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Utilization rate of fish resources in Banggai Laut waters

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ABSTRACT

Capture fisheries is one of the leading sectors that drive the economy of Banggai Laut Regency. Improved fishing technology is related to fishing efforts that will affect the sustainability of fish resource stocks in the waters of Banggai Laut Regency. This study aims to identify the rate of utilization of fish resources in an effort to develop a sustainable fisheries sector in Banggai Laut waters. The method approach used is "Surplus Production". This method serves as an estimator of the relative abundance of a fish resource in the waters of Banggai Laut Regency which is based on the catch per unit of fishing effort. The results showed that the capability of the fishing fleet in Banggai Laut Regency has not been able to reach potential fishing areas. The catch per unit effort (CPUE) of fish resources in Banggai Laut Regency still shows an increasing trend with the highest rate of increase by other fish group including crustaceans and mollusks, about 0.160 tons/unit in the 2014-2016 period. Meanwhile, the catch per unit effort of the large pelagic fish group showed an increasing trend with the lowest rate of increase, about 0.001 tons/unit in the 2014-2016 period. Therefore the utilization rate of fish resources in the waters of Banggai Laut Regency is still classified as under exploited.



INTRODUCTION

The potential of fishery resources in Banggai Laut Regency is very large because it is not only supplied from the Indonesian Fisheries Management Area (WPP) 714, but also from WPP 715 with a total potential of both fish resources of 1,063 tons/year. Potential fisheries resources include large pelagic fish resources, small pelagic fish resources, demersal fish resources, shrimp and other crustacean resources, mollusc resources (squid and sea cucumbers), commercial natural seed resources, coral resources, consumption reef fish resources, ornamental reef fish resources, marine turtle resources, marine mammal resources, and seaweed resources (KKP Research and Development Center for Marine and Fisheries, 2014).

Capture fisheries in Indonesia has a strategic role, but in its implementation it cannot be separated from the complexity of the problems it faces. Threats to the sustainability of fish resources and the capacity of business actors are a major concern in realizing sustainable

capture fisheries (Kusdiantoro et al., 2019). Strategic issues and general problems that become the main obstacles in realizing sustainable fisheries activities in Banggai Laut Regency are: 1) fisheries management; 2) law enforcement; and 3) level of knowledge of fishery business actors.

Production volume of fish resources in Banggai Laut Regency in 2016 was 68,863 tons. This number has increased by 14% from the production volume in 2015 which amounted to 59,191 tons. Fish resources in the water of Banggai Laut Regency contain of large pelagic fish, small pelagic fish, demersal fish, and reef fish such as crustaceans and molluscs (BPS Banggai Laut, 2017). As a new definitive area in 2013, Banggai Laut Regency certainly does not want its fish resources to be degraded just because it is too late anticipating efforts to increase the amount of production without controlling the utilization rate. There have been many examples of cases, such as in the north and south coast of Java, where fish resources are eventually degraded due to being oriented to production quantities only but forgetting the impact on the sustainability of fish resources. The high intensity of fishing in South and North Java has threatened the sustainability of fish resources. Based on data from the National Commission on Fish Resource Assessment (KAJISKAN) the utilization rate of fish resources in Java waters has reached 130% which clearly confirms that the sustainability of fish resources is threatened by overfishing which is indicated a decreasing trend in the number and size of fish catches from year to year (Jaya et al., 2017; Kusdiantoro et al., 2019; Triarso, 2013).

