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A STUDY OF THE UNDERSAMPLING PROBLEM OF FISH LARVAE OBSERVED AT THE FIXED STATIONS IN SOUTH BRAZIL*

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SYNOPSIS

The problem of daytime undersampling of larvae observed at two fixed stations made in the spawning ground of the Brazilian sardine is discussed. The size frequency composition of sardine is also discussed.

The predominant species on the stations was the larvae of *Sardinella brasiliensis*. The larvae of *Harengula spp.*, Scombridae, Bregmacerotidae, Ophidiidae were also collected, but not so abundantly.

When compared to other larvae, the undersampling of sardine larvae during daytime was extremely high. Because the sampling was done both vertically and horizontally at one fixed station and marked undersampling was observed at both stations, it was concluded that the undersampling was caused by avoidance. It was necessary to take this problem into careful consideration for computation of larval abundance.

INTRODUCTION

One of the purposes of study on early life history of fish is to clarify a relation between the mortality rate during larval stage and the recruitment of fish stock in succeeding years. A prerequisite for a computation of larval abundance is a knowledge of the rate of daytime avoidance of larvae.

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In calculating the larval abundance and survival rate of the California sardine (*Sardinops caerulea*) larvae, Ahlstrom (1954) revealed that there was a correlation between the undersampling rate and the size of sardine larvae. The regression line fitted to this correlation was used for adjustment of daytime undersampling.

In this paper the daytime undersampling problem of the larvae observed at the two fixed stations made in the spawning ground of the Brazilian sardine, *Sardinella brasiliensis* (Steindachner, 1879), is discussed and recommendations are given for handling this problem.

MATERIAL AND METHODS

Twelve series of vertical hauls were made during 24 hours at the fixed station No. 752, labelled *A*, on November 23-24, 1969 (Fig. 1). The station depth was 78 m and hauls were taken at two hours interval during a 24-hour period at latitude 23°32'S and longitude 44°04'W. The wire length was 70 m and the average towing velocity was 0.8 m per second.

Twenty four series of vertical hauls and 23 series of horizontal hauls were made during a 24-hour period at the fixed station No. 1323, or *B*, on January 19-20, 1971 (Fig. 1). The station depth was 65 m. All hauls were spaced at one hour intervals at latitude 24°18'S and longitude 45°28'W. The wire length of vertical hauls was 60 m and the average towing velocity was 0.8 m per second. The horizontal hauls were made with a towing velocity of 1.5-2.0 knots, or from 0.8 m to 1.0 m per second in the surface layer.

The net used in sampling was the conical-cylinder plankton net as recommended by UNESCO (1968), which had a mouth diameter of 113 cm and made of a nylon monofilament gauze of mesh aperture about 420 micra after use. A small flow meter was attached 25 cm inside of the hoop and three bridles of 150 cm length were used in front of it. The samples were preserved with a solution of 10% formalin. Fish eggs and larvae were sorted from plankton samples and for comparative purpose the relative abundance of eggs and larvae per 100 cubic meters of water strained was calculated.

The larvae collected were classified to family level with exception to Pleuronectiformes and Anguilliformes (Leptocephali), which were classified

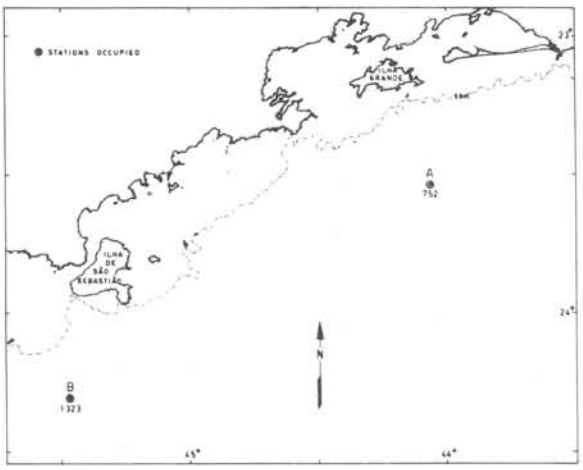


Fig. 1 - Location of fixed stations *A* and *B*.

only to order level. The predominant groups were identified to species and the percentage contribution of each determined.

