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Distribution and abundance of hake (Merluccius merluccius)
in the coast of Galicia. October 1972, March and November
1973, March 1974.

by

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Introduction

During October 1972, March and November 1973 and March 1974, four groundfish surveys have been carried out in the coast of Galicia (ICES Div. VIII c and IX a). The aim of these cruises has been to know the distribution and density of several species, measured in number and weight of individuals caught, per mile hauled, mainly of the youngest stages (age-group 0), which should not be fished.

This paper deals with hake (Merluccius merluccius), with special reference to the distribution of its youngest individuals.

Material and methods

Hauls were made by using a commercial vessel, otter trawler type, with 117 GRT and a power in the engine of 300 C.V. (Diesel).

Stations were selected closed to 100, 150, 200, 250 and 300 meters depth and disposed with a certain degree of regularity. It has to be remarked that some areas are unaccessible for trawling due to rough bottoms. This is also a conditionant factor in the distribution of the stations.

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The vessel was situated by DECCA system, with a maximum error of 300 meters. The effective duration of the trawls was 1 hour, and the average speed during them was 2.5 knots. All the hauls were made with daylight in order to get a minimum of variability in the catchability of fish.

After a first selection on board, the catch of each haul was put in numbered boxes and conserved in ice. They were landed within one or two days and transported to the laboratory where the catch was classified by species for their study.

Hake individuals were grouped into length categories, depending on the quarter of the year, as follows:

<u>4th</u>	Quarter:	0-20 cm; 21-23 cm; 24-45 cm; 46 and more cm
<u>1^{rst}</u>	Quarter:	0-23 cm; 24-45 cm; 46 and more cm

The reason for these groupings is due to the following facts:

a) From analysis by means of probability paper of the distribution of length frequencies (histograms in Fig. 1, representing each one between 5 and 10 thousand fish measured) it has been concluded that during the fourth quarter of the year, the limit length between 0 and 1 age groups was 20-21 cm. This means that fish measuring 20 cm or less were included in age group 0, and fish measuring 21 cm or more cm, were included in age group 1+. In the first quarter this limit was between 23-23 cm.

b) The legal size in this area for hake is 24 cm

c) 45 cm is assumed to be the size of first maturity for hake in this area (unpublished data).

Length for hake has been measured from the tip of the snout till the last rays of caudal fin, in intervals of 10 mm relating the measurement to the center of the interval.

Abundance was estimated by computing the weight and number of individuals of each one of the groups mentioned above, per mile

hauled. Since the same vessel, crew and gear has been used for all surveys, the relative value of the differences among hauls seems to be reasonable.

When representing, where possible, the numeric density isopleths, it has been taken into account a logarithmical scale, slightly modified, in order to include the unitary powers of ten. This has been: 100, 250, 500, 1000, 2500, 5000, 10000 ...

In table 1, the situation, depth, date and number of each haul is shown..

Results

In tables 2 to 5, hake density per mile hauled in number and weight (gr) for all surveys, is shown.

In figure 2 density, in number, of hake less than 24 cm in October 1972 cruise, is shown. The density in each station is represented by spots of different diameter. If one looks to the data of table 2 it can be seen that this group of hake less than 24 cm was mainly constituted by individuals of the 0 age group (up to 20 cm).

In figure 3 is represented the density of hake of less than 24 cm for March 1973 cruise. This group is coincident with all the 0 age group. If we assume that January is the month in which each annual class enters the following age group, then, hake less than 24 cm should be considered as belonging to age group 1. In any case, they should be the youngest age group being capable to be caught with such a gear.

Figure 4 represents the density of hake less than 24 cm during November 1973. Here again this group is mainly constituted by age group 0 individuals (up to 20 cm).

No figure was made for March 1974, due to the very low density of hake less than 24 cm.

Discussion

The following main items can be pointed out:

a) Areas and seasons of higher density

It seems to be evident that during October-November, the catches of hake less than 24 cm, have being higher than in March.

Having a look at the whole Galician coast (Fig. 2), one can see that in October 1972 main concentrations of "carioca" (youngest hake) were found in front of the Rias of Arosa and Pontevedra, between the 150 and 200 meters isobathics. In general catches were higher between the 130 and 200 meters isobathics.

In November 1973, this fact of major concentrations in front of the Rias of Arosa and Pontevedra, is confirmed again (Fig. 4), this time in depths ranging from 150 to 250 meters.

