Lagniappe

January 1, 2009 Volume 33, No. 1

Zombies, Fugu, Pufferfish and Murder

Least Puffer, Sphoeroides parvus. Photo courtesy Samford University Department of Biological and Environmental Sciences. .

Last July, a Chicago-area man was arrested for illegally purchasing research-grade tetrodotoxin (TTX). This toxin, found in certain fish species and in a few other animals, is more than 1,000 times more toxic than cyanide. The man who was arrested allegedly had intentions of assassination by use of TTX, which has a long and fascinating history of human use and misuse.

Tetrodotoxin is common name for anhydrotetrodotoxin 4-epitetrodotoxin tetrodonic acid. An incredibly potent neurotoxin, it has no antidote. The compound blocks action potentials in nerves by binding the “fast” sodium channels in nerve cell membranes. It was originally described in the fish order Tetraodontiformes, which includes the pufferfish, porcupinefish, ocean sunfish and triggerfish, but not all of these carry the toxin. TTX is actually the product of certain bacteria, including *Pseudoalteromonas tetraodonis* and some species of *Pseudomonas* and *Vibrio*. The latter are the most common source of bacteria associated with TTX production, particularly the common species *Vibrio alginolyticus*. The toxin is accumulated in fish via ingestion: The fish eat invertebrates that have accumulated the toxin. Other aquatic vertebrate animals, including some amphibians, have also demonstrated high levels of TTX.

In humans, TTX blocks the fast sodium current in muscle cells, preventing contraction. When the fast sodium current of the cells of the diaphragm are paralyzed, death occurs when breathing ceases. Symptoms of TTX poisoning usually develop within a half hour of ingestion, and death has occurred as quickly as within 17 minutes of ingestion. Other symptoms may include numbness of the lips and tongue, sweating, headache, weakness, ataxia, incoordination, tremor, paralysis, cyanosis, aphonia, dysphagia, seizures, dyspnea, bronchorrhea, bronchospasm, coma, hypotension, nausea, vomiting, diarrhea and abdominal pain.

The first recorded case of tetrodotoxin poisoning was by Captain James Cook, who recorded his crew eating some local tropic pufferfish and then feeding the remains to the pigs kept on board. The crew experienced numbness and shortness of breath, and the pigs died. This is a typical case of TTX poisoning from puffers, which usually have little or no toxin in the flesh but lethal concentrations in the

skin, entrails and particularly the liver. This characteristic is said to make for the most adventurous sushi dining experience (now banned) in Japan, where expert sushi chefs carefully prepare the meat of certain large puffers to make *fugu*, carefully avoiding any contact with skin or entrails. Even a slight nick of the liver with the knife used to prepare the sashimi or sushi can lead to death. The slightest tingling of the lips after the meal signifies that the diner has bravely avoided a completely unnecessary brush with death. In fact, most of the cases of TTX poisoning in Japan have been from fishermen preparing their own catches. Japanese health bureau sstatistics documented 20-44 incidents of fugu poisoning per year between 1996 and 2006, leading to 34-64 hospitalizations and 0-6 deaths per year, for an average fatality rate of about 6.8 percent.

Around the world, most reports of TTX poisonings have been associated with the consumption of puffers from waters of the Indo-Pacific ocean regions. A few cases, including fatalities, have been reported from pufferfish from the Atlantic Ocean, Gulf of Mexico and Gulf of California.

Louisiana waters are home to some eight species of pufferfish and three porcupinefishes. The most common may be the little least puffer, *Sphoeroides parvus*, which, when accidentally caught in a shrimp net will puff up to give the appearance of marshmallows mixed in with the shrimp. Little data exists on TTX in our species, but recent research from Japan indicates that similar species often tend to exhibit only traces of TTX. Other recent research on some Indian River Lagoon, Florida, puffer species indicates that saxitoxin and not tetrodotoxin may by the culprit in poisonings from some puffers. Saxitoxin is one of the toxins associated with paralytic shellfish poisoning. With many of the symptoms of saxitoxin poisoning being similar to those of TTX, it is clear that any consumption of these species should be avoided.

