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Marine Communities Under Water the Connections are Everywhere - Ames 1997 - Island Institute

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MARINE COMMUNITIES

Under water, the connections are everywhere

TED AMES

FOR CENTURIES the fisheries of the Gulf of Maine have produced a magnificent bounty of seafood. Fish and shellfish once seemed so abundant that the stocks were thought to be inexhaustible. Unfortunately, we have found otherwise, and in recent years we have so overwhelmed the Gulf's natural productivity that a number of species have been virtually eliminated from large areas of the coast. Others are seriously depleted.

Though biological diversity has been reduced, the Gulf of Maine continues to be very productive. Some species are abundant and continue to provide robust fisheries. Exactly how and why the Gulf responds to man's intrusion in the way it does is only now becoming clear.

The Gulf of Maine owes much of its biological productivity to the peculiar combination of geology, tides, currents and seasons. It is a leftover from the last Ice Age, with drowned mountains and rivers surrounding deep marine basins to form a very irregularly shaped basin.

When tides and currents encounter these barriers, they are forced from their paths and create numerous expanses of upwelling and eddy. Deeper currents draw nutrient-rich water upwards to the surface to host an abundance of marine life.

Other nutrients come from the land. Rivers and streams along the Gulf's northern rim pour their contents into its bays, diluting its salinity and enriching it with runoff to form an inner body of water that becomes sandwiched between the land and 50 fathoms by the Maine Coastal Current.

During their seasons, plankton multiply to create enormous populations. Directly or indirectly, they become a feast for all marine creatures.

FISHING COMMUNITIES

Fringing the shores of the Gulf of Maine are coastal towns and villages that have depended on harvesting the sea for centuries. Fishing is the natural business of these places and fishermen have lived there, pursuing cod and a multitude of other seafood. The perennial song of the bay has been, "The fish're in!"

Like the species they pursue, fishermen have adjusted to the complex marine world that surrounds them, responded to the secret inner rhythm of the sea, changing their fisheries and scale of effort to match changing markets and the abundance of particular stocks.

Community infrastructure reflects this. Different vessel types and support facilities appear as fisheries change, and like the biological communities they depend on, these shoreside niches have adjusted to accommodate a changing ecosystem.

At first, the changes occurring in the ecosystem seemed to be the result of natural variations. But as fishing technology improved, the changes seen in the marine environment have often been attributed to overfishing.

Many who fish for a living challenge this conclusion and insist that these are only natural variations in the system. A peek at how marine ecosystems work lets us see if that could be true.

BENTHIC COMMUNITIES

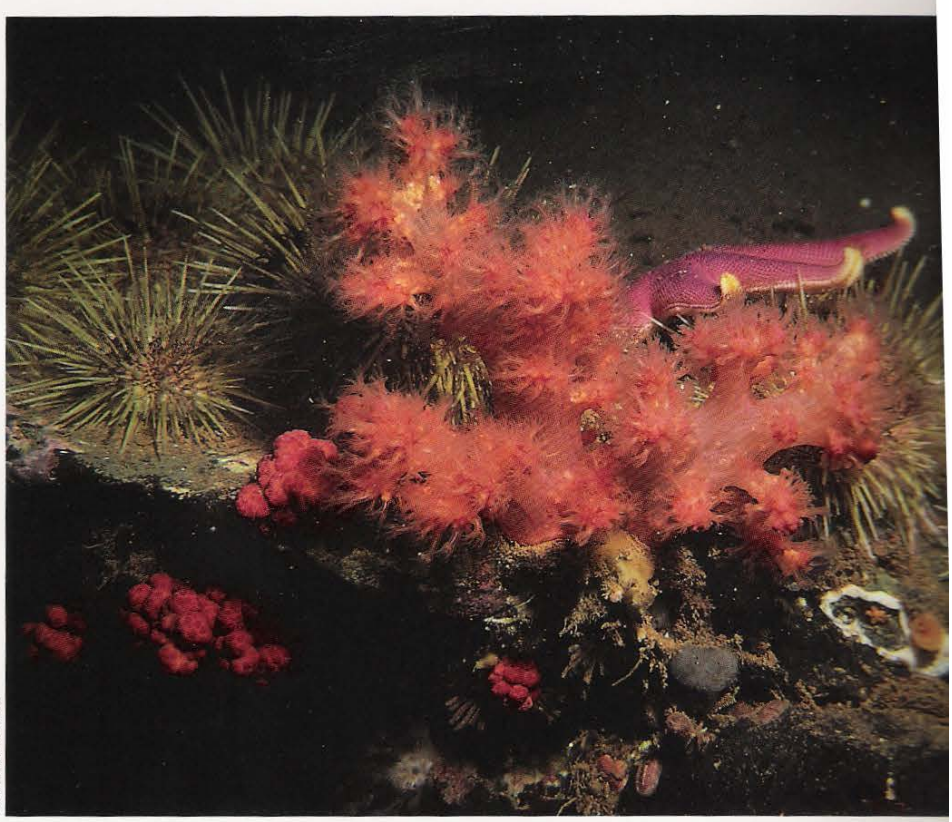
If you examined a tidal pool along the edge of the Gulf of Maine, you would see abundance and variety in the creatures living there. They are not found everywhere; different kinds of marine organisms exist in mud flats and other habitats.