Banggai Laut Regency is one of the archipelagic region which become a national fish barn with an increasing trend of productivity, so reasonable if the local governments will continue to accelerate fishing productivity. However, the absence of data on the rate and pattern of fish resource utilization in Banggai Laut Regency is an inhibiting factor in the formulation of sustainable fisheries management regulations that have the potential to cause overfishing symptoms as has happened in many other water areas. Therefore, the first step that the local government needs to take is to find out in advance what the actual rate of fish utilization in Banggai Laut waters. So that by knowing the rate of utilization, the local government has a basis in formulating appropriate regulations to regulate the types of fishing gear, types of fish that are allowed to be caught, fishing areas, fishing season and fishing capacity (Tuhuteru et al., 2015; Listiani et al., 2017). The strategy that needs to be done is to evaluate the relationship between productivity and fishing effort so that the trend of decreasing productivity with increasing fishing effort in each zone can be minimized (Nelwan et al., 2010a; Nugraha et al., 2012). Because if the form of this relationship indicates that in each zone there is a tendency to shift fish stocks due to increased fishing effort, it can be ascertained that the interaction opportunities with fishing gear are getting smaller, as a result the productivity of each fishing unit decreases (Maunder et al., 2006).

By paying attention to the conditions and problems faced, it is necessary to have policies in the management and utilization of fishery resources based on empirical research data, one of which is through analysis of the rate of utilization of fish resources. This study aims to determine the rate of utilization of fish resources in the waters of Banggai Laut Regency as the basis for formulating sustainable fisheries management policies in Banggai Laut Regency.

MATERIAL AND METHODS

Study site. The research was carried out from September to December 2017 in 7 sub-districts in Banggai Laut Regency, such as Banggai, North Banggai, Central Banggai, South Banggai, Labobo, Bangkurung, and Boka Islands Districts. (Figure 1).

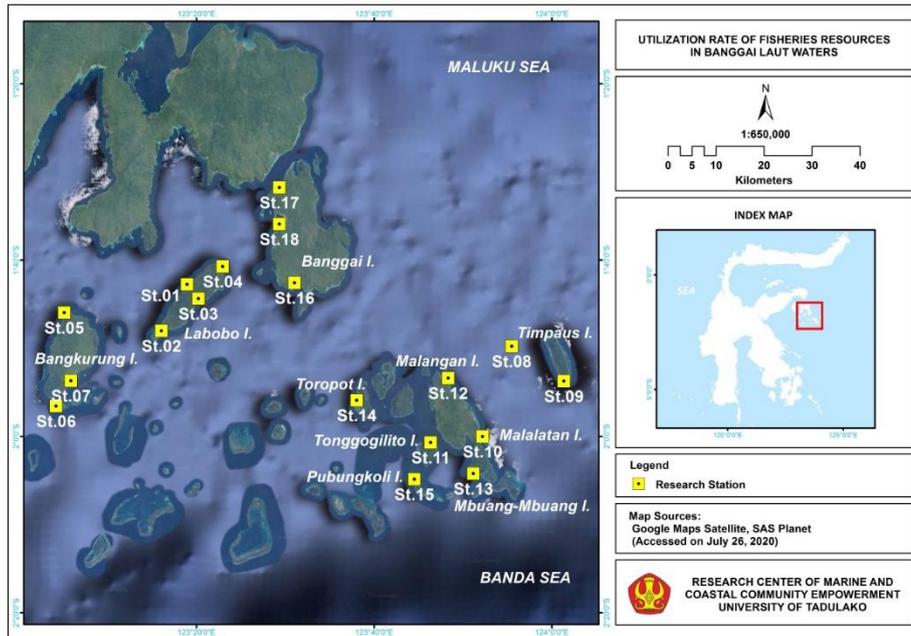


Figure 1. Research sites.

Procedures. The data used in this study include primary and secondary data. Primary data consists of data on fishing operation patterns and data on the composition of fish catch obtained through interviews with fishermen in 7 sub-districts in Banggai Laut Regency. Secondary data consists of fishing fleet data, fishing gear data, fishery production and fishing efforts obtained from BPS of Banggai Laut Regency 2017 and the Department of Marine Affairs and Fisheries of Central Sulawesi Province 2014–2016 (Table 1).

