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The Parasites of Northwestern Atlantic Herring (*Clupea harengus* L.)

by

S. McGladdery
Department of Biology, University of New Brunswick
Bag Service # 45111, Fredericton, N.B., Canada E3B 6E1

INTRODUCTION:

Interest in the parasite fauna of the northwestern Atlantic herring was aroused by work carried out on the northeastern Atlantic herring by MacKenzie and Johnson*. They attempted to show that certain parasites could be used as "biological tags" to distinguish one spawning population of Scottish herring from another. As a result of these, and subsequent studies by MacKenzie, biological tags have been incorporated into the management programme of the Scottish herring fishery. Since northeastern Atlantic herring and northwestern Atlantic herring do not act as hosts for the same parasite species, it is important to have comparable data for the northwestern Atlantic herring. As this information was lacking for all but a few specific parasite species, this survey was initiated. The principal aim is to determine exactly which parasites occur in these herring and whether any could be of use as "biological tags" to distinguish one population from another.

In addition to the helminth parasites discussed at the Third Annual Meeting of N.A.F.O. in September last year, two species of coccidian Protozoa have been identified in this survey, along with at least one species of Monogenean. The collection of blood smears has been discontinued due to the difficulty of obtaining blood from the fish before the onset of haemolysis (which renders the smear useless for parasite detection).

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*K. MacKenzie, & C. Johnston (1976) Recruitment of the Minch Herring Population, as determined by the use of parasites as biological tags and a new meristic character. I.C.E.S. CM 1976/H:34 Pelagic Fish (NTHN) Committee.

MATERIALS AND METHODS:

Within the Gulf of St. Lawrence, samples are being collected from the Baie de Chaleur and around Miscou Island, to the north, and from the Northumberland Strait and around Prince Edward Island to the south. The Bay of Fundy samples are collected from areas around Grand Manan and Campobello Islands and from Passamaquoddy Bay. Southwest Nova Scotia is being sampled from Scot's Bay to Trintity Ledge and Southeast Nova Scotia from Chebucto Head to Yarmouth. Samples are also being collected from Chedabucto Bay and Bras d'Or Lakes, Cape Breton Island. In addition, a single sample was obtained by a Fisheries Research Cruise off the Magdalen Islands and another single sample was collected from Corner Brook, Newfoundland.

Wherever possible, each site is sampled for three size classes of herring and on a seasonal basis. The size groupings used are:

1. sardines - no gonadal development, up to stage I*
2. juveniles - maturity stages I and II
3. adults - maturity stages III+

Each sample consists of 20 herring which are examined fresh being collected within 12-24 hours of death. Fresh fish are necessary to provide the live parasite specimens essential for accurate taxonomic study. This being a sine qua non in determining the presence or absence of a "biological tag". In addition to the fresh fish, a further 20 are frozen wherever possible in order to supplement the sample size but are used for quantitative data only.

Each fish is thoroughly examined for both internal and external parasites.

RESULTS:

Over 1200 fish have been examined since the start of the survey and the following parasites have been identified:

Eimeria clupearum, E. sardinae (Coccidia: Protozoa), Gyrodactylus harengi (Gyrodactyloidea: Monogenea), Brachyphallus crenatus, Hemiurus

*B.B. Parrish & A. Sommerville (1965) Oceanogr. Mar. Biol. Ann. Rev. Vol. 3: 346 pp.

levinseni, Derogenes varicus, Lecithaster gibbosus, L. confusus (Hemiuridae: Digenea) and Cryptocotyle lingua metacercaria (Heterophyidae: Digenea), Scolex pleuronectis (Tetraphyllidae: Cestoda), Hysterothylacium aduncum, Phocanema decipiens and Anisakis sp. (Anisakidae: Nematoda) and Echinorhynchus gadi (Echinorhynchidae: Acanthocephala)**

Other parasites have been found but remain to be identified. These include a monostome digenean and a number of cestode plerocercoids. The causative agent of certain gill cysts has also yet to be determined.

So far, no single parasite species has been found which exclusively differentiates one population from another. Most parasites occur in all the areas sampled shilst others occur too infrequently to provide an accurate distribution pattern. Some species, however, have shown clear differences in prevalence between sampling sites and it is the distribution of these parasites which will be described here.

