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UPDATE ON THE STUDY OF PARASITES AS SKIPJACK POPULATION MARKERS

770/82

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Dear Bob:

This is an interim report on the parasitological work completed since my account prepared last August.

Dissections were carried out until the second week of March this year, by which time we had examined 300 more fish. These included samples from New South Wales (103 fish), Papua-New Guinea (60), California (30), Ecuador (20), and New Zealand (80). The revised multivariate analysis comparing differences between areas is not yet complete. I am editing the data file so that comparisons will be based on one length group, namely 44 to 53.9 cm.

Before doing the area analysis I want to complete the schooling analysis. For the latter, after trying a variety of methods, I have settled on a comparison of variance in parasite number with, and between, schools. This was my original intention (mentioned to you in my letter of 19 January, 1981) but I had rejected the approach because my trial run failed. I had not transformed the data!

At the moment I seem to have two conclusions that may be useful to you.

1) <u>Virtually all the 44 to 54 cm fish caught off New Zealand have recently arrived from the tropics and have not been recruited as post larvae in New Zealand waters.</u>

This conclusion was given as an assumption in my earlier report (August 1981). You pointed out the assumption was not necessarily valid. However, I have since assessed it from a parasitological point of view and find the evidence in its favour is overwhelming. I will outline the points.

George Habib and Sandy have shown that the diet of New Zealand fish is different from fish in the tropics, being almost totally euphausids in New Zealand, and largely fish, squid and stomatopods in the tropics. One would, therefore, expect the parasite fauna derived from food organisms to be quite different in the two areas. Though the life cycles of the skipjack parasites are unknown, we can infer which parasites are likely to be ingested from work on related species. From this, it seems that most of the skipjack parasites are probably picked up via the food. Particularly important in this group are the didymozoids. Eight species of didymozoids were frequently encountered in fish from tropical waters (Table 1). The same eight species were just as common in fish from New Zealand. The similarity is remarkable considering the diets of the fish are so different. It is unlikely that larval didymozoids are found in a wide range of intermediate hosts in both tropical and temperate waters because as a family didymozoids are more or less restricted to the tropics. For example, Yamaguti (1970) reported 84 different species of didymozoids in the fish around Hawaii, yet no didymozoids were reported from fish along the Pacific coast of the northern United States (Pratt and McCauley, 1961) or along either coast of Canada (Margolis and Arthur, 1979). Only two or three species are found in the seas around Great Britain. None have been reported in fish from New Zealand (Hewitt and Hine, 1972). It is thus highly unlikely that all eight common tropical species of didymozoids could be picked up by skipjack in New Zealand waters.

It is also unlikely that the fish become infected when they are juveniles and then keep them for life. Adult didymozoids are thought to have a relatively short life span.

So we have to conclude that the 44 to 54 cm fish caught in New Zealand, until relatively recently had a diet very similar to their peers in the tropics, and this is not a diet that can be found in New Zealand waters.

2) New Zealand fish over 58 cm have not recently arrived from the tropics. They appear to have been in temperate waters since they first left the tropics at 44 to 54 cm.

In skipjack, the larval tapeworm *Tentacularia coryphaenae* is relatively evenly distributed over the central and western Pacific (Fig.1). (The lack of variability in the numbers of parasites is a trifle misleading as some small samples were heavily infected, such as those from New Caledonia and Ponape.)

In the tropics, the number of larvae increases with the size of the fish (Fig.2). The hump in the graph at around 50 cm is due to a predominance of Marquesas fish in the samples, as these fish tended to be more heavily infected.

The parasites are long-lived, almost certainly living as long as the fish. No dead ones or scar tissue were ever found. Thus, in the tropics fish evidently pick them up throughout their life. In New Zealand, however, the number does not increase. The fish arrive with a full complement of larvae and no more are added. The slight reduction in the average number suggested by the graph may be an artifact produced by the worms becoming more difficult to spot as the fish increases in size and the peritoneum and adjacent muscle thickens.

Tapeworms pass from host to host by ingestion. There is no known exception to this rule. Skipjack then almost certainly become infected by eating infected food. As the large New Zealand fish have no more parasites than the 44 to 54 cm fish that recently arrived from the tropics, the large fish have evidently been without a tropical diet since they were 44 to 54 cm. Of course they may not necessarily have been around New Zealand all the time.

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That is as far as I have got at the moment. Let me know if you think I have made any other assumptions that are invalid.

