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The role of *Callionymus lyra* and *C. reticulatus* in the life cycle of *Lernaeocera lusci* in Belgian coastal waters (Southern Bight of the North Sea)

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A survey of the dragonet *Callionymus lyra* and the reticulated dragonet *C. reticulatus* from Belgian coastal waters (Southern Bight of the North Sea) in June 1991 revealed 34% of dragonets infected with 1–7 *Lernaeocera lusci*. This same parasite infected 9% of the reticulated dragonets (mean intensity = 1). Parasite size is host-size-dependent. Of the parasites collected from *C. lyra* 64% were gravid adults (substage X), and a significant positive relationship between the number of eggs and axial length of the parasite was found. The parasites were overdispersed within the dragonet population ($s^2/m = 1.67$).

Key words: *Callionymus reticulatus*; *Callionymus lyra*; non-commercial fish; *Lernaeocera lusci*; host specificity; Belgian coast.

I. INTRODUCTION

The parasite faunas of many commercially important marine fish species have been studied extensively (Kinne, 1984), but little is known about the role of non-commercial fish species in the life cycle of marine parasites. This study investigates the role of the dragonet (*Callionymus lyra* L.) and reticulated dragonet (*C. reticulatus* C. & V.) in the life cycle of *Lernaeocera lusci*, a mesoparasite which uses sole [*Solea solea* (Jordan & Goss)] as its intermediate host and bib [(*Trisopterus luscus* (L.))] as its common definitive host (Slinn, 1970; Evans *et al.*, 1983).

Callionymus lyra is a poorly known non-commercial fish species in the southern North Sea (Van der Veer *et al.*, 1990). Although dragonets are widely distributed (Chang, 1951a; Van der Veer *et al.*, 1990) little information is available on their role in the marine ecosystem. Aspects of the biology of *C. lyra* have been presented recently by Van der Veer *et al.* (1990). *C. reticulatus* is less well known and information on this species is provided by Chang (1951b) and Boer (1971).

The occurrence of crustacean parasites on *C. lyra* has been reported on several occasions. Scott (1929) recorded adult *L. lusci* in the Irish Sea and Hansen (1923), Stekhoven (1936) and Kabata (1958) reported impregnated *Lernaeocera* spp. on *C. lyra*. Despite the high number of occasional records, Kabata (1979) states that the dragonet “does not play an important part in the life cycle of *Lernaeocera* spp.” *Lernaeocera lusci* has not been reported on the reticulated dragonet.