A celebrated, but unproven, intentional application of TTX could be in the creation of the Haitian zombie legend. In the 1970s, a Harvard ethnobotanist named Wade Davis reported that he had procured samples of “zombi powder” from voodoo sorcerers in Haiti. The samples included numerous ingredients, including ground human bones, but invariably contained TTX from powdered puffer fish. Davis reported that individuals who had committed acts against fellow villagers were sometimes sold to the sorcerers as slaves. The sorcerer would poison the individual with a powder applied to the skin (and TTX can be absorbed through the skin) to induce a near-death coma. Following entombment, the sorcerer would retrieve the unfortunate person, and perhaps administer additional powerful drugs, and enslave the near-brain-dead zombie. A few cases of psychotic people showing up in their villages years after their burials have been allegedly documented, though subsequent analysis of some zombie powders have been inconclusive. Davis has maintained that zombification is an imprecise process, with some people killed outright and others merely sickened, but that the fact that most Haitians believe in this form of social exile makes it a real phenomenon.

What became of the recent arrest for TTX assassination plans? It was also alleged that the arrested gentleman had previously posted an Internet solicitation for someone to kill his wife in exchange for $8,000 and an AK-47 assault rifle, and was in possession of documents about how to poison people. In the latest news of the case, he was arraigned in federal court for the possession of the illegal toxin.

– Glenn Thomas

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The Yellowfin Tuna Fishery in the Gulf

Yellowfin tuna (*Thunnus albacares*) is an important fisheries industry throughout the Gulf of Mexico, and especially in Louisiana. Recreational anglers come to Louisiana to fish the "Midnight Lump," an underwater slope 40 miles off the coast, to try their hand (and back) at hooking into 100-pound-plus yellowfin. Commercial fishermen rig longlines in the deep waters of the Gulf in an effort to make money selling the prized fish for sushi and sashimi. Yellowfin, however, was not always a sought-after species in the Gulf. In fact, fishing for yellowfin in the Gulf has been around less than 60 years.

Fishermen catching yellowfin tuna by pole and line fishing on an early experimental trip. They are standing in the racks on the Bureau of Commercial Fisheries Vessel HUGH M. SMITH. Photo courtesy NOAA Image Database Fisheries Collection

Yellowfin tuna fishing in the Gulf was first reported in 1950 when the U.S. Fish and Wildlife Service used the research vessel, *Oregon I,* to explore both purse-seining and live-bait methods. From 1950-53, the Gulf was fished to evaluate tuna population numbers, as well as to see if these collection methods were feasible. The results were less than desirable. The next year, 1954, FWS pursued tuna with the Japanese-style method of longlining. This approach was far more effective; catch per unit effort (measured by the number of fish caught per 100 hooks) for the following three years averaged 5.0, 4.4 and 4.5, respectively. These averages were good, but a market for these fish had yet to be developed.

Longlining for fish is a technique that the Japanese have used since the 19th century. A typical longline setup uses a very long, central line that can span anywhere from 5 to 30 miles through the

Lagniappe Fisheries Newsletter

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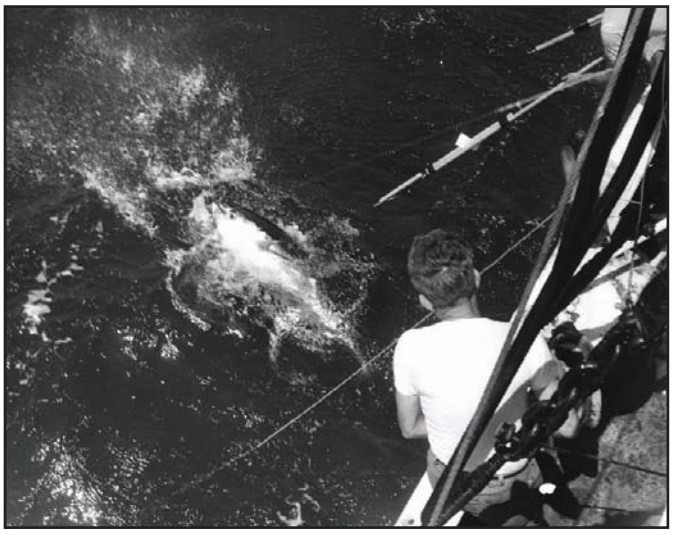

Preparing to tag a large yellowfin tuna caught on longline gear by the Bureau of Commercial Fisheries Ship OREGON in the Caribbean Sea on an experimental trip in 1961. Photo courtesy NOAA Image Database Fisheries Collection

water. Gangion lines with hooks are attached to the longline, which typically hang down hundreds of feet to where tuna are located. Each longline can have more than 1,000 gangion lines and hooks. It takes fishermen 8-10 hours to set up a longline in a desired location, and equally long to check the lines for tuna.

