

# Fish conservation status in eastern part of segara anakan Cilacap Indonesia

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## Fish conservation status in eastern part of segara anakan Cilacap Indonesia

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**Abstract.** Segara Anakan is an estuarine ecosystem located on the southern coast of Central Java Province which is very fertile with high biodiversity. However, the current condition is thought to have experienced a decline in biodiversity caused by sedimentation, overexploitation and water pollution problems so that it is feared that it will disrupt the preservation of organisms including fish. The purpose of this study was to determine the diversity of fish found in Segara Anakan Cilacap, and to know the conservation status of each species of fish caught in Segara Anakan in eastern Cilacap. This research was conducted using a survey method with cluster random sampling technique at 6 stations (3 stations on the Sapuregel River and 3 stations on the Kembangkuning River) with 3 replications each during highest tide. Fish collection is done by using a net and gillnet or gillnet that is installed during low tide and carried out during high tide. The diversity of fish in the waters of Segara Anakan is 36 species from 25 families. There are 16 species from 15 families in the Donan River and 34 species from 25 families in the Sapuregel River. The diversity of fish in the Sapuregel River is higher than in the Donan River. The status of fish in the eastern Segara Anakan waters management area is mostly in the LR (Least Concern) or low risk status and 1 NT (Near Threatened) species or threatened with extinction namely Sidat Fish (*Anguilla bicolor*)

Keywords: Segara Saplings, fish, conservation status, diversity

### 1. Introduction

Segara Anakan is a brackish water lagoon ecosystem with the largest mangrove forest in Java located on the southern coast of Central Java Province, precisely in Cilacap Regency or in the north of Nusakambangan Island at coordinates 07 ° 34'29.42 "LS-07 ° 47'32.39" LS and 108 ° 46'30.12 "East – 109 ° 03'21.02" East. Segara sapling ecosystems are very fertile ecosystems with high biodiversity. The area of Segara Anakan reaches approximately 34,018 ha [1]. Segara Anakan is an estuary that is a meeting between the Citanduy River, Cibeurem, Cikujang, Cikonde, Kayu Mati, Ujung Alang, Dangkal, Kembang Kuning, Sapuregel, and Donan. The Segara Anakan area is divided into 3 management areas, namely, the western part, the central part and the eastern part. The western part is a waters area which includes Citanduy River, Cibeurem River and Cikonde River. The eastern part covers the Donan River and the Sapuregel River, and the middle part is the Kembangkuning River which connects the two regions.

The Eastern Segara Anakan area is a shipping lane for industry and is used for other activities [1]. Industrial activities include petroleum processing industry with oil refining activities, crude oil loading and unloading in the area and oil processing, Cilacap Industrial Zone (KIC), cement industry, and residential areas so that the potential for the entry of solid material into the waters. Changes in water conditions can increase the chemical compounds so



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that it can trigger increased nutrient concentrations that will affect water quality and fish production.

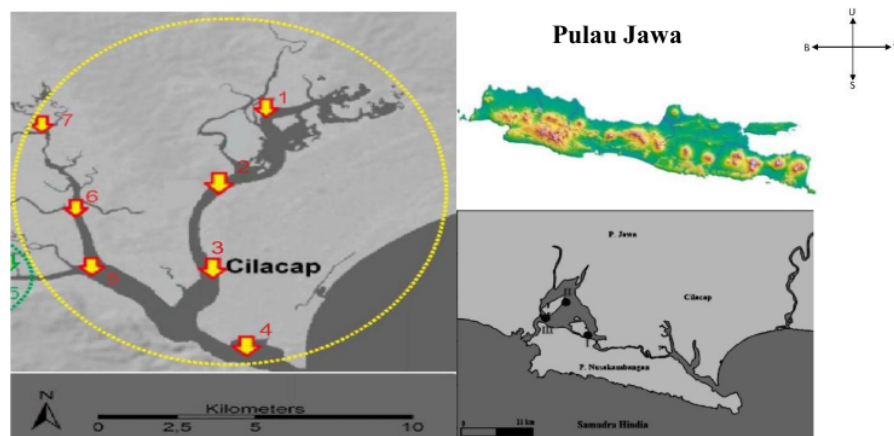
Estuary ecosystem is a river estuary that has the potential to accumulate sedimentation originating from material carried by the river flow from upstream which can be in the form of clay, mud and mixed with organic material [1]. There are 3 (three) main problems in Segara Anakan which are possible to cause the threat of fish diversity in Segara Anakan, such as sedimentation (water quality problems), decline in biological resources (illegal logging, conversion, overexploitation) as well as population growth problems. If the problem is not immediately addressed, the possibility of ecosystems and organisms in the ecosystem becomes threatened. In 2000, fisheries production in the lagoon reached 488 tons consisting of 41% shrimp, 39% fish, 13% crabs and 7% other biota [5]. The 2015 data was based on research by Nurfiarini *et al* (2015) that the diversity of fish in puppies consisted of 45 families and 87 species dominated by the families of Ambassidae, Engraulidae, Leognathidae, Mugilidae, Atherinidae, and Bagridae. If it is not quickly overcome, this situation clearly disturbs the balance of the communities that inhabit it, especially fish. What is likely to happen is the reduction in fish populations inhabiting the area. Even though the Segara Anakan mangrove area has contributed to coastal fishery production in a year of more than 62 billion rupiah (Budiman 2007).

