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Fish catch during Southwest Monsoon season in Taytay Bay, Northwest Sulu Sea, Philippines: with notes on live reef fisheries

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Abstract. Palawan produced 70 percent of the Philippines' LRFT export. The municipality wanted to maintain or save its LRF and bay fisheries, thus the objectives of this study are to gather information on the status of CPUE and LRF in Taytay Bay, and to provide recommendations to fisheries planning and management. Standard catch survey method was used to estimate CPUE of different gears. Survey was conducted every day between August and September 2009, representing the mid-Southwest Monsoon fishing season. Nine fishing gears operating in the bay were recorded. Drift gillnet has the highest effort and fish biomass landed, followed by Hookah-spear gun. Bagnet has the highest CPUE followed by Bottom gillnet, and were most efficient gears in terms of catch/fisher/hour. However, Bagnet CPUE tended to decrease through the years. Hook and line fisher composed more than half of the fisher's population of the bay and was the priority livelihood. The total fishing effort would soon put pressure to the LRF resources. It will also likely create an unequal distribution of type of fishers in the bay, which will make bay fisheries unstable. The total catch in the bay per month during Southwest Monsoon period was estimated to be 337.2 t. Serranidae consisted only 5% of the total catch. Of this, 40% were *Plectropomus leopardus*, and the rest were composed of third class serranids and tiger groupers. Of the serranid species caught, 13% were sold alive, while the rest were sold fresh. The low catch and smaller sized live fish species indicate that LRF is under pressure and may not be viable anymore. This is alarming since so many fishermen were competing to catch the same depleting resource, which can eventually collapse if no immediate management schemes will be introduced. Highlights of recommendations are: bag net should not operate in the municipal waters, bottom gill net should be continuously promoted in the bay; status of red grouper stock/population should be monitored, and immediate regulatory management schemes must be in placed; community-based aquaculture of high demand-high priced species, with complete breeding and grow-out technology like *Cromileptes altivelis* must be introduced to lessen the pressure on existing LRF species; the government should find means to let fishers indulge in more diverse fisheries to have a stable fishing industry; and another survey must be conducted during the Northeast Monsoon period.
Key Words: catch per unit effort, Taytay Bay, Sulu Sea, live fish trade.

Introduction. Fisheries management entails the management of both human and fisheries resources with good governance to guide and regulate them. In order to manage the fisheries, it is necessary to have basic and benchmark knowledge and information on species composition, species distribution, fishing gears, fish landings, abundance, and spatial and temporal occurrences. This information should be regularly studied in order to detect changes and know the trends and conditions of different fish populations and species in the management area, like the fluctuations in the average size of the population.

In Palawan, fish catch studies were conducted in Honda Bay and Puerto Princesa Bay (Gonzales 2004a, b) as prerequisites to the development of fisheries profile and bay-wide management plan. The catch per unit effort (CPUE) data was further used to evaluate the impact of a marine protected area in the bay (Gonzales et al 2014). Taytay Bay, Palawan has two fishing seasons: Southwest Monsoon season from July to October

and Northeast Monsoon season from November to March. This paper presents the fisheries of Taytay Bay during Southeast Monsoon season.

At the other end, the Live Reef Fish Trade (LRFT) begins with catching reef fish and keeping them alive, from their sources to the restaurants that serve them, mostly in Hong Kong and mainland China (WWF 2011). The Live Reef Fish (LRF) industry promises financial stability among fisheries sectors in many countries in Asia, including the Philippines. Large supply of LRF usually comes from well-endowed with coral reefs countries, such as the Philippines and Indonesia (Davis 2001). In mid-1980's, the Philippines was the supplier of 75-80% of the marine aquarium fish sold worldwide and at least one third of these exporters were also dealing in live reef fish for food. The estimated amount of exports of live fish increased in 1995 and reached 3,000 to 6,000 tons (Pratt 1995; Johannes & Riepen 1995).

The LRF trade suffers several problems relating to the supply of wild-caught, market-sized fish and the improved prospects for increased mariculture to supply the industry and meet consumer demand in 1995 (Chan 2000). In addition, LRF operators estimated around 20% have ceased to operate caused by the spread of ciguatera poisoning which was common in reef fishes especially the bigger size one. Because of this, demand for smaller size of fish increased (Cesar et al 2000).

