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Acoustic Tracking of Fish: How Continuous Data on Fish Movement Could Change the Planning of MPAs

To design effective MPAs, planners need information on the habitats and species they want to protect. Data on the home range of a particular fish species, for example, can be invaluable for siting marine reserves to protect that species. Over the past several decades, scientists have tracked fish movement through mark-and-recapture techniques or following fish with scuba divers — generating useful, though incomplete, information. But technological advances in the past decade have enabled what could be a key to effective MPA design: continuous data on individual fish movements over time, including in and out of proposed protected areas.

This tracking is enabled by acoustic telemetry — using battery-operated transmitters inserted into fish that collect and send data to receivers nearby. ("Acoustic" means the use of sound waves; "telemetry" means sending information from one place to another.) Although the technology has some limitations, including cost, it has been tested in several MPAs worldwide and yielded promising results. This month, *MPA News* examines the technology and the opportunities it offers to MPA planners and managers.

Window to the lives of underwater animals

Little is known about the home ranges of many fish species, or how the home ranges vary with age and season. This lack of information on movement and habitat preferences makes its difficult to determine effective MPA size and location. This is particularly the case for no-take marine reserves, where boundaries that are too small, or inappropriately placed, can result in inadequate protection for species of interest.

Traditional techniques for tracking fish movement have provided spotty data sets for researchers. Marking and releasing a fish, then recapturing it at a future date, yields two data points: where the fish was at initial capture and at recapture. All movement of the fish between those two points — potentially months or years apart — is lost. Other techniques such as following fish with divers can influence the behavior of the fish under study, and yield relatively short-term data.

Underwater acoustic telemetry was devised to provide a clearer and larger-scale view into the lives of marine animals. Developed in the 1970s but limited in marine use until recently by various factors, this technology is applied in two general ways. Researchers either manually track the movement of tagged fish from the water surface using hand-held hydrophones, or use networks of receivers attached to buoys to automatically monitor the data transmitted from the tags. The first method normally employs transmitters that emit a signal (a "ping" sound) every few seconds; this is great for real-time tracking of fish movement but results in a relatively short battery life (about one month) due to the frequent pinging. The latter method involves transmitters that ping less frequently, allowing for battery lives of up to a year or more.

To attach the transmitters to fish, researchers either surgically implant the devices (as small as 7 mm by 18 mm) in the abdomen after capturing and anesthetizing the animal, or feed the transmitter to the fish with food. Implantation is more difficult but tends to provide longer data series, as the feeding method results in eventual excretion of the transmitter. Each method places stress on the study animals, particularly deeper-water species whose swim bladders are not adapted to the pressures of surfacing (for the implantation process). However, researchers say that fish behavior stabilizes within hours to days after tagging. Ron O'Dor, a biologist at Dalhousie University (Canada) who has experimented with acoustic telemetry since 1980, says the smaller the tag, the less effect it has. "Schooling fish have been observed to return to the same position in the social 'pecking order' after tag implantation, so it seems that even other fish cannot detect their behavior changes," he says.

O'Dor notes the advances that have allowed the use of acoustic telemetry to become more feasible — namely the miniaturization of computer chips and lithium batteries, providing more power in smaller packages. "When I first started using acoustic tracking, the animals had to weigh half a kilogram [to be able to carry the acoustic devices]," he says. "Now animals as small as 10 grams can carry individually coded transmitters that last months to years depending on their transmission program." The tags are also more rugged than they used to be, and have dropped in price. Smaller tags may now sell for US$300 or so — still pricey, but

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much cheaper than a decade ago. (The website for VEMCO, one of the largest manufacturers of acoustic telemetry equipment, shows the variety of transmitters and receivers now available: www.vemco.com.)

Results of acoustic telemetry research in MPAs

James Lindholm, a biologist at the Pfleger Institute of Environmental Research (US), has used acoustic telemetry to study Atlantic cod in the temperate Stellwagen Bank National Marine Sanctuary (SBNMS), off the northeastern coast of the US. With arrays of receivers, he monitored the movement of cod released over different seafloor habitats: gravel-covered bottom and piled boulder reefs. Although cod can be a relatively mobile species, Lindholm found that more than 1/3 (37%) of individuals released over gravel exhibited strong site fidelity: they were present within a 0.5-km^2 area for most of the four-month study period. Over piled boulder reefs, an even higher percentage, 50%, of the cod showed strong site fidelity. (In the latter case, the remaining 50% of fish were observed to move among the four boulder reefs in the study area, up to 24 km and three reefs in a single day.)

