J. Mar. Biol. Ass. U.K. (2002), **82**, 415–417
Printed in the United Kingdom

The distribution of *Ceratothoa steindachneri* (Crustacea: Isopoda: Cymothoidae) parasitic in *Echiichthys vipera* in the north-east Atlantic

Tammy Horton* and Beth Okamura†

*Southampton Oceanography Centre, Empress Dock, Southampton, SO14 3ZH. †University of Reading, Whiteknights, PO Box 228, Reading, RG6 6AJ. *Corresponding author, e-mail: txh@soc.soton.ac.uk

The distribution of the recently discovered association of the parasitic isopod *Ceratothoa steindachneri* (Isopoda: Cymothoidae) with the lesser weever fish (*Echiichthys vipera*) is reported. *Ceratothoa steindachneri* appears to have colonized the south-west coast of the UK between the 1960s and the 1980s, possibly as a result of range expansion due to climate change. The occurrence of *C. steindachneri* in *E. vipera* from Arcachon, France, indicates that this association has been occurring for over 100 years. Our data confirm that *C. steindachneri* is able to parasitize a broad range of fish hosts.

INTRODUCTION

Cymothoid isopods belong to a group of fish parasites known to infect numerous fish families, largely in tropical and subtropical habitats. The parasites can be found on external surfaces, in the buccal cavity/gill chamber, or in the body cavity of fish. The discovery of a buccal inhabiting cymothoid in a population of *Echiichthys vipera* (Cuvier) in Whitsand Bay, Cornwall, in 1996 (B. Okamura, personal observation) was unusual, since species of the family Cymothoidae are rarely found in the cool and cold temperate latitudes (Brusca, 1981). The cymothoid was subsequently identified as *Ceratothoa steindachneri* Koelbel, 1878 (Horton, 2000). *Echiichthys vipera* represents a previously unrecorded host for *C. steindachneri* (Horton, 2000). *Ceratothoa steindachneri* was originally recorded infecting *Pagrus vulgaris* (a junior synonym of *Pagrus pagrus* (Sparidae)) (Koelbel, 1878). The species has since been recorded infecting *Serranus cabrilla*, *S. scriba*, *S. hepatus* (Serranidae), *Diplodus annularis*, and *D. vulgaris* (Sparidae) (for references see Trilles, 1994). There is also a record of *C. steindachneri* infecting members of the family Rajidae, which remains to be verified, as it may be the result of trawl transfers (Capapé & Pantoustier, 1976).

Here we report on the distribution of *C. steindachneri* in *E. vipera* in the north-east Atlantic. *Echiichthys vipera* occurs on all the coasts of Britain and can be locally abundant on sandy grounds.

MATERIALS AND METHODS

Sampling *Echiichthys vipera* at sites in the south-west of the UK was carried out using a beach seine net, a modified 'Riley' net (see Holme & McIntyre, 1971), or by trawling from a boat. The Marine Biological Association research boat 'Sepia' was used to trawl offshore at Whitsand Bay, Cornwall. In addition, *E. vipera* were examined from collections made by research beam trawling operations in the English Channel, Bristol Channel, and Irish Sea, carried out by CEFAS (The Centre for Environment, Fisheries and Aquaculture Sciences) (for sites see Figure 1). Finally, historical collections of *E. vipera* housed in the Natural History Museum, London (NHM), the Muséum National d'Histoire Naturelle, Paris (MNHN), the Cole Museum of Zoology, Reading (CMZ), Millport

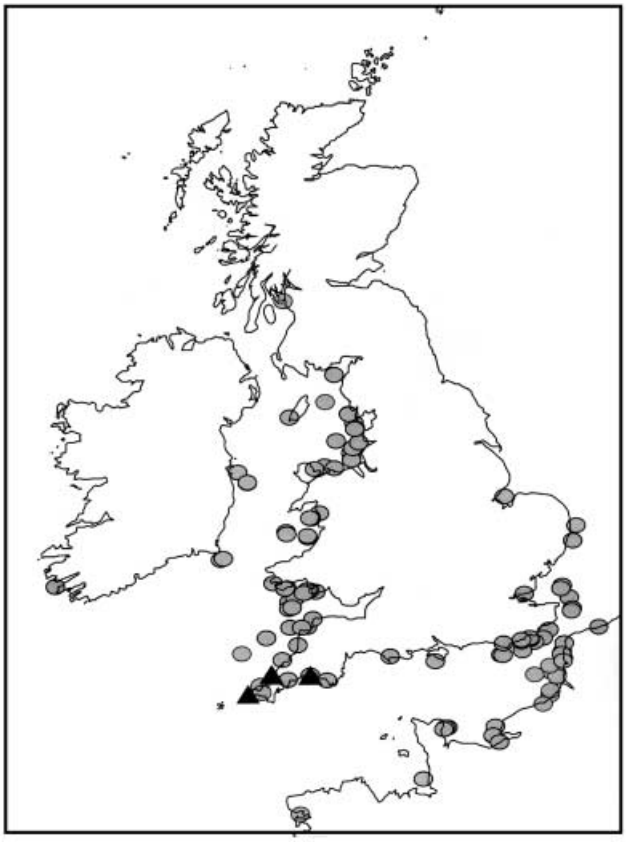

Figure 1. Sites from which samples of *Echiichthys vipera* have been examined for the presence of *Ceratothoa steindachneri*. Includes field collections and offshore trawls. Sites where *C. steindachneri* has been recorded are indicated by black triangles.

