

## Research Paper

# Dynamics of catch and effort in entangling net and handline dominated fishing ground

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### ABSTRACT

Policymakers may utilize important data on the catch and effort dynamics of fishing grounds as a tool to develop a sensible management strategy for sustainable resource use. Ragay Gulf's catch and effort evaluation was done to determine the number and seasonality of various gear units and kinds, catch rates and composition, fishing efforts, and estimate fisheries production. Ragay Gulf is one of the country's oldest fishing grounds, supporting a tremendous number of fishermen in the provinces of Quezon, Camarines Sur, and Masbate. Key informant interviews (KII) were undertaken to collect pertinent information on the Gulf fisheries. KII data complemented with actual landing surveys were utilized for catch composition analysis and then the estimation of fishing efforts and fishery production. Results showed that the Gulf is known as a handline and entangling net fisheries. The Northeast monsoon season is when the majority of gear types operate. Small pelagic fish, including sardines and scad, make up the dominant species in fisheries. Total fishing effort was estimated to be 1,404,711.9 trips per year, producing an estimated 30,286.3 metric tons of catch. Mean catch rates of the dominant gear type (Entangling nets) varied from 9.5 kg/trip (Bottom set-gill net) to 17.5 kg/trip (Encircling nets). The extraction rate of the fishing gear is calculated to be 7.76 MT/km<sup>2</sup>. Statistics of the Gulf's catch and fishing efforts are indicative of high exploitation levels.

Key words: catch and effort, gear unit and type, fishing effort, fishery production, Ragay Gulf

### INTRODUCTION

Some of the world's richest marine biodiversity may be found in coastal and nearshore environments. According to Stewart et al. (2010), coastal areas have sizable human populations as well; at least 50% of people on Earth live and work within 200 km. the coast. Numerous problems, including pollution, habitat loss, and deterioration brought on by human activity both on land and at sea, endanger coastal zones. While the decrease of their target species is typically linked to "environmental change" or some other kind of "pollution," fisheries, in contrast, have long been considered benign and their expansion unrelated to it (Pauly et al. 2002). The perception causes global fisheries production to continually decline, with catch per unit of effort (CPUE) falling since the 1980's (Pauly et al. 2002). Even with the declining trend in

fisheries production, global fishing effort has been continuously increasing (Anticamara et al. 2011).

Dubbed as the epicenter of marine biodiversity in the world (Carpenter and Springer 2005), the Philippines where 56% of the total 1,634 municipalities are coastal, and fishing is an important way of life as well as a major or sometimes the only source of livelihood for many coastal villagers (Pollnac et al. 2001, Muallil et al. 2011, Muallil et al. 2013). This pressing condition of the Philippines is already contributing to the decline of fishery production (Muallil et al. 2014). In the early 19th century, including the famous English biologist Thomas Huxley, thought fish stocks were inexhaustible (Smith 1994). Conversely, recent advancements in fishing technology coupled with increasing fish demands from the fast-growing population have resulted in widespread depletion of global fish stocks (Pauly et al. 2005), including the Philippines.

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The resources in the gulf are overfished, according to the Post Resource and Socioeconomic Assessment of Ragay Gulf. Between 1994-1995 and 2005-2006, the catch rates of 8 out of 14 fishing gears decreased by 48-90% (Fragillano et al. 1996). The catch composition changed to include fewer significant species for commerce (Jimenez et al. 2006). Fisheries production in the Gulf has decreased despite the increase in fishing efforts, a trend consistent in many of the traditional fishing grounds in the Philippines. The Ragay Gulf fishing sector is market-driven; fishermen have abandoned the traditional subsistence fishing strategy, in which they gathered fish to sustain their families and anticipated selling the bulk of the harvest for money. The results of this study clearly imply that commercially valuable species stocks are severely depleted.

According to the Post Resource and Social Assessment (PRSA) of Ragay Gulf by Campos et al. (2006), the population density of Camarines Sur increased from 201 people per km<sup>2</sup> in 1980 to 283 people per km<sup>2</sup> in 2000. In comparison to the population census conducted in 2015, the population density grew further to 354 people per km<sup>2</sup> (PSA, 2016). This number is higher than both the 2015 national average population density of 337 people per square kilometer and the regional average population density of 320 people per square kilometer. Consequently, natural resources are under strain as a result of the increased population density to meet the rising need for food.

Theoretically, effective management of a fishing ground's marine resources depends on an understanding of the dynamics of its fisheries. To do this, it is necessary to provide the decision-makers with timely, appropriate, and trustworthy information on the resource and its user. The goal of the study is to evaluate the catch and fishing effort in Ragay Gulf. Specifically, to determine the quantity of gear units and gear types that exploit fisheries resources in the gulf; the seasonality of various gear units and kinds; catch rates; and to estimate the gulf's fishery productivity.

