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Distribution of Eel Fish (*Anguilla bicolor*) in Cibeureum River, Cilacap District

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Abstract

Fish resources in the waters are very dependent on fish larvae resources. Catching eel from the size of the seed (glass eel) to the size of the adult eel has decreased in nature indicating that in the management of eel the economic aspect is more dominant than its conservation aspects. The purpose of this study was to design the management pattern of eel fish in Cibeureum River, Sidareja District, Cilacap Regency based on their ecology, water quality, and rate of exploitation. The research method used is explanatory research and sampling techniques using purposive sampling method in five sampling stations from upstream to downstream of the Cibeureum River. The research data were analyzed using descriptive analysis. The results of the study of the water quality of the Cibeureum River meet the water quality requirements as eel living areas in accordance with GR No.82 of 2001. The abundance of eel species has an Abundance Index (KR) 72.73 - 93.75%, Yellow Eel types have KR = 6,25 - 27.27%, Glass Eel and Silver Eel have abundance, KR = 0%. The distribution pattern of eel fish species of Elver and Yellow Eel has a random distribution pattern (Id = 0.95 and Id = 0.99). Glass Eel and Silver Eel do not have a distribution pattern (Id = 0). Growth rate of eel fish = 120.23 (1-). Total mortality rate (Z) of 2.88 per year that eel fish mortality in the Cibeureum River, mostly caused by fishing activities with exploitation rate (E) of 0.84 per year and it is thought to have exceeded the optimum value (overfishing). The management pattern of eel fish (*Anguila bicolor*) by limiting the time and area of capture are needed as well as the important role of TPI, cooperatives and Pokmaswas (Community Watch Group) in the eel catchment area.

Keywords: eel, abundance, distribution, size, level of utilization, alternative management.

Sumber daya ikan di perairan sangat bergantung pada sumber daya larva ikan. Penangkapan sidat dari ukuran benih (glass eel) hingga ukuran sidat dewasa mengalami penurunan di alam yang menunjukkan bahwa dalam pengelolaan sidat aspek ekonomi lebih dominan dibandingkan aspek konservasinya. Tujuan penelitian ini adalah merancang pola pengelolaan ikan sidat di Sungai Cibeureum, Kecamatan Sidareja, Kabupaten Cilacap berdasarkan aspek ekologi, kualitas air, dan laju pemanfaatan. Metode penelitian yang digunakan adalah penelitian eksplorasi dan teknik pengambilan sampel menggunakan metode purposive sampling di lima stasiun pengambilan sampel dari hulu hingga hilir Sungai Cibeureum. Data penelitian dianalisis menggunakan analisis deskriptif. Hasil kajian kualitas air Sungai Cibeureum memenuhi syarat kualitas air sebagai tempat hidup sidat sesuai dengan PP No.82 Tahun 2001. Kelimpahan spesies sidat mempunyai Indeks Kelimpahan (KR) 72,73 – 93,75%, jenis *Yellow Eel* mempunyai kelimpahan KR = 6,25 - 27,27%, *Glass Eel* dan *Silver Eel* memiliki kelimpahan, KR = 0%. Pola sebaran ikan sidat jenis *Elver* dan *Yellow Eel* mempunyai pola sebaran acak (Id = 0,95 dan Id = 0,99). *Glass Eel* dan *Silver Eel* tidak memiliki pola distribusi (Id = 0). Laju pertumbuhan ikan sidat = 120,23 (1-). Angka kematian total (Z) sebesar 2,88 per tahun dan kematian ikan sidat di Sungai Cibeureum sebagian besar disebabkan oleh kegiatan penangkapan ikan dengan laju eksploitasi (E) sebesar 0,84 per tahun dan diperkirakan telah melampaui nilai optimum (overfishing). Pola pengelolaan ikan sidat (*Anguila bicolor*) perlu dilakukan dengan membatasi waktu dan wilayah penangkapan serta pentingnya peran TPI, koperasi dan Pokmaswas (Kelompok Pengawas Masyarakat) di wilayah tangkapan sidat.

Kata Kunci: sidat, kelimpahan, sebaran, ukuran, tingkat pemanfaatan, alternatif pengelolaan.

