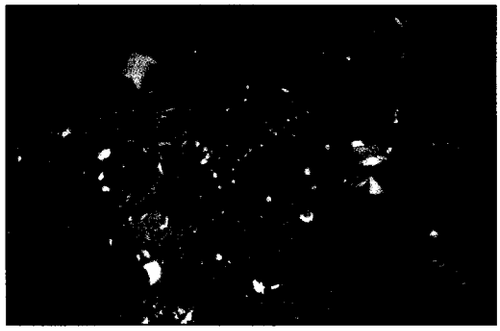
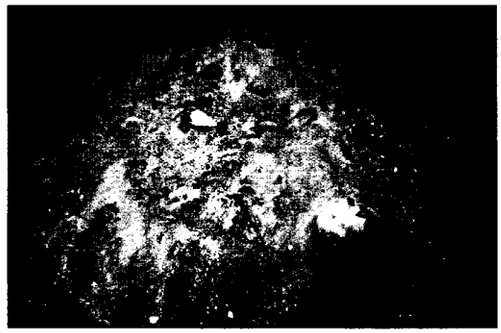
kilometers deep. At the press conference, which included Hollywood star Ted Danson, scientists and environmentalists called on governments to establish more marine reserves where trawling—but not all fishing—is banned. "We cannot continue to allow the use of trawling on such a broad scale if we are going to sustain fish habitat and marine biodiversity," said biologist Peter Auster of the University of Connecticut, Avery Point, author of one of the papers.

The most controversial paper, by Les Watling, a biologist at the University of Maine, Orono, and Elliott Norse of the Redmond, Washington–based Marine Conservation Biology Institute, equates the habitat damage caused by trawling with forest clear-cutting—long denounced by biologists as a major threat to biodiversity. Both techniques, the researchers argue, transform structurally complex habitats supporting many kinds of life into relatively flat, uniform environments that shelter fewer species. But trawlers cover far more ground than loggers, say Watling and Norse. Their estimate, based on scanty industry records, is that the worldwide fleet of trawlers drag up to 15 million square kilometers annually—an area 150 times greater than the forest cleared each year. Unlike loggers, however, some trawlers may sweep the same seafloor patches many times in a single year, leaving little time for slow-growing organisms to regain their toeholds. Trawling's long reach "was not previously appreciated," the pair concludes. "With the possible exception of agriculture, we doubt that any other human activity physically disturbs the biosphere to this degree."





Net loss. A patch of seafloor off Swan's Island, Maine, before (left) and after the area was swept by a scallop dragger.

CREDIT: PETER AUSTER

Another of the new studies, led by Jonna Engel of the Moss Landing Marine Laboratory in California, is among the first to document the change in biodiversity from trawling. Using sonar, video images taken from submarines, and samples of seafloor life, it compared a repeatedly trawled seabed 180 kilometers off the central California coast with a nearby swathe that was dragged less often. Engel's team found that the heavily trawled area was flatter and harbored fewer species than the lightly fished stretch. They also found that increased trawling reshuffled sea life communities: smaller, rapidly reproducing creatures—such as nematode worms—tended to replace larger, longer-lived organisms, such as some shellfish. Other studies suggest the ecological changes can persist for months or longer after trawling ends.

The idea that trawling produces undersea winners and losers also surfaced at last week's conference in Wales, which featured work in European waters. Dutch researchers, for instance, found that a century of trawling may have reshaped parts of the North Sea's floor into perfect habitat for Dover sole, a sought-after catch, and swept away less adaptable creatures, such as delicate anemones. "It's ironic that destructive fishing activity appears to have created just the kind of flat, homogenized habitat that sole prefer," says conference organizer Michel Kaiser of the University of Wales in Bangor.

Fishing industry officials point to such results in arguing that policy-makers need more information before establishing trawl-free zones. Trawlers and marine biologists agree that "some gear does impact some bottom types during some fishing operations," says Nils Stolpe of the New Jersey Seafood Harvester's Association in Bucks County, New Jersey. But "there isn't anything approaching a consensus on the effects, positive or negative."

