



### Marine biodiversity

## Every little fish

### New research points to a better way of protecting fish stocks

EVERYBODY knows that global fish stocks are heading for collapse. That is why governments try to limit the amount of fish taken out of the sea. But recent research suggests that the world is going about regulating fishing the wrong way—that fish stocks would fare better if efforts were made to protect entire ecosystems rather than individual species.

There are plenty of data to prove the importance of diversity on dry land. Until recently, however, there was little evidence that the same was the case in the oceans, which make up 90% of the biosphere, and on which a billion people rely for their livelihoods.

In order to establish whether diversity matters in the sea as well as on land, 11 marine biologists, along with three economists, have spent the past three years crunching all the numbers they could lay their hands on. These ranged from the current United Nations Food and Agriculture Organisation's database to information hundreds of years old, gleaned from kitchen records and archaeology. The results of their comprehensive analysis have been published in *Science*.

Marine biodiversity, they report, matters because it is variety *per se* that delivers services—such as maintaining water quality and processing nutrients—to humans as well as the goods people reap from the sea. It also ensures these goods and services recover relatively rapidly after an ac-

cident or natural disturbance. The new work is silent on exactly how biodiversity protects these things—merely showing that it does. Earlier work though has shown some possible mechanisms. One example from a study in Jamaica showed that continuously removing algae-grazers from a reef allowed the algae to overwhelm the coral.

The latest study, led by Boris Worm of Dalhousie University, in Halifax, Canada, gathered the available material into four separate groups. The researchers found the same result from different pools of data, in different types of marine ecosystems and at different scales.

### Trawling the data

In the first the marine ecologists re-examined 32 small-scale experiments in which researchers had altered the variety of sea life and recorded what happened. Overall, each of the six ecosystem processes examined—which included the maintenance of stability and improved water quality—worked better when there were more species than when there were fewer.

This is not as obvious as it may seem. Until now, some scientists have thought that many individuals of the same species with certain talents could perform specific tasks better than the same number of individuals from different species. For example, one type of seagrass may process nutrients more effectively than other types,

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so a bed devoted entirely to the talented seagrass might be expected to conduct this processing better than a mixed area. The research suggests this is not so.

Second, Dr Worm considered estuaries. Marine extinctions are uncovered slowly on a global scale, but local disappearances are much more rapidly apparent. They collected long-term historical records from 12 coastal areas in Europe and North America, including information on the Roman elimination of the Dalmatian pelican from the Wadden Sea and the removal of the Atlantic sturgeon from the Chesapeake Bay and the Delaware Bay.

Analysing these data revealed that estuaries and coastlines are less able to maintain, for example, water quality, as the number of species found within them declines. Going back over several centuries, when biodiversity falls, people desert the beaches, coastlines become more liable to flooding and blooms of algae are more likely to gain a footing.

That theory was tested on a third group of data—records kept by the United Nations from 1950 to 2003 of the fish and invertebrates caught in large expanses of the ocean all around the world. These data make up 83% of all records of all catches of fish over the past half-century. Dr Worm and his colleagues discovered that the more species an ocean region has, the more robustly it seems to cope with over-exploitation.

The findings suggest that governments should rethink the way they try to manage fisheries. Marine reserves are common in the tropics, but policymakers in temperate countries tend to focus on one species at a time to control numbers of that species caught. They might do better to spend more time thinking about ecosystems and less haggling over quotas.

Some governments claim to have al- ►►

ready come around to the idea. In America, Britain and Canada officials are considering how to redraft fisheries policy. Scientists hope that the move will push the inevitably unhappy compromise between their recommendations and fishermen's aspirations closer to their way.

Dr Worm's fourth analysis showed that the damage could be reversed. In it, he pooled data from areas where fishing had been banned, either because stocks had

collapsed or because the space had been designated as a marine reserve. These included the Georges Bank off the east coast of America and Canada, where disastrous overfishing for cod threatened the collapse of stocks.

On average, the number of species in the 44 sites increased by 23%. In the areas around the protected regions fishermen reported catching, on average, four times as many fish per trip as previously. The re-

searchers also examined whether the recovery was sufficient to make the protected areas more resilient to storms and changes in temperature, but the results were not statistically significant.

