Study of demersal fish resources for sustainability of capture fisheries in Pangandaran Beach, Indonesia

Lantun P Dewanti[1], Zahidah[2], Izza M Apriliani[1], Heti Herawati[2], Noir P Purba[3]

[1] *Laboratory of Fishing Management and Tecnologi, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia*
[2] *Fisheries Department, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia*
[3] *MEAL (Marine Research Laboratory), Universitas Padjadjaran*

ABSTRACT

Fisheries resource stock estimation is important information used to determine the appropriate management for the sustainability of fish resources. Demersal fish as a commodity with its various species and abundant numbers in the Indonesian waters is an important object to be researched. The method used in this research is descriptive quantitative. Primary data were obtained by making direct observations to the research location and interviews with fishermen and Pangandaran fishery port employees. Information obtained from the interview results in the form and size of the fishing unit, the fishing area, the number of operating trips for each fishing gear. The secondary data needed in this research is periodic data (time series) of the production of catches at TPI Pangandaran for the last 5 (five) years. Based on the research results, the main commodities of demersal fish in Pangandaran Beach are Trichiurus lepturus, Johnius trachycephalus, Saurida undosquamis, Pampus argenteus, Arius thalassinus, Chirocentrus dorab, Lutjanus bitaeniatus, Parastromateus niger, *and* Geres punctatus. *The fishing gear that catches demersal fish in Pangandaran is the gill net, trammel net, longline, mini bottom trawl, beach seine and lift net. The CPUE (catch-per-unit-effort) value of demersal fish is 0.072 tonnes per trip with a total allowable catch of 27.51 tonnes, MSY 34.39 tonnes and effort of 1200 trips per year. Basically, from these data it can be analyzed that the demersal fish production which is currently being utilized has experienced overfishing.*

Keyword: *CPUE, demersal fish, fisheries resources, MSY, production, Pangandaran*

1. INTRODUCTION

Demersal fish is a group of fish resources with a fairly high variety of species as well as a high volume of production. Demersal fish commodity has a high economic value, because several types of this fish group become export commodities [1] [2] [3]. Demersal fish is a group of fish whose habitat is in the form of mud or sandy mud [4]. Good management of fish resources can have an impact on the sustainability of the resource. This is the basis that capture fisheries activities need not only produce fish with abundant production but also must pay attention to the stock and sustainability of fish resource commodities.

Fish resource stock in population is an indicator that can be measured by evaluating the estimated density and biomass, calculating using catch data, fishing trips and catch data per unit of effort [5]. In calculating the estimated potential of fish resources, the surplus production method is used. This method can estimate the amount of sustainable potential, the amount of optimal effort, the total allowable catch and the CPUE of fish commodities including demersal fish. This study aims to determine the main types of demersal fish commodities, the types of

fishing gear used and the estimation of the potential and sustainability of demersal fish resources in Pangandaran Beach.

2. METHOD

The method used in this research is descriptive quantitative, which is a method that aims to provide a systematic, factual and accurate description of the factors, properties and relationships of the phenomena being investigated [6]. Data were collected using primary data and secondary data. Primary data as supporting data were obtained by conducting direct observations at the research location and interviews with fishermen and TPI Pangandaran employees. Information obtained from the interview results in the form and size of the fishing unit, the fishing area, the number of operating trips for each fishing gear. The secondary data needed in this research is periodic data (time series) of the production of catches at TPI Pangandaran for the last 5 (five) years. This data is the main data in the analysis, obtained from the annual report. The data analysis is done by calculating the potential with the surplus production method. This analysis is used to calculate the sustainable potential of demersal fish resources in waters [7] [8] [9].

3. RESULT AND DISCUSSION

3.1. Fishing Port Facilities at Pangandaran Beach

According to the Regulation of the Minister of Marine Affairs and Fisheries Number 16 of 2006 [10] concerning fishing ports, a fishery port is a place consisting of land and waters around it with certain boundaries as a place for government activities and fishery business system activities that are used as a place for fishing boats to dock, dock and or loading and unloading fish equipped with shipping safety facilities and fishery support activities.