## MATERIALS AND METHODS

### Study site

Ragay Gulf together with Burias Pass makes up a basin located in the Bicol Region southeast of Luzon, Philippines, and lies between latitudes 13° 00' N and 14° 00' N and longitudes 122°25' E and 123°20' E. (Fig. 1) it has a maximum width of about 25 nautical miles and the longitudinal length of about 75 nautical miles with the main axis oriented along the northwest-southeast axis Jamir (1990). The gulf covers an aggregate area of more than 3,900 km<sup>2</sup> and a total coastline of about 340 km (Jimenez et al. 2006). Municipal demersal fisheries can only utilize about one-seventh of the area because



**Fig. 1.** Ragay Gulf indicating the Municipal waters (Dark gray) of the 11 coastal municipalities of Bicol side.

of its depth (Warfel and Manacop 1950). It is bordered on the east by the Sierra Madre Mountain range and on the west by the Bondoc peninsula. Ragay Gulf is connected to the Sibuyan Sea to the west through the narrow gaps of Burias Pass and Between Bondoc Peninsula and Burias Island. The Gulf is one of the major fishing grounds in the Bicol region being monitored by the National Stock Assessment Program (NSAP) of the Department of Agriculture, Bureau of Fisheries and Aquatic Resources (DA-BFAR)

### Gear inventory

A set of interview guidelines for Key Informant (KI) was developed to obtain important information from the respondents, such as the number of gear units and description, fishing patterns, seasonality, fishing effort, catch rates, and catch composition. The local chief executive of the fishing villages (*Barangay*), the head of the local fishermen's association, and, if any, a member of the Municipal Fisheries and Aquatic Resources Management Council (MFARMC) make up KI. In each fishing village, the local chief executive was interviewed first, and then respondent was asked for the head of Sea guard or the Bantay Dagat, head of the fishermen's association and member of MFARMC if there is one to be the next respondent. In order to inventory the gear, KI interviews were done in 57 coastal barangays around the Ragay Gulf, which is composed of 11 municipalities. Important information for particular locales was gathered in order to characterize Ragay Gulf as a fishing ground based on the dominant fishing gear. KI was asked about the variety of fishing gear types and the quantity of units per kind that were accessible in each fishing community. Additionally, during the interviews, information on the frequency of fishing operations carried out each month using various gear types and their

anticipated total catch was gathered. This data revealed the seasonality of the gear types and catch rates.

### Catch and effort analysis

A series of KI interviews were used to validate historical data pertaining to catch rate (example: kg/trip), fishing operation (example: trips per week, per month, and year), and gear seasonality (peak and lean months). Fish catch, fishing operations, and seasonality of various fishing gear types per category were determined through interviews and used to reconstruct historical data. The number of average yearly fishing trips and the number of gear units were multiplied to determine fishing effort. In certain cases during the KI interview, surveys of catch and landing were also conducted in fishing villages around the gulf. The information obtained was processed to come up with reasonable estimations of the catch per fishing effort made on the resource using various fishing gear types as reliable indications of its quality.

Data on catch composition were gathered through recall interviews with key informants, such as those people (fishers) for whom fishing is their main source of revenue and subsistence. Data collection were chiefly based on the Key Informant Interview of Local Government Unit with corresponding inputs from local fishers in the area. Actual observations were also noted to validate information from the Key Informants. Additionally, secondary data from government organizations (such as NSAP of DA-BFAR) were used to calculate the contribution of important finfish species to the gulf's overall fisheries productivity.

### Fishery production estimation

For calculating the production contribution of each kind of fishing gear per municipality, data on the frequency of fishing operations, the number of units of fishing gear, and the validated and monitored catch rate were utilized. Fishery production for particular gear types was calculated by

summing the catch rate per particular gear unit, fishing frequency, and the quantity of particular gear units. The total fishery production of the gulf was estimated by obtaining the summation of total fishery production per municipality for its specific gear units.

## RESULTS

### Fishing gear types and gear units exploiting the Gulf

Fishermen utilized a variety of fishing gears (up to 38 different versions) to take exploit the multispecies fisheries in the Ragay Gulf. Fishermen in Ragay Gulf utilized a total of 7,798 units of fishing gear and 38 different types of fishing gear (Table 1). Entangling nets, which have thirteen variants, are the most common kind of fishing gear in the gulf, followed by handlines and impounding nets, both of which have seven variants. The spear has five and four variations, respectively, as do the barriers and traps. Likewise, to longlines, other hand tools, and other gears with only one variation. Additionally, more than 50% of the fishing equipment units utilized by fishermen exploiting the gulf were handlines and entangling nets.

Simple handlines (928), multiple handlines (914), conventional gillnets (878), troll lines (536), and bottom set long lines (535) made up the majority of the gear units (see Appendix A). All of the other fishing gears identified, with the exception of the ring net and stop seine or purse seine with gear units of 29 and 4, were deemed municipal fishing gears, which are allowed to fish up to fifteen kilometers from the shores of Ragay Gulf. Handline and gillnet fisheries are typical in the Gulf; in general, this gear category and gear types predominate the fishing gear units. The proportional breakdown of fishing gear units per municipality is shown in Table 2. More than a quarter (32%) of the total number of gear units working in the gulf were contributed by the municipality of San Pascual, followed by Ragay and Balatan with 14% and 13%, respectively, and the remaining 10% by other municipalities.

