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

Received November 10, 1971

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SYNOPSIS

Egg development of scaled sardine (Harengula pensacolae) was observed. The fertilized eggs were laid by mature adults on 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.

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).

* This study was accomplished while under contract as researcher at the Instituto Oceanográfico da Universidade de São Paulo on a fellowship awarded by the Fundação de Amparo à Pesquisa do Estado de São Paulo - FAPESP.

PUBL. N° 328 DO INST. OCEAN. DA USP.
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.

![Fish Image](image)

Fig. 1 - *Harengula pensacolae* 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. 2,1), 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 *A*o (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.

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

**FERTILIZED EGGS:**

1. one-cell stage (after 15 min)
2. 4-cell stage (after 60 min)
3. Morula stage (after 2 hours)
4. Stage *A*o (after 12 hours)

**PLANKTONIC EGGS:**

5. Stage *B*b
6. Stage *C*a
7. Stage *C*b
8. 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 ± 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 pensacola* in plankton samples during 1969-70 season

<table>
<thead>
<tr>
<th>Sample N°</th>
<th>Date</th>
<th>Time</th>
<th>Position</th>
<th>Lat.(S)</th>
<th>Long.(W)</th>
<th>Depth (m)</th>
<th>Temperature (°C)</th>
<th>Salinity °/oo</th>
<th>Sampling method**</th>
<th>Eggs dev. stage ***</th>
<th>Total n° eggs/plankton sample</th>
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** CRUISE JANUARY 30 - FEBRUARY 5, 1969

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** CRUISE MARCH 21-28, 1970

* 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. pensacolae 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.

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. pensacolae) 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. pensacolae 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. pensacolae in the region is weaker than that of the S. aurita.

We suspect that the spawning area of H. pensacolae 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 35.850/oo. 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 globo 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 globo 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 35,850/oo, na região da Ilha Grande.

ACKNOWLEDGEMENTS

I gratefully acknowledge the collaboration given by various staff members of the Instituto Oceanográfico da Universidade de São Paulo during this study and throughout the preparation of the manuscript. Special thanks are extended to Dr. Gelson Vazzoler and Frank Shaffer of the IOUSP for their critical reading of the manuscript. Special thanks are due to Dr. Marta Vannucci, UNESCO Expert and Dr. Naercio A. Menezes of Museu de Zoologia da Universidade de São Paulo for suggestions and revision of the manuscript.

REFERENCES