There are several facilities at the Cikidang Fishing Port. The main facilities at Cikidang Fishing Port are breakwater, revetment, pier, harbor pool, open road and drainage. Functional facilities, there are fish markets (TPI), navigation tools and shipping communications [11]. Supporting facilities, there is a meeting hall, mosque. This facility is relatively simple and still needs to be improved. Facilities in a fishing port are related to the existing capacity and effectiveness of the port as a center for fishery activities [12].

Table 1. Monthly Activity and Production of Cikidang Fishing Port, Pangandaran Beach

Month	Informations			
	Boat Trip (trip)	Production (Kg)	Value (Rp)	Average Price (Rp/Kg)
January	2,260	57,104	1,767,113,058	30,946
February	1,756	58,796	1,243,459,464	21,149
March	2,718	66,258	1,562,844,730	23,587
April	1,737	41,913	1,342,661,974	32,034
May	1,838	67,672	1,351,614,952	19,973
June	1,722	57,795	1,510,188,112	26,130
July	2,919	122,064	2,675,172,954	21,916
August	5,179	302,212	4,942,574,872	35,763
September	4,605	416,848	6,829,426,520	38,961
Oktober	4,702	179,853	5,955,039,191	41,528
November	4,066	149,262	4,627,810,795	43,222
December	2,986	80,918	3,269,840,310	49,413
Total	**36,488**	**1,600,694**	**37,077,746,931**	**34,613**

Source: Yearly Report of Cikidang Fishing Port [13]

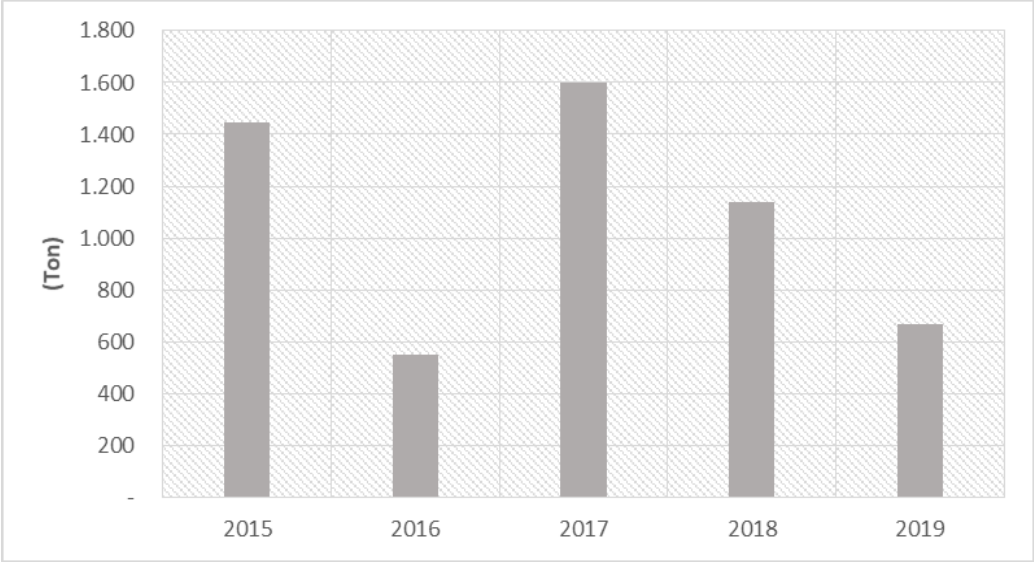

Fig 1. Fish Production in Cikidang Fishing Port [13]

3.2. Fishing Gear

There are six types of fishing gears that get demersal fish as catch (main catch and bycatch). Different types of fishing gear affect the stock and sustainability of demersal fish resources [14] [15]. Several types of fishing gear can put pressure on the ecosystem and on existing demersal fish resources [15]. At Pangandaran Beach longline, lift net, trammel net, gill net, beach seine and mini bottom trawl are operated to catch demersal fish. Gill nets are the highest production fishing gear used to catch demersal fish. The annual average production of this fishing gear is 8,529 tons per year. Gill net is a type of fishing gear that is widely operated in Indonesian waters [16] [17]. Apart from gill net, trammel is also a type of fishing gear that catches demersal fish with a production volume of up to 1,810 tons per year.