Menezes and Camaraschi (1999) stated that the presence and distribution of fish in rivers is influenced by biotic and abiotic factors such as: temperature, pH, salinity, substrate type, feed availability and reproductive strategy. Based on reports from the Citanduy Project Department of Public Works, sediments carried by the three major rivers namely the Citanduy river are 5 million m<sup>3</sup>, the Cimeneng river is 0.4 million m<sup>3</sup>, and the Cikonde river is 1.2 million m<sup>3</sup> annually due to sedimentation that is constantly feared by the surface water of the Citanduy river and other rivers that flow into Segara Anakan continue to increase and cause flooding around the river area. In addition, siltation due to sedimentation will accelerate the destruction of ecosystems in Segara Anakan. Also reported by Ardli & Wolff [2] that the lagoon area of

Segara Anakan currently was  $\pm$  600 ha. Under these conditions it is feared that it will disrupt the sustainability of fish. Based on the description above, the objectives of the study were to know the diversity of fish found in Segara Anakan Cilacap, and to know the conservation status of each species of fish caught in Segara Anakan in eastern Cilacap. By knowing the conservation status of each of these fish species, efforts can be made to protect, conserve and utilize these fish resources to ensure their existence, availability and sustainability for current and future generations.

## 2. Method

This research was conducted using a survey method with cluster random sampling technique at 6 stations (3 stations on the Sapuregel River and 3 stations on the Kembangkuning River) with 3 replications each during highest tide (Figure 1). Data of fish caught in the Sapuregel River were based on research data published by Setyaningrum [11].



Gambar 3.1 Research location in Eastern Part of Segara Anakan, Cilacap

Fish collection was done by using a net and gillnet or gillnet. The mesh size used is based on the mesh diameter of 1-2 cm, while the gill nets used are 0.5 - 4 inch in diameter with a net length of 30 m and width of 18 m. Installation of nets is done at low tide and then removal of nets is done at high tide. The fish caught are preserved using 4% formalin and labeled. Furthermore, the handling of fish is carried out in the Aquatic Biology Laboratory, where formalin is washed with running water, then 75% alcohol is replaced as a permanent preservative. Furthermore, the fish were identified by referring to Kottelat et al. [9], Nelson (2006), Marine Portal Identification and Fish Base.

The composition of fish species was analyzed qualitatively and used to differentiate fish species based on identification. Relative abundance is used to see the density of fish species at the study site. The relative abundance of species is obtained by counting the number of individuals of each species of fish per total individual species caught. To find out the conservation status of each organism, the diversity data of each organism is compared with the conservation status in the Red List of International Union for Conservation of Nature (IUCN Red List).

### 3. Result and Discussion

#### 3.1 Fish Diversity in the Sapuregel River

The number and species of fish caught in the Sapuregel River were 1,446 individuals representing 23 families and 34 species (Table 1). Sapuregel River is included in the mangrove ecosystem so it is still classified as fertile waters for fish habitat.

Fish caught in the rainy season are more dominant than the dry season. This is because during the rainy season the water level rises and a number of fish in the estuari habitat which is eurihalin are brought into the river, especially during high tide conditions. Fishing is done by installing a net at low tide then the net is lifted at high tide. So that the fish caught are affected by tidal conditions. During high tide, the physical chemistry conditions of waters in rivers that are estuary tend to be the same as mangrove waters due to tidal currents [10].

