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Investigations on the Occurrence of Nematodes in Herring off the Western British and Irish Coasts

by

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Introduction

Since the communications by Thiel, Kuipers and Roskam (1960) and Roskam (1960) reporting that nematodes of the herring could be harmful to man more attention to the occurrence of parasitic worms in herring had been paid.

Roskam (1966), Khalil (1969) and others carried out investigations on this problem in the North Sea and in the western British and Irish waters and obtained different infestation frequencies of larvae of Anisakis spec. and Contracaecum spec. in various years and fishing grounds. Hitherto more intensive investigations in the Sea of Hebrides don't exist.

Materials and Methods

On cruises of FRV "Ernst Haeckel" in summer and autumn 1973 during biological routine investigations the infestation of the herring by nematod larvae was examined. Table 1 shows the number of the examined herrings in different fishing grounds.

Table 1: Number of samples and herrings examined

Area	samples	herrings
West of Orkneys	4	343
North of Hebrides	3	266
St. Kilda	7	574
SW of Barra	13	1216
Klondyke-Stantonbank	7	556
Donegal	2	194
Bristol Channel	1	48
Total	37	3197

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Herrings were examined immediately after the catch. No microscopic examinations were done and no attempt was made to identify Anisakis and Contracaecum. The samples comprised in general 100, in some cases 50 fishes. We examined the body cavity, and no controls were made on infestation of the muscles. The obtained results probably underestimate the degree of infestation, because larvae could be overlooked by the used method. In order to accelerate the routine investigations a five-grade scale for infestation intensity was introduced:

Index,	Number of larvae
1	0
2	1- 3
3	4-10
4	11-30
5	>30

Results

In total 52,7 % of all examined herrings were infested. Among autumn spawning herring 53.4 % and among spring spawners amounting to less than 5 % of the herring stock 43,5 % were infested.

As former authors have shown infestation rate increases from a size of herring of about 23 cm. According to the size variations one can expect different infestation frequencies in various regions.

In table 2 can be seen that infestation also varies considerably in different length groups in separate regions.

In the most frequent length group of 26.0 - 28.9 cm can be seen a trend of decrease of the infection rate from north to south.

Thus 80 % of autumn spawners off the north coast of the Hebrides, 48 % in the region of St. Kilda, 55 % off Barra, 42 % on Klondyke, 27 % off northern Ireland, 22 % in the Donegal-Bight and 0 % off the Bristol Channel are infested by nematod larvae.

In the length group >28.9 cm similar relations can be noticed. An exeption to this rule is only the region of St. Kilda having lower infestation rates according to this assumption.

By comparison of the fishing ground St. Kilda and Barra, where investigations were done for three months, the same trend of the infestation rate can be observed during the investigation period. In August in the two regions the highest infestation rate of 55 % was found for St. Kilda and 61 % for Barra, whereas in July and October the corresponding lower infestation rates of 44 % on St. Kilda and 54 % on Barra were observed.

Off the west coast of the Orkney's was found a high infestation (78 %) as well. However a sample taken in July in this region shows a lower infestation of 54 %. Among spring spawners a decrease of the infestation from north to south outlines the same way.

The incidence of the infested herrings in general shows the same slope from north to south like the percentage of the infested fishes.

In figures 1 - 2a and 2 b the infection incidence per length group is shown. In most cases the infection incidence in the 27 cm group is distinctly lower than in the 26 cm group. This phenomen can be explained by a smaller infestation in the 4-years-old herrings compared to the 3-years-old ones. In most cases infestation of 4-years-old fishes is smaller than in 3-years-old ones or equal to them (table 3).

In the whole in the regions of St. Kilda and Barra in age-groups the following rate of infested fishes was found:

	3	4	5	6	≥ 6 years
%	62	48	73	67	67
n	178	1086	189	57	198

From samples of the Barra region in July and August follows a lower infestation rate in the 3-years-old fishes than in 4-years-old ones. This is caused by relatively small lengths of the 3-years-old herrings.

