ICES Identification Leaflets for Diseases and Parasites of Fish and Shellfish

Leaflet No. 7

Pseudoterranova larvae ("codworm"; Nematoda) in fish

Original by John W. Smith and Rod Wootten

Revised and updated by Matt Longshaw

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Susceptible species

Pseudoterranova has a low host specificity, with larval stages being recorded from at least 70 marine fish species and many invertebrates (Berland, 1961; Templeman *et al.*, 1957). Adult stages appear to be more host specific, occurring in marine mammals.

Disease name

Phocanemiasis, "codworm"

Aetiological agent

Pseudoterranova (=*Phocanema* =*Porrocaecum* =*Terranova*) *decipiens* is a complex of sibling species (Nematoda, Superfamily Ascaridoidea, subfamily Anisakinae). The sibling species include *P. decipiens sensu stricto* (=*P. decipiens* B; Krabbe, 1878), *P. krabbei* (=*P. decipiens* A) Paggi, Mattiucci, Gibson, Berland, Nascetti, Cianchi and Bullini, 2000, *P. bulbosa* (=*P. decipiens* C; Cobb, 1888), *P. azarasi* (=*P. decipiens* D; Yamaguti and Arima, 1942) and *P. decipiens* E of Bullini *et al*., 1997. Additional species in the genus *Pseudoterranova* include *P. cattani*, identified using allozyme markers in the Pacific, *P. kogiae* (Johnston and Mawson, 1939) infecting the pygmy sperm whale (*Kogia breviceps*) and *P. ceticola* (Deardoff and Overstreet, 1981) infecting dwarf sperm whale (*Kogia simus*).

Eggs produced by the adult females in mammalian hosts are shed into the water (Bowen, 1990). Following development in the egg, invertebrate hosts, usually copepods, eat second-stage larvae. Transmission to other copepods, amphipods, polychaetes, mysids and gastropods is possible via ingestion of infected copepods. The parasite undergoes further development to the third-stage larvae in fish hosts. It is possible for fish to fish transfer to occur through ingestion of infected fish. Adult parasites occur in pinnipeds. Adult stages occur as follows: *P. decipiens s.s.* occur mainly in the common seal *(Phoca vitulina*) and occasionally in grey seals (*Halichoerus grypus*); *P. krabbei* occur in grey seals; *P. bulbosa* occur in bearded seals (*Erignathus barbatus*); *P. azarasi* occurs in Stellar's sea lion (*Eumetopias jubatus*), and *P. decipiens* E adults occur in the Antarctic Weddell seal (*Leptonychotes weddelli*).

Geographical distribution

Specifically, *P. decipiens sensu stricto* occurs in coastal zones of the North Atlantic Ocean and Pacific Ocean; *P. krabbei* occurs in the Northwest Atlantic Ocean; *P. bulbosa* occurs in the Barents Sea, Norwegian Sea, Sea of Japan, and Canadian Atlantic waters; *P. azarasi* occurs in Japanese waters of the Pacific Ocean and *P. decipiens* E has been reported in Antarctic waters.

Associated environmental conditions

The rate of development of nematodes in seawater is temperature dependant. Furthermore, lower environmental temperatures reduce the numbers of larvae that penetrate into fish flesh. Larval worms in fish tend to be more prevalent in areas where the various hosts occur in large numbers such as inshore waters.

Significance

Pseudoterranova has limited significance as a pathogen of fish and is not recognized as a primary pathogen causing mortalities. Infections in marine mammals can be problematic and are associated with gastritis, enteritis, anaemia, dehydration and diarrhoea in infected hosts. *Pseudoterranova* is a potential human pathogen if larvae are consumed alive with raw or inadequately cooked fish (Margolis, 1977; Mercado *et al.*, 2001). Aesthetically, severely affected fish are likely to be unattractive to the consumer. Processed fish are screened for the presence of parasites but this is a time consuming and costly process.

