

What Does Your MPA Cost?: Considering the Various Costs of MPAs to Stakeholders and Management

Much discussion on MPAs, and particularly no-take marine reserves, focuses on their *benefits*: to the marine ecosystem — to research — even to fishermen as insurance against stock collapse, or as a potential source of fish spilling over into fished areas. There are *costs* from MPAs, too. Some costs, like the potential for foregone catches when no-take areas are placed on fishing grounds, often become a central focus in the planning of new MPAs.

There has been considerable study of the benefits of MPAs: seemingly any MPA-themed conference features multiple papers on fish abundance gains inside reserves. But there has been relatively little examination of the costs. Despite the high profile of foregone-catch arguments, for example, there are few rigorous studies on the actual economic impact of a new reserve on fishing revenue, comparing data from before and after site designation. And studies of the budgetary needs of MPAs, or how those needs can be managed most effectively, seem just as rare. This month, *MPA News* considers the range of costs associated with marine protected areas. We ask, what does it cost to operate an MPA — to resource users, to management, and to the ecosystem?

“Costs matter as much as benefits”

Tony Charles is a professor of Management Science and Environmental Science at Saint Mary’s University in Halifax, Nova Scotia, Canada. As an advisor to several fisheries organizations in Atlantic Canada and in his work on fishery and coastal management projects worldwide, Charles has viewed the costs of MPAs as well as their benefits. “Costs matter as much as benefits,” he says.

In a September 2007 presentation to the European Symposium on MPAs, Charles said any MPA planning process should consider the distribution of benefits and costs from the proposed site. “Who receives the benefits, who suffers the costs, and when do those benefits and costs occur?” he asked. The “when” aspect can be key: a fundamental tension in MPA planning comes from the fact that benefits from MPAs are often realized in the long term, while costs often arise in the short term. Benefits and costs can also vary geographically or in scale. In terms of the latter aspect, a benefit

may be international — such as the existence value of biodiversity in a protected area — whereas the corresponding cost is local in the form of negative impacts on displaced fishers. (“Existence value” reflects the benefit people receive from simply knowing that a particular, cherished environmental resource exists.)

The fact is, designating an MPA often produces winners and losers. Some MPA planning processes take this into account and attempt to minimize the losses for affected stakeholders by adjusting site designs, or provide economic compensation to assist affected parties in adjusting to the new regime. Some take both measures. The Great Barrier Reef Marine Park Authority (GBRMPA) assessed the potential socioeconomic impacts on fishermen from its Representative Areas Program, during which the no-take percentage of the Marine Park increased from 5% to 33% (*MPA News* 5:10). The neighboring state government of Queensland projected the impact of those expanded no-take areas on shore-based businesses, such as fish brokers and businesses dependent on recreational fishing (www.qraa.qld.gov.au/newsitem.jsp?product=305&news=403). Those Queensland findings were incorporated in a “Structural Adjustment Package” developed by the Australian Government that has disbursed tens of millions of dollars to fishermen and fishery-related businesses affected by the rezoning (*MPA News* 7:7).

In terms of costs to fishers from MPAs, there may be both opportunity costs — such as foregone catches due to restrictions in the MPAs — and increased operating costs, such as expenses incurred in having to travel to alternative fishing grounds farther away. For a clear summation of potential costs (and benefits) to fishers, see “Marine Protected Areas: Economic and Social Implications”, by James Sanchirico, Kathryn Cochran, and Peter Emerson, at www.rff.org/RFF/Documents/RFF-DP-02-26.pdf. The paper recommends that planners consider under what conditions an MPA’s benefits would outweigh its costs. “If reducing potential costs to fishermen is important, then one might look to set aside areas that contribute relatively less to their livelihood,” write the paper’s authors. “Why might one potential MPA site contribute less than another? It could be

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because the species are widely dispersed throughout the fishing grounds, or that the set-aside area is one of the least profitable areas to fish. Another reason could be that the current scale of the MPA is such that it does not make any discernable impact on fishing profits.”

Cost of MPAs as a fisheries management tool

Ray Hilborn, a fisheries scientist at the University of Washington (US) who serves as an advisor to several international fisheries commissions, says no-take marine reserves are often an inefficient tool for fisheries management. That is, compared to traditional fisheries management techniques (e.g., restrictions on gear, fishing times, fish size), reserves can confer greater costs with fewer benefits (in the form of reduced catches) depending on a variety of conditions.