Introduction

The river functions as a channel for water flow always at the lowest position in the earth's landscape, so that the condition of the river cannot be separated from the condition of the Watershed (PP 38 of 2011). Fish resources in river waters are very dependent on fish larvae resources. In the early stages of a fish's life cycle it has a high mortality because it is susceptible to predators, food availability and environmental changes that occur in nature. Disruption of fish life due to overfishing has a negative impact on fish stocks and the adult population of fish becomes smaller.

Eel fish found in America, Europe and East Asia include *Anguilla bicolor bicolor, A. bicolor pacifica, A. Nebulosa nebulosa, A. interioris, A. borneensis, A. celebesensis, A. marmorata, A. Obscura and A. Megastoma, A marmorata, A. bicolor bicolor* and *A. bicolor pasifica* are populas of "glass eel" that are exploited on a large scale to meet the increasing needs of consumers from year to year because they include rare animals (Roy, 2013). There are nine species and sub-species of eel found in Indonesia which have wider distribution and high genetic diversity (Sugeha and Suharti, 2008).

The southern coast of Java Island is an eel catching area ranging from seed size (glass eel) to adult eel size. None of the fishing grounds are permanent, will change according to the conditions of fishing activities. Understanding of the physical and chemical factors of waters influencing the development of aquatic biota such as flow patterns, salinity, temperature and turbidity is seen as abiotic factors in aquatic ecosystems that have many benefits in the process of fish survival, such as abundance and distribution (Anwar, 2008).

The size of the glass eel eel in the Poigar River Estuary with an average total length from April to July is 49.3 ± 2.9 cm. The largest size was found in July 51.10 ± 2.40 mm and followed in June with an average of 51.08 ± 2.03. The smallest size in April bulls is 44.5 ± 1.4 cm. Glass eel abundance for four months from April to July peak abundance occurred in May reach 1,841 individuals. Likewise with HTPU 614 which is the highest of the three other months. The density of the Glass eel eel in the Poigar River Estuary is 1,106.5 individuals in a 10 m sampling path area with a width of 0.75 m (Lumi *et al.*, 2019).

Cibeureum River, Sidareja Subdistrict, Cilacap Regency, was chosen as the research location because the waters are the eels to migrate to the headwaters of the river to breed into adult eel or vice versa if the gnadic eel fish will migrate to the open sea and spawn (katadromus fish). The Cibeureum River which is bordered by the Segara Anakan is a typical/rare/endemic fish habitat area so that the potential for eel fishing is high and a significant influence on migration patterns of eel fish populations.

At present, from collectors/collectors data, the catch of eel fish in the wild has begun to decline from year to year, indicating that in the management of eel the economic aspect is more dominant than its conservation aspect. For the sake of pursuing economic benefits, environmental aspects are ignored, such as overexploitation, the use of destructive fishing gear, catching small eels and laying eggs. Social aspects, such as the emergence of social conflict due to the use of fishing gear that is not environmentally friendly and the fading of local wisdom such as lack of concern for river cleanliness. Eel loss during migratory pathways or death due to decreased ability of eel fish to adapt to the environment (Aoyama 2009).

Alleged growth of Anguilla marmorata tropical eel in the Malunda River, West Sulawesi, namely $L\infty$ = 156.0 cm and K = 0.076 per year. The total mortality rate with the average length of the catch is Z = 0.328 per year. Natural death is estimated with an estimated value of M = 0.21 per year due to arrest (F) of 0.118 per year giving an estimated result of exploitation rate of 0.36. The level of exploitation has not shown more capture with an estimated value of 59% of the optimum F value. The estimated biomass is around 2,762.6 kg (Amir, 2008). The impact of the decline in the population of eel fish in the wild will ultimately impact on the scarcity of seeds for aquaculture activities, especially in Cilacap Regency so that it is necessary to manage eel fish.

The purpose of the study was to determine water quality, abundance, distribution, size, growth rate, mortality and rate of eel fish exploitation in relation to the catching methods applied, and design patterns of eel management in the Cibeureum River, Sidareja District, Cilacap Regency based on ecology, water quality, and the rate of exploitation. Based on the above background, a research on the management of eel fish is needed in order to preserve the resources of a wise and sustainable eel fish population so that it can be optimally utilized.

