THE SKIMMER ON MARINE ECOSYSTEMS AND MANAGEMENT

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Letter to the Editor: Marine conservation and sustainable food production are on a collision course [2]

Dear MEAM:

The last issue of MEAM included an interesting case of trade-offs between food production (in the form of food safety) and in-stream/watershed engineering for biodiversity conservation barriers in the Salinas Valley, California ("Integrated land-and-sea management: Examining three cases where marine practitioners are looking upstream [3]", MEAM 6:6).

From the article, I infer the practitioners in that case have found some compromises that allow both needs (food production and biodiversity conservation) to come away with something positive. That is welcome news because it goes beyond the superficial platitudes that get wide circulation in the marine realm - i.e., how if we all just practice good conservation (typically with lots of big no-take zones) then all the fish stocks will recover and there will be fish for all.

Now, no one can dispute that overfishing or irresponsible fishing practices are harmful to medium-term food security, even if they allow (excessive) catches to be maintained in the short term. But achieving medium-term global food security is going to require more than a few local scale win-win choices for biodiversity and food production.

Fortunately at the global scale some of the planners and policy-makers know this. Take note of the FAO and World Bank 2008 study of the "sunken billions" that could be returned to global economies if fisheries were curtailed everywhere that stocks are depleted, then allowed to rebuild to their long-term most-productive states (www.worldbank.org/sunkenbillions [4]). That's only a win-win when the foregone yield over the entire rebuilding period is considered optional food for the affected communities. In addition, think of the economic displacement caused by the harvest reductions needed for rebuilding, particularly in parts of the world where viable alternatives to fishing are not available. A soon-to-be-published follow-up study estimates that all those recovered billions in economic value might cover only two-thirds of the social assistance needed to take care of all the displaced employment.

Combine this with estimates that Serge Garcia and I did for a 2011 paper in the ICES Journal of Marine Science special issue on fisheries and climate change (http://icesjms.oxfordjournals.org/content/68/6.toc [5]). Taking into account the UN world population projections to 2050, and the proportion of dietary protein currently provided by fish in the parts of the world that will experience the most population growth, our estimates suggest that protein from capture fisheries and aquaculture will have to increase by another 50% over 2010 levels just to break even with current food security levels. Then we accounted for forecasts by FAO and OECD of expected declines in wheat and rice production as climate change makes summers hotter and drier in many wheat-producing areas and makes storms more severe in rice-producing areas (with concomitant flooding). A ***lot*** more aquatic protein is going to be needed, as livestock is not an option in parts of the world where grain production will already be declining.

It is becoming clear that there is an inseparable tripod of issues facing marine resource management: poverty alleviation and food security in a changing climate - sustainable fisheries and aquaculture - and aquatic biodiversity conservation. There are no easy solutions out there where all perspectives will walk away thinking that they are the winners. People must start having some serious discussions about some very painful choices that will need to be made in the next decade or so. MEAM might have a role in trying to prompt such dialogue.

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Why fisheries management without spatial considerations is ineffective: Interview with John Caddy [6]

It makes intuitive sense that if a given area of ocean offers several types of seafloor habitat, and if commercially targeted fish populations prefer one habitat over the others (particularly at different life stages), then stock assessments should account for the spatial distribution of the habitats.

However, says fisheries scientist John Caddy, this is too seldom the case. Caddy, former chief of FAO's Marine Resources Service, says stock assessments typically ignore habitats - particularly habitats that are uncommon, like those of high structural complexity in shelf waters. Instead, the assessments assume that the habitat across the fishery is homogenous and non-complex. As a result, fisheries are allowed to work in (and potentially damage) areas that are highly structured, and which may be disproportionately important to the health of a targeted stock.

In a paper published this April 2013 in the ICES Journal of Marine Science, Caddy suggested that fisheries assessments that do not account for uneven spatial distribution of structurally complex habitats are doomed to error ("Why do assessments of demersal stocks largely ignore habitat?" is available for free at http://icesjms.oxfordjournals.org/content/early/2013/05/23/icesjms.fss199.full?keytype=ref&ijkey=SePs6l3rReZLjjM [7]). MEAM spoke with Caddy about his conclusions, and the first part of the interview appears below. The full interview - including journal citations, as well as Caddy's views on why it has taken fisheries scientists so long to build spatial distribution into their models, and whether the health of fisheries could be improved through vast deployment of artificial reefs - is here [8].

