

New rumble resounds through Pacific

Oceanographers this month added a new sound to the deep sea in an effort to gauge the Pacific's temperature and to investigate global warming. The experiment, known as Acoustic Thermometry of Ocean Climate (ATOC), started after 18 months of delays triggered by environmental groups worried about the broadcasts' effects on marine life.

The ATOC team, led by researchers at the Scripps Institution of Oceanography in La Jolla, Calif., originally planned to send 200-watt transmissions every 4 hours from submerged speakers located off the coast of California and Hawaii. Listening posts around the Pacific would time the arrival of the extremely faint signals. The warmer the water, the more rapidly sound travels, so ATOC can reveal large-scale changes in ocean temperature (SN: 6/3/95, p.350).

In the face of strong protests, the experiment's organizers altered ATOC by reducing transmissions to only 1 day in 4. They also relinquished control of the sound transmitters to marine biologists, who plan to spend the next 10 months assessing how animals react to the low-frequency rumble. A transmitter 88 kilometers off San Francisco began sending signals Dec. 2, but ATOC participants await final approval from the state of Hawaii for broadcasts from Hawaiian waters.

Even during the biological phase of the experiment, researchers can gather useful climate data, says Andrew Forbes, ATOC's project manager. If the current tests show no harm to marine animals, the team could, in principle, move forward with full-scale climate measurements. By that time, however, funding for the 4-year, \$38 million experiment will have run out. Oceanographers must therefore apply for new funds to continue the acoustic thermometry, says Forbes.

The year of the hurricane

The Atlantic Ocean served up a roaring roster of hurricanes and tropical storms this year, making the 1995 hurricane season the second-busiest since the late 1800s. Meteorologists with the National Oceanic and Atmospheric Administration blame the surfeit of storms on a combination of far-flung weather factors reaching from the Pacific Ocean to Africa.

The Atlantic hurricane season ended on Nov. 31 after a total of 19 named tropical storms, 11 of which reached hurricane status. The average year spawns only 10 tropical storms, including 6 hurricanes.

The 1995 season stood out even more because each of the last 4 years has produced unusually few storms, in part because of a prolonged Pacific warming known as El Niño. This warmth disrupted atmospheric weather patterns around the globe and churned up air over the subtropical North Atlantic, birthplace of Atlantic hurricanes. Intense wind shear prevented infant weather systems from becoming major storms.

When El Niño died in early 1995 and Pacific temperatures returned to normal, wind shear over the Atlantic weakened, creating an environment conducive to storms.

Conditions in the stratosphere high above the equator also aided hurricane development. Although meteorologists do not understand the connection, they have noted that more tropical storms appear during years when stratospheric winds stream from west to east, as they did this year.

The 1995 hurricane season received a further boost from enhanced rainfall over the Gulf of Guinea late last year. The extra precipitation moistened West Africa's rainy season this year, stimulating strong low-pressure systems over the continent. When these disturbances move westward over the Atlantic, they can become embryonic storms.

Judging from current conditions around the globe, William M. Gray of Colorado State University in Fort Collins predicts that next year should bring an average hurricane season.

Fishing: What we don't keep

As any angler knows, fish thrown back—because they're too small, the wrong type, or hunted only for sport—often don't survive. Because of the trauma they undergo when they are hauled in the net and taken out of the water for sorting, virtually all fish that commercial trawlers throw back are dead by the time they hit the water. This by-catch can be staggering, a new study illustrates.

In work done for the Alaska Department of Fish and Game (ADFG), Larry Cotter of Pacific Associates in Juneau sieved through an ocean of 1994 data for groundfish harvested commercially in the Bering Sea, Aleutian Islands, and Gulf of Alaska. The National Marine Fisheries Service (NMFS) defines as groundfish nearly all area fish except salmon, crab, halibut, and herring. Cotter's analysis, released earlier this month, reports that fishers discard 15 percent—some 651 million pounds—of the annual groundfish catch.

These discards included about 17 million pounds of halibut, 4 million pounds of herring, 400,000 individual salmon, and 15.5 million crabs. Ironically, though most trawlers had fished for pollack, this species accounted for more than 245 million pounds of discards, most of them the wrong sex or size.

With overharvesting causing the collapse of many fisheries around the world, Alaska Governor Tony Knowles responded to the report by proposing a new policy to make fishers keep all they catch, even the wrong sex and size. Indeed, he argued, last year's groundfish discards would have provided roughly 50 million meals.

However, notes Andrew Smoker of NMFS in Juneau, the law demands that fishers discard some types of by-catch, such as halibut. The requirement aims at discouraging trawlers from circumventing halibut fishery management by bringing in this valuable species as a by-catch.

A United Nations treaty, opened for signatures last week (SN: 12/9/95, p.389), also addresses by-catch losses of highly migratory fish and stocks—such as the pollack—that straddle nations' 200-mile exclusive economic zones. The treaty would require the ratifying nations to minimize such waste "through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques."

Reproductive changes from overfishing

Before the collapse of cod fisheries off Canada's maritime provinces recently, annual harvests often removed 60 percent of the older adults. That was three times the recommended amount to sustain healthy stocks, notes Edward A. Trippel of the Department of Fisheries and Oceans in St. Andrews, New Brunswick. In many species of overexploited fish—including haddock, flounder, and cod—females have responded by beginning to spawn at an earlier age. While rebuilding the stocks rapidly, this response poses population risks, he argues in the December *BIOSCIENCE*.

In some cod stocks over the last 20 years, for instance, the age at first spawning has been nearly halved—from 5 or 6 years to less than 3. Trippel even cites an unpublished finding that Georges Bank cod spawn at 1.87 years old.

These younger breeders, which make up an increasingly large proportion of stressed stocks, not only weigh less but produce fewer and smaller eggs. For instance, the volume of a cod's egg drops by about 38 percent as the mother's length falls from 25.5 inches to 19. While a 17-inch spawner may release 370,000 eggs, he reports, veterans 34 inches long may produce 3.2 million.

Because bigger eggs yield larger, stronger, more active hatchlings, Trippel argues that moms' decreasing body size makes new generations increasingly vulnerable to predation.