Hilborn was asked to compare the costs to industry if traditional management methods were used in one sample area while no-take reserves were used as a fishery management tool in another, otherwise-equivalent area. “If there is well-directed catch regulation in one area and MPAs only in another area, then one would expect a ‘good’ outcome in the ‘traditional’ area, with stable stock sizes and economic profitability, as found in our better managed fisheries,” says Hilborn. “In contrast, using no-take MPAs only, you would find sedentary species almost exclusively inside the MPAs and severely overfished everywhere else. Highly mobile species of significant economic value would be depleted everywhere.” Under this scenario, he suggests, adjacent ecosystems (as well as fishermen) would bear costs of

the reserve. In reality, notes Hilborn, almost all Western countries combine MPAs and “traditional” techniques in their fisheries management strategies.

Still, it is possible that long-term benefits to fisheries from a marine reserve can outweigh the short-term costs. Hilborn, who with Raquel Goñi is studying the effects of spillover from Spain’s Islas Columbretes Marine Reserve on local lobster catches, confirms this. “It depends primarily on the fishery management system outside the reserves,” he says. “The poorer the fishery management system, the more likely it is that the fishery will be better off with the reserves.” He also acknowledges that some reserves are designated primarily to protect biodiversity, and not as a tool to help manage fisheries and produce higher fish catches. Deciding what is optimal in terms of costs and benefits therefore depends on your objectives, he says.

Hilborn has partnered with fisheries scientists Carl Walters and Chris Costello to produce modeling work for the Marine Life Protection Act (MLPA) process that is planning a network of marine reserves in the US state of California. “In our MLPA work, we have found win-win circumstances, where you get higher catch, catch-per-unit-effort, and abundance [as well as biodiversity protection],” says Hilborn. “This can occur when you have a source-sink dynamic in the larval dispersal. In those cases you want to protect the larval sources, while fishing in the sinks. The question is whether we know enough about larval dynamics to identify those spots.”

Costs of MPA management

The most direct costs imposed by MPAs are those for management: monitoring, enforcement, facilities management, and other budget items, including salaries for staff needed to perform these tasks. Kalli De Meyer, former manager of the Bonaire National Marine Park (BNMP), says she was surprised by a calculation of management costs for protected areas worldwide. “I had been managing the BNMP for 10 years when I attended the World Parks Congress [in 2003] and I remember hearing a keynote speaker expounding how cost-effective it is to set aside and manage protected areas,” says De Meyer. “He claimed the global cost of park management, both terrestrial and marine, was in the region of US \$1 per hectare. On the back of an envelope I was shocked to realize that BNMP had been running on closer to US \$100 per hectare. Explain that to funders!”

De Meyer notes there are “added costs” associated with managing marine protected areas, as opposed to terrestrial ones. “Boots and binoculars are just not enough,” she says, listing costs such as keeping boats up and running, mooring maintenance, compressors, diving equipment, and so on. “There is also the ongoing and high repair and replacement cost of equipment that is constantly out on the sea,” she adds.

MPA Tip: On decreasing your MPA’s overhead costs

These suggestions for decreasing your MPA’s overhead costs are from remarks by Sibylle Riedmiller in the April 2002 issue of *MPA News* (“Stretching Your MPA Budget: How to Do More with Less Funding”, *MPA News* 3:9). Riedmiller is project director for the Chumbe Island Coral Park, located 13 km southwest from Zanzibar, Tanzania. She credited these strategies in frugal management with helping the MPA survive through lean financial periods:

- Encourage help from volunteers;
- Keep some staff on seasonal schedules;
- Outsource monitoring to university students;
- Conduct marketing for your MPA primarily via the Web; and
- Choose technologies and technical equipment that are simple, appropriate, and low-cost to maintain.

Riedmiller said the last point was particularly important in developing countries. “Expensive, state-of-the-art equipment often breaks down in an environment characterized by tropical climates, power fluctuations, unskilled users, and lack of specialized spare parts,” she said. In contrast, old computers and reconditioned vehicles can often be maintained locally and at low cost.