Table 1. Data requirements, description and data analysis

Description	Analysis	Data Requirements
Fishing fleet	Descriptive	Number and types of fishing fleets
Fishing gear	Descriptive	Number and type of fishing gear
Fishing operation patterns	Descriptive	Fishing trip, fishing aid used by fishermen
Composition of fish catch	Descriptive	The number and types of fish caught by fishermen
Fish utilization rate	CPUE trend = a-bf	Annual Capture Fisheries Production (last 3 years) and Catching Effort (number of fishing gears and trips)

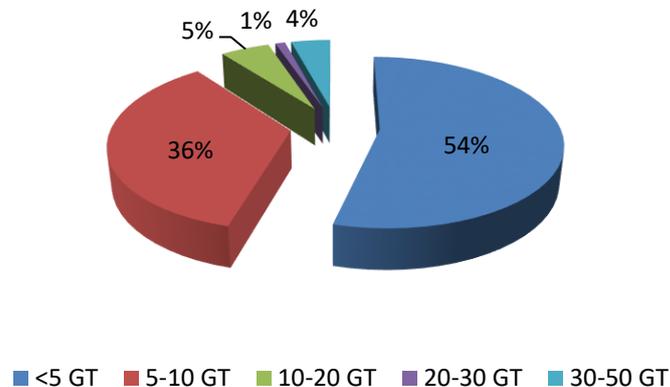
RESULTS AND DISCUSSION

Fishing Fleet. A fishing fleet is a group of vessels organized to conduct joint fishing operations in a fishing potential zone (KKP Directorate General of Capture Fisheries, 2017). In general, fishing fleets in Banggai Laut Regency are still on a small scale with a limited reach. This is illustrated by the fishing fleet data (Table 2) released by BPS Banggai Laut (2017) which shows that the dominant fishing activity is carried out by fishermen with outboard motor boats, namely 2,267 units (91,4%), followed by 117 units (4,7%) of non motorized boats and the smallest number of fleets, namely motor ships, amounting to 96 units (3,9%).

Table 2. Banggai Laut Regency fishing vessel (BPS Banggai Laut, 2017).

Districts	Fishing Vessel		
	Boat Without Motor	Outboard Motor Boat	Motor Ships
Banggai	-	221	31
Central Banggai	7	120	3
South Banggai	16	134	-
North Banggai	41	145	-
Labobo	-	153	2
Bangkabung	3	337	30
Bokan Islands	50	1,157	30
Amount	117	2,267	96

Based on the existing data, it showed that most fishermen have low coverage and limited access to fishing areas because only motor ships have sufficient fuel capacity for relatively longer trips (Ninef et al., 2019). Apart from low coverage, statistics for Banggai Laut Regency also show that 54% of the local fishing fleets operating in Banggai Laut Regency waters are vessels with a capacity below 5 GT (Figure 2). The low coverage of the local fleet certainly affects the optimization of fishing resources in other potential zones (Solihin et al., 2011; Department of Marine Affairs and Fisheries of Central Sulawesi Province., 2016). The large-scale fishing fleets such as the Purse Seine and Bagan Perahu which are seen operating in the waters of the Banggai Laut Regency and anchored in the Tinakin Laut area or in Banggai Bay are andon fishermen who come from other regencies or provinces such as South Sulawesi, Southeast Sulawesi, North Sulawesi, Gorontalo and Bali.

**Figure 2.** Percentage of vessel capacity operating in Banggai Laut waters.

Fishing Gears. Fishing gear data describes the patterns or ways of fishermen in utilizing fish resources, the level of progress of fishermen, the catch, the level of fisheries industrialization, as well as the risk of sustainability of fish resources in Banggai Laut Regency waters. The types of fishing gear in Banggai Laut Regency are quite varied. The most dominant fishing gear used by fishermen in Banggai Laut Regency is hand line, which is 1,818 units, while the least used is sero, which is 2 units (Figure 3).