In March 1973 the scope is different. In the sector Finis terre-Miño (Fig. 3) density of hake less than 24 cm, has decreased, and major concentrations are found between Ons island and La Guardia, mainly near the slope, whereas the northern half of this sector is nearly depopulated. In March 1974, density all over the area was so low that we can not talk properly of concentration zones of young hake.

Within such a fragmentary scope, it can be seen that between October-November and March there is a sharp decrease in the density of hake less than 24 cm, as a consequence, probably, of a heavy fishing mortality on 0 age group.

Anyway, the presence in March of a major concentration of young hake near the slope, could be related to a certain displacement of 0 age group towards major depths during the winter, and may be, towards the south. This could be in agreement with the work of Belloc (1935), who describes this kind of displacement.

b) Interannual differences

If we assume that the spawning season takes place during the first months of the year, then, hake less than 21 cm in October 1972 and less than 24 cm in March 1973, belonged to the 1972 year class. By assuming the same, the ones of November 1973 and March 1974

should belong to the 1973 year class. Taking into account only the stations which have been repeatedly sampled in October 1972 and November 1973, eight in total, it can be obtained for October 1972 an average density per mile of hake less than 21 cm, of 2109 fish, and for November 1973 of 144 fish, which means a density 14,6 times more abundant for 1972 year class than for the 1973 one. Doing the same calculation for March 1973 and March 1974, with 23 repeated stations, 1972 year class results to be 7.3 times more abundant in March 1973, than 1973 year class in March 1974. It can be assumed that 1972 year class was at least 7 times more abundant than the 1973 one.

Summary

During the months of October 1972, March and November 1973 and March 1974, four groundfish surveys have being carried out using a commercial fishing vessel, otter trawler type, in order to calculate the density, measured in number and weight of individuals caught per mile hauled, of several species.

This paper deals with some considerations on the abundance and distribution of the youngest individuals of hake (Merluccius merluccius) from data obtained from those surveys.

Hake (Merluccius merluccius) less than 24 cm length has shown to be more abundant in October-November than in March, specially in depths ranging between 150 and 250 meters, in front of the Rias of Arosa and Pontevedra (Figs. 2-4). In March 1973 (Fig. 3) hake less than 24 cm length, were concentrated in the deepest part of the continental shelf near the slope.

1972 year class has shown to be at least 7 times more abundant than the 1973 one.

References

- Belloc, G. - 1935. Etude monographique du merlu (Merluccius merluccius)
3^e partie. Rev. Trav. Off. Sc. Tech. Pêches Mar.,
8(2):145-202

Table 1

<u>n^o</u> of Haul	<u>Situation</u>		<u>Depth</u>	<u>Date</u>
	<u>Latitude</u>	<u>Longitude</u>		
1	41° 57' 30"	9° 00' 00"	100	24.10.72
2	42° 03' 42"	8° 58' 54"	102	" " "
3	42° 13' 09"	8° 57' 00"	100	" " "
4	42° 24' 24"	8° 58' 48"	95	" " "
5	43° 25' 36"	8° 59' 00"	161	25.10.72
6	43° 23' 12"	8° 48' 20"	139	" " "
7	43° 32' 30"	8° 26' 00"	135	" " "
8	43° 37' 24"	7° 00' 00"	106	26.10.72
9	43° 37' 48"	7° 07' 00"	102	" " "
10	43° 45' 24"	7° 22' 30"	143	" " "
11	43° 08' 24"	9° 22' 00"	132	27.10.72
12	42° 59' 36"	9° 26' 24"	146	28.10.72
13	42° 48' 06"	9° 18' 42"	137	" " "
14	42° 37' 18"	9° 14' 12"	105	" " "
15	42° 18' 54"	9° 10' 36"	152	29.10.72
16	42° 17' 48"	9° 14' 12"	199	" " "
17	41° 57' 30"	9° 00' 00"	100	25.03.73
18	42° 03' 42"	8° 58' 54"	102	" " "
19	42° 13' 09"	8° 57' 00"	100	" " "
20	42° 24' 24"	8° 58' 48"	95	" " "
21	42° 37' 18"	9° 14' 12"	105	26.03.73
22	42° 48' 06"	9° 18' 42"	137	" " "
23	42° 53' 30"	9° 25' 12"	161	" " "
24	42° 53' 18"	9° 31' 36"	201	" " "
25	42° 32' 18"	9° 23' 18"	201	27.03.73
26	42° 40' 18"	9° 29' 48"	201	" " "
27	42° 46' 48"	9° 31' 48"	201	" " "
28	42° 31' 36"	9° 19' 42"	147	" " "
29	42° 17' 48"	9° 14' 12"	199	28.03.73
30	42° 18' 54"	9° 10' 36"	152	" " "
31	42° 11' 48"	9° 09' 18"	148	" " "
32	42° 12' 12"	9° 13' 54"	201	" " "
33	42° 05' 42"	9° 06' 06"	144	29.03.73
34	42° 04' 51"	9° 19' 12"	203	" " "
35	41° 56' 48"	9° 20' 12"	203	" " "
36	42° 00' 00"	9° 09' 48"	144	" " "