Table 1. Fish Diversity in Sapuregel River [11].

No	Familia	No	Spesies	Kemarau		Penghujan	
				Σ ind	KR	Σ ind	KR
1	Gobiidae	1	<i>Pseudogobius javanicus</i>	-	0,00	207	16,83
2	Mugilidae	2	<i>Valamugil seheli</i> *	42	19,44	70	5,69
3	Cynglossidae	3	<i>Cynglossus microlepis</i>	-	0,00	259	21,06
4	Tetraodontidae	4	<i>Tetraodon kretamensis</i> *	1	0,46	4	0,33
		5	<i>Lagocephalus sp</i>	-	0,00	1	0,08
5	Leiognathidae	6	<i>Leiognathus oculus</i> *	5	2,31	14	1,14
6	Carangidae	7	<i>Caranx ignobilis</i>	-	0,00	29	2,36
		8	<i>Trachurus symmetricus</i>	-	0,00	4	0,33
		9	<i>Alectis indicus</i>	-	0,00	1	0,08
7	Ambassidae	10	<i>Ambassis kopsii</i>	-	0,00	3	0,24
		11	<i>Parambassis sp</i>	-	0,00	1	0,08
8	Drepanidae	12	<i>Drepane longimana</i>	-	0,00	6	0,49
9	Scianidae	13	<i>Nibea sp</i> *	4	1,85	6	0,49
10	Sillagnidae	14	<i>Sillago sp</i> *	1	0,46	1	0,08
11	Belanidae	15	<i>Xenentodon canula</i>	-	0,00	1	0,08
12	Oxuderudae	16	<i>Taenoides cirratus</i>	-	0,00	4	0,33
		17	<i>Sicyopterus sp</i>	-	0,00	8	0,65
13	Terapontidae	18	<i>Terapon jarbua</i>	-	0,00	1	0,08
		19	<i>Terapon theraps</i>	-	0,00	1	0,08
		20	<i>Mesopristes cancellatus</i> *	14	6,48	1	0,08
14	Engraulidae	21	<i>Stolephorus indicus</i> *	124	57,41	524	42,60
15	Ophichthidae	22	<i>Lamnostoma mindora</i>	-	0,00	1	0,08
		23	<i>Ophichthus aphostistos</i> *	1	0,46	57	4,63
		24	<i>Ophichthus frontalis</i>	4	1,85	-	0,00
16	Placycephalidae	25	<i>Platycephalus indicus</i>	-	0,00	4	0,33
17	Serranidae	26	<i>Epinephelus sp</i> *	4	1,85	5	0,41
18	Scatophagidae	27	<i>Scatophagus argus</i>	-	0,00	4	0,33
19	Lutjanidae	28	<i>Lutjanus russelii</i>	-	0,00	12	0,98
20	Paralichthyidae	29	<i>Pseudorhombus elevatus</i> *	1	0,46	1	0,08
		30	<i>Pseudorhombus arsius</i>	1	0,46	-	0,00
21	Muraenidae	31	<i>Gymnothorax polyuranodon</i>	2	0,93	-	0,00
		32	<i>Uropterygius concolor</i>	4	1,85	-	0,00
22	Eleotridae	33	<i>Eleotris acanthopoma</i>	4	1,85	-	0,00
23	Anguillidae	34	<i>Anguilla bicolor</i>	4	1,85	-	0,00
Kelimpahan				216		1230	
Total kelimpahan						1446	
Jumlah jenis				16		28	

The most caught species of *Stolephorus indicus* (anchovy) are able to adapt well in the Sapuregel River in both the dry and rainy seasons. These results are consistent with research by Suprastini et al., [12] *Stolephorus indicus* is found and adapted well in the Segara Anakan area of Cilacap. Furthermore, the *Valamugil seheli* species (mullet fish) have eurihalin properties that can live in a wide range of salinity, because they can live in freshwater, brackish and sea that are associated with reefs, often entering estuaries and rivers. Catfish mulls are migratory so they migrate to the river to reproduce (fish base). This is consistent with the results of research Latupapua (2011); Redjeki [10]; Wahyudewantoro [14] that mullet fish, anchovy, glodok fish caught in mangrove waters are mostly juvenile and juvenile phases.