Larval nematodes belonging to the genus Anisakis have been recovered from the body cavity of adult herring at all locations sampled. However the prevalence of infection at each location varies considerably from 10% in southeast Nova Scotia, to 95% in northeast Nova Scotia (Fig. 1). Within the Gulf of St. Lawrence and around Cape Breton prevalences of Anisakis infection are high, with a range of 16-95% (where 16% is an exceptionally low prevalence from Canso and all others are greater than 50%). The single sample from the southwest coast of Newfoundland shows a similarly high prevalence of infection (70%). In marked contrast to this prevalences within the Bay of Fundy and around southern Nova Scotia are much lower, ranging from 10-45%.

The only deviation from this pattern is shown by the 1981 sample from the eastern Bay of Fundy which has a higher prevalence (45%) than those found throughout the rest of the Bay of Fundy. Unfortunately the Scot's Bay fishery did not appear at all this year, hence further sampling from this location will not be possible until July 1983, when these fish will, hopefully return. Only then will it be possible to investigate the prevalence of Anisakis in this area further.

Another nematode commonly found, Hysterothylacium aduncum shows the opposite pattern (Fig. 2) with the greatest prevalences occurring within

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**The host locations and descriptions of most of these parasites are given by McGladdery (1981) NAFO SCR DOC 81/IX/124.

the Bay of Fundy and around southern Nova Scotia (10-90%) and lower prevalences occurring in the Gulf of St. Lawrence and around Cape Breton (4.7-13.0%).

The other nematode identified, Phocanema decipiens, occurs much less frequently in the herring than either Anisakis or Hysterothylacium, and the only Ancanthocephalan found so far, (Echinorhynchus gadi) also only occurs sporadically.

The commonest parasite found in herring is Brachyphallus crenatus, a hemiurid digenean. This occurs in both adult and juvenile herring from all the locations sampled. However, unlike the nematodes, which show variations in prevalence between areas, B. crenatus appears to have high, relatively uniform prevalences throughout (Fig. 3). The only variation appears to be between adult and juvenile fish, where juveniles have slightly lower prevalences of infection (10%-30%) than adults (30%-100%).

Another digenean found in herring, Derogenes varicus, shows a similar cosmopolitan and uniform distribution pattern although with much lower prevalences (ranging from 10-24%) (Fig. 4). There is a marked exception to this uniformity, however, with the single sample from Newfoundland showing not only a much higher prevalence of infection (60%) but also twice the intensity of infection found elsewhere (2.7 compared to 1.0-1.7). Further sampling from this area is necessary to show if this concentration of D. varicus is presistent.

Two digenean species belonging to the genus Lecithaster have been identified as L. gibbosus and L. confusus. Since only four specimens of L. confusus have been found so far, and the two species are not easily distinguished, they have been temporarily amalgamated for the purpose of this preliminary data analysis. The overall prevalences of Lecithaster are highly variable (Fig. 5) however, the exceptionally high prevalence of 95% found in the eastern Bay of Fundy may suggest a focus of infection in that area and may also be responsible for the slightly higher prevalences found in the Bay of Fundy and around southwest Nova Scotia, compared to those from Cape Breton and the Gulf of St. Lawrence. Unfortunately the high prevalence of Lecithaster found in this area in 1981 cannot be examined further until the return of the Scot's Bay fishery.

The only larval digenean identified so far is Cryptocotyle lingua, the metacercariae of which encyst in the skin of herring forming the "Black Spot" appearance which characterizes infection by this parasite. The data from this digenean is still being analyzed.

The only Monogenean identified so far is Gryrodactylus harengi, which is found on the gills of fish from all the locations sampled. They appear to have a high prevalence of infection throughout these locations, however, the data for these is still being analyzed.

A number of cestode plerocercoid larvae have been found but only one has been identified so far, a tetraphyllidean plerocercoid known as Scolex pleuronectis. There are two forms of these larvae - a large form measuring 2-3 mm in length and found in the posterior intestine, and a small form less than one tenth of the size of the larger larvae, which is found mainly in the pyloric caecae.