Table 1 (continued)

<u>n^{er}</u> of Haul	<u>Situation</u>		<u>Depth</u>	<u>Date</u>
	<u>Latitude</u>	<u>Longitude</u>		
37	42° 20' 18"	9° 16' 48"	252	30.03.73
38	42° 15' 21"	9° 20' 24"	247	" " "
39	42° 09' 06"	9° 19' 42"	247	" " "
40	41° 57' 30"	9° 00' 00"	100	1.11.73
41	42° 03' 42"	8° 58' 54"	102	" " "
42	42° 13' 09"	8° 57' 00"	100	" " "
43	42° 24' 24"	8° 58' 48"	95	" " "
44	42° 37' 18"	9° 14' 12"	105	8.11.73
45	42° 43' 06"	9° 24' 48"	137	" " "
46	42° 48' 00"	9° 28' 39"	161	" " "
47	42° 48' 06"	9° 18' 42"	137	" " "
48	42° 53' 30"	9° 25' 12"	161	9.11.73
49	42° 53' 18"	9° 31' 36"	201	" " "
50	42° 46' 48"	9° 31' 48"	201	" " "
51	42° 40' 18"	9° 29' 48"	201	" " "
52	42° 32' 18"	9° 23' 18"	201	7.11.73
53	42° 27' 06"	9° 19' 18"	249	" " "
54	42° 25' 30"	9° 12' 36"	146	" " "
55	42° 18' 54"	9° 10' 36"	152	2.11.73
56	42° 20' 18"	9° 16' 48"	252	7.11.73
57	42° 17' 48"	9° 14' 12"	199	2.11.73
58	42° 10' 30"	9° 14' 20"	190	" " "
59	42° 11' 48"	9° 09' 18"	148	" " "
60	42° 04' 51"	9° 19' 12"	203	5.11.73
61	41° 56' 48"	9° 20' 12"	203	" " "
62	42° 00' 00"	9° 09' 48"	144	" " "
63	42° 05' 42"	9° 06' 06"	144	" " "
64	42° 12' 12"	9° 13' 54"	201	6.11.73
65	42° 15' 21"	9° 20' 24"	247	" " "
66	42° 14' 24"	9° 23' 54"	260	" " "
67	42° 11' 36"	9° 18' 24"	240	" " "
68	42° 18' 54"	9° 10' 36"	152	21.03.74
69	42° 17' 48"	9° 14' 12"	199	" " "
70	42° 12' 12"	9° 13' 54"	201	" " "
71	42° 11' 48"	9° 09' 18"	148	" " "
72	42° 24' 24"	8° 58' 48"	95	22.03.74
73	42° 13' 09"	8° 57' 00"	100	" " "
74	42° 03' 42"	8° 58' 54"	102	" " "
75	41° 57' 30"	9° 00' 00"	100	" " "
76	41° 56' 48"	9° 20' 12"	203	23.03.74
77	42° 04' 51"	9° 19' 12"	203	" " "
78	42° 00' 00"	9° 09' 48"	144	" " "

Table 1 (concluded)

	<u>Situation</u>			
<u>n^{er} of Haul</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Depth</u>	<u>Date</u>
79	42° 05' 42"	9° 06' 06"	144	23.03.74
80	42° 32' 18"	9° 23' 18"	201	24.03.74
81	42° 31' 36"	9° 19' 42"	147	" " "
82	42° 26' 48"	9° 17' 12"	201	" " "
83	42° 25' 30"	9° 12' 36"	146	" " "
84	42° 37' 18"	9° 14' 12"	105	25.03.74
85	42° 43' 06"	9° 24' 48"	137	" " "
86	42° 48' 06"	9° 18' 42"	137	" " "
87	42° 48' 00"	9° 28' 39"	161	" " "
88	42° 53' 30"	9° 25' 12"	161	26.03.74
89	42° 53' 18"	9° 31' 36"	201	" " "
90	42° 46' 48"	9° 31' 48"	201	" " "
91	42° 40' 18"	9° 29' 48"	201	" " "
92	42° 09' 06"	9° 19' 42"	247	27.03.74
93	42° 15' 21"	9° 20' 24"	247	" " "
94	42° 20' 18"	9° 16' 48"	252	" " "
95	42° 27' 06"	9° 19' 18"	249	" " "

Table 2

Hake density per mile hauled. October 1972.

