

EGG DEVELOPMENT OF SCALED SARDINE *HARENGULA*  
*PENSACOLAE* GOODE & BEAN (PISCES, CLUPEIDAE)\*

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SYNOPSIS

Egg development of scaled sardine (*Harengula pensacolae*) was observed. The fertilized eggs were laid by mature adults in March 1, 1971. Some characteristics of fertilized eggs and plankton eggs are described. Plankton eggs collected during the summer season of 1969-70 suggest that the spawning area of this species is located in the region of Ilha Grande, Rio de Janeiro.

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INTRODUCTION

*H. pensacolae* is a common pelagic fish, distributed from Florida (U.S.A.) to Brazil. In Brazil it is not usually used as food and therefore is not subjected to fishery. Literature about egg development of this species is very scarce. Houde & Palko (1970) working with plankton eggs of *H. pensacolae* collected at sea near Florida succeeded in developing them up to the juvenile stage, but only outlined some characteristics.

In March 1, 1971, the author carried out artificial insemination on fishes caught with otter-trawl off Ilha de Santa Catarina at a depth of 50 m. The fertilization was carried out aboard the R/V "Prof. W. Besnard" and the observations on egg development continued on board.

The purpose of this paper is to describe some characteristics of the eggs of *H. pensacolae*. Since this species and the common sardine (*Sardinella aurita*) have very similar spawning behavior and egg characteristics, the data here presented can be used to distinguish them.

METHODS AND MATERIAL

Artificial fertilization was carried out by the wet method. The experiments were made in March 1, 1971 at 15:00 and we used two adult females and four adult males (SL: 127-149 mm) caught at station 1442 (27°44'S-48°23'W).

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The eggs were placed into a 500 milliliter beaker containing sea-water collected from the sea surface at the same station. During the experiment the room temperature varied from 25.0 to 24.3°C.

Our previous experiments with this species revealed that fresh adults with ripe ovaries can be used only for a short period of time after death. Egg removed from adult specimens dead for a long time do not show a normal reaction as for instance the elevation of the egg membrane.

Mature adults with ripe ovaries do not show a ventral enlargement, but with a slight pressure on the abdomen the translucent eggs flow out from a genital pore. Adult fishes used for artificial fertilization are shown in Figure 1.