Dr Worm reckons that, the way things are going, commercial fish stocks will collapse completely by 2048. The date may be spuriously precise, but the danger is there. And so, if Dr Worm is right, is a better way of making sure that it doesn't happen. ■

## Human evolution

# Eyeing up the collaboration

The whites of the eyes suggest early humans were co-operative

THE sight of a group of men standing round watching another man work on his car is familiar in cultures throughout the world. It is also an example of what seems to be a primal human interaction—the mutual direction of gaze. Indeed, being able to identify what someone else is looking at is thought to have been so important to humans that people evolved to have eyes surrounded by brilliant whites to assist with the process. Now new research from Germany backs up the idea.

People, more than any other primate, depend on their fellow humans to figure out where to direct their attention. Previous research has shown that human children are much more willing than chimpanzees to co-operate with a human adult in manipulating objects—for example, taking it in turns to drop a ball down a chute. And when the children do, they spend a lot more time looking at the face of the adult, monitoring where that person is looking.

Humans also happen to have scleras—the white part of the eye surrounding the iris—that are much bigger and brighter than the scleras of other primates. In fact, most other primates have scleras that are so dark that they camouflage which way the eyes are looking. The theory is that a white sclera surrounding a darker iris and pupil helps people work out where everyone else is looking. If this were correct, people might be expected to pay more attention to the eyes than do other primates.

So researchers at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, decided to compare adult chimpanzees, gorillas and bonobos with human children of a year or 18 months old. In the experiment, reported online in the *Journal of Human Evolution*, a human adult first attracted the attention of the non-human ape or the human child, and then looked up at the ceiling. The experimenter moved only

his eyes, moved his head and his eyes, or moved his head and kept his eyes closed. In later versions of the experiment he also turned around so that only the back of his head was visible and then either moved his head up or stayed still.

Both the non-human apes and the human children tended to look where they thought the experimenter was looking. But the non-human apes paid the most attention to where the experimenter's head was pointing, in particular, looking up when the head was pointed up, no matter what the eyes were doing. Human children, on the other hand, paid the most attention to the eyes, and were relatively indifferent to where the head was pointed.

The idea that people evolved eyes that make it easy for others to see where they are looking suggests just how important sociability was for early humans. If human interactions were primarily competitive, it would be advantageous to camouflage eye movements, as other apes seem to have done. That way, it would be hard for a competitor to see someone eyeing a tasty banana or potential mate. Instead, people have evolved to make it easy for others to see where they are looking. The advantages of co-operation seem to have outweighed those of competition.



Keep them peeled

## Space policy

# Mercy mission

Astronauts will be allowed to upgrade the Hubble space telescope after all

EDWIN HUBBLE was the first astronomer to describe the expansion of the universe, in a physical formulation made in 1929 that now bears his name. On October 31st America's National Aeronautics and Space Administration (NASA) announced that it would further expand man's knowledge of the universe by allowing astronomers to repair and upgrade the telescope that is named after him.

Since its launch in 1990 the *Hubble* space telescope has captured beautiful images of the universe, such as the birth of stars in stellar nurseries, while conducting rigorous science, such as the recent detection of planets orbiting stars near the centre of the Milky Way. In its 16 years of operation it has found the first convincing evidence for the existence of black holes, made observations supporting the theory that the universe's expansion is accelerating and confirmed that dark matter exists.

But the telescope is deteriorating. It has been in space for a long time. Dust and radiation are damaging its instruments. Without new batteries and new gyroscopes it would lose both the power and the ability to point in the right direction. It needs a service to extend its working life beyond the next two or three years.

A planned servicing mission was cancelled in January 2004 after the space shuttle *Columbia* was lost along with its crew of seven astronauts in 2003. NASA administrators deemed that future shuttle flights would be allowed to go only to the International Space Station, where astronauts could take shelter and await rescue, should the shuttle be damaged on launch.

Now the administration has had a change of heart. Part of the reason is that it turned out to be impossible to put together the alternative—a robotic mission to repair Hubble—before the telescope started to crumble. So officials re-examined the possibility of a manned mission. They found ▶▶