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Fisheries resources status of Selabung River during pre construction of Komering 2 Dam, Tigadihadji, South Sumatra

M Marini [1], Husnah[2*], Vipen[1], R M Purwoko[2] and E Prianto[2]

[1]Research Institute for Inland Fisheries and Extention Palembang
[2]Center for Fisheries Research, Pasir Putih 2 East Ancol North Jakarta, Indonesia

[*]Corresponding author
Email : samhudi_husnah@yahoo.com

Abstract. In the period of 2015-2019, 45 dam will be constructed in Indonesia. One of them is a cascade Komering 2 dam constructed in Selabung river, a tributary of Komering river, located in Tiga Dihadji District, South Sumatra. The present Perjaya irrigation dam which was built in 1991 in the down stream of Komering 2 reservoir experienced sedimentation and habitat loss of floodplain fisheries resource. Construction of Komering 2 dam could give negative effects to aquatic and fisheries resource of Selabung and Komering river. The information on the present state of fisheries resources in Selabung prior to the dam construction is important so that the impact of dam construction could be determined. A study in order to get information on the current state of fisheries resource in Komering 2 dam was conducted at three sampling sites in February and September 2018. Parameters observed were habitat characteristics and fish resources. The data was collected through field sampling and structured interview with the fishermen. Results of this study revealed that at the up stream, the riparian area is undisturbed covered by dense conservation forest while at the down stream inhabited by 300 families and 10 % of them are fishermen. Riparian area was covered by agriculture comodity. River bed was covered by peeble stone with most of water quality parameters still fulfil water quality standard of Indonesian regulation. Twenty three (23) fish species were recorded and six of them were dominant. Degradation of fish resources is noticed indicated by loss of 4 fish species, decreasing catch of 5 fish species, two introduced fish species and decreasing individual size of economical fish such as mahseer.

1. Introduction

Healthy aquatic environment has an important role for freshwater organisms. Every anthropogenic activities in freshwater ecosystem such as river could alter the structure and function of aquatic communities [1][2]. Damming the main river body for certain purpose could change river connectivity [2] and its ecosystem quantity and quality [3][4][5].

Selabung River, tributary of Komering River, administratively lies in three districts. A new cascade second Komering reservoir will be constructed in this river. In a period of 2015-2019, 45 new reservoirs will be constructed in Indonesia and one of them is located at Sukabumi village, Tiga Dihadji District, South Sumatra. Construction of reservoirs or dams is a part of Indonesian strategic development planning to support food and water security[6]. The current Perjaya irrigation dam built in 1991 in the down stream of proposed second Komering has already faced some issue such as sedimentation and habitat loss of floodplain fisheries resource both in the upper dan down part of the Perjaya dam. Construction of 2nd Komering reservoir could give more influence to aquatic and fisheries resource of Selabung and Komering river. Fisheries resources information in Selabung prior to reservoir construction will provide baseline data to predict the post impact of dam construction [7] [8]. The objective of this study was to verify the present state of fisheries resources (aquatic environment and fish resources) before contruction of 2nd Komering Dam.

2. Methodology

2.1. *Data collection*

Study in order to get information on the present state of fisheries resource in Komering 2nd prospective reservoir was conducted at Tigadihaji district, South Ogan Komering Ulu Regency, South Sumatra in February and September 2018. Three sampling sites were selected based on the river zone which are upper, middle and down stream of the prospective 2nd Komering dam. The upper stream site (Tangga Batu) located approximately 1 km to the prospective dam. The middle and down stream sites located at Kuripan and Kota Agung village (figure.1).

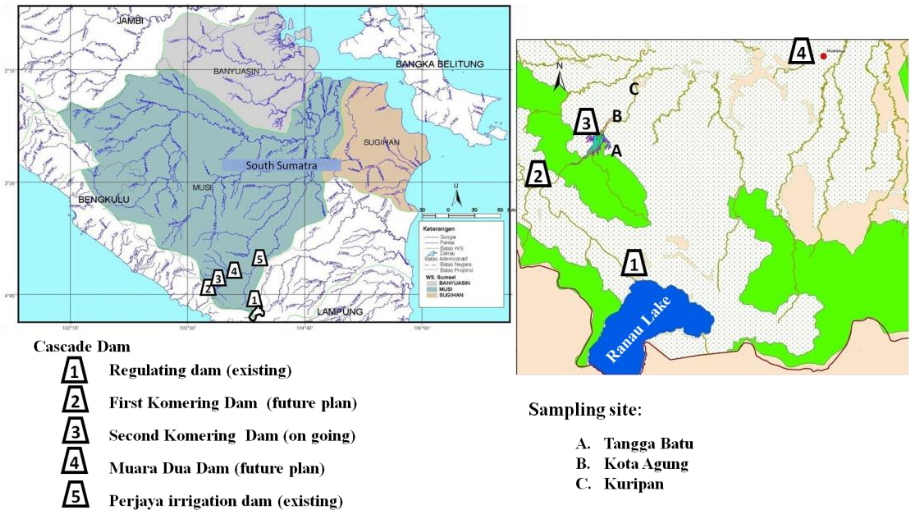

Figure1. Map showing Komering cascade dam and sampling site along Selabung River, South Sumatra, Indonesia (modification of Ministry of Public Work River System map [9][10]

Data collected consisted of habitat characteristics and fisheries resources. Habitat characteristic parameters were water and sediment qualities, riparian condition, aquatic organisms (attached algae, phytoplankton, zooplankton and macrozoobenthos), while fisheries resources measured were fish diversity, fish production potential and fisheries issue.