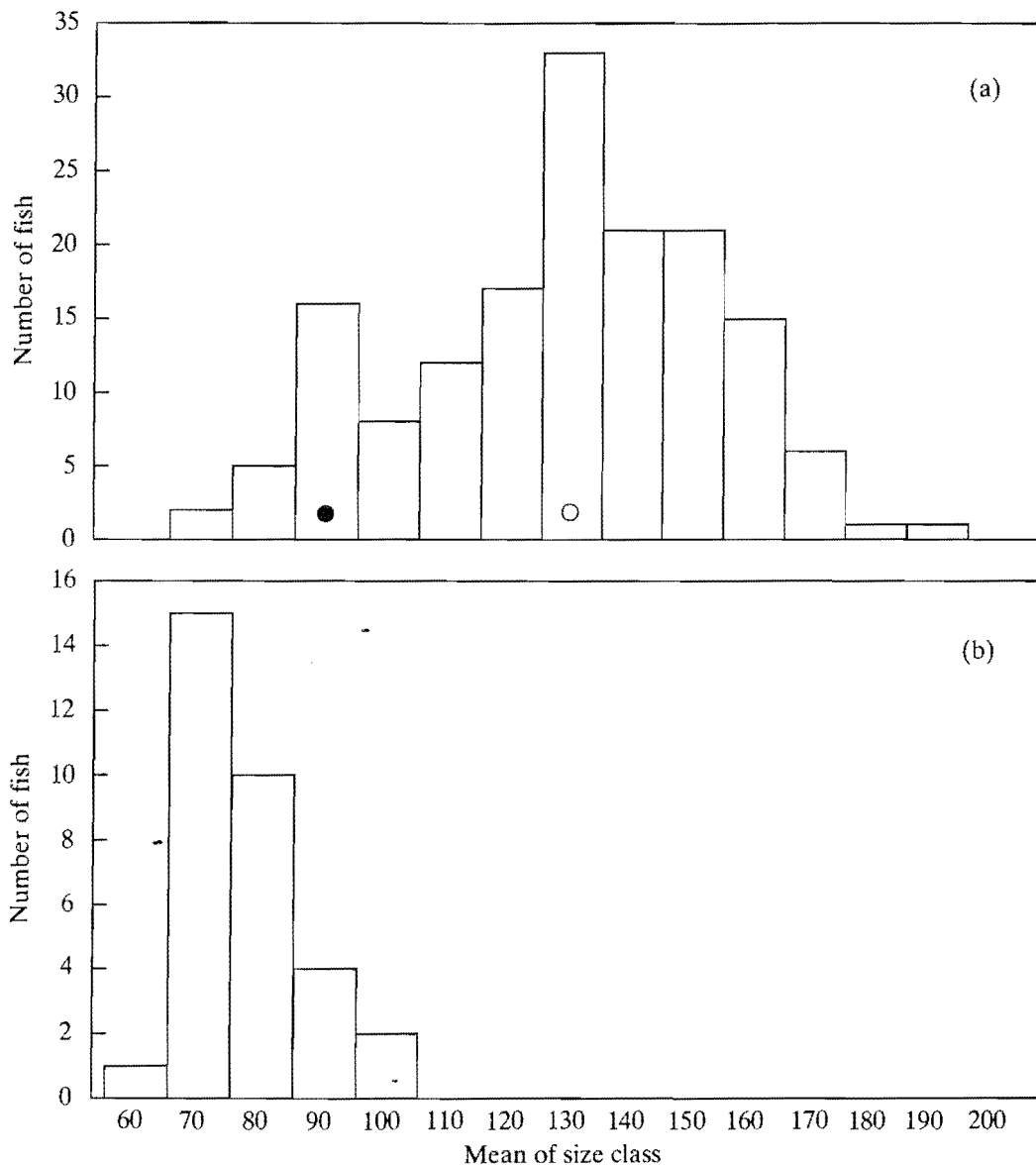


FIG. 1. Length-frequency distributions of *Callionymus lyra* (a) and *C. reticulatus* (b) in June 1991 in Belgian coastal waters. Age-groups of *C. lyra* are indicated (by eye). ● = I-group; ○ = II-group.

Most records of *L. lusci* on uncommon hosts (reviewed by Kabata, 1960, 1979) are anecdotal, and quantitative observations are largely unavailable. However, estimates of the ecological significance of the broad host specificity of *L. lusci* can only be made when sufficient quantitative data are provided.

This study presents data on the prevalence and the abundance of *L. lusci* on the dragonet and the reticulated dragonet in the Belgian Coastal Waters in June 1991, and estimates the possible role of these host species in the life cycle of *L. lusci* at the Belgian coast.

II. MATERIAL AND METHODS

During a summer survey (15 June 1991) with a research vessel 159 dragonets were collected in Belgian coastal waters (51° 28'27 N, 03° 03'48 E). Thirty-two *C. reticulatus* were collected from a nearby locality (51° 30'00 N, 03° 00'00 E).

Fish were preserved in 8% formalin immediately after capture. After 6 months fish were measured (total length: T.L.) and transferred to 70% ethanol. Figure 1 shows the

TABLE I. Classification of adult female *Lernaecera lusci* on *Callionymus lyra* (after Van Damme & Hamerlynck, 1992)

Substage	Definition
Pennella (P)	No flexure or one point of flexure
Immature (U)	Two or three points of flexure
Mature pregravid (W)	Genital region fully swollen
Mature gravid (X)	External egg strings present
X1	Immature eggs
X2	Mature pigmented eggs
Y	External egg strings partly or completely spent
Dead parasite (Z)	Remains of holdfast embedded in host tissue

length distributions of both the dragonets and the reticulated dragonets. The significant overlap of the lengths of different age groups of *C. lyra* and *C. reticulatus* made age-specific comparisons impossible. Therefore, the *C. lyra* were assigned to four length classes of between 70 and 185 mm.

