



Special Report

Sushi bars are pretty safe, but preparing raw fish at home is another matter.

By Mary Roach
CONSUMER HEALTH INTERACTIVE

At first glance it could be a fire hose, neatly accordioned behind a panel of glass and mounted on a wall. As the wall is in a museum devoted wholly to parasites, however, you have the unsettling feeling that upon closer inspection it will turn out not be a piece of safety equipment.

"*Diphyllobothrium*," says Shunya Kamegai cheerfully. Kamegai, a parasitologist, is the director of the Meguro Parasitological Museum in Tokyo. *Diphyllobothrium* is a tapeworm, in this case a 24-foot-long tapeworm. Kamegai speaks English, but you almost wish he didn't. Then you wouldn't know this tapeworm lived in a 40-year-old sushi eater. You wouldn't know what the man's doctor had to do to evict the specimen in one long museum-quality piece. You wouldn't know that it grew 20 centimeters a day in the man's belly. "Grew this big in two months after eating sushi," says Kamegai. You nod, silently calculating the hours that have elapsed since you ate raw fish at a cheap Tokyo sushi bar.



Each year some 2,000 Japanese fall ill from worms in raw fish. In the United States doctors don't have to report those kinds of illnesses to the Centers for Disease Control and Prevention, so statistics aren't available. But one thing is certain: Sushi is fast becoming an American fixture. As of 1993 an estimated 4,000 sushi restaurants were operating in this country, the majority having opened over the preceding seven years. It's not hard to see why: Sushi is healthful without being bland or monotonous. With its fusion of exotic flavors, sensual textures, and elegant presentation, sushi is just what many people want in a meal.

Kamegai himself was a statistic. But it wasn't a tapeworm that made him sick. What caused Kamegai's illness, indeed what causes most illnesses traced to worms in raw fish, was a less showy organism. Kamegai steps over to the museum's souvenir shop and picks up a key chain featuring a matchbook-size slab of Lucite. Inside it, half an inch long and delicate as corn silk, is a worm of the species *Anisakis simplex*.

"Very stomachache." Kamegai winces at the memory. "Very sharp pain." On the far wall is a photographic blowup of the front end of an anisakid. This is a creature with few charms. It excretes waste from its face. In place of a nose it has a prominent Black & Decker-esque attachment called a boring tooth, which it uses to drill holes in human intestines. It does this because it wants to get into the abdominal cavity, which it hopes will be a more hospitable place to settle down and raise a family. Thankfully, it's not. An anisakid worm needs to locate a seal stomach to complete its life cycle and reproduce. (The eggs leave the seal and grow into larvae that gets eaten by small crustaceans, which are eaten by large fish, which in turn are eaten by seals -- and sometimes by humans.)

After a week or so spent touring someone's innards, the worm dies. In the meantime it can make life so uncomfortable that anisakiasis is often misdiagnosed as stomach cancer or appendicitis. Indeed, the most dire side effect of anisakiasis is the unnecessary appendectomy.

In view of Kamegai's own experience, it's surprising to learn that he still frequents sushi bars. "Of course," he says, neatening a pile of sterling silver parasite earrings. "I go all the time." That's because Kamegai didn't get the worms from sushi bar fish. He got them from raw fish his wife prepared.

In both Japan and the United States, far more people get ill from fish fixed at home than from fish served in sushi restaurants. (See safety tips for preparing raw fish). According to Robert Price, a seafood microbiologist at the University of California at Davis, most of California's cases of anisakiasis have been traced to rockfish (a.k.a. rock cod or snapper) that people catch themselves and make into ceviche. (The tart lime juice marinade "cooks" the raw fish but doesn't seem to bother the worms.) Unfortunately for weekend fishing buffs, fish caught close to shore are more likely to have anisakid worms than fish caught far offshore. This is because seals, from whom the fish catch the worms, stay close to shore.

"When I eat sushi out I'm not worried," says Kamegai. "Sushi chefs are specialists. Do you want to see a white tapeworm?"

The sushi masters

For as long as there has been sushi, there have been sushi masters: men who teach other men about fish. The head instructor at Sushi Daigaku school, sushi master Konakai, has worked with raw fish for 50 years. He made sushi for the late Emperor Hirohito. He owns knives -- foot-long scalpel-sharp sabers -- worth \$1,000 each. His place of employment, just minutes from the parasite museum, is the world's only culinary institute devoted to sushi.

Translating for the master is instructor Tony Yoshizaki, a stout, energetic man whose evocative gestures and leaping eyebrows make up for his shortcomings in English. "I am Mr. Konakai's *katuade*. *Kata* -- right. *Ude* -- hand. Right-hand man!" As he talks he makes hatchet motions at his right wrist, an alarming image given the size of the knife at his side.