At station *A*, all specimens except disintegrated larvae were measured and grouped by 0.5 mm intervals. At station *B*, because the collections contained so many larvae which showed monomodal distribution, we measured circa 100 specimens picked up at random from each sample. The number of larvae at each size class was calculated and shown in percent. Since only few specimens were collected during daytime, a comparison of the size composition of night and day haul series is less important. Therefore only the size frequency of night-caught larvae was shown in Figure 5.

Fixed station data was taken by the R/V "Prof. W. Besnard" of the Instituto Oceanográfico da Universidade de São Paulo. I wish to thank Captain Adilson Gama and the crew of the vessel for collection of material at sea and the staff members of the Instituto Oceanográfico for laboratory works. Special thanks are due to Dr. E.H. Ahlstrom of the National Marine Fisheries Service and Dr. S. A. Antunes of the Instituto Oceanográfico for critical reading and revision of the manuscript.

RESULTS

- OCCURRENCE OF FISH LARVAE AT THE FIXED STATIONS

Abundance of the groups at each haul is shown in Tables I, II and III. Total counts for each species are given in Table IV.

TABLE I- Occurrence of fish larvae at station *A* in November 1969 (vertical hauls)

Family \ Sample number / Time	257 18:40	258 20:40	259 22:40	260 00:40	261 02:40	262 04:40	263 06:40	264 08:40	265 10:40	266 12:40	267 14:40	268 16:40	Total
Clupeidae	319	74	437	522	53	137	49	2	0	2	0	0	1595
Engraulidae	1	0	0	3	0	0	0	0	0	0	0	0	4
Scombridae	1	0	0	1	0	0	0	0	0	0	0	0	2
Bregmacerotidae	5	13	36	55	26	12	21	21	24	40	40	8	301
Sphyraenidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophidiidae	3	3	6	15	10	0	4	3	2	2	6	1	55
Pleuronectiformes	1	1	3	4	2	1	0	1	0	1	1	0	15
Gerridae	1	0	0	0	0	0	0	0	0	0	0	0	1
Synodontidae	1	1	3	2	4	2	1	4	2	0	2	2	24
Balistidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptocephalus	0	0	0	0	0	0	0	0	0	0	0	0	0
Gonostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Carangidae	5	0	0	2	1	0	1	0	0	0	1	0	10
Gobiidae	1	1	4	3	1	1	0	0	0	0	0	0	11
Exocoetidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	0	0	0	1	1	0	0	1	0	0	0	0	3
Triglidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Mugilidae	0	1	0	0	0	0	0	0	0	0	0	0	1
Lophiidae	0	0	1	0	1	0	0	0	0	0	0	0	2
Others	17	11	22	22	11	4	13	11	0	0	3	2	116
Total	355	105	512	630	110	157	89	43	28	45	53	13	2140

TABLE II - Occurrence of fish larvae at station *B* in January 1971 (vertical hauls)