Habitat characteristics and fisheries resources parameters were collected through field sampling, structured interview with local fishermen having experience more than 5 years, and secondary data. Surface water samples were taken directly from the river by using 3 plastic bottle samples with the volume of 1 L each and then preserved at temperature of 4°C for laboratory analysis. Sediment samples were collected by using 900 cm^2 surbur sampler and preserved at low temperature (4°C). Measurement of water and sediment quality parameters were conducted in-situ and ex-situ (appendix A).

Phytoplankton were collected directly by submersing 500 mL plastic sample bottle and preserved with Lugol's solution. Sampling of zooplankton was carried by filtering 50 L surface water through a plankton net with mesh size of 60 µm and preserved them with 10% buffer formaldehyde solution. Periphyton samples were collected by using circle scouring pad with a diameter of 2.8 cm in 5x5 cm^{-2}

substrate (stones and dead tree log) and diluted them to 150 mL distilled water. Periphyton samples were scraped for abundance and biomass measurement. For identification and abundance measurement, samples were preserved with Lugol's solution.

Macrozoobenthos samples were divided into two portions; one for identification and abundance measument, while the other portion for biomass measurement. Composite sampling for macrozoobenthos was conducted by using 900 cm^{-2} surber sampler with 50 x 50 cm^2 quadran transect into 5 sampling points at each sampling site. Samples were sieved through 50 x 50 cm^{-2} wooden box with wire mesh size of 1mm and then put into plastic bags and preserved with 10% buffered formaldehyde.

Identification of phytoplankton and periphyton followed [11] [12] [13], while zooplankton was identified according to [14]. Macrozoobenthos was identified by referring to references such as [15] [16] [17] [18] [19].

Samples collected were brought to Research Institute for Inland Fisheries and Extention laboratory, while sediment samples were sent to Soil Laboratory of Sriwijaya University, Palembang.

Except fish production potential, most of fisheries resources (fish diversity, fish catch and fisheries issue) data were obtained from structured interview and secondary data. Fish production potential was measured with rapid appraisal assessment based on macrozoobenthos biogenic capacity Leger-Huet method and transfer energy from producer (periphyton and macrozoobenthos) biomass to fish.

2.2.*Data analysis*

Water and sediment quality data were analyzed descriptively. Current status of water quality condition was determined by comparing the concentration of all water quality parameters with the concentrations stated in Indonesian Government Regulation Number 20 Year 1990 for Water Pollution Control. In addition, cluster analysis with single linkage clustering [20] was conducted to determine the similarity of water and sediment quality parameters among the sampling sites.

The abundance of phytoplankton, periphyton and zooplankton and macroozoobenthos were calculated based on [21]The biomass of periphyton and macrozoobenthos were analyzed with gravimetric approach and the results were converted to calories where 1 mg carbon equal to 9.88 calories [22].

Fish production potential (kg/ha) was estimated with rapid appraisal approach based on biogenic capacity of macrozoobenthos of Leger - Huet method [23] and productivity of producer [24] through trophic level transfer from periphyton to macrozoobenthos and fish. Leger-Huet formula was as follow:

$$K = BLk$$

Where:
K = Yearly aquatic productivity or standing stock ($kgkm^{-1}$ of river)
B = Biogenic capacity (Macrozoobenthos)
L = Mean river width
k = Productivity coefficient

To determine the productivity of producer to consumer, the biomass of periphyton (carbon) was converted to calorie. The percentage calorie transferred from periphyton to macrozoobenthos was estimated as 2.8% and to forage fish 0.7% [25]. To produce 1 kg of fish, 517 kilo calorie (kcal) is needed [26]. From these fish production potential estimation, only 30-50% of them are potentially harvested [27]. In this study percentage of fish available for harvest was 40% and fish production potential was calculated as follow:

$$Fish\ Production\ Potential\ (FPP) = \frac{(PPe \times 9.8 \times 2.8\% \times 40\%)}{517}$$

Where:
PPe : Productivity of periphyton (Carbon $kgha^{-1}$)
9.8 : Convertion factor from carbon to calorie
2.8%: Calorie transferred from periphyton to macroozoobenthos feeding fish
40% : Availbale fish production to harvest
517 : Calories need to produce 1 kg fish

$$Fish\ Production\ Potential\ (FPP) = \frac{(PPe \times 9.8 \times 0.7\% \times 40\%)}{517}$$

Where:
0.7% : Calorie transferred from periphyton to forage feeding fish

Other fisheries resource data such as fish production trend, fish diversity, and fishing activity were analyzed discretely

