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Scientific Note

First evidence of pompano dolphin (*Coryphaena equiselis*) spawning in the Central Mexican Pacific

MARCELA S. ZÚÑIGA FLORES [1], SOFÍA ORTEGA GARCÍA[1*], HERIBERTO SANTANA HERNÁNDEZ[2] & MA. DEL CARMEN RODRÍGUEZ JARAMILLO[3]

[1] *Centro Interdisciplinario de Ciencias Marinas. Av. Instituto Politécnico Nacional s/n Col. Playa Palo de Santa Rita, La Paz, B.C.S. 23096 México. *Corresponding author: sortega@ipn.mx*
[2]*INP-CRIP-Centro Regional de Investigación Pesquera, Manzanillo, Playa Ventanas s/n; Manzanillo, Colima, 28200 México.*
[3]*Centro de Investigaciones Biológicas del Noroeste, S.C. Mar Bermejo No. 195, Col. Playa Palo de Santa Rita, La Paz, BCS 23090, México.*

Abstract. The reproductive biology of pompano dolphin was studied by gonadal histology. The stages of gonadal development observed in both females and males suggested that this species is a batch spawner. We report the first evidence of the spawning of this species in waters of the Central Mexican Pacific.

Keywords: batch spawning, histology, gonadal maturity, Mexican Pacific

Resumen. Primer registro del desove del dorado *Coryphaena equiselis* en aguas del Pacífico central Mexicano. Se estudió la biología reproductiva del dorado por análisis histológico de las gónadas. Los grados de desarrollo gonadal observados tanto para hembras como para machos sugieren que la especie es desovante parcial. Reportamos, por primera vez, desova de esta especie en el Pacífico central mexicano.

Palabras clave: desovante parcial, histología, madurez gonadal, Pacífico Mexicano

The family *Coryphaenidae* includes only one genus, *Coryphaena*, and two species, the common dolphin *Coryphaena hippurus* (Linnaeus 1758) and the pompano dolphin *Coryphaena equiselis* (Linnaeus 1758) (Palko *et al*. 1982). The pompano dolphin has been found in several regions of the world, but its distribution is not accurately known because this fish is often confused with juveniles of the common dolphin (Shcherbachev 1973, Massutí 1997). *C. equiselis* usually inhabits open waters, but it is also found less frequently in coastal waters. Little is known about its geographical distribution, but it is probably distributed in more tropical and subtropical waters than *C. hippurus* (Collette 1984). The latter species is generally found in waters having surface temperatures above 24 °C (Mather & Day 1954). Information about the pompano dolphin in the Mexican Pacific is scarce, and no information is available about reproductive biology. The objective of this paper is to provide information on pompano dolphin reproduction using

morphological and histological approaches that serve to describe the stages of gonadal development observed in the samples collected in the Central Mexican Pacific (CMP).

Twelve pompano dolphin (7 females; 5 males) were obtained from the commercial long-line shark fishing fleet of Colima, Jalisco, and Michoacán in the CMP) (Fig. 1). The fish samples were collected in three periods: March to May 2005 (1), November and December 2006 (8), and January to March 2007 (3). Each fish was measured for fork length (FL), total weight (W) and the weight of gonads in grams (Wg). The sex was determined by macroscopic observation of the gonads. A piece of each gonad was fixed in formaldehyde (10 %) and transported to the laboratory. Each section was placed in cassettes with varying alcohol concentration (70, 80, 90 and 100%) in order to dehydrate the samples. The tissues were then lightened in xylene and were placed in Paraplast X-Tra with a fusion point of 54 °C -56 °C. From the paraffin inclusions, we obtained 4-µm sections of each gonad using a rotary microtome (Leica RM 2155). For the histological analysis, we stained the sections using a Hematoxylin-eosin (H-E) technique (Humanson 1979). The maturity stages were assigned using the histological classification proposed for *C. hippurus* by Zuñiga-Flores *et al*. (2011). The stages used for females were: early growth (I), secondary growth (II), tertiary growth (III), maturity (IV), spawning (V), and postspawning (VI). The stages used for males were: quiescence class (I), early maturation class (II), midmaturation class (III), late maturation class (IV), and regression class (V). These stages are based primarily on descriptions of general oocyte categories of ovarian development (Wallace & Selman 1981, de Vlaming 1983, Tyler & Sumpter 1996), on the definition of the continuous or discontinuous germinal epithelium, and on the stages of the germinal cells present in the testes (Grier & Taylor 1998). To confirm the female reproductive pattern observed, we measured the theoretical average diameter of the oocyte types present in the gonads analyzed (Saout *et al.* 1999). To measure the oocytes, images were taken with a 40X lens. The Image Pro Plus program (version 6.0) was used to measure the resulting images. The variability of oocyte diameter was analyzed using the Kruskal-Wallis nonparametric statistic (H). The gonadosomatic index (GSI) was calculated using the following equation: $GSI = \left(\frac{Wg}{W - Wg} \right) X\,100$ (Balbontín *et al*. 1993). This index was applied in both sexes.