At last years meeting this was the most promising parasite found with regards use as a biological tag. Subsequent samples, however, have revealed these larvae in Gulf of St. Lawrence herring as well as in Grand Manan and southern Nova Scotia herring thus negating its use as a biological tag for the Grand Manan spawning complex. It should be noted however that S. pleuronectis is a purely descriptive name of no taxonomic value and may therefore represent more than one tetraphyllidean species. It is still possible that, once these species are determined, they may show regional differences in distribution.

The two coccidian Protozoa found are Eimeria clupearum, from the liver, and E. sardinae, from the testes. Although the data for these is still being analysed they appear to have a wide range in distribution.

These protozoans, along with the body cavity nematodes and cestodes, are being included in a joint survey of specific parasites currently being conducted by the United States and Canada.

SUMMARY

Although no single parasite species has been found so far, which clearly differentiates one population of herring from another, there are

indications that prevalences of infection of some parasite species might be useful, especially if analysed along with other species (cluster analysis). As the raw data for this is still being collected, no such analysis has yet been made. The taxonomic status of certain parasites, such as Scolex pleuronectis, the tetraphyllidean cestode plerocercoid is not established. In addition, the information presented in part here, has yet to be investigated at the size class and seasonal level. Thus, parasites which appear uniform in distribution at present may yet reveal discrete distribution patterns when the data is analysed in greater detail.

The inherrent dynamic and unpredictable nature of herring populations also negates any sweeping conclusions at this stage. For example, the Scots' Bay spawning stock, which normally appears in July, did not appear at all this year so it was not possible to collect further samples from this location to investigate the unusually high prevalence of L. gibbosus and Anisakis sp. found in 1981.

The differences in prevalences shown by the nematodes Anisakis sp. and H. aduncum between the Bay of Fundy and the Gulf of St. Lawrence, already recognized for Anisakis*, provide the most distinct variations seen so far in parasite distribution in herring. It is hoped that differential prevalence data, along with cluster analysis, will provide information that can be applied in the future management of this valuable fish species.

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*L.S. Parsons + V.M. Hodder (1971) Variation in the incidence of larval nematodes in herring from Canadian Atlantic Waters, In: Comm. N.W. Atl. Fish. Res. Bull. 8: 5.14.

Figure 1:

Anisakis sp.

