

18 Leading Scientists Write About Life in the Ocean

THE MARINER'S GUIDE TO OCEANOGRAPHY

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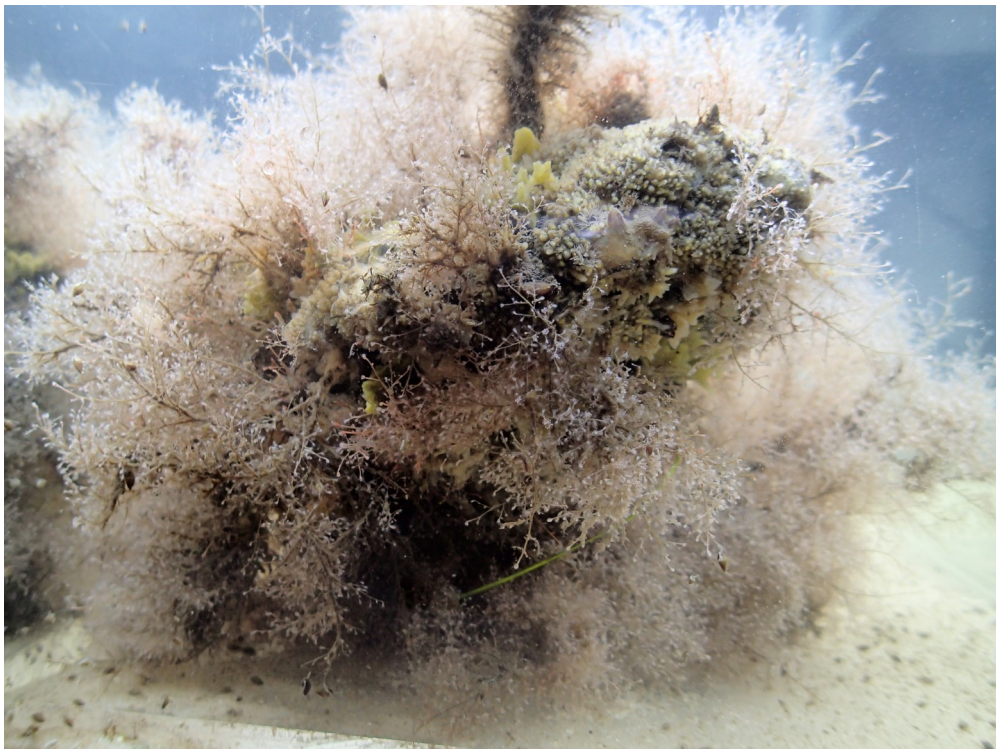

If you've been remiss and left your boat sitting for too many months in the water without hauling it out, you'll be introduced to a complex and dynamic assemblage of organisms known as the "fouling community." As the machinery hoists your boat up into the air, the bubbling and hissing of barnacles can be almost deafening. It is as if they know their world and all the miles they have traveled attached to your hull are coming to an end.

The noise seems to grow louder as the scrapers are raked back and forth, crushing the barnacles and shells and leaving round white basal scars on the wood, fiberglass, or metal. If the boat has been moored in a slip or remained at anchor for a year or longer, it may also blossom with luxurious mats of hydroids, mussels, and sea squirts. With a good beard of fouling growth, hull speed can be cut by as much as 40 percent and the fuel bill doubled. It is a constant battle with the sea, of pulling, scraping, and painting with antifoulant paints to keep a boat hull from turning into an artificial reef. Antifoulant paints help, but sooner or later the sea dissolves them away, and new life appears. Those with small boats that are hauled out on a trailer after each use needn't worry about the costs of the fouling community. They can sit back and enjoy its fascination.

Whenever any object, be it wood, steel, rubber, or plastic, is placed in the sea, it becomes overgrown with a diverse and easy-to-see as-

semblage of animals that varies tremendously in location and latitude. If your vessel is moored to a floating dock in warm brackish water, full of nutrients, then you can bet it will blossom within a few months. But it can sit at anchor in the crystal-clear waters of an ocean island, and chances are the water will be practically sterile, supporting few encrusting larvae.

