

THE OTHER GLOBAL WARMING PROBLEM

Japanese fishermen reel in nets weighed down by jellyfish the size of small refrigerators. Tons of green algae wash up on the coast of Brittany, emitting enough hydrogen sulfide that it kills a horse- and leaves its rider unconscious. It might sound like the first reel of a cheap science fiction movie. Unfortunately, it's not. Many scientists believe these phenomena are actually symptoms of how global warming is changing the ecology of the oceans - a threat that may prove even more serious than atmospheric warming.

As with the warming of the atmosphere, scientists, policymakers, and business executives are wrestling with the implications of this other – and in some ways more serious global warming problem. Among the questions they are posing: how much the ocean might change, how to cope with the risks and opportunities of those changes, and how governments might work together to slow or stop them from accelerating.

The best known marine warming issue is that the build up of greenhouse gases appears to be melting the polar ice caps, which could cause the sea to rise.

Although scientists estimate that sea level will rise between 19 and 58 centimeters over the century, caused mostly by melting of the ice caps and the expansion that takes place as water warms, the impact may be much greater than that, because of the slope of the ocean floor in coastal areas. “You can translate that by 20 or 30 in terms of impact,” says D. James Baker, a former undersecretary of Commerce/Administrator of the National Oceanic and Atmospheric Administration during the Clinton Administration

who now serves as Director of the Clinton Foundation's Global Carbon Measurement Program. His remarks were made during a 2009 presentation at Cornell University.

More coastal storms would mean more coastal flooding, which is already by far the leading cause of weather damage. Between 1970 and 2004, floods accounted for 90% of the economic costs of extreme weather worldwide, according to a recent paper by Howard Kunreuther and Erwann Michel-Kerjan, professors of risk management at the Wharton School.

Even slight changes in weather patterns could lead to catastrophic, Katrina-style disasters, particularly in hurricane-prone coastal areas. In the U.S., a 6% rise in average wind speeds could actually double the average annual expected losses from hurricane damage from \$5.5 billion to \$9.5 billion, and increase the largest possible hurricane from \$85 billion to \$150 billion, they write, quoting Association of British Insurers' estimates.

Changes beneath the waves are expected as well. In the past, the ocean has acted as a giant sponge for global carbon dioxide emissions. Scientists estimate that 20% to 35% of all manmade carbon ends up in the ocean. But recent research by Samar Khatiwala, a Columbia University oceanographer, published in *Nature* in November 2009, estimates that there is just so much carbon being produced now that the percentage of total carbon the ocean can absorb has declined. "If the emissions grow too quickly, then the ocean can't keep up," Khatiwala says. He theorizes that changes in ocean chemistry have also contributed to a declining capacity to absorb carbon dioxide, reducing the ocean's capacity by as much as 10% since 2000.

At the same time, scientists believe that reduced Ph levels in the water could have a catastrophic impact on shellfish and coral, inhibiting their ability to make shells. Economically, this could

lead to a huge disaster not only for shellfish farmers, but even more importantly, lead to the bleaching of the coral that is responsible for some of the world's richest marine ecosystems.

Water holds less oxygen as it warms. This causes many species to migrate north into cooler waters where they can breathe more easily. Scientists think that the arrival of 200-kilo jellyfish in Japanese waters, the 25-kilo squid off the coast of California, and the growth of algae in Brittany may all be related to changes in species' balance brought on by a slight warming of the seas.

Accentuated perhaps by global warming in combination with overfishing of predatory fish, these invasions are already having an adverse economic impact. While the sport fishing industry in California is reportedly enjoying a boom in fishing for the feisty giant Humboldt squid, Japanese fishermen are having a terrible time with their invader. In some places losing up to 30% of their catch because of the giant jellyfish, whose presence can destroy the rest of an entire net's catch – and on at least one occasion has even led to the capsizing of a fishing boat.

Eventually, we can expect to see many more changes wrought by global warming. A computer model by William Cheung, a professor at the University of East Anglia has examined the impact of global warming on 1000 species of fish. His model predicts that the many species will move more than 40km a decade toward either the North or South poles in search of cooler, more oxygen-filled waters. This is likely to reduce the numbers of fish in the tropics, he predicts, and could send the population of some species down by 50%, and in some cases, even into extinction.

Nor will farmed fish be exempt from these changes. Many farmed fish are actually grown in open nets in the sea, he says, which means that they must cope with the same changes as wild fish. “A

lot of fish are farmed in open nets in the ocean, so basically the farmed fish are experiencing the same marine environmental conditions,” he says.

In the first version of the model, Cheung’s model suggested that northern seas might gain as worsening conditions in the south pushed fish out. Now Cheung is not so sure. His new model, which incorporates other climate changes, such as acidification, suggests that the north won’t gain after all.

Acidification, for example, besides making it difficult for shellfish and coral to grow, may also make fish smaller, as more of their energy goes into keeping the chemistry of their skin balanced with the chemistry of the water, he says.

Of course, some species are likely to win in the general redistribution. One possible winner Cheung points to: fish parasites, which may increase as the environment becomes more favorable to them.

But it is an ill wind that blows no good and there will be other gainers from marine warming than giant jellyfish.