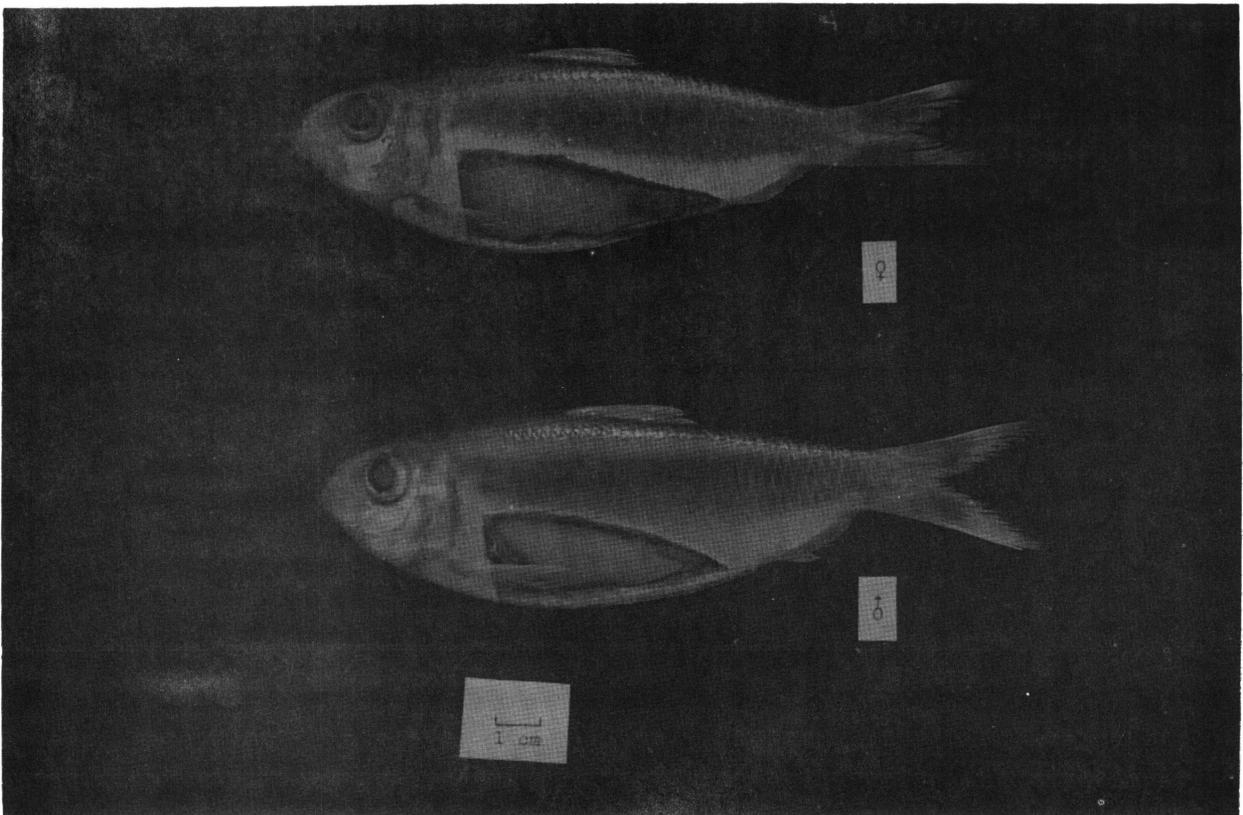


Fig. 1 - *Harengula pensacolata* Good & Bean, used for artificial insemination

#### RESULTS

**DEVELOPMENT OF THE EGGS** - The individual egg is buoyant and spherical in shape; contains a single oil globule in the yolk, and a very wide perivitelline space. The egg membrane is colourless and translucent without any marks on the surface. The first developmental stages of the eggs are shown in Figure 2.

After fifteen minutes of fertilization (Fig. 2,I), many eggs were floating in the middle layer, the egg membrane started to elevate from the yolk mass and some eggs showed first cleavage. A whitish yellow oil globule

appears on the vegetal pole of the yolk mass. This oil globule is smaller than that of common sardine (*S. aurita*) eggs; the former measures a mean of 0.089 mm and the latter 0.140 mm.

After fifty to sixty minutes, the egg membrane continues to elevate and many eggs showed a 4-cell and 8-cell stages (Fig. 2,II).

After two hours (Fig. 2,III), the perivitelline space became very wide, what is typical of this species and the elevation process of the egg membrane came to an end. The cell division proceeded to the morula stage and the eggs floated near the surface with the vegetal pole up. The cell division was regular, and proceeded rapidly at this stage.

After twelve hours (Fig. 2,IV), the eggs were in stage *Ac* (refer to Nakai, 1962). The embryo was well formed, but the eye had not yet appeared. The single oil globule was now located near the tail.