In the Philippines, the province of Palawan surfaces as one of the main suppliers of live fish to this industry, especially supplying species belonging to the family Serranidae, locally known as *Suno*. Live fish trader from Hong Kong made regular trips to Palawan to collect coral grouper or *Suno* (*Plectropomus leop*a*rdus*) and humphead wrasse (*Cheilinus undulatus*) but unlike early live fish operations in other South East Asian countries, most of the catch was taken by Philippine rather than foreign fishers (Barber & Pratt 1997).

Live grouper exports increased since 2008 in both volumes and value, having China as the biggest consuming country, is driving both demand and prices up and it is estimated that about 82 percent of live grouper exports from the Philippines go to and through Hong Kong (US-AID 2013).

Due to economic and biological over-exploitation of coral reefs and the environmentally damaging aspects of some harvesting techniques, including cyanide fishing and targeting of spawning aggregations for live fish trade, the concern was focused on the sustainability of supply for live fish trade (Cesar et al 2000). The fact that the environment is different and fishing techniques vary among nations, based on the study, Filipino fishers appear to use much greater quantities of cyanide per unit area than do their Indonesian counterparts, and Philippine reefs may be subject to higher levels of synergistically-injurious sedimentation and pollution than reefs in remote Eastern Indonesia (Erdmann & Pet-Soede 1997).

Palawan produced 70 percent of the Philippines' LRFT export, despite being only one of 36 sources in the country. In Palawan, 16 of 23 municipalities were documented sources. The major transhipment points were the municipalities of Roxas, Taytay, and Coron, all in northern Palawan, although there were also shipments coming from Balabac, Magsaysay, and San Vicente (Salao et al 2013).

However, recent information revealed that the LRF industry in Coron is in the verge of collapsing (Mamauag et al 2000). With this trend, it is likely that other LRF supply-areas will follow, if improper and unsustainable harvesting is continuously practiced and mitigating actions are not seriously taken. The existing exploitation and gathering practices and trends in other LRF areas make them likewise vulnerable to collapse of *Suno* stocks in their respective areas - just like in Coron.

Without proper conservation and management for the sustainable utilization of the commodity fish, like *Suno*, LRF could easily vanish, affecting thousands of fishers and their families in Taytay Bay. In the above context, the municipality of Taytay is aware that something has to be done to save the LRF of the bay in particular and the bay fisheries in general. In cooperation and with support from WWF-Philippines, the Western Philippines University (WPU) gather data on the current status of CPUE and LRF in Taytay Bay, as baseline data for the management of the bay.

Material and Method. Taytay is located North of mainland Palawan (Figure 1). The study site, Taytay Bay, is situated immediately East of the municipality of Taytay. Taytay is one of the top producers of anchovies (*Stolephorus heterolobus*), coral trout, red-belly yellowtailed caesio (*Caesio cuning*), and tuna (*Thunnus* sp.) in terms of catch. Most of the fisheries supply in Taytay area comes from Taytay Bay. Taytay Bay, is a known habitat of dugongs (*Dugong dugon*) (Salao et al 2013), and a source of the LRFT, particularly for coral trout.