MEAM: Our contributing editor Tundi Agardy has called your conclusion the "grand unifying principle of ecosystem-based management": that is, management must be built on a foundation of ecosystem understanding, which in turn is made possible by the use of physical cues to help identify priority areas. What are your thoughts on that?

John Caddy: The fact is that applying ecosystem-based management requires us to incorporate the complexity of physical structure, as well as the biological components of the habitat into our models. The majority of fishery models now in use do not do this, and hence, strictly speaking, are not ecological models. They tend to assume either that habitats are uniform in fish-producing capability (the "dynamic pool" assumption), or that calorific transfers in food webs alone are a realistic model of what goes on in a marine ecosystem. (How likely is a food shortage to occur for a depleted species?).

Obviously, the quantity of food available is important. But for juveniles of demersal fishes to harvest food organisms safely, suitable cover should be available nearby to protect them between feeding forays. Putting my ideas in their global context, terrestrial ecology has found that the disappearance of complex structures (forests) is the main reason for declines in biodiversity. Not having monitored how our activities affect those structural elements in the sea that are required for life-history completion, we are a long way from a similar perception.

As indicated in Walters and Juanes (1993), the absence of adjacent cover for demersal juveniles next to their food resources drastically restricts the proportion of a food easily available, given that distant excursions across open bottom are unwise in the presence of predators. One could reasonably postulate that a linear measure of the interface between structurally-complex habitats and open bottom (which is very sensitive to the impact of dredges and trawls) should be a good indicator of the potential survival of the juvenile stages of many species! More realistically, incorporating habitat and spatial components into fisheries models seems the way to go, at least for the benthic/demersal resources I was writing about. In addition, in many cases the micro-habitats are fractal in configuration, which has important implications for size selectivity of juveniles. It can be demonstrated that an increase in organism size in fractal habitats drastically reduces suitable cover for them, and leads to their dispersion or migration elsewhere: a high-risk process.

A more general comment is that ecological considerations dictate that for spatial management to be realistic, we must map habitat configurations more carefully. We need to include geological factors (outcrops, sediments, and structural complexity), and this requires underwater mapping capability. The critical habitats encountered must then be protected by introducing spatially focused management measures. A number of papers in the literature have emphasized the importance of restrictions on bottom-towed gear, including the protection of spawning, nursery, and migration routes from incidental damage (see Caddy and Seijo 2011). Experience in the Mediterranean suggests that establishing closed areas (reproductive refugia) for the larger spawners offshore could be an effective management measure. Now that satellite monitoring of fishing fleets is a reality, combining area/resource allocations to fleets in open areas, with realistic penalties for fishing closed areas, could become the norm.

For MEAM's full interview with Caddy, including citations, click here [8].

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Caddy also publishes a fisheries blog - titled "My Published Work on Fisheries Science" - at www.myfisherywork.com [9]

Integrated land-and-sea management, Part 2: Reconciling different management priorities within Gwaii Haanas, Canada [10]

Human activities in upland ecosystems - farming, forestry, development, and so on - typically have impacts downstream as well, in coastal or even offshore areas. Recognizing the connections between land and sea systems is a central part of coastal and marine ecosystem-based management. The feature article on integrated land-and-sea management in our June-July 2013 issue examined three cases where marine resource managers have worked to integrate upstream and downstream management ("Integrated land-and-sea management: Examining three cases where marine practitioners are looking upstream [3]", MEAM 6:6). That was Part 1 of MEAM's coverage of this subject.

Now, in MEAM's finishing coverage of integrated land-and-sea management, we examine a protected area on Canada's Pacific coast that straddles land and sea: Gwaii Haanas. The protected area - which includes rugged mountaintops, more than 100 watersheds, and marine waters extending seaward to the continental slope - combines the Gwaii Haanas National Park Reserve, the Gwaii Haanas National Marine Conservation Area Reserve, and the Haida Heritage Site (designated by the Haida Nation, an Aboriginal people). Each component carries its own priorities, particularly with regard to preservation and sustainable use. The joint management of Gwaii Haanas - conducted by a body that is made up of equal representatives of the Haida Nation and the federal Government of Canada - is now developing a site management plan by 2015 to balance those considerations. MEAM spoke with Norm Sloan, marine ecologist for Gwaii Haanas.

