



Founded in 1888 as the  
Marine Biological Laboratory

1426 c4.683(1142 m475. 561.119 223.29 558.689 226.8 553.889 226.8 c549.449 226.8 546.659 222.81 546.659 218.82 ch550.319 218.7 m550.319 220.8 551.159 223.86 553.889

**SPRING 2007**  
VOLUME 2, NUMBER 1

Lesso



## COVER STORY

### 2 Lessons from the Arctic

For three decades, MBL Arctic research programs have taught us how high-latitude ecosystems work. But there is still much to learn about how these rapidly changing environments will influence our climate.

## FEATURES

### 8 From Forests to Fields

On Tanguro Ranch, studies that evaluate the consequences of large-scale soybean agriculture in the Amazon could help reduce farming's effects on rivers.



### Balancing Act

## DEPARTMENTS

### 6 NEWS & NOTES

The latest findings from our laboratories and field sites.

### 12 MBL MOMENT

#### Why Polar Research Matters

Incoming Ecosystems Center director, Antarctic ecologist Hugh Ducklow, on the National Science Foundation's International Polar Year and why everyone should care about what scientists are learning at the North and South Poles.

### 14 ACCOLADES

### 15 COOL TOOL

#### Environmental Crystal Ball

Ed Rastetter uses fast computers and advanced programming to predict life in a warmer world.

### 16 SCIENTIST'S EYE VIEW

*MBL Catalyst's* guest science editor, Ecosystems Center co-director Jerry Melillo, explains that the choices we make today really will influence tomorrow's climate.

### 17 MEMORABILIA

#### Lord Mulgrave on Ice

A watercolor painting provides a startling look at an icy Arctic that existed before climate change.

For three decades, MBL Arctic research programs have taught us how high-latitude ecosystems work. But there is still much to learn about how these rapidly changing environments will influence our climate.

**I**n 1978, the first MBL Arctic research program was launched. The program was designed to study the interactions between the atmosphere, the land surface, and the ocean in the Arctic region. The program was led by Dr. [Name], who was a leading expert in the field of Arctic research. The program was funded by the National Science Foundation and the MBL. The program was a major success, and it led to the discovery of many new things about the Arctic region. The program was a major success, and it led to the discovery of many new things about the Arctic region. The program was a major success, and it led to the discovery of many new things about the Arctic region.

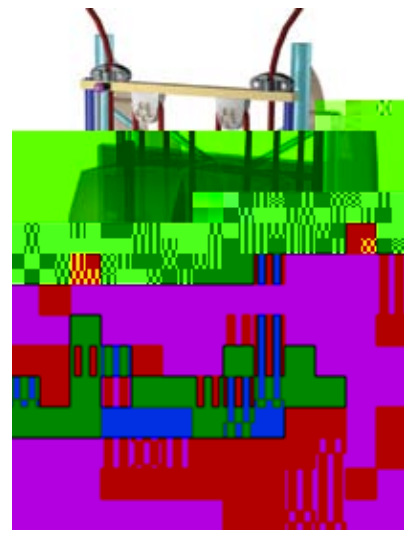
The program was a major success, and it led to the discovery of many new things about the Arctic region. The program was a major success, and it led to the discovery of many new things about the Arctic region. The program was a major success, and it led to the discovery of many new things about the Arctic region.



## A New PanArctic Approach









## Tiny Larval Fish Living Among Australia's Great Barrier Reef Spend the Early Weeks of Their Lives Swept Up in Ocean Currents That Can Disperse Them Far from Their Birthplaces. Given Such a Life History, One Might Assume That These Fish Would Be Genetically Homogeneous Within Their Dispersal Area. Yet Diversity Is Found to Be Surprisingly High and Individual Reefs Contain Different Fish Populations. For Such Rich Biodiversity to Have Evolved, Some Form of Population Isolation Is Required. Research Published This Year in the *Proceedings of the National Academy of Sciences* by MBL Scientists Gabriele Gerlach and Jelle Atema and Their Colleagues Showed That Many Fish Species Can Discriminate Odors in Ocean Currents and That Some Species Can Use Home Reef Scent to Return to the Reefs Where They Were Born. The Homing Behavior Could Support Population Isolation and Slow Genetic Divergence, Thus Possibly Favoring the Ultimate Formation of New Species. "This Research Shows That the Spatial Distribution of These Aquatic Organisms Is Far from Being Random Despite Long Larval Dispersal Stages of Several Weeks," Says Gerlach. "Apparently, These Larvae Use Sensory Mechanisms to Orientate and Find Their Way to Appropriate Habitats or Express Successful Homing Behavior to Their Natal Spawning Sites. This Might Play a Major Role in Processes of Population Separation and, Eventually, of Speciation." The Research Could Also Have Important Management Implications Not Only for the Great Barrier Reef, but Marine Environments in General.