Kottelat et al [9] that *Ophichthus aphostistos* (sea eel) was caught a lot especially in the rainy season even though this fish is a habitat in the muddy waters and belongs to the snake eels (Aguilliformes) group. In general, the types of fish caught in both seasons (dry and rainy) are able to adapt to the Sapuragel river habitat and have a relatively high abundance.

The relative abundance of fish in the Sapuregel River is highest in the families of Engraulidae (dry and rainy), Mugillidae (dry) and Cynoglossidae, Gobiidae (rainy) (Figure 2). The types of fish in the waters are part of the community only a few species are predominant. Among the 23 fish families found in the Sapuregel River, two families that are quite dominating



both in the dry and rainy seasons are the Engraulidae and Mugilidae families. The Engraulidae family and also the Gobiidae are mostly caught in the Sapuregel River, species of fish belonging to the Engraulidae family are quite a lot such as the *Stolephorus indicus* (Teri fish) and the Gobiidae family *Pseudogobius javanicus* (Glodog fish). Glodog fish, belonging to the Gobiidae family, have not been used as food in Indonesia [13]. Based on [3] when juvenile fish, Gobiidae is a herbivor that eats more diatoms and filamentous algae, while as adults switch to crustaceans, polichaeta and land insects.

Mugilidae family were found in Sapuregel River mainly during dry season. They are migratory species from the sea and are the largest group in estuaries in both subtropical and tropical regions [15]. Whereas, the Family of Cygnoglossidae dominated in the Sapuregel river area during rainy season. This family is eurihalin species but they were abundant in the Sapuregel River was caused by tides. They were migratory species from the sea and carried into the river.

Based on the IUCN Red list, the conservation status of each fish caught in the Sapuregel River is listed in Table 2. Based on the IUCN Red List, the conservation status for each fish in the Sapuregel River showed that there were 8 species of fish have not been evaluated yet (Table 3), 17 species in LC status (Table 4), 2 species of DD (Table 5) and 1 species in NT status (Table 6).

Table 2. Concervation Status of fish in Sapuregel River

No	Familia	Spesies	Status Konservasi
1	Gobiidae	<i>Pseudogobius javanicus</i>	NE
2	Mugilidae	<i>Valamugil seheli</i> *	NE
3	Cygnoglossidae	<i>Cygnoglossus microlepis</i>	LC
4	Tetraodontidae	1. <i>Tetraodon kretamensis</i> *	NE
		2. <i>Lagocephalus sp</i>	LC
5	Leiognathidae	<i>Leiognathus oculus</i> *	LC
6	Carangidae	1. <i>Caranx ignobilis</i>	LC
		2. <i>Trachurus symmetricus</i>	LC
		3. <i>Alectis indicus</i>	LC
7	Ambassidae	1. <i>Ambassis kopsii</i>	NE
		2. <i>Parambassis sp</i>	LC
8	Drepanidae	<i>Drepane longimana</i>	NE
9	Scianidae	<i>Nibea sp</i> *	LC
10	Sillagnidae	<i>Sillago sp</i> *	LC
11	Belanidae	<i>Xenentodon canula</i>	LC
12	Oxuderudae	1. <i>Taenoides cirratus</i>	DD
		2. <i>Sicyopterus sp</i>	LC
13	Terapontidae	1. <i>Terapon jarbua</i>	LC
		2. <i>Terapon theraps</i>	LC
		3. <i>Mesopristes cancellatus</i> *	LC
14	Engraulidae	<i>Stolephorus indicus</i> *	NE
15	Ophichthidae	1. <i>Lamnostoma mindora</i>	NE
		2. <i>Ophichthus aphostistos</i> *	NE
		3. <i>Ophichthus frontalis</i>	LC
16	Platycephalidae	<i>Platycephalus indicus</i>	DD
17	Serranidae	<i>Epinephelus sp</i> *	LC
18	Scatophagidae	<i>Scatophagus argus</i>	LC
19	Lutjanidae	<i>Lutjanus russelii</i>	LC
20	Paralichthyidae	1. <i>Pseudorhombus elevatus</i> *	NE
		2. <i>Pseudorhombus arsius</i>	LC
21	Muraenidae	1. <i>Gymnothorax polyuranodon</i>	LC
		2. <i>Uropterygius concolor</i>	LC
22	Eleotridae	<i>Eleotris acanthopoma</i>	LC
23	Anguillidae	<i>Anguilla bicolor</i>	NT

Notes :

NE = Not Evaluation, LC = Least Concern, DD = Data Deficient, NT = Near Threatened

Fish with not evaluation (NE) status meant that the species have not yet been evaluated for the possibility of extinction and distribution criteria, there were Gobidae, Mugilidae, Tetraodontidae, Ambassidae, Drepanidae, Engraulidae, Ophichthidae, Paralichthyidae.

