35 Years of Accelerated Depletion – or – Whose Fish Are They, Anyway? 1975-2010

Jim Ginter

October 19, 2010

I must admit that the general topic of this essay was selected prior to Allen Proctor asking me to present this year, and also prior to my being given the time period of 1975 to date for the focus of my essay. It has worked well, however, in that most of the activities I want to discuss have occurred in the past 35 years - both to create the problem and to try to resolve it.

THE PROBLEM

A simple statement of the problem is that we are extracting fish from the seas at a rate that cannot be sustained (thus the first half of my title). The Food and Agriculture Organization of the United Nations estimates that over 70% of the world's fish species are either fully exploited or depleted. A 2006 article in the journal Science reported that 29 percent of all fished species had collapsed, meaning that they were at least 90% below their historic levels. This group includes such well known species as cod, hake, haddock, deep sea flounder, blue fin tuna, many species of sharks, orange roughy and Chilean sea bass.

At the risk of sounding unduly alarmist, tonight I want to share with you a bit of what I have learned about this problem, its roots, and its difficulty. I'll also have to admit that I feel a bit "upstaged" by the article in this month's National Geographic entitled "Global Fisheries Crisis". I am convinced that we are facing a global problem that is important for a couple of reasons. First, the oceans remain a critical food source for much of the earth's population, and there are legitimate fears that the end of that food source is in sight. Second, even if you don't eat the fish, you will probably care that much of the oxygen we breathe is provided by lower level organisms in the sea. These marine organisms depend upon their ecosystem for survival, and depletion of populations of larger fish clearly threatens the balance of that ecosystem. Don Shackelford first introduced us to the ocean's effects on air quality in his March 2003 essay, "As Thy Purse Can Bear".

FACTORS THAT CONTRIBUTE TO THE PROBLEM

Let's look at some of the factors that contribute to the problem.

1. We are mostly in the dark

Compared to the land masses, we just know very little about the sea, its inhabitants, and their habits. This is in spite of the lifelong efforts of folks such as Jacques Cousteau, as report by Mike Scanlon in his January 1998 essay, "Commander's Palace".

There can be many reasons for our knowing less about the sea than the land and perhaps even the sky. One reason may simply be "out of sight, out of mind". Space exploration captured the imagination of many of us fifty years ago. The curiosity about the heavens may be rekindled every time we look at a starry sky or sit on an eastern facing sea shore and watch the majestic moon-rise with a fiery glow. This curiosity can be rekindled under a clear sky wherever you happen to be. Conversely, we don't see much of the face of the unknown when it comes to the sea. We can see and be fascinated by the light from a star that left its source thousands of years ago, but we cannot see whether the floor of the ocean on which we are floating is 4.5 meters versus 4.5 miles deep. It seems as if the oceans historically were viewed simply as pathways to interesting places, as described in Al Kuhn's April 1999 essay "The Centurian – Anson's Voyage Around the World", rather than being viewed as reservoirs of scientific information and valuable natural and biological resources. If a giant bluefin tuna lived on land, its size, speed and migrations would ensure its legendary status, with tourists flocking to photograph it in national parks. But because it lives in the sea, its majesty – comparable to that of a lion - remains largely unappreciated.

We know little about the terrain of the floor of the ocean and even less about its inhabitants. You may recall, for example, the news reports in just the last few days of the findings from a ten year global marine census. In its report on this decade long effort, the WSJ said that although as many as 6,000 new species had been identified, "the golden age of ocean discovery still lies ahead". Their estimate is that although nearly 250,000 ocean species have been identified, another 750,000 species still elude human discovery. It has been reported that only one ten thousandth of one percent of the deep sea has been subject to biological investigations. Even if this estimate is off by an order of magnitude or two, there is still much to learn.

Our sparse knowledge of the sea's inhabitants is not limited those living in its depths. In its annual report in 2009 NOAA (National Oceanic and Atmospheric

Administration) reviewed 522 individual stocks in US waters. One primary conclusion was that they simply could not determine the overfishing or overfished status of more than half of them. This lack of knowledge is much worse for the unregulated waters of the deep sea. What we think we know, however, paints a pessimistic picture, i.e. for those species we can estimate, their numbers are being depleted at an alarming rate.

2. Geography

For purpose of our discussion, I am defining deep sea as areas of the ocean that lie beyond the continental shelf areas surrounding most continents. This area generally has a depth greater than 400 meters, and it includes approximately 50% of the earth's surface. It's no surprise, then, that the area contains often astonishing biological and topographic diversity. Unlike the knowledge gained from the mountain climbing explorations reported by Mike Young in his February 1998 essay, "Because It's There", we know little about the features of the ocean's floor. Many of these areas are flat with silt and mud covered bottoms. In other areas underwater currents have carved canyons that link to the deeper regions, much like the erosion that we see on the face of a mountain

The deepest of these canyons is generally acknowledged to be the Mariana Trench, in the western Pacific Ocean. It is nearly 1600 miles long and has an average width of about 43 miles. The deepest portions that have been found are about 6.8 miles deep. If Mount Everest were placed in the trench, its peak would be 1.25 miles below the water's surface. The Mariana Trench is about six times longer and six times deeper than the largest trench most of us know, the Grand Canyon. I should also add that one of the reasons for special attention being paid to the topology of the Mariana Trench is that it has been proposed as a site for nuclear waste disposal. Such dumping has so far been banned by international law.

