Specimens of *P. s. streckeri* obtained in the present study are deposited in the Arkansas State University Museum of Zoology (ASUMZ 5272-5313). Representative samples of parasites are deposited in the USNM Helminthological Collection, USDA, Beltsville, Maryland 20705 as follows: *Opalina* sp. (USNM 79353); *Nyctotherus cordiformis* (USNM 79355); *Myxidium serotinum* (USNM 79354); *Mesocestoides* sp. (USNM 79356); *Oswaldocruzia* sp. (USNM 79357).

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**Research Note**

**Human Anisakiasis: Two Case Reports from the State of Washington**

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The change in U.S. dietary habits to include more raw seafoods is exposing the public to a greater risk of parasitic infection. One such zoonotic disease, transmitted from fish to humans, is anisakiasis, which is acquired by consuming raw or undercooked seafoods and involves the penetration of a larval anisakid nematode into or through the gastrointestinal tract. Of the 2 cases that occurred in Seattle, Washington, 1 represents the first reported occurrence of anisakiasis in the United States in which food served at a restaurant was implicated in the transmission of a larval *Anisakis* sp.

**Case Histories**

**Case 1**

A 46-yr-old male awoke on the morning of 12 April 1985 to find 2 larval nematodes wriggling in the posterior oropharynx. The previous evening the patient had eaten smoked salmon and tuna sushi at a restaurant. He experienced no symptoms on the evening following the meal. He coughed-up and manually extricated the helminths. Prior to eating at the restaurant, it had been several weeks since the patient had eaten any seafood products. Histological slides of one nematode showed it to be a third-stage larva belonging to the genus *Anisakis* (U.S. National Museum, Helminthology Collection No. 79656).

**Case 2**

On 3 December 1981 a 22-yr-old man felt a tickle in the back of his throat and removed a viable 5-cm-long worm. No other symptoms were noted. The patient frequently ate raw tuna, rock cod, and sea bass. He had never observed worms in the flesh of these fish. His last meal of sashimi was 2 wk prior to finding this parasite. Hematologic findings on 9 December 1981 were a total leukocyte count of 7,300, of which 8% were eosinophils. The worm was tentatively identified as the third-stage larva of *Anisakis* sp. by the State Health Department Laboratory. The specimen was not available to confirm this identification. Based on the size of the worm, however,
it seems more likely that it was the third-stage larva of *Pseudoterranova (=Phocanema)*, which may be 5-cm long, rather than *Anisakis*, which is rarely over 2-cm long.

In recent years, the number of cases of human anisakiasis in the United States has increased. Including these case reports from the Seattle area, at least 37 suspected or confirmed cases of anisakiasis have been reported from the United States and additional human infections are known to have occurred (J. W. Bier, Division of Microbiology, FDA, Washington, D.C., pers. comm.). Where geographical information is known, 32 (86%) of individual infections with a larval *Anisakis* nematode occurred in the western U.S. (including Alaska and Hawaii) and 5 (14%) were from the eastern United States.

The substantially higher number of cases reported from the western United States can be attributed to at least 3 factors: a greater concentration of various ethnic groups (e.g., Eskimos, Japanese, Chinese), who are known to consume raw foods; the recent trend of eating more raw seafoods (e.g., sushi, sashimi, lomi lomi, ceviche), either at home or at restaurants; and the large number of commercially important fishes, infected with larval ascaridoid nematodes, caught in the Pacific ocean (e.g., Myers, 1979, Journal of Food Protection 42:380–384; Dailey et al., 1981, California Fish and Game 67:240–245; Deardorff et al., 1982, Pacific Science 36:187–201). Infected fishes are usually associated with large numbers of marine mammals, which are the definitive host for this nematode. Such large concentrations of marine mammals are found along the U.S. west coast.

This case history represents the first confirmed report in the United States to implicate a restaurant in the transmission of third-stage larval *Anisakis*. It demonstrates that *Anisakis* larvae are capable of surviving some commercial procedures associated with the preparation of these types of foods. Two other human cases have been suspected following meals at different west coast restaurants. One undocumented case involved a Japanese tourist who experienced gastrointestinal upset after eating raw fish; and the other case involved a native Californian, who experienced nausea, vomiting, diarrhea, and pleural effusion following his meal of raw salmon and shellfish (Kobayashi et al., 1985, American Journal of Tropical Medicine and Hygiene 34:310–313). No worms were recovered from the patients in either of these cases.

Public health authorities are concerned about the problem of human infection resulting from parasites in seafood products (e.g., the recent increase in case reports of anisakiasis) and the possible involvement of restaurants in the transmission process. *Anisakis* larvae are sensitive to the temperature extremes of thorough cooking or freezing. Because heating is not always desirable, freezing is presently regarded as the most promising preventive measure (e.g., cost effective, ease of regulation) against infection with anisakid nematodes (Deardorff, 1986, Proceedings of the Eleventh Annual Tropical and Subtropical Fisheries Conference of the Americas, pages 285–291).

There is some confusion in the literature as to a suitable time and temperature relationship to inactivate ascaridoid larvae. The recommended time and temperature found in Japanese and European literature for freezing fish to kill anisakine larvae is −20°C for 24 hr; however, some North American species survive after 52 hr at this temperature (Bier, 1976, Journal of Milk and Food Technology 39:132–137). For example, Jackson and Bier (1981, FDA By-lines, No. 3, pages 152–156) recommended freezing fish intended to be consumed raw or partially cooked to −20°C for 60 hr and Deardorff et al. (1984, Journal of Food Protection 47:49–52) demonstrated that subjecting Hawaiian snappers to at least −20°C for 24 hr and rockfishes to at least −20°C for 120 hr was necessary to inactivate the living anisakines. The safe freezing period appears to vary, based on the product and type of larvae being tested. The effectiveness of commercial and domestic freezing and various time/temperature ratios for killing *Anisakis* larvae in whole salmon and rockfish, fishes that are commonly implicated in the transmission of anisakiasis in the United States, are currently being studied.