Lindholm says this variation in behavior, with some individuals of a species exhibiting strong site fidelity and others not, appears elsewhere in the global literature on acoustic tracking of fishes. "The mechanisms underlying this phenomenon will vary by species and are not well understood," he says. He points out that Atlantic cod fishermen have long believed there are two types of cod — so-called "rock cod" that stay put at partic-ular features, and other cod that move more widely. "The fact that we have observed this behavior over both gravel and piled boulder reef habitats suggests there is clearly something going on here," he says.

Despite the variability in behavior, the attractiveness of certain habitats to cod suggests that if managers were to designate no-take zones to protect the species, these habitats could be good candidates as sites, particularly for the individuals that exhibit site fidelity. SBNMS presently has no designated no-take reserves (aside from an overlap with a regional fishery management closure, in which Lindholm's study took place), but a five-year management plan review process is underway and is considering various conservation measures. (National Marine Sanctuaries in the US are not required to have no-take areas, but can consider such restrictions if warranted.)

"Should the sanctuary consider designating some type of marine reserve or research closed area, I believe the data we have will assist in identifying the types of habitats that should receive protection, the particular locations for potential reserves, and the size of potential reserves," says Lindholm. "If protection of cod becomes a priority, I think that discrete piled boulder reefs will be an obvious choice for protection." Although cod trawlers in the region have historically avoided setting their gear on high-relief habitats like piled boulder reefs,

Challenges in acoustic telemetry

Although acoustic telemetry holds great promise for marine reserve research, the technology presents certain challenges. James Lindholm, a biologist at the US-based Pfleger Institute of Environmental Research (PIER), says the main challenges are a combination of logistical concerns and equipment costs — both influenced by the nature of a research project.

To build an array of receivers in a reserve, the number of receivers will depend on the reserve size, depth of study area, and the species being tracked, among other factors. "If a reserve is tens to hundreds of kilometers in area, the number of receivers necessary to track fish across its boundaries may be prohibitively expensive," says Lindholm. (The receivers can be thousands of US dollars each.)

If a reserve is offshore or at a remote island, the boat time necessary to service the array and download data may be expensive, too. And the effective range of receivers can vary depending on environmental conditions, including ambient noise and water density. Lindholm says receiver range has been measured at 20 m in Indonesia, and 1 km in Antarctica. As a result, use of the technology may be more cost-effective in some areas than in others.

PIER maintains a total of 80 acoustic receivers in waters off California's Channel Islands, one of the institute's study areas for acoustic telemetry. "We are out at sea for several weeks at six-month intervals to download data and replace batteries," says Lindholm. "Despite the challenges, solid experimental design and good planning make using acoustic telemetry more than worthwhile."

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Other applications of acoustic telemetry for MPAs

Beyond indicating fish movement, acoustic telemetry can provide other information of potential use to MPA practitioners:

- The receiver buoys that relay data from tagged fish to shore computers can be outfitted to record environmental changes in real time, such as temperature, salinity, tide height, current direction, and current speed. Such data can be compared to fish movements and distribution to better understand how these factors affect fish behavior.
- Acoustic tags can be attached to video cameras of researchers to allow for geo-referenced surveys of benthic habitat, accurate to 1-2 m.
- The tags can also be attached to recreational divers, allowing for monitoring of visitor location for safety and control. A transmitter on dive gear or a dive boat, for example, could monitor visitor compliance with various regulations, such as no-diving zones. With some adaptation, the tags could also monitor respiration rates and fin-beat frequency of divers, relaying this safety-related information back to the boat.

[Adapted by *MPA News* from: O'Dor, R.K., Aitken, J.P., Babcock, R.C., Bolden, S.K., Seino, S., Zeller, D.C. and Jackson, G.D. (2001) Using radio-acoustic positioning and telemetry (RAPT) to define and assess marine protected areas (MPAs). In: J. Sibert and J. Nielsen (eds), *Electronic Tagging and Tracking In Marine Fisheries, Reviews: Methods and Technologies in Fish Biology and Fisheries, Vol. 1*. Kluwer Academic Press, Dordrecht, The Netherlands, pp. 147-166.]

recreational cod fishermen generally target these sites, returning to them regularly, says Lindholm.