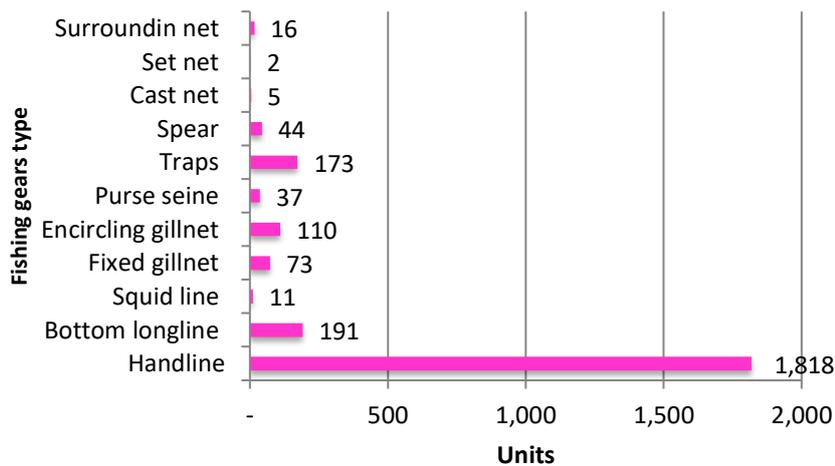


Figure 3. Fishing gears that operates in Banggai Laut waters.

The variety of fishing gears used and the multispecies character of tropical fish resources make the management of fish resources difficult to implement (KKP Directorate General of Capture Fisheries, 2014). However, several options may still be selected to manage fish resources in Indonesia, including: closing seasons and fishing grounds, limiting the smallest fish size, setting the mesh size, limiting fishing effort and fishing quotas (Suman, 2016). Of these various options, the urgent thing to do is the option to limit fishing effort.

Based on the fishing method, the dominant fishing gear used by fishermen in Banggai Laut Regency is a fishing line consisting of hand lines, bottom longlines and squid lines. Hand line are the most dominant fishing gear, which is about 73% of the total fishing gear used in Banggai Laut Regency. This shows a positive thing because fishing line is a fishing gear that is classified as selective to the type and size of fish that is the target of the catch. Based on the degree of selectivity, the fishing gears are more selective like gill nets, hook and line and traps or less selective like trawls, seines and entangling nets (Boopendranath, 2019). The use of selective fishing gear is not only beneficial for fisheries resource management, but also economically beneficial because by using selective fishing gear it is expected that the size of fish will be obtained according to market needs and reduce the risk of fish not being sold in the market (Nurhakim et al., 2009; Nanlohy, 2013; Khatami et al., 2018).

One of the technical aspects of fishing that affects the sustainability of fish resources is the modification of fishing gear and the use of fishing gears. Modification of fishing gear is defined as the use of fishing gear that are not in accordance with the regulations which can have a negative impact on fish resources (Latuconsina, 2010; Siregar, 2018).

The results of interviews conducted with fishermen in Banggai Laut District indicated that 70% of respondents did not modify their fishing gear. The fishing gear used is the one that has been used for a long time and is still considered effective and productive enough to be used today. Meanwhile, 30% of respondents are those who modify fishing gear because of the transfer of information from andon fishermen who are considered to be more effective in increasing catches.

The application of technology gives a significant meaning to the sustainability of fish resources. The application of technology in fishing must be efficient, develop and increase production and minimize environmental damage. Catching fish with an environmentally unfriendly method will accelerate the process of overfishing because the low selectivity of fishing gear and the use of destructive fishing methods has resulted in damage to fish resources and aquatic habitats. However, legal fishing gear also has the potential to cause overfishing if the application of effort exceeds the capacity that allows the fish stock to recover.

Fishing Operation Pattern. The results of the study show that 80% of the fishermen in Banggai Laut Regency take one day trip or carry out a day fishing operation (Figure 4). Meanwhile, 15% of fishermen carry out fishing operations for 3 full days and 2% are those who carry out fishing operations for a week.

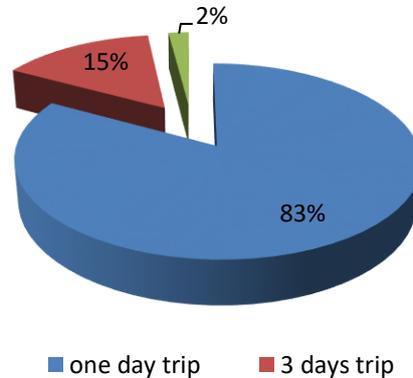


Figure 4. Fishing trip in the waters of Banggai Laut.

