thermore, that paper cites unpublished work by the group suggesting that the proteins may also be involved in the movements of the growing tips of neurons and might thus contribute to axonal migration during development and synapse formation. If all this is borne out by future work, APP may turn out to have more talents than anyone suspected.

–JEAN MARX

MARINE BIOLOGY

Interest Blooms in Growing Jellyfish Boom

SAN FRANCISCO, CALIFORNIA—A jellyfish invasion might sound like the plot of a bad movie on late-night TV. But the pulsing, tentacled predators were a star attraction at a marine science meeting* here last week.

Populations of some jellyfish appear to be exploding in several parts of the world, U.S. and Russian scientists reported, raising fears that they are taking over ecosystems that nurture key commercial fish stocks. The Gulf of Mexico and the Bering and Black seas have been particularly hard hit. In some cases, however, researchers don't know whether the blooms are unusual or just natural population fluctuations, says Claudia Mills, a jellyfish expert at the University of Washington's marine laboratory in Friday Harbor.

In the Bering Sea off Alaska, the population of *Chrysaora melanaster* has jumped at least 10-fold over the past decade, reaching record numbers last year, reported biologist Richard Brodeur of the National Marine Fisheries Service in Newport, Oregon. Brodeur suspects that long-term climate shifts, which have affected ice cover and water temperatures, may explain the increase. But whatever the cause, the huge summer blooms could deliver a two-fisted punch to the Bering's fish stocks, which account for 5% of the world's catch.

The problem is that the 2-meter-long jellyfish not only compete for food with young pollock—one of the Bering's most valuable fish—but also feed on them. In a 1999 study conducted off the Pribilof Islands, Brodeur reported, the jellyfish consumed about 5% of the annual crop of zooplankton and about 3% of newborn pollock. Some fishing boat captains now avoid one area, dubbed "Slime Bank," because countless jellyfish foul their nets.

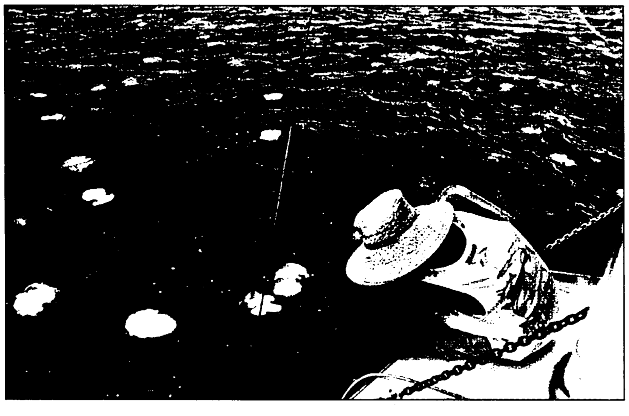
In the northern Gulf of Mexico, a foreign jellyfish produced a huge bloom last summer, reported Monty Graham of Alabama's Dauphin Island Sea Lab. Native to the tropical Pacific Ocean, *Phyllorhiza punctata* apparently drifted in from the Caribbean. Now, Graham and colleagues are waiting to see whether it and several native species continue to thrive, perhaps encouraged by declining coastal water quality and a growing thicket of offshore oil-drilling platforms. The platforms' steel legs, Graham speculates, may be one source of the hard substrate that jellyfish polyps—a bottom-dwelling life stage—need to thrive.

Russian scientists, meanwhile, are keeping a close eye on booming Black Sea jellyfish, which have contributed to falling anchovy catches in the past several decades. Tamara Shiganova of the Shirshov Institute of Oceanology in Gelendzhik, Russia, noted that two species—one apparently native and the other introduced from the western Atlantic Ocean—now appear in often alternating blooms, vacuuming up the plankton that feed young fish. The Atlantic invader, *Mnemiopsis leidyi*, may soon get its comeuppance, however, because yet another exotic jellyfish has arrived—one that feasts on *M. leidyi*. Meanwhile, *Mnemiopsis* has invaded the nearby Caspian Sea, prompting fears that it could endanger a threatened seal species by reducing fish populations.