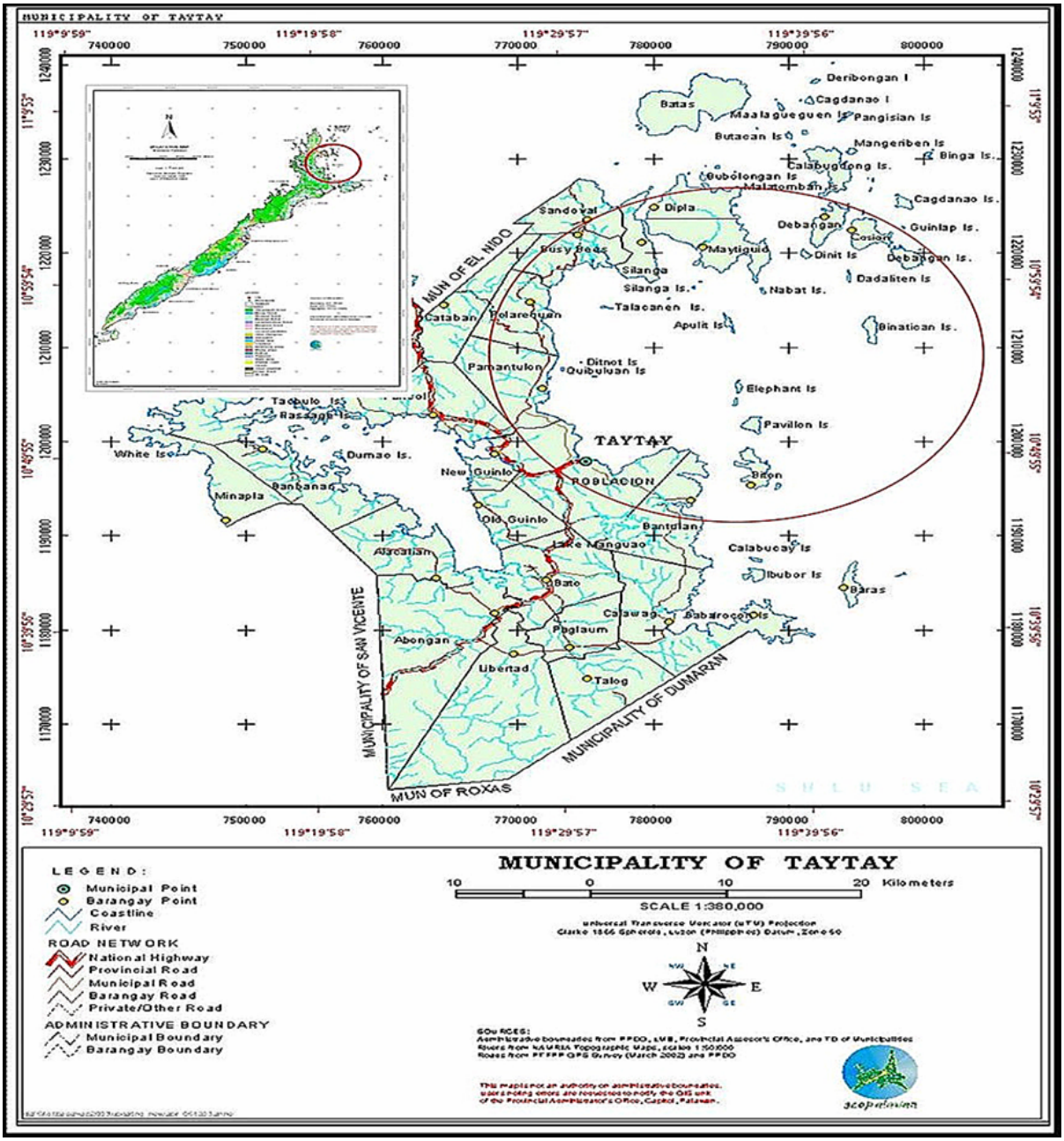

Figure 1. Map of Palawan showing the location of the area, Taytay Bay, Palawan Philippines (Map source: National Mapping and Resource Information Authority 2014).

Standard catch survey method was conducted to estimate the total fish catch and CPUE for each surveyed fishing gears used in Taytay Bay. The survey was conducted between the August 5 and September 5, 2009, representing the mid-Southwest Monsoon CPUE of the year.

Before the actual survey, the first two authors rendered lectures, practicum exercises and survey pre-test with the staff of the Municipal Agriculture Office (MAO) on CPUE data collection. The actual fish landing survey was carried in four sites: Taytay pier

or *Pantalan*, *Biton*, *Little Tondo* and *Binsilao*. The sites were revisited to augment the information gathered for the fishing gears by the same group on August 12, 2009 through ocular survey and administered interview. Records of the Barangay Fisheries and Aquatic Resource Management Council (BFARMC) were also used as references for this study. Gonzales (2005) was mainly used to identify fish species landed at survey sites.

CPUE data included species composition and their total weights (in kilograms) while effort data composed the number of fishermen, number of fishing vessels, types of fishing gear used, fishing duration (such as hours or days) and area of fishing. Further, percentage and amount of LRF were determined from the total catch and which gear has the highest percentage of LRF caught.

Results and Discussion

Fish catch. Pamo-lambat (drift gillnet) has the highest fish catch in terms of biomass landed (Table 1), followed by Pana-compresor (hookah with spear gun). Pana-manomano (skin dive spear gun) and kawil-pampusit (jigger) have the lowest catch, respectively.

It is usual for drift net to land more catches than hook and lines. However, the hookah with speargun landing fishes second to driftnet is unusual. Thus fishes landed by compressors should be evaluated.

