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On some features of the infestation of the mouth-breeding fish *Tilapia melanotheron* Rüppel, 1852 by the parasitic copepod *Paeonodes lagunaris* van Banning, 1974

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Abstract

The paper reports on a habitat study of the Sakumo-Lagoon, Ghana, West-Africa, in which a new parasitic copepod species, *Paeonodes lagunaris* van Banning, 1974, was found in the buccal cavity of the host *Tilapia melanotheron* Rüppel, 1852. Data are given of the infestation rate and intensity of *P. lagunaris*, together with their relationship with the salinity of the area and the age of the host.

Introduction

There are very few animal species adapted to specifically brackish water; most are either of marine or freshwater origin (Remane & Schlieper, 1971).

It is therefore of interest to give data on species new to science occurring in brackish water, or in water of varying salinity. In this vision, it is of importance to pay attention to the new parasitic copepod species, *Paeonodes lagunaris* van Banning, 1974, found on the host *Tilapia melanotheron* Rüppel, 1852, a fish known for its high tolerance of rapid variations in salinity (Irvine & Brown, 1947). Changes in the infestation rate over a period of varying salinity should — given a relative constancy of the other main ecological factors — help to determine the origin of *P. lagunaris.*

As stated by Hill & Webb (1957) many tropical lagoons offer very favourable "experimental" conditions. This paper deals separately with:

1. The main ecological features of the lagoon in which host and parasite occurred.
2. The host, *Tilapia melanotheron,* with a brief description of its biology.
3. The infestation rate and intensity over a period of 5 months after the main rainy season.

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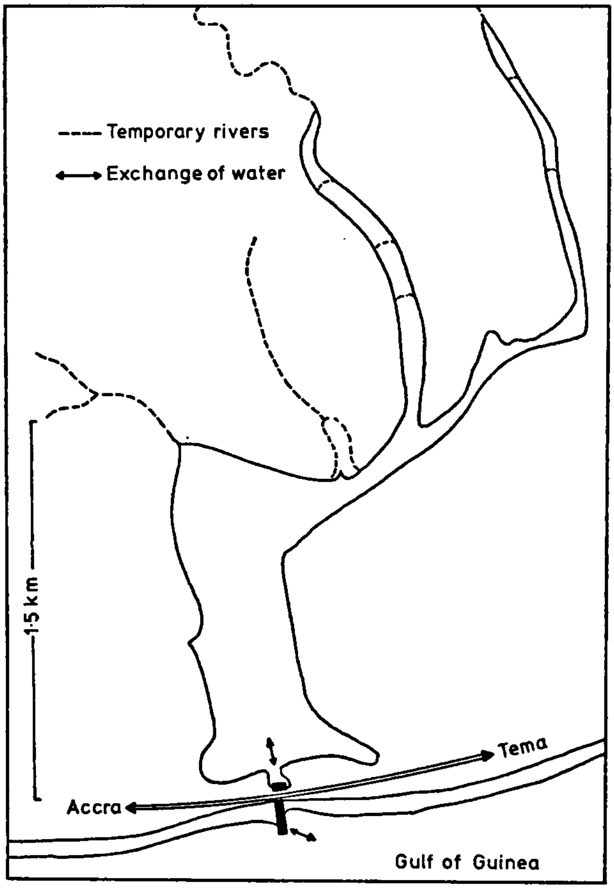

Fig. 1. Sakumo-Lagoon. General View.

The lagoon

The Sakumo-Lagoon is situated on the West-African Coast, 20 km east of Accra, close to the FAO/UNDP Fishery Research Unit at Tema. (There is a larger lagoon of the same name 12 km west of Accra.)

It has, except during the main rainy season, an average surface area of 1 km², with a mean depth of 50 cm. It was a very typical "closed-type" lagoon (Boughey, 1957) until pipes were laid under the sand-bar to enable the construction of a road along the coast. With these pipes permanently communicating with the sea, the lagoon now represents, to a certain extent, a transitory stage between a closed and an open lagoon (fig. 1).