Family \ Sample number / Time	555 08:45	557 09:45	559 10:50	561 11:50	563 12:50	565 13:45	567 14:45	569 15:45	571 16:45	573 17:45	574 18:45	576 19:45	578 20:58	580 21:48	582 22:50	584 24:00	586 01:15	588 02:35	590 03:45	592 04:50	594 05:40	596 06:45	598 07:45	600 08:35	Total
Clupeidae	0	1	2	2	3	0	2	4	6	14	11	1308	336	280	286	467	210	793	513	262	102	2	3	1	4558
Engraulidae	3	2	0	1	0	0	1	0	1	0	3	2	2	20	22	17	9	16	2	3	15	1	0	1	121
Scombridae	0	0	0	1	1	3	1	0	0	9	4	280	27	28	19	40	10	30	7	5	0	0	0	0	465
Bregmacerotidae	0	0	0	1	0	0	1	0	0	0	0	2	2	1	0	1	0	1	0	0	0	0	0	0	9
Sphyraenidae	1	0	0	0	0	1	0	1	2	0	0	8	2	2	2	1	0	3	0	1	0	1	0	0	25
Ophidiidae	1	0	1	2	2	0	1	2	1	0	1	3	5	3	2	0	4	4	7	2	1	3	0	0	45
Pleuronectiformes	2	2	4	6	1	2	6	1	2	0	0	44	9	6	17	14	7	9	6	12	2	7	6	1	154
Gerridae	0	0	0	0	0	0	0	0	0	0	0	1	3	2	1	2	5	0	0	0	0	0	0	0	14
Synodontidae	1	0	1	0	1	0	0	1	1	1	1	2	2	1	1	5	3	2	1	0	0	0	0	1	25
Balistidae	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Leptocephalus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	6
Gonostomatidae	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Carangidae	2	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5
Gobiidae	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
Exocoetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Triglidae	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Mugilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lophiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	12	17	14	19	15	15	9	7	13	16	14	93	22	17	17	18	12	12	13	21	3	4	14	6	403
Total	23	24	23	32	23	22	24	16	27	40	35	1760	407	360	370	565	257	824	555	307	124	18	23	9	5869

TABLE III-Occurrence of fish larvae at station *B* in January 1971 (horizontal hauls)

Family \ Sample number / Time	556 09:30	558 10:15	560 11:24	562 12:30	564 13:30	566 14:30	568 15:32	570 16:37	572 17:35	575 18:30	577 19:32	579 20:40	581 21:35	583 22:39	585 23:50	587 01:05	589 02:45	591 03:35	593 04:30	595 06:05	597 07:05	599 07:57	601 08:45	Total
Clupeidae	10	1	1	18	39	3	24	24	58	26	915	2194	5574	5316	4149	3524	1168	1540	879	22	37	5	19	25546
Engraulidae	0	0	0	0	1	0	0	1	1	0	0	0	0	20	7	0	5	0	0	1	0	1	0	37
Scombridae	3	0	0	2	0	0	2	1	1	1	61	115	190	174	89	128	27	17	22	2	0	0	1	836
Bregmacerotidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphyraenidae	2	0	1	5	15	6	4	4	3	2	0	5	6	5	4	3	4	1	1	2	4	6	0	83
Ophidiidae	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pleuronectiformes	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1	0	1	0	0	6
Gerridae	0	0	0	0	0	1	1	0	0	0	3	8	25	38	9	2	4	2	4	0	1	0	0	88
Synodontidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balistidae	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0	4
Leptocephalus	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Gonostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carangidae	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gobiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exocoetidae	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3
Serranidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Triglidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mugilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Lophiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	22	10	1	38	54	9	11	22	22	0	14	19	48	92	38	35	13	11	7	6	13	9	8	502
Total	37	11	4	65	109	20	42	52	86	30	993	2342	5845	5646	4297	3693	1223	1572	914	33	57	21	28	27120

TABLE IV - Comparison of abundance of fish larvae collected at the fixed stations

Species	Cruise November 1969 (St. *A*)			Cruise January 1971 (St. *B*)					
	Vertical hauls			Vertical hauls			Horizontal hauls		
	Fish larvae collected	Percent of total	Rank	Fish larvae collected	Percent of total	Rank	Fish larvae collected	Percent of total	Rank
Sardinella brasiliensis	1595	74.5	1	4345	74.1	1	24296	89.6	1
Harengula spp.	0	0	-	213	3.6	3	1250	4.6	2
Bregmaceros atlanticus	301	14.0	2	9	0.2	11	0	0	-
Euthynnus alletteratus	0	0	-	146	2.5	5	231	0.9	4
Other scombrids*	2	0.1	10	305	5.2	2	605	2.2	3
Engraulidae	4	0.2	9	121	2.1	6	37	0.1	7
Pleuronectiformes	15	0.7	5	166	2.8	4	6	0.02	8
Ophidiidae	55	2.6	3	45	0.8	7	1	0.003	-
All others	168	7.9	-	514	8.7	-	694	2.6	-
Total	2140	100.0		5869	100.0		27120	100.0	

* Identified as *Auxis spp.*

Sardinella brasiliensis larvae were predominant and contributed 74.5% of total larvae collected at station *A* and 74.1% and 89.6%, respectively for vertical and horizontal hauls at station *B*.