MEAM: Gwaii Haanas National Park Reserve was created under the National Parks Act, which generally enshrines preservation with no commercial use. Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site was created under the NMCA Act, which enshrines sustainable use. What are the main challenges in balancing the respective approaches as well as the management entities - namely Parks Canada, Fisheries and Oceans Canada (DFO), and the Haida Nation?

Norm Sloan: There are many challenges involved in managing Gwaii Haanas. These include:

- Building relationships and trust among partner organizations and external organizations.
- Reconciling different perspectives and worldviews.
- Working together to manage marine resources in Gwaii Haanas to be in line with ecosystem objectives.
- Building new governance structures on top of existing ones.

To understand some of these challenges, one must understand our complex history and governance structure. Our legal name - Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage Site - represents laws, values, and accords along our path to establishment.

In 1985, the Haida, the Aboriginal people of Haida Gwaii, designated Gwaii Haanas a Haida Heritage Site and blockaded a logging road, preventing logging activity on Lyell Island. This act resulted in mass arrests. Ensuing legal tumult and media coverage led the federal Government of Canada and provincial government of British Columbia to commit in 1988 to creating a protected area in the southern 15% of Haida Gwaii's lands and surrounding waters.

In 1993, the Government of Canada and the Haida Nation signed the Gwaii Haanas Agreement, which committed Canada to managing Gwaii Haanas in cooperation with the Haida Nation. Twenty years after its signing, it is still referred to as an agreement before its time. At its core is an agreement to disagree. The Haida Nation and the Government of Canada both assert ownership over Gwaii Haanas, but they agree to put aside this difference in order to work together to protect the area. The Agreement allows each party to maintain its respective authorities under Haida and Canadian laws. This is unique in that it provides a process for two different governments to come together and make shared decisions under two different authorities.

The Agreement created the Archipelago Management Board (AMB), a consensus-based decision-making body composed of two representatives of the Council of the Haida Nation and two Parks Canada staff, representing Canada. Since 1993, the AMB has managed Gwaii Haanas' 1500 km^2 of lands, including 1700 km of shoreline. Within Gwaii Haanas, Haida subsistence hunting, fishing, gathering, and trapping are permitted. The first terrestrial management plan in 2003 excluded marine waters, but underscored the inseparability of land and sea toward eventual integrated management. Terrestrial management goals include: preserving natural and Haida cultural heritage, managing human use (visitation), and informing citizens about conservation and heritage from a unique place-based perspective.

After nearly two decades of working to designate a marine conservation area adjacent to the terrestrial protected area, Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site was established in 2010, with the signing of the Gwaii Haanas Marine Agreement. This 3400-km^2 area is protected under Parks Canada's 2002 Canada National Marine Conservation Areas Act. This Act is known as enabling legislation, which defines a process by which Parliament creates permanent NMCAs that are representative of Canadian marine regions.

Numerous federal agencies cooperate in NMCAs with their individual mandates unfettered. DFO's work continues to be guided by the Fisheries Act, Oceans Act, and Species at Risk Act. The roots of DFO's fisheries mandate are three priorities: fisheries stock conservation; enabling constitutionally guaranteed Aboriginal subsistence for

food, social, and ceremonial purposes; and providing stock to the commercial and recreational fishery sectors.

The NMCA Act mandate includes maintaining ecosystem structure and function (first priority), enabling multiple sustainable uses (such as fisheries, tourism, aquaculture), informing the public on marine conservation, facilitating visitors' experiences, and cooperating with academia and NGOs in applied research. The only explicit prohibition in NMCAs is extraction of non-renewable resources (petroleum, minerals, and aggregates). In 2010 for the establishment of Gwaii Haanas's marine portion, a record of public consultations was tabled in Parliament along with an Interim Management Plan including a zoning strategy enabling coexistence of sustainable uses with preservation. There are two zone types - sustainable use and full protection (no-take) - and more may be created. Haida subsistence use is permitted throughout the entire Gwaii Haanas Marine [as the marine portion of Gwaii Haanas is called].