Methods

The research method used is explanatory research and using purposive sampling method in five sampling stations from upstream to downstream of the Cibeureum River. The research targets are eel fish, Cibeureum River water, abundance and distribution of eel fish with several variables, namely TSS (Total Suspended Solid, TDS (Total Dissolved Solid) measurement, turbidity, salinity, pH, temperature, length and weight of fish, and fisherman description, which includes knowledge, attitudes and actions. ampling of fish and water is done every station with 3 replications through fishing equipment installed in the afternoon, with the position of the trap door facing the river by the river tied to a tree around the river. Sampling of surface water is included in the 2.5 liter volume. Retrieval responden of eel fishing (group of Mina Kaliwungu fishermen and united eel cooperatives) in five sampling stations from upstream to downstream of the Cibeureum River.

Result and Discussion

Water Quality

The results of water quality measurements at observation stations I, II, III, IV, and V still meet the requirements for eel life. Water quality conditions still meet the water quality requirements that are good for eel growth and development. Based on research conducted by Murniati (2015), the value of water salinity is also influenced by tides in the range of 5 - 35 ppt. Based on the results of the study and compared with the value of quality standards, water quality at the observation site of Station III still meets the requirements for the growth of eel life.

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Table 1. Measurement of Cibereum River Water Quality for the Period June - July 2018

No	Parameter	Unit	Station					BMA Klas III*
			I	II	III	IV	V	
1	Temperature	ºC	27,7	27,3	27,7	26	26	Deviation 3
2	Salinity	ppt	4,3 ± 1,5	5,7 ± 1,5	9 ± 1	10,7 ± 5	26,3 ± 6,4	
3	pH	Unit	6,9 ± 1,3	7 ± 1,1	7,1 ± 1,1	7,1 ± 0,3	7,2 ± 0,3	6 – 9
4	Dissolved O2	mg/l	6,5 ± 1,0	6,8 ± 0,9	6,8 ± 0,60	7,2 ± 0,3	6,8 ± 0,5	3
5	Current speed	m/det	0,3	0,3	0,3	0,3	0,3	
6	TSS	mg/l	17,3 ± 11,0	14,7 ± 4,2	22,7 ± 8,3	28,7 ± 24,7	13,3 ± 3,1	400
7	TDS	mg/l	677,3 ± 468,2	2002,3 ± 2315,2	2825 ± 1866,4	8115 ± 5542,3	19477,3 ± 15315,8	1000

*) BMA: Water Quality Standard based on Government Regulations Number 82 Year 2001: Concerning Water Pollution Management and Control

According to Harianto (2014), the optimal pH range for eel growth is 6.6 - 7.7. Oxygen content of 7.2 ± 0.3 mg/ l. Based on water quality research specifically the parameters of dissolved oxygen in the river which is the area of eel fish life in Bengkulu Province shows the value of dissolved oxygen ranged from 6.2 to 7.8 ppt (Samuel, 1997). The higher TDS value indicates the greater amount of dissolved substances in a waters. The lowest TDS value was found at observation station IV. Water quality parameter values still meet the standards for the development of eel fish.

According to Haryono (2016), for the development of eel fish seed temperature ranges between 17-25 ° C, while for the development of fish and other autistic biota in public waters <30 ° C (Haryono, 2016). Surface water temperature conditions are still supportive as a habitat for eel fish growth. Salinity for juvenile development, eel fish 0- 0-35 ppt (Widyatuti, 2013). Optimal salinity for glass eel growth according to Widyatuti (2013) is 10% will continue to decrease the need for salinity along with its growth. Water pH 7.2 ± 0.3. Based on Fahmi's observation (2010) that the pH value was 7.2, the dissolved oxygen content was 6.8 ± 0.5 mg / l. Dissolved oxygen in the Cibeureum river at these five stations still qualifies for eel fish breeding. The value of dissolved oxygen (O2) for eel cultivation at the enlargement stage is > 4 ppt (Sasongko, 2007). Physically, eel fish are able to live at low oxygen concentrations. In apoea condition that is the state of respiratory muscles in a state of rest for 30 minutes (Widyatuti, 2013).