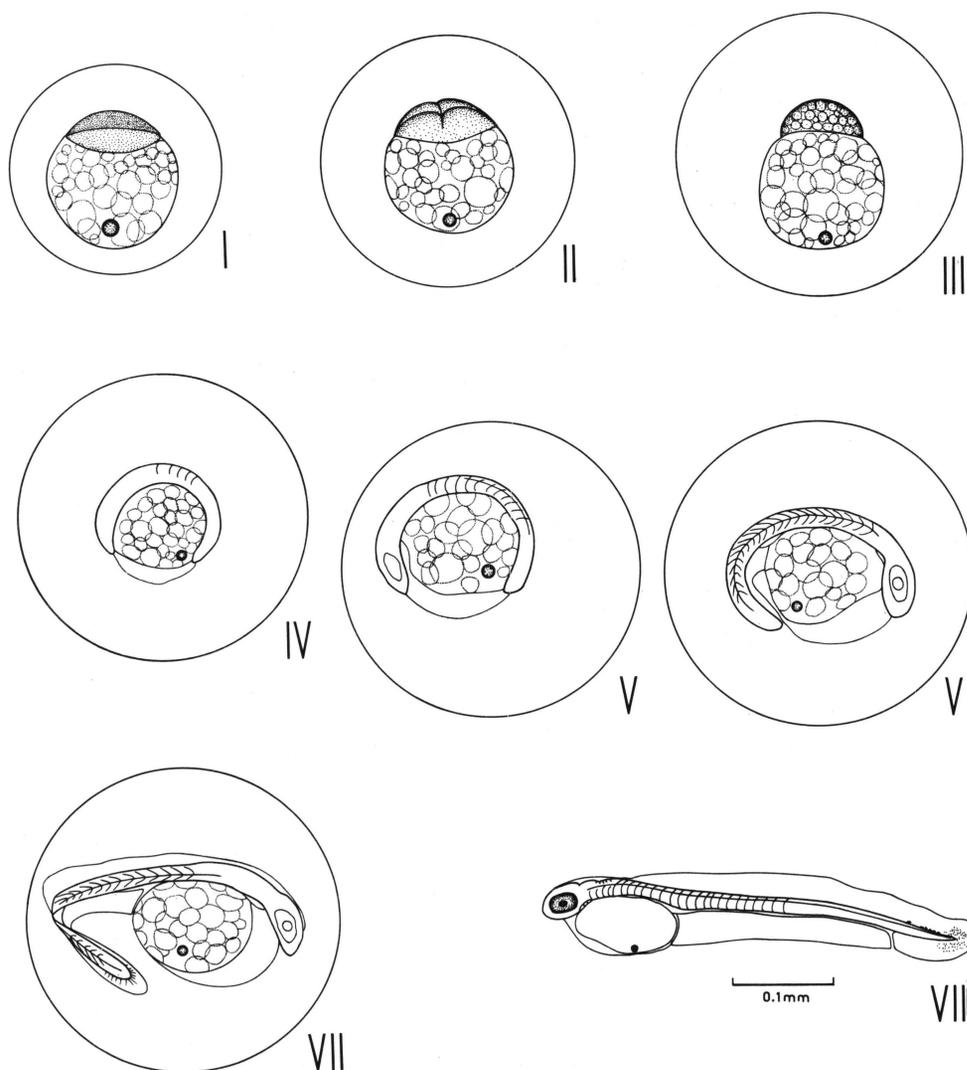


Fig. 2 - Eggs of scaled sardine *Harengula pensacolae*, showing the different developmental stages

FERTILIZED EGGS:

- I - one-cell stage (after 15 min)
- II - 4-cell stage (after 60 min)
- III - Morula stage (after 2 hours)
- IV - Stage *Ac* (after 12 hours)

PLANKTONIC EGGS:

- V - Stage *Bb*
- VI - Stage *Ca*
- VII - Stage *Cb*
- VIII - Newly hatched larva

After this phase the water of the beaker turned putrid and the embryos stopped their development. Histograms of egg diameters at each developmental stage are shown in Figure 3.

The diameters of the eggs after the end of the elevation of the egg membrane (about two hours after fertilization), have a mean of 1.638 mm, and range from 1.48 to 1.72 mm. The 99 per cent confidence limits of the sample mean is  $1.638 \pm 0.019$ , with a range of 1.619 to 1.657 mm. The mean of the oil globule diameter is 0.089 mm, ranging from 0.071 to 0.101 mm, and the mean of the perivitelline space is 0.90 mm.

The egg membrane is a little thicker than that of the common sardine (*S. aurita*) eggs and the yolk mass is roughly segmented.

When fixed in formalin solution, the eggs at the first developmental stages (not yet developed to the gastrula stage) showed cell division deformation and a cloudy appearance of the perivitelline space. Therefore, the deformation commonly observed in eggs at the initial developmental stage in a plankton sample are not only influenced by the physical shock of net collection (Nishimura, 1958), but also by the formalin fixation.

The next stage of plankton egg development, is shown in Figure 2 (stages Bb, Ca, Cb and newly hatched larva). The eggs were drawn from plankton samples collected on the cruises of the Sardine Project realized during the summer season in 1969-70. The method used in sampling plankton eggs was given by Matsuura (1971).