Determining the number of fishing trips of one type of fishing unit in a year is by taking into account how many fishing units are operating in one year. The factors that affect the number of trips per year for fishing units in Banggai Laut Regency are factors of weather and season conditions, availability of fuel oil, and availability of operational/logistical funds.

Another effort made by fishermen in Banggai Laut Regency to maintain the effectiveness of their fishing is through the use of fishing aids. The results of the study show that there are 2 types of fishing aids that are widely used by fishermen in Banggai Laut Regency, namely FADs and light aids. FADs are the dominant fishing tool used, namely as many as 65% of the total respondents, while the other 35% admit to using lights as a fishing aid (Figure 5).

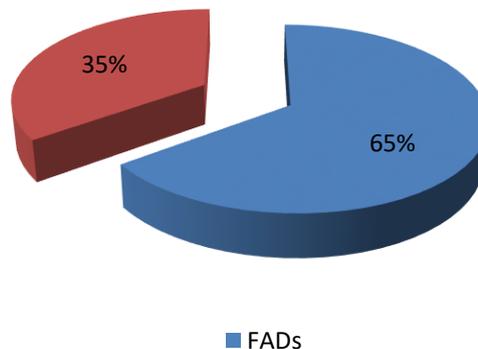


Figure 5. Fishing aids in Banggai Laut Waters.

Composition of Fish Catch. The composition of fish species produced in Banggai Laut Regency includes commodities of large pelagic fish, small pelagic fish, demersal fish, reef fish and other fish species (squid and octopus). The results of the fish composition analysis are based on data obtained from the Departement of Marine and Fisheries of Central Sulawesi Province which was confirmed through interviews with Banggai Laut fishermen in 7 sub districts (Figure 6) shows that production of small pelagic fish is the largest, namely 60% of the total production, which is dominated by flying fish and mackerel. The second largest is the demersal fish group, which is 14% of the production volume, which is dominated by lencam and red snapper. Next is the large pelagic fish such as skipjack and mackerel which account for 9% of the total production. Meanwhile, other fish groups, such as squid, account for 9%,

and groups of reef fish, such as grouper and baronang, account for 7% of the volume of fish production in Banggai Laut Regency.