3. Results

3.1. Aquatic environmental quality

Selabung river is small order stream and one of water sources for Musi River. The elevation of three sampling sites; Tangga Batu (Sukabumi), Kota Agung and Kuripan, are 228, 194 and 172 above sea surface level (SSL). River bed of Tangga Batu was covered by cobble to boulder with particle size of 64 mm to more than 256 mm, while at Kota Agung and Kuripan they were mostly covered by peeble stone (16-63 mm) and sandy to sandy-loam soils sediment. The river width was in the range of 52.75-61 m and the water depth in the range of 0.26-0.75 m. This river is categorized as clear and fast flowing water with water transparency and current velocity in the range of 0.71-0.75 m 0.94-2.10 m $second^{-1}$ respectively. According to State Minister of Environment of Regulation Indonesia number 28 year 2009, this river was also classified as oligotrophic to mesotrophic indicating by low chlorophyll *a* (0- 2.54 μgm^{-3}) and total phosphorus (10-24 $\mu g\ L^{-1}$).

Descriptive analysis on 22 water and sediment parameters indicated that all parameters were in the range of allowable limit of A class criteria of Indonesia Government Regulation number 20 year 1990 on pollution control meaning that the river has not been polluted yet (appendix. B).

Cluster analysis on water and sediment parameters in three sampling sites in February resulted in two groups. The first group was Tangga Batu site and the second group consisted of 2 sites; Kota Agung and Kuripan site (figure 2).

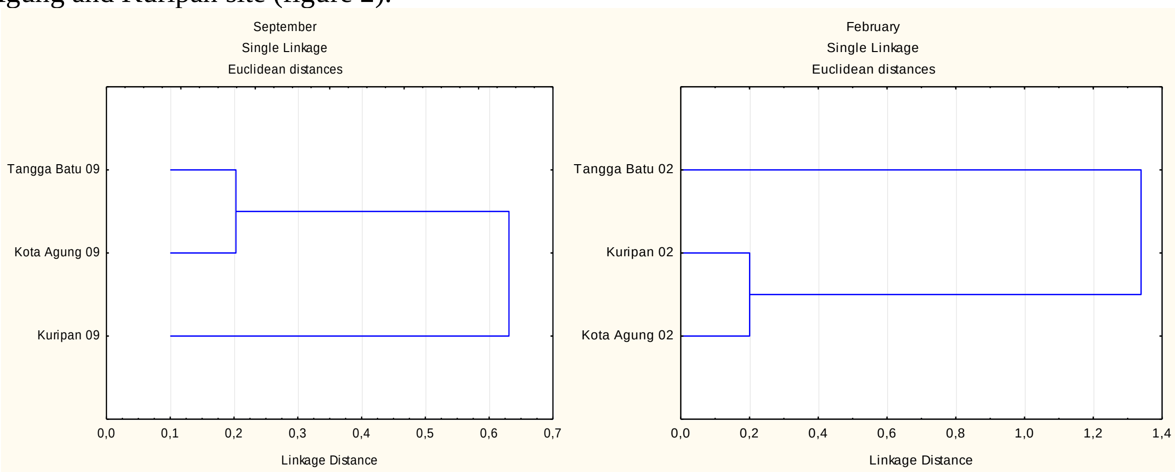

Figure 2. Cluster analysis of 22 water and sediment parameters of 3 sampling sites in Selabung river, South Sumatra in February and September 2018.

The first group (Tangga Batu) was characterized by low concentration of organic carbon, silt and clay fraction in the sediment, low concentrations of conductivity, chlorophyll *a*, and total phosphorus, and high concentration of sand fraction in sediment, pH, chemical oxygen demand (COD), nitrite and ammonia in the water. The second group (Kota Agung and Kuripan) was characterized by high concentrations of organic carbon, silt and clay fraction in the sediment, high concentrations of conductivity, chlorophyll *a*, total phosphorus and low pH, nitrite and ammonia in the water.

In September, on the contrary, the cluster analysis resulted into two groups and it was different from February analysis. The first group belong to Kuripan sites and the second group belong to Tangga Batu and Kota Agung (the bordering village of Tangga Batu). Kuripan site was characterized by high organic carbon and silt fraction in the sediment, low turbidity, total suspended solids, dissolved oxygen, COD, chlorophyll and high nitrate concentration in the water (appendix. B).

Alteration in water and sediment quality quantitatively or qualitatively influenced community structure such the abundance and composition of aquatic organisms in the river including phytoplankton, zooplankton, periphyton and macrozoobenthos. Identification on phytoplankton found 15 genus of Bacillariophyceae, 5 genus of Cyanophyceae and 12 genus of Chlorophyceae. Selabung river has low phytoplankton abundance. In February, phytoplankton abundance in Tangga Batu, Kota Agung and Kuripan was 6480, 2900, and 5960 cell L^{-1}respectively, while September they were 2120, 1500, 1900 cell L^{-1}. Phytoplankton community structure were mostly dominated by Bacillariophyceae both spatially and temporally (figure 3). A similar condition was also recorded in zooplankton, where 7 genus of zooplankton was found, and 4 of them (*Difflugia, Euglena, Phacus and Trachelomonas*) belong to Mastisgophora and 2 genus belong to Monogononta. Mastigophora is the dominant genus both spatially and temporally (figure 4). The number of genus and abundance of zooplankton varied spatially and temporally. In February the abundance in Tangga Batu, Kota Agung and Kuripan site were 17, 0, and 33 ind.L^{-1} while in September they were 14, 14 and 21 individu L^{-1} respectively. The lowest number of genus and abundance were recorded in Kota Agung site in September.