Marina basins with sewage discharges are by far the best areas to create life on your boat bottom. The rich green soup of diatoms and phytoplankton sustains the seed stock.

It all begins with a primordial slime. Even freshly sunk wooden wharf pilings that leach out noxious repelling creosote, designed to destroy all life, are eventually conquered by sea slime made of bacteria and later filamentous algae. This forerunner of new life lays down a coating and protects the first pioneering animals from man's poisons. Usually the first to settle are the barnacle larvae, that have a great propensity for fiberglass boat bottoms, or if there is a heavy set of oyster larvae drifting by when an object is first submerged and sufficiently coated, those will be the primary settlers. Then come the sponges, sea squirts, hydroids, etc. The community may change drastically with the seasons, particularly frigid-temperature waters where blistering cold winters will kill off all but the most rugged survivors.

Some years wharf pilings, styrofoam floating docks, and boat bottoms become heavily encrusted with certain sea squirts; other years they support rich growths of fluffy pink hydroids and brown tufted bryozoans, or thick scalps of mussels. Salinity greatly affects what settles. A year of drought makes the water saltier, allowing a more diverse community to grow. A very wet year will have fewer animals. Animals also vary tremendously from open exposed coasts to protected harbors, finger-fill canals, and dredged-out boat basins where there is seldom any wave action.

The longer an object sits in the water, unmoving and stationary, the more life grows on it. A floating dock, a wharf piling, a bridge abutment, a sunken automobile, or a more or less permanently moored vessel becomes an artificial reef. Animals beget animals.

Eventually there are two categories of life within the fouling com-

munity—the sessile and the motile, the sedentary and the crawlers. The sessile forms, such as barnacles, oysters, and serpulid worms, cement themselves to a hull or piling by calcareous secretions. Mussels use specialized byssus threads, while sponges, hydroids, bryozoans; sea squirts fuse their living tissues directly onto the substrate.

These rely upon the movement of seawater, the tide, currents, and winds pushing water to provide them with their food. Plankton, the microscopic plants and animals that float in the water, and tiny particles of detritus from the marshlands and mangroves make up the feast.

The mechanisms of collecting food from this soup of life are similar, whether it's the feathery legs of barnacles that jump out of their protected shells like jack-in-the-boxes to snatch a passing copepod, or the hairy sweep of a bryozoan zooid. Hydroids and anemones reach up with inviting colorful tentacles and sting the passersby to death, while filler feeding sponges, oysters, mussels, and sea squirts pump water through their entire bodies straining out food, receiving oxygen, and passing out wastes.

Within such a community there is not much competition for food, but a tremendous competition for space. The weaker are crowded out, the stronger flourish. And from the moment the larvae or young are scattered into the sea they must find holdfasts or perish.

Then there are the hunters within the community, the ones that prowl the forests of hydroids and hide within the crannies of barnacles, or the mounded clusters of leathery sea squirts. These are the errant polychaete worms and nudibranches, small shelless snails. Hundreds—if not thousands—of small mud crabs and sea fleas or amphipods spend their lifetimes creeping among the colonies, picking out worms, eating decaying sea squirts or pieces of sponges. Or perhaps they feast on tiny snails or newly attached small bivalves.

Hairy brittlestars wave their snaky legs out from the canals of sponges. Tiny dragonlike nudibranches creep and slide over the hydroid colonies, devouring their pink polyps and transferring the hydroid's stinging cells into their own bodies, protecting them from hungry fish. Uncountable millions of tiny monsters called skeleton shrimp bob their peculiar elongated bodies as they crawl from branch

to branch of the hydroids, scraping off diatoms and unicellular algae. A bristleworm seizes an unsuspecting sedentary worm in its powerful jaws. Slipper limpets creep slowly along, grazing on the surface like cows.

