



# Catch and fishing effort statistics of fisheries in Albay Gulf, Philippines

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**Abstract.** Albay Gulf is one of the major fishing grounds in the Bicol Region characterized by a multi-species fishery with an estimated annual production of 11,756.46 MT. Fishers predominantly utilize handlines (41.46%), entangling nets (16.91%) and other fishing gear. There are 9,141 gear units distributed to 31 distinct gear types, which commonly exploit pelagic/demersal fish species and invertebrates from the gulf. The ten most productive types of fishing gear and methods are bottom-set gill nets, multiple handlines, bottom-set long line, simple handline, troll line, fish corral, bag net, gleaning, trammel net, and drift gill net. These methods account to 84.35% of the total production in Albay Gulf of which fishing operations are greatly influenced by temporal seasonality and availability of the target species. Indication of overfishing in the gulf was observed based on the estimated annual catch per unit area (15.27 MT/ km<sup>2</sup>) as catch per unit effort of fishers are significantly reduced, highly seasonal and erratic availability of target species, disappearance of traditional species and species replacement of less economic value.

**Key Words:** fishing, multi-species, fishing gear, fishery production, overfishing.

**Introduction.** Fisheries are of paramount importance because of their economic contribution to the livelihood, employment, and income of the people (Nieves et al 2009). Albay Gulf is one of the major fishing grounds in the Bicol Region providing livelihood, income, and employment to the families of fishermen living in the coastal areas. However, previous assessment of the National Stock Assessment Program of Bureau of Fisheries and Aquatic Resources (NSAP-BFAR) in Albay Gulf recorded a decline in fish landed catch, from 1,372 MT in 2014 to 840 MT in 2018. Moreover, record shows that 50% to 90% of the common pelagic fish species are caught below the maturity size (Lanzuela 2015), revealing a typical case of growth overfishing. The increasing demand for fish due to a rapid population growth and increasing exports has substantially increased fishing pressure, therefore resulting in declining catch rates in many traditional fishing grounds (Barut et al 1997).

The status of overfishing in the area can be determined by a decline in catch and catch rate, increasing fishing efforts, mortalities, exploitation rates being noted and changes or shifts in species composition, levelling of marine landings, and concentration of fishing effort occur within a small area (Armada 2004). Capture fisheries assessment is basically an analysis of catch and effort which is one of the key tools in providing basis for management of a fishing ground (Soliman & Dioneda 1997). This reveals condition, efforts and the degree of harvesting resources which give an idea on the index of abundance and exploitation in the area. Thus, this study focused on the fisheries assessment of catch and effort to identify fishing gears used, catch rate, estimated production and key species caught in Albay Gulf.

## Material and Method

**Study area.** The study was carried out in 82 barangays (smallest administrative division in the Philippines) along Albay Gulf from March 12, 2019 to May 10, 2019. The gulf is

bounded by the municipalities of Bacacay, Sto. Domingo, Manito, Rapu-rapu and Legazpi City of Albay Province, and municipalities of Prieto Diaz, Bacon District and Sorsogon City of Sorsogon Province. It has an approximate area of 770 km<sup>2</sup> and is located at the southeastern part of Luzon and eastern part of Bicol along the Pacific Coast between 13.124°N latitude and 123.99°E longitude.

**Gear inventory.** Key Informant (KI) interviews were carried out to gather vital information pertaining to the number of fishing gear units, fishing frequency and seasonality of fishing operation of various fishing gear. KI interviews in the form of gear inventory were conducted in 82 coastal barangays constituting seven municipalities and two cities surrounding Albay Gulf. Identification of fishing gear and its classification were based on the guide by Umali (1950). Salient data, e.g., number of fishing gear units and type for specific localities were obtained for characterization of the gulf as fishing ground based on dominant fishing gear.

**Catch and effort data.** Catch and effort data were obtained through a recall interview of key informants. Barangay Fisheries and Aquatic Resources Management Council (BFARMC) officials and/or key fishers who are knowledgeable on fishing practices and dynamics in their area were the primary source of catch and effort data. An official form was prepared and used to derive the fishing trips and their seasonality, catch and species composition. Furthermore, related secondary data were obtained from the Municipal Agriculture Offices (MAO) of the coastal Local Government Units (LGU) and the National Stock Assessment Program-Region V (NSAP-V) for records validation. Recall interview was also utilized to identify the data on catch composition. Only the members of the fishing folk communities with a minimum of five years' exposure in the gulf were the subject of the study. Persons involved in fish landing were also part of the recall interview.

