us with an important tool to ensure that we harvest the potential that biotechnology holds for consumers in a responsible way."

–PHILIPP WEIS

CLIMATE

River Flow Could Derail Crucial Ocean Current

Some of the biggest rivers in the world are dumping 7% more water into the Arctic Ocean than they were in the 1930s—an increase of 128 cubic kilometers per year. The finding, reported on page 2171, fits well with climate-model predictions that precipitation at high latitudes will increase as global temperature climbs. If the warming trend continues, the influx of fresh water could have a major impact on ocean circulation and northern climate. But many experts caution that too little is known to make any solid predictions about such effects. "I would call this intriguingly important," says Bert Semtner, an oceanographer at the Naval Postgraduate School in Monterey, California.

Freshening up. Large Eurasian rivers such as the Yenisey are pouring more fresh water into the Arctic Ocean.

To get the results, ecosystem scientist Bruce Peterson and colleagues at the Marine Biological Laboratory in Woods Hole, Massachusetts, teamed with hydrologists from the University of New Hampshire, Durham, and the State Hydrological Institute in St. Petersburg, Russia, to analyze discharge records for six major Eurasian rivers. The records spanned 64 years, about twice as long as comparable records for major Arctic rivers in North America. Figures for each river varied widely from year to year but, on average, the total annual runoff increased by 2 cubic kilometers each year.

Global warming is likely to be causing the increase, climatologists say. Higher temperatures mean more evaporation, especially in the subtropics. Warmer air can hold more moisture, which then precipitates as air masses move to high latitudes, leading to an increase in river discharge. "There is no other measure of change in [the] Arctic freshwater budget that's as accurate and comprehensive," Peterson says.

The researchers estimate that for each degree of global warming, these six Eurasian rivers would pour an extra 212 km^3 per year into the Arctic Ocean. If global temperature rises by 5.8 degrees Celsius by 2100—the upper end of estimates from the Intergovernmental Panel on Climate Change's (IPCC's) 2001 report*—the rivers might increase freshwater flow to the Arctic Ocean by 1260 km^3 per year.

"It's a worrying number," says co-author Stefan Rahmstorf, a climatologist at the Potsdam Institute for Climate Impact Research in Germany. Increasing river runoff, he explains, might put the brakes on an important current in the North Atlantic called the thermohaline circulation (THC). Under present conditions, cold, salty surface waters sink to great depths and then move south, while warmer water on the surface moves northward. Any freshening of the surface waters in the North Atlantic would reduce the seawater density and slow the THC.

Climate models by Rahmstorf and colleagues at Princeton University suggest that the IPCC's worst-case warming scenario would put discharge in the ballpark of the amount needed to bring the THC to a halt. Contributions from other Arctic rivers, precipitation onto the Arctic Ocean, and melting ice (such as that on the Greenland ice cap) could push the THC across the threshold. That would put a damper on warming near the North Atlantic, Rahmstorf says. THC shutdowns have had severe consequences in the past, he points out: 11,000 years ago, a sudden, massive pulse of freshwater into the North Atlantic chilled Europe. "It's not just an odd thing that happens in models," Rahmstorf says.

Much remains to be learned. "I would be very careful about anything more than very loose speculation on the influence of the runoff and changes in the overturning of the North Atlantic," says Knut Aagaard, an oceanographer at the University of Washington, Seattle. Some researchers, for example, question how much influence additional discharge could have on the THC. Semtner says that factors such as direct warming of the ocean surface might have more sway in weakening the THC. That's one question that may be clarified by researchers participating in the Coupled Model Intercomparison Project. They are now running six major climate models, all including a major pulse of freshwater from the Arctic Ocean. Results are expected to be released next spring. –ERIK STOKSTAD

* IPCC, *Third Assessment Report—Climate Change 2001.*

FISHERIES SCIENCE

Report Seeks Answers To Marine Mystery

A sleek sea lion with a hefty appetite for fish could become the centerpiece of a massive ecological experiment. A panel of the National Academies* last week recommended that the U.S. government run a decade-long test off Alaska to determine whether commercial fishing is a threat to Alaska's dwindling Steller sea lion population. The advice, requested by Congress, could help settle a high-stakes dispute over catch restrictions in one of the world's most valuable fisheries.