Concerning other species, the occurrence patterns at the two stations were somewhat different. At station *A* the second predominant species was *Bregmaceros atlanticus* (Goode & Bean, 1886) larvae, followed by the groups of Ophidiidae, Synodontidae and Pleuronectiformes in this sequence. At station *B* the second predominant species in vertical hauls was the group of Scombridae, followed by *Harengula spp.*[1] and Pleuronectiformes. In horizontal hauls *Harengula spp.* ranked second and then Scombridae, Gerreidae, Sphyraenidae and Engraulidae followed in order of abundance.

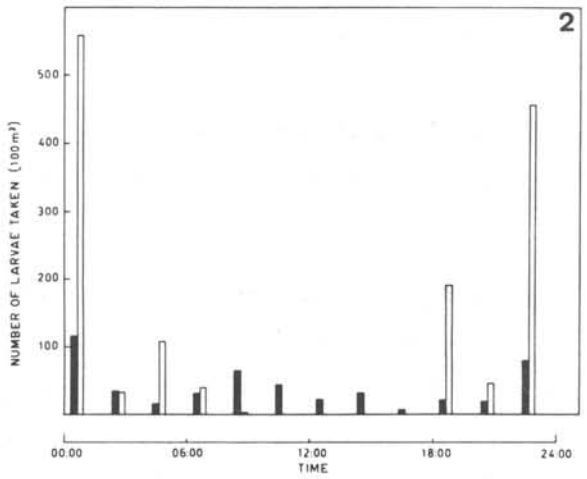
Comparing the occurrence of fish larvae in vertical and horizontal hauls at station *B*, we can notice that sardine larvae were collected more abundantly in surface horizontal hauls. On the other hand the larvae of *Harengula* species were collected more abundantly in vertical hauls (4.6%) than in horizontal hauls (3.6%).

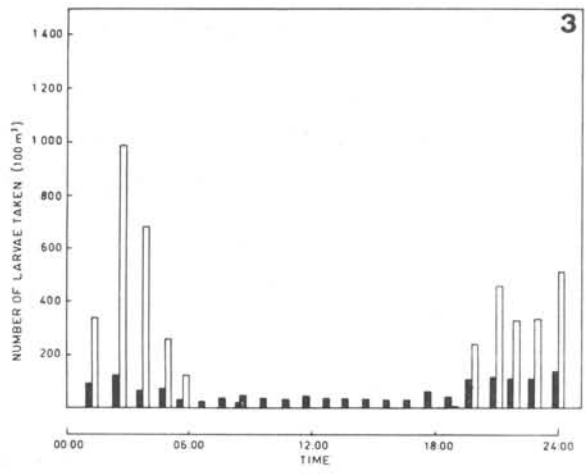
[1] Two *Harengula* species occur in south Brazilian waters, i.e. *H. jaguana* and *H. clupeola*. A key for identification of the two species (Whitehead, 1973) cannot be used for larvae.

- UNDERSAMPLING PROBLEM

The occurrence of sardine larvae and others are shown in Figures 2, 3 and 4. Almost all sardine were collected from night hauls at both stations. The difference between night and day catches was so great that we could not compare the distribution of sardine larvae caught by day and by night. The night/day catch ratio of larvae is presented in Table V.

The night/day catch ratio at station *A* was 32.4 for sardine larvae and 2.3 for others. Second ranked species, *Bregmaceros atlanticus*, showed little difference between day and night catches inasmuch as the night/day catch ratio was only 1.03.