Table 3. Species of fish in Sapuregel River with NE (Not Evaluation) Status

No	Familia	Spesies	Status Konservasi
1	Gobidae	<i>Pseudogobus javanicus</i>	NE
2	Mugilidae	<i>Valamugil seheli</i> *	NE
3	Tetraodontidae	<i>Tetraodon kretamensis</i> *	NE
4	Ambassidae	<i>Ambassis kopsii</i>	NE
5	Drepanidae	<i>Drepane longimana</i>	NE
6	Engraulidae	<i>Stolephorus indicus</i> *	NE
7	Ophichthidae	1. <i>Lamnostoma mindora</i>	NE
		2. <i>Ophichthus aphostistos</i> *	NE
8	Paralichthyidae	<i>Pseudorhombus elevatus</i> *	NE

Keterangan : NE = Not Evaluation

There are 17 species of fish that have Least Concern (LC) status. Least Concern status is the IUCN category given for species that have been evaluated but do not fall into any category.

Table 4. Species of fish in Sapuregel River with LC (Least Concern) Status

No	Familia	Spesies	Concervation Status
1	Cygnoglossidae	<i>Cygnoglossus microlepis</i>	LC
2	Tetraodontidae	<i>Lagocephalus sp</i>	LC
3	Leiognathidae	<i>Leiognathus oculus</i> *	LC
4	Carangidae	1. <i>Caranx ignobilis</i>	LC
		2. <i>Trachurus symmetricus</i>	LC
		3. <i>Alectis indicus</i>	LC
5	Ambassidae	<i>Parambassis sp</i>	LC
6	Scianidae	<i>Nibea sp</i> *	LC
7	Sillagnidae	<i>Sillago sp</i> *	LC
8	Belanidae	<i>Xenentodon canula</i>	LC
9	Oxuderudae	<i>Sicyopterus sp</i>	LC
10	Terapontidae	1. <i>Terapon jarbua</i>	LC
		2. <i>Terapon theraps</i>	LC
		3. <i>Mesopristes cancellatus</i> *	LC
11	Engraulidae	<i>Ophichthus frontalis</i>	LC
12	Serranidae	<i>Epinephelus sp</i> *	LC
13	Scatophagidae	<i>Scatophagus argus</i>	LC
14	Lutjanidae	<i>Lutjanus russelii</i>	LC
15	Paralichthyidae	<i>Pseudorhombus arsuis</i>	LC
16	Muraenidae	1. <i>Gymnothorax polyuranodon</i>	LC
		2. <i>Uropterygius concolor</i>	LC
17	Eleotridae	<i>Eleotris acanthopoma</i>	LC

Keterangan : LC = Least Concern

There were 2 species with DD concervation status, they were *Taenoides cirratus* and *Platycephalus indicus* (Table 5). It meant that the information about that fish were inadequate to estimate the risk of extinction based on population distribution and status.



Table 5. Species of fish in Sapuregel River with DD (*Data Deficient*) Status

No	Familia	Spesies	Concervation Status
1	Oxuderudae	<i>Taenoides cirratus</i>	DD
2	Platycephalidae	<i>Platycephalus indicus</i>	DD

There was one species of fish that had NT status, that was species of Eel fish (*Anguilla bicolor*) belonging to Familia of Anguillidae (Table 6). Eel fish have unique habitat characteristics, because they are able to adapt in fresh, estuary and sea waters. In its life cycle the fish undergoes six phases, namely eggs, pre-leptocephalus, leptocephalus, glass eels, adults and broodstock. Eel has katadromus properties, which live in fresh waters and when they will spawn (reproduce) eels migrate very far into the sea. To reach the river mouth, the eel must be able to follow the river flow. After reaching the river mouth, the eel must oppose the waves to arrive in the middle of the sea and must adapt to changes in salt content.