Meanwhile, myriads of tiny copepods orbit the fouling community, feeding on waste that provides food to passing fish. Smaller fish, such as gobies and blennies, and transparent grass shrimp hide within the fouling community, seeking refuge from their predators.

All of this life is fascinating to watch. Simply tear off clumps of fouling growth, spread it out in a jar or a glass dish, and examine it with a magnifying glass or a dissecting microscope.

But if your vessel is made of wood and hasn't been pulled for a year or two, some of these creaturres can be deadly. It's the ones that get *into* the wood and tunnel their way through your hull that can be devastating. When all the barnacles and other fouling growth are scraped away, and you see tiny pinholes staring back at you, you have met the wood borers. It can be a costly encounter.

Shipworms and gribbles have sent many a ship to the bottom after honeycombing the hull with their burrows. Shipworms, the best known of which are *Toredos*, are not worms at all, but very primitive clams modified with teeth that rasp away at the wood and twist and turn until their burrows are made. They do not eat the wood, merely prepare it for protected, comfortable homes. Their shell is only a tiny portion of the clam's great elongated body, which may stretch for a foot or more through the wood out to the surface, where it can siphon in water and remove plankton. Perhaps to make their burrows more comfortable or to lend support, they secrete a lime coating.

If you break apart an infected board, you will see dozens of white tubes and a large fleshy "worm" inside. Often the wood is so weakened that a two-by-four crumples in your fingers. When shipworms die, they leave sand-filled tubes behind and can destroy the stoutest timbers.

But even more ominous to the wooden boat owner are the gribbles that can actually digest cellulose and devour wood. Tiny crustaceans called isopods, gribbles are related to pill bugs, or rolly-pollys, that one finds under rocks in gardens. When you see a wharf piling that

is eaten down to a point, as if someone had put it into a gigantic pencil sharpener, then you're looking at their handiwork. They are scarcely two millimeters long, but they have caused mighty bridges to crumple into the sea. When you walk out on a dock and it wobbles dangerously, or dig your pocket knife into the keel and it goes through like peanut butter, then beware the gribbles.

They are practically impossible to see with the naked eye, but cut off a chunk of wood, examine it under a dissecting scope, and you can watch them in their own little burrows eating away. They eat their dry weight in wood every ten days, which puts termites to shame. Each has a highly developed pair of jaws; the right one with a rasp and the left with a file. As they saw away at the wood, fragments are crushed and swallowed. They are amazingly resistant to antifoulant paint. All they need is one little scraped area where the surface is exposed, and they move in and take over.

Nevertheless, the requirements for gribble homesteading are not simple. Gregarious creatures, they prefer to live in wood that is already infested with others of their kind. If an isopod lands on a surface and eats a burrow, and after a while no others come to stay, it will leave and go elsewhere to find company. Sometimes they will abandon wood that has been almost devoured and move on.

Usually this migratory movement takes place at night. The males leave first, and when they are established in a new piece of wood, the females join them. They arrive swimming, and crawl over the surface, going from burrow to burrow to see if a male is there, poking their antennae down inside. If the burrow is occupied by the opposite sex, they disappear into their new home and raise a family. Between the borers, fungus, bacteria, and all the encrusting creatures that attach, it is only a matter of time before wood disappears entirely.

As a biologist, a boat and dock owner, I have very mixed feelings about wood borers. Costly though they are to humans, they have their place in the design of nature.

They clean the rivers and estuaries of wood. Rivers help nourish the sea by dumping leaves, bark stems, and branches of upland vegetation into these arteries of water that feed out to the sea. But they also

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carry down huge logs and often entire trees that are washed away by currents slicing into the riverbanks. Sooner or later—it may take years—it all ends up in the sea. So do pines and palms, and mighty oaks along the forested shorelines when a hurricane sends gigantic waves pounding the shore. Foundations of houses are periodically washed out during storms and topple into the water. Who cleans up? Busy little borers, the bivalves and isopods digging their burrows into wood. When you hear the sick "clang" of a boat propeller colliding with a submerged floating log, you have wood borers to thank that it doesn't happen more often.