Haul	up to 20 cm		21-23 cm		24-45 cm		46 cm and more	
	number	weight	number	weight	number	weight	number	weight
1	461	12,448	25	1,684	2	336	-	-
2	1257	27,937	46	3,209	10	1,545	-	-
3	476	14,199	28	2,032	5	691	-	-
4	856	39,812	77	5,262	10	1,180	-	-
5	3971	70,908	-	-	-	-	-	-
6	1495	32,357	12	709	6	1,539	-	-
7	714	22,315	16	996	2	150	-	-
8	1366	20,836	6	541	15	2,277	1	850
9	591	14,235	4	342	22	2,933	-	-
10	3971	55,819	2	121	4	466	-	-
11	2918	64,046	18	1,154	-	-	-	-
12	39	1,269	5	411	1	356	2	2,164
13	2132	34,956	3	290	7	2,057	1	2,000
14	26	778	2	180	2	522	-	-
15	6667	89,877	8	435	3	767	-	-
16	4996	74,656	20	1,388	16	2,341	-	-

Table 3

Hake density per mile hauled. March 1973

<u>Haul</u>	<u>up to 23 cm</u>		<u>24-45 cm</u>		<u>46 cm and more</u>	
	<u>number</u>	<u>weight</u>	<u>number</u>	<u>weight</u>	<u>number</u>	<u>weight</u>
17	95	5,571	51	6,603	-	-
18	80	4,848	47	6,552	-	-
19	211	13,610	142	21,414	-	-
20	42	2,948	102	14,980	-	-
21	42	2,580	108	14,395	1	1,151
22	38	1,820	12	2,040	1	437
23	52	1,974	8	1,288	-	-
24	68	3,370	11	1,532	3	3,929
25	24	1,309	15	4,118	3	2,971
26	38	1,820	12	2,040	-	-
27	71	2,718	11	2,121	-	-
28	80	4,141	23	4,498	2	2,285
29	235	6,394	20	4,230	1	2,339
30	79	3,134	19	2,864	1	620
31	85	3,395	22	3,582	1	1,434
32	144	4,362	9	1,680	1	1,032
33	50	2,177	53	8,703	1	269
34	229	8,263	22	4,517	1	219
35	62	2,447	7	1,545	1	884
36	107	6,355	48	6,300	-	-
37	80	4,338	36	8,626	2	1,336
38	293	10,948	13	2,637	1	681
39	298	10,049	9	2,231	2	2,219

Table 4

Haks density per mile hauled. November 1973

Haul	up to 20 cm		21-23 cm		24-45 cm		45 cm and more	
	number	weight	number	weight	number	weight	number	weight
40	67	2,071	13	1,944	16	2,105	-	-
41	111	3,407	2	131	3	598	-	-
42	162	4,813	15	1,001	9	1,440	-	-
43	51	2,101	13	1,063	14	1,654	-	-
44	200	5,583	1	89	2	681	1	275
45	33	1,010	-	-	3	978	1	287
46	70	1,665	1	56	6	2,271	1	775
47	37	1,009	2	125	5	1,953	2	1,227
48	41	1,073	4	273	2	805	1	320
49	84	1,964	-	-	1	102	1	242
50	290	7,735	2	27	-	-	-	-
51	269	8,000	6	328	1	456	-	-
52	130	3,087	2	228	-	-	1	235
53	412	11,358	3	209	1	254	-	-
54	200	4,306	-	-	1	178	-	-
55	371	8,109	2	219	-	-	-	-
56	243	6,204	-	-	1	162	-	-
57	151	3,050	1	55	-	-	-	-
58	288	6,336	1	46	4	1,140	-	-
59	126	2,735	1	68	3	778	-	-
60	241	7,508	9	510	10	1,310	1	769
61	36	1,237	5	665	3	326	-	-
62	273	6,452	2	129	2	438	-	-
63	230	5,076	5	286	2	259	-	-
64	228	7,128	3	220	1	108	-	-
65	55	1,550	2	75	3	1,495	-	-
66	11	407	1	59	4	1,781	1	718
67	15	517	1	70	11	4,020	1	531

