A ZONING APPROACH TO MANAGING MARINE ECOSYSTEMS

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The Problem of Open Access

Leo Tolstoy begins his 1878 novel *Anna Karenina* with a fascinating observation: "Happy families are all alike; every unhappy family is unhappy in its own way." The list of fundamental weaknesses in US ocean governance in Cicin-Sain and Knecht (2000) suggests that our country manages our Exclusive Economic Zone (EEZ) under a variety of dysfunctional regimes, each dysfunctional in its own way. Years of watching interminable conflict and almost universal dissatisfaction among ocean interests have convinced me that there is only one kind of management framework with a high probability of working well from a broad range of perspectives: comprehensive ocean zoning.

Open access is a major contributor to dysfunction in US ocean governance. The ocean's physical processes, biological patterns and human uses are heterogeneous, but, unlike the Earth's land surface, where boundaries between different uses are often readily apparent, many uses of oceans overlap spatially. The tradition that people can go wherever and do whatever they want is why the sea is often called "the last frontier" (e.g., Lemonick 1995; NOAA 1999). The "frontier mentality" serves some purposes of governance so long as the ratio of users to resources is very low. But as American frontier historian Frederick Jackson Turner (1893) observed, "the democracy born of free land, strong in selfishness and individualism, intolerant of administrative experience and education, and pressing individual liberty beyond its proper bounds, has its dangers as well as its benefits." As the ratio of users to resources grows, competition among interest groups has increasingly undesirable effects.

Some of the least reversible and most pernicious effects of competition in frontiers are the harm it causes to biodiversity and its users (in the sea these include fishermen, divers, whale watchers). Frontier users inevitably cause profound ecological changes that lead to the end of frontier systems of use. Since the 1990s marine scientists have documented a ubiquitous pattern of changes that strongly suggest we are nearing the end of the sea's frontier era. These include:

1) accelerating loss of marine biodiversity (Norse 1993; Butman and Carlton 1995; MCBI 1998)

2) sharply reduced abundance of species at higher trophic levels (large predators) (Pauly et al. 1998; Steneck and Carlton 2001);

3) serial depletion of fisheries (moving from one abundant species or biomass-rich place to the next as each is depleted, as described by Fogarty and Murawski 1998 and Orensanz et al. 1998);

4) extensive elimination of benthic structure-forming species such as corals, sponges and tubeworms (Watling and Norse 1998);

5) proliferation and spread of weedy unusable or nonnative species such jellyfishes (Brodeur et al. 1999) and starfishes (Buttermore et. al. 1994); and

6) dramatic changes in biogeochemical functioning (Peterson and Estes 2001);

There are many legitimate sectors with interests in the sea, including shipping, defense, energy production, telecommunications, commercial fishing, sportfishing, recreational diving, whale watching, pleasure boating, tourism and coastal real estate development. In theory—and, very occasionally, in practice—the public's interests transcend the interests

of these sectors. Much of humankind depends on marine ecosystems to provide food and other crucial economic products, and all of us depend on marine ecosystem services that include generating oxygen and absorbing carbon dioxide (thereby slowing global warming). But competing uses are degrading the oceans' capacity to meet vital human needs. Scientists now recognize that the most important threat to the sea's biodiversity is fishing (Jackson et al. 2001). Open access competition is particularly fierce among people who fish for commerce, sport and subsistence.

As fishing pressure increases, competition among sectors of the commercial fishing industry and between commercial and recreational fishermen leads to what ecologist Garrett Hardin (1968) calls "The tragedy of the commons" and what social scientists (e.g. Taylor 1990) call a "collective action dilemma." This is a situation where all individuals or groups behave in an economically rational way (for example, by catching fish before someone else gets them), thereby ensuring the collapse of the resources that everyone depends on. Thus, it results from an inherent divergence between the interests of individuals, companies or user groups and those of society. Open access competition for the ocean's goods and services harms many—perhaps all—sectors of users and the public.

Zoning Dramatically Reduces Problems Resulting From Open Access

Zoning is a place-based ecosystem management system that reduces conflict, uncertainty and costs by separating incompatible uses and specifying how particular areas may be used. Thus, it provides an alternative to worsening problems caused by open access within nations' EEZs. Some elements of zoning, including leasing of offshore lands for oil and gas exploration and production, have already become commonplace on the world's continental shelves and slopes. Others, including networks of marine reserves, have gained strong support from marine scientists and conservationists interested in maintaining the sea's biological diversity. The prospect of methane-hydrate mining, offshore wind farms and offshore aquaculture furthers the potential for conflict unless the USA can determine which ocean uses are compatible and incompatible, and establish a mosaic of zones that separate incompatible uses.

Zoning can occur by happenstance or by design, but the second is preferable in at least two ways. Zoning by design allows zoning decisions to be made with all of society's goals in mind, not just single goals. And zoning by design increases the chance that adjacent zones are compatible.

A Simple Zoning System

Experience in the largest zoned area of ocean, the Great Barrier Reef Marine Park off Queensland, Australia shows that a simple zoning classification is crucial for public acceptance (Day 2002). A simple, workable system might have four major types of zones:

1) *No-go zones* (e.g., seabird nesting colonies) so sensitive that human visits (except by permitted researchers) are prohibited seasonally or permanently (these zones are very limited in extent);

2) *Marine reserve zones* that fully protect marine biodiversity by prohibiting extractive or any other harmful uses;

3) *Buffer zones* adjoining no-go zones and marine reserves that allow extractive uses that do not degrade marine habitats; and

4) *General use zones* that allow a wide range of human activities, and are likely to comprise a plurality of the zoning scheme.