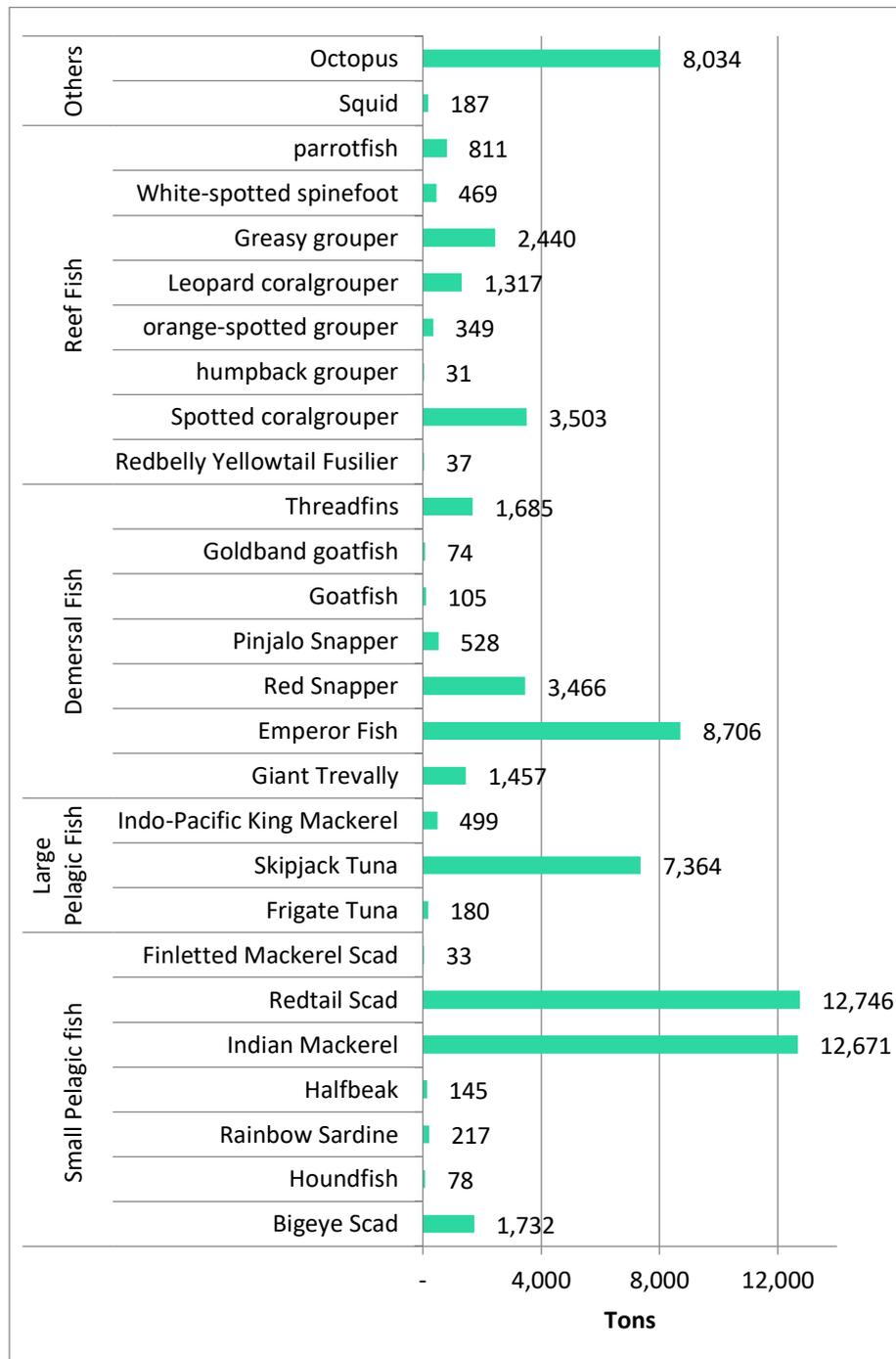


Figure 6. Composition of fish catch in Banggai Laut waters.

Fish Resource Utilization Rate. The level of fishery productivity in Banggai Laut Regency shows an increasing trend from 2014 to 2016 (Departement of Marine and Fisheries of Central Sulawesi Province, 2016). The potential for capture fisheries production in Banggai Laut Regency based on the type of fish has different potentials. Small pelagic fish group is the most productive fish resource in Banggai Laut Regency, reaching 73,453 tons of the total fish production in the 2014–2016 period. Demersal type group production was the second largest, namely 17,705 tons in the 2014–2016 period. Next is the production of the large pelagic fish group, reaching 10,848 tons. Other fish species, such as squid and octopus, can reach 10,531

tons, and the production of reef fish is the smallest for the 2014-2016 period, which is 10,124 tons (Figure 7).