Shippers should profit from the growing navigability of the northern waters now that the polar ice cap is melting. The Northeast and Northwest Passages dreamed of by explorers four hundred years ago are now a reality, at least for a few weeks in the summer, and offer a shipping shortcut of thousands of miles.

The Beluga Group, a German shipping company made the first commercial Northeast Passage cruise in the summer of 2009, shortening the usual 11,000 mile trip from Korea to Europe by 4,000 miles. Already, the company has booked cargo for its new cruise this coming summer. Ironically, Beluga executives note, the passage made possible by the melting ice cap is much more

ecologically friendly than the classic passage through the Suez, because it takes much less fuel.

Other businesses have been helped as well. A cable company has also found a way to profit from the melting ice, by linking North America and Japan directly through a line set down in the Northwest Passage, cutting transmission times between North America and Japan.

Real estate speculators too have already made millions already on ice cap bets. They have bought land in Hudson's Bay and other regions of Canada's north shore, tundra that once cost pennies per acre, which they have now sold for thousands as shippers prepare staging ports along the route in the far north, according to Baker. But not everyone intends on passing through. Oil, gas, and other resources once locked away under ice can now be much more easily retrieved as well.

Today, however, policymakers are more focused on how to mitigate the risks of climate change.

Kunreuther and Michel-Jerjan argue that one of the most important steps to be taken is to encourage property owners to take out more flood insurance and to invest in more flood mitigation measures, such as elevating their homes.

However, getting them to actually make such an investment is a challenge, the authors note. A number of surveys have found that people tend not to invest in any kind of emergency preparation even if they live in a high risk area – and even if they have just seen a disaster. For example, just 10 months after Hurricane Katrina, they note, 83% of survey respondents on the Atlantic and Gulf Coasts had not fortified their home and 68% had not invested in a hurricane survival kit.

Typically, Kunreuther and Michel-Kerjan write, people either ignore the risk or make the correct economic calculus that the chance of being wiped out by a natural disaster in the near future is rather unlikely. Even if a storm is expected in 35-50 years, homeowners may conclude that the odds of it happening in the next three years are rather low, and if they expect to move within three years, they may find it hard to justify carrying insurance. Although people in flood plains are technically required to buy policies from the government-sponsored National Flood Insurance Plan, in practice, many do not, the authors write. In the end, even though it makes sense from a societal point of view to insure these risks, many people are under-insured.

To correct for that myopia, the two suggest that the way the US government's flood insurance is underwritten should be changed. They say insurance be written not as an annual policy but on a long-term basis, and conveyed along with the property. That, coupled with the extension of long-term home improvement loans for risk reduction measures (in order to match the savings of insurance premiums against the cost of mitigation investments), would help encourage owners to think long term.

Unfortunately, this inability to think collectively and long-term about the ocean is the rule and not the exception. "In just the last fifty to one hundred years, the brief span of a single human lifetime, people have spent much of the wealth of oceans, although the effects of overexploitation can be traced back much further," writes Callum Roberts in his 2007 book, *An Unnatural History of the Sea*.

Roberts, a professor of the environment at the University of York, notes that overfishing has been a problem in Europe, at least, for the past 1000 years. Almost without exception, Roberts has found that the traditional solution to overfishing was not to fish less but to start cultivating fish or find new fishing beds. In the 13th

century, he writes, stocked ponds covered 40,000 hectares (62,000 acres) in central France, and vast numbers of ponds were also present in the rest of Europe at the time as well. Later, in the 15th century, he argues that some of the early New World expeditions were in part scouting expeditions in search of easier fishing.

But at this point, experts say, there is no running away to better fishing grounds. Just as with atmospheric warming, marine warming is a collective, multifaceted problem that demands a collective, multifaceted solution – exactly the kind that humanity has always found extremely difficult to craft.

“We know all the problems in dealing with the environment is not so much a problem between man and the environment but a problem amongst human beings,” says international marine governance expert Yves Henocque, director of science, nature and society for the French Research Institute for the Exploitation of the Sea (IFREMER) at Issy les Moulineaux.

Many countries have maritime strategies, but there is a limit as to what single nations can achieve. Australia, for instance, has not been able to prevent the deterioration of the Great Barrier Reef despite its efforts, he says. On the other hand, international agreements on how to cope with marine climate change have proven difficult to achieve, for a variety of reasons.

Beyond the technical complexity, there is also a geopolitical challenge. One is that although there is a governing group for the oceans, UN Ocean, the UN organization that is supposed to enforce the Law of the Sea, the capacity of the UN to enforce any conduct is limited to the will of the nations that belong to that body – and complicated by the fact that the US is not a signatory of the Law of the Sea.

Another, and one of the most important lessons of Copenhagen, Henocque says, is that any climate change agreement must be put into a geopolitical, developmental context. “You cannot just reduce climate change to an environmental problem. You have to put that into a sustainable development perspective and take into consideration not only the environment but the social aspect.”

He is not confident that such an agreement can be reached. What does seem to be a bit more workable, he says, are regional agreements. However, even here, problems can arise when the users of a common ocean aren't at the same economic level – a key factor in any climate change agreement.

As incremental and complex such regional agreements might prove, Honocque believes that such a regional approach may really be the only way to stop the ocean's decline. “It's going to take time but I see that as the only solution to really tackle on a big scale and in a long-term and efficient way the maritime socio-economics system which is not only the environment but the users,” he says.

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