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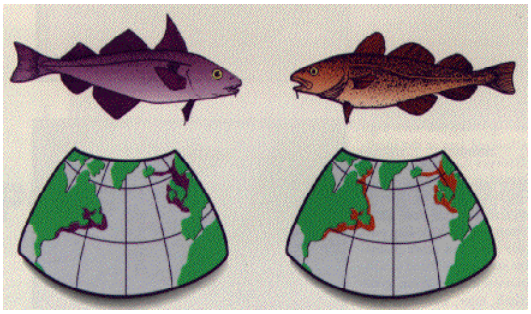
The Mystery of the Disappearing Fish

Overfishing may be only part of the reason why Georges Bank is becoming deserted. Read on to find out how scientists are trying to solve this problem.

In 1887, the biologist G. W. Wilcox wrote: "Yet where the mackerel come from in the spring, where they go late in the fall, why they are found in great abundance off the New England coast for a series of years, and perhaps next year in the Gulf of St. Lawrence, remains as much a mystery and matter of theory as one hundred years ago."



Two important species on Georges Bank are haddock (above, left) and cod (above, right). The areas they're often found are shown in the maps. GLOBEC hopes to shed light on their lives.

In 1995, that mystery still remains. But aided by technology that collects information on very large and very small scales, scientists are beginning to make progress.

One project that is putting pieces of the puzzle in place is GLOBEC (GLOBal Ocean ECosystems Dynamics). This five-year project brings together a team of seventy scientists from twenty-two research institutions in the United States and Canada. The scientists want to understand how changes in the world's climate affect the abundance and production of animals in the sea. This may lead to better techniques for managing the existing stocks of fish.

GLOBEC will take place in several phases, at different sites around the world. It begins at Georges Bank, where four species of animals are under study. These are larval cod and haddock, and two kinds of copepods, tiny, shrimp-like animals that live alongside the larval fish. All are zooplankton (small, mostly drifting animals) and are key links in the marine food chain.

Something is known about the lives of larval cod and haddock already. Says WHOI biologist Peter Wiebe, who is a leader of GLOBEC: "For the first six months of life, the animals go from hatching out of the egg, to little larvae that can't even feed, to larvae that can feed and then grow up and become more agile and swim and finally settle out and live near the bottom." Yet sometime during those first six months of life, nearly 99% of the larval fish will die. Those that do enter the fishery must survive another three to five years before they are big enough to be caught.

Why do so many die? Are they eaten by predators? What creatures do they eat? Is the water too hot—or too cold? GLOBEC hopes to find the answers.

SMALL-SCALE RESEARCH

To learn more about these animals, biologists travel to Georges Bank to collect and observe them. They collect them with a net system called MOCNESS (Multiple Open and Closing Net and Environmental Sensing System.) This is a series of nets controlled by a shipboard operator at the surface. The MOCNESS system is "flown" to the seafloor, and slowly recovered. Each of its nets opens and closes in sequence. As each net opens, the system records the temperature, depth, and salinity of the water at that level.

The MOCHNESS net system brings back samples from many different water levels

Combining that information with the ability to study the creatures they capture at a very fine level of detail, the scientists can create snapshots" of life at different levels of the ocean.

EACH IMAGE TELLS A TALE

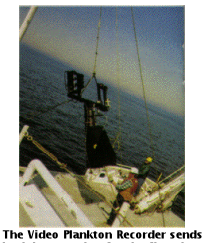
MOCNESS delivers a lot of important data. But many animals in this environment are too delicate, or too small, to be captured by tow nets. They are destroyed in the process, or they pass through the net's openings. Another piece of equipment, the Video Plankton Recorder, makes video images of those creatures. It lets scientists observe the animals in their own natural environment, without disturbing them.