Table 5

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Hake density per mile hauled. March 1974

Haul	up to 23 cm		24-45 cm		46 cm and more	
	number	weight	number	weight	number	weight
68	4	155	4	1,353	2	2,211
69	1	63	4	902	-	-
70	3	116	4	1,280	1	585
71	1	34	7	1,480	1	454
72	50	2,744	5	699	-	-
73	65	3,278	35	2,892	-	-
74	31	1,718	14	1,795	-	-
75	20	1,085	12	1,530	-	-
76	4	248	22	5,979	2	1,585
77	4	204	10	3,022	1	702
78	14	741	19	2,884	-	-
79	4	154	28	3,478	1	713
80	2	106	9	3,335	3	2,792
81	7	390	6	1,833	1	619
82	-	-	1	174	2	1,714
83	3	167	3	738	-	-
84	27	1,638	13	1,331	-	-
85	4	240	6	861	-	-
86	13	680	3	640	-	-
87	7	357	10	3,070	1	1,292
88	5	212	12	3,398	2	1,349
89	8	466	1	139	1	924
90	55	2,739	1	102	-	-
91	11	634	3	651	1	648
92	3	219	12	3,714	5	3,872
93	6	341	11	2,641	2	1,615
94	2	96	4	1,648	2	1,388
95	1	55	2	651	1	874

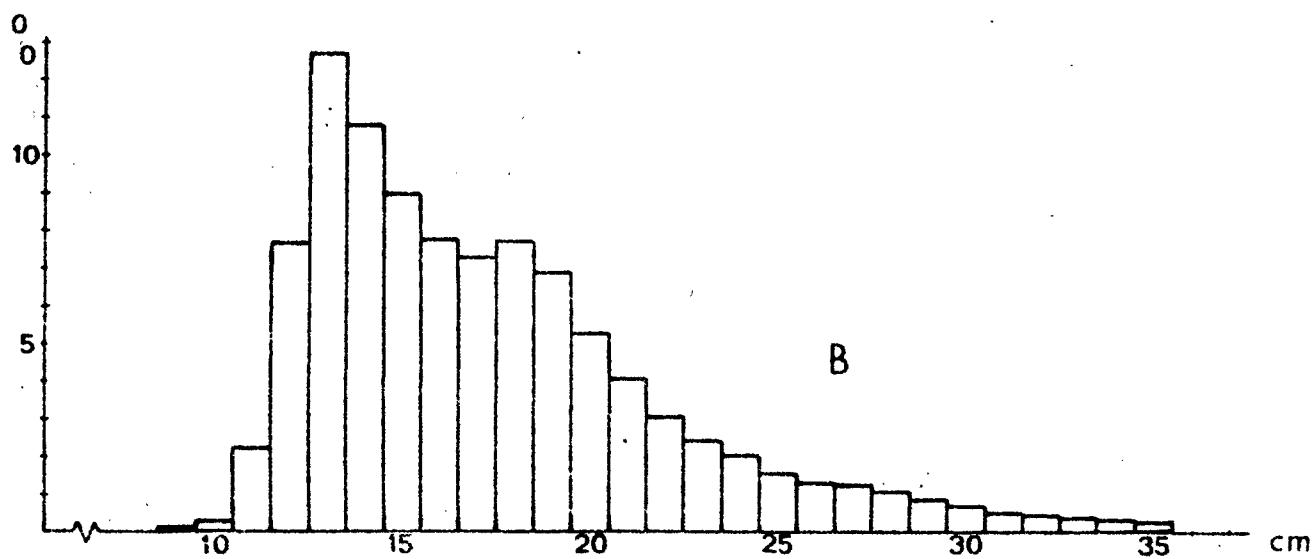
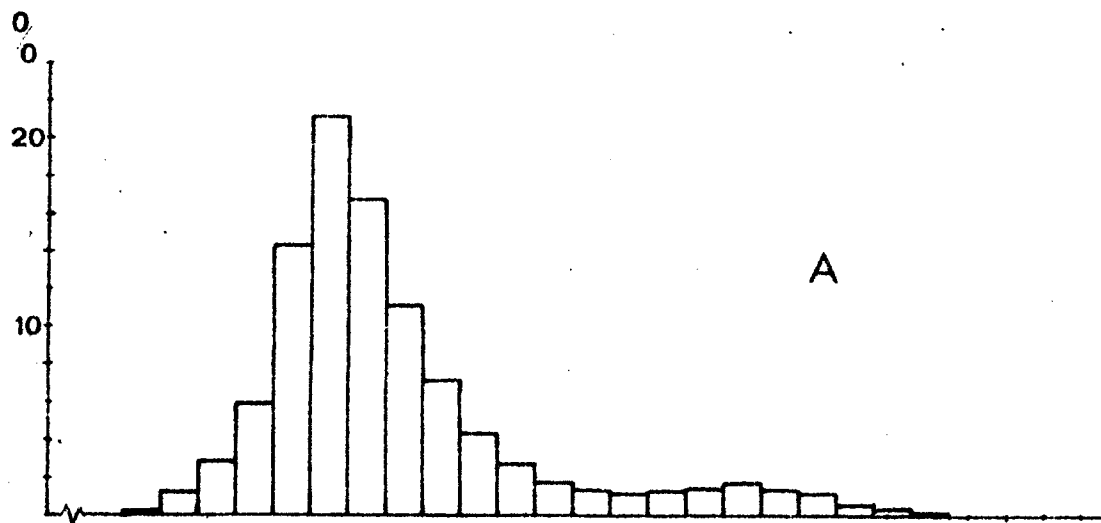