Improvements in refrigeration and gear in 1957-58 allowed for longer outings, and the first Japanese longlining fleets began fishing the Gulf of Mexico. By 1963, the Japanese fleets were producing quarterly fishing reports that documented where and when tuna were caught, total annual catch, as well as catch per unit effort. During this time, the number of fish caught varied from 73,429 fish in 1965 to only 2,242 fish in 1967. The number of catches per 100 hooks ranged anywhere from 3.15 to a dismal 0.17. The reports also tell us that fishing activity was heaviest in April and July, and lightest in October and November.

The Magnuson-Stevens Act, passed in 1976 to eliminate foreign overfishing and create a U.S. Exclusive Economic Zone (EEZ), in effect phased out foreign fleets in the Gulf over a period of years. The vacant niche allowed U.S. fishing vessels to take over the Gulf tuna industry. The legislation proved successful, with the total number of American fishing vessels increasing by 40 percent during the following 20 years.

Fishermen focused more on tuna fishing once their market became better established. Even billfishers began converting their rigs to target tuna. Standardized data from yellowfin catches by U.S. vessels is available beginning in 1985. Since then Louisiana fishermen have brought in a yearly average of 4,160,663 pounds of tuna. The most pounds in a year was in 1988 when 12,391,978 pounds of yellowfin was harvested. Annual harvest weight since then has slowly decreased; the harvest average from 2000 to 2007 was 2,783,776 pounds. A reason for the large disparity in weight can be attributed in part to the number of fishing boats. Years 1988-89 saw between 350 and 400 vessels fishing for tuna, compared with only 44 currently registered vessels.

There are a few reasons why fishing effort has decreased. One obvious reason is the economy; it can cost fishermen as much as $20,000 to get a tuna boat ready for a fishing trip. Using different bait is also a challenge. In 2001, federal regulators made it illegal for longliners to use live bait, hoping that bycatches of billfish would be reduced. Typical live bait used was either live chub mackerel or big-eyed scad. And if these challenges aren't enough, regulations were recently passed by the Fisheries Service to make tuna fishing a "limited-access program." Under this stipulation, no new commercial permits can be sold; the only way someone can get a permit is to buy it from someone who already has one.

Recent assessments of the yellowfin tuna population in the Gulf are encouraging, perhaps in part due to the decrease in fishing pressure. Currently commercial longliners in Louisiana are not restricted by

a quota. Recreational anglers seeking yellowfin are allowed three fish per day, all of which must be over 27 inches.

– **William Sheftall IV**

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Commercial Fishing Season for Large Coastal Sharks Closed

Commercial fishing for Large Coastal Sharks, as defined by Louisiana rule (L.A.C. 76:VII.357), closed in Louisiana waters at 11:30 p.m., Dec. 31, 2008. The National Marine Fisheries Service also closed the federal waters of the Gulf of Mexico at this time. The commercial season will remain closed in federal waters until 30 days after promulgation of the 2009 seasonal rule for harvest of sharks in the Federal Register. Since the opening date of the season in federal waters is not known at this time, no date has been set for the re-opening of the commercial large coastal shark fishery in Louisiana state waters.

During the closed season, all commercial harvest, possession, purchase, exchange, barter, trade, sale or attempt to purchase, exchange, barter, trade or sell large coastal sharks or their fins is prohibited. The large coastal shark group is composed of the great hammerhead, scalloped hammerhead, smooth hammerhead, nurse shark, blacktip shark, bull shark, lemon shark, sandbar shark, silky shark, spinner shark and tiger shark.

