SUSTAINABILITY

Resolving Mismatches in U.S. Ocean Governance

Problems in ocean resource management derive from governance, not science. Ocean zoning would replace mismatched and fragmented approaches with integrated regulatory domains.

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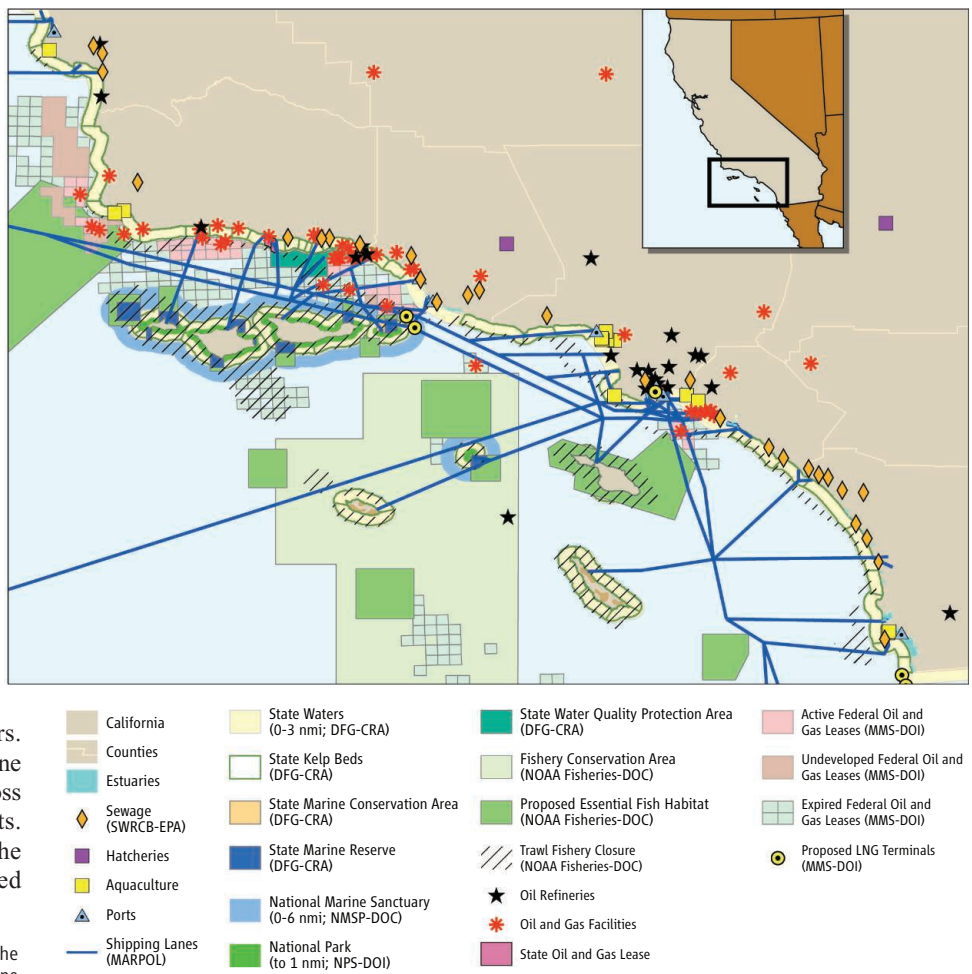
That the oceans are in serious trouble is no longer news. Fisheries are declining, formerly abundant species are now rare, food webs are altered, and coastal ecosystems are polluted and degraded. Invasive species and diseases are proliferating and the oceans are warming (*1*). Because these changes are largely due to failures of governance, reversing them will require new, more effective governance systems.

Historically, ocean management has focused on individual sectors. In the United States, at least 20 federal agencies implement over 140 federal ocean-related statutes. This is like a scenario in which a number of specialist physicians, who are not communicating well, treat a patient with multiple medical problems. The combined treatment can exacerbate rather than solve problems. Separate regimes for fisheries, aquaculture, marine mammal conservation, shipping, oil and gas, and mining are designed to resolve conflicts within sectors, but not across sectors. Decision-making is often ad hoc, and no one has clear authority to resolve conflicts across sectors or to deal with cumulative effects. Many scientists are now convinced that the solution can be found in ecosystem-based management (*2*). Ecosystem-based management focuses on managing the suite of human activities that affect particular places. This is a marked departure from the current approach. The time has come to consider a more holistic approach to place-based management of marine ecosystems, comprehensive ocean zoning (*3*).



Fragmentation of management for human uses of marine areas in southern California.

Management regimes for individual sectors operate under different legal mandates and reflect the interests of different stakeholders, so governance is riddled with gaps and overlaps (*4*). Fishing has a larger impact on biological diversity than any other human activity (*5*), but the Magnuson-Stevens Act, which governs fisheries, contains no mandate to maintain biodiversity. Ecosystem-based fisheries management (*6*) is only a partial solution—it does not account for impacts on nontarget species or manage other activities that degrade fisheries, such as pollution or wetlands loss (*7*). The problem of fragmented governance is growing, as new place-based activities in the sea [e.g., aquaculture, wind farms, liquefied natural gas (LNG) terminals] are increasing the potential range and severity of conflicts across sectors.