Periphyton (attached algae) and macroozoobenthos play an important role in carbon and energy cycle of river ecosystem. These organisms are also use commonly as pollution indicator. Similar to phytoplankton, periphyton community was composed of three class of Bacillariophyceae (22 genus), Cyanophyceae (3 genus) and Chlorophyceae (13 genus). High contribution of periphyton in the Silabung river were reflected by their abundance and biomass. In February, their abundance in Tangga Batu, Kota Agung and Kuripan sampling sites were 14.920, 55.060, and 24.260 million cellm^{-2} respectively, while in September they were 52.32, 6.360 and 12.600 million cellm^{-2} respectively. Periphyton abundance increased 3 three folds in Tangga Batu site from February to September, while it was inversely happened in bordering village (Kota Agung) where the abundance decreased about eight folds and two folds in Kuripan site. Analysis on periphyton composition revealed that Bacillariophyceae was still the dominant class in Selabung river followed by Cyanophyceae and Chlorophyeceae (figure 5).

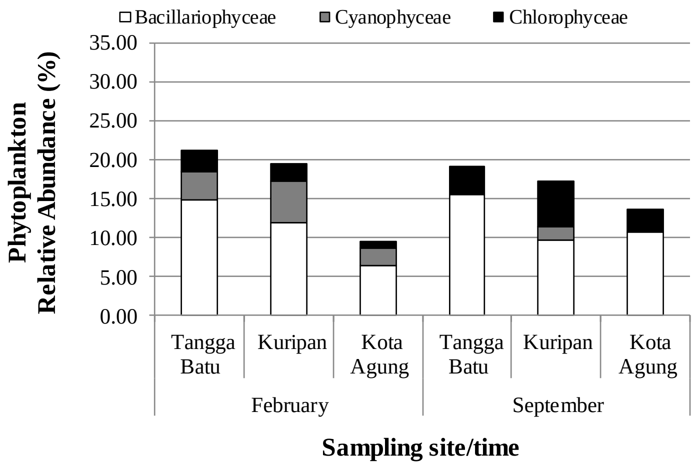

Figure 3. Relative abundance (%) of phytoplankton groups at three sampling sites of Selabung river, South Sumatra in February and September 2018

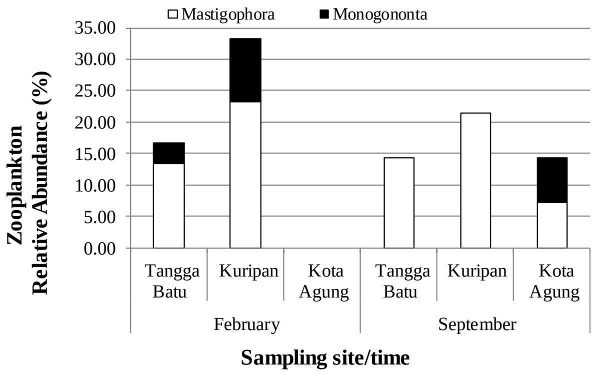

Figure 4. Relative abundance (%) of zooplankton groups at three sampling sites of Selabung river, South Sumatra in February and September 2018

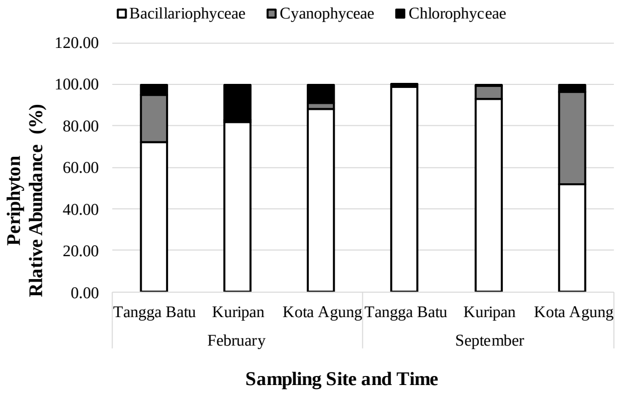

Figure 5. Relative abundance (%) of periphyton groups at three sampling sites of Selabung river, South Sumatra in February and September 2018

Identification and measurement of macrozoobenthos were conducted only in February while macrozoobenthos collected in September could be not be analyzed due the long queue of proccess.analysis. Macrozoobenthos in Selabung river were composed of 11 families, 9 of them belong to Insect and 2 families belong to Gastropode. The abundance of this organisms in Tangga Batu, Kota Agung and Kuripan were 176, 420, and 121 individual m^{-2} respectively. It showed that the abundance increased along with increasing elevation site. Chironomidae and Caenidae are the dominant families in Tangga Batu and Kota Agung sites whereas Thyaridae and Physidae (figure 6).