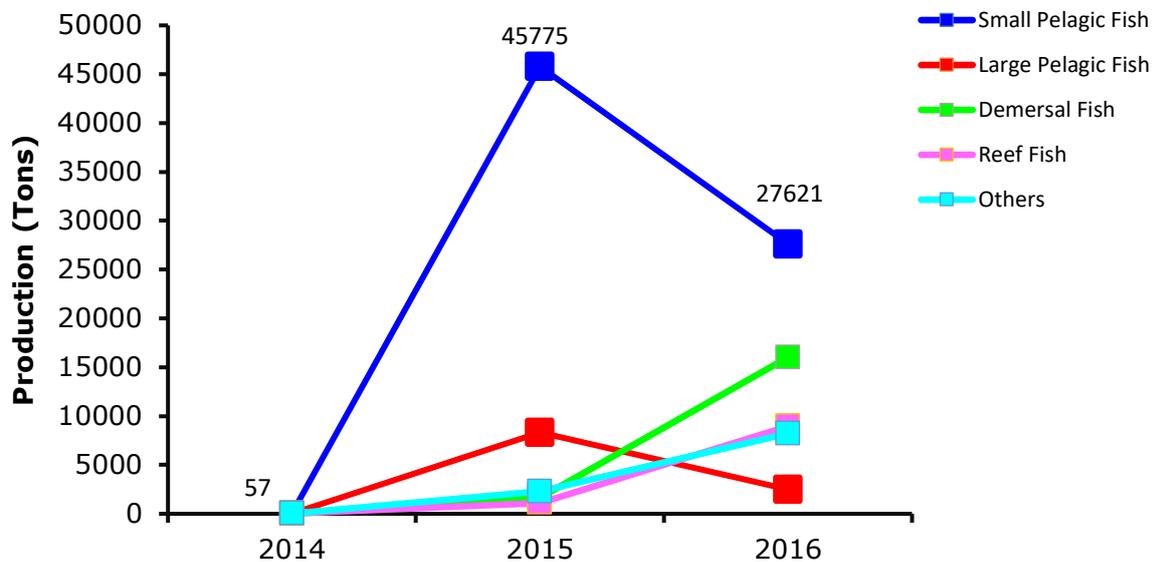


Figure 7. Fluctuations in Banggai Laut capture fishery production in 2014–2016.

The relationship between fishing effort and production is an initial description of fluctuation in production in relation to the large number of fishing gear units operating. The limited growth and development of fish resources in a water area will have an impact on the availability of fish for fisheries in a water area that is used for fishing activities (Nelwan et al., 2015; Kusdiantoro et al., 2019).

The preservation of fish resources is related to the catch rate of various types of fishing gear operated by fishermen in the waters of Banggai Laut Regency. Figure 8 shows the catch rate for each group of fish species in the period 2014–2016.

Fishing productivity is a measure of the capability of each fishing unit in each zone. The relationship between productivity and fishing effort shows that the trend of productivity decreases with each increase in fishing effort at all fishing units in each zone (Nelwan et al., 2010b). If there is a decrease in the trend of CPUE, it is advisable to control the seine net fishing effort by regulating the number of vessels, fishing gear, fishing time and area as well as limiting fishing quota (Salmarika et al., 2018).