https://doi.org/10.1017/S0025315402005660 Published online by Cambridge University Press

Table 1. *Account of specimens of* Echiichthys vipera *examined for* Ceratothoa steindachneri *from historical collections at the Natural History Museum (NHM), the Muséum Nationale d'Histoire Naturelle (MNHN), the Cole Museum of Zoology (CMZ), Millport Specimen and Supply (MSS), the Dublin Museum (DM) and from field collections (F) and trawled samples from the Marine Biological Association (M) and Centre for Environment, Fisheries and Aquaculture Sciences (C).*

Location and source of *E. vipera* specimens	Date of collection	Number of *E. vipera* examined	Prevalence of *C. steindachneri* (%)
Museum Specimens			
English Channel (NHM)	1951	8	0
British Coast (NHM)	1959	8	0
Isle of Man (NHM)	1960	30	0
North Sea (NHM)	1961	110	0
Plymouth (NHM)	1983	18	22
Mouth of River Thames (NHM)	1989	27	0
La Rochelle, France (MNHN)	?	2	0
Brest, France (MNHN)	?	1	0
Granville, France (MNHN)	?	3	0
Golfe de Gascogne, France (MNHN)	?	5	0
Marseille, France (MNHN)	?	1	0
Dieppe, France (MNHN)	?	1	0
Algeciras, Spain (MNHN)	?	1	0
Sète, France (MNHN)	1879/1897	2/2	0
Trouville, France (MNHN)	1858	2	0
Arcachon, France (MNHN)	1897	3	66
Dunkerque, France (MNHN)	1897	2	0
North-east Atlantic (MNHN)	1955	5	0
United Kingdom (MNHN)	1978	4	0
Ireland, various sites (DM)	various	11	0
Kames Bay, Isle of Cumbrae (MSS)	?	?	0
Cole Museum (CMZ)	1959	17	0
Field Collected			
Bristol Channel (C*)	14/09/00	60	0
English Channel 1998 (C*)	08/98	241	0
English Channel 1999 (C*)	09/98	168	0
Irish Sea, Isle of Man(C*)	06/99	200+	0
Weymouth (C)	01/07/98	20	0
Whitsand otter trawl, 'Sepia' (M)	1996	unknown	present
Whitsand otter trawl, 'Sepia' (M)	1997	unknown	present
Whitsand otter trawl, 'Sepia' (M)	09/04/97	35	34.3
Whitsand otter trawl, 'Sepia' (M)	09/06/99	75	2.7
Whitsand otter trawl, 'Sepia' (M)	15/06/99	44	6.8
Whitsand Bay seine netting (F)	16/06/99	5	0
Whitsand Bay seine netting (F)	17/06/99	11	18.2
Whitsand Bay seine netting (F)	13/07/99	5	60
Whitsand Bay seine netting (F)	14/07/99	6	33.3
Whitsand Bay seine netting (F)	15/07/99	15	0
Whitsand Bay seine and trawl (F) (M)	11/08/99	30	6.7
Bantham Bay (F)	11/06/99	20	0
Barley Cove, Ireland (F)	09/99&08/00	2/3	0
Pentewan Beach (F)	06/04/00	2	0
Whitesands Bay (F)	07/04/00	1	100
Rhossili Bay (F)	06/05/00	15	0
Widemouth Bay (F)	29/08/00	5	0
Perran/Ligger Bay (F)	30/08/00	5	20
Polzeath (F)	31/08/00	8	0
Woolacombe Bay (F)	09/00&07/01	3/4	0
St Ives Bay (F)	22/07/01	8	0
Praa Sands (F)	23/07/01	1	0
Bigbury Bay (F)	22/08/01	5	0

*, denotes n-values pooled across several sites.

Specimen and Supply (MSM), and the Dublin Museum (DM) were studied. In all cases the buccal cavity of each fish was inspected for the presence of *Ceratothoa steindachneri*. Many samples consisted of only a few *E. vipera* and thus provide little confidence about the presence or absence of cymothoids at that site.

RESULTS AND DISCUSSION

Ceratothoa steindachneri was present in *E. vipera* at three sites in Cornwall; Whitsand Bay, Whitesands Bay, and Perran/Ligger Bay. Parasite prevalences in the *E. vipera* population of Whitsand Bay varied from 5.4% to 34.3%

https://doi.org/10.1017/S0025315402005660 Published online by Cambridge University Press

over a 5-y period (see Table 1). It would appear that the parasite has not spread from the south-west of Britain, since large samples of *E. vipera* were inspected from the Irish Sea, Bristol Channel and English Channel, and *C. steindachneri* was not detected.