The results of the study TSS value at each station has a varied value. The amount of TSS is caused by the amount of sediment carried to each station. TSS value is smaller due to wider deposits because it is in the position of the four rivers meeting. According to Siswanto (2010) the value of TSS affects the condition of a waters. Large TSS values tend to experience high sedimentation. The river mouth is the area with the highest sedimentation (the TSS value is greater). The TDS value of 19,477.3 ± 15315.8 mg/ l is the highest compared to the other four stations. TDS also affects the condition of a waters. According to WHO (2003), the TDS value is the amount of dissolved solids both organic and colloidal ions in a waters. Based on the results of water quality research observations of in situ water parameters at each observation station on the Cibeureum River showed that the water quality at Stations I, II, III, IV and V which included temperature, salinity, pH brightness, water velocity and dissolved oxygen as well as laboratory test results regarding TSS value refers to results that still meet the requirements for eel fish habitat, while the TDS value exceeds the quality standard of fishery activities.

Abundance, Distribution and Size of Eel

Table 2. Abundance of Eel Fish Caught at Five Observation Stations on the Cibeureum River in June - July 2018

Station	Relative Abundance (%)			
	Glass eel	Elver	Yellow eel	Silver eel
I	00,00	78,95	21,05	0,00
II	0,00	77,27	22,73	0,00
III	0,00	72,73	27,27	0,00
IV	0,00	83,33	16,67	0,00
V	0,00	93,75	6,25	0,00

The results showed the highest abundance index value was owned by the Elver with index of 72.73 - 93.75% then followed by Yellow eel with an abundance index of 6.25 - 27.27%, while Glass eel and Silver eel were not abundant with values an abundance index of 0.00%. Overall, of the four types of eel fish that have the highest relative abundance and dominate in each station, namely Elver and Yellow eel. According to Sriati (1998), abundance is affected by habitat type, the submerged area during high tides and water levels during the rainy season, tidal movements, and seasons. The large number of eels obtained at stations III and V is due to the large number of mangroves and water hyacinth in both stations. Mangroves are plants that are usually in estuary areas. According to Findra *et al*. (2016), mangrove ecosystem has a very important role in the life cycle of fish life, especially in juvenile stages. In some species of fish, juvenile stages live in mangrove habitats that aim to protect and search for food, but in adult stages the fish will move to deeper habitats.

Based on the analysis of the distribution pattern of eel species, it is known that the distribution pattern of biota is influenced by the type of habitat that includes the physical chemical parameters of water and food and the adaptability of a biota in an ecosystem

(Alfitriatussulus, 2003). The distribution pattern of the Glass eel stadia in the Cibeureum River does not have a distribution pattern, this is caused by the Glass eel habitat on the seabed because the eel spawns in the sea. The pattern of random distribution is caused by several factors, including environmental conditions, substrate types and eating habits and ways of reproduction (Risawati in Alfitriatussulus, 2003). This random distribution pattern means that the survival rate of fish in juvenile larval stages is low, this is evidenced by the small number of fish found when the larval stages in the estuary area towards the river and towards the sea. Spread is random means that the species do not have a tendency to live in colonies and can survive anywhere in an ecosystem. The pattern of random spread also occurs due to positive competition between individuals, so that it will encourage the formation of the division of space between individuals.

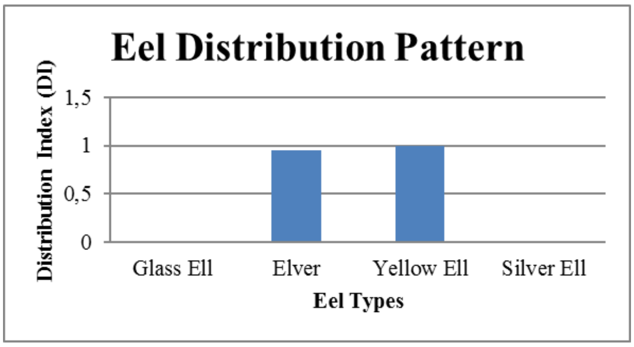

Figure 1. Distribution pattern of eel fish in all Cibeureum River observation stations in June - July 2018

Silver eel stadia (adult eel) has a distribution index of 0 (DI = 0), not found in the Cibeureum River. According to the results of research by Aoyama *et al.* (2001), stating that differences in the size distribution of eel fish are thought to be caused by the determination of the sampling area, namely in the river estuary that is still close to estuary waters or in river mouth areas, so the opportunity to get large eel fish (Silver eel) in the process of upstream uptake for growth or vice versa for spawning ruins is still very low or even not found.