Table 1

Fish catch (kg) per sampling station per fishing gear, Southwest Monsoon 2009

Fishing gear	*Biton*	*Little Tondo*	*Binsilao*	*Pantalan*	*Total (kg)*
Panti (Palubog)		1,338.5	382.7	209.5	1,930.7
Pamo (lambat)		840.0		4,535.8	5,375.8
Pana (mano-mano)				2.5	2.5
Pana (compressor)		2,143.7		745.5	2,889.2
Kawil	49.9		5.5	170.4	225.8
Kitang			213.9	122.1	336.0
Basnig				170.0	170
Kawil (pampusit)		3.0			3.0
Baklad (malalim)				93.8	93.8

Fishermen using the gears in Table 1 mostly landed there catch in Pantalan site. The reason for this might be that Pantalan is centrally located in mainland Taytay, where most of the fish buyers were stationed, and the place was more accessible to market, though other landing sites like Little Tondo and Binsilao were also active fish trading sites. In addition, fish landings of Panti-palubog (bottom gillnet) and Pana-compressor (hookah with spear gun) were higher in Little Tondo than in Pantalan.

Fishing effort. The Pamo-lambat (drift gillnet) has the highest effort (no. of fishers x fishing time) (Table 2), followed by Kitang (bottom longline), while Kawil-pampusit (jigger) and Basnig (bagnet) have the lowest effort. The high fishing effort of driftnet (Pamo lambat) and hookah (pana compressor) in Table 2 supported the high volume of landings by these gears (Table 1).

Table 2

Fishing effort (FE) of fishing gears (no. of fishers x fishing time/trip) recorded in Taytay Bay

Fishing gear	*Biton*	*Little Tondo*	*Binsilao*	*Pantalan*	*Total FE trip^{-1}*
Panti (Palubog)		316.0	122.0	71.0	509.0
Pamo (lambat)		472.0	3,260.0		3,732.0
Pana (mano-mano)				14.0	14.0
Pana (compressor)		1,140.0		114.0	1,254.0
Kawil	568.0		8.0	280.0	856.0
Kitang			920.0	960.0	1,880.0
Basnig				42.0	42.0
Kawil (pampusit)		40.0			40.0
Baklad (malalim)			192.0		192.0

Catch per unit effort. The CPUE of various fishing gears in Taytay Bay is shown in Figure 2. The fishing gear Basnig (bag net) had the highest CPUE followed by Panti-palubog (bottom gillnet), while the fishing gears with lowest CPUE were Kawil–pampusit (jigger), Kitang (bottom longline) and Pana-mano-mano (skin dive spear gun). This means that bag net and bottom gillnet fishing methods were the most efficient gears in terms of catching fish by volume (weight) per fisherman per hour.

This result implies that the fish species caught by basing, which are generally pelagic and by bottom gillnet, which are generally demersal are still abundant in the bay.