Now De Meyer is executive director of the Dutch Caribbean Nature Alliance (DCNA), an NGO that has led the development of a US \$40-million endowment fund for protected areas. According to DCNA calculations, interest generated by that endowment will produce enough annual revenue to cover the basic operational costs of 10 protected areas (five MPAs and five terrestrial parks) in the Dutch Caribbean, which consists of Aruba, Bonaire, Curaçao, Saba, St. Eustatius, and St. Maarten. DCNA's three-volume study of the fund is available at www.dcnanature.org/donations/trustfund.html.

"Now that the Dutch Caribbean has created a regional network, it is fascinating to be able to compare spending across a range of parks," says De Meyer. "One of the things that has struck us is that spending is often a poor reflection of the time and effort that is poured into protected area management." She cites, for example, the budgetary figures reported for law enforcement at Dutch Caribbean protected areas. These figures are often too low and don't reflect the realities of enforcement, she says. "Law enforcement expenditures, as reported in budgets, sometimes only include things like travel (to go to court), attorney fees (for advice or to write letters), translation costs, and equipment needed only for law enforcement activities, such as calipers to measure net mesh sizes," says De Meyer. "Often the reports don't reflect the huge amount of time spent on patrolling; following up on incident reports; the often long and tedious process of pursuing prosecutions; and overseeing and issuing permits."

MPA cost vs. MPA value


In 2002, environmental consultant Pippa Gravestock conducted a global survey of incomes and expenses for MPAs, including the minimal and ideal levels of funding necessary to manage an MPA effectively. Her survey of 79 MPAs found that a large majority of sites reported shortfalls in the funding necessary to meet their management needs ("The cost of operating an MPA", *MPA News* 5:5).

Gravestock's analysis of the survey findings looked for correlations between cost of management and various MPA characteristics. She found that MPA funding needs were positively correlated with visitor numbers and MPA surface area. In general, the more visitors an MPA had and the larger it was in size, the greater its management costs were. Thus, on a cost-per-hectare basis, large, highly visited MPAs were no more efficient than smaller, less-visited sites.

"At the most basic level, you would think that economies of scale should be present within any organizational structure," she says. In other words, you might expect larger MPAs to have more efficient cost structures than smaller MPAs — somewhat similar to how a

larger factory is generally able to produce goods more efficiently than a small factory. "But my findings were actually that MPAs come in so many different shapes and sizes, with differing objectives and differing circumstances (proximity to population centers, accessibility, habitats etc.) that no clear evidence could be found for economies of scale," says Gravestock.

"Policing a very large and inaccessible offshore MPA may look like good value in terms of dollars per hectare, but protecting an unusual and unique habitat at a far higher cost per hectare may be money better spent," says Gravestock. "To turn one's budgetary firepower exclusively on 'big and efficient' (though perhaps rarely visited) MPAs may neglect the 'small and beautiful' MPAs where 'beauty' may equate to 'effectiveness in moving public opinion' or 'critical contribution to ecosystem services'. Indeed, if there was one over-riding finding in my survey, it was that MPAs cross so many orders of magnitude in their key metrics that modeling based on any one factor is generally a poor guide to their actual financial needs.

"I suppose what we need is a measure of 'value per hectare' to weigh against 'cost per hectare,'" says Gravestock, who is now studying costs associated with MPAs on the high seas. "I needn't tell you, though, that calculating 'value per hectare' would be the hardest part." 

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Benefits of MPAs

The adjacent article discusses various costs that MPAs impose. There are benefits from MPAs, too — both to humans and the environment. The IUCN book *Guidelines for Marine Protected Areas* (available at www.iucn.org/dbtw-wpd/edocs/PAG-003.pdf) provides the following list of potential MPA benefits:

- Conservation of biodiversity, especially critical habitats of threatened species;
- Refuge for heavily exploited species;
- Protection of attractive habitats/species on which sustainable tourism can be based;
- Increased productivity of fisheries by:
 - Insurance against stock collapse;
 - Buffer against recruitment failure;
 - Increase in densities and average sizes of individuals;
 - Increase in reproductive output;
 - Provision of dispersal centers for propagules and adults (spillover);
 - Maintenance of more natural species composition, age structure, spawning potential, and genetic variability;
- Contribution to increased knowledge of marine science through:
 - Information on functional linkages;
 - Implementation of the precautionary principle;
 - Provision of ecological benchmarks and control sites for research;
 - Potential as nodes in monitoring networks; and
- Protection of cultural diversity, such as sacred places, wrecks and lighthouses.