A dead tree carried out into saline water eventually becomes waterlogged and sinks. Then it blossoms into a flowering garden of red beard sponges, purple and pink glistening chunks of sea pork, waving clusters of pink hydroids and white sea anemones. It becomes a gathering place for schools of fish—grunts, spadefish, sea bass, mullet, snapper, and grouper in warmer latitudes. They all come to pick and choose among the abundance.

A sunken boat on a barren mud bottom becomes the richest habitat around, a gathering ground for fish, often a home for lobsters. Man, wanting to increase the fishing grounds, is now deliberately creating artificial reefs by sinking cars, scuttling obsolete ships, and hauling bargeloads of junked cars, concrete blocks, culvert pipes, and rubber tires out and dumping them.

When he puts out sea buoys that mournfully clang their warning to ships, he creates yet another habitat. A simple scraping with a dip net on a channel marker produces a profusion of life, millions of tube-building amphipods, flatworms, polychaetes, and minute crabs, so many that it boggles the mind. The life is ephemeral; it reproduces explosively, in incredible numbers, before it dies off, or is devoured by fish. And the fish are eaten by man.

The fouling community is an expense and a nuisance to the boat owner who must scrape the barnacles and other growth off his hull. But when he casts his line near a buoy and reels in a bluefish that has been feeding on shrimp that have been feeding on amphipods and worms, the fouling growth is an asset. And if he scoops up some of

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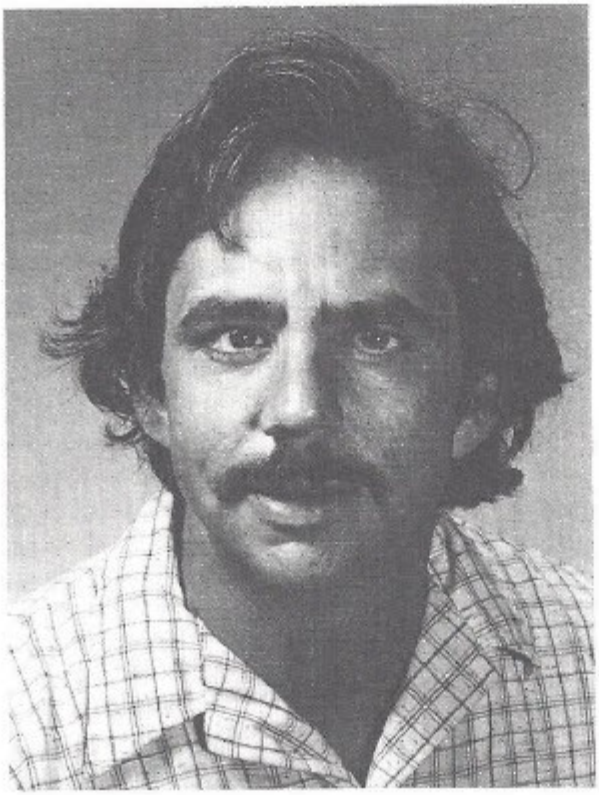
SUGGESTED READING

Bibliography of Protozoa, Sponges, Coelenterata, and Worms, by D'Arcy W. Thompson (Boston: Longwood Press, 1977, reprint of 1885 edition).



Jack J. Rudloe is the president of Gulf Specimen Company, Inc., in Panacea, Florida, a supplier of living marine fishes and invertebrates for teaching and research. He is the author of eight books and currently is writing a ninth book, his first novel. He has written nearly twenty articles for Audubon, Sports Illustrated, National Geographic, Scientific American, *and several other publications.* The New York Times, The Wall Street Journal, Sports Illustrated, *and* Audubon *among many others, have carried features on Mr. Rudloe's life as a marine collector and his efforts to save Florida's marshes.*

Mr. Rudloe has traveled to Madagascar, Honduras, Nicaragua, Haiti, Costa Rica, Guatemala, and Suriname in search of such creatures as the giant isopod, deep-water sharks, and the giant toadfish.