Interim management guides operations until the adoption of the full Management Plan in 2015. By then zones and implementation strategies for all activities, including fishing and recreational use, will be defined and actions prioritized in order to work towards alignment with ecosystem objectives, currently under development. The interim plan is founded on guiding principles that include the need to balance protection and ecologically sustainable resource use, being able to demonstrate accountability and fostering innovation through the adoption of adaptive management approaches. Managing interactions among resource users will be challenging. This framework of ideas for balancing protection and sustainable resource use, complemented by the parallel progress on socio-economic and cultural objectives, will propel innovation for Gwaii Haanas Marine.

A primary challenge for Gwaii Haanas Marine will be integrating varying government mandates and legislations, respecting divergent viewpoints and opinions on "sustainability" while ensuring the partnership's overall objectives. Adding to this complexity is the fact that commercial fisheries are sectored, each industry sector operating in the area (e.g., herring, sea urchin) must be engaged through its individual established advisory processes under law. The approach being undertaken by AMB is first to identify areas of overlapping priorities with respect to marine resource management and emphasize similar goals as opposed to differences.

MEAM: How is the Archipelago Management Board set up to balance the respective management approaches and entities?

Sloan: From 1993 to 2010, the AMB consisted of two representatives of the Haida Nation and two representatives of Parks Canada. In 2010, with the designation of Gwaii Haanas Marine and the integration of the terrestrial and marine protected areas, the AMB expanded from four members to six, and now is composed of three representatives of the Haida Nation and three from the federal Government of Canada (two from Parks Canada, and one from DFO).

The AMB meets twice a month to discuss issues and make decisions. Each decision is signed off by one Government of Canada representative and one Haida Nation representative. Each party is responsible to implement that decision within its organization.

MEAM: Why do you think it is so rare for there to be a protected area extending from mountaintop to seafloor like Gwaii Haanas?

Sloan: One of the reasons that linked land-sea protected areas are rare is that marine protected areas are a much newer concept than terrestrial parks. Within Parks Canada, for example, our first national park was established in 1885, in the Rocky Mountains. We designated our first coastal terrestrial park in 1904, but it wasn't until 1986 that our first marine policy was issued. Our first marine park (Fathom Five) was designated soon after, in 1987.

When the Haida designated Gwaii Haanas a Haida Heritage Site in 1985, they included the marine area. In the Haida worldview, everything is connected to everything else: people, plants, animals, land, sea, and air. This worldview is, essentially, the science of ecology - the study of the ever-changing relationships in nature.

Gwaii Haanas's success will depend on the relationships we build - among the AMB partners as well as with other First Nations and stakeholders. Building these relationships often requires reconciling different worldviews and working through conflict. This work can be difficult, but it leads to better management solutions in the end. As we work toward an integrated land and sea management plan, Gwaii Haanas is still at the leading edge of natural and cultural resource management.

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Tundi's Take: Engagement of citizens in research may be a pain for scientists, but citizen science holds many benefits [11]

By Tundi Agardy, MEAM Contributing Editor. tundiagardy@earthlink.net

1. There are certain undeniable facts about effective marine management:
2. We know enough to recognize we should adopt an EBM approach and manage more comprehensively;
   Despite this knowledge, we often need more science (natural and social) to detail how to improve management;
3. Additionally, we need to harness science to monitor progress in order to make sure our management measures are succeeding (and if not, to know how to amend them); No amount of public sector funding is likely to create enough capacity to get 1-3 done; and
4. Enthusiastic citizens can help fill the capacity gap - but only if they are well-trained to be systematic in observations and reporting, and motivated to participate consistently.

This sort of cooperative arrangement can have its perils. Citizen science is notoriously hard to achieve: it is different from having citizens volunteer to help with management tasks. For science to be scientific, it must be robust - not only in the framing of questions, but also in the acquisition of data to support or refute hypotheses. When data are collected by many different individuals, inconsistencies in collection can cause all sorts of errors. This is true even when those many individuals are trained scientists.... Citizens, with their wide spectrum of education, training, experience, and motivations, can introduce so much variability that the robustness can evaporate if not managed well.