Each locale hosts its own unique community of species that are better adapted to its conditions. Stationary species are lifelong residents of their communities and include seaweeds, barnacles and worms. Others are transient or seasonal and stay only as long as local conditions are acceptable.

If you looked closely, you would find that wherever the habitat changes, the mix of species within a community also changes.

That difference reveals the preference and tolerance of a species for a particular type of bottom, current strength, salinity and other features. Such preferences include the available food supply, shelter and the presence of predators and competitors.

This creates a patchwork of different communities abutting each other, reflecting the changing habitat. Ultimately, these form a vast mosaic of communities that covers nearly every square inch of bottom throughout the Gulf of Maine. But these are not the only biological communities present.



Robert Michelson

PELAGIC COMMUNITIES

Creatures living within the water column form pelagic communities, many of which overlap with bottom communities. Pelagic communities are usually separated by indistinct boundaries between bodies of water that vary with time — the interface at the edge of a current, the temperature gradient, or the depth that light can penetrate.

Many key members are tiny and include plankton whose abundance depends on the season (light intensity) and the concentration of dissolved nutrients. The eggs of most benthic and pelagic community members are released into the water column, their larvae feeding on plankton and each other until they metamorphose and become part of some other community.

Species grazing on this living potpourri include cre tures from the benthic community, like barnacles an scallops, and others from the pelagic community th range in size from zooplankton to herring to whale Still others, the cod, pollock, hake, seals, whales, etc eat the grazers. Many of those feeding are themselv recent survivors of earlier plankton stages, now grown

Unlike the patchwork segregation existing belo them, the mixture and abundance of species in pelagi communities are in a state of constant change. Thi creates a tenuous, almost ephemeral collection of species that migrate seasonally to areas where the essential plankton abundance is occurring. While somewhat predictable, the actual times of arrival, locations, and character of the pelagic community are inherently variable.

CHANGE

A tidal pool visited each summer over a long period of time would appear to change little. The kinds of creatures found there one summer would probably still be found there during the next, indicating a remarkably stable biological community living in a remarkably stable place.

But this is misleading. Only those who can best accommodate the stresses of a habitat will inhabit it. Tidal pool creatures are there because they can tolerate living under those conditions better than others competing for the same niche.

time, but when conditions become too severe, they must move to more agreeable locations. Those left behind must endure the new conditions or die.

Such changes occur each season in the Gulf of Maine. To the uninitiated, whole populations seem to appear mysteriously in one area, remain for a period of time, and then disappear once again. Those more intimately connected to the marine environment realize this nearly continuous movement of species is the normal condition.

Change is, in fact, the most obvious constant in the sea. Its inhabitants are attuned to its timeless rhythm, and have orchestrated their life cycles to coincide with it. This ensures that proper conditions occur at each life stage, which, in turn, ensures the collective survival of each community in a delightfully complex series of events.

LINKAGES

Stepping back, we see that the life found in a tidal pool is not only a community of interdependent creatures living together, but the tidal pool community itself is dependent on a larger, more complex community for its maintenance and survival. The converse is also true, for the sum of community interactions describes the well-being of the Gulf of Maine.

Some interactions between biological communities, for example, involve species that belong to different communities during different stages of their lives. In fact, the developing stages of marine life often demand a whole series of different communities for critical habitat.

Cod, scallops, lobsters and a host of other commercial species have life histories of this type. Such species have synchronized their spawning to coincide with seasonal plankton blooms. Timing is critical, for successful reproduction depends on the eggs hatching when the plankton are still small enough to eat. If the larvae arrive too early, they starve; too large, and they are eaten.

Survivors of pelagic stages then occupy a sequence of critical subtidal habitats in nursery areas of the Gulf of Maine. These different biological communities must be close enough together for the juveniles to shift to and from, for as they grow larger, different prey are needed for food and different shelter becomes necessary for protection from predators.

If one of these critical biological communities is too far away, or is too damaged to support them, a bottleneck forms that makes it difficult for the species to maintain itself in that area.

The bottleneck need not be absolute. But when it occurs, there will be fewer of that species to eat the available prey. Over time this shift in "who eats whom" redirects the flow of energy through the food web to restricted species to hold onto its niche.

