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Sosodek (*Atherinomorus lacunosus*) fish resources in the coastal waters of Labobo Island and Bangkurung Island, District of Banggai Laut, Indonesia

Evron Asrial[1]*, Daduk Setyohadi [2], Erwin Rosadi[3], Nego Elvis Bataragoa[4], Muhammad Marzuki[5], Hamid[1], Aryani Rahmawati[1], Rusmin Nuryadin[1]

[1] *Department of Fisheries Resource Utilization, Faculty of Fisheries, University of 45, Mataram, West Nusa Tenggara, Indonesia*

[2] *Department of Fisheries Resource Utilization, Faculty of Fisheries and Marine Science, University of Brawijaya, Malang, East Java, Indonesia*

[3] *Department of Fisheries Resource Utilization, Faculty of Fisheries and Marine Science, University of Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia*

[4] *Department of Waters Resource Management, Faculty of Fisheries and Marine Science, University of Sam Ratulangi, Manado, North Sulawesi, Indonesia*

[5] *Department of Aquaculture, University of Mataram, Mataram, West Nusa Tenggara, Indonesia*

I. Back Ground

Indonesian coastal marine is a habitat for several species of silverside fish groups, one of which is a fish of sosodek (*Atherinomorus lacunosus* Foster, 1801). Fish of sosodek has many names including the hardyhead silverside, slender hardyhead, pitted hardyhead, robust hardyhead [1], broad-banded hardyhead [2], and wide-banded hardyhead silverside [3]. We embed the common name for *A. lacunosus* originating from Banggai waters is Banggai Hardyhead Silverside.

Sosodek species of fish live in coastal waters of Banggai region (Central Sulawesi, Indonesia) since more than a century ago. According to [4, 5], the entire Indo-Pacific waters are the waters of East Africa to Tonga, Japanese waters (north to south), and Australian waters (south to north) is a habitat of *A. lacunosus*. Its spread from the Mediterranean Sea, the Indian Ocean through the Suez Canal, to the Pacific Ocean [6], South Africa [7], in the Seychelles Islands [8], in India [9], and in the Marshall Islands [10]. In addition to living in Banggai (Indonesia), *A. lacunosus* also found in the waters of Anambas Islands (Indonesia) [11]. The Tunisian coastal waters are habitat for the species of *A. locunosus* that called "exotic silverside" [12].

Banggai community is utilizing sosodek for daily diet, and some people use it as bait for fishing coral reef fish. Sosodek fish dishes are favored by the Indonesian navy soldiers under the command of General Soeharto (ex the Indonesian President 1966-1998) when stopped in Banggai. Historically, before the fleet of warships Indonesia will head West Irian (now: Papua Province) to fight against the Netherland army in 1962 via command of "Operation of Mandala", they stopped in Salakan (Banggai). Local people flocked to help the Indonesian navy soldiers. Help the main thing is the people presenting cuisine sosodek sour soup to soldiers every day (pers. com. Amin, 2016).

The main benefit of sosodek fish for the community of Labobo Island and Bangkurung Island is for everyday consumption. Type of culinary is "sosodek sour sauce" dish is eaten with a meal of fried potato of Banggai "classy" for residents Labobo Island and Bangkurung Island (pers. com. Manaf, 2016).

II. Meaning and Name of Sosodek

According to the Banggai language, the word of "*soso*" means compressing or pressed, and the word "*dek*" is sealed across the gap (usually used on sailing ships). Thus, "*sosodek*" can be translated loosely to "strengthening the group (to avoid interference)" (pers. com. Masridin, 2016).

Labobo society calls sosodek fish with the name of "indigenous fish" and "stubborn fish" (naughty fish). It said indigenous fish because: (a) sosodek fish dishes served on customary deliberation activities, and (b) the custom/tradition Labobo and Bangkurung eating sosodek in everyday life. This fish is called a stubborn fish because the fish can only be eaten with two hands.

III. Utilization of Sosodek

Sosodek fish resources utilization form of fishing activities carried out only by residents of Labobo Island and Bangkurung Island. Fishing activity takes place in the waters just Labobo and Bangkurung since more than a century ago. Sosodek fishing ground located in the area of coastal waters around the Labobo Island as far 2-10 meters from the shoreline. Bottom waters ramps (flat) with the base substrate is rocky and/or sandy,

the water depth ranges from 30-100 cm. Until 10 years ago, the waters of the Mansalean Village (Labobo) is the best fishing ground of sosodek. But this time the villagers are no longer seeing sosodek at the waters of village. Sosodek move to other waters are lots overgrown with large trees that canopy juts into the coastal waters around the Labobo Island. This species is able to adjust its phenology to the environmental conditions [6].

Labobo residents who work as fishermen sosodek as many as six persons since 2009, which captures sosodek each week came from the Island of Labobo. While Bangkurung Island residents who catch sosodek not work as fishermen of sosodek, and they only catch sosodek just before releasing sperm and eggs (spawning).

Means of fishing used by each fisherman of Labobo Island consists of fishing gear in the form of nets (scoop net) with diameter of 6 meters (1 unit) and fishing vessel (1 unit). In addition to the nets, fishermen has also operated a beach seine, but currently has no longer operated to capture sosodek. While the fisherman of sosodek in Bangkurung Island using gear types of scoop net. During the study (February-March 2016), sosodek fish longest size is 10.66 cm. For comparison, a body length of sosodek fish caught in the waters of New Caledonia reach 14 cm [6].