Tiny larval fish living among Australia's Great Barrier Reef spend the early weeks of their lives swept up in ocean currents that can disperse them far from their birthplaces. Given such a life history, one might assume that these fish would be genetically homogeneous within their dispersal area. Yet diversity is found to be surprisingly high and individual reefs contain different fish populations. For such rich biodiversity to have evolved, some form of population isolation is required. Research published this year in the *Proceedings of the National Academy of Sciences* by MBL scientists Gabriele Gerlach and Jelle Atema and their colleagues showed that many fish species can discriminate odors in ocean currents and that some species can use home reef scent to return to the reefs where they were born. The homing behavior could support population isolation and slow genetic divergence, thus possibly favoring the ultimate formation of new species. "This research shows that the spatial distribution of these aquatic organisms is far from being random despite long larval dispersal stages of several weeks," says Gerlach. "Apparently, these larvae use sensory mechanisms to orientate and find their way to appropriate habitats or express successful homing behavior to their natal spawning sites. This might play a major role in processes of population separation and, eventually, of speciation." The research could also have important management implications not only for the Great Barrier Reef, but marine environments in general.

(







# Ba a c Ac

H d / e ec e e-s s a  
es ces Ea 's ec s/s e s. de ee a a s  
e a ac s a ac e ? T e MBL's  
C c H. s s e. e a .

Chuck Hopkinson isn't your average outdoorsman. Whenever this avid hiker, boater, skier, and swimmer is in nature, he takes in a lot more than just the scenery. What he sees is the literal value of what nature provides us for free: oxygen to breathe, water to drink, and natural resources to harvest.

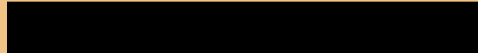
In fact, Hopkinson, a senior scientist with the MBL's Ecosystems Center, has recently helped create a novel way to evaluate the natural resources too many of us take for granted. In a paper published last February in *BioScience*, he and several colleagues describe a balance-sheet approach known as "ecosystem services-based management," a promising new tool that links ecology and economics.

The new method assigns absolute values to the services that ecosystems provide to society and the human actions that degrade these services. "It's a way for natural resource managers to quantify the change in value of ecosystem services so they can base their actions on minimizing the value of service reductions," says Hopkinson.

One area that could benefit from this approach is Plum Island Sound in northeastern Massachusetts, where Hopkinson is the lead principal investigator on the Plum Island Ecosystem Long Term Ecological Research project.

Since the mid-1980s, MBL Ecosystems Center scientists and their collaborators have been documenting environmental changes in the Plum Island Sound estuary, which is heavily affected by rapid

rates of development. The suburbanization is occurring in two watersheds that run through 26 towns and drain into the sound.



Evidence that Earth's ecosystems are changing is mounting to say the least. One way to understand the effects of these changes is through extended scientific assessments known as Long Term Ecological Research (LTER) projects. With funding from the National Science Foundation, LTER scientists study model ecosystems over many years, then use math and computer modeling to predict how environmental changes will affect them—and similar ecosystems—in the future. Such research is crucial to the wise management of our planet for the benefit of future generations.