Habitat preferences also play a role in tropical species behavior. In 1999, biologists Hazel Oxenford and Newton Eristhee of the University of the West Indies, Cave Hill (Barbados), used hand-held hydrophones to study acoustic tagged Bermuda chub in two reserves of the St. Lucia Marine Management Area (SMMA), at the Caribbean nation of St. Lucia. Each reserve consisted of coral reef habitat: one bisected a relatively broad coral reef while the other encompassed a narrow, fringing one. The home ranges of the chub in each reserve reflected the reef shape, with circular home ranges observed in the first reserve and elongated home ranges in the second.

Movement of the commercially important chub across the reserve boundary into fished areas was recorded frequently in the case of the first reserve, namely to the contiguous reef outside the boundary. The second site, with no contiguous reef, had very little spillover. This was consistent with fish-count findings by other researchers, who had reported modest increases in fish biomass in the first reserve and much larger increases in the second. Although Oxenford says there are no plans to alter SMMA reserve boundaries for the time being, and that her study was not undertaken to inform such changes, "The research results could have broad application to other reserve areas where boundaries dissect rather than encompass whole habitats," she says.

Oxenford points out that using hand-held hydrophones to collect tag data, although more labor-intensive than using arrays of moored receivers, may be more practical in environments like St. Lucia, which has a narrow island shelf with strong surface currents. "Placement of sono-buoys more than 100 m or so to seaward of the reefs would have to include deepwater moorings," she says. "Because of the currents, very strong flotation devices would be required on the moorings to prevent the sono-buoys from being dragged down horizontally onto the bottom."

In any case, the acoustic telemetry she used was a big improvement over mark-and-recapture studies, says Oxenford. "We were working in reserves with a recent history of public outcry, especially from reef fishers upset over reduced fishing area," she says. "Repeated capture of fish by researchers within the reserves would have been unacceptable at that time, and undoubtedly would have caused public outrage. Visual recapture would have been the only acceptable alternative. However, the number of diver-hours in the water would have had to have been very large to obtain the same volume of data as our study."

Selecting for individuals with smaller home ranges?

Darren Parsons, a biologist at the Leigh Marine Laboratory (New Zealand), used an array of receivers to study the home-range size and location of snapper (*Pagrus auratus*) in the 5.5-km^2 Cape Rodney to Okakari Point (CROP) Marine Reserve, a no-take area in New Zealand. Prior fish-count research had indicated that density of snapper inside the reserve was 16 times greater than in adjacent fished areas, suggesting a degree of site fidelity within the CROP reserve. Such fidelity was apparent in Parsons' study, but he also discovered that there was considerable home-range overlap within the population, a previously unrecognized behavior. Furthermore, snapper individuals tagged in the study resided in home ranges two orders of magnitude smaller than documented in prior decades.

Parsons acknowledges that the same species may have larger home ranges elsewhere. "The snapper we tagged were reef residents," he says. "Snapper tagged in previous studies have been 'school' snapper that spend a lot of time over soft sediment bottoms, where there are fewer resources per unit area. Therefore, one would expect their movement to be more expansive to encompass the same amount of resources." Some researchers have suggested that school snapper may have home ranges of 25 km in diameter, he says.

Even within Parsons' sampling of fish in the CROP reserve, there were differing home-range sizes. Again, this variation within a species is consistent with acoustic telemetry studies of other species, like Lindholm's research on Atlantic cod. Over time, says Parsons, reserves could theoretically select for individuals with smaller home ranges, leading to increased concentration within reserves and decreased spillover outside of them. But it may be hard to prove that is occurring — much less plan for it — with so many other factors present, both environmental and populational.

"Additional considerations in reserve design include habitat type and conspecific density, both factors that may change after a reserve is established," Parsons says. "With these complications in mind, I am not sure that so much effort should be placed on the design of marine reserves instead of on just trying to create them."

Using satellite tagging to protect highly migratory species

The most sophisticated electronic tags communicate with satellites orbiting Earth, providing data on a tagged animal's position, vertical movements, and thermal history. Because these tags are relatively large — larger than the acoustic tags described in the adjoining article — they have been used primarily to track movements of large pelagic species, like tuna and sea turtles. Satellite tags have generated data on migratory routes across whole oceans.