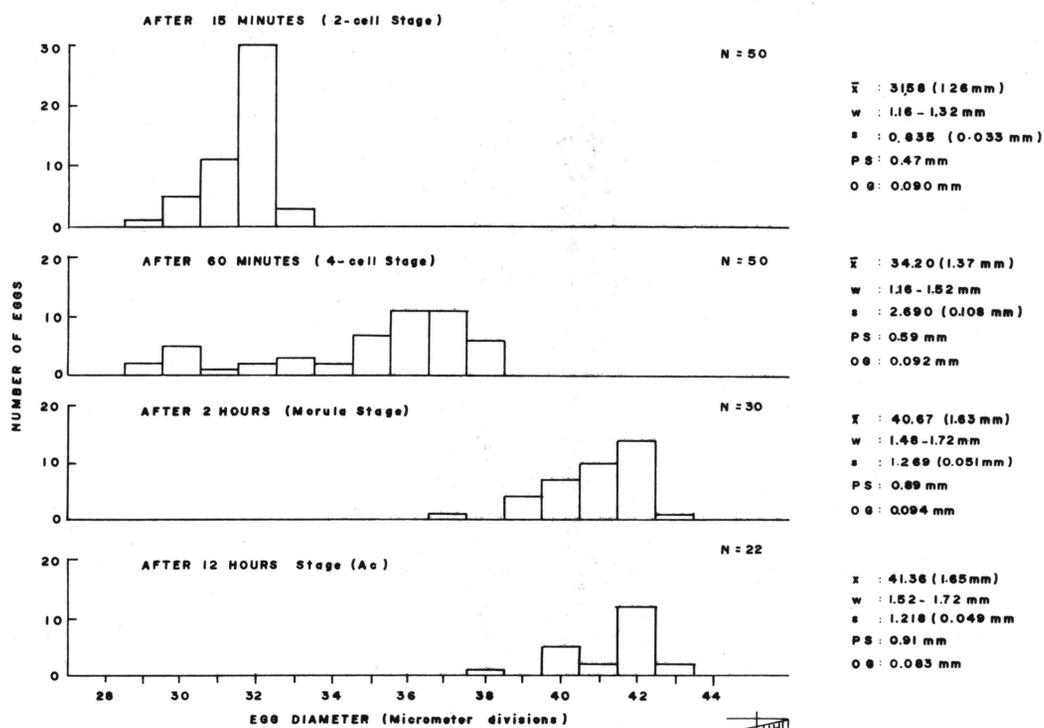


Fig. 3 - Dimensions of fertilized eggs of *Harengula pensacolae*.

One micrometer division = 0.04 mm

$\bar{x}$  - mean egg diameter  
w - range distribution  
s - one standard deviation

N - number of eggs comprising distribution  
PS - mean perivitelline space  
OG - mean oil globule

TABLE I - Occurrence of eggs of *Harengula pensacolatae* in plankton samples during 1969-70 season