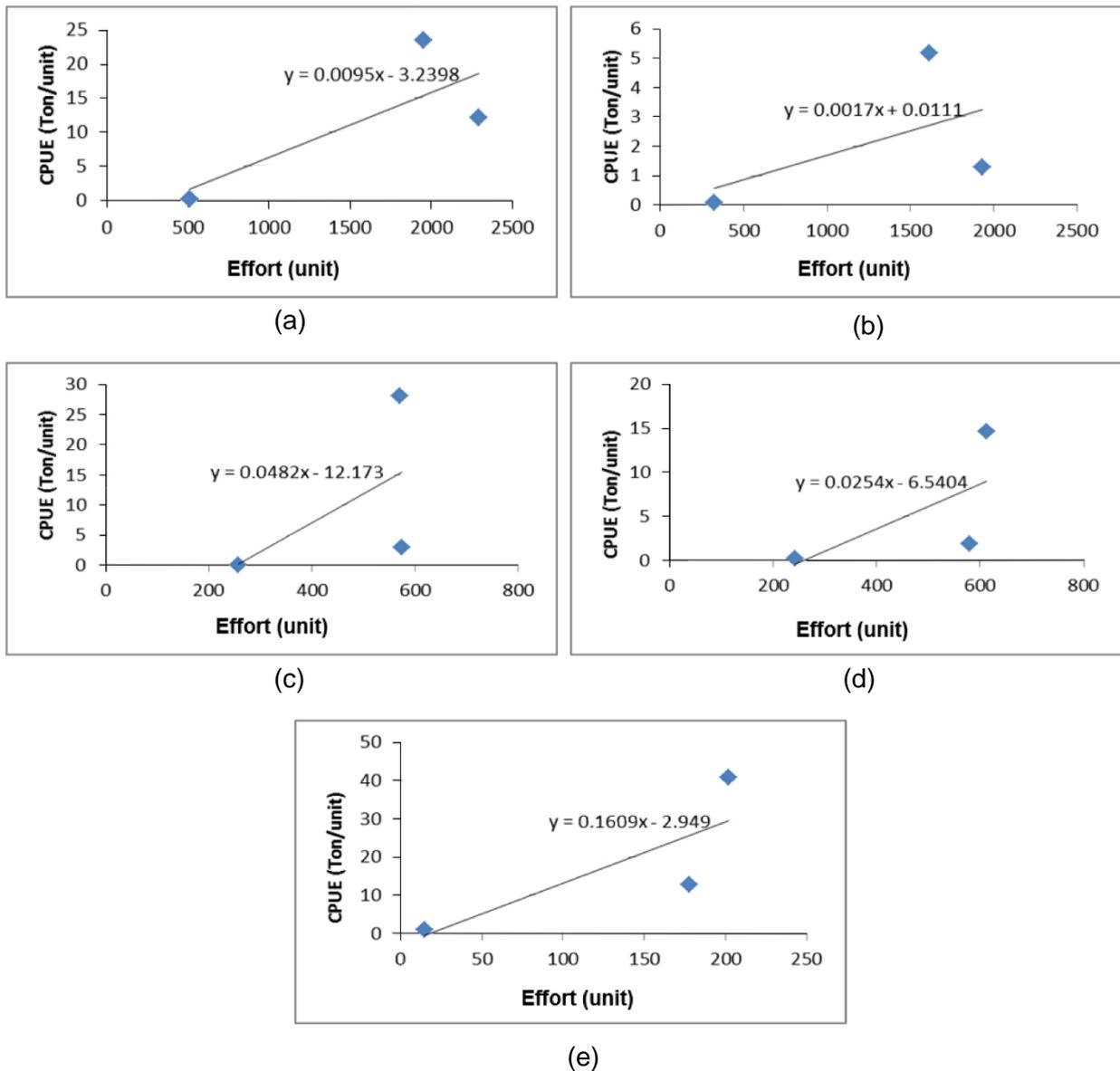


Figure 8. Catching rate of each group of fish resources in Banggai Laut waters. (a) small pelagic fish; (b) large pelagic fish; (c) demersal fish; (d) coral reef fish; and (e) other fish.

The utilization rate of fish resources in relation to fishing effort in each group of fish species in the waters of Banggai Laut Regency still shows an increasing trend in CPUE along with the addition of fishing effort. The catch per unit of fishing effort (CPUE) of fish resources in Banggai Laut Regency still shows an increasing trend with the highest rate of increase by other fish species including crustaceans and mollusks, about 0.160 tons/unit. Demersal fish group occupied the second highest rate of increase about 0.048 ton/unit. Furthermore, the third highest rate of increase was the coral fish species group about 0.025 tons/unit. Small pelagic fish group occupied the fourth highest rate of increase about 0.009 tons/unit. Meanwhile, the large pelagic fish group showed an increasing trend with the lowest rate of increase about 0.001 tons/unit in the 2014-2016 period. Therefore, the rate of utilization of fish resources in the waters of Banggai Laut Regency is still classified as under exploited. Although the rate of utilization is still under fishing, ethical, legal and regulatory aspects, especially on limiting access to fishing and intensity of law violations, need government attention so that the sustainability of fishery resources in the waters of Banggai Laut Regency can be guaranteed.

CONCLUSION

Utilization rate of fish resources in relation to fishing effort for each group of fish species in the waters of Banggai Laut Regency still shows an increasing trend in CPUE along with the addition of fishing efforts. When CPUE increases along with increasing fishing effort, biologically it shows the growth and development of under exploited fish resources, or in other words it is still possible to be optimized. As a result, this condition still has a big chance to get profit economically but still requires consideration in the context of capture fisheries management. Data quality is also an important factor to concern capture fisheries management in Banggai Laut Regency.

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