"You need to do something at this [large] scale if you want to understand what's driving the [population] decline," says panel member Larry Crowder, a fisheries biologist at Duke University in Durham, North Carolina. "But it's not an easy thing to pull off."

Steller sea lions once dotted North Pacific shores from California to Japan, with an estimated 70% living in Alaskan waters. Over the last 30 years, however, Alaskan populations have plummeted by 80%, to fewer than 70,000 animals. Scientists have long debated the cause. Whereas some blame fishing boats for taking too much of the mammals' prey, others finger climate change, predators, disease, or poaching.

* *The Decline of the Steller Sea Lion in Alaskan Waters*, National Research Council, 2002 (www.nap.edu/catalog/10576.html).

Barking for answers. Researchers want to test whether fishing threatens Steller sea lions.

CREDITS: (TOP TO BOTTOM) ROBERT MAX HOLMES/MARINE BIOLOGICAL LABORATORY; KENNAN WARD/CORBIS

Two years ago, federal biologists concluded that commercial fishers catching pollock and other groundfish posed a serious threat to the sea lion's recovery, and they imposed major restrictions on Alaska's $1 billion fishery. That alarmed Senator Ted Stevens (R–AK) and other members of Congress, who ordered the academies' study.

In a preliminary report issued 4 December, a panel led by zoologist Robert Paine of the University of Washington, Seattle, concludes that fishing probably isn't the major cause of recent population losses. But it says that commercial catches can't be ruled out as a significant problem. In hopes of resolving the issue, the committee recommends setting up four experimental zones in Alaskan waters. Fishing would be banned for up to 50 nautical miles around two sea lion breeding colonies and permitted near two others. Biologists would then compare sea lion population trends. The experiment "is the only approach that directly tests the role of fishing in the decline" while controlling for other factors, such as climate change, the panel says.

Fishing industry representatives appear relieved that the academies didn't put the blame squarely on them. And ecologists are pleased by a renewed call for what they say would be one of the biggest real-world ecological experiments ever, albeit a tardy one. "It should have been done 10 years ago; it's a shame we've waited this long," says Andrew Trites, a marine mammal specialist at the University of British Columbia, Vancouver.

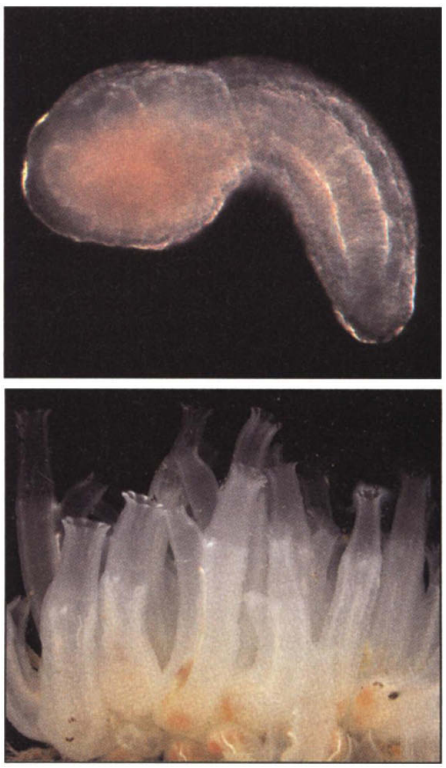
The National Marine Fisheries Service must approve any test, and no decision is expected until sometime next year. The panel will shortly release a final version of its report. –DAVID MALAKOFF

COMPARATIVE GENOMICS

Tunicate Genome Shows a Little Backbone

This week, researchers are unveiling the DNA code of one of the most unusual creatures sequenced to date: the sea squirt. These tiny marine animals have long captivated biologists because even though the adults are typical, squishy invertebrates, their larvae might be modern doppelgängers of the ancestor to the vertebrates.

