



**Establishment and Operation of a Regional System of
Fisheries *Refugia* in the South China Sea and Gulf of Thailand**

REPORT

**REPRODUCTIVE BIOLOGY OF THE PRIORITY SPECIES
(GONAD MATURITY AND GSI)
BOLINAO, PANGASINAN
(JULY – SEPTEMBER 2021)**

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I. Introduction

Fish reproductive biology is crucial for fishery management (Jakobsen et al., 2009), where managers rely on size at first maturity and the onset and duration of spawning season for managing fisheries (Dias Neto, 2010a). As part of the baseline data collection for the establishment of fisheries refugia in the 3 sites, the gonad maturity and GSI of the priority species were studied. After a series of consultation in Bolinao Site and in reference to the results of the Fisheries Landing Survey and the Ichthyoplankton Survey, the committee decided for the conservation of Siganid refugia. Siganid, locally known as “Malaga”, are among the commercially important fish commodities in Bolinao, Pangasinan.

II. Materials and Methods

Data Collection

The identified priority species selected for the proposed fisheries refugia site in Bolinao, Pangasinan were Siganidae (rabbitfish) based on the series of consultations from the LGU and the fisherfolk. (Figure 1a-1b).

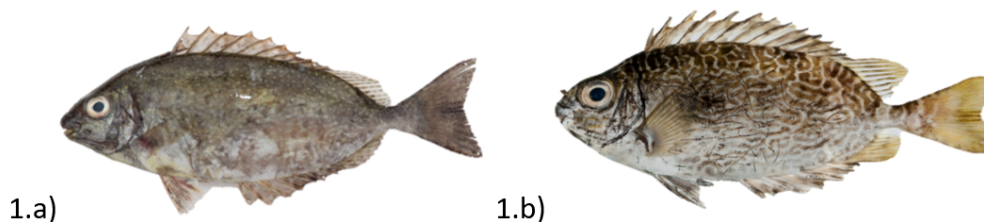


Fig. 1. Fisheries Refugia - Priority Species

Two technical enumerators were collecting the samples for reproductive biology. Ten samples for every species were randomly collected and purchased from the local markets of each site. The samples were dissected on-site daily from April 2021 to March 2022. Total lengths, weight and gonad samples were recorded for each sample. The sex of each fish sample were identified by visual examination (Figure 2). The gonads were dissected and weighed by a digital weighing scale.

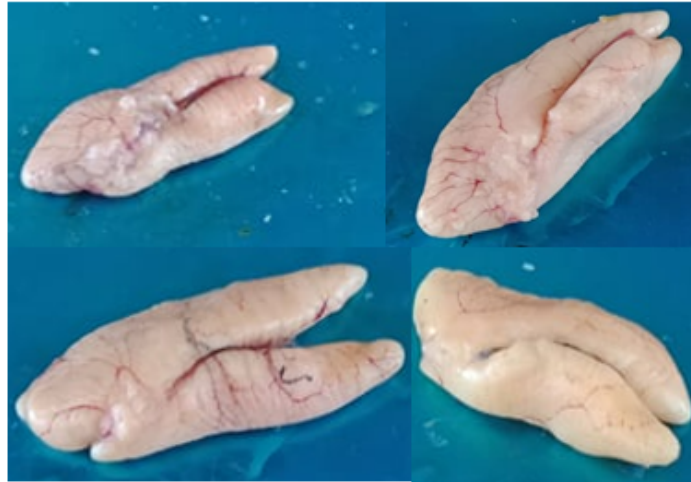


Fig. 2. Gonads dissected from female, *S. canaliculatus*.

Data Analyses

The mean Gonado-somatic Index (GSI) was used to determine the spawning season for each species (Figure 3).

$$\text{Gonado-somatic Index (GSI \%)} = \frac{\text{Weight of gonads (g)}}{\text{Weight of fish (g)}} \times 100$$