The Micronesia Challenge: Assessing Progress Over the Past Two Years

In November 2005, President Tommy Remengesau of Palau challenged his fellow leaders in the Micronesia region of the Pacific Ocean to conserve 30% of their nearshore marine waters by 2020. His “Micronesia Challenge” was intended to help address threats to the region’s marine resources, such as climate change, while positioning Micronesia as a global leader in conservation.

Neighboring governments accepted the challenge. Within five months, leaders of the Federated States of Micronesia (FSM) and Marshall Islands, as well as the US territories of Guam and the Commonwealth of Northern Mariana Islands, pledged to meet the 30% target, in addition to a related goal to protect 20% of their terrestrial lands by the same date (“The Micronesia Challenge”, *MPA News* 7:9).

Efforts to meet the challenge are now underway, including the establishment of a major new endowment to fund conservation activities in the region. For a snapshot of some of the progress so far, *MPA News* spoke with:

- **Marion Henry**, assistant secretary of the FSM Division of Resource Management and Development, and
- **Willy Kostka**, executive director of the Micronesia Conservation Trust (www.mctconservation.org), which serves as the housing mechanism for what will be a US \$18-million Micronesia Challenge endowment.

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MPA News: As one of the countries that pledged to meet the Micronesia Challenge, how close is FSM to meeting its goal of protecting 30% of its nearshore waters?

Marion Henry: As of now, we have established 26 MPAs constituting about 4% of our marine ecosystems. Admittedly, not all these MPAs are effectively managed. In June 2008, a meeting was convened to develop regional indicators of management effectiveness with which to track our progress over the next 12 years. Although we have an indication of the areas of biological significance within the FSM, we will be completing Rapid Ecological Assessments this October that will assist us in getting a better handle on the status of and gaps in management.

MPA News: What are the main obstacles to meeting the goal in FSM?

Henry: The FSM has a complex federal system of government comprising four largely autonomous States (Yap, Chuuk, Pohnpei and Kosrae) with numerous islands (607 inhabited islands) extending across a vast

expanse of ocean (total EEZ of 3 million square miles). As such, successful efforts to design and establish a nation-wide protected area network will take time and must be built from the bottom up, beginning with communities, local governments, and state governments.

To begin to address these challenges, a core team led by the FSM Protected Areas Coordinator and composed of representatives from the FSM National Government, the Micronesia Conservation Trust, and The Nature Conservancy (Micronesia Program) has been working with state governments and local conservation NGOs to build support for protected areas. Members of the core team have made numerous state visits to give presentations, facilitate workshops, and meet informally with local communities, elected leaders, and other key stakeholders.

MPA News: Palau intends to create a self-funding protected area network for itself through establishing a trust fund and implementing a tourism user fee (*MPA News* 8:1). Another Pacific nation, Kiribati, is establishing an endowment to finance its Phoenix Islands Protected Area (*MPA News* 9:8). How will the FSM Government fund its own protected area network?

Henry: In December 2007, the five governments involved in the Micronesia Challenge (FSM, Palau, Marshall Islands, Guam and the Commonwealth of the Northern Mariana Islands) agreed to utilize the Micronesia Conservation Trust (MCT) as an endowment manager. MCT began as a nongovernmental organization in FSM to assist locals in accessing international funding for conservation activities. But it has now become regional to accommodate the decision to use it as an endowment manager for Micronesia Challenge funds, with high-profile board members from throughout the region [including leaders from the public and private sectors]. We will be raising funds from international sources for the endowment to ensure sustainable financing over the long-term.

Internally, FSM has earmarked funding through the Compact of Free Association [i.e., financial assistance from the US, which formerly governed FSM in trust] that is now being used for activities in conservation and resource management, including protected areas. We also aim to establish a national-level endowment to help provide sustainable financing for our protected areas, with money from local and international sources.


MPA News: What is the status of fundraising for the \$18-million Micronesia Challenge endowment?

Willy Kostka: Thus far over \$13 million has been pledged from various institutions — The Nature

Conservancy, Conservation International, and the Global Environment Fund. The government of Taiwan has contributed Palau's portion of the endowment. MCT will begin managing these funds in September 2008. The five governments in the Challenge are leading the fundraising.