Gross clinical signs

The presence of larvae coiled in capsules of irregular shape, especially in flesh is indicative of infection. Larvae in fish are 10–60 mm long, and creamy white, yellow, brown, or reddish brown in colour.

Control measures and legislation

None feasible for fish. Adequate cooking or freezing kills larvae in fish flesh for human consumption. *Pseudoterranova* is not an OIE-notifiable disease.

Diagnostic methods

Fish fillets can be screened using candling techniques. Dead nematodes in the flesh fluoresce in the presence of ultraviolet light. Parasites should initially be identified using morphological characters followed by molecular methods for discriminating sibling species such as DNA sequence analysis and use of allozyme markers (Mattiucci *et al., 2007).*

Morphologically, *Pseudoterranova decipiens* larvae in fish are characterized by anterior boring tooth (bt) close to the opening of the excretory pore (ep). Nerve ring (nr) located anteriorly. The excretory duct (ed) runs back from the excretory pore and expands into the excretory canal. The oesophagus (oes) comprises a relatively long preventriculus (pv) and ventriculus (v). The intestine (int) immediately behind the ventriculus is produced forwards as an intestinal caecum (ic). Posteriorly, the intestine narrows to enter the rectum, which opens at the anus. The tip of the tail bears a small spine or mucron.

Histologically, parasites can be recognized by the presence of an external cuticle, a muscle layer and an intestine. The parasite causes local mechanical compression of tissues with a fibrous capsule of host origin surrounding larvae in some hosts.

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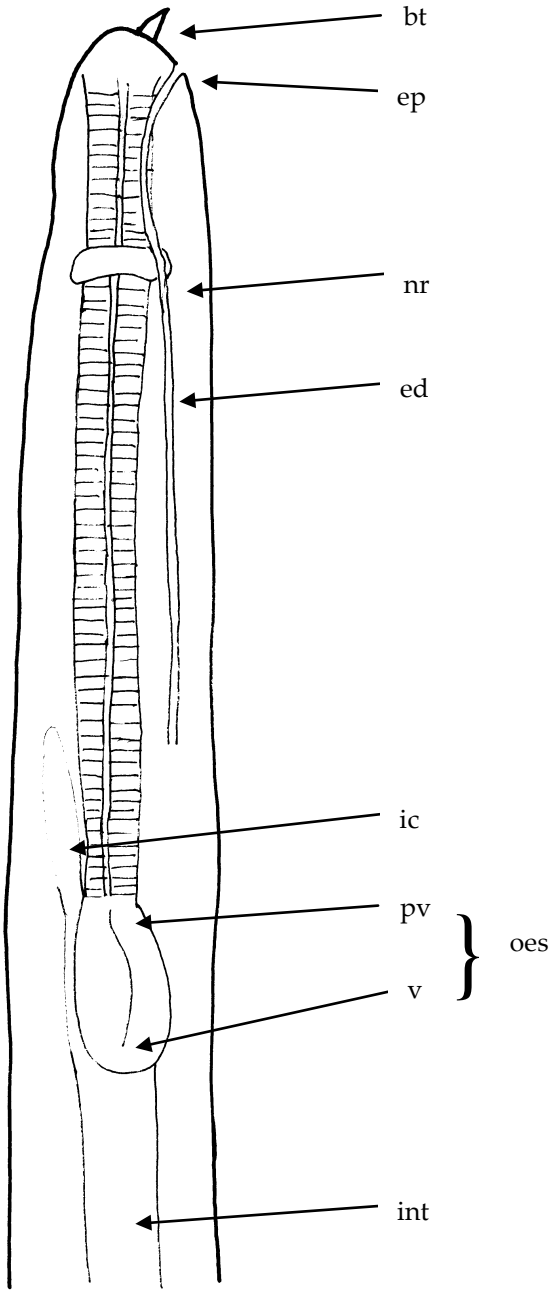

Figure 1. Line drawing of *Pseudoterranova decipiens* larvae from fish showing main diagnostic characteristics of the parasite. See section on "diagnostic methods" for explanation of the labelling.

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