ESTIMATING FECUNDITY AN ASSESSMENT OF THE POPULATION DENSITY OF SEA CATFISH (*ARIUS MACULATUS*) IN PANGUIL BAY

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ABSTRACT: *This study was conducted to gather necessary evidence on the few catches of an endemic species of Sea Catfish, Arius maculatus, in certain parts of Panguil Bay that may lead to the decreasing population density of the said species and to determine necessary actions that must be recommended to prevent further deterioration of the population. Its primary target is to determine the estimated fecundity and population density of the Arius maculatus and how it connects to the fewer catch of fisherfolks among the three sampling sites in Panguil Bay, Philippines. The study used a random sampling capture-based method to collect specimens and a gravimetric method to estimate the number of vitellogenic oocytes present in the ovaries of the collected female sample. Fecundity, as well as the population density of collected Arius maculatus, is assessed and estimated. The study concludes that there is a low fecundity of Arius maculatus in the three sampling sites in Panguil Bay, confirming the few catches among fishers. The estimated fecundity can be used to validate the low of catch further by using its figure in the population density estimation. Population density estimations affirm that there is a decrease in the number of Arius maculatus in Panguil Bay. Further study is advised to directly pinpoint the cause of decreasing population of Arius maculatus in the Panguil Bay area.*

KEYWORDS: *Fecundity, Arius maculatus, Population Density, Panguil Bay, Gravimetric Method, Vitellogenic Oocytes*

1.0 INTRODUCTION

Panguil Bay covers three different provinces: Lanao del Norte, Zamboanga del Sur, and Misamis Occidental. Its geographical location is vast and can be a host of different species that impact the economy and livelihood of the local community of the three provinces. According to [1] Panguil Bay may be small compared to other places, but it is rich in different species of crabs, seashells, and fishes. The possibility is that the pattern of availability of fishes its strength as a function of population size [2].

Local fishermen from an informal interview confess that overfishing is rampant in the area that probably led to the decreasing population of "Tambangongo," the local name of *Arius maculatus* in the Bay area. An extensive investigation that phenotypic changes could occur from a harvested population due to evolution, environmental variation, and overfishing. In addition, fishers can sustain their children's education and support their family's needs in general. Further, fishing provides an adequate income for their survival and likely compiles the curve of low income and boom the locality's economy [3]. This simply implies the imminent danger of these environmental threats to the population of an endemic species that might cause a further decline in the population and possible extinction if not addressed.

According to [4] fecundity may give us a rough estimate of the possible number of spawns that could become mature Sea Catfish provided no other harsh conditions, and unfavorable events could happen along the among all the female catch during sampling, fecundity can be Catfish could be a potential solution to the problem on the sensitivity of *Arius maculatus*, so knowing its morphological behavior is the key in estimating fecundity and population density in general developmental stages of these spawn. According to [5] The use of gravimetric method to estimate the fecundity is the best way measured, and population density can be estimated. According to [6] Observation on the morphology of the Sea By the number of vitellogenic oocytes found

This investigation primarily aims at gathering a piece of significant evidence that, indeed, the Population density of *Arius maculatus* that is said to be endemic in Panguil Bay has few catches of the fishermen and come up with evidence-based conservation measures to protect and preserve this highly particular species of Sea Catfish. However, based on the research [7] that the said species can be found in the Indo-west pacific specifically in the inner gulf of Thailand which has 15,989 individuals. The reproduction of eggs refers to the availability of females and males and also the factors affecting its survival rate, if there is a low fecundity, there is a low density of a species in a particular area [8]. In addition, there was minimal or even no research study conducted about the *Arius maculatus* that assess the current conservation status of this endemic species. For over a decade, very few to very minimal studies were conducted, which occupies a significant gap in the progress and development of literature about this particular endemic species of Sea Catfish. Furthermore, this study provides information that will help the community solve the existing problems like pollution and overfishing that will affect the ecosystem of other different species also living in the Bay. Lastly, this study intends to estimate the population density using the measured fecundity of *Arius maculatus* in Panguil Bay.