Discussion

The comparative low infestation rate of the 4-years-olds can be caused by different reasons such as immigration of less infested herrings of another population, a general lower infestation in 1972 as a result of less abundant occurrence of nematodes in plankton or by a food competition developed by the increase of the herring stock and for a slower growth of the 3-years-olds of the age class 1969.

According to Khalil the life span of Anisakis larvae in herring is unknown. It can be assumed that larvae remain in fish for as long as it is devoured by the final host. The increase of the infestation in older herrings is traced back to accumulation.

3-years-old fishes of the age-group 1969 had been nearly 3/4 cm smaller than the 3-years-olds of 1970. Thus it is presumable that the less intense growth can be one reason, if not the main reason, of the lower infestation of the 4-years-olds in 1973. Accordingly strong year classes such as the class 1969 could be less infected than smaller year classes. Further this could be still expressed in older herrings of former outstanding year-classes. As in the age-group $\geq$ 6 especially slower growing year classes 1963 and 1966 is present, the relatively small infestation rate of older herrings in the region west of the Hebrides could be explained.

The discussed results give reason to revise - by further investigations in connection with meristic characteristics and other methods - in what extent the different infestation rates north of Scotland, west of the Hebrides and north of Ireland represent various herring populations.

References

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Table 2 Percentage number infected in length-groups of autumn and spring spawning herrings

(in brackets = number examined)

area	month	spring spawners 23.0-33.9	autumn spawners 16.0-22.9	23.0-25.9	26.0-28.9	>28.9 cm
W-Orkneys	Aug.	57(35)	42(38)	75(12)	78(169)	100(38)
"	Juli	0(1)			59(82)	57(14)
N-Hebrides	Aug.	54(24)	36(22)	52(21)	80(167)	88(56)
St. Kilda	Juli	33(12)		50(4)	44(196)	60(133)
	Aug.	33(3)	100(1)	50(20)	55(121)	70(54)
	Okt.	20(5)		100(1)	44(32)	58(12)
W-Barra	Juli	50(2)		41(22)	54(414)	73(37)
	Aug.	25(4)		43(14)	61(147)	78(14)
	Okt.	34(29)		70(17)	54(410)	69(141)
NW Stanton	Aug.	83(5)		100(3)	67(12)	59(74)
Klondyke	Aug.	25(4)		25(12)	42(40)	44(43)
Klondyke	Juli	0(11)	1(95)	31(43)	27(99)	43(35)
N-Irland Donegal	Nov.	100(1)		60(5)	22(87)	49(102)
Bristol	Nov.	0(1)		29(7)	0(26)	40(15)

Table 3 Percentage number infected in age-groups of autumn spawning herring

(in brackets = number examined)