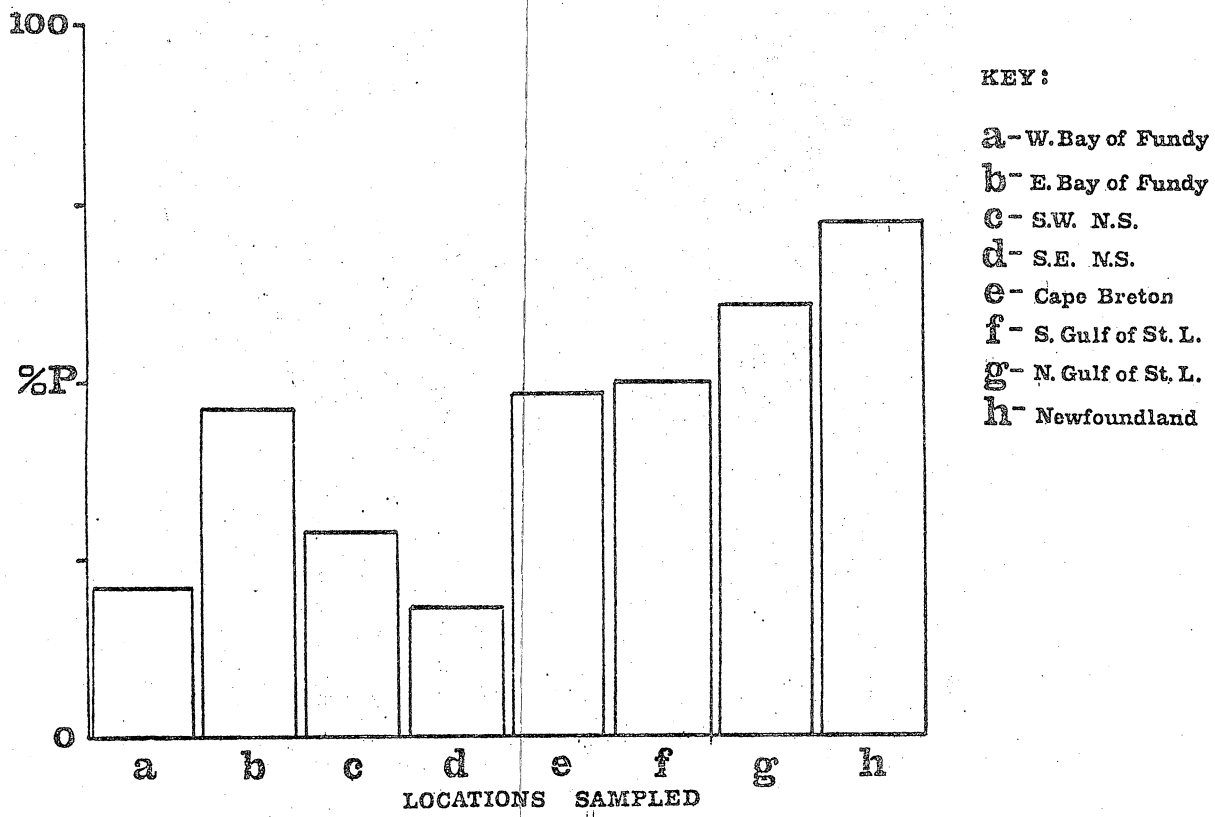
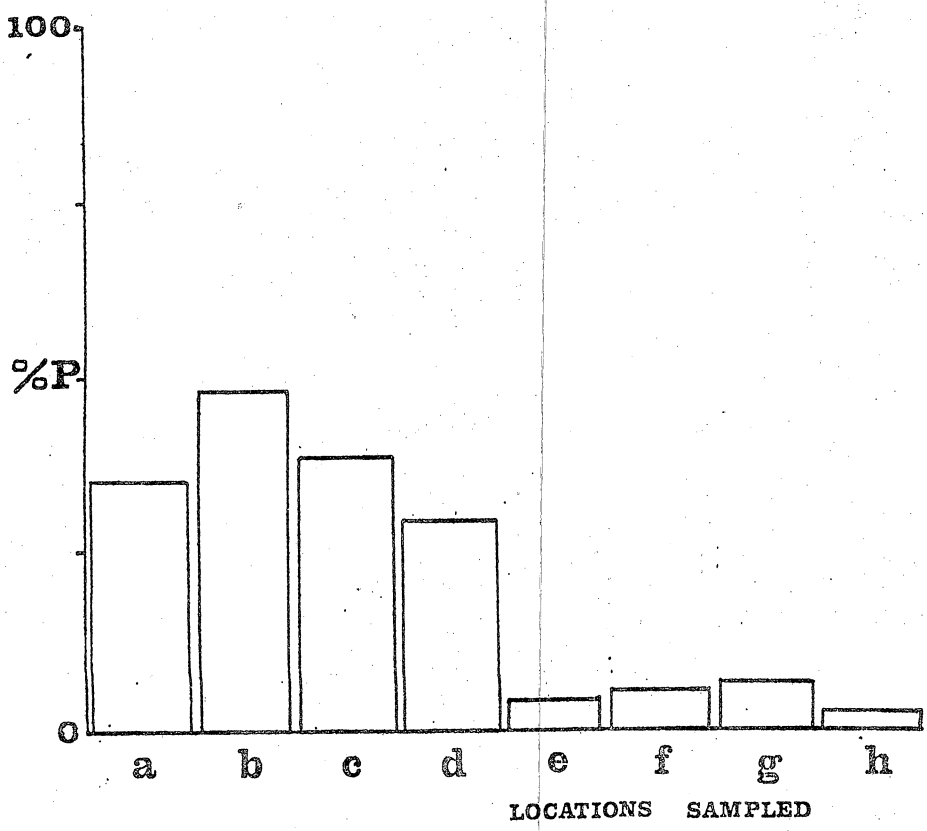


Figure 2:

Hysterothylacium sp.