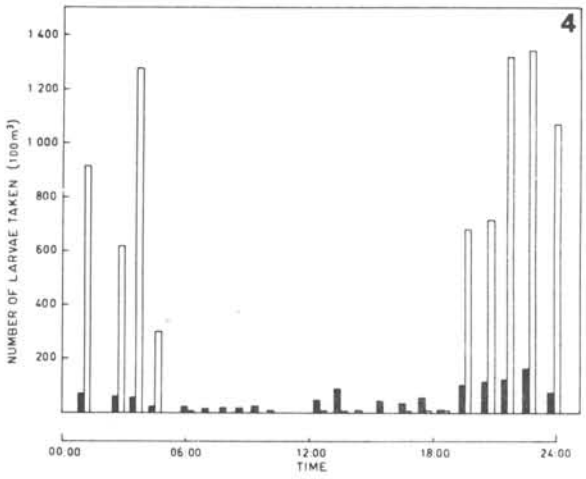


Fig. 2-Diurnal change of occurrence of sardine larvae (white column) and all other larvae (black column), observed at the fixed station *A* in November 23-24, 1969. VERTICAL HAULS.

Fig. 3-Diurnal change of occurrence of sardine larvae (white column) and all other larvae (black column), observed at the fixed station *B* in January 19-20, 1971. VERTICAL HAULS.

Fig. 4-Diurnal change of occurrence of sardine larvae (white column) and all other larvae (black column), observed at the fixed station *B* in January 19-20, 1971. HORIZONTAL HAULS.

Species	Station *A* (November 1969)			Station *B* (January 1971)					
	Vertical haul			Vertical haul			Horizontal haul		
	Day	Night	N/D[1]	Day	Night	N/D	Day	Night	N/D
Sardinella brasiliensis	7.2	233.5	32.4	0.6	392.5	615.2	1.7	826.3	486.1
Harengula spp.	0	0	-	3.9	14.7	3.8	10.6	34.3	3.2
Euthynnus alletteratus	0	0	-	0.5	7.1	15.1	0	7.7	-
Bregmaceros atlanticus	22.4	21.8	1.03	0.2	0.7	3.1	0	0	-
All others	11.6	26.4	2.3	29.4	68.2	2.3	17.1	35.8	2.1
All larvae	41.2	281.7	6.8	34.6	483.2	14.0	29.4	904.1	30.8
Number of hauls[2]	6	6		13	11		13	10	

Note: For comparative purpose, the average number of larvae per 100 m^3 of water strained was used

[1] Night/day catch ratio

[2] Because the sampling was not conducted exactly in one hour interval at station *B*, there was a difference in number of hauls during day and night times.

TABLE V - Diurnal differences in average number of fish larvae collected at the fixed stations, *A* and *B*

At station *B* the night/day catch ratio was 615.2 for sardine larvae in vertical hauls and 486.1 in horizontal hauls. *Harengula spp.* showed the night/day catch ratio of 3.8 and 3.2, respectively in vertical and horizontal hauls. *Euthynnus alletteratus* (Rafinesque, 1810) showed the night/day catch ratio of 15.1 in vertical hauls, whereas in horizontal hauls it was not collected in daytime hauls. The ratio obtained for other species were 2.3 and 2.1, respectively in vertical and horizontal hauls.

Comparing the night/day catch ratio of sardine larvae with those given by other authors (generally less than 10) our values were extremely high. Since only sardine larvae showed such elevated values at fixed stations, we cannot assume that the sampling method was inadequate.

- SIZE FREQUENCY OF SARDINE LARVAE

Table VI shows a comparison of the size frequency composition between day and night catches at two stations. The size frequency of night-caught sardine larvae collected at the fixed stations is shown in Figure 5.

At station *A* a bimodal size frequency was observed, i.e. a small-size group with average length 6.3 mm, ranging from 4.0 to 8.5 mm and a large-size group with average length 12.5 mm, ranging from 9.0 to 16.5 mm. The number of larvae was 1378 for the former and 146 for the latter. We may assume that these two groups were derived from different spawning periods.

A difference in size frequency of sardine larvae collected from vertical and horizontal hauls at station *B* was not observed. This suggests that the size composition of sardine larvae is the same in upper and deeper layers.