Sosodek fishing operation is average of eight days (fishing days) per month or 96 days per year (for 12 months/year). Sosodek fishing time took place from morning to evening for 12 months in a year. Period sosodek ultimate arrest lasted only 6 months/years is the period from July to December when the spawning season.

Sosodek fishing activities is an activity one day fishing trip. Fishermen set out from home base in the morning and return in the afternoon. In each trip of sosodek catch, the fishing operation activities do as much as 10-14 times in several fishing ground. The fishermen caught sosodek an average of 200 kg in each fishing trip. The sosodek are then put into a plastic bag each of approximately 1 kg/bag, and sold for IDR 2.000-3.000,- per bag (US$ 0.15-0.23). Thus, the fishermen income of sosodek could be expected to reach Rp. 1.6 million - 2.4 million (US$ 119-178) per month

Fishermen sell sosodek by visiting villages in its path when it would return to his village after the completion catch sosodek. Target of sosodek consumers are housewives in every village. Thus, this sosodek market type is a monopoly market that there is one seller and many buyers, whereby the seller (fishermen) to function as a price maker, while the buyer/consumer (housewife) as price takers.

IV. Mass Reproduction (Uniqueness)

Sosodek is endemic fish, and its main habitat in the waters around the Island of Labobo (Sub-district of Labobo) and the Bangkurung Island (Bangkurung Sub-district), District of Banggai Laut. Living in coastal waters with swimming area 0-20 meters from the shoreline, and the waters depth of 2-3 meters. Observations result on the ground was that the colony of sosodek is really like to gather under the boat dock because protected from the heat of the sun.

Sosodek adolescents and adults settled in Labobo Island waters. While Boniton beach waters (Bangkurung Island) serve as area to release and whole eggs hatch, only lasts for 6 months per year. Natural spawning occurs once every month during the period July to December when the fish measuring 10-12 cm/individual. Another version says that sosodek perform mass reproduction of each month throughout the period of one year. In New Caledonia, *A. lacunosus* has several spawning periods during the year [6].

Sosodek (male & female) may be pregnant in bulk and simultaneously in the waters of Labobo Island. They swam together are clustered toward the waters around Labobo Pauno Island (Small Labobo Island) on the night of 14 AH so that we will never see a sort of sosodek fish in the waters of Labobo Island. The whole sosodek then unite to form resembling/similar large fish, then went swimming at night 15 AH toward spawning areas in waters of Boniton beach, and arrived in these waters before dawn to spawn.

The process of releasing sperm and eggs throughout sosodek place after dawn that preceded the male fish release sperm (up white waters) and females release their eggs. When releasing sperm and eggs, sosodek body in an upright/standing on your head at the top of the water, and shaking his body. The whole of sosodek experience "broken belly" and fainting (torpor) after the spawning process is completed. The fish that are blackouts regained consciousness when the sun is shining bright (about 7 am). Furthermore, the entire sosodek are in a state of broken belly swim together leaving the Bangkurung waters to the waters of Labobo.

Genesis of unique mass reproduction of sosodek fish continued and repeated continuously every year at the time and the same waters. This event has been going on since more than a hundred years ago. This mass reproduction gives adversely affect to the existence of a population of sosodek fish resources. Sosodek fishing activities that harm sosodek fish populations take place ahead of sosodek releasing sperm and eggs. With all the effort, people catch as many sosodek fish most delicious that when they are pregnant.

V. The Level and Status of Exploitation

To estimate the potential stock of reserves and catchment of sosodek, then the analysis used is a model developed by Hilborn and Walter (1992). Results of linear regression analysis based on the model of Hilborn and Walter (1992), the value a = -778.2605, the value of b_1 = 64.9866, b_2 = -1.4243, and b_3 = 0.3211, with a

value of R^2 = 96.77% (CpUE variations can be explained by variations in fishing effort of 96.77%). Subsequently obtained value of r (the natural growth rate of the stock biomass constant) = 64.9866, the value of q (catchability coefficient) = 0.3211, and the value of k (carrying capacity/maximum carrying capacity of the natural aquatic environment) = 142.089. By using the parameter r, q and k then the stock position at this time (standing stock) acquired potential stockpiles of sustainable (Be) on the current conditions of sosodek fish in the waters of Labobo and Bangkurung of 71.044 tons/year.

Referring to yield of sosodek on 2015 amounted to 115.20 tons, the level of exploitation sosodek amounted to 187.05%. If it is associated with the opinion of Dwiponggo (1987), the sosodek exploitation status already is in the depleted category, which means "reserve of sosodek fish resources drastically reduced every year so that the sustainability of resources is very threatened, the fishing effort must be stopped".

Sosodek population decline caused by the death because of it fishing factor, especially those carried out by the local fishermen who catch sosodek in conditions gonads mature. Sosodek mass catch are carried out by fishermen when sosodek swim from waters of the Labobo Island to the waters of Labobo Pauno Island, and toward the waters of Boniton beach in the Kanari Village (Bangkurung Island) through Labobo Pauno Island, for spawning. Such conditions occur repeatedly every mid-month in the year of AH. The result is not going on spawning and the absence of a new generation of sosodek.

According to resident of the Mansalean Village (Labobo Island), a drastic reduction of sosodek population thought to be caused by: (a) mortality due to fishing mortality in spawning season and destructive fishing (bombing), and (b) emigration due to logging trees on the beach (sosodek shelter). If such circumstances is allowed to happen then it is very likely sosodek fish will disappear from the waters around the Island of Labobo and Bangkurung Island as happened on the Bakalan Island where sosodek who has been missing since 1975.

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