**Table 1.** Total number of fishing gear variants and number of gear units per gear category in Ragay Gulf.

Gear Categories	Number of Variants	Total Number of Gear Units
Entangling nets	13	1793
Handlines	7	3558
Longlines	1	536
Barriers and Traps	4	391
Impounding nets	7	398
Spear	4	407
Miscellaneous hand instruments	1	714
Others	1	1
<b>Total</b>	<b>38</b>	<b>7,798</b>

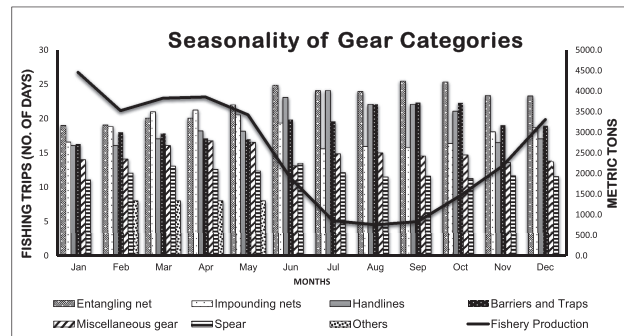
**Table 2.** Relative proportion of Fishing gear units per Municipality to the total number of gear units operating in the gulf.

Municipality	Total Number of Gear Units	Relative Proportion of Gear Unit per Municipality (%)
San Pascual	2521	32
Ragay	1107	14
Balatan	1005	13
Pasacao	635	8
Minalabac	617	8
Del Gallego	526	7
San Fernando	434	6
Bato	372	5
Bula	248	3
Sipocot	174	2
Lupi	159	2
<b>Total</b>	<b>7,798</b>	<b>100</b>

**Fishing efforts, seasonality of fishing gear types and gear units in the Gulf**

An estimated 1,404,711.9 trips were made to fish in the Gulf annually (Fig. 2). The Municipality of San Pascual contributes more than 25% of the total fishing efforts, or 500, 800.9 fishing trips annually. San Pascual looms above other municipalities in terms of the overall number of gear units, which is around 2,521. This was followed by Pasacao with 10% (142, 495.4 trips/year) and Ragay with 13% (181, 220.7 trips/year). The rest of the municipalities contributed between 21,705.5 and 97,110 trips each year, or less than 10% of the equivalent of individual fishing efforts.

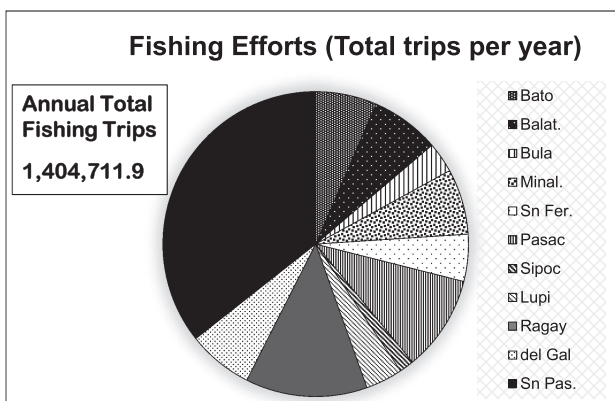
The Northeast monsoon (November-late March) and the Southwest monsoon (June-October) are the two seasons that trigger the bulk of the fishing activity in Ragay Gulf. The prevailing monsoon dictates fishing activities here as a function of fishery production (Fig. 3). Fishery productivity is



**Fig. 3.** Seasonality of fishing efforts and fishery production contribution of fishing gear category.

higher during the northeast monsoon and lower during the southwest monsoon for fishing gear categories such as impounding nets, entangling nets, and spearfishing. On the other hand, gear categories such as handlines, long lines and barriers, and traps peaks of operation during the periods of southwest monsoon and lean during the northeast monsoon.

In terms of annual fishing operations, entangling nets (such as bottom set gillnets "Palubog" and drift gillnets "Palutang") and handlines (such as simple handlines "Kawil" and artificial bait "Buyod-buyod") dominated the different gear categories (see Appendix B). Nearly half of the overall fishing operations in the gulf were made up of the combined fishing operations of the municipalities of San Pascual (13%) Pasacao (13%) Minalabac (13) and Bato (10) in terms of their relative contribution to the fishing operation (Trips/year). Less than 10% of the overall fishing efforts in the gulf came from the remaining municipalities.



**Fig. 2.** Relative fishing efforts per municipalities exerted in Ragay Gulf.

**Catch rates of dominant fishing gear types in the Gulf**

Catch rates of fishing gear types vary within gear categories; presented in Table 3 are the top 20 gear types in terms of kilogram caught per fishing trip. Catch rates of various fishing gear types differ within gear categories. The encircling gillnet, with a catch rate ranging from 47.8 to 212.1 kg/trip, is the highest among the gear types. Entangling nets account for more than 50% of all gear types or variants. This was followed by impounding nets with 25% in terms of the number of variants, followed by barriers and traps, handlines, long lines, and spears with 5%. Furthermore, other fishing gear types with mean catch rates of 9.0 kilogram and below per fishing trip mainly belong to fishing gear categories of handlines (see; Appendix C). For Multiple handlines and Pole and Line, respectively, the mean catch rates of these handlines vary from 8.9 to 2.5 kg/trip. Compared to other gear types in the same category, such as fish pots (6.9 kilogram/trip), crab pots (3.4 kg/trip), and squid pots (kg/trip), the fish corral with 19.3 kg each operation, were substantially higher.