Sample No	Date	Time	Position		Local depth (m)	10 m depth		Sampling method**	Eggs dev. stage ***	Total no eggs/plankton sample
			Lat. (S)	Long. (W)		Temper. (°C)	Salinity ‰			
CRUISE JANUARY 30 - FEBRUARY 5 1969										
137	Jan 30	12:00	23°05'	43°34'	37	26.48	35.27	H	(Ca	(32
138	Jan 30	14:15	23°15'	43°30'	62	26.91	35.49	H	(Cb	( 5
141	Jan 31	18:15	23°18'	44°27'	36	26.35	35.27	H	Cb	17
156	Feb 3	07:45	23°07'	44°20'	25	26.58	34.86	H	Ca	1
161	Feb 5	15:55	23°35'	45°07'	20	24.15*	35.52*	H	Cb	7
CRUISE SEPTEMBER 26-30, 1969										
217	Sep 27	15:30	23°19'	44°14'	48	20.00	35.85	V	Bb	2
220	Sep 28	15:50	23°32'	43°33'	48	20.91	35.77	V	(Bb	(16
221	Sep 28	17:00	23°24'	44°36'	44	21.38	35.67	V	(Cb	( 3
									Ca	6
222	Sep 29	15:25	23°14'	44°27'	34	21.07	35.79	V	Bb	1
225	Sep 30	13:00	23°47'	45°03'	42	20.67	35.71	V	Ba	2
226	Sep 30	14:35	23°37'	45°07'	28	21.07	35.65	V	Bb	1
CRUISE NOVEMBER 21-25, 1969										
269	Nov 24	19:10	23°14'	44°12'	43	23.64	35.4	V	Cb	8
270	Nov 25	00:30	23°25'	44°39'	42	22.96	35.2	V	Aa	1
279	Nov 25	23:00	23°39'	45°07'	31	23.24	35.1	V	(Aa	(13
									(Cb	( 7
									( ?	(14
CRUISE JANUARY 06-16, 1970										
310	Jan 12	10:05	23°08'	43°38'	48	19.92	35.09	V	Cb	2
331	Jan 15	19:20	23°39'	45°07'	31	19.62	35.27	V	Ca	3
CRUISE MARCH 21-28, 1970										
350	Mar 22	09:35	23°06'	44°29'	26	20.95	35.37	V	Ca	1
351	Mar 22	13:25	23°04'	44°26'	25	21.55	35.23	V	(Bc	(1
									(Ca	(1
									(Cb	(4
352	Mar 23	13:15	23°05'	44°10'	23	19.20	35.25	V	Cb	5
353	Mar 23	14:35	23°06'	44°06'	20	20.83	35.25	V	Ca	2
371	Mar 28	10:00	24°00'	44°59'	65	20.83	35.48	V	Bc	2

\* 15m depth

\*\* Sampling method: V = Vertical haul; H = Horizontal haul

\*\*\* According to Nakai, 1962

SPAWNING AREA OF *H. PENSACOLAE* IN THE REGION OF ILHA GRANDE, RJ — The spawning area of this species is shown in Figure 4. The figure is based on data taken from plankton samples. Table I shows the occurrence of *H. pensacolatae* eggs collected during the 1969-70 season.

The presence of eggs in the plankton indicates that the spawning season of this species on the region from Cabo Frio to Ilha de São Sebastião, seems to extend, at least, from September to April.