MBL Ecosystems Center scientists currently have leadership roles in LTER projects located in the Alaskan Arctic (Toolik LHRs, cas

...with  
**Hugh Ducklow**  
*incoming director of the MBL  
 Ecosystems Center*



*Hugh Ducklow is a marine ecologist who studies plankton dynamics and biogeochemistry and works regularly at Palmer Station in Antarctica. In May he will become the director of the MBL's Ecosystems Center. He is currently the Glucksman Professor of Marine Science at the Virginia Institute of Marine Science (VIMS) at the College of William and Mary. His research centers on the interactions between climate change and ecosystem function, especially on the Antarctic Peninsula, a region that is warming especially fast. Hugh has conducted research in the North Atlantic, central North Pacific, equatorial Pacific, Arabian Sea, Red Sea, Southern Ocean, Great Barrier Reef, Caribbean, Black Sea, Baltic Sea, Hudson River, and Chesapeake Bay.*

**MBL** Why should we study polar regions that most people don't think much about on a regular basis?

**HD** The polar regions are important because they are the most sensitive to climate change. The Arctic is warming twice as fast as the rest of the world, and the Antarctic is warming even faster. This is because of the albedo effect: as ice melts, the dark ocean surface absorbs more heat, leading to further warming. This has significant implications for global climate and sea level rise. Additionally, the polar regions are home to unique and often irreplaceable species and ecosystems. Studying these regions helps us understand the limits of life and the potential impacts of human activities on the planet.

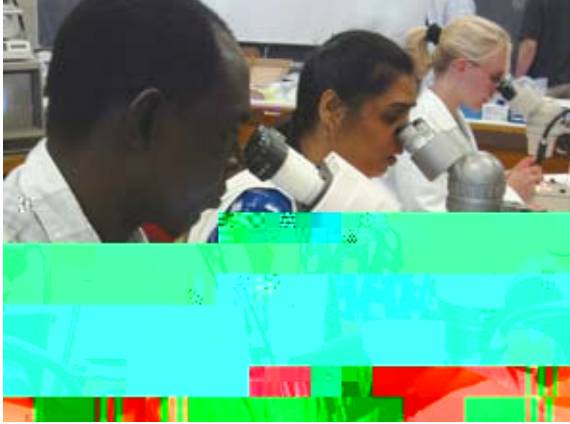
**MBL** What is the importance of the International Polar Year and how is the MBL participating?

**HD** The International Polar Year (IPY) is a global scientific effort to study the polar regions. It is held every 60 years, with the most recent one in 2007-2008. The MBL is participating in the IPY through various projects and programs, including the MBL Polar Program. This program focuses on understanding the physical, biological, and chemical processes in the polar regions and their interactions with the global climate system. The MBL is also contributing to the IPY through its research and data collection efforts in the Arctic and Antarctic.

The MBL is also participating in the IPY through its research and data collection efforts in the Arctic and Antarctic. The MBL is also contributing to the IPY through its research and data collection efforts in the Arctic and Antarctic. The MBL is also contributing to the IPY through its research and data collection efforts in the Arctic and Antarctic.

The MBL is also participating in the IPY through its research and data collection efforts in the Arctic and Antarctic. The MBL is also contributing to the IPY through its research and data collection efforts in the Arctic and Antarctic. The MBL is also contributing to the IPY through its research and data collection efforts in the Arctic and Antarctic.





## ACCOLADES

- MBL Corporation member **Thomas D. Pollard**, chair and Sterling Professor of Molecular, Cellular and Developmental Biology at Yale University, and former MBL Physiology course faculty member **Joan Steitz**, Sterling Professor of Molecular Biophysics and Biochemistry and a Howard Hughes Medical Institute Investigator at Yale, received the 2006 Gairdner International Awards, which are among the most prestigious in science.
- MBL Corporation member and former Physiology course director **Joel Rosenbaum** (Yale University) received the









*The Shipwreck*, J.M.W. Turner

The painting depicts a dramatic scene of a large wooden sailing ship, possibly a galleon, partially submerged in a dark, stormy sea. The ship's hull is visible, showing a reddish-brown color, and its masts and rigging are partially submerged. The sky is filled with heavy, dark clouds, and the water is turbulent, with white foam from the waves crashing against the ship's hull. The overall mood is dramatic and somber, capturing a moment of crisis and the power of nature over human-made vessels.

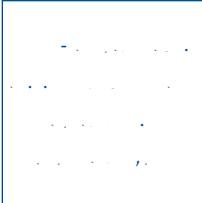
*Adventures by Sea from Art of Old Time,*

... 1 2 ...



IN THE NEXT *CATALYST*

... K... MBL  
f...  
f... MBL  
*Catalyst*  
f... K...



MBL  
... 02

[www.MBL.edu](http://www.MBL.edu)