Table 6. Species of fish in Sapuregel River with NT (*Near Threatened*) Status

No	Familia	Spesies	Concervation Status
1	Anguillidae	<i>Anguilla bicolor bicolor</i>	NT

The Eel fish (*Anguilla bicolor bicolor*) is important commodities, and the demand for fish availability in the global market was increasing drastically nowadays. This demand impact to high eel exploitation. Reduced catches of eel be caused by high rates of exploitation, declining environmental quality, sedimentation, mining, and other development impacts. The life cycle of eel is very complex, one of the interesting stages is the movement between Leptocephalus that live in the sea into glass eel which migrates into fresh waters. Eel have a habit of spawning in warm seas at a depth of about 400 m (Matsui, 1982). Glass Eel will enter the river mouth at night when the tide is high and salinity at the river mouth is low. The high level of catching results in the increasingly threatened availability of glass eel in nature. Initially excessive exploitation was only glass eel, but starting from 2010, it became more diverse, that was from glass eel to fingerling [6]. As a result of these threats the status of eel fish (*Anguilla bicolor*) became Near threatened (NT)

### 3.2 Fish Diversity in the Donan River

The number and species of fish caught in the Donan River during the study were 534 individuals representing 16 families and 16 species. In the dry season, the fish caught consisted of 6 families, namely the Gobiidae family (48.5%), Sillaginidae (30.3%), Mugilidae as much as 12.1% and other families (Cichlidae, Serranidae, and Carangidae), respectively, only around 3%. In the rainy season 11 families were obtained, but as many as 90% of the fish caught were Engraulidae (90.2%), namely *Stolephorus indicus* (Table 7). *Stolephorus indicus* is a fish that lives in groups that are found in coastal waters entering the river mouth and to tolerate brackish water [8].

Table 7. The number and species of fish caught in the Donan River during rainy and dry season

No	Familia	Spesies	Dry		Rainy	
			$\Sigma$ ind	KR %	$\Sigma$ ind	KR %
1	Tetraodontidae	<i>Lagocephalus lagocephalus</i>	-	-	2	0,4
2	Terapontidae	<i>Mesopristes cancellatus</i>	-	-	1	0,2
3	Leiognathidae	<i>Secutor indicus</i>	-	-	1	0,2
4	Leiognathidae	<i>Leiognathus equulus</i>	-	-	5	1,0
5	Cygnoglossida	<i>Cygnoglossus microlepis</i>	-	-	1	0,2
6	Paralichthyidae	<i>Pseudorhombus arsius</i>	-	-	3	0,6
7	Ambassidae	<i>Ambassis vachelli</i>	-	-	11	2,2
8	Scatophagidae	<i>Scatophagus argus</i>	-	-	1	0,2
9	Gobiidae	<i>Pseudogobius javanicus</i>	16	48,5	13	2,6
10	Engraulidae	<i>Stolephorus indicus</i>	-	-	452	90,2
11	Polynemidae	<i>Eleutheronema tetradactylum</i>	-	-	4	0,8
12	Cichlidae	<i>Oreochromis niloticus</i>	1	3,0	-	-
13	Mugilidae	<i>Valamugil seheli</i>	4	12,1	7	1,4
14	Serranidae	<i>Epinephelus sp</i>	1	3,0	-	-
15	Sillaginidae	<i>Sillago sihama</i>	10	30,3	-	-
16	Carangidae	<i>Caranx ignobilis</i>	1	3,0	-	-
Total			33		501	

Fish caught in the rainy season was more diverse (12 families) than the dry season (6 families). This was because during the rainy season the estuarine water level rises with increasing the debit of river water, so the composition of fish found were a mixture of species of freshwater fish and seawater but it was still tolerably to brackish conditions.

Based on observations in the 2 river of Donan and Sapuregel obtained of a diverse fish compositions. Sapuregel River has more diverse composition compared to Donan River. The composition of a species of fish is generally influenced by habitat conditions and water quality of waters. When referring to water quality (Table 8) in the two rivers, the results were not significantly different, because the water quality in the two locations still met the quality standards for the life of organisms in mangrove or estuarine areas. Therefore differences in the composition of fish species between the two rivers could be affected technically when sampling, for example sampling time, sampling operation techniques, which then resulted in differing composition of fish caught between location.