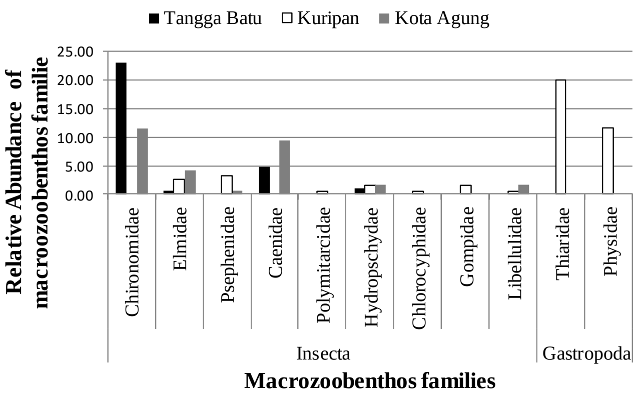

Figure 6. Macrozoobenthos composition at three sampling sites of Selabung river , South Sumatra in February 2018

Structured interview with local fisherman who has more than 10 years experience showed that there were alteration of water and enviromental quality since the construction of dam at the outlet of Ranau Lake to Selabung river, and the construction of first Perjaya dam in 1991 at the down stream of the 2nd Komering dam. Turbidity is related to water level. During low water level (May to August), Selabung river was clear; moderate turbidity occurred during moderate water level (September-November) and high turbidity when water levelwas high (Desember-April).

3.2.Fisheries resources

The number of people live in the vicinity of three sampling sites aproximately 300 people and 10% of them are part time fishermen. The main income of the local people are derived from agriculture activities such as coffee plantation and rice farming. There is limited information on fish resources such as diversity, abundance, and other biological aspects in 2nd Komering dam area. Landuse is comprised of protected forest and steep contour areas. The only available mode of transportation to proposed 2nd Komering dam is motorcycle rental which its return cost was 250 thousand rupiah. Available fisheries data was derived from a study conducted in Ranau Lake, upper part of Selabung river, tributary of Selabung river to Komering river (Muara Dua district), Martapura and the fifth and the last cascade dam (Perjaya irrigation dam built in 1991) in Komering river drainage area.

In 2006-2007, the number of fish species recorded at 5 locations from the source of water to the downstream of Perjaya dam ((Ranau lake, Selabung river (upperstream of 2nd Komering dam, Komering river/Martapura, Perjaya dam, and Cempaka Village/Komering river) was 10, 13, 23, 28 and 6 species, respectively. The dominant species in Ranau lake was mostly benthopelagic fish such as hampala barb (*Hampala macrolepidota)* and green river cat fish (*Hemibagru*s nemurus).In *Selabung* river it was dominated by hampala barb and minnow (*Puntioplites bulu*) and mahseer (*Tor douronensis, T. tambra, T. soro,* and *T. tambroides*), in Martapura green river catfish followed by tin foil barb (*Barbode schwanenfeldi*), fake tinfoil barb (*Puntiosplites waandersii*) and hampala barb.

While in Perjaya they were fake tinfoil barb, *si umbut* (*Labiobarbus leptochella*), *milom* (*Labeo chrysophekadion*), dalum (*Bagarius yarelli*) and java/silver barb (*Barbonym gonionotus)* and in Cempaka it was tin foil barb, silver barb, and *green river catfish* [28] The number of fish species in Perjaya dam in 2014 decreased to 21 species [29].

Estimation of fish production potential (standing stock) with Leger and Huet method of three sampling sites in Selabung river indicated higher fish standing stock (figure 7). There was a tendency that the standing stock decreased along with low water level. In Kota Agung sites fish standing stock decreased three folds in September from 258.68 kg/ha to 84.37 kg/ha.

Estimation of fish production potential with transfer energy from producer to consumer (productivity of periphyton) gave a lower fish standing stock (less than 200 kg/ha) than Huet and Leger method (figure 8). Figure 8 is also shown that direct estimation of standing stock through transfer energy from producer to consumer resulted a higher standing stock of macrozoobenthic fish feeder than periphyton fish feedr.

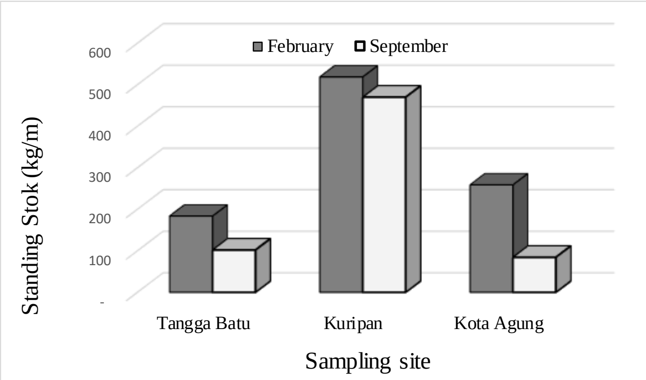

Figure 7. Standing stock of fish based on Leger and Huet method at three sampling sites of Selabung river, South Sumatra in February 2018

