Hasil Turinitin Nomei fish (Harpadon nehereus, Ham. 1822) reproduction biology in Tarakan waters

by Taqwa Taqwa

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Abstract. Nomei fish (*Harpadon nehereus*) is one of the fish that has important economic value in the waters of Tarakan. This species is caught in waters with trawl fishing gear. In this study, *H. nehereus* fecundity is described based on 1100 female specimens captured in Tarakan waters from November 2016 to October 2017. The spawning season is predicted to occur twice a year, namely December-February and June-August, and reaches peaks in February and June. The average fecundity was 38,731 ± 7,757. The average sex ratio (female / male) was 0.94.

1. Introduction

Fecundity is the maximum physiological reproductive potential of an individual during his lifetime and is one of the main pillars of population theory and applied biology. Many strategies have evolved to form patterns in fecundity so that lifetime reproductive success is maximized under the selective pressure of evolution experienced by an organism. Fecundity is an important component of sexual reproduction. There are two main categories of temporal patterns in fecundity, namely semi-transparency (the production of offspring only once during the life of the organism) and iteroparity (repetitive production). Factors that influence temporal fecundity variations include age, length-weight relationship, population density, partner choice, and environmental variability [1].

In the world, Nomei Fish (H. nehereus) is known as “Bombay Duck”. The fish is widespread in the Western Indo-Pacific from India to the Solomon Islands [2]. The maximum length of a Nomei Fish can exceed 40 cm, and generally between 10-25 cm. This species is benthopelagic and is oceanodromous, living in brackish water and seawater, which can be found in soft-water coastal and estuary waters. Occupy deep waters off the coast for most of the year, but also gather at river mouths to find food during the rainy season. These aggressive predators prey on small fish [2–4].

The bottom trawl is one of the fishing gear used to catch fish of this species. Nomei's fish catch in Indonesia increased from 12,200 tons in 1990 to 15,200 tons in 1995 [2]. This fish is marketed fresh, dried or smoked. Nomei fish production in the world from 2010 to 2014 was 225,306 tons; 207,569 tons; 257,384 tons; 277,119 tons and 257,206 tons, respectively [5]. Its production declined to 230,633 tons in 2017 [6]. The reduced production of this species is thought to be caused by overfishing. Overfishing is one of the problems in the utilization of fish resources. Uncontrolled capture of economic species can cause

extinction [7]. This research is an attempt to preserve Nomei fish species. Research on fecundity is useful in efforts to protect species and regulate fishing so that sustainable fisheries can be realized.

Table 1. Nomei fish production in Tarakan waters.

Year	Production (ton)
2001	58.8
2007	73.5
2010	84.9
2011	150

Source: Local government for marine and fisheries of Tarakan.

2. Materials and methods

2.1. Location

This research was conducted for one year in the waters of Tarakan Island. A sampling of Nomei fish was carried out at the Tibi Strait location (see figure 1). Sampling is done every tide period (twice every month). Sample analysis was carried out at the Biology Laboratory of the Faculty of Fisheries and Marine Sciences, University of Borneo, Tarakan.

Figure 1. Sampling location.

2.2. Sample

100 fish samples were taken every month. All fish were measured in total length (TL) to the nearest 1 mm and weighed with a digital scale (0.01 g).

2.3. Parameter

The parameters observed included reproductive biology aspects, which are Gonad Maturity Level (TKG), Gonad Maturity Index (IKG), fecundity and sex ratio. TKG determined morphologically include the color, shape, and size of the gonad. Gonad development is qualitatively determined by observing TKG I-V based on gonad morphology. Fecundity was estimated by counting the number of eggs in the female fish gonad (50 head), carried out on the gonad with TKG IV. The method used to estimate fecundity is the gravimetric method. The total weight of fish gonads was measured, then preserved with 4% formalin. Observation of egg samples was done by taking three parts of the sub-gonad, namely anterior, middle and posterior. The weight of the sub-gonad is measured using a digital scale with a precision level of 0.01 gram, then the number of eggs is calculated using a magnifying glass and a hand counter.

2.4. Data analysis

IKG is calculated based on a comparison of gonad weight and the overall bodyweight of fish using the following formula [8]:

$$\mathbf{GSI} = \frac{\mathbf{G_m}}{\mathbf{B_m}}$$

Explanation: GSI = Gonad maturity index (%).
G_m = Gonad weight of the fish (gram).
B_m = Total weight of the fish (gram).