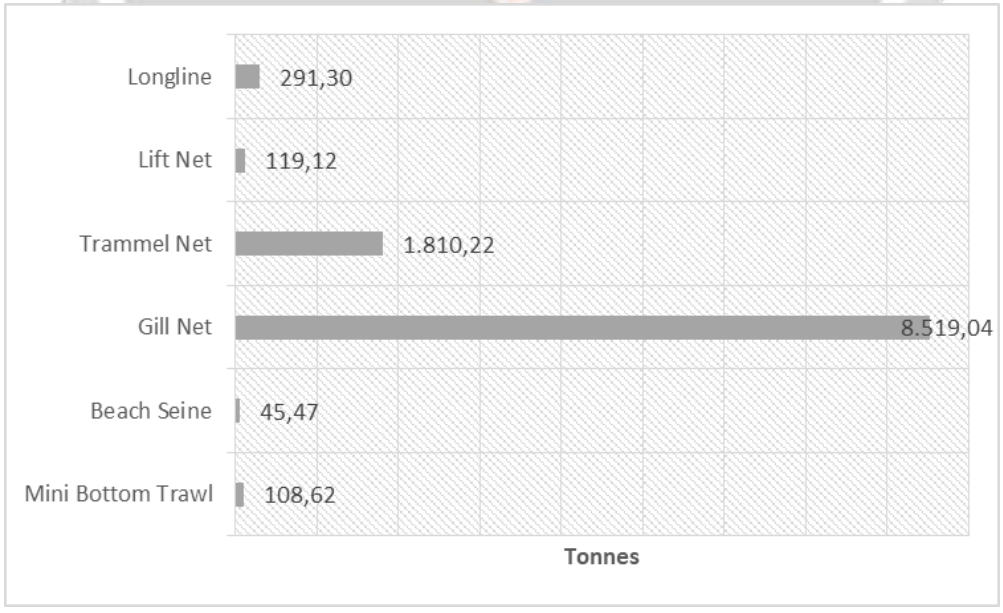

Fig 2. Demersal Fish Production based fishing gear used in 2018 [18]

3.3. Demersal Fish Potential in Pangandaran Beach

Based on Capture Fisheries Statistics Pangandaran [18] Demersal fish commodity with the highest production is *Trichiurus lepturus* with production reaching 14,536.92 tons per year. *Trichiurus lepturus* fish is a demersal fish resource which has high economic value [19] [20]. *Trichiurus lepturus* fish of a certain size becomes a commodity that is exported by fishermen. In Pangandaran *Trichiurus lepturus* it is captured using a bottom gill net. In other areas, such as Palabuhanratu, *Trichiurus lepturus* production is produced from several types of fishing gear including longlines, *Trichiurus lepturus* fishing line, purse seine, seine net, and lift net [21]. The fishing area for Trichiurus lepturus in Pangandaran is scattered around the West Coast and the East Coast of Pangandaran [22]. Fishermen take boats to the fishing grounds and catch them using gill nets. Apart from *Trichiurus lepturus*, *Johnius trachycephalus* also contributed with a production of 5,546.96 tons per year. It continued by *Saurida undosquamis* with a production of 2,252.70 tons per year, *Pampus argenteus* with a production of 2,057.24 tons per year.