At some point, when too few survive, the local population will collapse. In turn, this induces a chain reaction where each of the several habitats once lived in would have vacant niches. If the missing species were a critical food source in some of those communities, other species would disappear, too.

The loss of cod, for example, would not just affect the herring, crabs and lobsters being eaten by adult cod. The spring and summer pelagic communities, and a host of benthic communities in which the cod live while growing from inch-long, post-metamorphic juveniles to adults, would have to find a substitute prey for the missing cod if they were to survive. Cod eggs and larvae are eaten by herring, mackerel and scallops, but when they become juveniles, these are eaten by many different fish, shellfish, marine birds and mammals.

Having these interrelationships linked through a series of biological communities moderates the effect a species may have on others within the system. Unfortunately, we have succeeded in bypassing these restraints with potentially disastrous effect.

THE FISHERMAN'S DILEMMA

When a successful year-class of cod appears in a natural system, many survive because predators can't eat them all. The number of predators will increase, but because it takes time for them to reproduce and grow, and because other factors affect how many survive to become adults, they increase more slowly.

This creates a living surplus and a cushion for the ecosystem against poor year-classes of cod in the future. Eventually the system adjusts to a new balance between cod, their food supply and predators.

Fishermen are ultimately bound by the same limits that constrain natural predators; but unlike predators catching food, they are motivated by the price of cod in the market. If the price is up, large numbers of fishermen will enter the fishery. This increases the number of predators much faster than would occur naturally and the number of cod is quickly reduced. This eliminates the cushion, and makes the stock susceptible to further declines in abundance.

New technology has had a more subtle effect on abundance. Technology seems to be a natural proclivity of humans, and in the short term, it lets fishermen catch more fish, more easily.

But there aren't more codfish, even though there appear to be. Instead, the cod that were previously inaccessible can now be caught. New technology has made the fisherman a more efficient predator.

With each new device, fishermen have been able to reduce stocks to ever lower levels. With fewer fish remaining, they again have to work harder to catch

them. Fishermen using the old gear have usually been starved out. They had become less efficient predators.

In fact, landings continue to drop until the increased efficiency of the new gear is offset by the ability of the remaining cod to sustain their population. In the past, a new balance formed, but with a smaller stock of cod more susceptible to decline and collapse.

Until recently this allowed both fishermen and cod populations to maintain themselves in uneasy balance, for fishermen, you see, were still functioning as part of the ecosystem. It is this balance that needs to be recaptured.

Looking over the abandoned fish plants and neglected groundfishing boats along the coast, it seems obvious that the submerged hangouts of cod are not the only habitats that have been emptied. A surfeit of ex-fishermen is blunt testimony to what happens to predators when the prey's all gone. The niche they once occupied has also been abandoned.

The bustling factories and busy coastal towns were, in the final analysis, only an artifact of the ecosystem and fishermen, too, are ultimately bound by the same natural laws as were the cod.

Too many commercial species have disappeared from our coastal waters for us to ignore the obvious. The combination of modern electronics with large fishing vessels has created a technology too powerful for stocks to withstand. The balance no longer exists.

The atrophy of groundfishing along Maine's coast is a stark reminder of how fragile our marine ecosystem is. While the loss of cod, haddock, herring and winter flounder from our bays is tragic enough, we have far more to lose if we fail to protect the web of biological communities that sustains all our fisheries.

Our losses have been local. Catching too many haddock on Georges Bank didn't cause the collapse of haddock in Penobscot Bay. It was caused by damaging critical nursery habitats while catching up the fish around Perry's Ledge, Sunken Seal Island and Bay Ledge. If fishermen want to see haddock back in Penobscot Bay, those are the areas they have to start protecting.

To advise "You are catching too many" simply doesn't provide fishermen with a constructive course of action. To make them realize how important local events are, could. Protecting local spawning habitats and nursery areas provide the key to using the Gulf of Maine's productivity more effectively. We need to fish smarter.

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Whales

FIND THEM WHERE THE FOOD IS

To human eyes the surface of the ocean can be a desert — just waves, maybe the occasional seabird. Suddenly the surface is parted; a whale or dolphin emerges for a few quick breaths and then silently slips below.

The brief appearance of a cetacean (a whale or dolphin) can change the ocean "desert" into an arena of life while revealing a picture, albeit still a clouded one, of interactions within the subsurface marine community.

Each summer, thousands of tourists venture out to sea, almost as sure of sighting a whale as if they were traveling to an aquarium. Whale watching boats take them to places called the Ballpark, the Rock, the Kettle, the Fingers. The tourists are rarely disappointed; something attracts whales and dolphins to these locations year after year.

A study of the distribution patterns of whales and dolphins is largely a study of the ecology of the distribution of their prey. Cetacean distributions are far from regular or random; they are, during the feeding season, where the food is. A naturalist scanning the ocean searching for the first whale of the day isn't really looking