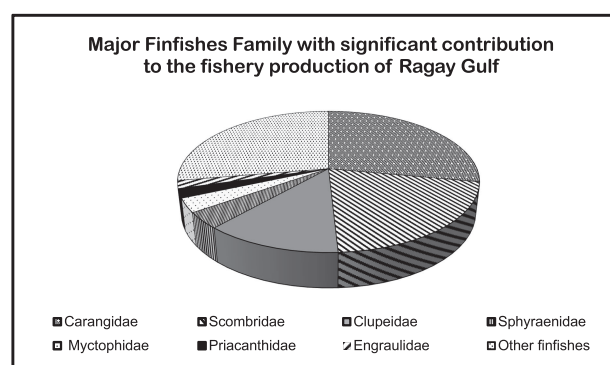
**Table 3.** Catch rates of top 20 fishing gear units in terms of kilogram caught per fishing trips.

Fishing Gears		Catch rate (Kg/trip)		
English Name	Local name	Min	Max	Mean
<b>Entangling nets</b>				
Encircling gill net	Patalang	47.8	212.1	117.5
Drift gill net	Kurantay	9.0	52.6	26.1
Drift gill net	Largarete	8.0	65.0	26.0
Drift gill net	Pangkanoos	5.4	44.8	25.1
Drift gill net	Panke-palutang	7.9	54.6	23.1
Drift gill net	Barangay	7.9	54.6	23.1
Drift gill net	Patitig	8.0	48.0	21.1
Drift gill net for halfbeaks	Bugkat (Pambugiw)	3.2	35.6	18.1
2-ply	2-ply	6.7	15.0	9.5
Bottom-set gill net	Panke-palubog	5.4	14.1	9.5
Bottom-set gill net	Rabnot	5.4	14.1	9.5
<b>Impounding nets</b>				
Stop Seines	Pangulong	80.0	1000.0	435.8
Ring net	Kalansisi	30.0	324.7	175.1
Beach Seine	Sinsuro	8.1	281.6	79.8
Bagnet	Basnig	20.0	85.0	38.1
Push net	Pansilo	5.9	87.6	32.8
<b>Barriers and traps</b>				
Fish corral	Bunoan	11.5	26.7	19.3
<b>Handlines</b>				
Multiple troll line	Rambo	5.9	17.1	9.3
<b>Longlines</b>				
Bottom-set long line	Kitang	7.0	13.1	9.7
<b>Spear</b>				
SPGN using compressor	Pana-compressor	2.3	83.0	38.1

**Fishery production estimates of the Gulf**

As shown in Table 4, the fishery production in the Ragay Gulf (Bicol side) was 30,286.3 metric tons. Impounding nets (14,729.9 MT), entangling nets (6,875.9 MT), and handlines (5,420.4 MT), with corresponding contributions of 49%, 23%, and 18%, accounted for the majority (90%) of fishery production. Additionally, less than 10% of the entire fishing productivity of the Ragay Gulf was contributed by other gear types.

In terms of fishery production contributed by the 11 municipalities, almost a quarter (23%) of it came from the municipality of Balatan with 6,890.5 MT (see; Appendix D), this was followed by municipalities of San Pascual with 15% (4,488.9 MT), Bula 13% (3,987.3 MT), San Fernando 11% (3,259.9 MT), Minalabac 11% (3,184.9 MT), Pasacao 10% (2,924.9 MT), Ragay 8% (2,429.5 MT), Del Gallego 4% (1,214.4 MT), Lupi 3% (858.1 MT), Bato 3% (905.0 MT) and Sipocot < 1% (142.6 MT). The purse seine (2,688 MT), a kind of commercial fishing gear that is prohibited in the municipal waters of the gulf, was the primary contributor from the municipality of Balatan. Considering that a very small portion of the gulf is commercial water which lies between San Fernando and San Pascual area, its operation within the gulf is generally construed as an encroachment to the municipal water. Likewise, the push net was found to contribute relatively high, which ranges from 1.12 (San Pascual) to 2926.9 MT (San Fernando) compared to other fishing gears.



**Fig. 4.** Fishery contribution of major finfish families to the total fishery production in the Gulf.

**Table 4.** Relative fishery contribution per gear categories to the total production estimates of Ragay Gulf.

Gear Categories	Fishery Contribution (Mt)	Relative Contribution per Gear Category (%)
Impounding nets	14729.9	49
Entangling nets	6875.9	23
Handlines	5420.4	18
Longlines	1721.9	6
Barriers and Traps	1170.7	4
Spear	242.3	1
Miscellaneous hand instruments	124.8	< 1
Others	0.28	< 1
<b>Total</b>	<b>30286.3</b>	<b>100</b>

### Species composition of Finfishes caught in Ragay Gulf

Presented in Figure 4 were the dominant fish family contributing to the bulk of fishery production in the gulf of more than 10% came from the family Carangidae (28%), Scombridae (21%), and Clupeidae (12%), while others contributed < 10%.

The top 20 finfish species that constitute the majority of fishery production in Ragay Gulf are primarily pelagic fish from seven families (Table 5). The dominant family Carangidae has seven species, six of which are members of the genus *Decapterus* and one of which is a member of the genus *Selar*. The family Scombridae, which includes six species from the genera *Auxis*, *Euthynnus*, and *Rastrilliger*, came next. Followed by family Clupeidae, which includes three species from the genera *Sardinella* and *Spratelloides*. Other fish families having a single genus include Priacanthidae, Engraulidae, Sphyracidae, and Myctophidae.

