

### Danger on the Reefs

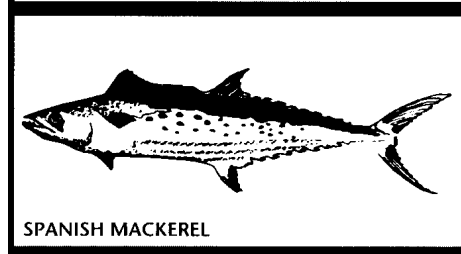
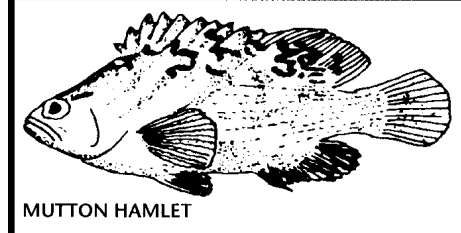
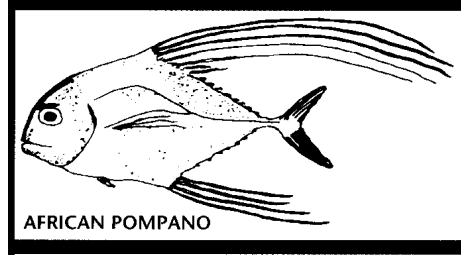
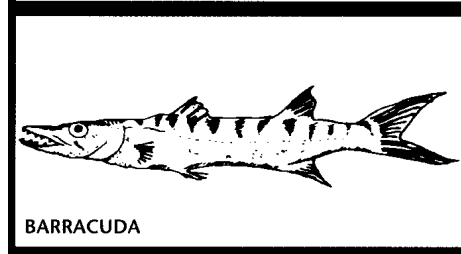
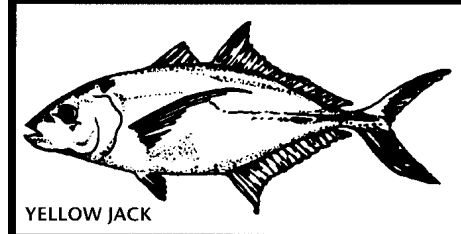
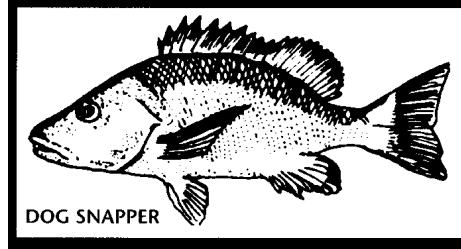
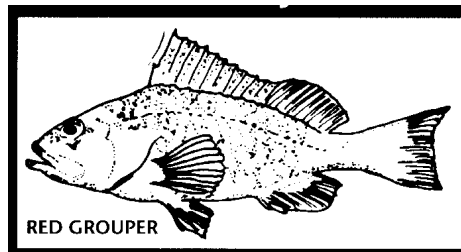
When Dr. Iuan Behar and his wife Sandra ordered amberjack in a Providence, Rhode Island, seafood restaurant, they thought they were consuming nothing more exotic than a tasty tropical fish. But at dawn the following morning, Sandra, a nurse, woke with a racing pulse—her heart was beating 140 times a minute, her skin was flushed, she felt anxious and confused. Dr. Behar, now the Director of the Division of Gastroenterology at Rhode Island Hospital in Providence, called Sandra's boss to report that she was too sick to come to work.

"The next thing I knew, I woke up in the hospital," Dr. Behar says. His daughter had discovered him lying unconscious on the bathroom floor, victim of a seizure. Hooked to a respirator, he was receiving massive intravenous doses of mannitol meant to ease the pressure in his dangerously swollen brain. Sandra was stricken with severe vomiting, diarrhea, and delirium.

The unsuspecting Behars had been blindsided by ciguatera poisoning, an illness brought on by the consumption of tropical fish that have been contaminated by eating toxic dinoflagellates found in seaweeds, sediments, and coral rubble. Worldwide, ciguatera affects between 10,000 and 50,000 seafood consumers every year. "It was a very scary experience," Dr. Behar says. "I'm very fortunate to be alive."

Ciguatera is found primarily in island waters. It is endemic in the Caribbean, South Pacific, and Australia's Great Barrier Reef, and in virtually all subtropical waters of the United

These are just a few of the known ciguatoxic fish. Ciguatoxic species can vary from place to place, and larger fish of a given species are more likely to be poisonous than smaller fish.



States, including Florida, Hawaii, Guam, the US Virgin Islands, Puerto Rico, and many Pacific Territories. Ciguatera species include mahi-mahi, red and yellowtail snappers, grouper, barracuda, red bass, and moray eel.

There is no proven test for ciguatera poisoning, either in patients or contaminated fish. Over 175 gastrointestinal, neurological, and cardiovascular symptoms have been recorded. Diarrhea, abdominal pain, and nausea usually appear within 24 hours of eating the ciguatera fish; the illness can progress to include numbness, itching, or tingling of lips, hands, and feet, low pulse rate, high pulse rate, dizziness, severe fatigue, hair loss, rashes, anxiety, depression, and a reversal of temperature sensations in which cold objects feel hot to the touch and scalding items feel like ice.

These symptoms are often bewildering to doctors who minister to stricken tourists returning from the tropics or to patients who eat tainted fish in inland cities. Dr. Behar attributes his own survival to a neurologist at the hospital who by chance had recently read an article on ciguatera poisoning. Although fatal attacks are relatively rare, symptoms can linger for months or even years. Astringent foods such as liquor, wine, vinegar, and pickles can trigger relapses. Four years after their ciguatera poisoning, Sandra Behar suffers from recurrent stomach cramps, and the soles of Dr. Behar's feet are numb.

Ciguatera poisoning has been known for hundreds of years. Spanish colonists in the Caribbean blamed the sickness on a marine turban snail called "cigua," and it struck Captain Cook in New Caledonia in 1774. Later theorists blamed diseased fish or pollution. Only recently have researchers traced the sickness to the dinoflagellate *Gambierdiscus toxicus*, a dinoflagellate that lives attached to busily red, brown, and green seaweeds and also occurs free in sediments and coral rubble. Herbivorous fishes eat the seaweeds and the attached dinoflagellates. Since ciguatera toxin is soluble in fat, it lodges in the fishes' tissues and travels up the food chain as the smaller fish are eaten by predators. The largest, oldest, and thus most desirable fish are often the ones that have accumulated the most toxin and are the most dangerous.

For residents of the tropics, ciguatera poisoning is not only a health threat, but it makes their seafood, a potentially lucrative export product, undesirable in international markets.

Don Anderson does not eat local fish when he travels to the tropics, and he warns seafood lovers to be wary of reef-dwelling tropical fish sold in mainland restaurants. Although much progress has been made in ciguatera research, many toxicological, physiological, and ecological mysteries remain about this illness and its dinoflagellate source.

"The natural habitat of the ciguatera dinoflagellates is complex and highly variable, and further complications are added by the diverse pathways with which the toxins move through the food web," Anderson says. "This is a marine phenomenon that will give up its secrets very slowly."