California's Channel Islands illustrate the potential for conflict and fragmentation of management authority (see figure, above).

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In 2003, California established a network of fully protected marine reserves and conservation areas that allow limited take in the state waters (0 to 3 nautical miles) of the Channel Islands National Marine Sanctuary. This followed a 5-year multiagency, multistakeholder process. Yet federal agencies still have not implemented the proposed reserves in federal sanctuary waters (3 to 6 nautical miles) because the roles of the two National Oceanic and Atmospheric Administration agencies (Fisheries and National Marine Sanctuaries) are unclear.

Spatial mismatches between scales of governance and ecosystems are common. Current subdivisions of state, federal, and international waters are understandable in historical and political terms. But it makes little ecological sense for managing highly migratory fishes or for LNG terminals, which can be built in state or federal waters.

Spatial mismatches typically arise from jurisdictional boundaries too small for effective management. Leatherback and loggerhead sea turtles forage over much of the Pacific, but bycatch reduction efforts required in U.S. fisheries are not used in foreign fisheries, which potentially contributes to ongoing declines (*8*). Western and Eastern substocks of Atlantic bluefin tuna migrate, so the high catches in the East may cancel the potential benefits of restricted catches in the West (*9*).

Sometimes, the causes of the problems are too far removed from the effects. Farming in the Mississippi River watershed contributes to nutrient loading and hypoxia in the Gulf of Mexico, displacing fishes and other marine organisms (*10*). Jurisdictions can also be too large. Cod management in the northwest Atlantic focused on the whole region as local stocks experienced serial depletion (*11*).

Temporal mismatches between biological systems and human institutions can also degrade marine ecosystems. Annual appropriations and 2- or 4-year voting cycles drive many policy processes. But problems affecting marine systems can occur on time scales that are too fast for these policy rhythms (e.g., sudden collapses of fish populations, outbreaks of invasive species or harmful algal blooms) or too slow (e.g., increases in ocean temperatures, acidification, or the cumulative loss of wetlands). The white abalone fishery in California expanded and crashed rapidly in the early 1970s, 20 years before the management agency restricted fishing (*12*). Longline tuna fisheries in the Gulf of Mexico reduced oceanic whitetip sharks by 99.7% over five decades, but the change was so gradual that managers failed to notice or prevent it (*13*).

Problems generated by fragmentation and mismatches become particularly severe in systems that include multiple, interactive, and cumulative stressors. Just as stressed humans are more susceptible to opportunistic infections, stressed ecosystems lack robustness and resilience. On the U.S. West coast, the combination of degraded spawning habitat, shifting ocean temperatures, and overfishing led to population declines and endangered species listings for salmon. This did not occur in Alaska, because of better river conditions, protection of spawning habitat, and a spatial fisheries permit system (*14*).

These governance problems are difficult to alleviate even after they become well understood (*15*). Incremental improvements in sectoral governance can reduce some problems (e.g., overfishing of target species), but they generally cannot address fragmentation and mismatches.

Marine spatial planning with comprehensive ocean zoning can help address these problems. Although property rights and management arrangements in the sea differ from those on land, spatial planning could be initiated with cooperation among federal, state, tribal, and local authorities. Zoning would not replace existing fishing regulations or requirements for oil and gas permits, but would add an important spatial dimension by defining areas within which compatible activities could occur.

Key elements of successful zoning include locating and designating zones based on the underlying topography, oceanography, and distribution of biotic communities; designing systems of permits, licenses, and use rules within each zone; establishing compliance mechanisms, and creating programs to monitor, to review, and to adapt the zoning system. Not only does comprehensive ocean zoning directly address fragmentation and spatial mismatches, zoning also facilitates efforts to adjust governance to the rhythms of human institutions and the dynamics of spatially bounded ecosystems.

Of course, establishing an effective system of ocean zoning in the United States will present a formidable challenge. But other countries, including Belgium, China, Germany, the Netherlands, and the United Kingdom, have already begun implementing or experimenting with marine spatial planning (*16*–*18*). Massachusetts is considering legislation to develop and implement an ocean management plan (*19*). A striking example of comprehensive, multiple-use zoning of marine resources is Australia's Great Barrier Reef Marine Park. It provides specific areas with high levels of protection, while allowing other uses, including fishing, to continue elsewhere (*20*).

The transition to comprehensive ocean zoning in the United States will not be easy. Critics point to the contentiousness of efforts to introduce zoning, the difficulties of developing legislation acceptable to all stakeholders, and failures to achieve desired results even after zoning is established. But our current approach simply cannot address the critical issues in the oceans. Recovering ocean ecosystems will require a better understanding of the consequences of interconnections among ecosystem components, as well as a systemic change in the way we consider issues and make choices regarding ocean use.

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