The skin, mouth cavity and gill cavity of the fish were checked for crustacean parasites. The staging of the adult female *L. lusci* on the hosts was based on the nomenclature of Van Damme & Hamerlynck (1992), which is a modification of the staging system of Sproston & Hartley (1941). A summary of the diagnostic characters of each substage is given in Table I. The terms prevalence, mean intensity and abundance are used as recommended by Margolis *et al.* (1981).

The effect of host size on parasite axial length (AL; measured along axis between the basis of the mouth cone and the posterior end) was studied by linear regression. Fifty-four *Lernaecera* (X substages) collected from dragonets were measured for this purpose.

The variance to mean ratio (s^2/m) was calculated to measure the degree of dispersion of *Lernaecera* within the *C. lyra* population (Elliott, 1971). Chi-square tests on the s^2/m ratios were used to measure dispersion. The observed frequencies were then compared with the expected frequencies of the negative binomial distribution. A non-parametric test (Kruskal-Wallis) was used to determine whether significant differences in parasite abundance occurred between the size groups.

III. RESULTS

Lernaecera lusci collected from *C. lyra* and *C. reticulatus* were identified by the presence of antennary processes (Kabata, 1979). Recently, Tirard (1991) has shown that the presence of antennary processes is a valid criterion to distinguish *L. lusci* from *L. branchialis*.

Thirty-four per cent of dragonets collected in June 1991 were infected with *Lernaecera lusci*. Most (98%) were attached in the mouth and gill cavities. Only 2% were attached to the skin. About 9% of reticulated dragonets were infected with *L. lusci*.

The overall mean intensity of infection on *C. lyra* was 1.76 and a maximum number of seven parasites was found on a fish of 166 mm total length. The variance to mean ratio is greater than unity (1.67, $\chi^2 = 380$, $P < 0.01$) revealing that the parasites were overdispersed within the *C. lyra* population. The observed distribution can be described by the negative binomial model ($k = 0.48$; goodness-of-fit,

TABLE II. Abundance, prevalence and variance to mean ratio of *Lernaeocera lusci* on *Callionymus lyra* belonging to different size classes (June 1991) in the southern North Sea

Size classes	<i>N</i>	Prevalence (%)	Abundance	s^2/m
< 100 mm	31	25.8	0.36	1.79*
101–125 mm	43	37.2	0.51	1.22
126–150 mm	52	38.5	0.64	1.79*
> 150 mm	28	33.3	1.15	3.61*

*Variance to mean ratios significantly different from 1.