The genome sequence of the sea squirt *Ciona intestinalis* "will help us unzip several evolutionary changes that occurred at the transition between invertebrates and vertebrates," says Paolo Sordino of the Zoological Station in Naples, Italy. *Ciona*'s branch on the evolutionary tree puts it closer to humans than are other invertebrates whose genomes have been sequenced, such as nematodes and fruit flies, but farther away than mice are. As such, it offers a different view of the history of human DNA.



Telltale tunicate. Vertebrate-like traits in the sea squirt larva (*top*) prompted the sequencing of its genome.

Sea squirts have puzzled biologists for more than a century. The adults live attached to pilings, rocks, and boat bottoms. Their bodies are cloaked in a leathery sheath, or tunic—hence their scientific name, tunicates. Charles Darwin thought they were relatives of mollusks. In the mid-1800s, Russian biologist Alexander Kowalevsky countered that the mobile tunicate tadpole, with its dorsal cartilaginous column resembling a spine, should be grouped with vertebrates and not clams and snails—even though tunicates never develop a backbone. His view stuck: Now any species that even temporarily possesses a dorsal nerve cord, notochord, primitive brain, and a few other traits is considered a chordate, a member of the phylum that includes vertebrates.

Some evolutionary biologists once argued that tunicates gave rise to backboned critters. That view has been abandoned in favor of a history in which the two simply share a common ancestor. Nonetheless, this sequence "is an opportunity to peek into the [early] chordate condition from a genomic point of view," says Sean Carroll, an evolution and development (evo-devo) researcher at the University of Wisconsin, Madison.

In early 2001, sea squirt researchers Nori Satoh of Kyoto University in Japan and Michael Levine and Daniel Rokhsar of the University of California, Berkeley, convinced the sequencers at the Department of Energy

CREDITS: P. DEHAL *ET AL.*

ScienceScope

Mass Protest The rectors of Italy's 77 state universities resigned en masse this week to protest government plans to cut budgets and freeze hiring. The dramatic move came as Parliament debated plans to cut spending at some universities and research institutions by up to one-third.

The resignations—which can still be withdrawn—are "a consequence of a policy of dismantling research and university culture," says Flaminia Saccá of Rome University, who also handles research policy for Italy's largest opposition party, the "Democrats of the Left." The protesters want lawmakers to restore budget increases promised by previous governments or to at least minimize cuts.

Italy's finance ministry called the move "impetuous," because lawmakers are still hammering out the final budget. But the rectors say the risky gesture was necessary to call attention to academia's financial plight. As *Science* went to press, researchers said the issue could be resolved soon.

Chain Reaction Saddled with legal bills, a Japanese researcher once accused of industrial espionage is suing a former friend for $770,000. Hiroaki Serizawa, a biologist at the University of Kansas Medical Center in Kansas City, has told a Tokyo court that he was deceived by Alzheimer's researcher Takashi Okamoto, who allegedly asked him to hold biological materials taken from the Cleveland Clinic in Ohio (*Science*, 18 May 2001, p. 1274).

Last year, U.S. prosecutors charged the two scientists with conspiring to export "trade secrets." They later dropped the espionage charges against Serizawa, who remains in the United States, but they are still seeking to extradite Okamoto from Japan for trial in Ohio. Serizawa is prepared to testify against Okamoto, says Serizawa's attorney, Patrick McLaughlin of McLaughlin & McCaffrey in Cleveland. In the meantime, he needs to pay legal fees—and he is suing Okamoto for help. The Tokyo court will start hearing the case next week. Okamoto's attorney could not be reached.

Serizawa is also job hunting after being denied tenure by the University of Kansas. But that task has been complicated by his decision to plead guilty to one count of giving the FBI false information. It's difficult, says McLaughlin, "to recover from damage like that to one's professional reputation."

Contributors: Pallava Bagla, Andrew Lawler, Leigh Dayton, Jocelyn Kaiser, Alexander Hellemans, Dennis Normile