**Fishery production estimation.** Result of data validation was used to estimate the overall production of fishing gear types in the gulf and the municipalities located in the area. The production per type of gear was determined by identifying the product of catch rate per specific gear unit multiplied by the product of fishing frequency and number of specific gear unit (Olaño et al 2009). The summation of the total fishery production per municipality shows the total fishery production in the gulf. Validated data was used to estimate the monthly and annual fishery production of the gulf per municipality and production contribution of fishing gear types. The following formula was used in computing fishery production:

$$\text{Estimated Production} = \text{catch rate} \times \text{fishing frequency} \times \text{no. of gear units}$$

## Results and Discussion

**Gear inventory.** Fishermen in Albay Gulf utilize a total of thirty-one (31) distinct types of fishing gear ascribing a multi-gear fishery. The fishing gear can be classified into seven gear categories (Umali 1950) namely entangling nets, handlines, longlines, barriers and traps, impounding nets, spear, and miscellaneous hand instruments. Most of the fishermen owned more than one type of fishing gear which are being used on varying seasonality and abundance of the target species. Fishing gear in other areas of the Philippines have also undergone modifications from the original design and evolved into species-specific fishing gear with adopted local names (Hermes et al 2004). These modifications will lead to more efficient catch of target species and higher exploitation rate.

A total of 9,141 fishing gear units as shown in Table 1 are distributed in Sorsogon (25%), Rapu-Rapu (23%), Manito (18%), Legazpi (18%), Sto. Domingo (8%), Prieto Diaz (4%), and Bacacay (3%) along the Albay Gulf. Fishermen utilize multi-gear predominantly handlines with 3,790 units (41.46%), followed by entangling nets (16.91%), miscellaneous hand instruments (10.89%), spear (10.20%), barriers and

traps (7.76%), longlines (6.57%) and impounding nets (6.21%). Highest count of gear units for handlines was og-og with 1,036 units. Panke-palubog with 898 units recorded the highest count for entangling nets. Speargun used during night-time was higher in gear units than those used during daytime operation (pamana) with 537 and 395 units, respectively. Bobo-pansira recorded 381 units for barriers and traps, while pansilo (210 units) exhibited the highest for impounding nets.

Table 1  
Types and count of fishing gear

<i>Fishing Gears</i>	<i>Variants</i>	<i>No. of units</i>	<i>Percentage</i>
Handlines	8	3,790	41.46
Entangling nets	8	1,546	16.91
Miscellaneous hand instruments	1	995	10.89
Spear	2	932	10.2
Barriers and Traps	5	709	7.76
Longlines	1	601	6.57
Impounding nets	6	568	6.21
<b>Total</b>	<b>31</b>	<b>9,141</b>	<b>100</b>

**Common species caught, catch rate and production estimates.** Albay Gulf is generally characterized as a multi-species fishery. Highlighting some of the species commonly caught, "bolinao" (*Encrasicholina* sp.) was recorded to be the usual catch of fishers using basnig (bag net). Panke-palutang (drift gill net) on the other hand usually catches pelagic species like "malasugi" (*Istiophorus* sp.) and other pelagic species such as "buraw" (*Rastrelliger kanagurta*) and "salay-salay" (*Atule mate*). Moreover, kitang (bottom set long line) usually catches big species of "kuwaw" (*Priacanthus* sp.), "bukhawon" (*Lethrinus* sp.), "maya-maya" (*Lutjanus* sp.) and other demersal fish species. Og-og (multiple handline) commonly caught species are "pundahan" (*Katsuwonus pelamis*), "turingan" (*Auxis thazard*) and "bangkulis" (*Thunnus albacares*). Several studies of these species have been reporting a decrease in catch production not only in the Philippines, but globally. In fact, the current exploitations of said species are observed to be beyond the exploitation level due to intensive fishing and overexploitation (Lanzuela 2015; Salarpouri et al 2018; Ganga et al 2012; Ehrhardt et al 2006; Rohit & Gupta 2004; Anushika et al 2020; Jabbar et al 2017; Al-Qishawe et al 2017; Purwiyanto et al 2020; Koya et al 2012; Mallawa & Zainuddin 2018). Observation of the pelagic fisheries indicate declining catch per unit effort as well as changes in species composition which can result to collapsing stock population of commercially targeted species. Overfishing and habitat destruction have been among the problems in the country for decades mainly because of human activities and other issues (FAO 2020).

Catch rates of most fishing gears vary widely ranging from 0.25 kg/trip (bigawnan, tina-tina, buyod-buyod, og-og, bunuan, bintol-kasag, flashlight, pamana, and pagtagati/panagun-has) to as high as 350 kg/trip (basnig) (Table 2). Basnig recorded its peak catch during the summer months due to the abundance of anchovies. Bunoan registered the second highest catch rate of 250 kg/trip. This is followed by rambo (troll line) with a catch rate of 200 kg/trip and panke-palubog (bottom-set gill net), panke-palutang (drift gill net), and kasikas (troll line) with a catch rate of 100 kg/trip.