And even some ocean protection advocates are uneasy about tarring trawling with clear-cutting's reputation. The analogy is "inaccurate at best and incendiary at worst," says Dery Bennett, head of the American Littoral Society, a coastal protection group based in Highlands, New Jersey. Trawled areas, he believes, generally recover far more quickly than clear cuts if left alone. In addition, he says, the comparison may poison the atmosphere for scientists and fishermen working together to ban trawling in particularly sensitive areas such as coral reefs and nursing grounds for young fish.

The United States has already taken limited steps toward protecting reefs and some nursing grounds, notes National Marine Fisheries Service deputy director Andy Rosenberg. But he says policy-makers will want more specific information before closing more waters to trawling. "The science is still spotty and too inconclusive," he says. The new studies, he adds, "should really help the policy debate move forward."

–DAVID MALAKOFF

PARTICLE PHYSICS

A Second Hint of Symmetry Violation

CHICAGO—The first glimpse of stocking may once have been looked on as shocking, as the classic musical has it, but the second one was eagerly anticipated. For more than 30 years that's been true in physics, ever since experimenters studying the decay of particles called kaons in 1964 were shocked by a violation of their beloved laws of nature. Since then they have realized that the effect, a basic asymmetry in physics called CP violation, might explain why the universe contains more matter than antimatter, and they have been eager to get a second look at it in other particles. Now another case of CP violation may finally be showing its ankle, in particles called B mesons.

The evidence is tantalizing but not conclusive, says Al Goshaw of Duke University and co-spokesperson of the Collider Detector at Fermilab (CDF) collaboration, whose paper on the work is soon to appear in *Physical Review Letters*. "If it's there, we'll see it" with more data, he adds. And plenty of data are on the way at Fermilab's Tevatron accelerator, when its Main Injector, which will increase the luminosity of the colliding beams of particles, fires up in 2000, producing hundreds of times more B mesons. The results should also be encouraging for physicists at the Stanford Linear Accelerator's so-called B factory, a particle accelerator specifically designed to study CP violation in B mesons, which could begin taking data by April next year.

The asymmetry that these physicists are so eagerly pursuing is a subtle difference in the behavior of particles when their charges are reversed and space is reflected about the three axes. Because that transformation turns matter into antimatter, any difference in behavior, such as reaction rates, under a CP transformation could help explain why there is much more matter than antimatter in the universe. Since the effect was spotted in kaons, it had not turned up in any other particle, and physi-

cists have wondered whether CP violation is a general principle of nature or is somehow restricted to a single system.

Its expected signature in the CDF experiments was a slight difference in the rate at which B mesons and anti-B mesons decay to a particular set of particles. In an analysis led by a group at the Massachusetts Institute of Technology, the collaboration studied the decays of about 200 B and anti-B mesons created in the debris of proton-antiproton collisions and saw a lower decay frequency for B mesons—but with a weak statistical confidence. "We're not claiming a detection," says Barry Wicklund, a CDF collaborator at Argonne National Laboratory—just a hint of indecorous behavior to come.

–JAMES GLANZ

CHINA

15 New Projects Bolster Basic Research

BEIJING—After an intense nationwide competition, China has selected 15 projects to inaugurate one of the largest basic research programs in the country's history. The program, which will receive $300 million and run through 2003, has been endorsed at the highest level: "It is a top concern to make China prosper through science and education," says Premier Zhu Rongji. The winning projects (see table) will be officially announced next week by the Ministry of Science and Technology (MOST).

In transition. Wu Wenjun cedes control to student.

The projects, which concentrate R&D resources in rapidly growing fields that are expected to contribute to the country's economic prosperity, are the first to be awarded under an initiative called Program 973. It's named for the year and month (March 1997) it was proposed by the National Committee of the Chinese People's Political Consultative Conference, China's top consultative body. The competition was fierce. Scientists at the Chinese Academy of Sciences (CAS), universities, and government agencies submitted 207 proposals in six areas that the government designated as national priorities. Specialist reviewers winnowed the contenders to 25, and a 19-member cross-disciplinary expert panel made the final selection after hearing presentations from researchers and relevant agency officials.