Researchers suggest such data could be used to protect some of these species, such as endangered loggerhead turtles that get caught as bycatch in longline gear. Tracking data suggest these turtles gather near temperature gradients on the edge of warm water masses. By mapping the daily and seasonal movement of these gradients, turtle "hotspots" could be identified to longline vessels at sea, which could then avoid fishing these areas.

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UN Biodiversity Meeting Calls for Networks of MPAs

In February, delegates from 161 nations met in Kuala Lumpur, Malaysia, for biannual talks on strategies to conserve global biodiversity. The meeting — the Seventh Conference of the Parties to the UN Convention on Biological Diversity (CBD COP-7) — featured decisions on international protected-area planning and the conservation of marine and coastal ecosystems, among other items. *MPA News* invited Bud Ehler, Vice-Chair (Marine) for the IUCN World Commission on Protected Areas, to explain the implications for MPAs:

A Perspective on the Biodiversity Conference

By Bud Ehler, IUCN World Commission on Protected Areas

The new protected areas objective adopted by the Parties to the Convention on Biological Diversity (CBD) on 20 February sets governments on the path to translate World Summit on Sustainable Development commitments (*MPA News* 4:3) into operational programs to conserve biodiversity. The Parties adopted a program of work to significantly reduce the current rate of biodiversity loss. This includes establishing and maintaining comprehensive, effectively managed, and ecologically representative national and regional systems of MPAs by 2012. Emphasis was also placed on strengthening the management of protected areas and ensuring that their costs and benefits are equitably shared.

On the subject of funding, the Parties called on the Global Environment Facility (GEF) to further develop its portfolio on protected areas toward "comprehensive, representative and effectively managed protected area systems addressing system-wide needs." (The GEF is an independent financial organization that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods.) Donors were encouraged to increase support to address the long-term financial sustainability of protected areas, to "help achieve the target of securing, by 2008, sufficient resources to meet the costs to effectively implement and manage national and regional systems of protected areas."

The Parties also adopted a strong program of work for marine and coastal biodiversity, updating the 1998 program. Although decisions were deferred on proposed targets and timetables, the Parties agreed to a national-level framework for marine and coastal protected areas (MCPAs) that includes the key contributions of multiple-use MCPAs and "representative MCPAs where extractive uses are excluded", nested within broader ocean-governance frameworks such as integrated coastal management and sustainable fisheries.

Challenged by concerns raised by NGOs over the impacts of high-seas bottom trawling on fragile deep-sea ecosystems, including seamounts, the Parties to the CBD called on the UN General Assembly to take urgent action to eliminate destructive practices adversely impacting such vulnerable ecosystems beyond national jurisdiction.

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New report provides options for financing MPAs

Looking to supplement your MPA's funding? A new report provides a list of 30 mechanisms for financing the conservation of marine biodiversity. Published by WWF (an NGO) through its Center for Conservation Finance, *Financing Marine Conservation: A Menu of Options* outlines potential sources of funding, with brief examples of how the mechanisms have been used worldwide. For readers who want more information on particular mechanisms — ranging from conservation trust funds, to tourism entry fees, to fishing and mining access fees, and more — the report provides web links to external sources of expertise.

Melissa Moye, director of the Center for Conservation Finance, says the report is designed to help practitioners determine what they need. "The examples are the easiest way to help MPA managers and others identify mechanisms that might work for their specific case," she says. The report leads readers through a series of questions intended to gauge the feasibility of options.

Moye co-wrote the report with Barry Spergel, formerly of WWF and now a private consultant, who authored a similar, though not marine-focused, report in 2001, *Raising Revenues for Protected Areas: A Menu of Options* (*MPA News* 3:10). Both reports are available online in PDF format on the website of the WWF Center for Conservation Finance, at http://www.worldwildlife.org/conservationfinance.

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MPA Perspective When Is Coral Reef Rehabilitation an Appropriate Use of MPA Funding?