Table 2  
Catch rate of fishing gear types exploiting Albay Gulf

<i>Fishing Gears</i>		<i>Catch Rate Range (kg/trip)</i>		<i>Mean</i>
<i>English Name</i>	<i>Local name</i>	<i>Minimum</i>	<i>Maximum</i>	
Entangling nets				

Bottom-set gill net	Panke-palubog	0.50	100.00	7.20
Trammel net	Three-ply	0.50	60.00	8.28
Crab gill net	Pangasag	0.50	10.00	2.66
Drift gill net	Panke-palutang	0.50	100.00	12.57
Drift gill net	Largarete	0.50	50.00	12.82
Drift gill net	Pangkanoos	0.50	19.50	5.00
Drift gill net	Salupil (Panke sa boya)	6.00	15.00	10.54
Drift gill net	Bugkat (Pambugiw)	0.50	30.50	7.98
Handlines				
Simple handline	Kawil	0.50	50.00	6.87
Simple handline	Lagulo	0.50	3.00	1.70
Troll line	Rambo	0.50	200.00	8.88
Troll line	Kasikas	0.50	100.00	10.32
Pole and line	Bigawnan	0.25	10.00	1.88
Squid jigger	Tina-tina	0.25	5.50	2.05
Simple handline	Buyod-buyod	0.25	30.00	2.47
Multiple handline	Og-og	0.25	60.00	5.35
Longlines				
Bottom-set long line	Kitang	0.50	60.00	8.65
Barriers and Traps				
Fish corral	Bunoan	0.25	250.00	21.09
Fish pot	Bobo pansira	0.50	10.00	2.97
Crab pot	Bobo pangasag	0.50	16.00	2.23
Squid/cuttlefish pot	Bobo panglokus/kanoos	0.50	40.00	4.74
Lobster trap	Bobo (banagan)	0.50	1.00	0.70
Impounding nets				
Dip net	Pansilo	0.50	20.00	5.57
Crab lift net	Bintol (Kasag)	0.25	50.00	5.64
Crab lift net	Bintol (Alimango)	0.50	5.00	2.23
Lift net	Bintol (Banagan)	2.00	10.50	5.29
Bagnet	Basnig	3.00	350.00	134.10
Push net	Pang langaw-langaw	1.00	15.00	5.83
Spear				
Speargun	Flashlight	0.25	15.00	3.03
Speargun	Pamana	0.25	50.00	3.26
Miscellaneous hand instruments				
Gleaning	Pagtagati/Panagun-has	0.25	20.00	2.37

Table 3  
Annual production (MT) and contribution of top ten fishing gears in Albay Gulf

No.	Fishing Gears	Local Name	Production (MT)	%
1	Bottom-set gill net	Panke-palubog	2,217.06	18.86
2	Multiple handline	Og-og	1,569.92	13.35
3	Bottom-set long line	Kitang	1,548.44	13.17
4	Simple handline	Kawil	1,523.67	12.96
5	Troll line	Rambo	777.32	6.61
6	Fish corral	Bunoan	492.97	4.19
7	Bagnet	Basnig	419.54	3.57
8	Gleaning	Pagtagati/Panagun-has	406.45	3.46
9	Trammel net	Three-ply	403.84	3.44
10	Drift gill net	Panke-palutang	342.92	2.92
	Drift gill net	Largarete	68.68	0.58

Drift gill net	Bugkat (Pambugiw)	56.54	0.48
Drift gill net	Salupi (Panke sa boya)	46.17	0.39
Drift gill net	Pangkanoos	43.06	0.37
Others		1,839.88	15.65
<b>Total</b>		<b>11,756.46</b>	<b>100</b>

In terms of annual production, a total of 11,756.46 mt was estimated based on the fishing gear contributions along the gulf and resulted to a catch per unit area of 15.27 mt/km<sup>2</sup> relative to a 770 km<sup>2</sup> area of the gulf. Unfortunately, Silvestre and Hilomen (2004) stated that values of about 15-20 mt/km<sup>2</sup> catch per unit area is an indicative sign of overfishing. In fact, annual catch per unit area of Albay Gulf was more than twice higher compared to adjacent fishing ground of Lagonoy Gulf (6.5 mt/km<sup>2</sup>) (Soliman et al 2008) which really shows intense fishing pressure despite the smaller size of the gulf. Table 3 shows the top ten fishing gears with a relative contribution to the production estimates. Top ten fishing gears are bottom-set gill net (2,217.06 mt/18.86%), multiple handline (1,569.92 mt/13.35%), bottom-set long line (1,548.44 mt/13.17%), simple handline (1,523.67 mt/12.96%), troll line (777.32 mt/6.61%), fish corral (492.97 mt/4.19%), bagnet (419.54 mt/3.57%), gleaning (406.45 mt/3.46%), trammel net (403.84 mt/3.44%), and drift gill net-panke palutang (342.92 mt/2.92%) along with the other variants such as largarete, bugkat, salupil and pangkanoos (214.45 mt/1.82%). These ten fishing gears shared about 84.35% of the total production estimate in Albay Gulf. On the other hand, production contribution per municipality (Table 4) showed Rapu-Rapu dominating by contributing 26.61% (3,128.72 mt), followed by Sorsogon 25.88% (3,042.60 mt), Legazpi 16.25% (1,910.83 mt), Manito 14.47% (1,700.65 mt), Sto. Domingo 7.67% (901.44 mt), Bacacay 5.73% (673.27 mt), and Prieto Diaz with the smallest share of 3.39% (398.95 mt). These production contributions can be attributed by the number of fishing gears in the area wherein top municipal production contributors namely Rapu-Rapu and Sorsogon also possessed the highest number of fishing gear units of 2,060 and 2,313 units, respectively.