MPA News: What kinds of organizations and projects will receive funding through the endowment?

Kostka: MCT can give grants both to government agencies and NGOs. The Micronesia Challenge is a government-led initiative, so government is going to be

leading the implementation of Challenge activities. I see government's roles as setting policies and legislation, providing enforcement, and allocating local funding sources to projects, among other activities. In contrast, I see NGOs' main role as being the liaison between local communities and government agencies (as well as outside technical groups). I also see local NGOs providing technical assistance — i.e., monitoring, training, etc. — to local communities. Nongovernmental organizations in FSM, for example, have made some very good progress working with local communities and on the ground. 

Future issues for the Micronesia Challenge

The Micronesia Challenge Support Team — consisting of a wide range of policy makers, stakeholders, and international institutions — recently assessed efforts to implement the Challenge, including lessons learned. The excerpt below summarizes what the team identified as “future challenges” for implementation efforts to address (for the full assessment, e-mail Bill Raynor, chair of the Micronesia Challenge Support Team, at braynor@tnc.org):

- Work with communities to identify the best ways to support their conservation efforts and address their socio-economic needs.
- Develop and implement sustainable finance strategies and disbursement, monitoring, and management mechanisms in all jurisdictions.

- Develop and implement a coordinated regional fundraising strategy.
- Continue to showcase the Micronesia Challenge to the international community to build global support until all goals are achieved.
- Institutionalize the Challenge in all jurisdictions so that the commitment survives future leadership transitions.
- Standardize the measurement of conservation baselines across the region.
- Define and measure “effective management” across the region.
- Develop a long-range business plan for the Challenge detailing implementation benchmarks and financial needs.

Notes & News

Handbook available on Marxan good practices

A new handbook describes good practices in the use of Marxan, a popular free software program used as a decision support tool in marine and terrestrial reserve design. Published by the Pacific Marine Analysis & Research Association (PacMARA), the handbook distills the advice of 25 expert users on issues relevant to systematic conservation planning and the use of support tools like Marxan. Although peer-reviewed internally, it is still open to comments and subject to revision. A final version is expected in early 2009.

The *Marxan Good Practices Handbook*, as well as the previously published *Marxan User's Manual*, are available on the PacMARA website at www.pacmara.org. Marxan was described in the October 2004 *MPA News*, including cases in which it was used to plan marine reserve networks (*MPA News* 6:4).

New marine World Heritage sites named

The UNESCO World Heritage Committee has inscribed two new sites with marine components on its World Heritage List. The Lagoons of New Caledonia represent the main diversity of coral reefs and associated ecosystems in the French Pacific Ocean archipelago of New Caledonia, and are among the three most extensive reef systems in the world. Yemen's Socotra Archipelago in the northwest Indian Ocean is remarkable for its rich biodiversity and endemism: its marine component has 253 species of reef-building corals, 730 species of coastal fish and 300 species of crab, lobster, and shrimp. For more information, go to <http://whc.unesco.org/en/news/451>.

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Daniel Owen is a barrister at Fenner's Chambers in the UK. He specializes in public law relating to use of the oceans. His essay here focuses on the continental shelf beyond 200 nautical miles from the baseline: the "outer" continental shelf. The term *continental shelf* has both a legal meaning and a geological and/or geomorphological meaning. It is the legal sense that is considered here.

Owen provides the following disclaimer: "The material in this essay is a summary and necessarily involves simplification of a complex area of international law. It should not be relied upon or treated as a substitute for legal advice in relation to individual situations. Daniel Owen shall have no responsibility for any loss that may arise from reliance on any part of the material contained in this essay." He holds the copyright to this essay.

geological and geomorphological criteria (Art. 76 (4)). Relevant data are required to apply those criteria. However, the maximum outer limits are 350 nm from the baseline or 100 nm from the 2500-m submarine depth contour (Art. 76 (5)). The part of the continental shelf beyond 200 nm is referred to here as the outer continental shelf or, for brevity, the outer shelf. Whereas the shelf within 200 nm is overlain by the EEZ (if the coastal State has claimed an EEZ), the outer is overlain by the high seas. The rest of this essay focuses on the outer shelf specifically.