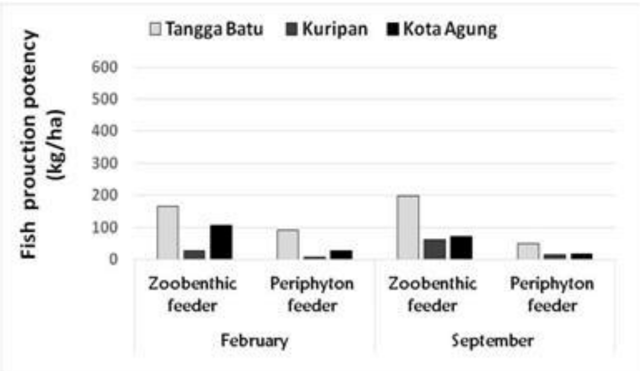

Figure 8. Fish Production Potential at three sampling sites of Selabung river, South Sumatra in February 2018.

Structured interview with fishermen on fisheries resources and their issue occured in Selabung river noted that fishing activities along Selabung river depend on water level and turbidity. In the upstream, fishing gears used was hook and line operating for the whole year, whereas longline was operated during high water level and turbid water. At the down stream, the fishing gears operated were hook and line and long line operated during high water level, while drift gillnet and cash net was operated at moderate water level. Issues facing the local people and fishermen were decreasing in fish resources and captured fish size. There is no any fisheries regulation that led to decreasing fish resources. There were three dominant species of *Bagarius yarelli*, *Schistorynchus heterorhynchus* and *Hemibagrus nemurus* from > 15 kg fish^{-1} to 0.5 kg fish^{-1}. Fish species which is scarce at present are *Rasbora* sp., *climbing perch*, small catfish and *Oreochromis mossambicus.* New introduced fish species recorded in Selabung was nile tilapia (since 2006) and cattle fish (since 2017).

4. Discussion

4.1. Aquatic environmental quality

The dynamic of inland ecosystems is related to the terresterial antrophogenic activities and the pulse of water level [25]. In Selabung river, the presence of dam at the outlet of Ranau lake and Perjaya dam at the downstream of 2nd Komering river, influence the water and sediment qualities. Varied group characteristics resulted in cluster analysis of water and sediment quality were driven by the water level. In February the big linkage among the first group (Tangga Batu) site and the second group (Kota Agung and Kuripan) was related to rainfall in the range of 200-300 mm [30] that increased the water velocity, flushing of the river bank that suspend the soils material from the river bed resulted in an increase in conductivity, total dissolved solids, and decreasing chlorophyll *a*. On the contrary, in September where the rainfall was in the range of 50-100 mm, water and sediment quality of Tangga Batu and Kota Agung was different from Kuripan sites (figure 2). Low water level created more slow water velocity and caused deposition of organic carbon on the river bed and total suspended solids in water column. It was indicated by more silt fraction in soils sediment in Kuripan site. Oligotrophic to mesotrophic state of Selabung productivity could be related to the presence of reserved forest at the upper part of 2nd Komering river dam. Approximately 138,61 hectare of this forest will be cut down (and flooded after 2nd Komering river dam project completed). This alteration would change the ecosystem from lotic to lentic type and all of their assemblages.

The species number and abundance of phytoplankton at three sampling sites were related to fast water current/velocity in the range of 0.94-2.10 m second^{-1} even though total phosphorus occurred in moderate concentration (0.107- 4.9 mg $^{-1}$). The swift flow of water causes the short time for phytoplankton to grow and live in this area. Based on the water velocity value, Tangga Batu site was categorized as steep gradient or cascade habitat type characterized by high turbulence, white water, velocity more than 50 cm/s, substrate cobble, boulder course exposes, slope 4-7%, and flat bed stream reach [31] This habitat type reduced the water residence time and it could not support phytoplankton growth and reproduction. Previous study at the head of Selabung river (outlet of Ranau lake to Selabung river) showed a similar result where phytoplankton abundance was low, 1388 to 1700 cell L^{-1} in March and 34-230 cell L^{-1} in September [32]. [33] mentioned that the abundance of phytoplankton mostly related to conductivity and total dissolved solids. However, in this study high phytoplankton abundance was recorded in Tangga Batu when the conductivity was lower than that in Kota Agung and Kuripan. Out of three phytoplankton classes, Bacillariophyceae, known also as diatom, was dominant both spatially and temporally. This phenomenon could be related to their ability to respond to environmental degradation at the assemblage level through shifts in dominant taxa and diversity pattern, as well as at individual level. Species composition changed related to current velocity [33]. Similar to phytoplankton, steep and cascade habitat along with high current velocity could explain for low genus and number of zooplankton in upstream of Selabung river. The dominance of Mastigophora at all sites and sampling time may related to their great capacity of adaptation, even when nutrients are scarce [34].

