

Embryo development timeline, mating behavior and reproductive parameters in *Sympterygia acuta* (Arhynchobatidae), a common coastal skate species from the Southwestern Atlantic

Diego Martín Vazquez¹, Francisco Rodriguez², Valeria Gabbanelli³, Juan Martín Díaz de Astarloa³, Ezequiel Mabragna³

¹Instituto de Investigaciones Marinas y Costeras-CONICET, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Argentina; ²Aquarium Mar del Plata, Mar del Plata, Argentina; ³Laboratorio de Biotaxonomía Morfológica y Molecular de Peces, Instituto de Investigaciones Marinas y Costeras-CONICET, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Mar del Plata, Argentina.

Studies in captivity on chondrichthyans allow to investigate in detail embryonic development and other aspects of reproduction. Skates are oviparous and their egg cases can be easily maintained under laboratory conditions. Of the nine skate species inhabiting coastal waters from the Southwest Atlantic, embryo development timeline has been performed only in *Sympterygia bonapartii*. Here, we describe for the first time the complete embryonic development with a timetable of *S. acuta*, a coastal species with a marked seasonal reproductive cycle. Other features such as mating behavior, incubation period, size at hatching and sex proportion are also provided, through the study under controlled conditions of captivity. Three mature females of *S. acuta* were maintained in a 20000-liter tank with aerated seawater in a closed system, at Mar del Plata Aquarium. Specimens were kept trying to mimic natural conditions (11-21°C, natural photoperiod) from September 19th to December 22nd, 2017, but one female died by November 14th. A total of 53 egg cases were deposited in a period of 80 days. Egg cases were collected after deposition and placed in floating baskets in the same tank. Four mature males were also present in the tank. Embryonic development was described in detail analyzing a total

of 42 embryos sampled every 14 days. The first half of the embryonic development shows the appearance of the embryonic axis and cranial structures, development and growth of gill filaments, presence of dorsal fins, growth of pectoral and pelvic fins with differentiation into claspers and a pulsatile heart. After 70 days until hatching, the embryo acquires the typical batoid disc, mouth and nares become neonatal, gill filaments are resorbed and spiracles begin to pump bringing oxygenated water into the internal gills, spinulation, epidermal and eye pigmentation are set, and yolk is being absorbed. After hatching, the embryo is fully pigmented, breathes normally, has reabsorbed most of the yolk, and is able to swim independently. Incubation period at 11-21°C was between 89-108 days (mean±S.D., 94.2±5.9 days). Size at hatching ranged from 87-94 mm (mean±S.D., 90±2.5 mm total length), sex ratio (F:M) was about 1-1.1 and viability of egg cases was ~ 98%. Considering the time period shared by the three egg-depositing females (50 days), estimated relative fecundity was 13 eggs/female. Copulation events recorded by video are also described. *Sympterygia acuta* is a good model to carry out studies in captivity on skates, given its rapid adaptability and good reproductive performance.

Keywords: Bignose fanskate, embryonic development, incubation period, copulatory behavior, captivity.