Under this classification scheme, nonconsumptive activities such as boating and recreational diving can occur in Zones 2, 3 and 4; fishing methods that don't degrade marine habitats can occur in Zones 3 and 4; all kinds of fishing, oil and gas development, sand and gravel mining, port facilities and municipal waste discharges can occur in Zone 4. So, spearfishing, purse-seining, most pot fishing and most hook and line fishing could occur in Zones 3 and 4, while trawling and dredging would occur only in Zone 4.

Subzones can be used to differentiate incompatible uses within the four zones listed above. For example,

within Zone 3 or 4, sportfishing subzones can be established around artificial reefs to provide quality recreational fishing without competition from commercial fishing.

Political Benefits of Zoning

Unlike the land, zoning in the ocean will not be hampered by questions of private ownership, although mosaics of traditional uses need to be considered seriously. Zoning is likely to engender political opposition simply because it is new and different, therefore frightening. But I have a growing sense that the question is not whether the USA should have comprehensive ocean zoning throughout the EEZ, but rather how can we effect the best possible transition from the current open access system to a zoning system. A broad variety of interests will benefit from zoning and are likely to support zoning because they:

1) Don't have to compete incessantly for resources;

2) Are legally and socially acknowledged to be legitimate; and

3) Have enough certainty and stability to make long-term capital investments.

Many interests will prefer to have unfettered, nearly uncontested access to some of the sea over fighting forever to get whatever they can from all the sea because it is better to be certain of having all of something than to risk having none of everything. Zoning also encourages public participation in governance; zoning mosaics designated through transparent democratic processes have the highest probability of getting "buy-in" from the diversity of interests in the sea. Moreover, zone boundaries can be changed as new information about resources and uses is incorporated into regular rezoning processes.

Questions to be Addressed

There is enough precedent for zoning on land throughout the USA and in Australia's Great Barrier Reef Marine Park to inform a US ocean zoning process without having to rethink things from first principles. But getting from here to there will involve a lot of planning, unanticipated problems, unanticipated benefits, and adaptation to new understanding. To do so, we need to begin addressing—at minimum—the following questions.

1) What proportion of the sea should be allocated to the various zones?

2) How can government best incorporate information about existing values, threats and uses to maximize zoning benefits and minimize disruption to users?

3) What interests (e.g., fiber optic cables, pipelines, shipping, marine reserves) require connectivity and how can zoning fulfill their connectivity needs?

4) What activities are compatible and incompatible within zones and between adjacent zones?

5) How large should various zones be and how should they be shaped?

6) What are the special needs of national defense and how can they best be incorporated into the zoning scheme?

7) Are there adequate state and federal legal authorities for establishing a zoning system, or are new authorities needed?

8) Are there implications of domestic zoning for international law that need to be taken into account?

9) What is the ideal governance structure to oversee zoning and rezoning and the congressional committee structure to authorize and appropriate funds to it?

10) At what scale is zoning best accomplished: national regional or statewide? Should zoning begin in federal waters, state waters or both? And how should federal and state zoning systems be coordinated?

11) What are the most effective means of

maximizing meaningful public participation in government zoning decisions?

12) Given the short-term dislocation that will inevitably occur as a result of zoning, what is an appropriate transition strategy to minimize harm while achieving the long-term goal?

13) Both before and after zones are initially established, what kinds of monitoring and assessment are needed to inform the rezoning process?

14) How can zones be designed as experiments to yield the maximum amount of unambiguous information for decision making?

15) What are the best ways (technologically and socially) to draw "lines on the water" to make the zoning mosaic real in the minds of the public?

16) What are the conditions necessary for effective and affordable enforcement of the zoning mosaic?

17) How many years should the initial zoning pattern be in place before rezoning is initiated?

18) What needs to happen before the USA can get started?

Final Caveats

Zoning will reduce competition within zones, but will not eliminate it. Combining zoning with mechanisms such as individual fishing quotas or co-management schemes could further reduce competition in an orderly way, clearly a desirable outcome.

Zoning decisions need to favor long-term sustainability and achieve a genuine balance between various user groups and public interest conservation groups. The failure of US marine fisheries management clearly shows that user groups are not capable of making sustainable decisions when faced with the collective action dilemma. Conservation groups that do not profit from sale of marine resources do not suffer from the collective action dilemma.

Determining zoning of uses involving tens of millions of people, hundreds of billions of dollars and change-resistant institutions will undoubtedly set off powerful political currents for many years. The seeming difficulties in doing so will sometimes seem insurmountable. Careers will end and institutions will change. We will need to take the unprecedented step of training a new generation of multidisciplinary ocean managers to oversee the zoning process. But the alternative—accelerating loss of the ocean resources on which our economy and well-being depend—is worse than any problems that will arise from zoning the EEZ. Taking this first essential step through the worrisome, maddening, fascinating and exciting zoning process will ultimately lead to dramatically improved ocean management in the USA and could well serve as a model for nations around the world and, perhaps, for governance on the High Seas

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