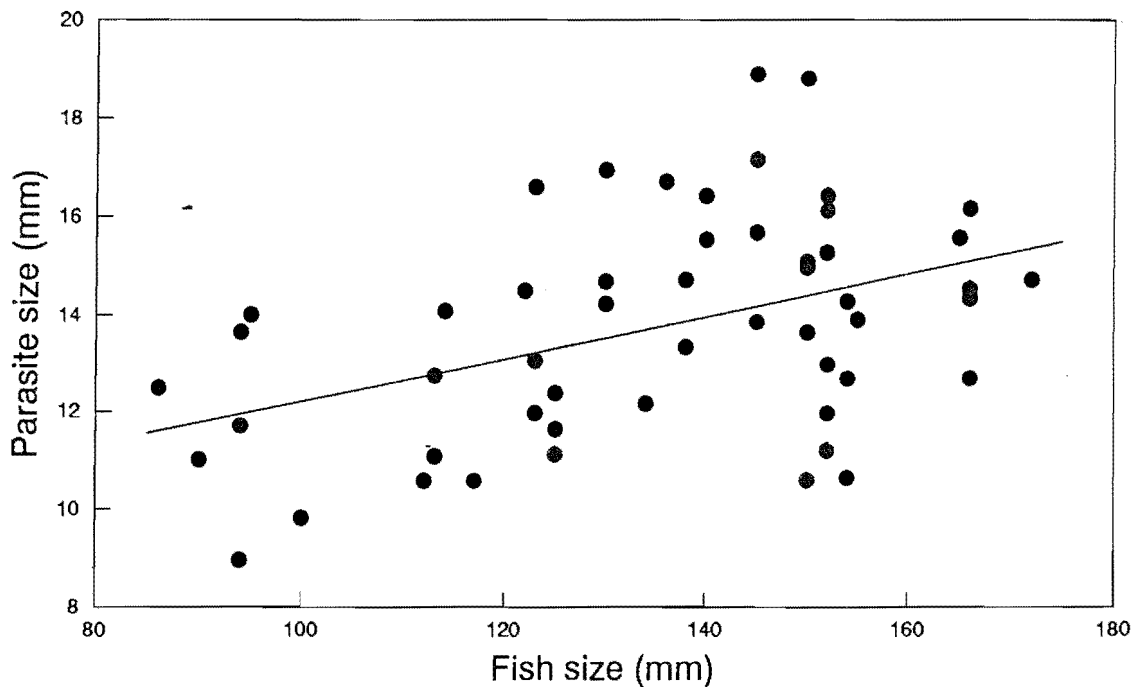


FIG. 2. Relationship between fish host length and parasite length for *Lernaeocera lusci* on the dragonet. The linear equations are given in the text.

$\chi^2 = 5.18$, d.f. = 6, $P > 0.05$). The mean intensity and prevalence of *L. lusci* on dragonets of different size classes are presented in Table II. Prevalence was highest for dragonets between 100 and 150 mm (c. 38%) and was lowest in, respectively, the smaller (<100 mm) and the larger size classes (>150 mm). There were no significant differences in the abundance of *L. lusci* among size classes of *C. lyra* (Kruskal–Wallis; $P > 0.05$). In three of four size classes the parasite populations were significantly overdispersed (Table II).

Lernaeocera lusci collected from dragonets of variable length were measured (Fig. 2): there was a significant positive relationship between total length of the fish (TL) and axial length of the parasite (AL) ($AL = 8.065 + 0.042 TL$, $r^2 = 0.174$, $F = 10.75$, $P < 0.01$).