### DISCUSSION

The decrease in average fish size is one of the primary effects of increasing fishing pressure a form of compensatory mechanism. Such phenomena are not common in tropical fish populations, including those in the Philippines (Armada 2004). In response to changes in the fish stocks they exploit, fishermen continually improve their fishing equipment. The alteration of gear types that belong to the entangling net and

handline into new versions, such as troll line and drift gillnet, to target certain groups of fish, reflecting the fall in fish catch, is one such adaptation seen in the Gulf. Ideally, most fishermen would use nets with larger mesh sizes and would engage in less fishing. According to Pauly (1998), as a result of increased stock exploitation, fish sizes are reduced while fishermen adjust by creating nets with lower mesh sizes. This goes on until the fishermen are forced to employ fine-meshed nets and spend more time fishing due to a lack of fish. Scenarios shown in the proliferation of many gear variants.

Overfishing is seen in the Philippine small pelagic fisheries. A shift in species composition, such as the partial replacement of sardines, scads, and mackerels in the catch by anchovies, which indicates a gradual stock collapse, is evidence for this. *Diaphus phillipsi*, a deep-water fish species with a minor similarity to anchovies that is locally named "Sirom-sirom" that contributes 969.3 MT or 3% of the fishing production in the Ragay Gulf (see Table 5). Furthermore, the absolute value of the overall capture is starting to drop because this species is the command low price pelagic fish. The fishermen who rely on fishing primarily for sustenance and revenue are directly impacted by this vicious cycle of overfishing and declining catch quality. They are forced by this circumstance to fish extra harder for a decreasing catch, a classic illustration of economic overfishing

The major types of fishing gear are used to catch almost 70% of the finfish in the Ragay Gulf. Total fishery production of the gulf of 30,286.3 MT relative to the total area of 3,900

**Table 5.** Fishery contribution of major finfishes caught in Ragay Gulf.

Finfishes				
Family	Scientific name	Local Name	*Relative composition	Fishery Production contribution (Mt)
Carangidae	<i>Decapterus kurroides</i>	Pulang buntot	6.8	2058
	<i>Decapterus macrosoma</i>	Sibubog	3.8	1148
	<i>Selar crumenophthalmus</i>	Matangbaka	3.6	1089
	<i>Decapterus macarellus</i>	Sibubog	2.8	846
	<i>Decapterus tabl</i>	Sibubog	2.8	847
	<i>Decapterus russelli</i>	Sibubog	2.5	756
	<i>Decapterus maruadsi</i>	Sibubog	2.1	635
Clupeidae	<i>Sardinella gibbosa</i>	Tunsoy	5.1	1543
	<i>Sardinella lemuru</i>	Tamban	4.6	1392
	<i>Spratelloides gracilis</i>	Bolinao	2.7	816
Engraulidae	<i>Encrasicholina punctifer</i>	Bolinao	1.8	544
Myctophidae	<i>Diaphus phillipsi</i>	Sirum-sirom	3.2	968
Priacanthidae	<i>Priacanthus macracanthus</i>	Kuwaw	2.1	636
Scombridae	<i>Auxis rochei</i>	Turingan bilugon	9.5	2876
	<i>Euthynnus affinis</i>	Turingan	4.2	1270
	<i>Rastrelliger kanagurta</i>	Kabalyas	3.6	1089
	<i>Auxis thazard</i>	Turingan lapad	3.1	937
	<i>Rastrelliger faughni</i>	Buraw	2.7	816
	<i>Katsuwonus pelamis</i>	Rayado	1.7	513
Sphyracidae	<i>Sphyracna barracuda</i>	Baracuda	3.7	1119
Others	<i>Others finfishes &lt; 1%</i>	--	27.7	8388
<b>Total</b>		<b>--</b>	<b>100</b>	<b>30286.2</b>

km<sup>2</sup> (Jimenez et al., 2006), with total fishing efforts of 1,404, 711.9 trips per year showed that an average of 7.76 MT/ km<sup>2</sup> very low compared to adjacent fishing ground the San Miguel bay with 20,173.5 MT with total fishing efforts of 840, 960 trips per year showed 18.1 MT/km<sup>2</sup> (Hilomen et al., 2003). It is possible that the fishing ground is indeed overfished given the increasing fishing effort and low fishery productivity.

Differences in fishing efforts exerted by different municipalities in the Gulf might be attributed to the relative dependence as the primary source of income. The distribution of various gear units and types per locality is an indicator of variability in terms of its dependence on fishing as the source of livelihood. The lack of opportunities outside fishing of majority of coastal communities puts them at risk of threats of changing climate (Allison et al., 2009). Over-dependence on marine resources increases fishing efforts.

Biological and economic overfishing persists in the Philippines, especially in coastal and traditional fishing sites with its current productivity. According to reports, catch rates significantly decreased between the early 1950s and the middle of the 1980s (Zaragosa et al., 2004). Additionally, analyses of small pelagic fish species in different fishing sites (Ingles and Pauly, 1984; Corpuz et al., 1985; Lavapie-Gonzales et al., 1997) produced extremely high exploitation ratios, which are a blatant sign of overfishing. These fisheries scenarios do not make an exception for Ragay Gulf, which is regarded as a traditional fishing ground for small pelagic. Collectively, these levels of exploitation endanger the survival of small pelagic populations. According to Dalzell and Ganaden 1990; Trinidad et al. 1993) the fishing pressure has to be reduced by 50–65% for sustainability.