How can we ensure that citizen science is good science? Training is obviously key. So, too, are the communications that go into marketing opportunities to get involved, to engage these citizens. People may be motivated to participate for a wide variety of reasons: they may want to contribute to a cause, and have time and energy to devote to it; they may want to collect first-hand information to support a preconceived notion or stance; they may desire praise or need fodder for a resume; or they may want to live out a fantasy of being a marine biologist (fact is, nearly everyone I have ever met wanted to be a marine biologist at some point in their lives; most quickly recognized that it was not a very lucrative way to earn a living, and went on to do other things...). How one engages citizens in citizen science will affect outcomes. Understanding what motivates participation in science, and getting citizens engaged for all the right reasons, is essential for harnessing their energy effectively and for having confidence in the information they acquire. This takes time and effort.

Yet it can be done, with good results. My first exposure to really great citizen science came from my time in the US state of Rhode Island, when an organization - the Salt Pond Watchers - rallied to get consistent, defensible, long-term information on the condition of coastal ponds and the pressures affecting them. It could be said that this citizen science laid the foundation for Rhode Island's pioneering initiatives on coastal zone management and marine spatial planning. Enough data were generated by Salt Pond Watchers to perform robust statistical analyses on coastal issues, building a solid case for what needed to be done to improve the condition of the adored coastal habitats of the Ocean State.

Getting citizens engaged, trained, and participating is well worth the effort. And perhaps the greatest benefit of citizen science is not in the acquisition of data or the generation of information - it is in the building of a highly informed constituency in favor of good science and, ultimately, the sound resource management that science supports.

Someone once said, "We cannot love what we do not know." The more people can learn about the oceans, the more they will care - and the greater the chance that EBM has a hope of delivering effective management.

The EBM Toolbox: Coastal and marine citizen science projects [12]

[Editor's note: The goal of The EBM Toolbox is to promote awareness of tools for facilitating EBM. It is brought to you by the EBM Tools Network, an alliance of tool users, developers, and training providers.]

Participants in the EBM Tools Network listserv were recently asked to provide examples of coastal and marine citizen science projects. They offered a wealth of them: more than 30 projects.

The list is indicative rather than comprehensive, and tends to focus on projects described in English and mostly from the US. Still, it gives an idea of the diversity of citizen science projects in practice. Projects range from subtidal reef monitoring by volunteer divers (Phytoplankton Monitoring Program), to tagging undersized Atlantic bluefin tuna (Tag a Tiny), to transcribing old ship logs in search of historic weather patterns (Old Weather), and much more.

Phytoplankton Monitoring Program
www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/phytoplanktonmonitoringprogram.aspx [13]

Tag a Tiny
www.tunalab.org/tagatiny.htm [14]

Old Weather
www.oldweather.org [15]

The full list of projects and their websites is here [16].

[Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at www.ebmtools.org [17].]

Project aims to guide EU monitoring and implementation of spatially managed areas [18]

The EU-funded project "Monitoring and Evaluation of Spatially Managed Areas" (MESMA) is analyzing marine spatial planning in practice in Europe. The ultimate goal of the four-year project, which started in 2009, is to inform wider implementation of MSP in the region, namely by drawing lessons and good practices from 13 case studies of spatially managed marine areas. Scheduled for completion by the end of 2013, MESMA is applying a framework to monitor and evaluate each of the 13 cases.

Luc van Hoof of the IMARES research institute at Wageningen University in the Netherlands is leading the MESMA project. MEAM asked him for insights he has gained so far from the project. He responds below.

On lessons learned so far in MESMA

"MSP and spatially managed areas (SMAs) in the EU are currently a mixed basket, with only a few actual plans in place and several more plans either in progress or anticipated. As for good practices and lessons learned in our case study analysis, we observe so far that:

- In those cases where an ecosystem-based approach toward sustainability has not been considered a prime objective of marine management, there is usually also no incentive to embark on a process of marine spatial planning.
- Implementation of the European Habitats and Bird Directives (Natura 2000) as well as the Marine Strategy Framework Directive have often been a trigger to move toward MSP.
- Despite the absence of an overall MSP framework in the EU, ecological conservation considerations have resulted in the designation of marine protected areas in some cases. At the same time, in other cases, MPAs have not been designated because of a perceived lack of scientific evidence.
- Early-stage public participation, as well as involvement of all governmental bodies relevant to the MSP, results in a faster MSP process, from what we have seen.
- Legal constraints to full MSP implementation are particularly clear in transboundary areas between EU member states, and even more so between EU and non-EU countries. In such cases, national interests often get higher priority than the promotion of sustainability in the entire spatially managed area. Regional Seas Conventions could have an important role to play here."