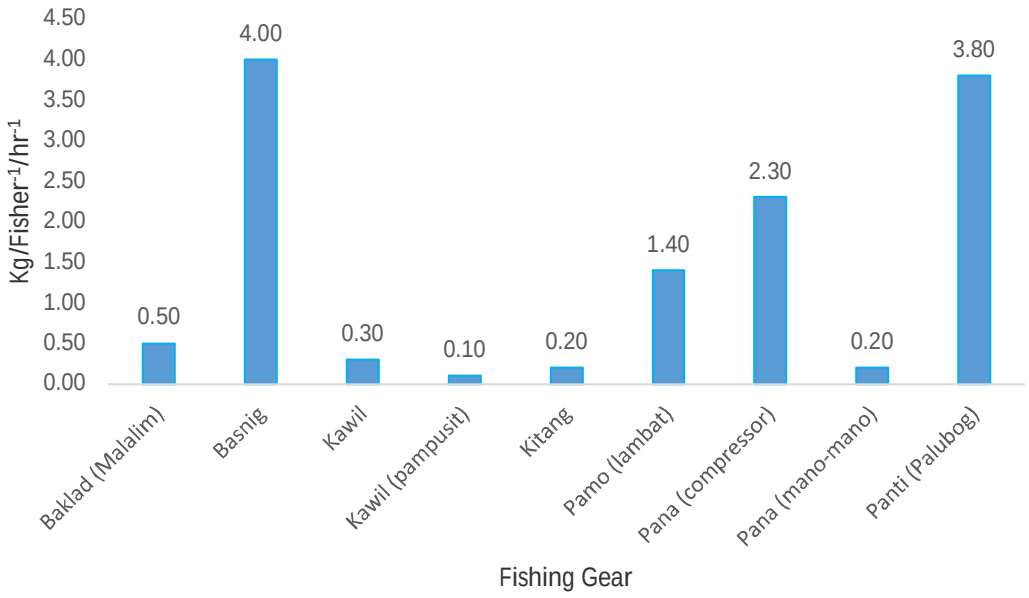

Figure 2. Catch per unit effort of various fishing gears in Taytay Bay, Southwest Monsoon 2009.

The CPUE of Basnig (bag net) (4 kg fisher^{-1} hr^{-1}) for the month of August to September in 2009 was higher than that reported in 2013 (Salao et al 2013). This suggests that the fish catch of basing is decreasing in the area. The CPUE of pana-compressor users was 2.3kg fisher^{-1} hr^{-1}, following the panti-panlubog at 3.8 kg fisher^{-1} hr^{-1}.

Ideally, bag net and bottom gillnet found to be efficient in terms of CPUE should be promoted to be used in the bay. However, bag net should not operate in the municipal waters of Taytay since it is an active gear as stated in the Fisheries Code of the Philippines (1998). Hence, bottom gill net should be continuously promoted to be used in the bay.

Number of fishermen. The gear with most number of fishermen involved was the Kawil (hook and line) (Figure 3), followed by Panti-palubog (bottom gillnet) and Pana-compressor (hookah with spear gun). This indicates that Kawil (hook and line), panti-panlubog (bottom gillnet), pana-manomano (spear gun), and kawil-panpusit (jigger) remained popular to fishers in the bay. This may be so, because of low capital inputs and cost of operation of the said gears. It is important to note that these gears are traditional artisanal gears, except for pana-compressor, which has evolved from skin spear fishing into a more efficient gear (longer fishing time and deeper water operation). This evolution has impact however on the over exploitation of fishes and opened opportunities to use blast fishing.

Data also show that most of the fishers in the bay were in Kawil (hook and line) fishing, which is the gear for catching live red groupers (*Plectropomus* spp.). Live red groupers command high price in the market, thus Kawil fishing with low capital inputs, gathering high valued fishes has become a priority source of income by the local fishermen. With relatively low fishing effort (Table 3), but with high number of fishermen

(Figure 3), the total fishing effort would soon put pressure to the red grouper resource. Hence status of the red grouper stock/population in the bay should be monitored.