Like phytoplankton, Bacillariophyceae dominated the periphyton community at all sampling sites and sampling time, however this periphytic Bacillariophyce abundance was extremely higher than that planktonic Bacillariophyceae. It could be related to the biological character of periphytic Bacillariophyceae living by attached to the substrate and moderate concentration of total phosphorus concentration in the water column and sediment. Decreasing in periphyton in September was related to low rainfall 50-100 mm, nutrient and mineral run off from the terrestrial and increasing in silt fraction on the sediment (appendix.B). Concentration of total phosphorus in Tangga Batu, Kota Agung, and

Kuripan changed from 14.62, 20.70 and 24.30 µg L^{-1} in February to 12.50, 12.30 and 10.7 µg L^{-1} in September.

Macrozoobenthos diversity and abundance were related to substrate type, water level and water velocity. High abundance of Chironomidae and Caenidae in Tangga Batu and Kota Agung sites were related to fast water velocity, clear water and diverse substrate type not only pebble particles but also cobble and boulder. The bigger the particle the more the particle embedded to the bed of river [31], and it provide habitat for Chironomidae and Caenidae to protect them from fast flowing water behind the boulder and cobble particles. Chiromidae has a wide feeding guild from predator, collector, filterer, shredder whereas Caenidae has more specific feeding guild as collector [35] [36]. The occurrence of protected forest at the upper part of Tangga Batu site, could contribute to the detritus such as dead materials from three flowing rivers through all sampling sites. In Kuripan site with river bed covered by pebble and smaller particles, both Physidae and Thiaridae dominated the macrozoobenthos community. Physidae is group macrozoobenthos occurred as scraper feeding guild and live attached to gravel and pebble. These small particles gave a suitable habitat for Physidae. Thiaridae is an invasive family which is also indicator of clear water. There are limited information on the interaction among these families since most of available data was based on family level and not to genus level.

4.2. Fisheries resources

Fish resources in Selabung river and the upper part of Komering river are mostly threatened by physical habitat modification in term of construction of cascade dam starting from the source of the water located in the outlet of Ranau lake to Selabung river and upper part of Komering river. At present there are two existing dams already established which are Ranau lake regulation dam and Perjaya irrigation dam built in 1991, followed by on going 2nd Komering dam project, and next two propose dam, 1st Komering and Muara Dua dam (figure 1).

The presence of regulation dam at the outlet of Ranau lake disconnect the water flow from and to Ranau lake and Selabung river, and decrease the water level faced by some villages located at the downstream of the proposed 2nd Komering (structured interview with people in Kota Agung and Kuripan village). This disconnectivity affected spawning migration from Ranau lake to Selabung river of mahseer, the economic fish of Ranau lake and Selabung river. Mahseer is a carnivorous fish feed on small fish and prawn [32] and they spawn during rainy season on the shallow water with river bed covered by cobble to gravel particles. In 2006-2007, none of this species was recorded in fishermen catch from Ranau lake, but they were still contribute to the fishermen catch at the upper part of Selabung river with relative abundance in the range of 1.35 to 10.78% [28]. [37] reported that most valued species in fishery are found notably impact and might become endangered because of dam construction. In addition [38] mentioned the important connectivity for certain species and life stages which need diverse habitat patches to complete their life cycle.

The downstream of Ranau lake to the proposed 2nd Komering area, according to Forestry Ministry Regulation of Indonesia number 866 is protected forest and the reserve area of mahseer and goonch. Structure interviews with local fishermen recorded that the river area where the dam wall will be constructed is the deep river pool area known locally as "ulak *gelombang maut"* and the habitat of big size mahseer and goonch. Most of the fishermen catch the fish at the downstream of the proposed dam; only a few fishermen catch fish at the upper stream of the proposed dam. The average daily fish catch at the downstream on high water level from hook and line was 0.5-1 kg of goonch while from static hook and line (*tajur*) was 4 kg of goonch. In clear water (August to October), catch from static hook and line was 2- 3 individual goonch per day and hampala barb and *Schismatorhynchus heterochynhus* by drift gillnet. On the other hand, at the upper stream of proposed dam, the catch during high water level (turbid water) with hook and line was consisted of goonch with 4-10 kg per fish, 25 kg individual mahseer and 3kg (12 individual fish) green river catfish. While static hook and line during turbid water caught the average daily catch of 15 unit. There was no catch activity during clear water (dry season) at this area. This data indicated that mahseer, goonch and green catfish move to this river for spawning purpose.

The occurrence of deep pool such as ulak gelombang maut and other deep pool located at the upper part of ulak gelombang maut named by the local people as "ulak pancur' of Selabung river should be maintained in order to sustain those economical fishes. The construction of proposed 2nd Komering dam wall will make the sustainability of two pools and the fish resources in danger.

Out of two fish production potential estimation, Leger and Huet approach gave a higher value than that of productivity approach. Leger and Huet approach uses macrozoobenthos as consumer while the second approach use indirect estimation by using periphyton as the biogenic capacity component. It give some bias in setting the transfer energy coefficient from periphyton to forage feeding guilds (zoobenthic and periphyton feeder).