"The officials related the state's needs in each field, a very important factor in the panel's decision making," explains Shao Liqin, deputy director-general of MOST's Department of Basic Research. The program is seen as complementing a 1991 initiative aimed at stimulating applied research in strategic areas. To encourage younger scientists, says Zhu Lilan, the government also required that principal investigators should be less than 60 years old.

Another 10 projects are still in the running, says Zhang Cunhao, deputy chair of the expert panel and president of the National Natural Science Foundation (NNSF), which coordinated the review with MOST. "They can re-enter next year" as part of plans to hold an annual competition through 2003, he says, "and some of them have high hopes of being endorsed as key projects," he says. Each 973 project is expected to receive between $2.5 million and $7.5 million over 5 years, which dwarfs the amounts given out by NNSF. "The input into each of the 15 projects is 10 times" what NNSF would normally provide, Zhang says.

Although the 15 projects span the six priority areas, Science and Technology Minister Zhu Lilan says some important fields are not represented because of a dearth of eligible applications. One notable omission, she says, is research into how to improve prenatal care and reduce the number of babies born each year with disabilities. While the need is great, she adds, no high-quality proposals were submitted. "It seems that some scientists capable of doing the research in this area have not paid enough attention to this issue."

Scientists whose projects were chosen for the program welcome the additional resources. Wu Wenjun, a mathematician with the CAS Systems Science Institute in Beijing and a member of CAS, says that the new grant will quadruple funding, to nearly $500,000 a year, for his lab's work on developing expert systems. "So, we will be able to do things that were impossible before," he says. "We can develop our own software and apply our findings to reality instead of only exploring such applications in theory." Wu, in his 70s, has ceded control over the project to one of his students, 35-year-old Gao Xiaoshan, in keeping with the stated principle that the research projects should be headed by younger scientists. "It's high time to allow young people to display their talents," he says.

The 973 program is only one of several channels that the Chinese government is using to increase support for basic research. In June, Premier Zhu approved a Knowledge Innovation Program at CAS that will provide $650 million over 3 years to strengthen basic research across the academy. CAS is in the process of consolidating or closing roughly one-third of its 120 institutes. MOST is already supporting some 200 national key labs, which received $10.5 million this year. And the government recently announced that money for the construction and operation of large-scale scientific projects will grow by some $240 million over the next 5 years. University-based research should also benefit from a government pledge to boost education spending by one percentage point of the country's domestic national product each year for the next 5 years, says Shao.

–XIONG LEI

Xiong Lei writes for *China Features* in Beijing.

CHINA'S TOP PROJECTS*

	Life sciences
(1)	Create and maintain system to study "disease" genes
(8)	Strengthen search for new treatments against major diseases
(13)	Basic research on formation and growth of tumors
	Information science
(2)	Applied theory and high-performance software in information technology
(3)	Graphic, phonetic, and natural language comprehension and cognition
(3)	Mathematical mechanization and automated reasoning platform
	Agriculture
(5)	Mechanisms of photosynthesis and its application to agriculture
(13)	Development and application of core collections of crop germplasm
	Resources and the environment
(6)	Mechanisms and forecasting of strong continental earthquakes
(6)	Basic research on rare-earth materials
(8)	Formation and evolution of the Qinghai-Tibet Plateau and its impact on the environment and resources
(10)	Improved forecasting of major climatological and meteorological disasters
	Energy resources
(10)	Hazard prevention at China's major power systems
	New materials
(10)	Mechanisms, structure, and preparation of functional crystal materials
(15)	Basic research on a new generation of steelmaking

SOURCE: STATE COUNCIL OF CHINA
* RANKINGS BASED ON VOTING BY REVIEWERS, INCLUDING TIES.

Ranked research. Life and information sciences lead the way in new basic research program.

CREDITS: CAS