The lagoon is filled during the main rainy season with fresh water brought in by 2—5 temporary rivers. This fresh water supply stops by the end of July, but the lagoon continues to discharge its fresh water into the sea down to the level of a sill just below the pipes. The following spring tides bring

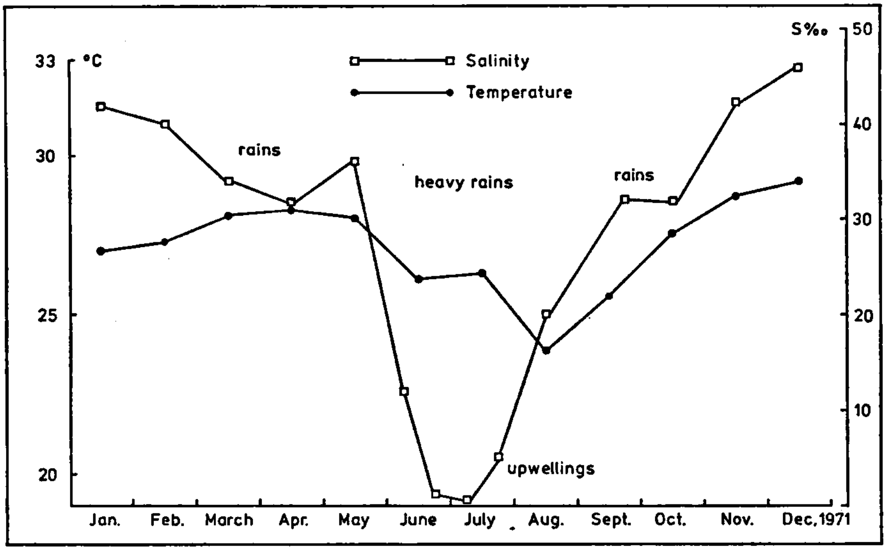

FIG. 2. Annual cycle of salinity and temperature. Data: F.R.U. Tema, Pauly.

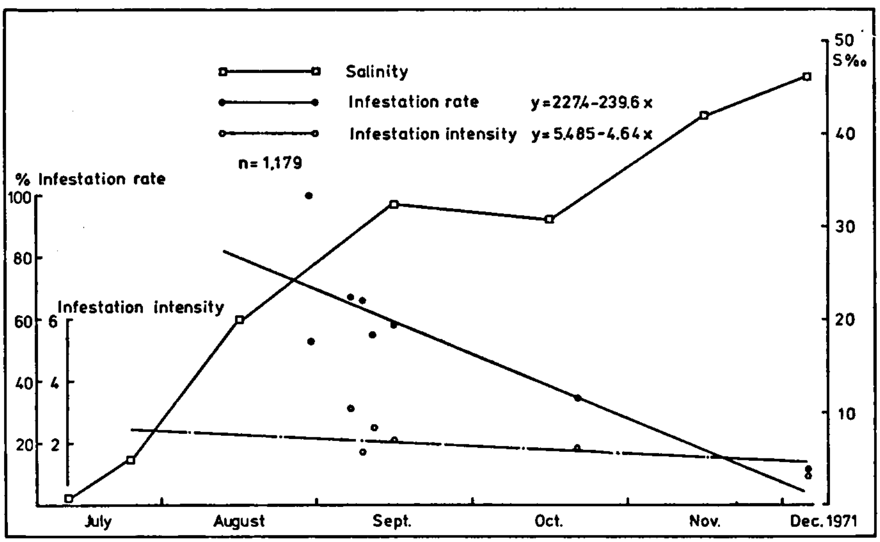

FIG. 3. The influence of salinity on infestation rate and infestation intensity.

sea-water into the lagoon, salinity increases very rapidly, first near the pipes, then, evaporation being extremely strong, in the more shallow areas which communicate with the freshwater system. The temporary rivers dry out, thus closing the lagoon on its "fresh-water side".

Although the salinity is reduced by the occasional rains of the second rainy period it continues to increase to a maximum of 50—60‰ in April-March, before the next rainy season starts. The temperature of the lagoon water is affected by the air temperature, by that of the inflowing freshwater and rains, and by the temperature of the inflowing tidal waters. The lowest temperature recorded was of an inflowing tide during the upwelling season (18°C), the highest that of a shallow area in December in the early afternoon (34°C) (fig. 2).