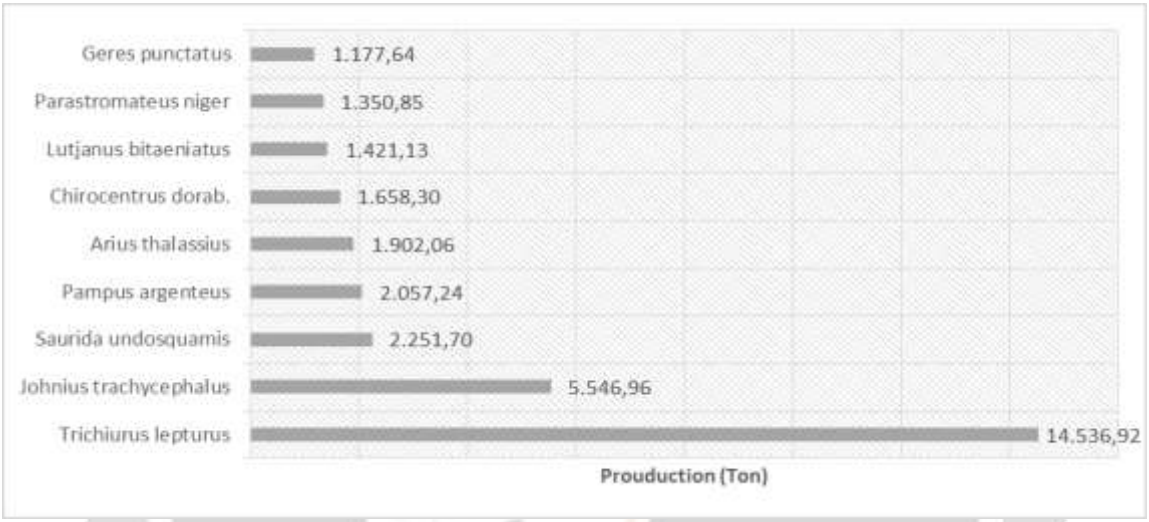

Fig 3. Main Commodity of Demersal Fish in Pangandaran [18]

3.4. Estimation of Demersal Fish Resource

Using the Schaefer model aims to determine the optimum effort value, so that it can determine the maximum effort value that can be used without disturbing and affecting stock productivity in the short and long term or can be called the maximum sustainable yield. The Schaefer model is often used in the estimation of fish stocks in tropical waters because the data processing is classified as simpler because it only requires a small amount of data. The Schaefer model can be used if there is data on catch production and CPUE (Catch Per Unit Effort) in several years [20].

Table 2. Catch and effort demersal fish from 2013-2018 in Pangandaran Beach

Year	Catch (C) (ton)	Upaya (F) (trip)	CPUE (ton/trip)	ln CPUE
2013	240,321	20291	0,0118	-4,4360
2014	241,68	49978	0,0048	-5,3317
2015	593,443	26049	0,0228	-3,7818
2016	455,49	76027	0,0060	-5,1175
2017	739,3282	27297	0,0271	-3,6088
2018	30720,7	339261	0,0906	-2,4018

The data used are production and effort data from 2013-2018. Furthermore, the data is calculated using the CPUE method. This process is carried out to be able to calculate data on the sustainable potential of demersal fish resources in the district. Pangandaran. Since 2013, the production of demersal fish has been in the range of 240 tons to 739 tons. This value is then standardized using the Fishing Power Index (FPI) calculation by assessing the fishing gear

with the highest CPUE. The results showed that the potential value of demersal fish resources was 0.072 tonnes per trip. So that Pangandaran fishermen catch demersal fish resources of only 72 kg per trip. Furthermore, the Maximum Sustainable Yield (MSY) value is calculated, which is 39 tons, while the Total Allowable Catch is 27.51 tons per year.

4. CONCLUSIONS

1) The main demersal fish commodities in Pangandaran Beach are *Trichiurus lepturus, Johnius trachycephalus, Saurida undosquamis, Pampus argenteus, Arius thalassinus, Chirocentrus dorab, Lutjanus bitaeniatus, Parastromateus niger, and Geres punctatus*.
2) Fishing gear that catches demersal fish in Pangandaran are gill net, trammel net, longline, mini bottom trawl, beach seine and lift net.
3) The CPUE value of demersal fish is 0.072 tons per trip with a total allowable catch of 27.51 tons, MSY 34.39 tons and the effort of 1200 trips per year

5. REFERENCES

[1] Ma'mun A, Priatna A, Hidayat T, Nurulludin N. Distribution and Potential of Pelagic Fish Resources in the Territory of the Republic of Indonesia 573 Fisheries Management (Wpp Nri 573) Indian Ocean. *J Researchers in Indonesia*. 2017; 23 (1): 47. doi: 10.15578 / jppi.23.1.2017.47-56

[2] Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia. *Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia No.18 / PERMEN-KP / 2014 Regarding the Regional Fisheries Management Territory of the Republic of Indonesia*. Vol. 2009; 2014.

