

## The New York Times

### What's Making That Awful Racket? Surprisingly, It May Be Fish

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“Eerie Thumps Haunt Some Cape Residents,” a headline in The News-Press of Cape Coral, Fla., said. “Noise May Cost City Big Bucks.”



Mating calls of the black drum can carry through sea walls and into homes.

It was the end of January 2005, during the spawning season for a fish appropriately called the black drum. Nightly mating calls were at a crescendo. But no one living in the area seemed to realize the din was of aquatic origin.

The retirees who had come to spend their winters relaxing on the gentle estuaries and canals of the Gulf Coast in Florida blamed the municipal utility system. They were pushing the City Council to pay an engineering firm more than \$47,000 to eliminate the noise reverberating through their homes.

Then James Locascio, a doctoral student in marine science at the University of South Florida, rescued the city from financial folly. After reading the newspaper article, Mr. Locascio called a Council member just hours before a vote to appropriate the money. He explained that at 100 to 500 hertz, black drum mating calls travel at a low enough frequency and long enough wavelength to carry through sea walls, into the ground and through the construction of waterfront homes like the throbbing beat in a passing car.

“Black drum have taken a liking to the canal system in Cape Coral,” Mr. Locascio said. “Their nightly booming is like a water drip torture that lasts for months.” At first

residents wouldn't buy it. "The most vocal and persistent complainers said that there was no way a fish could produce a sound that could be heard inside a house," he recalled.

Mr. Locascio and David Mann, a marine biologist at the University of South Florida who is a bioacoustics expert, recruited these naysayers into a study by asking them to score noise levels and times in notebooks. "We took their data and plotted them with the fish sounds we had recorded with hydrophones under the water," Mr. Locascio said. "Concordance was perfect."

A similar situation unfolded two decades ago in Sausalito, Calif., when houseboaters were inundated with toadfish calls. The Marin Independent Journal said in an editorial, "We don't believe for an instant that the drone keeping Sausalito houseboaters awake at night is caused by a bunch of romantic toadfish humming their version of the Indian Love Song."



Fred Bavendam/Minden Pictures  
Toadfish also produce sounds.

Greg Coppa, a retired high school science teacher, was also greeted with derision when he said he heard noisy fish while boating near Block Island in Rhode Island. "Some people even asked what I drank before hearing the sounds or gave me that look reserved for a good but pathetically impaired friend," Mr. Coppa said, laughing.

With the help of Rodney A. Rountree, a senior scientist at the research company Marine Ecology and Technical Applications and an adjunct assistant professor at University of Massachusetts at Amherst, Mr. Coppa learned that the fish he had imagined to be a massive sea creature was actually the tiny striped cusk eel, which can sound like a jackhammer.

Naturalists as far back as Aristotle have known that fish make sounds. But when Jacques Cousteau titled his 1956 documentary "The Silent World," it seemed that he captured the public's imagination about underwater life while leaving our ears deaf to fish barks, chatter, groans, drones and cries.

“His diving tanks masked all the sounds in the water,” Dr. Rountree said. “In fact, the oceans are a noisy place.”

Yet of the 30,000 species out there, only about 1,200 sound producers have been cataloged, and far fewer have been recorded. Even common goldfish have merited just two scientific publications. In fact, said Philip Lobel, a professor of biology at Boston University, “Most aquarium fish are sonic. Keeping fish in an aquarium is like keeping a canary in a soundproof cage.”

The most definitive tome on fish sounds was published in 1973 by the auspiciously named Marie Poland Fish and William H. Mowbray. Working at the Narragansett Marine Laboratory at Rhode Island University, they were granted access to Navy audio recordings made to detect enemy submarines. Because noisy underwater life kept interfering with the military’s objectives, the authors were asked to tease out the biologic from the manmade. The resulting work, “Sounds of Western North Atlantic Fishes: A Reference File of Underwater Biologic Sounds,” identifies the vocalizations of over 150 fish.

For most fish, the sonic mechanism is a muscle that vibrates a swim bladder not unlike our vocal cord. The bladder is a gas-filled sac used for buoyancy, but it can also be used as a sort of drum. The Gulf toadfish contracts its sonic muscle against its swim bladder thousands of times a minute to generate a loud drone. At nearly three times the average wingbeat of a hummingbird, toadfish have the fastest known muscle of any vertebrate. Cusk eel rattle bones against their bladder, but clownfish have a sonic ligament they use to “chirp.”