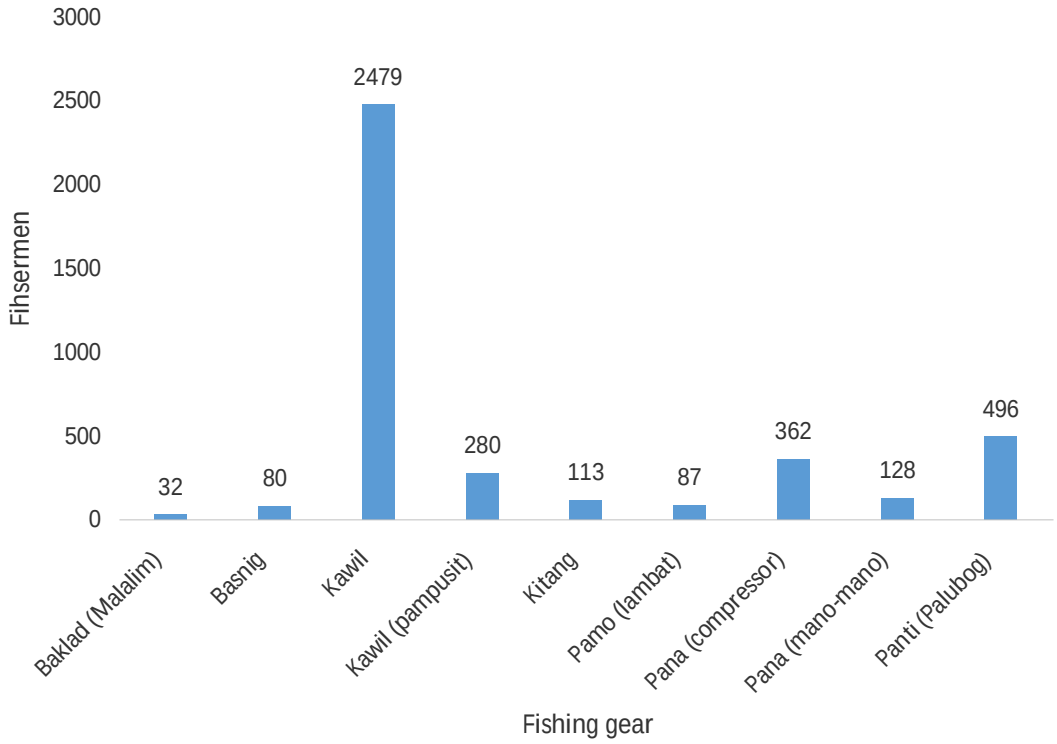

Figure 3. Number of fishers using different fishing gears in 16 barangays around Taytay Bay, 2009.

In terms of type of fishers, Taytay Bay fisheries was dominated by Kawil (hook and line) fishers (Figure 3). This may be so, because the use of hook and line is ideal for live fish fishing. It has high survival rate and has minimal damage to the fish, which in turn commands high market price. However, the high number of Kawil fishers may create an unequal distribution of type of fishers in the bay. Type of gears used will reflect the volume and fish species that can be harvested from the bay. This situation is basically not healthy to the bay fisheries, since if something goes wrong with the live (*buhay-buhay*) fisheries, which is related to Kawil fishers, more than half of the fisher's population of the bay will be affected. Hence, it is suggested that fishers should indulge in diverse fisheries in order to have a stable fishing industry in the Bay, and management regimes regarding this aspect should be in place.

Total fish catch. Taytay Bay was dominated by Kawil (hook and line) and Pana-compressor (hookah with spear gun) fisheries in terms of type of gear, number of fishermen, number of hours fishing and volume of catch.

Kawil (hook and line) has the highest catch, composing 34% of the total catch, followed by Pana-compresor (hookah with spear gun) having 27%, and Panti-panlubug (bottom gillnet) with 12%. While the lowest landings were Kawil-pampusit (jigger), Pana-manomano (skin dive spear gun), and Kitang (bottom long line) (Table 3).

The above results show that the highest total fish landing in Taytay Bay come from Kawil and Pana-compressor of which are two identified gears effectively gathering live red groupers. This indicates that most fishers in Taytay Bay were into live red grouper fishery and were contributing to 61% fish landing of the bay.

The high number of Kawil fishers will create an unequal distribution of type of fishers in the bay. This situation is basically not healthy to the bay fisheries, since if something goes wrong with the live (*buhay-buhay*) fisheries, which is related to Kawil fishers, more than half of the fisher's population of the bay will be affected. The highest total fish landing in Taytay Bay come from Kawil and Pana-compressor which are known

effective gears for gathering live red groupers. Most fishers in Taytay Bay were into live red grouper fishery.

Table 3

Estimated total fish catch of various fishing gears in Taytay Bay per month, Southwest Monsoon 2009

Fishing gear	*Fishing hr/day*	*No. of days fishing/month*	*Total no of hours*	*Total no. of fishermen*	*Grand total (ton)*	*(%) Percent composition*
Panti (Palubog)	1	22	22	496.0	41,389.5	12
Pamo (lambat)	12	18	216	87.0	27,069.1	8
Pana (mano-mano)	7	25	175	128.0	4,000.0	1
Pana (compressor)	6	18	108	362.0	90,076.7	27
Kawil	8	22	176	2,479.0	115,090.5	34
Kitang	10	22	220	113.0	4,442.4	1
Basnig	7	18	126	80.0	40,800.0	12
Kawil (pampusit)	10	18	180	280.0	3,780.0	1
Baklad (malalim)	24	28	672	32.0	10,505.6	3

Live reef fish. The total fish caught by hand line fisheries in Biton consisted only of 5% fishes belonging to family Serranidae (*Lapu-lapu*) (Figure 4). Based on the total catch, landing of serranids was estimated to be around 17 tons per month. Of this, 40%, around 8 tons were *Suno*, and the rest were mostly composed of 3rd class serranid species (aswang) and tiger grouper *(Plectropomus oligacanthus*). Of the serranid species caught, 13% (2.2 tons) were sold in live state, while the rest were sold fresh.