In addition to the canyons and mountain ranges on the ocean floor, there are a large number of features known as seamounts. These seamounts are underwater mountains, with an elevation of more than 1000 meters, or over a half mile. They are generally thought to have volcanic origin and their steep slopes have gradient angles of up to 60 degrees. Their summit area is relatively small. We think there are about 30,000 seamounts in the Pacific Ocean and about 1000 in the Atlantic Ocean. The special importance of the

seamounts to tonight's topic is that they are biological oases. They induce underwater currents that then create flows of nutrients. These flows lead to increased biomass of plankton, and this, in turn attracts greater populations of prey organisms, with the hierarchy continuing up through the food chain. Some species congregate in great density around particular seamounts or fields of sea mounts. They are of great interest to the fishing industry that concentrates on approximately 70 species inhabiting seamounts.

One such example is orange roughy. These popular table fare congregate with extraordinary density around sea mounts off New Zealand, and Australia, and in the North Atlantic. They are often depicted as just cascading down the sides as if they were molten liquid. Their density was such that when their "hotspots" were initially located, the resulting catch often exceeded the boats' handling capacity and large portions of the first catches were just dumped. The orange roughy fishery is about 25 years old, and an estimated one million tons of fish have been landed since it began. When a new orange roughy hotspot is located, it is active for two to three years, and then the population is depleted to a point where continued fishing is no longer economically viable.

The dramatic diversity of the deep sea floor makes the development of a comprehensive understanding of its features and its inhabitants very difficult, indeed. The great depths challenge our technology, and we are able to explore with only highly localized probes from either manned or unmanned devices. The diversity of undersea geographic features also makes it more difficult to develop estimates of the current population of sea life and their locations.

3. Behavior of the fish

When we look at the problem of depletion of the deep sea fisheries, we have to attribute some of the cause to the behaviors of the fish themselves. First, as we have mentioned, some species tend to congregate around areas where their preferred food source or living conditions are especially prevalent. Once the fisherman spots such a population, it receives disproportionate fishing pressure until the stock is greatly reduced.

Second, at the greater depths of the ocean the life cycles of the fish are slower. They grow more slowly, it takes longer for them to mature to a point of being capable of reproduction, and they live longer. The older adult fish play a disproportionately important role in the sustainability of the population. Again

focusing on the orange roughy as an example, they reach reproductive maturity in twenty five to 40 years and they reproduce very slowly. Their life span is as long as 150 years, with more than 50 being very common. Most of the filets you will see in the grocery seafood counter are more than 50 years old, and you easily could be eating a fish that was born when Lincoln was president. With this set of conditions, the heavy catches from a newly found hotspot can quickly devastate a fish population. Further, the populations are restored very slowly, if at all. Rather than waiting around, fishermen typically just continue their search for a new hotspot. A recommendation that I saw and am likely to remember is that as a consumer, you should avoid eating any fish that is older than your grandmother. Since it is difficult o make such a determination on a fish by fish basis, I suspect that we will just have to use this factor as one of the criteria in choosing the species of fish we will or will not consume.

Third, some of the species are highly migratory, and the common term is "straddling stock". Migration over hundreds or thousands of miles presents several problems. First, it makes the monitoring of fish populations for the setting of limits or other regulatory control extremely difficult. Second, in migration the fish move in and out of a "no man's zone", where no nation is seen as having primary control or ownership over that population. If a population of blue fin tuna spends part of the year in the waters of country A, part in the waters of country B, and part in the deep sea that is outside all territorial boundaries, who can be responsible for management of that population? (thus, the second part of my title tonight: Whose fish are they anyway?) Spending at least part of the year in unregulated waters also exposes them to rogue fishermen who thrive on the absence of controls. The bluefin tuna is a good example, with these giants of the sea being taken for their soft belly meat that is so highly valued in Japan. Another example would be many species of deep water sharks. Their fins have great value in some societies, and they are often caught, their fins removed, and the carcass dumped back into the ocean. You can imagine how many shark fins a large vessel can accumulate (and therefore how many sharks it can kill) on one deep sea trip. More than half of the stocks of the highly migratory deep sea sharks are ranked as either overexploited or depleted.