Silvestre and Pauly (2004) noted that increased fishing pressure and overfishing have occurred in many coastal areas as a result of high fish demand, expanding fishing populations coupled with a dearth of rural livelihood opportunities, advances in fishing technology, and accelerated industrial fisheries development. As a result, landings have plateaued (if not decreased), catch rates, earnings, and resource rents have decreased, and there is fierce rivalry and conflict among fishermen.

## CONCLUSION

Bottom set gillnets, drift gillnets, basic handlines, and multiple handlines dominate the entangling and handline fisheries in Ragay Gulf. The seasonality of gear types is clear and species-dependent; the Northeast monsoon period is when the majority of gear types operate at their peak, with other gear types, like handlines, taking advantage of rough waters during the Southeast monsoon to boost capture. The Philippines' other extensively exploited fishing sites show comparable levels of

exploitation based on catch rates and fishing efforts. Fishery production relative to the gulf area clearly showed overfished fishing grounds.

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Dynamics of catch and effort in entangling net and handline dominated fishing ground

**Appendix A.** Number of Gear Units Per Fishing Gears Types Identified per Municipalities in Ragay Gulf.

Fishing Gears		Municipality											Total
English Name	Local name	Bato	Balat.	Bula	Minal.	Sn Fer.	Pasac	Sipoc	Lupi	Ragay	del Gal	Sn Pas.	
<b>Entangling nets</b>													
Bottom-set gill net	Panke-palubog	44	16	40	28	31	152	35	50	173	61	248	878
Bottom-set gill net	Rabnot		2										2
Trammel net	3-ply	3					1			7	52	76	139
2-ply	2-ply	10										40	50
Gill nets for crabs	Pangasag	35	13	5				15		6	12	31	117
Drift gill net	Panke-palutang	38	45		10		15	5	9	59	9	72	262
Drift gill net	Largarete	30	25	7	11	6	15			3	4	62	163
Drift gill net	Barangay	10	26	3	1					6			46
Drift gill net	Kurantay			5			15						20
Drift gill net	Patitig											7	7
Drift gill net for halfbeaks	Bugkat (Pambugiw)	4	3	1	2					1	1	1	13
Drift gill net	Pangkanoos					2						70	72
Encircling gill net	Patalang						3			21			24
<b>Handlines</b>													
Simple handline	Kawil	55	175	32	30	7	61	25	30	171	64	278	928
Multiple troll line	Rambo	12	18	8	20		15					210	283
Troll line	Kasikas	15	130		80	70	20		15	60		145	535
Pole and line	Bigawnan				20	15		5		25	54	50	169
Squid jigger	Tina-tina		25	11	3	60	6	10		103	3	221	442
Artificial bait (variable)	Buyod-buyod	21	39	10	23		3	3	5	45	73	65	287
Multiple handline	Og-og	20	165	25	160	100	155			108	1	180	914
<b>Longlines</b>													
Bottom-set long line	Kitang	5	117	5	36	31	84	7	5	47	5	194	536
<b>Barriers and Traps</b>													
Fish corral	Bunoan							19		21	84	57	181
Fish pot	Bobo Pansira				5		6		9	3	4		27
Crab pot	Bobo pangasag				15		6	15	10	36	30		112
Squid/cuttlefish pot	Bobo panglokus/kanoos	8	2		5	3	7	15		30	1		71
<b>Impounding nets</b>													
Push net	Pansilo	6	50	30	75	50				37	7	3	258
Crab lift net	Bintol (Kasag/Alimango)				15	0	5	0	1	1	2	9	33
Shrimp lift net	Bintol (pasayan)						3						3
Bagnet	Basnig									13			13
Beach Seine	Sinsuro	1	4	25	5		13					10	58
Ring net	Kalansisi		10		7	1	8			3			29
Stop Seines	Pangulong		3				1						4
<b>Spear</b>													
Spear gun at night	Flashlight		5	5	24	8			12	7	5	215	281
Spear gun	Pamana	2	2	6	10		11		12	6		65	114
Spear	Salapang with light										3		3
SPGN using compressor	Pana-compressor								1	6		2	9
<b>Miscellaneous hand instruments</b>													
Gleaning	Panagun-has	53	130	30	32	50	30	20		108	51	210	714
TOTAL		372	1005	248	617	434	635	174	159	1106	526	2521	7797