By Mark Erdmann, Bunaken National Park (Indonesia)

Over the past few years, a range of coral reef rehabilitation techniques has been developed, many involving the placement of three-dimensional hard substrate forms (including cement, rock and ceramic) in areas of degraded reef. Although the science of reef restoration ecology is truly in its infancy (and hence a steep learning curve is to be expected), these methodologies have tended to draw a negative response from reef ecologists, who often compare them to the many ill-conceived artificial reef projects of the past — including dumping of used tires to create "reefs" that aggregate fishes. These skeptics maintain that reef rehabilitation is expensive and drains resources that would be more prudently dedicated to better management of intact reefs, and that it is best to allow natural reef recovery processes to run their course in degraded areas.

While these criticisms certainly have merit and should be carefully considered by MPA managers on a case-by-case basis, I strongly believe that there are situations where reef rehabilitation (defined herein as efforts to enhance natural reef recovery processes in areas that have suffered severe degradation, with the end goal of returning the reef to its natural condition prior to damage) is an appropriate intervention. In particular, rehabilitation should be considered in those situations where an MPA's reefs:

1) Have suffered large-scale, physical damage and show no signs of natural recovery on an economically meaningful decadal time scale;
2) Are currently well-managed, with major threats to the reefs under control;
3) Have sufficiently good water quality and larval availability to support vigorous reef growth; and
4) Can attract dedicated funding for reef rehabilitation (e.g., from the private tourism sector) that would not otherwise be available for general reef management.

I would like to focus on one specific example of this: that of legacy blast-fishing damage in MPAs in the "Coral Triangle". Across Southeast Asia, hundreds of thousands of hectares of once-productive coral reefs have been decimated by blast fishing, leaving vast rubble fields in their place. Despite generally excellent water quality and abundant coral larval availability, these rubble fields often show no signs of natural recovery on a decadal scale. This is because corals recruiting to unconsolidated rubble are quickly smothered when the rubble invariably moves as a result of currents or waves. This "alternate stable state" is particularly frustrating to those MPA managers who have instituted effective management but are forced to live with legacy bomb damage; to them, reef rehabilitation is an enticing option.

One case study is Bunaken National Park in Indonesia, where blast fishing has been largely brought under control but large areas of rubble field remain (many blasted nearly 20 years ago). Two stakeholder groups have shown strong interest in rehabilitating these rubble fields to increase productive reef area: village fishers eager for enhanced fisheries yields and dive operators hoping to spread effort among more dive sites and thus raise the diver carrying capacity of the park.

In response to this interest, the Seacology Foundation (http://www.seacology.org) provided a grant to the park village of Manado Tua to purchase 600 ceramic "EcoReef" modules to rehabilitate a nearly 1-hectare rubble field in return for the villagers' commitment to set aside this area as a no-take zone. While this rehabilitation effort is focused upon fisheries enhancement (the area is off-limits to divers), local dive operators donated nearly 300 hours of dive time to install the EcoReef modules to help determine if this methodology is one in which they might invest to restore other degraded sites.

Completed in mid-January 2004, the results to date have already been impressive. The ceramic "snowflakes", designed to mimic a branching coral thicket, immediately attracted large numbers of both schooling and sedentary fishes to the previously barren and lifeless rubble field. Benthic recruitment to the modules has been rapid, with coralline algae, bryozoans, vermetid worms, tunicates, and hard coral recruits now covering the modules. Perhaps most encouragingly, over one hundred coral fragments transplanted to the EcoReef modules (by simply wedging between the ceramic spines) have shown 100% survival, with nearly two-thirds of the fragments cementing to the modules and laying down new tissue over the ceramic in the first two months. Additional transplantation is scheduled for May 2004.

To be sure, the verdict on the success of this reef rehabilitation project will not be clear for 3-5 years. A grant from the Packard Foundation will permit us to monitor the biological and socioeconomic impacts of the project for the next three years to gauge cost-effectiveness of this technique. Villagers, dive operators and park management are pleased with the results to date and hopeful that within five years' time, the ceramic modules will no longer be visible — overgrown by a thriving reef with high fisheries productivity. The potential for such a result certainly seems worth the effort.

Photos and video of the Manado Tua installation are viewable at http://www.ecoreefs.com.

Editor's note

When MPA habitats become severely degraded, active rehabilitation by management may be desirable — or necessary, in some cases — to restore ecological functions formerly provided. Such rehabilitation can be controversial, however, when artificial technologies are applied. The concept of "naturalness", which management normally strives to protect with an MPA, becomes somewhat blurred.