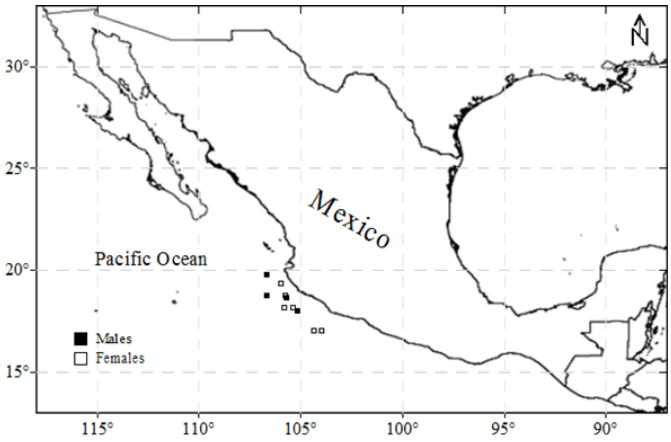

Figure 1. Study area.

Sizes of all pompano dolphin sampled ranged from 23 cm FL to 32 cm FL with a mean of 26 cm FL. The histological analysis showed that three females were in maturity (IV) with a GSI average value of 6.10, 3 were in spawning with average GSI of 4.46 and 1 was in postspawning (VI) with a GSI value of 3.73. Gonad analysis of males showed that 4 specimens were in midmaturation (III) with an average GSI value of 2.13. One male was in late maturation (IV) with a GSI average value of 3.88.

The gonads of the pompano dolphin showed organization similar to the gonads of the common dolphin (Beardsley 1967). The average GSI values observed confirm the maturation pattern of the ovary of the pompano dolphin. Maturation was considered asynchronous because oocytes in different stages are present in the ovary simultaneously (Wallace & Selman 1981, de Vlaming 1983). The same pattern was observed in the common dolphin (*Coryphaena hippurus*) (Beardsley 1967). At least five oocyte types were found (cortical alveoli (Ca), early vitellogenic (Ev), late vitellogenic (Lv), migratory nucleus (Mn) and hydrated oocyte (Ho)) in the observed stages (Figs. 2 -3). The results suggest that the *C. equiselis* could spawn several times during a spawning season and that the CMP could be an important spawning area for this species.