The Video Plankton Recorder consists of four independent cameras, operating at different angles, and at different resolutions. As the cameras roll, a strobe light flashes at the rate of 60 frames per second, as the system is towed through the water. The strobe lights the section of water in such a way that silhouettes of the animals living there are revealed. The tiny, delicate, often transparent animals could not be seen in any other way.

Says Cabell Davis, a WHOI biologist who developed the Video Plankton Recorder with his colleague Scott Gallagher, "It's a completely different view of what the ocean looks like, by looking at it directly on this small scale. There's a

lot of structure down there." He says that at this scale, the marine snow, minute particles of debris that float down from the surface, "almost looks like trees in a forest."

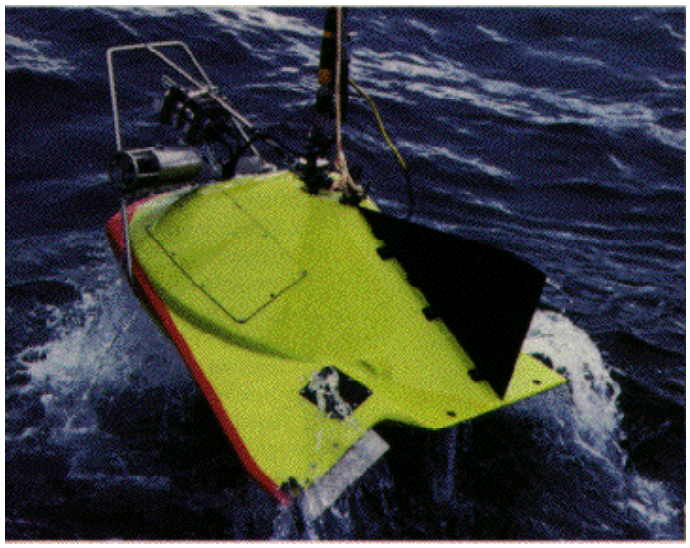
Peter Wiebe adds that with the Video Plankton Recorder "We can now begin to look at the orientation of the animals in space. We can look at what's around them, what they're oriented to, and we can know this very, very precisely." By seeing where the animals place themselves in relation to one another, it's possible to better understand how they live.



The Video Plankton Recorder sends back images, that for the first time, let scientists observe microscopic life forms, undisturbed, in their natu environment.

MAKING SENSE OF SOUNDS

GLOBEC scientists are using acoustics to tell the story, as well. For this, they rely on a remotely-operated vehicle called the Green Bomber. It carries an echosounder that sends high frequency sounds into the water, and records the returning echoes. Each echo tells the scientists the shape and location of the creature off of which the sound bounced. Scientists use the echoes to learn the acoustic size and location of animals at specific levels of the sea.



The "Green Bomber" creates acoustic pictures of the underwater world.

THE BIG PICTURE

Along with the close-up studies of microscopic creatures, GLOBEC examines the big picture of water flow in and around Georges Bank as well. For this, oceanographers use an instrument called a C-T-D (a Conductivity-Temperature-Depth recorder).

The CTD tells the researchers the temperature and salinity of a given section of water. Those calculations, coupled with the depth at which the readings are taken, make it possible to calculate the flow and movement of the Bank's water.

Satellites help provide big-picture information as well, sending back data about the temperature of the water, and the location of blooms of phytoplankton, the microscopic plants eaten by many sea creatures.

FITTING PIECES TOGETHER

What is the bottom line? "We want to be able to say how fast the animals are growing, how fast they're reproducing, and what kinds of controls exist to either enhance that growth or cause it to be less than optimal," says Peter. With that type of information, when changes take place on the Bank, in temperature, in salinity, in currents, or in abundance of phytoplankton, scientists may be able to predict the effects on fish population.

The investigators haven't yet solved the mystery of the disappearing fish. But they have their hunches. They suspect that rising water temperature, particularly in January and February, the start of the growing season for cod and haddock larvae, may be partly responsible. As the study continues, more evidence needed to solve the mystery will doubtless be revealed.