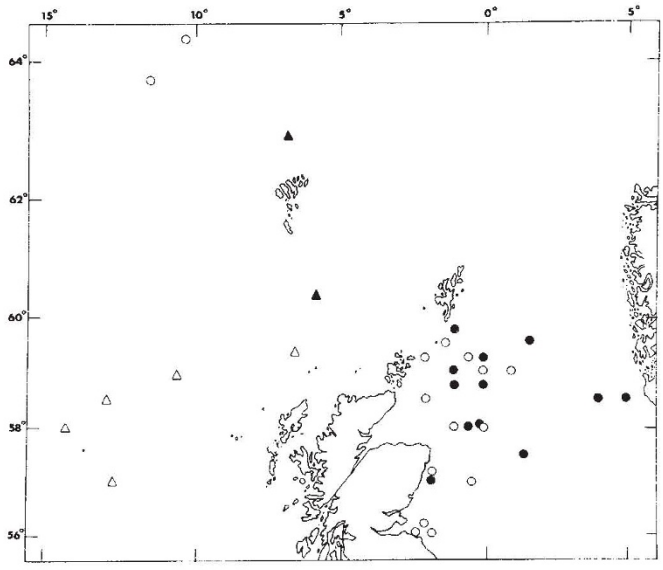
# *Thysanoessa inermis* and *T. longicaudata* (Euphausiidae) as First Intermediate Hosts of *Anisakis* sp. (Nematoda: Ascaridata) in the Northern North Sea, to the North of Scotland and at Faroe

REPORTS[1,2] that live larvae of the nematode *Anisakis* from raw or inadequately cooked fish may cause eosinophilic granuloma of the alimentary tract in man have stimulated research into the ecology, taxonomy, physiology and pathogenesis of this genus in fish (natural second intermediate hosts), marine mammals (natural final hosts) and man and laboratory animals (abnormal hosts)[3,4]. But little attention has been paid to earlier stages in the life cycle or to a search for first intermediate hosts. A knowledge of early developmental stages of *Anisakis* might contribute to an understanding of geographical and other variations in abundance of the larvae in economically important fish. Uspenskaya[5] reported larval *Anisakis* in one of 855 specimens of the amphipod *Caprella septentrionalis* Krøyer, 1838, in one of 990 specimens of the decapod *Hyas araneus* (L.) and in one of an unspecified number of euphausiids *Thysanoessa raschii* (M. Sars, 1864) from the Barents Sea. Oshima *et al.*[6] found five larvae in 3,247 specimens of *T. raschii* and *T. longipes* Brandt, 1851, collected in the northern North Pacific Ocean and Bering Sea. Kagei[7], according to Gibson[4], mentioned *T. inermis* (Krøyer, 1846) as a first intermediate host of *Anisakis*.

*Anisakis* sp. larvae have been found in two species of *Thysanoessa* from the northern North Sea, north of Scotland and at Faroe. The euphausiids were extracted from routine plankton samples collected in 1969 and preserved in 4% formaldehyde on the fishery research vessels Scotia (now Scarba) and Explorer. A total of 2,730 specimens of *T. inermis* from twenty-seven localities are examined for larval nematodes. Eighteen of 1,335 specimens from twelve of these localities (Fig. 1) were infected with larval *Anisakis*, the incidence of infection at individual localities ranging from 0.5 to 4.0%. Examination of 950 specimens of *T. longicaudata* (Krøyer, 1846) from seven localities revealed infection in three of 335 specimens from two localities (Fig. 1), the incidence being 0.7 and 1.0%. This seems to be the first published report of larval *Anisakis* in *T. longicaudata* and also the first published record of them in any invertebrate in these waters.




**Fiig. 1** Chart showing localities at which *Thysanoessa inermis* and *T. longicaudata* were collected and the distribution of infection with larval *Anisakis*. ●, Infected *Thysanoessa inermis*; ○, uninfected *T. intermis*; ▲, infected *T. longicaudata*; △, uninfected *T. longicaudata*.

Only one larva was found in each infected euphausiid; in preserved hosts the larva lay coiled in the haemocoel of the thorax, occasionally with the head or tail extending into the abdominal haemocoel. Observations on the behaviour of larval *Anisakis* in live euphausiids have not yet been possible. The larvae, probably second stage, were from about 5.1 to about 20.6 mm long and morphologically resembled third-stage larvae from fish, designated *Anisakis* sp. larva (1) by Berland[8]. Free-living second-stage larvae of *Anisakis* are comparatively small; such larvae experimentally hatched from eggs in sea water were ensheathed and about 0.22 to about 0.29 mm long (about 0.33 to about 0.37 mm long including the sheath). These probably exsheath after being eaten by euphausiids and grow to the lengths reported above; no euphausiid has so far been seen with larvae less than about 5 mm long. Larval *Anisakis* cannot be specifically identified as yet. There may be only the one species in the areas considered here, possibly *A. simplex* as defined by Davey[3].

Larval *Anisakis* were not seen in other euphausiids (463 specimens of *T. raschii*, 500 of *Nyctiphanes couchii* (Bell, 1853) and 488 of *Meganyctiphanes norvegica* (M. Sars, 1857)) collected at some of the localities where infected *T. inermis* or *T. longicaudata* were found. However, Dr P. van Banning (private communication) found an *Anisakis* larva, about 19.0 mm long, in one of 3,178 specimens of *M. norvegica* collected in 1970 from the northern North Sea.

Further work is necessary before any assessment can be made of the relative importance of *Thysanoessa* species, euphausiids in general and of other invertebrates in the life-cycle of *Anisakis*.

The only other larval nematodes seen during the present survey were *Contracaecum* sp.[8]; they occurred singly in some *T. raschii* and *N. couchii* (and in some chaetognaths *Sagitta elegans* Verrill, 1873) from the inshore locality off the north-east coast of Scotland where *T. inermis* infected with larval *Anisakis* were found (Fig. 1).

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# *Archaeopteryx* Again

HEPTONSTALL[1] believes that my estimate of the mass of *Archaeopteryx*[2,3] (200 g) is far too light, and that a figure of 500 g is more likely.

He derives the figure of 500 g by comparing the linear dimensions of the bones of *Archaeopteryx* and *Columba livia*, and using the reconstruction by Heilmann[4] to suggest the body size. I should like to criticize this comparison for a number of reasons.

First, Heptonstall suggests that the average mass of *Columba livia* is 400 g, a value derived from Pennycuick[5], but this species seems to be rather variable in size, for Hartman[6] quotes the