Mark Erdmann is USAID's marine protected areas advisor for the 890-km^2 Bunaken National Park, located in North Sulawesi, Indonesia. (USAID is the US Agency for International Development.) In this piece, he proposes that the use of artificial habitats for rehabilitation is sometimes appropriate, and that Bunaken National Park provides a good example of such a case. Readers are invited to respond with their insights.

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Notes & News

New book: lessons learned from Bunaken National Park

Lessons learned from five years of developing a collaborative management system at an Indonesian MPA have been compiled in a new book, *Building Effective Co-Management Systems for Decentralized Protected Areas Management in Indonesia: Bunaken National Park Case Study*. The book examines development of Bunaken National Park's co-management board, involvement of stakeholders in management, and development of a collaborative enforcement scheme for the park, among other aspects of the Bunaken experience. To order a printed copy, e-mail Mark Erdmann, a co-author of the book, at erdmann@nrm.or.id. The book is also available online at http://www.nrm.or.id. Follow the links to documents/reports/technical reports.

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Report details rehabilitation of delta in Mauritania, including national park

An 11-year project to rehabilitate thriving wetlands in Mauritania's 160-km^2 Diawling National Park — which had turned desert-like following construction of a nearby dam that cut off water flow in 1990 — is documented in a new report from IUCN. *The Rehabilitation of the Delta of the Senegal River in Mauritania* describes how resource managers used artificial flooding to re-establish diverse estuarine and mangrove ecosystems in the park and surrounding region. Waterbird counts and fish catches have risen exponentially since the project began, consistent with the park's objectives to promote biodiversity conservation and sustainable development among local populations.

"The Diawling project shows that the ecosystem approach, when applied to the restoration of a severely damaged wetland, can have very positive effects on both livelihoods and biodiversity," says report co-author Olivier Hamerlynck, a former technical advisor to the project. Core funding for the project was provided by the Ministry of Development Cooperation of the Netherlands, through the IUCN Wetlands and Water Resources Programme, and by the French Global Environment Facility. The report is available online in French and English at http://www.iucn.org/themes/wetlands.

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Meeting to be held to seek consensus on marine reserve science

Recent issues of *MPA News* have exhibited some of the international dialogue among researchers on marine reserve science and the effectiveness of reserves in fisheries management (*MPA News* 5:6 and 5:7). Such discussions may benefit from an upcoming conference in the US in June. To be convened by the National Fisheries Conservation Center (a US-based NGO), the conference will seek consensus in the debate over reserve usefulness for fisheries by bringing together scientists, managers, fishermen, and conservationists, among other stakeholders. The website for the Consensus Conference on Integrating Marine Reserve Science and Fishery Management, to be held June 7-9, 2004, in Long Beach, California, is at http://nfcc-fisheries.org/consensus.

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Conference Calendar: May 2004

2-6 May — "4th World Fisheries Congress: Reconciling Fisheries with Conservation: The Challenge of Managing Aquatic Ecosystems". Vancouver, British Columbia, Canada. Web: www.worldfisheries2004.org/home.htm

3-7 May — "International Congress on the Application of Recent Advances in Underwater Detection and Survey Techniques to Underwater Archeology". Bodrum, Turkey. Web: www.uw-detection-for-archeology.org

10-11 May — "Ocean Zoning: Can It Work in the Northwest Atlantic?". Halifax, Nova Scotia, Canada. Web: www.oceanzoning.ca

10-12 May — "The Oceans in a High-CO_2 World: An International Science Symposium". Paris, France. Web: ioc.unesco.org/iocweb/co2panel/HighOceanCO2.htm

10-13 May — "EurOCEAN 2004: European Conference on Marine Science and Ocean Technology". Galway, Ireland. Web: www.eurocean2004.com

11-14 May — "Global H2O Partnership Conference". Cairns, Australia. Web: www.hilltops2oceans.org/conference.html

11-14 May — "The Influence of Climate Change on North Atlantic Fish Stocks". Bergen, Norway. Web: www.imr.no/2004symposium/

23-26 May — "19th International Conference of The Coastal Society". Newport, Rhode Island, USA. Web: www.thecoastalsociety.org/conference.html

23-26 May — "28th Annual Larval Fish Conference". Clemson, South Carolina, USA. Web: www.lfc2004.org/

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For an up-to-date calendar of more than 50 MPA-related conferences around the world, go to www.mpanews.org