On national or regional differences observed in approaches to MSP in Europe

"In cases where spatial management is already in place, it is striking that two of the existing marine spatial plans were instituted at the international level (the Wadden Sea Plan and the Baltic Sea Action Plan). In contrast, where planning initiatives are ongoing or anticipated (the majority of the case studies), marine spatial plans are much more focused on the national level. Very often the plans are made for parts of the national waters - like the different plans for the Celtic Sea and Pentland Firth (in Scotland), which are each part of the UK marine area."

On the MESMA framework, which provides a series of steps for monitoring and evaluating spatially managed areas

"The MESMA framework (www.mesma.org/default.asp?ZNT=S0T1O750 [19]) was built on the basis of good practice and lessons learned from existing approaches. It builds, for example, on components of ecosystem-based management: scoping, performance measures, assessment, and adjustment. It is equally footed in policy analysis.

"The MESMA framework is more than a set of logical steps. It is complemented by a detailed user manual that gives guidance on its practical implementation for the assessment of spatially managed areas. For example, it contains suggestions on how to structure the analysis for each of the steps of monitoring and evaluation, depending on user preferences and the quality and availability of information.

"It is also worth mentioning that the framework can be used for different depths of analysis. It can be helpful on the one hand as a structured step-by-step, go-through-the-boxes systematic approach to setting up monitoring and evaluation of a spatially managed area. On the other hand, it is a flexible framework allowing the user to enter the framework at any point."

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The MESMA Final Conference is 8-10 October 2013 in Lisbon, Portugal: www.mesma.org [20]

Notes & News: Timor-Leste - Biodiversity offsets - Rhode Island MSP - Payments for ecosystem services [21]

Timor-Leste approves guidelines for co-management of natural resources

The nation of Timor-Leste - in the heart of SE Asia's Coral Triangle - has adopted its first comprehensive guidelines for establishing community and government co-management of natural resources, on land and at sea. The guidelines were prepared by Conservation International for the Timor-Leste National Coordinating Committee, and are available at http://www.coraltriangleinitiative.org/library/technical-report-guidelines-establishing-co-management-natural-resources-timor-leste [22].

Report available on relatively new concept of marine biodiversity offsets

Biodiversity offsets are measures taken to compensate for damage to wildlife. In the marine ecosystem, such offsets have been proposed as a way to account for various adverse impacts threatened by new or existing uses. The offsets - which could take the form of creating new habitats to replace impacted ones, among other strategies - would achieve no net loss or preferably a net gain in marine biodiversity.

Earlier this year, a study on marine biodiversity offsets was released by The Crown Estate, a commercial property organization that manages a diverse portfolio on behalf of the UK. Marine biodiversity offsets remain a relatively new idea, and the report is among the few studies anywhere on it. The report relies on two hypothetical cases to guide thinking on how biodiversity offsets could be planned in UK waters, in particular the calculation of equivalence in designing marine offsets. The study "Marine Biodiversity Offsetting - UK Scoping Study" is at www.thecrownestate.co.uk/media/397708/marine-biodiversity-offsetting-uk-scoping-study.pdf [23].

New publication provides detailed case study of Rhode Island's MSP process

A new publication describes the process by which the US state of Rhode Island developed a marine spatial plan for its waters, and provides up-to-date information on the plan's implementation. Called a practitioner's guide, it is intended to serve as a resource for ocean planners everywhere. The 68-page document offers a detailed look at a particular MSP process. "The Rhode Island Ocean Special Area Management Plan: Managing Ocean Resources Through CMSP" is available at http://seagrant.gso.uri.edu/oceansamp/pdf/Practitioner_Guide.pdf [24].

Guide: Best practices for developing Payments for Ecosystem Services schemes

The UK Department for Environment, Food, and Rural Affairs (Defra) has released a best practice guide to assist with designing and implementing Payments for Ecosystem Services (PES) schemes. Drawing on examples from around the world, the manual helps users to:

- Understand the principles of PES;
- Identify and test potential opportunities and suitable partners for PES; and
- Find solutions to technical, legal and institutional issues.

"Payments for Ecosystem Services: A Best Practice Guide" is available atwww.gov.uk/government/publications/payments-for-ecosystem-services-pes-best-practice-guide [25].

Printer-friendly version [26] PDF version [27]