The first secret of the masters can be found inside a hulking metal freezer in the corner. It is this: With few exceptions, the sushi served at the average restaurant has been frozen. This is a good thing. Freezing kills parasites. In many cases the fish is frozen right on the deep-sea fishing boats to keep it from spoiling on the lengthy return voyage. The same is true in the States, though it's not a requirement. "The transport of fresh fish," says Peter Schantz of the CDC's division of parasitic diseases, "is such that the most practical way to do it is to freeze it."

Frozen sushi? Yoshizaki nods. He says it's hard to tell the difference between fresh raw fish and fresh-frozen. As long as it's frozen right away, he insists, the taste is the same. As for texture, he continues, mushy fish is caused by poor freezing practices, not freezing per se. A fillet shouldn't be left in the freezer longer than two weeks. "Freezer burn," he says. "Fish become watery. No good." Thawing in hot water is another no-no. "Defrost too fast. Fish get soft."

Not much to worry about

Even if freezing didn't do such a good job of deep-sixing parasites, only a few fish would present any real problems. Tuna, for instance, live too far from land to mingle with seals and pick up many worms. Salmon and rockfish are another story, says Ann Adams, a parasitologist at the Food and Drug Administration's seafood products research center in Bothell, Washington. In Adam's 1994 study of sushi in Seattle, 10 percent of the salmon pieces checked had anisakids -- usually just one, but sometimes two or three. Among the rockfish pieces, only one out of 30 samples was inhabited. On a happier note, all but one of these worms were dead or dying -- not really a surprise since they'd been frozen stiff.

As for supermarket salmon and rockfish, no one's done a systematic survey, but the worms show up occasionally. "I've seen them in rockfish at my neighborhood market," Price says. "Right next to the overwrap, crawling around." People who are planning to cook the fish have nothing to worry about. Dead, the things are harmless and don't affect the taste. Price, a freshness fanatic, is actually happy to see live wrigglers. "It's a good way to tell that the fish hasn't been frozen."

Even if someone happens to swallow a live worm, there's not that much to worry about. In the normal course of events, a swallowed anisakid goes right through the body. "Probably you and I have swallowed one and never knew it," Price says.

The Japanese avoid the salmon problem by never serving it raw. In place of California rolls, smoked salmon, and broiled eel, Tokyo diners eat gizzard shad, ark shell ligament, and siphon of gaper. Today's lesson is on sea bream.

"You call it another name," says Yoshizaki. "Rocks..."

"Not rockfish."

"Yes!" Yoshinaki makes paddling motions. "Swimming in a tank at Tsukiji market this morning!" His eyes light up. "After make, eat for lunch." I relay Price's line about anisakiasis in California being traced to raw rockfish.

Konakai looks up from beneath formidable steel wool eyebrows. "Americans are afraid. Because of E. coli *oh ichi go*

nana." He means *Escherichia coli* O157:H7, the sometimes lethal strain of bacteria that has become a problem in hamburger. "Remember," he says, "sushi man has pride. Make good sushi. Also, lots of experience."

How can he tell if worms are in this rockfish? I'd heard that chefs candle fillets -- hold them up to bright light looking for parasites. But in the Seattle study candling failed to detect anisakid worms in any sushi later found to contain them. Konakai doesn't teach candling. "Sushi man got to be like doctor," he says. "Make surgery. Cut open everything. If worm, eye can see. Throw away fish."

Can eye see tapeworm larvae? They're white and small as rice grains, all but indistinguishable from bits of fat. How can a chef hope to see them in a white-fleshed fish? "They are ivory," Konakai says. "Fish is more clear."

To dodge tapeworms, a restaurant patron probably doesn't have to count on the sushi man's eye. They rarely show up in the kinds of fish that people eat raw. They're freshwater organisms, and most sushi is made from oceangoing fish. The majority of tapeworm cases in this country are from pike caught on fishing trips in the Great Lakes and then undercooked over a campfire. Some 50 to 70 percent of northern pike harbor tapeworms.

What happens if someone swallows the larvae? Not much. Tapeworms are relatively benign, more like low maintenance pets than a dread pathogen. Symptoms (feelings of fullness, nausea) are rare. "They just hang in there and undulate," says Adams, who's never had a tapeworm but claims she wouldn't mind. "Hey, you get to refer yourself in the plural."

Contrary to popular mythology, having a tapeworm can't help someone lose weight, Adams says. (The rumor may have been started by scam artists who sold the worms as diet aids.)

On the whole, American sushi is very safe. People are far more likely to get sick after eating a rare burger, pink chicken, or raw oyster shooters. And the fish is getting safer still. Thanks to a new FDA program, all fish processors (including foreign exporters, who supply two-thirds of our fish) will have to undergo detailed training in the safe handling of seafood. If parasites are identified as a hazard in a particular species and one of its intended uses is sushi, the fish must be frozen.

Class is through. Master Konakai picks up a small cutting board, raising it like an offering at an altar, and places it before me: six pieces of never-been-frozen rockfish -- the freshest, possibly the most treacherous, fish I'll ever eat.

I am pleased to report I returned home with but one worm. The one locked in a hunk of Lucite on my key chain.

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