5. Conclusion

The aquatic resources of the proposed 2nd cascade Komering dam in Selabung river support fish life and growth. The current issue on the environment and fisheries due to the existing regulation dam in the outlet of Ranau lake, and Perjaya dam at the downstream of 2nd Komering river, have to be taken into consideration in constructing the 2nd Komering, and the next two dam construction projects 1st Komering and Muara Dua dam.

6. Appendices

Appendix A. Parameters, methods, reference of water and sediment quality of Selabung River, South Sumatra

Parameter	Unit	Method	References
Surface Water			
On Site			
River width	m	Visual	
Water depth	m	Electronic Depth Sounder	
Water Transparency	m	Visual Secchi Disc	
Water Current	m $second^{-1}$	Manual stopwatch	
Air Temperature	ºC	Electronic SCT meter	
Water Temperature	ºC	Electronic SCT meter	
Conductivity	µS cm^{-1}	Electronic SCT meter	
Turbidity	NTU	Oakton T-100 Turbidity meter	
Total Dissolved Solids (TDS)	mg L^{-1}	Electronic SCT meter	
pH		Colorimeteric	
Dissolved oxygen	mg L^{-1}	Titration	[21]
Total Alkalinity	mg $CaCO_3L^{-1}$	Titration	[21]
Total Hardness	mg $CaCO_3$ L^{-1}	Titration	[21]
Laboratory			
Chemical Oxygen Demand (COD)	mg L^{-1}	Dichromate Refluc	[21]
Total Suspended Solids (TSS)	mg L^{-1}	Gravimetric	[40]
Chlorophyl *a*	mg m^{-3}	Spectrophotometric	[21]
Nitrite	mg L^{-1}	Sulphanilamide	[39]

Parameter	Unit	Method	References
Nitrate	mg L^{-1}	Brusin sulphate	[40]
Amonia	mg L^{-1}	Phenate	[41]
Total phosphorus	mg L^{-1}	Digester persulphate and ascorbic acid	[21]
Sediment			
pH		KCl	[42]
Organic Carbon	%	Gravimetric method	[42]
Total Nitrogen	%	Kjedhal	[42]
Total Phosphorus	%	Digester ascorbic acid	[42]
Water Content	%	Gravimetric method	[42]
Soil Texture fraction	%	Hydrometer method	[42]
Bottom Type	%	50 cm x 50 x cm Bottom Transect	[43]
Biology			
Phytoplankton	cells L^{-1}	Settling method Inverted Microscope	[21]
Zooplankton	individual L^{-1}	Direct counting	[21]
Periphyton	cells m^{-3}	Settling method Inverted Microscope	[21]
Periphyton Biomass	mg Carbon m^{-3}	Gravimetric method	[21]
Macrozoobenthos Biomass	mg Carbon m^{-2}	Gravimetric method	[21]

Appendix B. Sediment and Water Quality Parameters in Three Sampling Sites of Selabung River in 2018

Site	Unit	Tangga Batu	Kota Agung	Kuripan	Tangga Batu	Kota Agung	Kuripan
Date		**February**			**September**		
pH H2O		6.86	6.86	5.71	7.13	5.65	6.78
pH KCL		6.54	5.84	4.89	6.4	4.93	6.14
Organic carbon	%	0.11	0.85	7.54	0.76	1.91	5.93
N-Total	%	0.01	0.08	0.45	0.08	0.17	0.45
P-Total	%	0.056	0.007	0.018	0.03	0.02	0.02
Water content	%	1.68	3.66	3.74	0.65	0.68	1.18
Sand	%	100	61.62	61.58	90.91	90.91	72.65
Silt	%	0	31.09	31.12	2.01	2.01	20.23
Clay	%	0	7.29	7.3	7.08	7.08	7.12

Site	Unit	Tangga Batu	Kota Agung	Kuripan	Tangga Batu	Kota Agung	Kuripan
Air Temperature	^oC	25.3	30.2	26.5	31.4	28.2	31.1
Water Temperature	^oC	25.6	25.3	25.2	26.2	25.5	25.9
Turbidity	NTU	3.02	3.91	4.49	1.98	1.98	1.74
Conductivity	$\mu S\ cm^{-1}$	162	176.8	174.3	167	178.8	176
TSS	$mg\ L^{-1}$	1.4	1.6	1.23	11.67	8.67	3.33
Dissolved Oxygen	$mg\ L^{-1}$	4.9	5.4	6	7.9	8.1	9.2
COD	$mg\ L^{-1}$	4.9	0.83	0.67	1.33	1	0.83
Water pH		8.5	6.96	7.2	8.5	7.5	8.5
Chorophyll a	$mg\ m^{-3}$	1.83	2.54	2.44	0.54	0.55	0.40
Total phophorus	$mg\ L^{-1}$	4.9	0.242	0.207	0.125	0.107	0.123
Nitrate	$mg\ L^{-1}$	4.9	0.7472	1.1652	1.724	2.008	3.123
Nitrite	$mg\ L^{-1}$	4.9	0.0077	0.0036	0.003	0.004	0.003
Ammonia	$mg\ L^{-1}$	4.9	0.0077	0.0024	0.027	0.145	0.101

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