The value of growth parameters based on eel length indicates that eel growth in the Cibeureum River can reach a maximum size of 120.23 cm, which takes more than 15 months. The smaller of growth coefficient, the longer time needed for the species to approach the infinitive length. This is consistent with Nasution's statement (2009) that the K value indicates the speed of an individual to reach asymptotic length (L∞), so that the greater the K value the faster the L∞ value is reached or the shorter the species life span. Sparre & Venema (1999) stated that the speed of growth does not have absolute and dynamic values related to the stage of life development, metabolic rate and environmental conditions. Anderson & Gutreuter (1983) added that species continue to experience a long increase, even in conditions of unsupportive environmental factors.

Table 2. Eel Fish (*Anguilla bicolor*) Caught at Each Station on the Cibeureum River for the Period 30 June - 18 July 2018

Station	Total (N = 97)				Percentage
	Glass eel	Elver	Yellow eel	Silver eel	
I	0	15	4	0	19,59
II	0	17	5	0	22,68
III	0	16	6	0	22,68
IV	0	15	3	0	18,56
V	0	15	1	0	16,49

The difference in K growth value at each sampling station on the Cibeureum River is likely due to differences in the sample size analyzed, the sampling period, food abundance and environmental conditions. According to Froese *et al.* (2000), K values>0.3 per year are included in the high category. According to Morgan (1980) that growth is influenced by several factors namely food, temperature, and density. According to Suman *et al*. (1994), differences in species growth from different waters are thought to be caused by differences in the size range of the species analyzed, food abundance, and water conditions and the analytical methods used. Meanwhile according to Tiews *et al.* (1970) in Nurul *et al.* (2013) argue that differences in the growth of the same species are partly due to environmental conditions, especially temperature and food availability.

Eel growth curves by plotting age (month) on the x-axis and total length (cm) on the y-axis until fish are more than 20 months old. The curve illustrates the growth rate of the eel. Eel who have a young age have a faster growth rate compared to those who have old age (approaching L∞). From this curve it can also be seen the time needed for the eel to approach L∞ of 120.23 cm, which is 18 months (± 1.5 years). At five eel sampling stations on the Cibeureum River, there were asymptotic length differences at each station. This is in accordance with Effendie (2002) which states that the difference in value obtained can be caused by two factors, namely internal factors are heredity (genetic), parasites, and diseases while external factors are temperature and food availability. It can be predicted that the availability of feed/ food at Station I might be abundant to provide enough energy for its growth, so that the growth rate is relatively faster. The success of spawning determines the strength of the recruitment of new individuals into stock.

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Mortality Rate

Table 4. Eel Mortality Rates in the Cibeureum River

Parameter	Value	Information
Total Mortality (Z)	2.88	Use curves based on length conversion in FiSAT II
Natural Mortality (M)	0.47	Using the Pauly formula (1984)
Capture mortality (F)	2.41	F = Z-M
Exploitation rate (E)	0.84	E = F/Z

The results of the analysis of the mortality rate of eel as a whole in the Cibeureum River 2.88 per year with a natural mortality rate (M) of 0.47 per year and capture mortality (F) of 2.41 per year. The estimated value of exploitation rate (E) from this study is 0.84 per year. At five eel fishing stations on the Cibeureum River, values were not much different. The high level of total mortality shows that the reduction in eel stock in the waters is not only caused by the magnitude of the pressure of capture, but also due to natural death. Beverton & Holt (1957), suspects that predation is a common external factor as a natural cause of mortality. According to Pauly (1984), what affects the natural mortality value (M) is the maximum length factor (L∞) and the growth rate and environmental factors, namely the average temperature of the waters. According to Haryono (2016), it is stated that for the development of eel fish seeds the temperature ranges between 17-25ºC, while according to Nugroho *et al* (2011) for the development of eel fish a temperature range between 29-30ºC is needed. Based on this, it can be assumed that the increase in mortality rate of eel fish is caused by the increasing number of eel fish predators. In addition, the range of water temperatures is less supportive for eel fish growth.