Table 4  
Production (MT) contribution and fishing gear units of municipalities in Albay Gulf

<i>Municipalities</i>	<i>Production (MT)</i>	<i>Production Contribution</i>	<i>Fishing Gear Units</i>
Rapu-rapu	3,128.72	27%	2,060
Sorsogon	3,042.60	26%	2,313
Legazpi	1,910.83	16%	1,641
Manito	1,700.65	14%	1,680
Sto. Domingo	901.44	8%	735
Bacacay	673.27	6%	313
Prieto Diaz	398.95	3%	399
<b>Total</b>	<b>11,756.46</b>	<b>100%</b>	<b>9141</b>

Almost all fishing gears are being operated year-round except the trap and lift net for lobster, with no operations during the third to early fourth quarter of the year due to scarcity of the target species. Other operations such as trip frequency and production contribution of fishing gears are greatly influenced by temporal seasonality (Figure 1). Emphasizing the top ten fishing gears, panke-palubog entangling net and og-og handline for instance both obtained higher production contribution during the southwest monsoon "habagat" season (June-October). On the other hand, higher catch for kawil handlines and bunuan barriers and traps were observed during the northeast monsoon "amihan" season (November-February). While kitang longline, basnig impounding net, three-ply entangling net, panke-palutang entangling net and pagtagati/panagun-has miscellaneous hand instrument have more production contribution during the trade winds of

summertime. Generally, higher production contributions were recorded during the summertime that endows the gulf with fair fishing condition and therefore resulting in higher fishing trip frequencies.

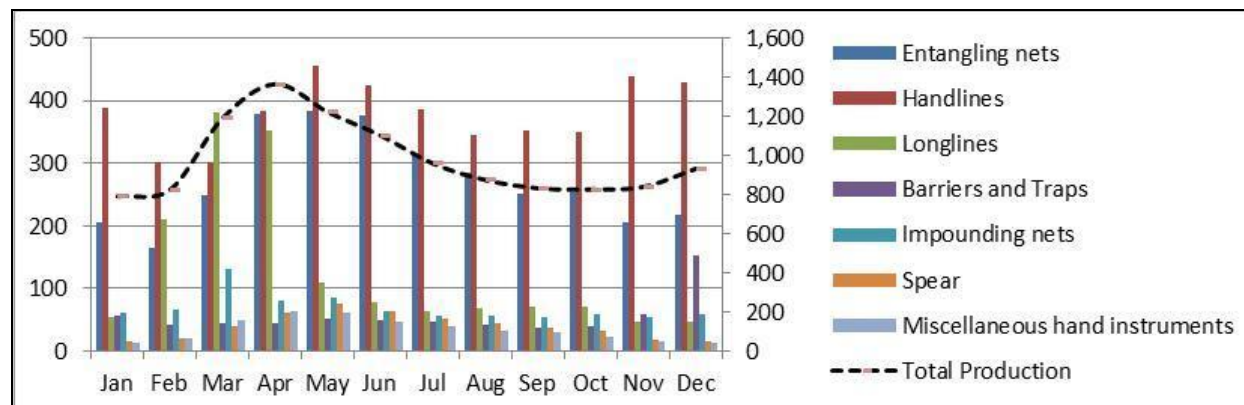


Figure 1. Production (MT) seasonality of major gear classification in Albay Gulf.

**Conclusions.** The fishery in Albay Gulf is characterized as a multi-species fishery and utilizes multi-fishing gears dominated by handlines and entangling nets. Fishing operations are present year-round and thus fishing is a way of life in the gulf. These operations are greatly influenced by temporal seasonality and availability of the target species. Furthermore, the higher production contribution of fishing gears observed was attributed by the higher fishing frequencies as well as the higher number of fishing gear units in the area. Generally, estimated annual production and catch per unit area indicate high fishing pressure and overfishing in the gulf.

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