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.

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