Table. 5. Estimated Values of Total Mortality Coefficient (Z), Natural Mortality (M) and Mortality Due to Capture (F), and Rate of Exploitation (E) of Eels based on Observation Stations on the Cibeureum River

Station	Mortality			Eksploitation Rate (E)
	Total (Z)	Natural (M)	Catching (F)	
I	1,17	0,71	0,46	0,40
II	1,99	0,62	1,37	0,69
III	1,95	0,65	1,31	0,69
IV	1,30	0,63	0,67	0,52
V	1,57	0,83	0,74	0,47

The natural mortality rate (M) of eel fish from the Cibeureum River is mostly caused by fishing activities. The highest mortality mortality (F) occurred at Station II of 1.37 per year and the lowest was at Station I of 0.46 per year influenced by predation, disease, spawning stress, hunger and old age. The high rate of capture mortality and the decrease in natural mortality rate can be caused by a decrease in the number of fish that grow to old age and experience natural death, and have been caught first because of fishing activities. The large capture mortality rate and the low natural mortality rate can also indicate the suspicion of growth overfishing, namely the small number of old fish because young fish do not have time to grow due to being caught (Sparre & Venema, 1998). According to Jefry & Syahroma (2007), mortality due to capture (F) tends to vary from year to year depending on the effort of catching (effort), the greater the effort of catching and the number of fishing gear that operate, the greater the mortality of fish due to capture.

Exploitation rate (E) is an index that describes the level of utilization of stock in a waters. Sparred an Venema (1998) states the value of E = 0.50 indicates the level of maximum/ optimum stock utilization, E <0.50 indicates underfishing, and E> 0.50 indicates the level of stock utilization has overfishing. Judging from the overall exploitation rate in the Cibeureum River which reached E = 0.84 (Table 7) shows that eel fishing in the Cibeureum River is above the optimum value (E = 0.50). This indicates a high fishing pressure or overfishing conditions for eel stocks in the waters of the Cibeureum River. In accordance with the statement of Ernawati and Mohammad (2010) which explains that the higher the level of exploitation in an area, the greater the mortality mortality.

Recruitment Patterns

Table 6. Monthly Percentages of New Additions (Recruitment) *Anguilla* Sp Cibeureum River

Month	Recruitment Percentage (%)
January	4.98
February	0.21
March	5.54
April	10.20
May	10.44
June	16.06
July	5.64
August	16.57
September	6.14
October	6.31
November	17.91
December	0.00

The results obtained showed that recruitment occurs almost all year long every month from January to December, only in December there is no recruitment. Alleged peak eel recruitment occurred in June, August and November. Eel recruitment pattern every year shows 3 pulses (mode) that overlap each other (overlapping) with the peak recruitment occurs in June, August and November. This is presumably due to the behavior of eels that do partial spawning (partial spawner). In general, the pattern of eel recruitment every year is not much different from the peak recruitment that began around April - October in central Indonesia. Fahmi & Hirnawati's research (2010) showed that the abundance of eels in the Cimandiri River peak occurred in November, then followed in October and August, this is not much different from the results of the analysis in this study.

The recruitment pattern is related to the time of spawning (Ongkers, 2006). The peak of eel recruitment occurred in June (16.06%), August (16.57%), and November (17.91%). This is likely due to the shifting of the eel spawning season marked by the emergence of new individuals from spawning results in April (Figure 10). Eel spawning may also be influenced by shifts in the dry and rainy seasons. According to Sriati (1998), abundance is affected by habitat type, the area of the area submerged during high tides and water levels during the rainy season, tidal movements, and seasons. The alleged recruitment pattern with the FiSAT II program is often not in accordance with reality in nature. The model is based on two assumptions that rarely occur in reality, namely all samples grow with a single set of growth parameters and one month in a year there is always zero recruitment (Pauly, 1984). Nevertheless, the model traced to FiSAT II is useful for estimating how the recruitment of eel populations occurs within one year.