Table 8. Water Quality Measurement in Donan and Sapuregel River

Parameter	Unit	Sampling Location		Water quality standard (Mangrove ecosystem)*
		Donan River	Sapuregel River	
pH	unit	6.6	6.8	7 – 8.5
Water Temperature	°C	30.5	28.1	28 – 32
Salinity	ppt	30.5	29.3	< 34
TSS	mg.l <sup>-1</sup>	115.1	83.4	80
DO	mg.l <sup>-1</sup>	3.2	3.4	>5
BOD	mg.l <sup>-1</sup>	4.4	4.3	20

Note \* = Kepmen LH Nomor 51 Tahun 2004 : Water Quality for Biota Life

Water quality will influence the fish diversity and there was a relationship between habitat and environmental variables [4]. The measurement of Total Suspended Solid (TSS) concentrations in the Sapuregel and Donan Rivers have beyond the standard for biota life determined at 80 mg.l<sup>-1</sup>. The high concentration of TSS is caused by the two locations experiencing the insertion of solid material carried from the river due to human activities such as agriculture, industry and settlements in the catchment area. Dissolved oxygen is one of the main elements in the metabolic processes of organisms, especially for the process of respiration. Dissolved Oxygen (DO) in water has a very important role for the survival of marine organisms (Dewanti *et al.* 2018). Besides oxygen is also needed for the oxidation of organic and inorganic materials. The main source of oxygen in a waters comes from a process of diffusion of free air and photosynthesis of organisms that live in these waters. The results of DO measurements at the study site showed low DO concentrations ranging from 3.2 to 3.4 mg.l<sup>-1</sup> lower than those required for biota life

Fish has a very important role in human life because of its position in the web of life [9], and has a very high potential in commercial terms. The comparison of fish composition and abundance between river of Donan and Sapuregel are presented in Table 9.

Table 9. The comparison of fish composition and abundance between river of Donan and Sapuregel

No	Familia	Species	Local Fish Name	S. Donan		S. Sapuregel	
				Σ ind	KR %	Σ ind	KR %
1	Gobiidae	1. <i>Pseudogobius javanicus</i>	Glodok	29	5.4	207	14.3
		2. <i>Lagocephalus lagocephalus</i>	Bunteg pisang	2	0.4		
2	Tetraodontidae	3. <i>Lagocephalus sp</i>				1	0.1
		4. <i>Tetraodon kretamensis</i>				5	0.3
3	Mugilidae	5. <i>Valamugil seheli</i>	Belanak	11	2.1	112	7.7
4	Terapontidae	6. <i>Mesopristes cancellatus</i>	Rekrekan	1	0.2	15	1.0
		7. <i>Terapon jarbua</i>				1	0.1
		8. <i>Terapon theraps</i>				1	0.1
		9. <i>Cygnoglossus microlepis</i>	Lengdai	1	0.2	259	17.9
6	Leiognathidae	10. <i>Secutor indicus</i>	Petek baworan	1	0.2		
		11. <i>Leiognathus equulus</i>	Petek	5	0.9	19	1.3
7	Sillaginidae	12. <i>Sillago sihama</i>	Bojor	10	1.9	2	0.1
8	Carangidae	13. <i>Caranx ignobilis</i>	Kue	1	0.2	29	2.0
		14. <i>Trachurus symmetricus</i>				4	0.3
		15. <i>Alectis indicus</i>				1	0.1
9	Ambassidae	16. <i>Ambassis vachelli</i>	Peprek	11	2.1		
		17. <i>Ambassis kopsii</i>				3	0.2
		18. <i>Parambassis sp</i>				1	0.1
		19. <i>Pseudorhombus arsius</i>					
10	Paralichthyidae	20. <i>Pseudorhombus elevatus</i>	Tapel buruk	3	0.6	1	0.1
		21. <i>Drepane longimana</i>				2	0.1
		22. <i>Nibea sp</i>				6	0.4
12	Scianidae					10	0.7

13	Belanidae	23. <i>Xenentodon canula</i>			1	0.1
14	Oxuderudae	24. <i>Taenoides cirratus</i>			4	0.3
		25. <i>Sicyopterus sp</i>			8	0.6
		26. <i>Eleutheronema tetradactylum</i>	Kuro	4	0.7	
15	Polynemidae	27. <i>Oreochromis niloticus</i>	Nila	1	0.2	
16	Cichlidae	28. <i>Epinephelus sp</i>	Kerapu	1	0.2	9
17	Serranidae	29. <i>Stolephorus indicus</i>	Teri			0.6
18	Engraulidae	30. <i>Scatophagus argus</i>	mancung	452	84.6	648
19	Scatophagidae	31. <i>Lamnostoma mindora</i>	Kiper	1	0.2	4
20	Ophichthidae	32. <i>Ophichthus aphostistos*</i>				0.3
		33. <i>Ophichthus frontalis</i>				58
		34. <i>Platycephalus indicus</i>				4
21	Placycephalidae	35. <i>Lutjanus russelii</i>				0.3
22	Lutjanidae	36. <i>Gymnothorax polyuranodon</i>				12
23	Muraenidae	37. <i>Uropterygius concolor</i>				0.8
		38. <i>Eleotris acanthopoma</i>				2
24	Eleotridae	39. <i>Anguilla bicolor</i>				0.1
25	Anguillidae					4
		Number of Individual		534	100	1446
		Number of Spesies			16	100
		Number of Familia			15	34