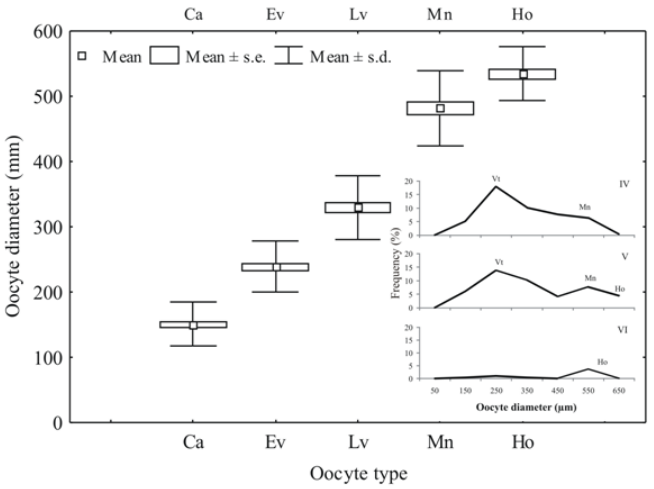

Figure 2. Diameter variation of oocyte types (Ca (oocytes in the cortical alveolus), Ev and Lv (vitellogenic early and advanced oocytes), Mn (postvitellogenic or in migratory nucleus oocytes) and Ho (hydrated oocytes)) observed in three ovarian development stages of the dolphin: IV (maturity), V (spawning) and VI (postspawning) (Kruskal-Wallis test: $H_{(4, n=217)} = 194.68$, $p < 0.05$).

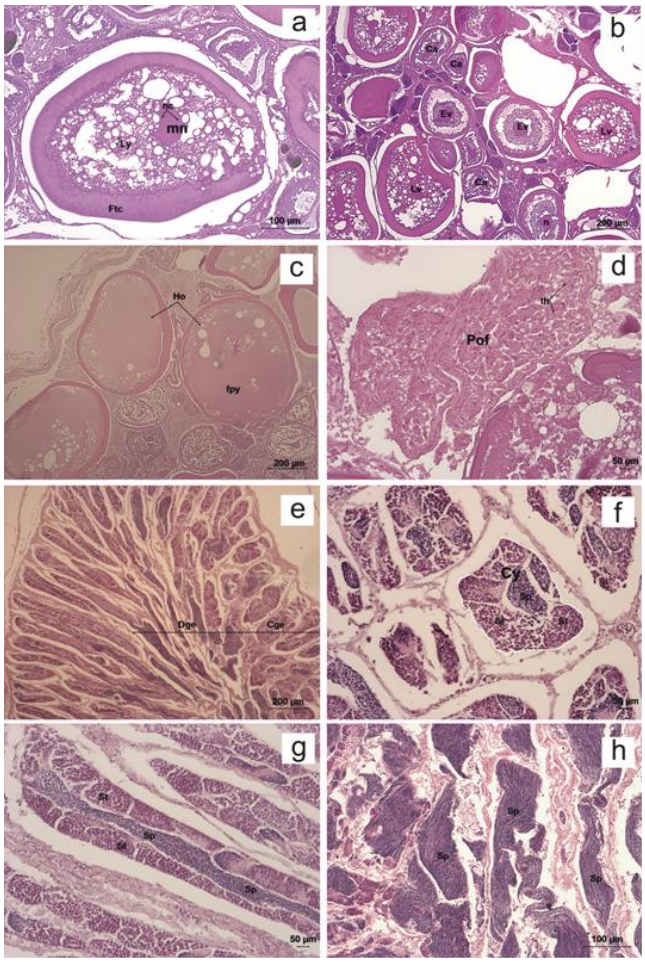

Figure 3. Histological transverse sections of the ovary (a-d) and testis (e-h) of the pompano dolphin (*Coryphaena equiselis*) collected from the spawning grounds (CMP) Stain: Harris´s hematoxylin and eosin. (a and b) females in stage IV or maturity, (c) female in stage V or spawning and (d) female in stage VI or postspawning. (e and f) males in stage midmaturation and (g and h) male in late maturation stage. Mn Migratory nucleus oocyte, nc nucleolus, n nucleus, ftc follicle and thecal cells, Ly lipid yolk, Ca cortical alveolus oocytes, Ev early vitellogenic oocytes, Lv late vitellogenic oocytes, Ho hydrated oocytes, fpy fluid protein yolk, Pof postovulatory follicle, th thecal cells, Dge discontinuous germinal epithelium, Cge continuous germinal epithelium, Cy spermatogenic cyst, St primary and secondary spermatocytes, Sp spermatids.

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