from adult fish



from juveniles

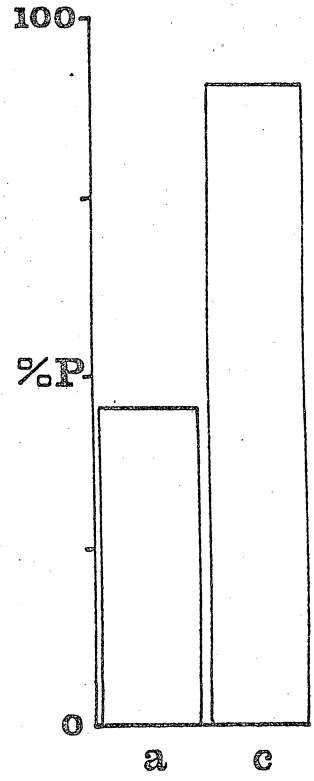


Figure 3:

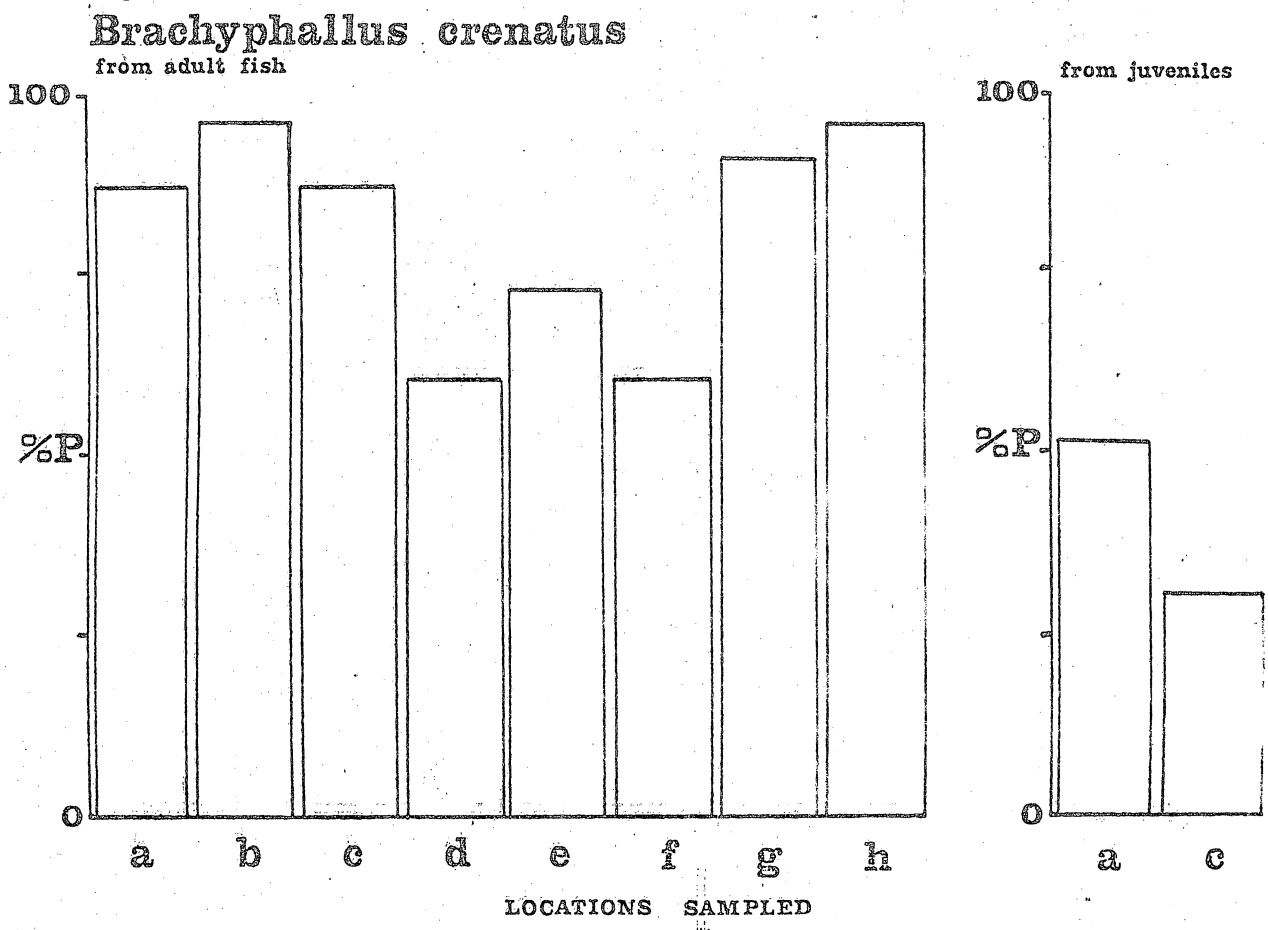


Figure 4:

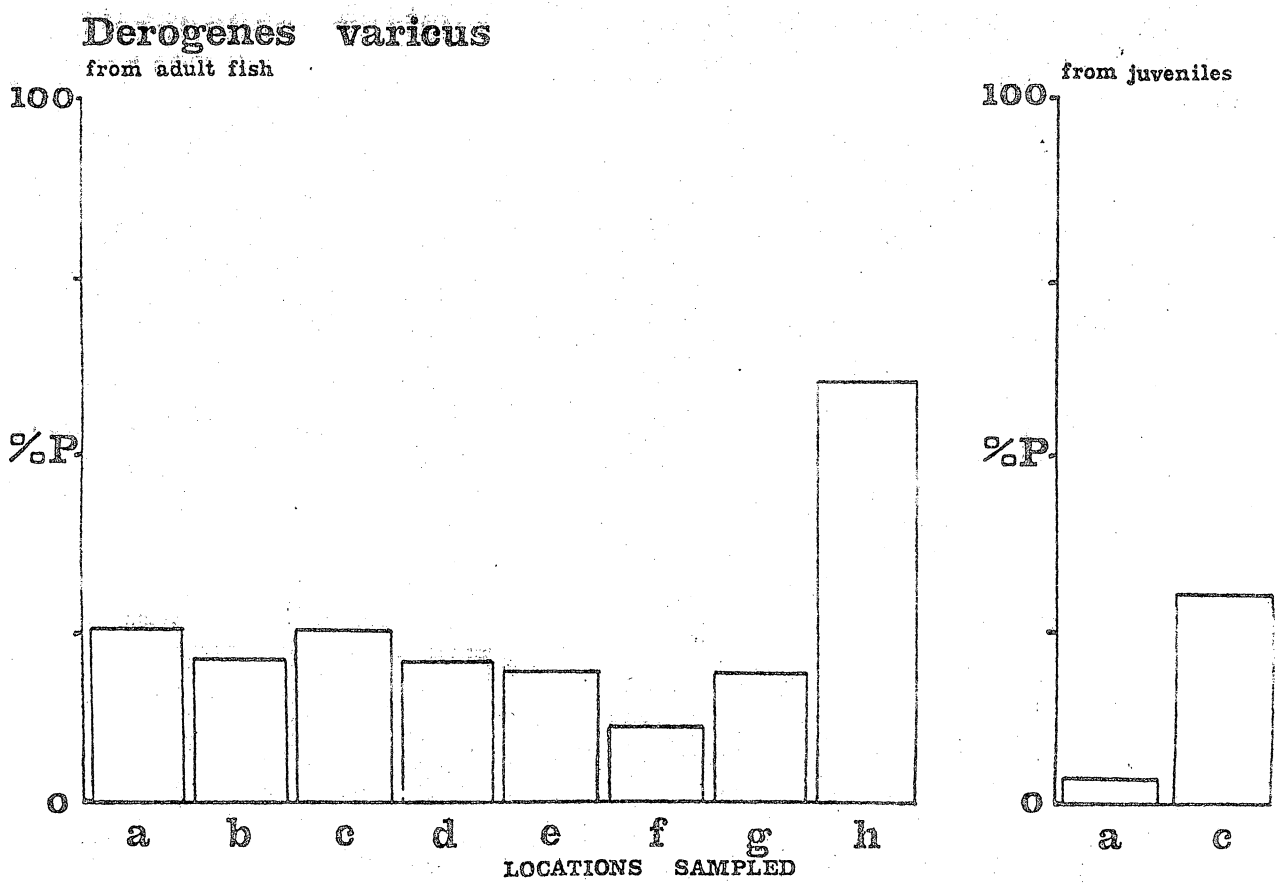
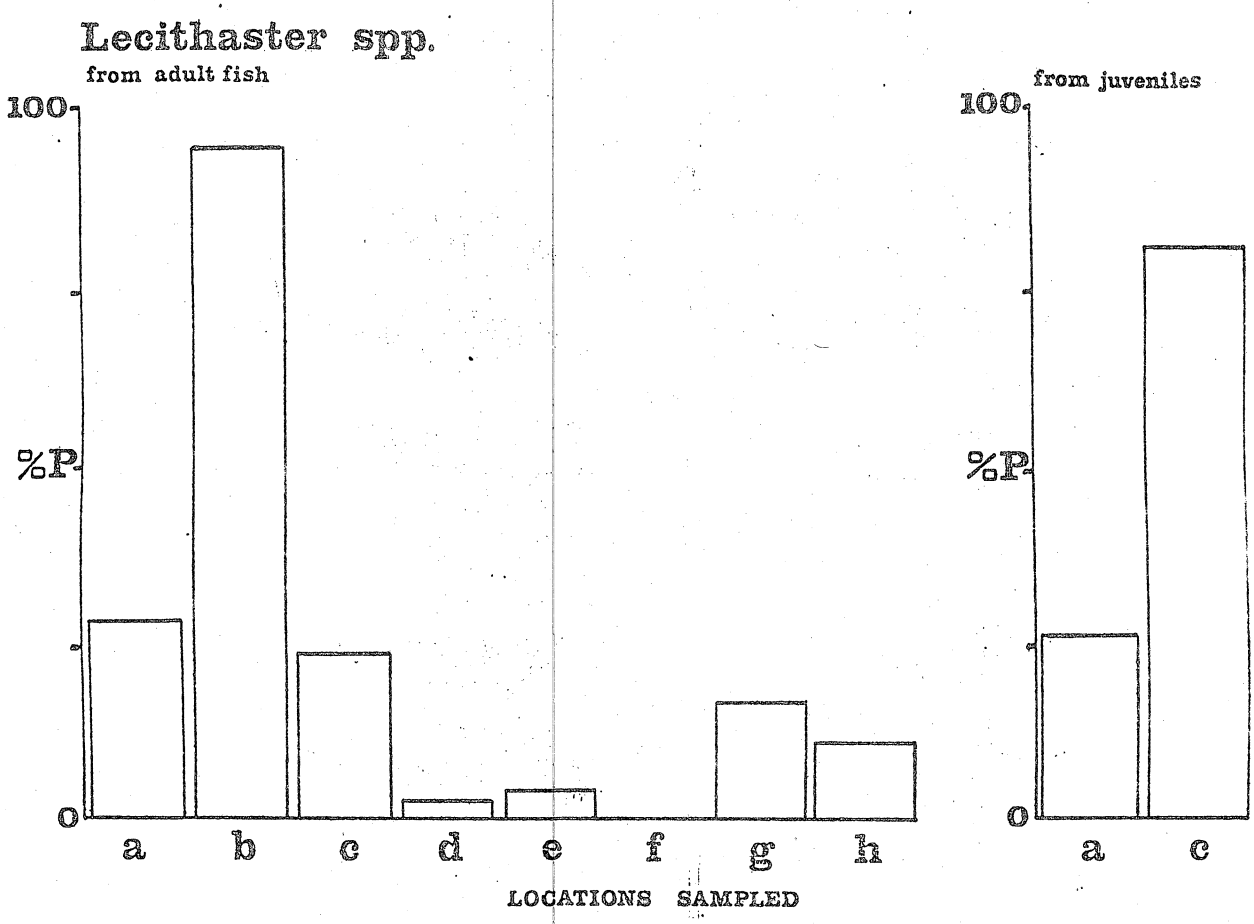


Figure 5:


Lecithaster spp.
from adult fish
from juveniles
100
%P
0
a
b
c
d
e
f
g
h
LOCATIONS SAMPLED