The host

The cichlid fish *Tilapia melanotheron* Rüppel, 1852 *) is a very typical inhabitant of West African coastal lagoons. Its high tolerance to rapid changes of salinity and its detrivorous feeding habits make it the most productive fish in the Sakumo-Lagoon. This, together with its good taste, make it the subject of an intensive fishery. *T. melanotheron*, is one of the few ♂ mouthbreeding species of the genus *Tilapia* (Lowe-McConnel, 1959).

Reproduction takes place year-round, with a peak in March-April and another in September (Aronson, 1951). This would make most larvae and juveniles go through at least a few weeks in fresh water. An extended discussion of the biology of *T. melanotheron* has been published elsewhere (Pauly, 1973).

Infestation rate and infestation intensity

Material and methods

The fishes examined (1,289 in total) were all caught with seinenets, killed and immediately preserved in 4% formaldehyde. Each fish was measured to the nearest mm (total length), sexed, and its weight, intact and eviscerated, determined; the number of parasites in the buccal cavity was recorded. The zero-hypothesis of the t-test (after Student) has been tested at the 5% level.

Results

a. The sex-ratio was approximately 50 : 50.
b. There was no noticeable difference in the length size attained by the two sexes.

*) Systematic position and name of the species after Thys van den Audenaerde (1968). The re-elevation of the now subgenus *Sarotherodon* to genus rank and the renaming of the species to *Sarotherodon melanotheron* (Rüppel) has been proposed by Trewavas (1973).

TABLE I. The influence of salinity on infestation rate and infestation intensity. The samples taken on October the 11th and December the 5th were reduced to their 9 cm, 10 cm and their 8 cm, 9 cm, 10 cm total length classes respectively, so their mean length would be similar of that of the other samples (cf. fig. 4).

date	30. VIII	7. IX	9. IX	11. IX	15.-16. IX	20. X	5.XII	1971
number of fish	3	117	89	69	797	202	12	
mean total length in the sample (cm)	10.2	10.1	10.0	10.2	10.3	10.2	10.1	
Infestation rate in %	100	67	66	55	58	35	17	
mean infestation intensity	5.3	3.1	1.7	2.5	2.1	1.9	1.0	
mean salinity in ‰	20	32	32	31	31	31	46	

c. The infestation rate (number of infested fish/total number of fish) and the infestation intensity (number of parasites/number of infested fish) decreased rapidly with increasing salinity (tab. I; fig. 3), for both best fit straight lines, the correlations are significant at the 0.1% level, the slopes being significantly $\neq 0$ at the 0.1% level.

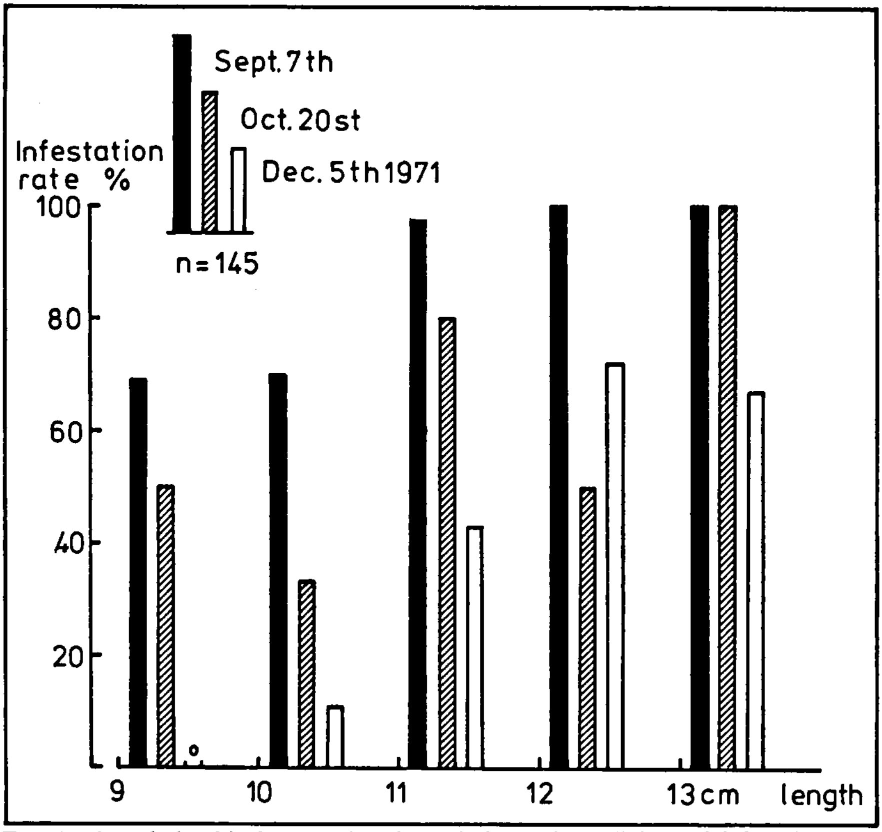

FIG. 4. The relationship between length (age), increasing salinity and infestation rate.