I will not be able to be at the skipjack meeting in August as at that time I will be attending the Fifth International Congress of Parasitology in Canada. One of the things we will be discussing is parasites as biological tags. I hope to pick up some extra ideas that I can use in preparing the final report which I will start on my return in September.

Yours sincerely

Bob.

R. J. G. Lester

Table 1

AVERAGE NUMBER OF DIDYMOZOIDS IN SKIPJACK
(ALL LENGTHS) FROM TWO ZONES

	N.Z.	Tropics
Didymoproblema fusiforme	2.6	2.4
Didymocylindrus filiformis	10	6
Didymocylindrus simplex	20	12
Lobatozoum multisacculatum	0.13	0.04
Oesophagocystis dissimilis	7	9
Kollikeria sp.	5	7
Didymocystoides intestinomuscularis	10	40
Coeliodidymocystis sp.	1.3	0.8
Lagenocystis katsuwoni Univittelannulocystis katsuwoni }	15	45
(Number of fish	150	434)

Fig 1

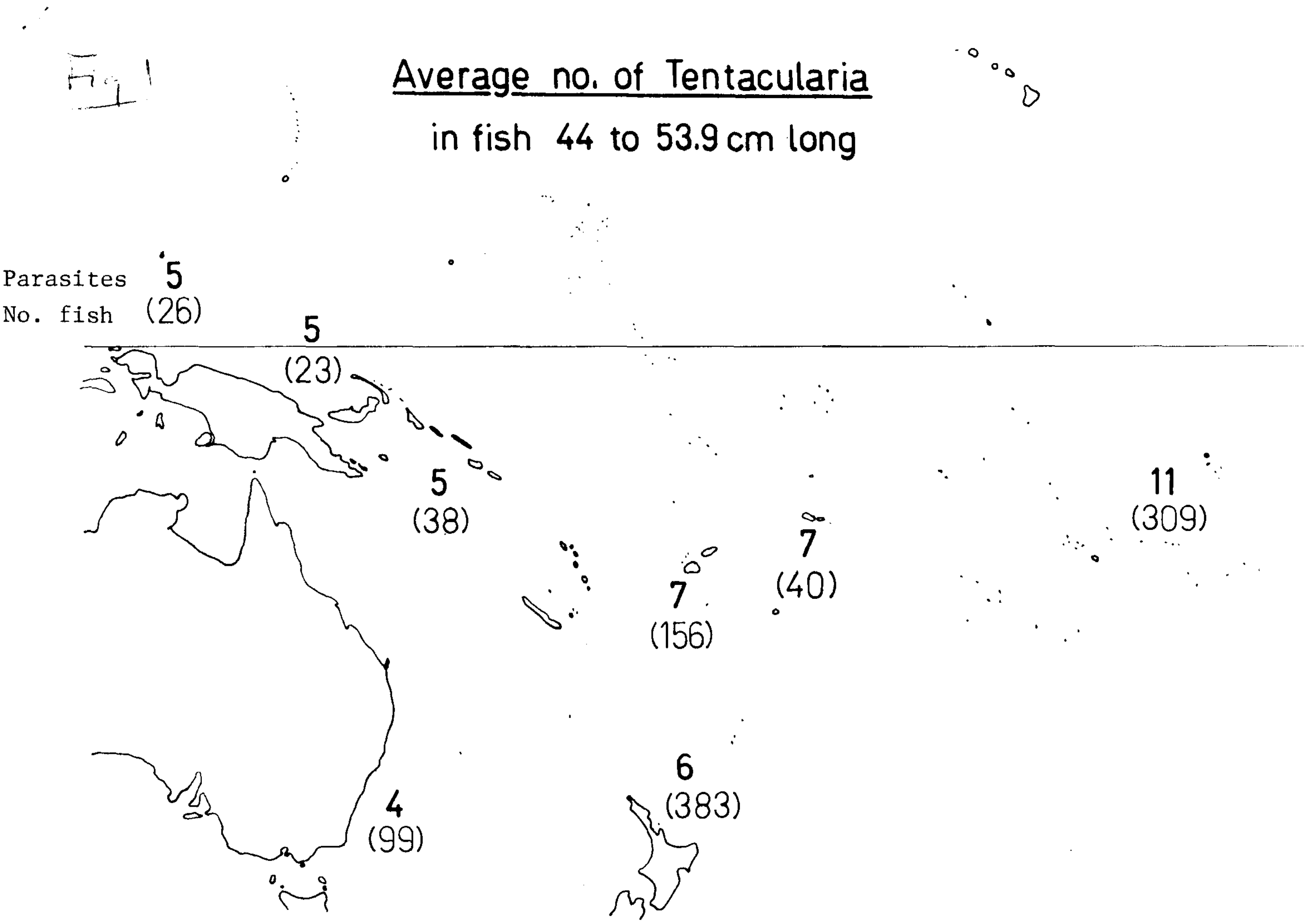
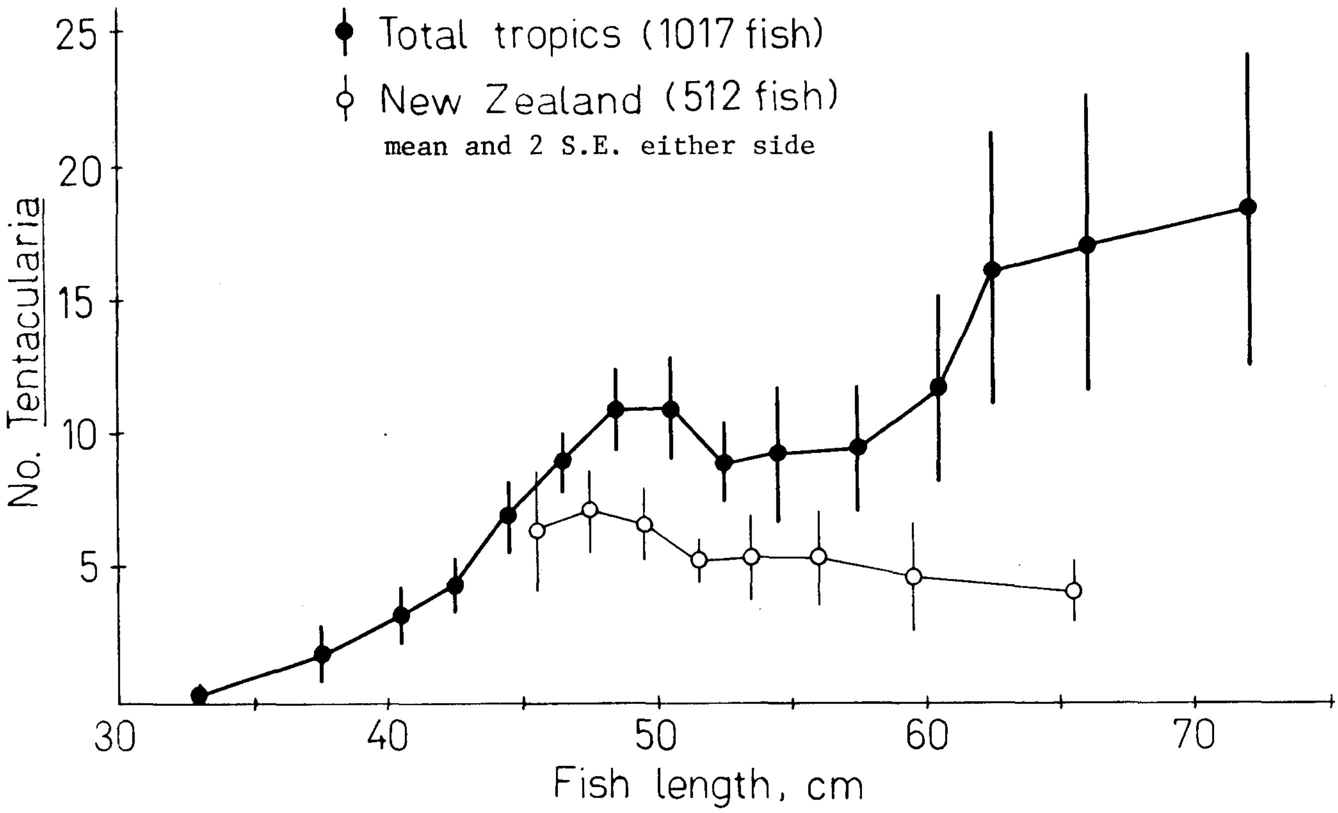

Average no. of Tentacularia
in fish 44 to 53.9 cm long
Parasites 5
No. fish (26)
5
(23)
5
(38)
11
(309)
7
(40)
7
(156)
6
(383)
4
(99)

Fig 2


Total tropics (1017 fish)
New Zealand (512 fish)
mean and 2 S.E. either side
No. Tentacularia
25
20
15
10
5
30
40
50
60
70
Fish length, cm