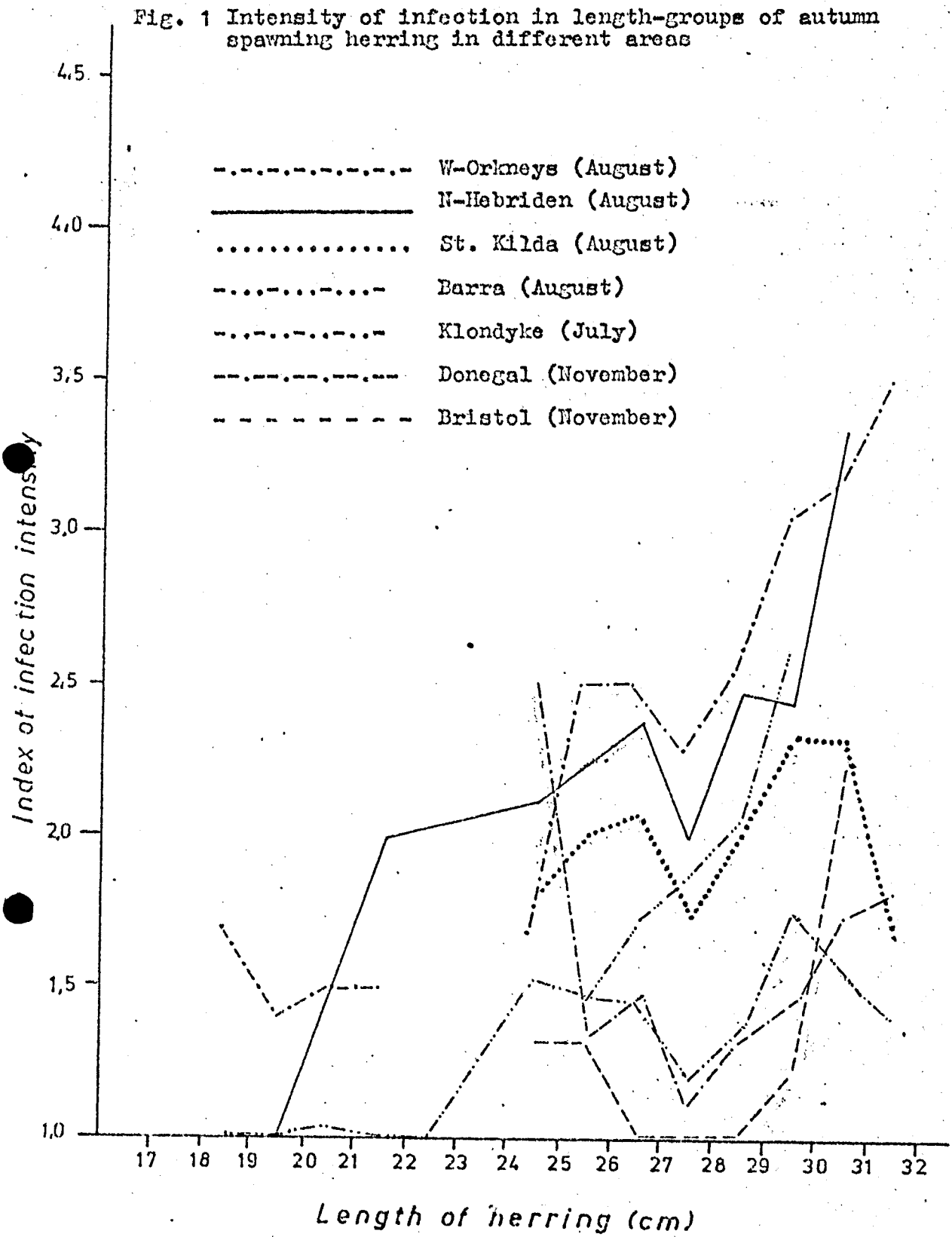
area	month	2	3	4	5	6	>6 year
W-Orkneys	VII		77(30)	42(50)	88(8)	75(4)	67(3)
	VIII	42(38)	89(66)	77(121)	100(16)	100(15)	100(4)
N-Hebrides	VIII	36(22)	78(51)	76(149)	78(14)	93(15)	100(15)
St. Kilda	VII		43(7)	43(171)	67(43)	63(30)	62(81)
	VIII	100(1)	54(28)	49(102)	81(31)	100(4)	67(3
	X		67(3)	38(29)	75(4)	75(4)	60(5)
Barra	VII		34(38)	42(299)	71(31)	100(1)	73(15)
	VIII		41(27)	62(132)	86(14)	(-)	100(2)
	X		75(75)	50(353)	73(66)	61(18)	71(56)
NW Stanton	VIII		100(4)	54(11)	75(12)	75(4)	55(58)
Klondyke	VIII		16(25)	58(26)	18(11)	0(1)	53(32)
Klondyke/ Irland	VII	1(84)	27(194)	32(57)	53(15)	23(6)	31(16)
Donegal	XI		25(65)	26(34)	38(13)	25(8)	54(74)
Bristol	XI	20(5)	42(12)	7(15)	12(8)	67(3)	60(5)

