ICHTHYOLOGY

Fishy Conversations

Scientists are now eavesdropping on fishy conversations. They hope to explain why undersea creatures talk and how the talk affects other fish.

By HOWARD SIMONS

➤ SPINY LOBSTERS are like men, their voices become deeper as they grow older.

This is one of the preliminary findings of Dr. James M. Moulton of Bowdoin College, Brunswick, Me., who spent this summer at the Bermuda Biological Station eavesdropping on the conversations of undersea life.

In countless other marine biology stations and research laboratories throughout the world, other researchers like Dr. Moulton are studying the various aspects of the oceans. (See SNL, Oct. 4, p. 218.)

The aim is twofold:

They hope to unravel some of the mysteries of what many scientists feel is the "last frontier," the oceans.

They hope that their studies will one day provide mankind with limitless harvests that will feed an expanded population which the land will no longer be able to sustain.

Although the sea has been an integral part of mankind's history, little is actually known about the sea itself, and less about the life beneath its surface. It is only relatively recently that man has turned to the sea in an intensive effort to probe its secrets and map its nature. One of these secrets, the one Dr. Moulton is probing, is the talk between fish.

Ancient Voices

Historically, savants have, in passing, made note of the fact that beneath the surface of the sea there are fishy conversations taking place. Aristotle compared the voices of fish with those of land animals. Capt. John Smith, when he was Governor of Bermuda in the early 17th century, noted that the grouper made a sound that earned the fish its name. And, William Penn chronicled the sounds of the drum fish as early as 1685.

But it was not until the Second World War that undersea conversations by whales, lobsters, shrimp and fish earned more than passing interest. Up to this point in the history of undersea noises man had pretty much relied on a tool that was not very well-adapted to hearing under water, his ear. The advanced technology gave him a new tool: electronic gear that could detect the screws of an enemy's propeller or the echo from a submarine's hull.

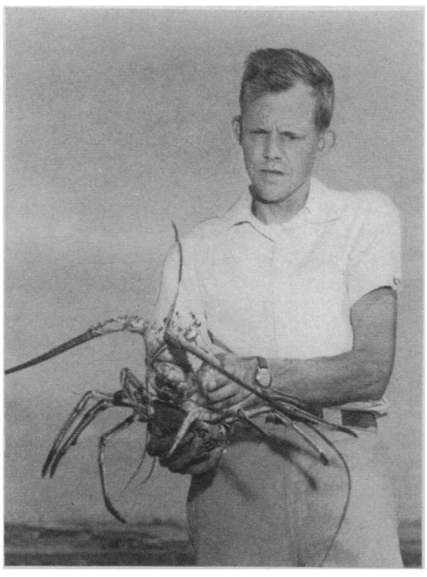
As often happens, the new tool carried along with its new problems. Submariners of both the Allied and Axis fleets were plagued with reports of enemy craft in the vicinity, only to learn that there were no craft. Research since has implicated a host of undersea life as the culprits in the deadly hide-and-seek game of ferreting out enemies while blinded beneath tons of water. The problem still exists.

The sounds emitted by fish and other marine animals plagued landlubbers too. The harbor defense forces in Chesapeake Bay, for example, were being alerted frequently until it was learned that they were responding to the calling of thousands of drums or croakers moving into the Bay each spring to breed.

Finally, it was found that a single call of a common toadfish was intense enough to trigger an acoustical mine that was meant to be tripped by the sound of a passing ship.

Dr. Moulton is interested in these more practical problems of undersea talk because he is interested in all its aspects. But his primary work is basic research. He wants to try to learn why crustacea and undersea mammals and fish talk. Who do they talk to? What effect does the fish conversation have on the behavior of other fish? How do they talk? How do they listen?

Dr. Moulton's research along the Atlantic Coast from Maine to Bermuda, together with that of other investigators, is only now beginning to nibble away at the mysterious bait of fish talk.



THIS LOBSTER RASPS—This Bermuda spiny lobster talks, and what is more, its voice gets deeper as it grows older. The lobster is being held by Dr. James M. Moulton of Bowdoin College, Brunswick, Me., a scientist who listens in on undersea conversations. He has been eavesdropping in the waters surrounding Bermuda while doing research at the Bermuda Biological Station.

For example, Dr. Moulton explains, not all fish talk as much as others. Curiously, it is found, sound production is more widespread among salt water fishes than fresh water fishes. Similarly, another scientific enigma is the fact that fishes living in clear, warm seas such as around Bermuda seem to have evolved a greater variety of sound-producing mechanisms than have fishes in Dr. Moulton's home territory of cold northern waters.

What does the talk sound like? Jacks and grunts, which produce sound by rubbing teeth or other skeletal parts of their body together, sound like the "noisy eating of celery," Dr. Moulton says.

"The toothplate rubbing of puffers and porcupine fishes produces a sound similar to that of a klaxon horn."

The tiny snapping shrimp, one to three inches long, literally snaps a single oversized claw. Together, several of the small shrimp sound like "fat frying."

The spiny lobster makes two sounds: a rasp when it is disturbed or injured; and a "rattle" during the daytime only, when it is unperturbed. At night, the lobster is quiet, although more active.