d. Larger (older) fish had a higher infestation rate than smaller (younger) fish, with a tendency for the difference to increase with time after the main rainy period (fig. 4).
e. The infestation rate of a sample consisting of 797 fishes made in the night from October 15th to 16th 1971 was:
♂♂ = 59.8%
♀♀ = 55.0%
f. In this sample the infestation intensity of the ♂♂ is significantly higher than that of the ♀♀.
♂♂ = 2.30; ♀♀ = 1.97 (fig. 5).

Discussion

The most obvious result is that *P. lagunaris* is euryhaline. It infects mostly young fishes during the main rainy season, but loses much of its ability to infect *T. melanotheron* with increasing salinity, as is shown by the infestation of the fish at a much lower rate when euhaline condition occur. Since pockets of freshwater remain a few months in the dead-ends of the dried-up rivers where fishes could be infected, it cannot be excluded that *P. lagunaris* looses

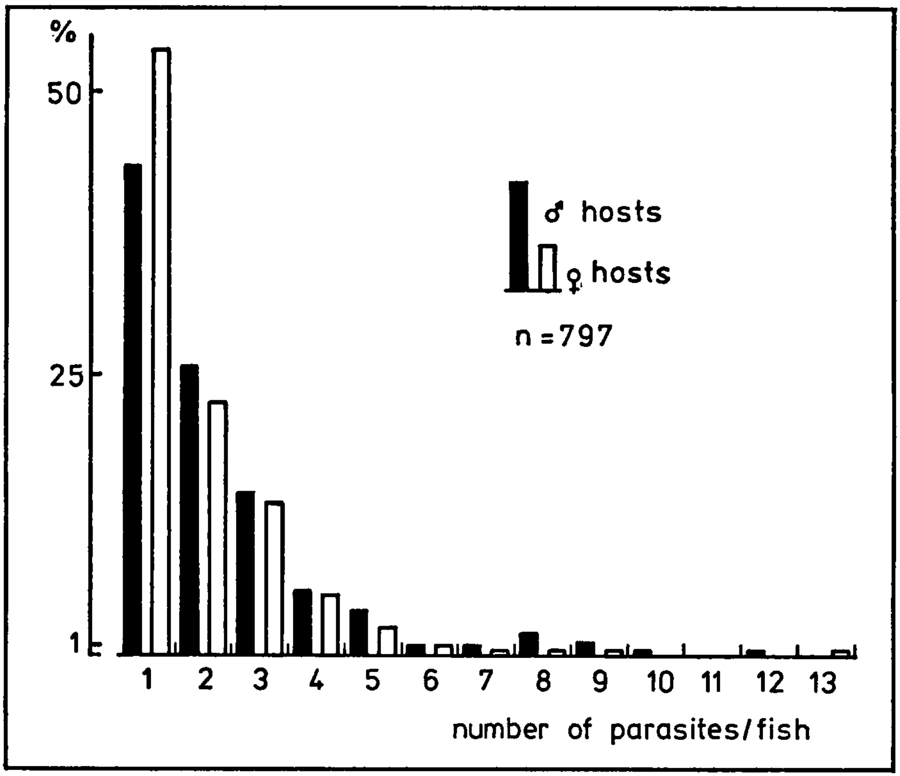

Fig. 5. Composition of the infestation in the sample of the 15th to 16th of October.

even all of its ability to infect *T. melanotheron*, or that the free-swimming larvae die as soon as meso- or even oligohaline salinity occurs.

The lack of exact data on the growth and the recruitment of *T. melanotheron* prevents a more detailed analysis of the relationships between infestation rate, infestation intensity and salinity (figs. 3 & 4) from which the average life-span of *P. lagunaris* under varying salinity could possible be derived.

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