On the flip side, notes Mills, some jellyfish have disappeared—along with other marine species—with little notice from polluted coastal waters, such as the Adriatic Sea and Puget Sound. Determining how such departures and arrivals influence complicated marine food webs will be difficult work, she says, involving laborious field surveys and careful counts of the contents of jellyfish's stomachs. Handling their gelatinous, watery bodies and stinging tentacles can be a chore, she adds: "Jellyfish can be really unpleasant."

–DAVID MALAKOFF

* Second Symposium on Marine Conservation Biology, 22–25 June.



Gelatinous onslaught. Jellyfish blooms, like this one in the Gulf of Mexico, present a puzzle.

CREDITS: (TOP TO BOTTOM) GREGORY OCHOCKI/PHOTO RESEARCHERS; MONTY GRAHAM

Going with the flow. Harbor seals use their whiskers to follow trails of turbulence.

MARINE MAMMALS

By a Whisker, Harbor Seals Catch Their Prey

When mammals began to colonize the ocean some 50 million years ago, they immediately faced a huge challenge: hunting under water. The sharp vision their ancestors had evolved on land to take advantage of the transparency of air was of little use in the ocean's murky darkness.

Some species of dolphins and whales adapted to the new environment by evolving echolocation, which allows them to "see" with their ears. How other marine mammals manage to hunt without echolocation has long been a mystery, though. On page 102, German researchers report that part of the answer has been hiding in plain view: They use their whiskers.

Earlier studies by several researchers had shown that seal whiskers are remarkably sensitive to even the slightest bending. "They can use whiskers like we can use our hands for object identification," explains Guido Dehnhardt of Ruhr University Bochum in Germany. "They can measure the height of objects, they can discriminate different shapes, and they can very accurately determine an object's surface." In 1998 Dehnhardt, then at the University of Bonn, and his colleagues showed that whiskers are not just sensitive to objects but even to tiny movements of water generated by passing fish.

Given this exquisite sensitivity, seals might use their whiskers at close quarters to detect moving prey and then identify them by touch, some researchers speculated. But they assumed that a fish's wake would vanish too quickly to help the seal stalk its prey over longer distances.

Skeptical, Dehnhardt's colleagues at the University of Bonn decided to test real fish in real water. As they reported last year in the *Journal of Experimental Biology*, a goldfish leaves behind swirling vortices that can linger for up to 30 seconds. In addition, the water in the goldfish's wake continues to flow significantly faster than the surrounding water for as long as 3 minutes. Based on these results, they calculated that the larger fish that seals favor (such as herring) might leave trails as long as 180 meters. These wakes might serve as the underwater equivalent of a bloodhound's scent trail—if a seal had the sensory equipment to detect it.

Dehnhardt and his colleagues tested this possibility by training two harbor seals to chase a miniature, propeller-driven submarine. After the seals had learned the task, the team placed a mask over their eyes and headphones over their ears before launching the sub. After shutting off the sub's motor to eliminate acoustic clues, the researchers removed the headphones and allowed the blindfolded seals to begin their search. Even without the use of their eyes, the seals quickly began tracking the sub. Several lines of evidence suggest that the seals were relying solely on their whiskers. They closely followed the wake of a sub taking a curving path, even though sound waves and electrical fields would have guided them in a straight line instead. Moreover, once a seal found the sub's wake, it lost it in only 3% of the trials. To eliminate the possibility that the seals were actually following some chemical taste, the researchers masked the seals' whiskers and left only their mouths uncovered. Significantly, the seals always failed these trials.

"Fascinating work," says Paul Nachtigall of the University of Hawaii, Manoa. "Dehnhardt is picking up an old problem that was a huge controversy but that nobody ever really explained. And his idea makes good sense."

Markus Horning of Texas A&M University in Galveston calls the work "a huge step forward in pinniped foraging behavior and ecology." It can, for example, explain some of the observations that Horning and his coworkers have made of Weddell seals hunting under the antarctic ice (*Science*, 12 February 1999, p. 993). Cameras placed on the back of the seals showed them swimming along curving paths just before catching fish. "The path that the seals take is what we'd expect if they were following a hydrodynamic trail," says Dehnhardt.

Seals may not be the only animals that follow hydrodynamic trails to hunt in murky waters. "Only the toothed whales such as dolphins and sperm whales have sonar systems," Dehnhardt points out. "And it's interesting that all the other [marine mammals] have well-developed whiskers." Far from simply being vestigial hairs, whiskers may ultimately prove to be the eyes of the ocean.