Alternative Management of Eel Fish Populations

Based on the results, the quality of the Cibeureum river water is close to the observations of insitu and laboratory tests that the quality is still suitable for the development of eel. The abundance of eel fish based on the results of research by respondents that the abundance of eel fish in the Cibeureum river 25 respondents (50) sometimes evenly distributed, 10 respondents (20%) equally distributed, 9 respondents (18%) very equally distributed, 5 respondents (10%) were unequally, 1 respondent (2%) was very unequally. The value of respondents with the results of abundance analysis has a relative value, that eel fish found at each station.

Catches of eel fish per year based on the results of research by respondents in the Cibeureum river 36 respondents (72%) sometimes decrease, 7 respondents (14%) decrease, 6 respondents (12%) are greatly reduced, 1 respondent (2%) does not decrease. From the results of research that has been conducted based on the results of an analysis of growth and rate of eel exploitation in the Cibeureum River shows that eel fish is suspected of overfishing or high fishing pressure occurs where the exploitation value of 0.84 per year, this value exceeds the value optimum exploitation rate of 0.5. Overfishing is defined as a high amount of fishing effort so that fish stocks do not have the opportunity (time) to develop, this causes lower total catches (Sparre & Venema, 1998). Therefore we need an alternative management of eel in the waters of the Cibeureum River, Cilacap Regency.

Mortality coefficient describes the reduction in fish abundance in an age group at a certain period of time due to natural factors and capture. Natural mortality is caused by predators, diseases, parasites, due to old age and the environment which is largely influenced by circumstances that change throughout their lives. Eel fish is generally caused by a high frequency of catching. Evidenced by the results of observations in the field and direct interviews with fishermen mentioned that many fishermen who catch eel every day in the Cibeureum River by using fishing gear that is not selective. Some local fishermen also stated that there was an over exploitation which was suspected to be further including the condition of growth overfishing of eel fish due to the use of fishing gear that was not environmentally friendly, namely by using pleped redesign, apong and strom (electric fishing) which not only damaged the population eel fish but also to other fish populations both large (adult) and small (puppies). The level of exploitation that occurs can be said to be vulnerable to eel resources in the waters of the Cibeureum River, therefore there is a need for management in terms of capture. Basically, fisheries management aims to make fish resources sustainable and sustainable. Population parameters play an important role in stock assessment (Sparre & Venema, 1999). One of the main parameters is regulating mortality due to capture (F). One effort that can be done to manage eel fish resources that have shown overfishing (decreasing fish size) in an area/ region is to place restrictions on fishing areas and fishing times, for example by arranging the installation of bubu or wuwu and the moratorium on installing bubu in certain areas. . This is regulated so that eel fish that are not caught can reproduce, resulting in the recruitment and recovery of eel stocks in the fishing area.

An important thing that can be done in the management plan for eel fish resources is the need for an important role of the fish auction place (TPI), as a data center for fish catches production including eel catches. TPI pioneering in Kaliwungu village has started with the construction of a pier as a boat berth. With the government's plan to build TPI, it will ease the production of eel fish in the Cibeureum river, which will facilitate management.

According to the Fisheries Law No. 31 of 2004 that fisheries management is carried out to achieve optimal and sustainable benefits and guaranteed sustainability of fish resources, furthermore fish management is all efforts, including integrated processes in information gathering, analysis, planning, consultation decision making, allocation fish resources and the implementation and law enforcement of laws and regulations in the field of fisheries, which are carried out by the government and other authorities aimed at sustaining the productivity of aquatic biological resources and agreed objectives.

Conclusion

Cibeureum River water quality meets the water quality requirements. Elver fish species abundance have the highest abundance index among others while Eel and Yellow Eel species in the Cibeureum River has a random distribution pattern. Eel fish mortality in the Cibeureum River, Cilacap Regency is partly large caused by fishing activities, hence it is important to limit the catching time and the eel catchment area.

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