A coastal State party to UNCLOS cannot unilaterally fix the outer limits of an outer continental shelf. Instead, there is a multilateral process it has to go through, involving a body called the Commission on the Limits of the Continental Shelf, or CLCS (Art. 76 (8) and Annex II). In broad terms, step one involves the coastal State making a submission to the CLCS on the outer limits, and step two involves the CLCS making recommendations to the coastal State. In essence, the coastal State can then do one of two things. It can either accept the CLCS's recommendations, and establish outer limits on the basis of them, whereupon those limits become final and binding. Or it can disagree with the recommendations and make a revised or new submission to the CLCS.

UNCLOS specifies that the deadline for making submissions to the CLCS is 10 years from the date of entry into force of UNCLOS for the coastal State in question (Annex II). In May 2001 and June 2008, the parties to UNCLOS adopted important decisions regarding that deadline. In practice, the CLCS has received 12 submissions so far (see

MPA Perspective The Outer Continental Shelf: Opportunities for Marine Environmental Protection

By Daniel Owen

This essay is about the continental shelf regime in international law. After introducing the regime, the essay briefly focuses on its relevance to environmental protection of the so-called *outer* continental shelf, such as via designation and management of MPAs. Article and annex references in this essay are to the 1982 United Nations Convention on the Law of the Sea (UNCLOS — text available via www.un.org/Depts/los/index.htm).


The continental shelf starts at the seaward limit of the territorial sea, and comprises the seabed and subsoil (Art. 76 (1)). Unlike the exclusive economic zone (EEZ), the continental shelf has no water column element. The coastal State has sovereign rights for the purpose of exploring the shelf and exploiting the shelf's "natural resources" (Art. 77 (1)). Such rights are exclusive (Art. 77 (2)). The natural resources of the shelf have economic importance — e.g., oil and gas. However, the shelf's natural resources are not restricted to non-living resources; they also include living organisms belonging to so-called "sedentary species" (Art. 77 (4)). The UNCLOS definition of "sedentary species" creates scope for debate in fact and in law about what is, or is not, such a species.

Assuming no spatial constraints imposed by neighboring States, the outer limits of the continental shelf lie 200 nautical miles (nm) from the baseline (like the EEZ) or at the "outer edge of the continental margin" (Art. 76 (1)), whichever is farther offshore. The outer edge of the continental margin is determined by

www.un.org/Depts/los/clcs_new/clcs_home.htm), some of which are partial submissions and some of which are by more than one coastal State. For any given coastal State party to UNCLOS with an outer shelf, uncertainty about the outer limits of that shelf will remain until that State has completed the multilateral process and has adopted valid final and binding limits.

If a coastal State has an outer shelf, it has sovereign rights to explore that outer shelf and to exploit its natural resources. So, for example, it has the exclusive right to exploit "sedentary species" and non-living resources — e.g., gas hydrates — of the outer shelf. But, as a corollary, it also has the right to regulate such activities in order to protect the marine environment. Thus the continental shelf regime, in potentially bringing areas of seabed and subsoil beyond 200 nm within coastal State jurisdiction, creates opportunities for protection of that seabed and subsoil by the particular coastal State in question. In all this talk of *rights*, it should be added that certain *duties* regarding environmental protection on the continental shelf also exist (e.g., Arts. 194 (5) and 208).

The right of the coastal State to regulate certain activities on the outer shelf in order to protect the marine environment may, in principle, be applied to the management of any MPAs located there. If a coastal State were to designate one or more MPAs on its outer continental shelf, its right to regulate certain activities there could, in principle, be used to effect management of such sites. Of course, the extent to which activities could be managed would need to be consistent with the coastal State's sovereign rights regarding the continental shelf. The extent of the management would also need to reflect the fact that the outer continental shelf is overlain by high seas.

The fact that the outer continental shelf is overlain by high seas potentially raises some complex issues. In particular, it raises the possibility of some interactions between the exercise of high seas freedoms in the waters overlying the outer shelf (e.g., bottom trawling for non-sedentary species, which may damage sedentary species) and a coastal State's rights regarding its outer shelf (e.g., the exclusive right to exploit sedentary species there). Further discussion of these interactions and their possible outcomes can be found in a 2006 report by the author, available at www.ngo.grida.no/www/fneap/Projects/Reports/WWF_Owen_Jurisdiction.pdf (paragraphs 219-231). 

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