—**CARL ZIMMER**

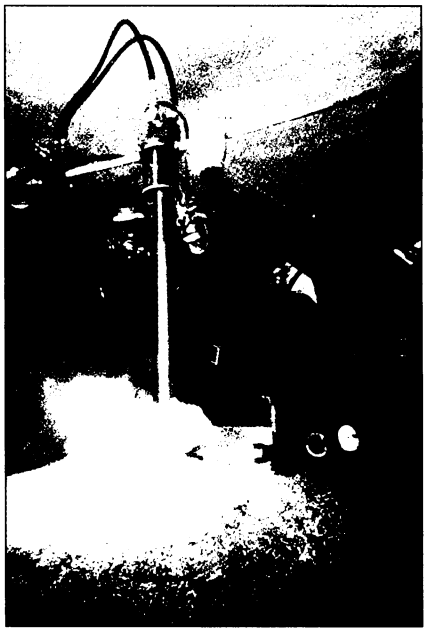
Carl Zimmer is the author of *Parasite Rex* and *At the Water's Edge*.

CLIMATE CHANGE

Experts Urge Speedup To Mine 'Archives'

BERN, SWITZERLAND—The disappearance of tropical ice caps, giant coral heads, and old-growth teak forests is taking its toll on present-day ecosystems. But a group of prominent scientists say that such environmental assaults also rob them of an important source of data about past climates—and they want international action before it's too late.

"Unfortunately, some of the most valuable paleoclimate archives are being rapidly destroyed, largely as a result of human influences. We cannot afford such an irreversible loss," the researchers write in a letter published on page 47. In the letter, and in a session planned for an international meeting on global change next week in Amsterdam, the scientists propose a Global Paleoclimate Observing System (GPOS) for gathering indirect "proxy" data on climate change.



Threatened. Dying corals could erase centuries of paleoclimate data.

CREDIT: PAGES–IGBP

Bits and pieces of such data are already being collected through various national and international research programs, but the major international climate observation systems have no significant paleo component. And because no one can stop ice caps or glaciers from melting, researchers want to tap data-rich ice cores and other proxy samples or data before they disappear. Raymond S. Bradley, one of the main organizers of the paleoclimate initiative, who heads the geosciences department at the University of Massachusetts, Amherst, likens it to rescuing deteriorating books or magnetic tapes. But instead of being in library basements, the proxy paleoclimate archives are scattered across the globe, from the sea floor to alpine glaciers.

"It is a major scientific loss if we have not sampled 500-year-old trees that are being cut down to make furniture, or corals being blown up to make room for piers, or rapidly melting ice caps," Bradley says. By analyzing such sources, he explains, scientists can obtain a long-term view of climate change that is lacking in present-day measurements.

The researchers concede that their proposal lacks details. Some want to see new networks of paleoclimate experts—each specializing in specific climate systems—that would help coordinate research and share data through the existing World Data Center for Paleoclimatology in Boulder, Colorado. Others, such as geoscientist Lonnie G. Thompson of Ohio State University's Byrd Polar Research Center in Columbus, suggest a "virtual institute" to coordinate detailed regional studies of proxy archives. Keith Alverson, who directs Past Global Changes, a Bern-based group that promotes international paleoclimate research, says researchers in different countries should adopt standards that make it easier for them to pool their data. One way to do that would be to persuade U.N.–sponsored climate-monitoring programs—the Global Climate Observing System, Global Terrestrial Observing System, and Global Ocean Observing System—to add paleo data to their efforts, he suggests.

Although other paleoclimate experts embrace the intent of the letter, some question the need for a new structure. David J. Verardo, director of the paleoclimate program at the U.S. National Science Foundation—perhaps the world's top funder of such research—says that the U.S. Global Change Research Program already supports efforts to recover and store the sort of information GPOS's advocates are concerned about. More money for existing research programs may be all that is needed, he says.

But GPOS advocates want a more systematic approach. "We have to prioritize the vanishing archives and retrieve as much of the data as we can now," says Alverson, who thinks an international effort is necessary. "An awful lot of irreplaceable information is being lost. A decade from now, it may be too late."

—**ROBERT KOENIG**