Table 4 Index of infection intensity in age-groups of autumn spawning herring

(in brackets = number examined)

area	month	2	3	4	5	6	>6	total
West of Orkneys	VII		2.17(30)	1.57(51)	2.5o(8)	2.5o(4)	2.67(3)	1.91(96)
"	VIII	1.45(38)	2.64(66)	2.30(121)	3.19(16)	3.40(15)	4.00(4)	2.41(260)
North of Hebrides	VIII	1.59(22)	2.65(51)	2.17(149)	2.50(14)	3.13(15)	3.47(15)	2.37(266)
St. Kilda	VII		1.28(7)	1.58(171)	1.77(43)	2.13(30)	1.95(81)	1.75(332)
	VIII	2.00(1)	1.89(28)	1.78(1o2)	2.45(31)	3.00(4)	2.13(30)	2.00(196)
	X		2.00(3)	1.45(29)	1.75(4)	2.25(4)	1.60(5)	1.60(45)
Barra	VII		1.50(38)	1.60(299)	2.13(31)	4.00(1)	1.87(15)	1.66(634)
	VIII		1.56(27)	1.90(132)	2.57(14)		2.00(2)	1.90(175)
	X		2.12(75)	1.63(353)	2.11(66)	1.89(18)	2.09(56)	1.80(568)
Northwest of Stanton Bank	VIII		2.75(4)	1.82(11)	2.08(12)	2.75(4)	1.93(58)	2.01(89)
Klondyke	VIII		1.24(25)	2.00(26)	1.18(11)	1.00(1)	1.91(32)	1.66(95)
Klondyke-North of Irland	VII	1.01(84)	1.38(194)	1.44(57)	1.80(15)	1.83(6)	1.38(16)	1.33(372)
Donegal	XI		1.34(65)	1.32(34)	1.54(13)	1.38(8)	1.74(74)	1.50(194)
Bristol Channel	X	1.20(5)	1.00(12)	1.07(15)	1.12(8)	2.00(3)	1.60(5)	1.19(48)

Fig. 1 Intensity of infection in length-groups of autumn spawning herring in different areas