FIG.1.- Length frequency distribution for hake. A: 4th quarter. B: 1st quarter.

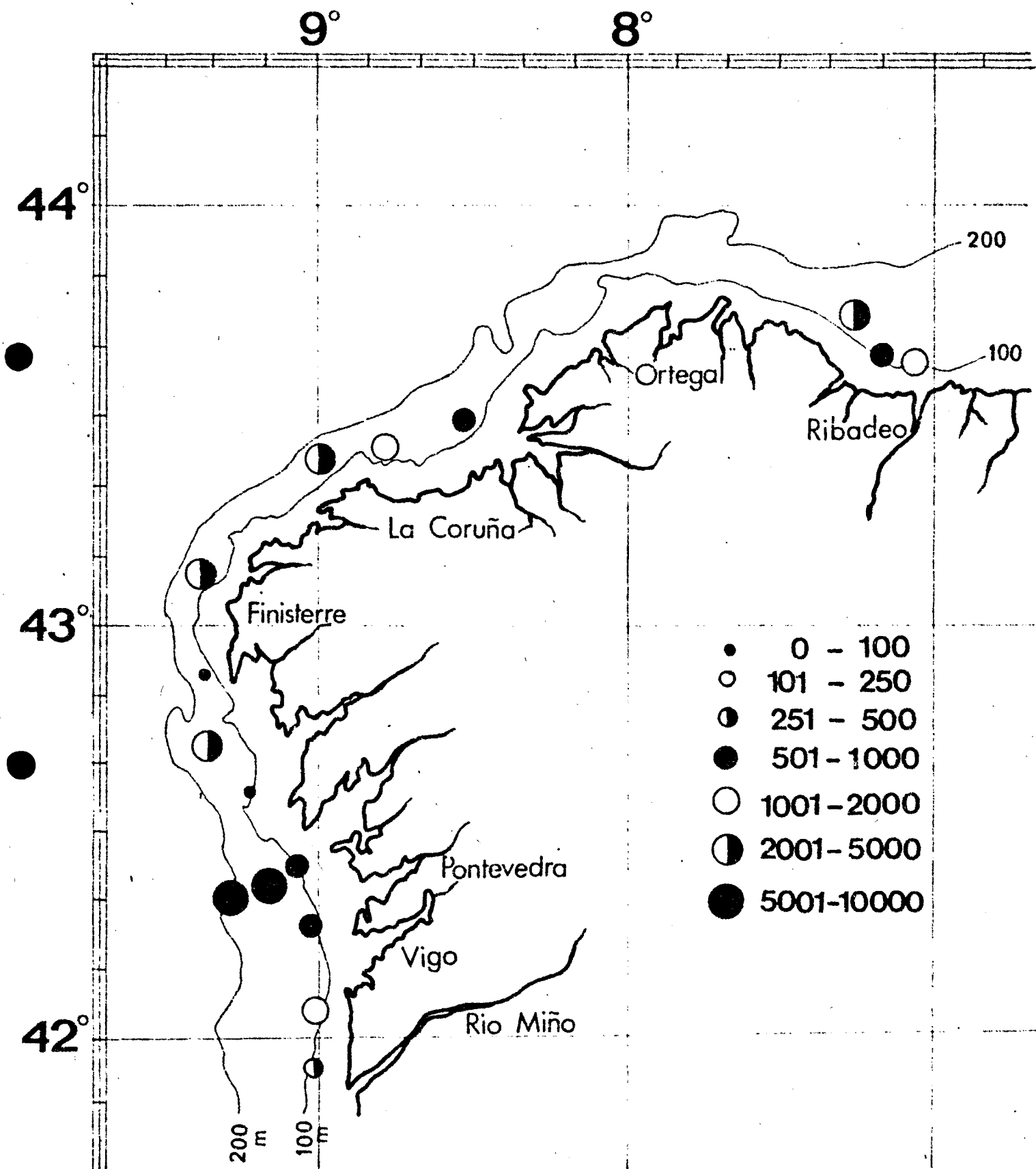


FIG. 2.- Hake (less than 24 cm) density