2.0 RESEARCH MATERIALS AND METHOD

2.1 Research Design and Research Environment

The study made used of the descriptive comparative research design utilizing various sampling sites of Panguil Bay it includes the different types of processes before the conduct of the research. The researcher further used the capture-based method to collect fish and identify samples species from the three sampling sites; fishnets were the primary tool in catching the needed sample for analysis. A random sample from the three (3) specified various sampling sites of Panguil Bay, namely Barangay Camalan of Lanao del Norte, the City of Tangub of Misamis Occidental, Barangay Maquilao, and Barangay Mantic. Lastly, informal interviews from local fishers are considered data that could be used to analyze and formulate recommendations.

2.2 Research Specimen

Sea Catfish (Arius maculatus) are the research specimen of this investigation, freshwater or marine fish with barbels resembling whiskers around the mouth. Typically, bottom-dwelling, they are primarily found in freshwater or brackish water. Panguil Bay has that type of water that is a favorable habitat for the Sea Catfish. The color of the Sea Catfish is greyish, or sometimes, if the sunlight is reflecting it, it will be brownish.

2.3 Data Gathering Procedure

Catch–Based Method and Identification. After the rigorous process of asking permission and preliminary protocols to the Local Government Unit and the DENR and the BFAR, a scheduled sampling to the three sampling sites was administered. Total catch, Aquatic pH, and water temperature are noted during the sampling sessions. To identify the samples, the researcher adopted the basic preliminary identification process through published references or field guides on Sea Catfish and with the help of Expert/s from Polomolok, South Cotabato, Marine Biologist Dr. Samson A. Mino using pictorial keys taken on the field.

Fecundity Measure using Gravimetric Method. The total number of collected samples (*Arius maculatus*) were counted and identified. Females were separated from males since the main research subject was only a female specimen. The female specimen was subjected to a vitellogenic oocyte extraction process through the use of the gravimetric method or gravimetric sampling. The collected eggs from each sampling period per day were weighed and subjected to the gravimetric method [9].

2.4 Data Analysis and Statistical Treatment

The study made use of the fecundity formula to where then F = Fs x GW/GWs where F = to the estimated fecundity of an individual, Fs = number of the oocyte in a sample, GW = the total weight of the ovary, and GWs = the weight of the sample of the ovary. In practice, it usually is necessary to count more than one subsample from each fish to get a reliable estimate of the fecundity [10]. Another primary significant variable in this study is the population density formula where D_P= N/A, in this *equation*, D_P is the density of population, N is the total population, and A is the total land area [9].

3.0 RESULTS AND DISCUSSION

Table 1. Fecundity of *Arius maculatus* per day.

	Day (Duration of Data Gathering)	Number of Female Catches	Total Mass of Eggs (grams)	Fecundity Sampling Site 1 (Maquilao)	Fecundity Sampling Site 2 (Mantic)	Fecundity Sampling Site 3 (Camalan)	Total
Day 1		9	11	222	228	228	678
Day 2		9	12	257	236	244	737
Day 3		13	12	244	265	249	758
Day 4		11	13	262	268	280	810
Day 5		11	11	234	216	256	706
Day 6		12	12	233	241	248	722
Total		65	70	1452	1454	1505	4411