TABLE VI - Size frequency composition of sardine larvae taken at two fixed stations

Size class (mm)	Station *A*		Station *B*			
	Vertical haul		Vertical haul		Horizontal haul	
	Day	Night	Day	Night	Day	Night
3.25				1		
3.75			1	5	3	
4.25		2	1	4	1	4
4.75		12	0	5	1	53
5.25	2	113	0	6	0	141
5.75	7	222	0	26	2	315
6.25	29	454	1	64	1	553
6.75	11	455	0	67	4	378
7.25	2	110	0	51	2	122
7.75	0	9	0	80	2	610
8.25	1	1	1	164	2	1089
8.75		0	0	417	2	2289
9.25		1	0	835	5	4126
9.75		1	1	781	4	5332
10.25		2	0	752	3	3977
10.75		10	1	400	5	2476
11.25		12		285	1	1254
11.75		21		184	1	561
12.25		25		55	1	143
12.75		31		20		157
13.25		19		8		103
13.75		13		3		50
14.25		6		11		103
14.75		3		5		103
15.25		0		5		50
15.75		0		1		
16.25		2		0		
16.75				1		
Total	52	1524	6	4236	40	23989

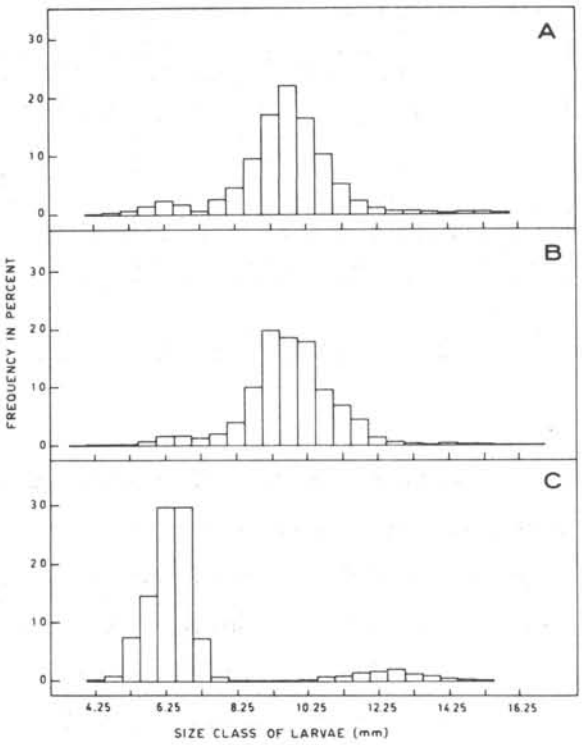


Fig. 5 - Size frequency composition of night-caught sardine larvae. A: station *B* (horizontal hauls) B: station *B* (vertical hauls) C: station *A* (vertical hauls)

DISCUSSION

The undersampling problem of fish larvae during daytime, especially when used small size and low speed sampling gear, is well known. Clutter & Anraku (1968) summarized the undersampling of zooplankton by avoidance.

Concerning clupeid larvae, the undersampling problem has been discussed by many workers, as summarized in Table VII. From this Table we can notice that the night/day catch ratio of the Brazilian sardine larvae at the fixed stations was extremely ligh. What factors might cause such marked undersampling during daytime? We can reject an hypothesis of diurnal vertical migration of sardine larvae, since the undersampling was observed both in vertical and horizontal hauls. There remains a possibility that the sampling was not made in the same water mass during daytime and the clumping of sardine larvae caused the apparent undersampling at the fixed stations. This is

less probable inasmuch as similar undersampling was observed at both fixed stations and these were occupied in different places and times. Futhermore the occurrence of fish eggs at two fixed stations showed that there were no distinct difference between day and night time samples[2].

Avoidance may be the main cause of this phenomenon. Clutter & Anraku (1968) considered various factors which could cause avoidance of zooplankton, i.e. pressure acceleration, visual, acoustic and light effects. It is very difficult to know which factors affected the avoidance of the Brazilian sardine larvae.