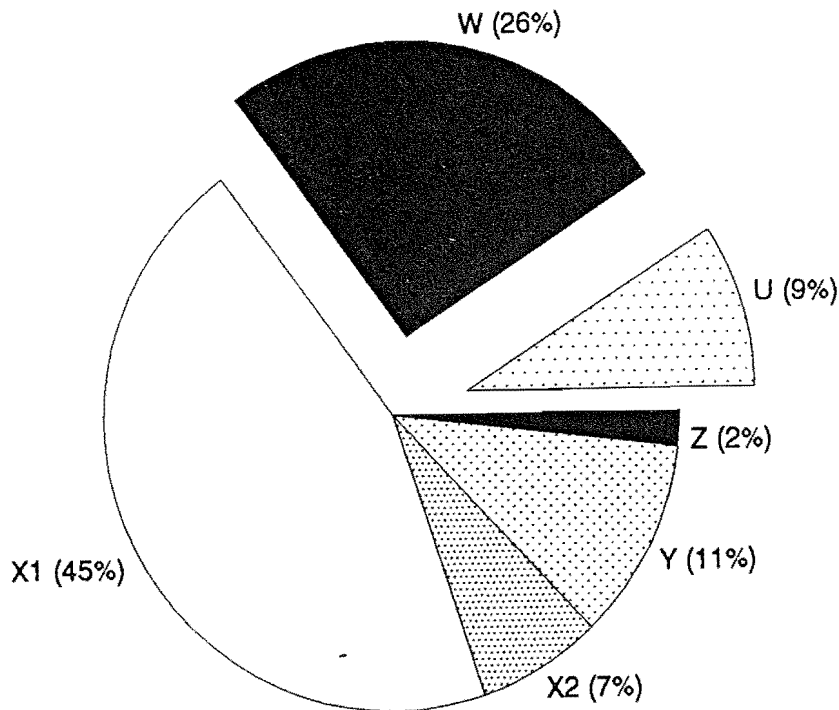


FIG. 3. Population structure of *Lernaecera lusci* on *Callionymus lyra* ($n=45$) at the Belgian coast (June 1991). For description of the substages see Table I. The slices of the immature stages have been set apart.

The population structure of *L. lusci* on *C. lyra* is presented in Fig. 3. Juvenile stages (P1 and P2) were not found, indicating either low transmission levels prior to fish capture or the short duration of this stage. The mean number of eggs of the X1/X2 substages collected from *C. lyra* was 517 (minimum 286, maximum 1400). There is a significant linear relationship between the axial length of the parasite (AL) and the number of eggs ($\ln(\text{eggs}) = 5.614 + 0.06 \text{ AL}$; $F = 4.729$, $P < 0.05$).

Of the three parasite specimens which were collected from the reticulated dragonet two belonged to the W substage and one belonged to the X2 substage.

IV. DISCUSSION

Euzet & Combes (1980) define host specificity as euryxenic when parasites are found in different host species which are not related phylogenetically. Rohde (1981) noted that parasites which exhibit euryxenic host specificity usually infect one species more heavily than others. Thus, adult female *L. lusci* show a clear preference for *Trisopterus luscus* (Slinn, 1970; Kabata, 1979), and other hosts are only occasionally parasitized. So far, there were a high number of anecdotal records of *L. lusci* on uncommon hosts (for a review, see Kabata, 1960, 1979), but, apart from Boxshall (1974), quantitative observations are largely missing. Yet, the present study illustrates that the ecological significance of occurrences on uncommon hosts should not be underestimated. Kabata (1960) noted that such occurrences may be very important in enabling certain species to survive or extend their distribution.

A range of hypotheses can be put forward to explain overdispersion in marine fish parasites. In the present study, the aggregated pattern of *L. lusci* on *C. lyra*

may be due partly to the differences in parasite abundance among size (and hence age) classes of this fish species. Though no significant differences were found smaller fish harboured fewer parasites than larger fish (Table II). However, in comparison with fish between 100 mm and 150 mm in length, a lower prevalence was found for fish larger than 150 mm. Testing of explanatory hypotheses for these observations is complicated by the paucity of information on migratory habits of the dragonet.

The population structure of *L. lusci* on *C. lyra* is characterized by the high number of parasites with egg strings (X). Some of the parasites may have overwintered with the fish. Indeed it was found that *C. lyra* collected in March 1991 harboured ovigerous females (P. A. Van Damme, unpubl.). A minority of the parasites collected during the present study (34%) nevertheless were in immature substages U and W, which suggests that transmission also occurred shortly before sampling.

Dragonets and reticulated dragonets are found in water less than 50 m deep (Van der Veer *et al.*, 1990). Boer (1971) reported that the reticulated dragonet is more common outside the coastal area while the dragonet is more common within. Therefore, *C. reticulatus* probably plays a less important role in the life cycle of *L. lusci*, which is typically a coastal parasite species (Kabata, 1979; Tirard & Raibaut, 1989). The observation (O. Hamerlynck) that reticulated dragonets are less common on soft sandy bottoms, the preferred habitats of dragonets and soles, might also reduce their significance as final host in the life cycle of *L. lusci*.

Parasites belonging to the genus *Lernaeocera* show a variable degree of pathogenicity towards their final hosts, some of which (such as *Trisopterus luscus*, *Merlangius merlangus* and *Gadus morhua*) are of economic importance (Kabata, 1981). The assumption that non-commercial fish species, such as the dragonet, play an important role in the life cycle of these pathogenic parasite species may lead to a re-appraisal of their role in the North Sea ecosystem.

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