Why undersea creatures talk is very much a mystery. Dr. Moulton, and others, have speculated heavily and their theories run the gamut from sound produced for defensive purposes to mating calls. All or none may be true.

Sea Robins' Song

Sea robins, Dr. Moulton points out, have been shown to respond to imitations of their staccato calls played back to them underwater. Male gobies, some drums and cods all develop a call during the breeding season which, when played into the water, stirs females in captivity.

Squirrel fish and grouper of the Great Bahama Bank, Dr. Moulton says, "bark at an approaching hydrophone much the same as a dog will bark at an approaching automobile.

"The black angelfish of the same waters incorporates a whining call into recognition behavior toward an approaching member of the same species."

Other fish grunt at signs of danger. Still others moan when protecting their nests. The list of sounds and reasons for them seem almost as inexhaustible as the numbers of fish in the oceans.

Dr. Moulton believes from his own work and that of others, that "many fishes create sounds as integral parts of their normal behavior patterns and it is probable that at least in many instances the sounds may serve to facilitate breeding." This aspect of fish talk may prove to be a key to harvesting the seas to feed future generations.

Looking to the future, Dr. Moulton says: "Much remains to be done in studying

the relations of sound production and sound detection to the animals of the sea. It may be that someday introduction of appropriate sounds into the sea may serve to increase the catches of commercial fishermen, and to conserve valuable fish populations by driving them around obstacles or areas unfavorable to their survival."

To pursue his aim that one day might spell increased harvests of the sea, Dr. Moulton uses many avenues of attack. At the Bermuda Biological Station, for example, he takes a small boat out into the cool blue waters surrounding the Islands and drops a hydrophone overboard to listen in on the talk below. At the same time, every grunt and groan is being recorded on tape. The Maine scientist has become so adept at his eavesdropping that he has little or no trouble identifying many of Bermuda's fish from what he hears, but cannot always see.

He may repeat his eavesdropping off a dock at night, or in the tanks at the Station to learn what effect captivity has on sound production. At other times he dissects fish to learn the structure of their sound-producing mechanisms, as well as their hearing aids.

Fish, he explains, have ears that are much like those of humans. They have adapted them, however, to their specific purposes and there appear to be almost as many variations as there are species of fish. If one wonders why he has never seen an ear on a fish it is because fish lack both the external and middle ears of humans. They also lack man's most important sound receiving instrument, the long, coiled cochlea of the inner ear.

"Hearing" Without Ears

Crustacea, such as lobsters and shrimp, on the other hand, have no ears. It has been postulated that they "hear" by picking up vibrations through any solids that they walk on.

Some fish, Dr. Moulton points out, hear over a frequency range comparable to that of humans, but the upper limit does not exceed about 13,000 cycles per second. It has yet to be demonstrated that a fish can hear in the upper adult human reaches of about 17,000 cycles per second.

To complicate an already complicated mystery, Dr. Moulton states, there are other factors that must be considered. One of these is known as the lateral line system. All fish have tiny receptors either on the surface of their bodies or close to the surface. The lateral line system is connected to the fishes' ears, and is sensitive to low frequency sounds. The role of these pressure receptors that usually run in a lateral line along each side of the fishes' bodies remains unsolved.

Listening to fish talk is not the work of scientists alone. Professional fishermen throughout the world are just as aware of undersea conversations as are Dr. Moulton and his colleagues.

Dr. Moulton, whose work is supported by a grant from the National Science Foundation and who is on the staff of the Woods Hole Oceanographic Institute, seems to be

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Questions

ASTRONAUTICS—What are the names of three new international cooperative groups expected to begin work soon? p. 227.

ICHTHYOLOGY—How do some species of shrimp talk? p. 234.

ROENTGENOLOGY—What drug has been used to stop the heart's action momentarily? p. 230.

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Fishy Conversations

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as much an historian of fish talk as he is a researcher. For some years now he has collected bits and pieces of information as to how professional fishermen use fish sounds and fish hearing to increase their catches. Most of what he has learned points up a timeless trial and error method of various peoples to use fish talk as bait.

Syrian fishing boat crews station a crew member in the hull to detcet the resonance of a certain category of sounds that they associate with a particular bottom configuration over which fishes feed in large numbers.

Japanese fishermen have long associated the croaking of certain kinds of marine fishes with a good fishing season. Okinawan fishermen use scare ropes and sound tubs. English fishermen in Robin Hood's Bay thrash the water to scare the fish into shallow water. In Borneo fishermen use coconut rattles. In the United States menhaden and herring fishermen bang their boats.

"Fish listening reaches its highest refinement perhaps," Dr. Moulton says, "on the east coast of Malaya where specially trained leaders of fishing crews submerge their whole bodies in the water to listen for sounds that will guide the placing of nets. These fish listeners are trained in their art for years."

Today, he points out, Canadian and U. S. Fish and Wildlife investigators are interested in listening on the Grand Banks for seasonal sound production of cod and haddock as an indication of population density.

It appears that the voices of talking fish may soon be heard more loudly than ever before.

Science News Letter, October 11, 1958

Do You Know?

Anoxia, or lack of oxygen, is generally believed to be an underlying factor in cerebral palsy.

The earth's polar motion, or *free nutation,* akin to the wobbly motion of a spinning top, creates its own ocean tides.