TABLE VII - Comparison of the night/day catch ratio of clupeid larvae observed by various authors

Authors	Sampling gears	Species	N/D[1]	Period of observations
Wallace (1924)	Peterson young fish trawl	*Clupea harengus*	3.2	1921-23
Russel (1926 & 28)	2 m stramin ring trawl	*Sardina pilchardus*	5.7-13.9	1924-26
Silliman (1943)[2]	Closing net	*Sardinops caerulea*	4.1	1931 & 41
Ahlstrom (1954)	1 m standard net	*Sardinops caerulea*	6.5	1940, 41, 50 & 51
Bridger (1956)	Helgoland larva net	*Clupea harengus*	6.3	1952-53
Bridger (1956)	Helgoland larva net	*Sardina pilchardus*	4.1	1952-53
Bridger (1958)	Gulf-III net	*Clupea harengus*	0.7 - 1.1	1955-56
Ahlstrom (1959)[2]	Closing net	*Sardinops caerulea*	3.9	1941, 50 & 51
Ahlstrom (1965)	1 m standard net	*Sardinops caerulea*	6.4	1950-58
Present author[2]	1.13 m conical-cylinder net	*Sardinella brasiliensis*	32.4	1969 (station *A*)
Present author[2]	1.13 m conical-cylinder net	*Sardinella brasiliensis*	615.2	1971 (station *B*)
Present author[3] (in preparation)	1.13 m conical-cylinder net	*Sardinella brasiliensis*	3.3	1969-71

[1] Night/day catch ratio

[2] Observation at fixed station

[3] Night/day catch ratio was calculated using the average number of sardine larvae (per 100 m^3 of water strained) taken at positive stations on the cruises of 1969 through 1971.

[2] The author failed to identify any of fish eggs taken at two fixed stations. In order to see a variation of occurrence of fish eggs during day and night times, a type of fish egg was chosen as an indicator of water mass and named type III-D egg. Averages of occurrences of III-D eggs in percent of total eggs were 7.6% and 12.3%, respectively in night-caught and day-caught samples at station *A*, and 25.0% and 23.5%, respectively in night-caught and day-caught samples from vertical hauls at station *B*. This fact seems to prove that the same water mass has been sampled during day and night times. Notwithstanding the fact mentioned above, it is possible, if not certain, that occasional expections occur, suggesting that an areal concentration of sardine larvae has happened during night.

Analysing the plankton samples from the CalCOFI investigations, Isaacs (1964) concluded that the abundance of sardine larvae taken during daytime coincided with that of the mortality of night time samples. He suggested that the daytime sampler might act as predator for sardine larvae which caught only weaker or less alert larvae.

Because an occurrence of only few sardine larvae during daytime was observed at the fixed stations, it is not adequate to adjust the daytime samples with the ratio of night/day catches. Therefore the samples collected during daytime should not be used for computation of larval abundance, at least when used the same sampling gear.

RESUMO

Um dos objetivos do estudo quantitativo do ictioplâncton é esclarecer a relação entre a mortalidade de larvas e o recrutamento do estoque nos anos sucessivos.

Para computar a abundância de larvas é necessário obter as informações sobre a eficiência da captura. Dois fatores têm que ser considerados: um, o escape de larvas pequenas através da malha da rede e, outro, a "avoidance" de larvas maiores durante o dia.

Este trabalho apresenta as observações feitas sobre a variação diurna de ocorrência de larvas de peixes, realizadas em 1969 e 1971 em duas estações fixas localizadas no sul do Brasil.

As larvas mais abundantes pertenciam a *Sardinella brasiliensis*. Outras que predominaram foram: *Bregmaceros atlanticus*, *Euthynnus alletteratus* e *Harengula* spp. Foram observadas coletas mais abundantes de larvas de sardinha na camada superior.

As larvas de sardinha foram coletadas principalmente durante a noite. O "undersampling" foi considerado devido à "avoidance". A razão entre capturas médias durante a noite e o dia foi tão grande que é preciso uma consideração sobre o fator de "avoidance" das larvas de sardinha para a computação de abundância do mesmo.

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