Fecundity is determined by the gravimetric method using the formula:

$$F = \frac{S1 + S2 + S3}{SW1 + SW2 + SW3} * W$$

Explanation: F = Fecundity (item)
S = Gonad weight (gr)
SW = Gonad sample weight (gr)
W = The number of eggs in the gonad sample (butir)

Sex ratio is calculated by the formula:

$$Nk = \frac{M}{F}$$

keterangan : Nk = Sex ratio
M = Total amount of male fish (head)
F = Total amount of female fish (head)

3. Result and discussion

The distribution of TKG (Figure 2) shows that Nomei fish with TKG V were found in January, February, June, and July. This indicates that the Nomei fish spawning season occurs twice a year. Spawning peaks occur in February and June. Slightly different spawning times occur on the coast of Saurashtra, India, in which the spawning times occur in December, January, and June [9]. The time difference in the spawning process can be caused by various conditions such as water quality, the availability of food nutrition, and environmental conditions. Spawning is the peak of the reproductive cycle, so the factors that affect

reproductive maturity will also affect spawning. Environmental factors such as temperature, oxygen, adequate and appropriate diet, water conditions, light, meteorological conditions are important factors that control fish reproduction [10,11].

The size of the fish when it was first mature gonad has been reported by several researchers which were 24.4 cm; 25.5 cm, and 22.1 cm [9,12,13]. In this study, it was found that the fish began to mature gonads at a size between 20.1- 21.0 cm. The decrease in fish size when gonads begin to mature indicates environmental pressures on fish populations [14].

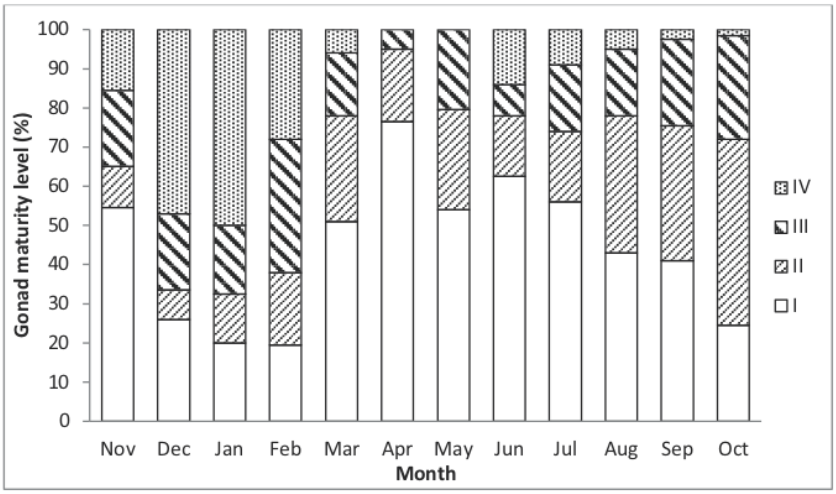

Figure 2. The distribution of Gonad Maturity Level

IKG value increases along with the development of gonads from TKG I to TKG IV. However, the IKG value decreased at TKG V.
The range of IKG values in female fish is higher than male fish (Table 3).

Table 2. IKG values (%) based on TKG.

TKG	Male	Female
I	0.03 – 0.18	0.02 – 0.14
II	0.19 – 0.41	0.15 – 0.43
III	0.42 – 0.73	0.44 – 1.13
IV	0.74 – 8.77	1.14 – 9.76
V	0.07 – 0.29	0.15 – 0.39

Nomei fish fecundity ranges from 6882 to 71539 eggs, the larger the size of the fish, the more eggs are produced (Table 4). Bodyweight has a significant correlation with fecundity [15]. [13] reported that the estimated fecundity was an average of 314 eggs / g of fish. Fecundity estimates involve a number of assumptions and may differ depending on species reproduction strategies [16].

Table 3. Fecundity based on fish length.

Long (cm)	Fecundity
20.1 – 21.0	10433 ± 3551
21.1 – 22.0	26196 ± 6927
22.1 – 23.0	40156 ± 8183
23.1 – 24.0	55632 ± 9463
24.1 – 25.0	60878 ± 10661

Sex ratios affect the rate of growth and trajectory of the evolution of the population. Sex ratios affect population dynamics. Besides, it is also affected and affects recruitment, mortality, immigration, and emigration. The sex ratio is measured as the ratio of the number of male and female individuals. Male and female sex ratio 1: 1 is an evolutionarily stable strategy [17]. Overall, the sex ratio between males and females is 1.00: 0.93. In this study, the sex ratio varies every month. The range of sex ratio is between 1.00: 0.85 to 1.00: 0.98. Variations in sex ratio are mainly caused by various physiological and ecological mechanisms, including temperature, salinity, season and interactions with other species. Predation may be a very important factor [18]. The highest sex ratio occurs in December just before the spawning season. These results are similar to previous studies with an overall sex ratio of 1: 0.99 [19]. Female dominance occurs between September-December and reaches its peak in November and December.

4. Conclusions

The peak spawning season of this species is thought to occur in February and June. The highest number of females is found in December before the spawning season.

Acknowledgment

I would like to thank Professor Jamaluddin Jompa and Professor Darmawan who have helped and motivate the authors to write this article.

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