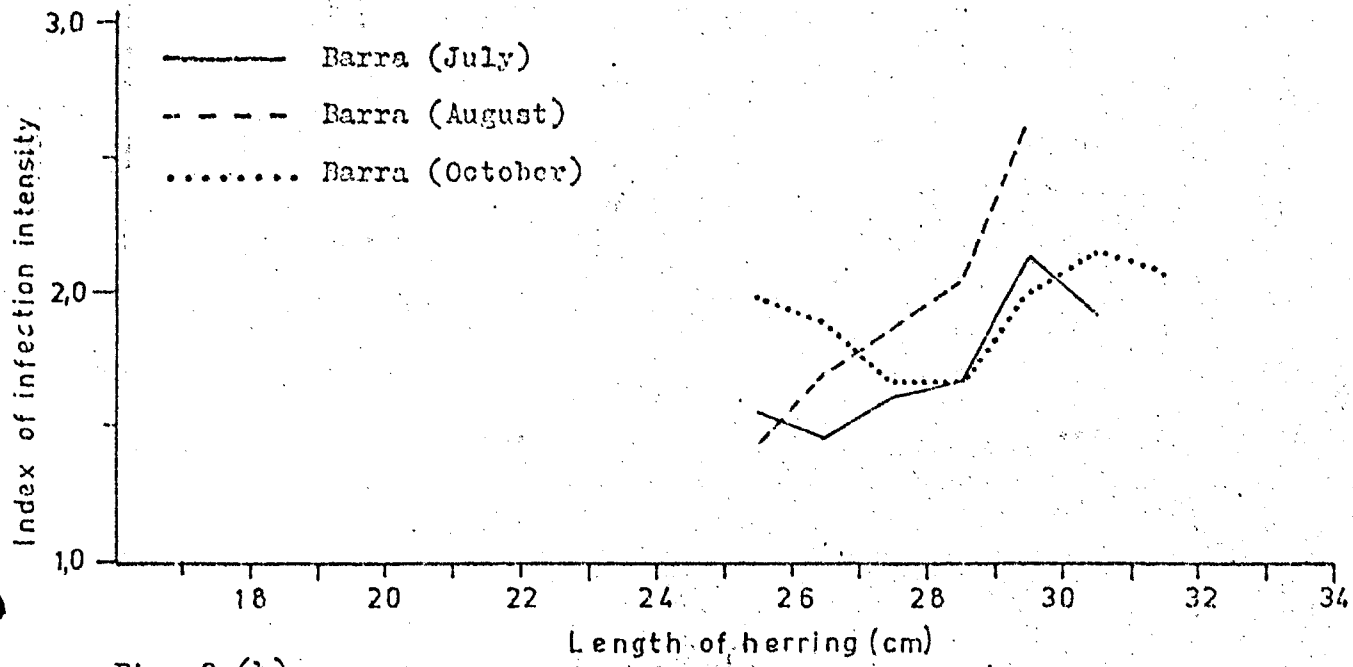


Fig. 2 (b)

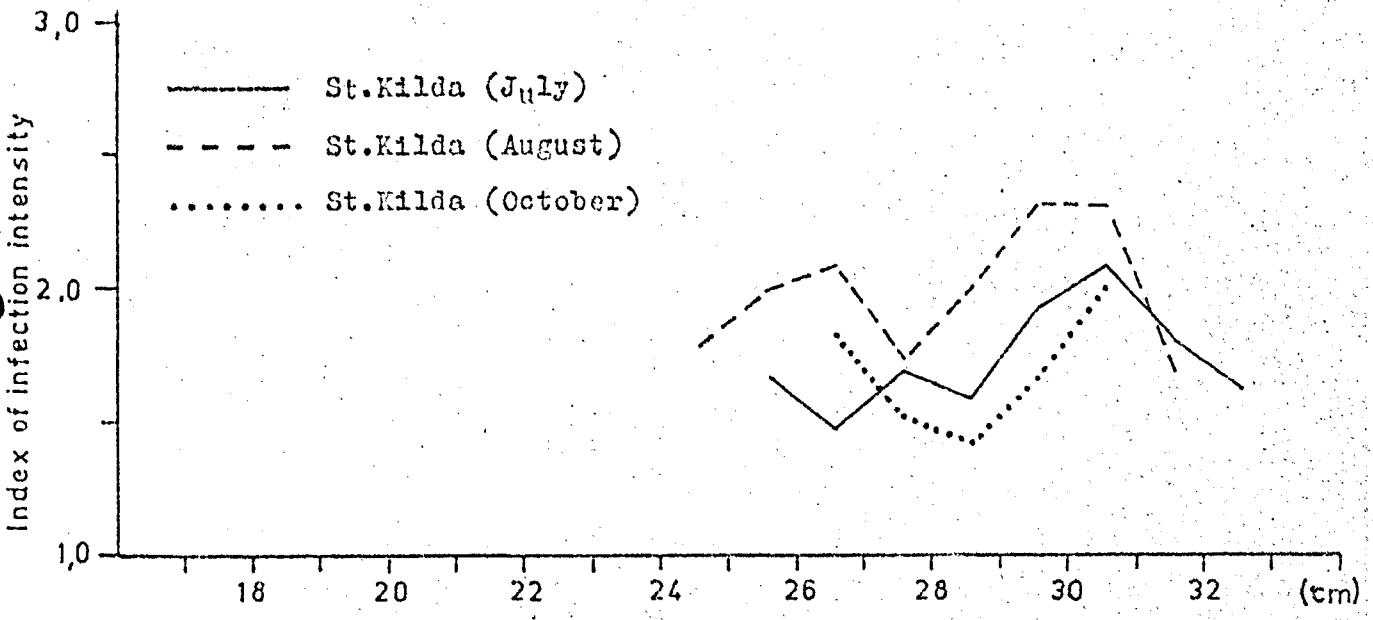


Fig. 2 (a) Intensity of infection in length-groups of autumn spawning herring in St. Kilda (a) and Barra area (b)