The table shows the estimated fecundity per sampling site. One primary significant observation that can be drawn from the obtained data is that the sampling site is that all the obtained fecundity or number of eggs were consistently very close to each other. Day 4 obtained the highest level of fecundity in the third sampling site while the lowest fecundity is on the first sampling site during the first sampling period. It was also noticed that site one and two almost have the same total fecundity with a very slight difference. Further, the researcher caught a male *Arius maculatus* during the data gathering, even if the data wasn't shown on table 1 it is a must that the researcher indicate the number of males being caught during the data gathering, the total male were caught is 105 out of 170 Sea Catfish and 65 of it is female *Arius maculatus* in which were used for the extraction of the eggs for estimation of fecundity. Furthermore, the highest numbers of the female catch are during the third day however, during extracting their eggs, a few of the fish does not have an egg that reflects less mass in grams being computed. Threats to eggs include changes in water temperature and oxygen levels, flooding or sedimentation, predators and disease that may affect the production of eggs, or sometimes the fish may not develop an egg due to unknown reason at all [11]. This simply connotes that fecundity and productivity could vary essentially over time and other environmental factors. Morphological and physiological attributes of fish could be altered and changed due to tremendous fishing. The decline of productivity could be due to the overexploitation of fish, such as overfishing. Accordingly, in a region where overfishing is observed, fish would develop fewer eggs when they are not given a chance to recover from a series of catches. The high demand for this variety of Sea Catfish in the market would compel fishers to overexploitation in the fishing ground leading the productivity of fish in terms of egg production to decline. Accordingly, favorable environmental factors would increase the fecundity level of Sea Catfish, while unfavorable environmental factors decrease fecundity among Sea Catfish production. The highest total fecundity per day is on day 4. It shows that the fish being caught has great eggs may be due to environmental factors such as the number of productive males, amount of available food, and other environmental factors that could affect the production of the egg [12].

The total fecundity obtained amongst the three sampling sites from the

Table 2. Population density Estimate

Sampling Sites	Total Fecundity (Number of Sea Catfish)	Estimated land Area (Panguil Bay)	Population density Estimate
Barangay Maquilao (1)	1452	60 km^2	24.2 Sea Catfish/km^2
Barangay Mantic (2)	1454	60 km^2	24.2 Sea Catfish/km^2
Barangay Camalan (3)	1505	60 km^2	25.1 Sea Catfish/km^2
Total	4411	180 km^2	24.5 Sea Catfish/km^2

six days of sampling is considerably moderate relative to the possible annual measure. This connotes that there are still enough eggs that would be available for the next generation. However, are these figures obtained in the investigation sufficient to maintain the species' population for the next generation and onwards? An average range of eggs production of varied species of Sea Catfish during each breeding period from April – June would rich to around 20,000 spawns still attainable. However, others[13] confirmed that it depends on the species. confirm that with this value, there is still a need for us to prevent the alteration of the environmental condition so that it would not disrupt the natural order of the egg fertility process. In addition, based on the data that may link this to the new assumed batch of the population, it may lower due to the factors affecting the survival rate of this future new fish that will be added to the population of *Arius maculatus.* Data is shown from table 1 that the total fecundity is low which can be linked to the decline of the population through this estimated fecundity that may affect the future population of *Arius maculatus*. The data shows that sampling site 1 has a total of 1452 and an estimated land area of 60 km^2, resulting in 24.2/km^2. Sampling site two is 1454 with an estimated land area of 60 km^2, resulting in the estimated population density of 24.2 species/km^2; for sampling site 3, it has 1505 with an estimated land area of 60 km^2, which resulted in 25.1 species/ km^2. The total estimated fecundity for the three sampling sites has 4411 and an exact land area of 180 km^2, and a total estimated population density of 24.5 km^2 in the whole Panguil Bay.

4.0 CONCLUSION

The low Fecundity level of the three-sampling site significantly denotes the low population density of the endemic species of *Arius maculatus* in the whole Panguil Bay area. The potential reproductive method through Fecundity estimation and gravimetric measurement confirms a low egg production of *Arius maculatus* in Panguil Bay due to exploitation, overfishing, and pollution that is brought about by improper fisheries management and irresponsible human activity of the locality. Moreover, the estimated fecundity level that reflects the declining population density could serve as an ecological threat that might lead to further decrease in population and, if not addressed, would probably result in an unprecedented extinction of species.

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