The dominant fish species in the Donan and Sapuregel rivers with a relative abundance of > 10%) are *Pseudogobus javanicus*, *Cygnoglossus microlepis*, and *Stolephorus indicus*. The abundance of *Pseudogobus javanicus* and *Cygnoglossus microlepis* is higher in the Sapuregel River higher than in the Donan River, whereas *Stolephorus indicus* is more abundant in the Donan River.

Table 10. Fish Conservation Status in Donan River with LC (Least Concern) status

No	Nama famili	Nama Spesies	Status Konservasi
1	Tetraodontidae	<i>Lagocephalus lagocephalus</i>	LC
2	Terapontidae	<i>Mesopristes cancellatus</i>	LC
4	Leiognathidae	<i>Leiognathus equulus</i>	LC
5	Cygnoglossidae	<i>Cygnoglossus microlepis</i>	LC
6	Ambassidae	<i>Ambassis vachelli</i>	LC
7	Scatophagidae	<i>Scatophagus argus</i>	LC
8	Gobiidae	<i>Pseudogobus javanicus</i>	LC
9	Engraulidae	<i>Stolephorus indicus</i>	LC
10	Serranidae	<i>Epinephelus sp</i>	LC
11	Sillaginidae	<i>Sillago sihama</i>	LC
12	Carangidae	<i>Caranx ignobilis</i>	LC

Based on Tables 10 and 11 can be seen from the conservation status of the IUCN Red List (Froese & Pauly, 2017) fish caught in the Donan River include: 12 low risk status species or LC (Least Concern) and 5 NE species (not evaluated).

Table 11. Fish Conservation Status in Donan River with NE (Not Evaluated) status

No	Nama famili	Nama ilmiah	Status Konservasi
1	Leiognathidae	<i>Secutor indicus</i>	NE
2	Paralichthyidae	<i>Pseudorhombus arsius</i>	NE
3	Polynemidae	<i>Eleutheronema tetradactylum</i>	NE
4	Cichlidae	<i>Oreochromis niloticus</i>	NE
5	Mugilidae	<i>Valamugil seheli</i>	NE

One of the 5 species with NE status was *Oreochromis niloticus* (Tilapia). This fish is an introducing fish that is very invasive and disturbs various ecosystems, especially those located in the tropics. *Oreochromis niloticus* is an aquatic species that is often cultivated and possibly carried by floods and released into rivers to estuarins. If the diversity of fish is compared between the two locations, it can be seen that both the number of families and the number of species are more in the Sapuregel River than in the Donan River (Table 12).

Table 12. Comparison Of Fish Community Structure In Sapuregel dan Donan River

No	Parameter	Donan River	Sapuregel River
1	Number of familia	18	35
2	Number of spesies	18	34
3	Conservation Status		
	- NE (Not Evaluation )	5	9
	- LC (Least Concern)	11	22
	- DD (Data Deficient)		2
	- NT (Near Threatened)		1
			( <i>Anguilla bicolor</i> )
4	Dominating fish	<i>Stolephorus indicus</i> (84,6%)	1. <i>Stolephorus indicus</i> (44,8%) 2. <i>Cygnoglossus microlepis</i> (17,9%) 3. <i>Pseudogobus javanicus</i> (14,3%)

#### 4. Conclusion

The diversity of fish in the waters of Segara Anakan is 36 species from 25 families. There are 16 species from 15 families in the Donan River and 34 species from 25 families in the Sapuregel River. The diversity of fish in the Sapuregel River is higher than in the Donan River. The status of fish in the eastern Segara Anakan waters management area is mostly in the LR (Least Concern) or low risk status and 1 NT (Near Threatened) species or threatened with extinction namely Sidat Fish (*Anguilla bicolor*)

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