**Appendix B. Annual Fishing Trips of Fishing Gear Types in Different Municipalities in Ragay Gulf.**

Fishing Gears		Municipality (Trips/yr)											Mean
English Name	Local name	Bato	Balat.	Bula	Minal.	Sn Fer.	Pasac	Sipoc	Lupi	Ragay	del Gal	Sn Pas.	
<b>Entangling nets</b>													
Bottom-set gill net	Panke-palubog	453	137	304	162	227	349	113	672	314	174	227	285
Bottom-set gill net	Rabnot		145										145
Trammel net	3-ply	96					128			52	368	217	172
2-ply	2-ply	672								84		60	272
Gill nets for crabs	Pangasag	152	88	240				192		116	284	70	163
Drift gill net	Panke-palutang	178	139		98		279	90	224	122	150	128	156
Drift gill net	Largarete	176	148	112	102	85	280			122	160	145	148
Drift gill net	Barangay	236	198	112	60					84			138
Drift gill net	Kurantay			272			256						264
Drift gill net	Patitig											320	320
Drift gill net for halfbeaks	Bugkat (Pambugiw)	336	92	112	98					136	192	204	167
Drift gill net	Pangkanoos					68						336	202
Encircling gill net	Patalang						280			153			217
<b>Handlines</b>													
Simple handline	Kawil	307	159	296	352	226	176	175	280	140	195	207	228
Multiple troll line	Rambo	236	153	168	544		144					160	234
Troll line	Kasikas	247	132		44	184	84		196	170		162	152
Pole and line	Bigawnan				224	68		20		141	61	96	102
Squid jigger	Tina-tina		72	56	52	148	176	85		141	32	203	107
Artificial bait (variable)	Buyod-buyod	136	80.75	68	90		84	102	120	130	130	153	109
Multiple handline	Og-og	401		232	202	108	172			141	288	216	220
<b>Longlines</b>													
Bottom-set long line	Kitang	56	123	112	151	166	245	60	192	141	157	191	145
<b>Barriers and Traps</b>													
Fish corral	Bunoan							83		248	218	207	189
Fish pot	Bobo Pansira				80		116		90	236	180		140
Crab pot	Bobo pangasag				80		96	271	90	102	180		137
Squid/cuttlefish pot	Bobo panglokus/kanoos	136	288		36	60	296	92		120	180		151
<b>Impounding nets</b>													
Push net	Pansilo	28	84	9	100	272				101	164	192	119
Crab lift net	Bintol (Kasag/Almango)				56		96		240	84	144	94	119
Shrimp lift net	Bintol (pasayan)						204						204
Bagnet	Basnig									133			133
Beach Seine	Sinsuro	240	108	256	170		136					104	169
Ring net	Kalansisi		244		101	16	252			94			141
Stop Seines	Pangulong		168				208						188
<b>Spear</b>													
Spear gun at night	Flashlight		188	70	192	17.5			192	83	119	288	144
Spear gun	Pamana	40	188	63	192		136		192	137		276	153
Spear	Salapang with light										68		68
SPGN using compressor	Pana-compressor								80	62		80	74
<b>Miscellaneous hand instruments</b>													
Gleaning	Panagun-has	126	54	122	101	162	106	68		127	162	166	119
	TOTAL	4252	2989	2604	3287	1808	4299	1351	2568	3712	3607	4502	34977

Dynamics of catch and effort in entangling net and handline dominated fishing ground

**Appendix C. Catch Rate of Fishing Gear Types Exploiting Ragay Gulf.**

Fishing Gears		Catch rate (Kg/trip)		
English Name	Local name	Min	Max	Mean
<b>Entangling nets</b>				
Bottom-set gill net	Panke-palubog	5.4	14.1	9.5
Bottom-set gill net	Rabnot	5.4	14.1	9.5
Trammel net	3-ply	1.0	11.0	5.0
2-ply	2-ply	6.7	15.0	9.5
Gill nets for crabs	Pangasag	2.0	6.4	3.3
Drift gill net	Panke-palutang	7.9	54.6	23.1
Drift gill net	Largarete	8.0	65.0	26.0
Drift gill net	Barangay	7.9	54.6	23.1
Drift gill net	Kurantay	9.0	52.6	26.1
Drift gill net	Patitig	8.0	48.0	21.1
Drift gill net for halfbeaks	Bugkat (Pambugiw)	3.2	35.6	18.1
Drift gill net	Pangkanoos	5.4	44.8	25.1
Encircling gill net	Patalang	47.8	212.1	117.5
<b>Handlines</b>				
Simple handline	Kawil	4.5	13.4	7.3
Multiple troll line	Rambo	5.9	17.1	9.3
Troll line	Kasikas	4.9	14.1	8.3
Pole and line	Bigawnan	1.5	3.7	2.5
Squid jigger	Tina-tina	2.4	7.8	4.6
Artificial bait (variable)	Buyod-buyod	2.4	4.3	3.4
Multiple handline	Og-og	6.2	15.1	8.9
<b>Longlines</b>				
Bottom-set long line	Kitang	7.0	13.1	9.7
<b>Barriers and Traps</b>				
Fish corral	Bunoan	11.5	26.7	19.3
Fish pot	Bobo Pansira	3.7	11.0	6.9
Crab pot	Bobo pangasag	1.7	6.1	3.4
Squid/cuttlefish pot	Bobo panglokus/kanoos	1.8	4.2	3.0
<b>Impounding nets</b>				
Push net	Pansilo	5.9	87.6	32.8
Crab lift net	Bintol (Kasag/Alimango)	1.8	6.0	4.0
Shrimp lift net	Bintol (pasayan)	2.5	6.5	3.0
Bagnet	Basnig	20.0	85.0	38.1
Beach Seine	Sinsuro	8.1	281.6	79.8
Ring net	Kalansisi	30.0	324.7	175.1
Stop Seines	Pangulong	80.0	1000.0	435.8
<b>Spear</b>				
Spear gun at night	Flashlight	1.7	4.2	3.0
Spear gun	Pamana	0.6	3.2	2.0
Spear	Salapang with light	1.0	2.0	1.8
SPGN using compressor	Pana-compressor	2.3	83.0	38.1
<b>Miscellaneous hand instruments</b>				
Gleaning	Panagun-has	1.2	2.1	1.6