A final behavior of fish that exacerbates the problem is that they are part of the food chain. The wealthier nations consume disproportionately from the higher levels of the food chain (e.g. tuna, swordfish, halibut). As described in the

aforementioned National Geographic article, these fish consume much larger numbers of creatures below them in the food chain. An example in the article is that one 1,000 pound tuna might consume as many as 15,000 smaller fish in a year. If members of the highest level of the chain are removed, then the numbers of fish below them in the chain grow. This can mean an increase in the numbers of intermediate and smaller fish, who, in turn, consume the organisms below them in the food chain. This goes on until we can see a reduction in the density of the algae and plankton that drive both the ocean ecosystems and also our atmospheric conditions.

4. Behavior of the fishing industry

Since most of the historical fishing activity occurred near shore, that is where the depletion occurred first. As more fisheries were depleted, fishermen redoubled their efforts to catch as many fish as possible and focused on catching the larger fish. We have already discussed the greater importance of the larger, more mature fish in maintaining the fish population. The total catch from the oceans has remained about the same for the past several years in spite of the greatly reduced fish population. The fleet producing that catch has doubled in size since 1970, and scientists generally consider this number to be twice the capacity at which future fish populations can be maintained.

As near shore fish populations declined, countries began to encourage or require members of their fishing industry to move farther out, into the deeper, unregulated, waters. This has led to major changes in fishing technology. It strikes me that much of this technological innovation is not too dissimilar to the advances in racing yachts reported by Mike Young, in his April 1994 essay, "Not Lipton's Cup of Tea". Much of today's deep sea fishing takes place at depths of one quarter mile to one mile, and the average depth at which fish are caught continues to increase. Today's fishing vessels are much larger, and more and more of the fishing is done with trawlers dragging nets along the ocean's bottom (the estimate is that currently about 80% of the deep water catch comes through trawling). Deep sea fishing vessels are known to trawl at depths down to more than a mile on the continental slopes. Their massive dragnets weigh up to 15 tons, and losses of up to 95-98% of the coral cover of some seamounts as a result of deep-sea bottom trawl fishing have been documented.

Fishing vessels now use automatic trawl nets that electronically detect the approaches of fish schools, have navigation aids including satellite positioning systems (remember the seamounts), and use spotter planes as fishfinders. They are like floating fish factories, with up to 80 miles of submerged longlines containing thousands of baited hooks or 40 mile long driftnets that sweep up everything in their path. These driftnets can have opening circumferences of almost two miles (the equivalent of 10 New York City blocks wide by two Empire State Buildings high).

Since the nets sweep up everything in their path, their use leads to substantial bycatch, that is dumped back into the sea. Almost none of these discarded creatures survive the ordeal. It is estimated that between one third and one half of the total commercial catch is caught and tossed back because they are the wrong species, too small, damaged in capture, or exceed a particular quota. The number is much higher for some fishing operations. In shrimping it is estimated that 85% of the catch is unwanted and dumped back into the sea. I recall one dramatic photo in which the total catch was a stack about the size of a Volkswagon Beetle, and the actual take was less than a gallon. The introduction of turtle nets in the northern section of the Gulf of Mexico shrimping operations has reduced the harm to the delicate species of sea turtles, but little has been done to reduce the harm to other species of fish and invertebrates. This includes some 35 million juvenile red snapper killed annually, in a commercial and recreational fishery that's already on the brink of collapse from overfishing.

The fishing industry and its customers have done a remarkable job of handling the movement from one species to another as stocks are depleted. We talked about Orange Roughy earlier, so named because of its color and the roughness of its scales. Prior to the 1980's, when it these fish were commonly known as slimeheads, the species attracted little commercial attention. It is now heavily depleted. Similarly, the Patagonian toothfish had little commercial appeal. When renamed Chilean Sea Bass, it was heavily sought and it, too, is severely threatened. In addition to this renaming of the species, there is much mislabeling, in which one species is simply substituted for another without the customer's knowledge. Many plates of sea scallops are actually stamped from the wings of sea rays with a cookie cutter like device. Some localized studies have found as many as 80% of the restaurant sales of red snapper to be other, cheaper species.

WHAT'S BEEN DONE

With the extent of the depletion and the severity of its implications for world hunger, it should be no surprise that many have attempted to call attention to and to address the problem.

Many nations claim 200 mile Exclusive Economic Zones (EEZs) in which they attempt to control the overfishing taking place. To offset political pressures from placing restrictions on the take from their own waters, many nations offer subsidies to fishermen. With this practice a nation offers subsidies (taking a wide variety of forms) to maintain or even expand its fleet if the fishing activity is moved farther offshore, into the unregulated deep sea. Annual subsidies worldwide are estimated at between 20 and 25 billion dollars (the US number in 2000 was 1.25B) , and without these subsidies the worldwide fleet would be substantially reduced. (remember that we earlier said that we have twice as many fishing boats as can be sustained).