in number, for October 1974 survey.

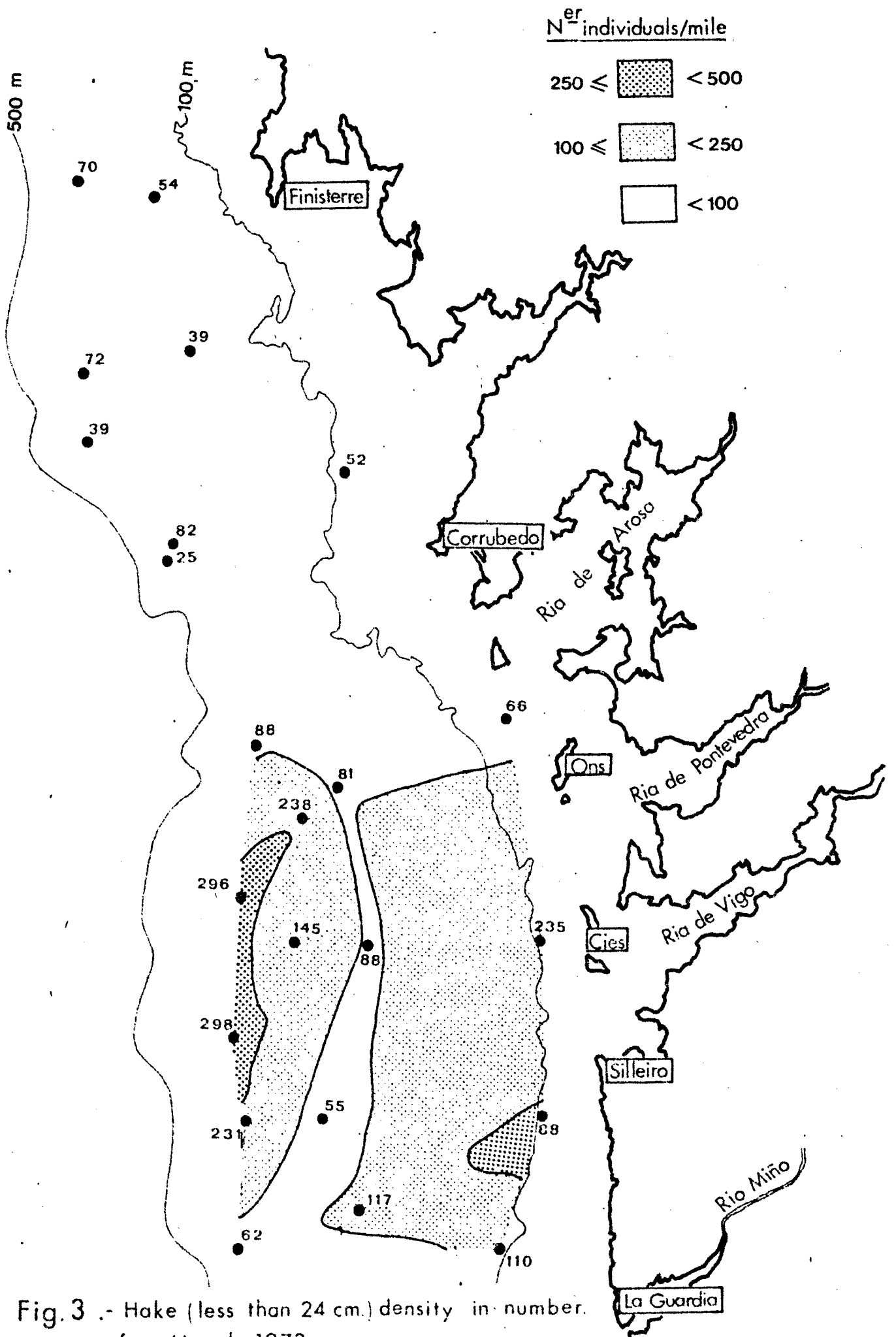


Fig. 3 .- Hake (less than 24 cm.) density in number for March 1973 survey.