Fig. 3. Formula for GSI

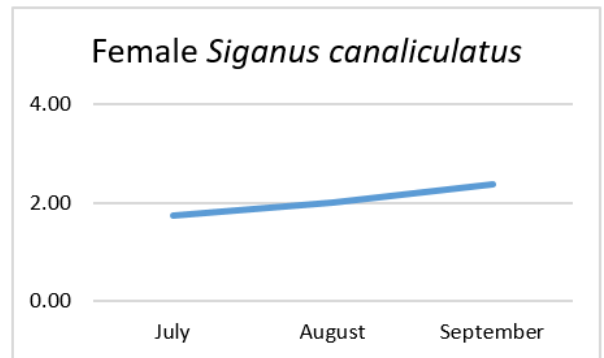
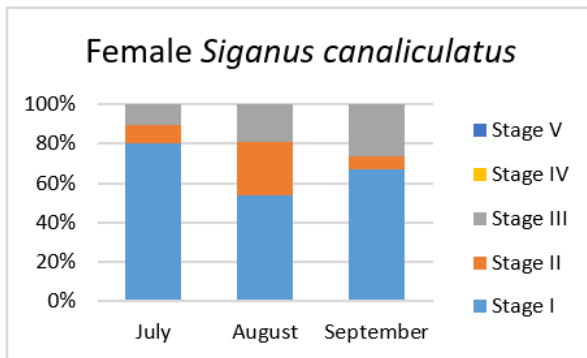
GSI was used to explore peaks of maturity in female gonads per month. After calculating the GSI, the gonads, both male and female, were staged visually. The gonads were identified in stages as: Undifferentiated: J (juvenile). Females: Stage 1 (virgin/immature), Stage 2-3 (mature resting) Stage 4(reproductively developed), Stage 5 (spawning). Males: Stage 1 (virgin), Stage 2 (mature resting), Stage 3 (reproductively developed/ripe), Stage 4 (spawning). The mean GSI values were plotted versus months to search for patterns of reproductive periodicity. The overall sex ratio of males to females was evaluated with χ^2 - test (Sokal and Rohlf, 1995).

III. Results

Siganus canaliculatus (white-spotted spine foot)

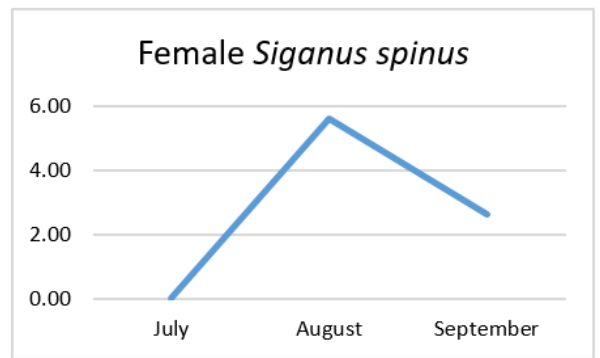
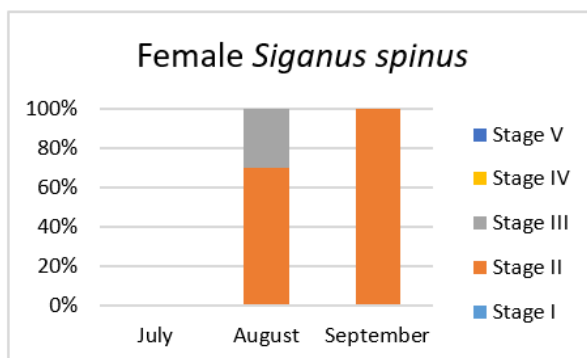
S. canaliculatus comprised 86 females and 423 males, the individuals were obtained between July and September of 2021. Stages I gonad were mainly observed in most months comprising 41-66%, no stages IV and V were recorded for the second quarter

of the sampling. The monthly GSI value for females ranges from 1.75 (± 0.72) to 2.38 (± 0.54).

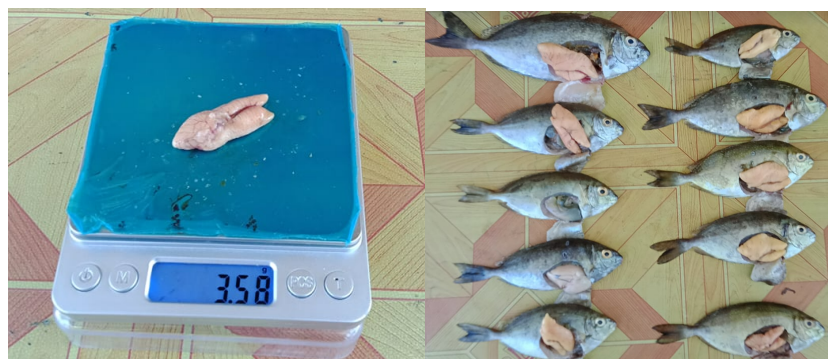


***Siganus spinus* (little spinefoot)**

A total of 15 females and 17 males were recorded for *S. spinus*. Immature gonads were only observed (Stages I and II) comprised about 70-100% and 0-30%. No female samples were recorded in the month of July. GSI result ranges from 2.65 (± 0.14) to 5.60 (± 1.71) for female.



IV. Documentation





V. References

Dias Neto, J. (2010a). *Gestão do uso dos Recursos Pesqueiros Marinhos No Brasil*. Brasília: Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis.

Jakobsen, T., Fogarty, M. J., Megrey, B. A., and Moksness, E. (2009). *Fish Reproductive Biology: Implications for Assessment and Management*. Oxford: Blackwell.

Sokal, R.R. and F.J. Rohlf. 1995. *Biometry: the principles and practice of statistics in biological research*. 3rd edition. W. H. Freeman and Co. New York. 887 pp.