Study of historical museum collections revealed that *C. steindachneri* is likely to have been present in the Whitsand Bay population of *E. vipera* since at least 1983 (Table 1). Furthermore, examination of specimens of *E. vipera* from the Atlantic coast of France confirmed that the species has been a host of *C. steindachneri for over 100 years (see Table 1).*

Ceratothoa steindachneri was first collected from Lisbon, Portugal, and was described in 1878 by Koelbel. The geographical range has not been fully elucidated, but there are records from Portugal, Tunisia, Yugoslavia, Montenegro, Morocco and both Atlantic and Mediterranean coasts of France (Horton, 2000). This previous distribution suggests the normal range is in warmer Atlantic and Mediterranean waters and that the presence of *C. steindachneri* in Britain represents a range expansion.

A range expansion most often occurs as a result of changes in environmental conditions and it has long been anticipated that, as a result of global warming, warm water Lusitanian species would extend their distribution further northwards, while cooler water boreal species would retreat. The western end of the English Channel forms the northern limit of many warmer water species and the southern limit of many arctic/boreal species. For these reasons changes in distribution patterns and abundance are more evident in this region than elsewhere in northern Europe (Southward et al., 1995). The spread of *C. steindachneri* into south-western British waters is highly suggestive of a range expansion following climate change.

Population studies of the lesser weever fish conducted from 1968–1970 at the Marine Biological Association in Plymouth did not reveal the presence of these parasites despite many hundreds of fish being measured to obtain size-class data (R. Swinfen, personal communication). Although the researchers were not looking for mouth inhabiting parasites, since *C. steindachneri* causes significant distortion of the mouth, it is unlikely that the parasites were missed. The presence of *C. steindachneri* in *E. vipera* museum specimens from Arcachon, France, in 1897 indicates that the association has been ongoing for some time.

Whether *Ceratothoa steindachneri* is indigenous to British waters, or a relatively recent arrival due to range expansion, cannot be determined at present. We therefore designate it here as a *cryptogenic* species (crypt- Greek, *kryptos*, secret; -genic, New Latin, *genic*, origin), a species that is not demonstrably native or introduced, as defined by Carlton, (1996). Should current warming trends persist, we predict *C. steindachneri* will become more widespread in *E. vipera* populations in British waters.

This work is supported by the University of Reading with additional grants from The Linnean Society (A.G. Side Fund, to support research in systematic biology), and The Marine Biological Association of the United Kingdom (Annual Award Bursary). The authors would like to thank Dr Stuart Rogers and Dr Jim Ellis of CEFAS, Lowestoft, and Dr Richard Nash for help in obtaining weever fish samples. We would also like to thank the curators of both the Natural History Museum, London, the Muséum Nationale d'Histoire Naturelle, France, and the Dublin Museum, Ireland for allowing access to their collections, and Libby Snell, David Morritt and David Buss for help with fieldwork.

REFERENCES

Brusca, R.C., 1981. A monograph on the Isopoda Cymothoidae (Crustacea) of the eastern Pacific. *Zoological Journal of the Linnean Society*, **73**, 117–199.

Carlton, J.T., 1996. Biological invasions and cryptogenic species. *Ecology*, **77**, 1653–1655.

Capapé, C. & Pantoustier, G., 1976. Liste commentée des Isopodes parasites de selaciens des côtes Tunisiennes. I. Côtes septentrionales, de Tabarka à Bizerte. *Archives de l'Institut Pasteur de Tunis*, **3**, 197–210.

Holme, N.A. & McIntyre, A.D., 1971. *Methods for the study of marine benthos*. Oxford: Blackwell Scientific Publications. [IBP Handbook, no. 16.]

Horton, T., 2000. *Ceratothoa steindachneri* (Isopoda: Cymothoidae) new to British waters with a key to north-east Atlantic and Mediterranean *Ceratothoa*. *Journal of the Marine Biological Association of the United Kingdom*, **80**, 1041–1052.

Koelbel, C., 1878. Uber eininge neue Cymothoiden. *Sitzungsberichte der Akademie der Wissenschaften in Wien*, **78**, 401–416.

Southward, A.J., Hawkins, S.J. & Burrows, M.T., 1995. Seventy years' observations of changes in distribution and abundance of zooplankton and intertidal organisms in the western English Channel in relation to rising sea temperature. *Journal of Thermal Biology*, **20**, 127–155.

Trilles, J.P., 1994. Les Cymothoidae (Crustacea, Isopoda) du monde (Prodrome pour une faune). *Studia Marina* (1–2), **21/22**, 1991, 1–288.

Submitted 31 August 2001. Accepted 8 April 2002.