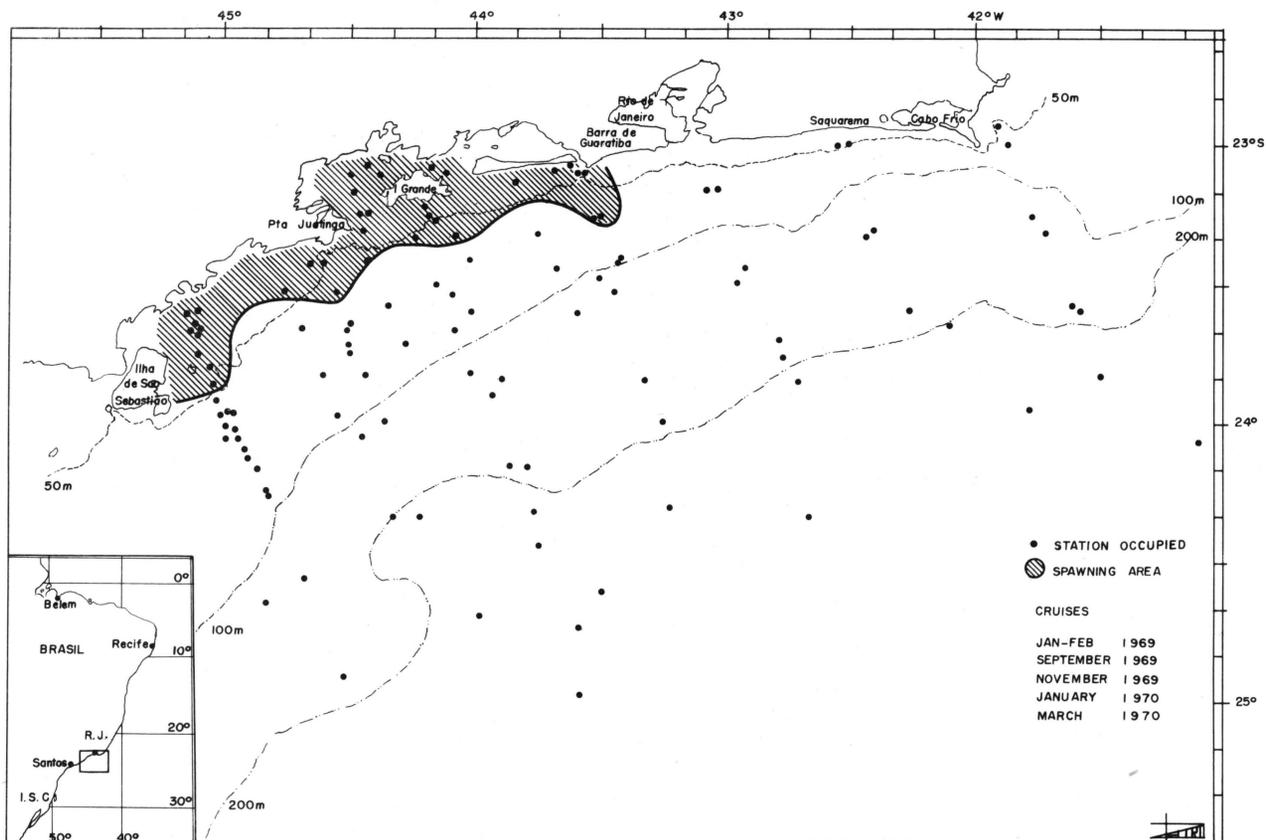


Fig. 4 — The known spawning area of the scaled sardine *Harengula pensacolatae* in southern Brazil

The spawning area of this species is near the coast and does not exceed 10 n.m. from the coast line, and apparently it does not go deeper than 65 m.

The spawning areas of the common sardine (*S. aurita*) and the scaled sardine (*H. pensacolatae*) overlap to a certain extent in this region but while the most intensive spawning ground of the former occurs at sounding depths between 50 to 100 m, that of the latter does not reach 65 m contour.

The maximum number of *H. pensacolatae* eggs collected at one station is 204 and that of *S. aurita* eggs 10,816. The mean egg number per station of the former is smaller than that of the latter (17:999). This fact shows that the spawning intensity of *H. pensacolatae* in the region is weaker than that of the *S. aurita*.

We suspect that the spawning area of *H. pensacolatae* may extend as far as south-western region of Ilha de São Sebastião, but this will be discussed

later when data from samples to be collected in the next summer season will be available.

The temperature at the 10 m depth level in the spawning area ranges from 19.20 to 26.97°C and salinity from 34.86 to 35.85‰. The temperature-salinity range on the spawning area shows that the spawning of *H. pensacolae* occurs in coastal waters.

#### RESUMO

Neste trabalho são apresentadas as observações sobre o desenvolvimento de ovos de sardinha cascuda (*Harengula pensacolae*). Os ovos foram fecundados artificialmente a bordo do N/Oc. "Prof. W. Besnard" na viagem de março de 1971, na região sul do Brasil.

- 1 - Os ovos são isolados e planctônicos. A forma é esférica com um pequeno glóbulo de óleo no vitelo. A membrana do ovo é incolor e sem estrutura na superfície. Os ovos têm espaço perivitelino bem amplo.
- 2 - O valor médio do diâmetro dos ovos é 1,638 mm com a distribuição de 1,48 a 1,72 mm. A média de diâmetro do glóbulo de óleo é 0,089 mm com a distribuição de 0,071 a 0,101 mm. A média do espaço perivitelino é de 0,90 mm.
- 3 - A época de desova desta espécie, baseada na coleta de ovos e larvas, vai de setembro a abril.
- 4 - A desova ocorre nas águas costeiras (não ultrapassa a linha de 65 m de profundidade) com temperatura de 19,20 a 26,97°C em 10 m de profundidade com salinidade de 34,86 a 35,85‰, na região da Ilha Grande.

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