[3] Muawanah U, Yusuf G, Adrianto L, et al. Review of national laws and regulations in Indonesia in relation to an ecosystem approach to fisheries management. *Mar Policy*. 2018; 91 (January): 150-160. doi: 10.1016 / j.marpol.2018.01.027

[4] Nurhayati M, Wisudo SH, Purwangka F. PRODUCTIVITY AND PATTERNS OF TUNA FISHING SEASON yellowfin PRODUCTIVITY AND SEASONAL PATTERN OF TUNA Yellowfin (Thunnus albacares) FISHING IN FISHERIES MANAGEMENT AREA 573. *J Aquatics*Indones.2018; 3 (2).

[5] Conscience TW, Wahyuningrum PI, Wisudo SH, Gigentika S, Arhatin RE. Model design of Indonesian tuna fishery management in the Indian Ocean (FMA 573) using the soft system methodology approach. *Egypt J Aquat Res*. 2018; 44 (2): 139-144. doi: 10.1016 / j.ejar.2018.06.005

[6] Budiasih D, Dewi N. CPUE and Level of Utilization of Cakalang (Katsuwonus Pelamis) Fisheries Around Palabuhanratu Bay, Sukabumi Regency, West Java. *Agrieconomics*. 2015; 4 (1): 37-49.

[7] Halim A, Wiryawan B, Loneragan NR, et al. Developing a functional definition of small-scale fisheries in support of marine capture fisheries management in Indonesia. *Mar Policy*. 2019; 100 (April): 238-248. doi: 10.1016 / j.marpol.2018.11.044

[8] Stacey N, Gibson E, Loneragan NR, et al. Enhancing coastal livelihoods in Indonesia: an evaluation of recent initiatives on gender, women and sustainable livelihoods in small-scale fisheries. *Marit Stud*. 2019; 18 (3): 359-371. doi: 10.1007 / s40152-019-00142-5

[9] Sudarmo AP, Baskoro MS, Wiryawan B, Wiyono ES, Monintja DR. Small-scale Fisheries: The Fishermen's Decision-Making Process In Relation To Factors That Influence Fishing. *Mar Fish J Mar Fish Technol Manag*. 2013; 4 (2): 195. doi: 10.29244 / jmf.4.2.195-200

[10] Schuhbauer A, Sumaila UR. Economic viability and small-scale fisheries - A review. *Ecol Econ*. 2016; 124: 69-75. doi: 10.1016 / j.ecolecon.2016.01.018

[11] Rachman S, Purwanti P, Probolinggo SK, Timur J, Probolinggo K, Seine net J. Factor Analysis of Production and Feasibility Work of Large Net (Seine net). *A ECSOFiM*. 2013: 1 (1).

[12] Purwangka F, Wisudo SH, Iskandar BH. Identification of Potential Hazards and Occupational Safety Technologies in Seine net Fisheries Operations in Palabuhanratu, West Java Identification of Potential Hazard and Safety Technologies of Seine net Fisheries Operations in Palabuhanratu, West Java. *J Ocean Nas*. 2013; 8 (2): 60-72.

[13] Dewanti LP, Ismail MR, Rizal A, Rahmaningrum SF, Apriliani IM. Stock assessment of hairtail fish (Trichiurus spp) Landed in pangandaran, West Java. 2020; 8 (1): 192-196.

[14] Garcia SM, Staples DJ. Sustainability reference systems and indicators for responsible marine capture fisheries: A review of concepts and elements for a set of guidelines. *Mar Freshw Res*. 2000; 51 (5): 385-426. doi: 10.1071 / MF99092

[15] Tampubolon PARP, Sulistyaningsih RK, Nugraha B. TROLL LINE NERITIC SHEETS FISHERIES IN STRAIT, EAST LOMBOK (FMA 573). *IOTC*. 2015; (Fma 573): 1-14.
[16] Siswoyo, Rahmat E. Operational Technique of Seine net Net in Agung Lampung City Waters. *Litkayasa Tech Bul*. 2018; 16 (2): 87-90.
[17] Ministry of Maritime Affairs and Fisheries of the Republic. *Decree of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number Kep.06 / Men / 2010*. 2010: 30.