The common movement to the open sea creates a tragedy of the commons. This is a situation in which there is open access to a common resource and it is in the selfish best interest of each participant to draw from the resource at a level that is unsustainable in the aggregate. As the fish are depleted, fishermen are forced by economic necessity to increase the efficiency and the intensity of their efforts. This leads to more rapid depletion and more destructive means of obtaining fish.

Some level of international cooperation will be required for the problem to be addressed. The United Nations has had its FAO (Food and Agriculture Organization) working on the problem for several years. There are other, more regional international associations. Some agreements have been produced, but suspected violation of them is widespread. Between 1986 and 1992, distant water fleets fishing in international waters off the Grand Banks removed 16 times the quotas of cod, flounder, and redfish permitted by the Northwest Atlantic Fisheries Organization. In another example, several countries agreed to cut Atlantic swordfish catches in 1991. Spain and America did so, but not others. Japan's catch rose by 70%, Portugal's by 120%, and Canada's by 200% (remember the tragedy of the commons). France, Ireland, and Italy were among the countries that continued use of large-scale drift nets on the high seas after they were banned by the UN in 1991. Such issues of the dynamics of

international politics and power were discussed by Chuck Hermann in his December 1991 essay, “Hegemon”.

International law requires fishing vessels, like all ships, to be enrolled in some national registry, as a means of identifying the ship and tracking its activities. There is nothing to prevent owners from registering a ship under the flag of a nation that has not signed or does not abide by the fishing treaties. These are known as flags of convenience (FOCs). In the waters surrounding the Antarctic, for example, more than half of the illegally caught Patagonian toothfish (remember the Chilean sea bass?) was brought aboard FOC vessels Since 1980 the number of nations maintaining FOC registries has increased from 11 to 27, and about 10% of the world’s fishing vessels are now registered with FOC nations. This surely seems to be a much freer and more unruly atmosphere than might come from exercise of naval power such as that described by Fred Milford, in his November 1997 essay, “Kaigun – The Imperial Japanese Navy 1868-1945”.

Some developing countries rely heavily on their coastal waters and have difficulty controlling them, even if they want. Off West Africa, for example, poorly regulated fleets, both local and foreign, are wiping out fish stocks from the productive waters of their continental shelf. Subsistence fishermen in Senegal, Ghana, Guinea, Angola, and other countries are being deprived of their families’ main source of protein. The conditions of these areas were covered by John Eckler in his February 1982 essay, “A Hand Up – Not A Hand Out”. The European fleet declares catches of approximately 13,000 tons a year in this area, but recent reports show that the catches are closer to 88,000 to 110,000 tons a year, up to eight times the declared total. This pressure increases, of course, as more limits are placed on fishing in the waters of developed countries and with the economic pressures forcing many developing countries to generate revenue by allowing access to their waters.

A lot of effort has gone into aquaculture (or fish farming), with much productivity from it. As much as 40% of the current seafood consumed comes from these operations. There are a couple of serious challenges with the current technology of fish farming. First, as on the land, there is a serious problem of waste handling and waste disposal. Second, the primary source of food in fish farms is pellets that are made from pulverized fish from the ocean. In other words, the fish farmers catch the smaller fish, pulverize them, and feed

them to their stock. This practice, then, does little to preserve the food chain or to reduce the pressure on the lowest levels of the chain. One author wondered whether, if it takes five to ten pounds of fish pellets to produce a pound of desirable fish flesh, we might not just as well eat the fish pellets and increase the production of protein for human consumption by an order of magnitude.

Where does this leave us today?

Where does this array of facts and statistics, leave us?

1. I believe there is a real problem of depletion of the ocean's fisheries and that the depletion continues at a steady, if not increasing rate.
2. The ocean's fisheries are a crucial food source for the world…and this goes well beyond our own personal efforts for healthier living.
3. Regulation of fishing input (boat licenses, number of days fishing permitted, net size and configuration) has not succeeded due to the difficulties of multinational cooperation and monitoring.
4. Regulation of fishing output (e.g. catch limits) has not succeeded due to the same problems, lack of multinational cooperation and monitoring.
5. Some have called for the creation of Marine Protected Areas, where no fishing at all is allowed and the ecosystem has a chance to regain its balance. Again, multinational cooperation and monitoring and enforcement remain keys to success.
6. Aquaculture is worthy of continued technological development and probably should receive greater investment than is currently the case. Just as the world had to go to consumption of domestic animals, we need to stop ravaging the wild fish populations and learn how to replace them with sustainable domestic operations.
7. We seem to have insufficient information about all aspects of the problem. The result is a set of management efforts that are driven by politics rather than scientific understanding.

More than anything, I expect the problem will continue for some time, it will attract more and more attention and concern, and we'll hear a lot more debate

about the problem, its causes, and proposed solutions. I hope this paper may have equipped you a bit better for these discussions.