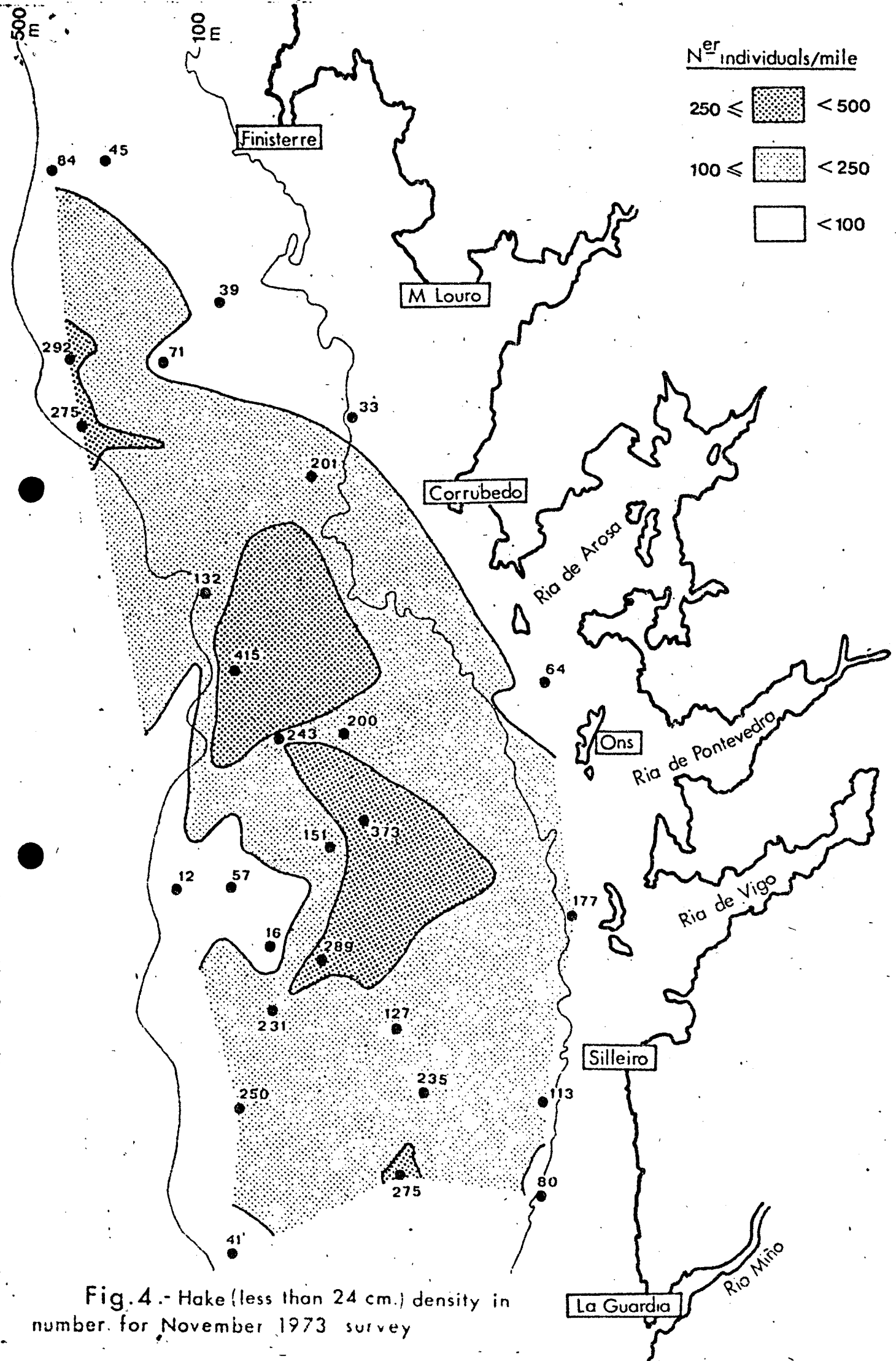


Fig.4.- Hake (less than 24 cm.) density in number for November 1973 survey