There is no allowable harvest at any time for all prohibited species, which include basking shark, white shark, bigeye sand tiger, sand tiger, whale shark, smalltooth sawfish, largetooth sawfish, Atlantic angel shark, Caribbean sharpnose shark, smalltail shark, bignose shark, Caribbean reef shark, dusky shark, Galapagos shark, narrowtooth shark, night shark, bigeye sixgill shark, bigeye thresher shark, longfin mako, sevengill shark and sixgill shark.

Some Chinese Seafood May Contain Melamine: Pt. 2

News about the use of melamine in Chinese seafood is alarming to U.S. consumers. The recent revelations about Chinese use of melamine in dairy products to "trick" protein analyses generated considerable concern primarily in Asia, where some babies had been poisoned. The latest news about the use of melamine in some Chinese aquaculture feeds reveals possible significant contamination of exported fish products over the last six years or more.

Melamine refers to both a chemical and to a resin that is produced from it. Human ingestion of melamine is implicated in reproductive damage, and bladder or kidney stones, which can lead to bladder cancer. Melamine has a high nitrogen content that allows it to mimic protein, which characteristic has led to some Chinese companies putting it into feedstock as an extremely cheap way of falsely boosting its protein content readings.

Recent reports have shown that melamine is being used by some companies in China to boost the protein content readings in feedstock being given to cultured seafood. This concerns U.S. consumers, since more than 80 percent of the seafood in the United States is imported, and by volume, China is the largest exporter of seafood to the U.S.

China exports significant amounts of shrimp and catfish products, representing two of the ten most consumed seafood products in the U.S. In fact, China is the world's largest producer of farm-raised seafood, exporting billions of dollars worth of shrimp, catfish, tilapia, salmon and other fish. The U.S. imported about $2 billion of seafood products from China in 2007, about double the volume of four years earlier, according to the U.S. Department of Agriculture.

The use of melamine to falsely boost feed protein analyses has been revealed to be, unfortunately, fairly widespread in Chinese animal culture systems. However, unlike in cows and pigs, the edible flesh in fish that have been fed melamine contains residues of the nitrogen-rich substance. Recent studies conducted by the U.S. Food and Drug Administration's (FDA) Animal Drugs Research Center found disturbing levels of melamine in certain fish. The report states that the FDA's Animal Drugs Research Center found that trout, tilapia, and catfish which were raised on melamine-tainted feed contained concentrations of the toxic chemical of up to a whopping 200 parts per million (ppm), which is over 80 times the maximum "tolerable" level the FDA has set for safe human consumption.

U.S, importers typically rely on government inspections, and on exporters, to ensure the fish they buy are safe. In the U.S., commercial fish farms have to use feed from a handful of approved suppliers, but in China, there may be hundreds of thousands of sources for feed, said Steve Dickinson, who ran a salmon-farming business in Washington state and is an American attorney in China's coastal city of Qingdao. Melamine has "infected the whole system in China," he said. Even some Chinese feed suppliers are no longer denying the commonality of melamine spiking. When more than 15 feed suppliers in various parts of China were contacted, most of them declined to comment or said they didn't add melamine. But some of them said the practice of spiking feed with it had been going on for at least the last six years, with inspectors checking some types of feed products more tightly than others. The FDA is not yet testing for melamine in seafood.

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THE GUMBO POT

Golden Oyster Stew

1 pint oysters, with liquid
1/2 cup onion, chopped
1/2 cup celery, sliced
1/4 cup margarine or butter
2 cups sliced fresh mushrooms
1 t salt
1/4 t pepper
2 cups milk
1 1/2 cups cheddar cheese, grated
1 can (10.5 oz) cream of potato soup
1 jar (2 oz) pimento, diced
1/4 t liquid hot pepper sauce

Remove any remaining shell particles from oysters. Cook onions and celery in margarine until tender. Add mushrooms and cook one minute. Over low heat, stir flour, salt and pepper into vegetable mixture. Add milk gradually and stir until thickened. Add cheese. Stir until melted. Add oysters, soup, pimento and liquid hot pepper sauce. Heat for 5 to 10 minutes or until oysters begin to curl. Makes 6 servings.

Reprinted from *A Louisiana Seafood Cookbook*, courtesy of the Louisiana Sea Grant College Program.

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