Jockel Finck/Associated Press

Herring release bubbles in a “fast repetitive tick.”

Other fish use stridulation, rubbing their bones together in a way that is comparable to plinking the tines on a comb or using a ratchet mechanism on their pectoral fins to make sounds. Herring release bubbles from their anus in a “fast repetitive tick.”

Still, despite careful dissection, the sonic mechanism in many species remains a mystery.

Fish sounds have been documented as a way to attract mates, to show aggression and to express fear or distress, but other subtle “speech” characteristics go undeciphered.

“They have a fairly sophisticated mechanism of sound communication, with different meanings depending on the social context of the sounds,” said Andrew H. Bass, a professor of neurobiology and behavior at Cornell University. “Sound communication probably first evolved among fishes.”

Despite the variety and sometimes voraciousness of the noise, fish can rarely be heard from shore, because the meeting point between air and water creates an actual sound barrier. Sounds generally bounce off the air-water interface.

New sophisticated, and less expensive, underwater microphones have aided research, making passive acoustics, or the act of just listening, more productive.

Dr. Rountree dropped a hydrophone into the water off Cape Cod in the first passive acoustics survey of the area. He was amazed to find the abundant chatter of cusk eel, which were not known to live in the area. The prevalence of cusk eel had eluded researchers at the nearby Woods Hole Oceanographic Institute for more than a hundred years, despite intensive exploration in the area.

Another unusual finding was made by Gerald D’Spain at the Scripps Institution of Oceanography in San Diego. Dr. D’Spain reported that he had recorded fish “chorusing” along the Pacific coast, from Ensenada all the way up to Point Loma. He likens their sound to “the wave” at a sports stadium, with the chorus moving up the coast like spectators leaping from their seats and hooraying in a coordinated roll. He also said he believed that the chorus was transferred from fish to fish at nearly the speed that sound travels in water — about four and half times as fast as sound travels in air.

These microphones are also picking up “biologic unknowns” — the sounds of unidentified fish and other marine life. Dr. Mann with the University of South Florida and the Navy researcher Susan Jarvis discovered a mystery fish deep in the Bahamas that was making calls 600 meters down. “You know there is a sound source out there,” Dr. Mann said. “You know where it is, but you don’t know what it is.”



Yuriko Nakao/Reuters  
A variety of toadfish.

Unfortunately not everyone who listens to fish is doing research. Poachers in China have started using hydrophones to locate the nearly extinct yellow croaker, whose swim bladder can fetch up to \$60,000 because of its reputed medicinal value.

Dolphins also follow fish chatter to track their prey. “The Top 10 species of fish in the diet of a dolphin make sounds,” Joseph J. Luczkovich, an associate professor of biology at East Carolina , said..

With the growing recognition of the importance of mating calls for spawning fish has come another concern. The increase in ambient noise from tankers, sonar and seismic surveying for oil, which often occurs at the same sonic frequency as these calls, may be drowning out fish communication.

Pushed by researchers, the National Marine Fisheries Service has made listening to all marine life, not only whales and dolphins, a priority. Since many dinner table fish like cod, sea bass and haddock make sounds connected to propagation, simply recording sea life offers potential for fisheries management at a time when populations are in decline.

“By listening to the underwater soundscape, there are a lot of things we can determine about what’s out there and what they are doing,” said Brandon Southall, director of the ocean acoustics program at the National Oceanic and Atmospheric Administration.

The agency hopes that passive acoustics can help identify breeding grounds in need of protection and can be used as a tool to assess population numbers accurately. Such noninvasive techniques would be a big step forward, Dr. Lobel of Boston University said.

“Without passive acoustics, they have to catch endangered fish like cod and cut them open to see if they are ripe with eggs,” he said. “They have been killing tons of fish just to find out where they are spawning.”

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[http://www.nytimes.com/2008/04/08/science/08fish.html?pagewanted=1&\\_r=1](http://www.nytimes.com/2008/04/08/science/08fish.html?pagewanted=1&_r=1)