale 1989 p. 13): "We need to move toward regeneration of resources, instead of trying simply to conserve them. We need to restore, replace, to recycle, to renew, and to respond to change. But especially, we need to emphasize the regenerative capacity of all living systems, to learn to use them in ways that enhance that regenerative capacity."

Success in this endeavor will depend on managing and husbanding both wild and cultured fishery resources in a more holistic and ecologically-sound manner.

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