**Appendix D. Fishery Production of Various Fishing Gear Types per Municipalities in Ragay Gulf (MT).**

Fishing Gears		Municipality											Total
English Name	Local Name	Bato	Balat.	Bula	Minal.	Sn Fer.	Pasac	Sipoc	Lupi	Ragay	del Gal	Sn Pas.	
<b>Entangling nets</b>													
Bottom-set gill net	Panke-palubog	74.16	30.86	70.40	61.52	33.51	435.33	28.20	666.40	370.32	281.54	735.07	2787.3
Bottom-set gill net	Rabnot		2.86										2.9
Trammel net	3-ply	2.74					1.61			2.52	92.11	91.39	190.4
2-ply	2-ply	26.04										26.00	52.0
Gill nets for crabs	Pangasag	10.88	15.96	3.58				6.89		3.24	6.79	6.14	53.5
Drift gill net	Panke-palutang	27.34	218.34		27.72		167.00	3.33	90.47	80.32	29.00	173.26	816.8
Drift gill net	Largarete	119.88	91.20	21.70	27.81	0.99	32.86			3.42	8.93	164.81	471.6
Drift gill net	Barangay	381.36	313.72	13.02	1.03					22.82			732.0
Drift gill net	Kurantay			175.10			371.35						546.4
Drift gill net	Patitig											132.28	132.3
Drift gill net for halfbeaks	Bugkat (Pambugiw)	16.86	7.30	3.36	0.51					3.38	4.93	2.81	39.1
Drift gill net	Pangkanoos					0.38						222.46	222.8
Encircling gill net	Patalang						3.50			825.31			828.8
<b>Handlines</b>													
Simple handline	Kawil	79.20	379.90	39.81	66.92	9.82	38.39	14.37	41.58	220.00	37.82	883.56	1811.4
Multiple troll line	Rambo	42.06	89.72	7.60	172.96		7.56					312.71	632.6
Troll line	Kasikas	10.75	135.78		30.76	53.34	3.84		11.55	108.44		134.04	488.5
Pole and line	Bigawnan				33.04	0.84		0.07		5.90	4.40	25.41	69.7
Squid jigger	Tina-tina		4.20	4.08	0.90	85.46	5.81	0.94		49.38	0.18	271.46	422.4
Artificial bait (variable)	Buyod-buyod	7.57	18.93	2.13	10.66		0.58	0.71	3.21	8.84	18.45	29.91	101.0
Multiple handline	Og-og	35.84	726.18	33.54	263.21	45.40	334.05			122.68	0.97	333.08	1895.0
<b>Longlines</b>													
Bottom-set long line	Kitang	2.86	285.76	4.20	196.54	89.84	552.09	2.52	9.79	56.13	7.71	514.48	1721.9
<b>Barriers and Traps</b>													
Fish corral	Bunoan							76.00		143.52	690.44	158.33	1068.3
Fish pot	Bobo Pansira				1.95		3.82		8.98	10.41	1.23		26.4
Crab pot	Bobo pangasag				3.38		2.38	7.52	4.13	14.15	18.68		50.2
Squid/cuttlefish pot	Bobo panglokus/kanoos	2.98	3.70		0.10	0.30	6.30	1.28		10.72	0.44		25.8
<b>Impounding nets</b>													
Push net	Pansilo	1.68	860.40	9.45	1773.25	2926.90				16.20	1.93	1.12	5590.9
Crab lift net	Bintol (Kasag/Alimango)				6.30	0.00	2.76	0.00	0.25	0.21	1.06	8.38	19.0
Shrimp lift net	Bintol (pasayan)						0.56						0.6
Bagnet	Basnig									238.36			238.4
Beach Seine	Sinsuro	52.80	120.55	3586.20	348.95		477.40					13.79	4599.7
Ring net	Kalansisi		886.34		145.68	0.57	362.24			86.99			1481.8
Stop Seines	Pangulong		2688.00				111.56						2799.6
<b>Spear</b>													
Spear gun at night	Flashlight		1.86	1.33	3.83	0.13			10.27	3.22	1.08	145.15	166.9
Spear gun	Pamana	0.11	0.21	0.70	5.40		1.22		10.18	1.08		38.27	57.2
Spear	Salapang with light											1.86	1.9
SPGN using compressor	Pana-compressor								1.32	1.74		13.37	16.4
<b>Miscellaneous hand instruments</b>													
Gleaning	Panagun-has	9.97	8.69	11.13	2.52	12.45	2.76	0.85		19.90	4.84	51.67	124.9
<b>TOTAL</b>		<b>905.1</b>	<b>6890.5</b>	<b>3987.3</b>	<b>3184.9</b>	<b>3259.9</b>	<b>2925.0</b>	<b>142.7</b>	<b>858.1</b>	<b>2429.2</b>	<b>1214.4</b>	<b>4488.9</b>	<b>30286.1</b>