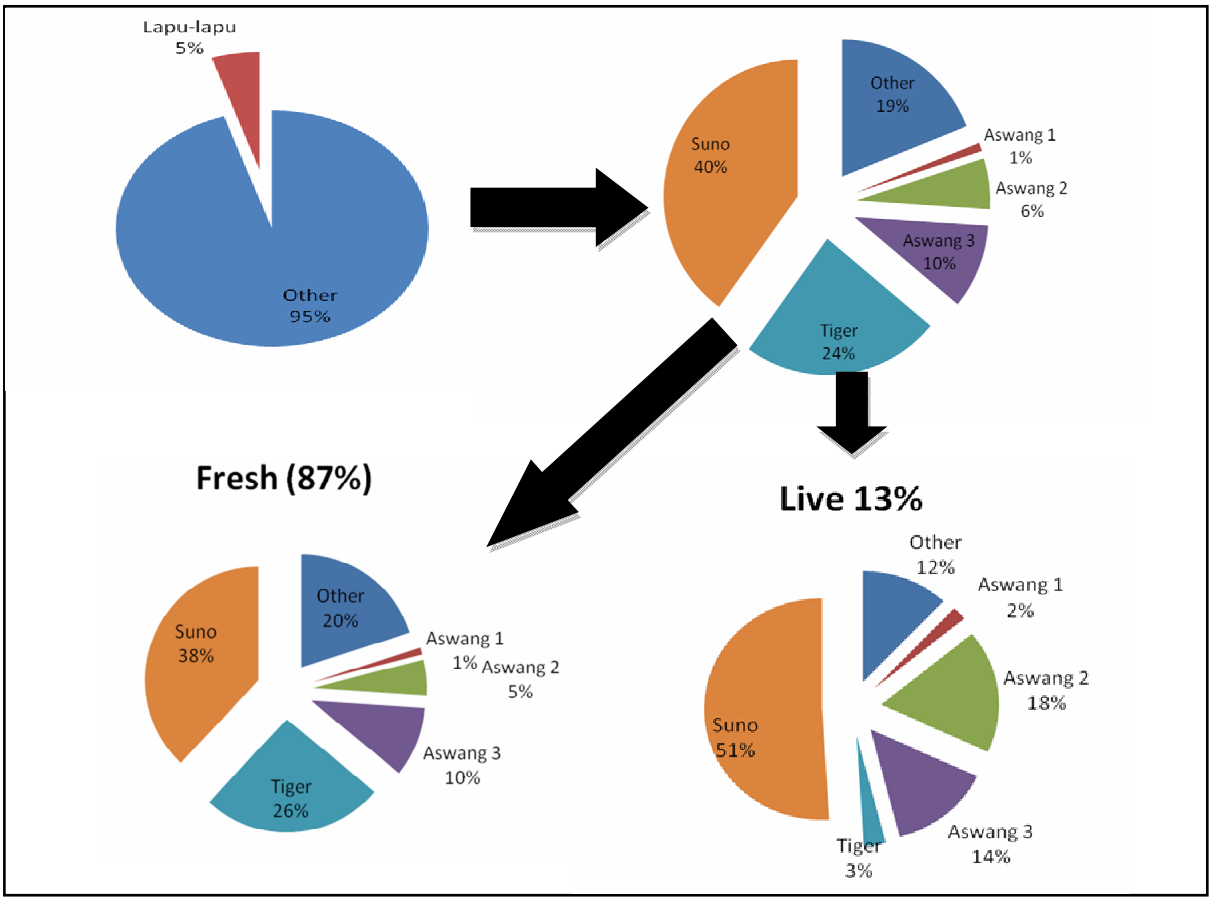

Figure 4. Percentage of *lapu-lapu* (serranids) in the total fish catch in Taytay Bay, Southwest Monsoon 2009.

According to Gonzales & Dolorosa (1994), Palawan fishers identify 3rd class serranid species (aswang) as*: Cephalopholis urodelus, Epinephelus areolatus, E. argus, E.*

fasciatus, E. lanceolatus, E. macrospilus, E. merra E. ongus, E. pachecentron, and E. sexfasciatus on their work in Ulugan Bay, Palawan in 1990-1991, wherein the serranids catch was composed of 43% aswang.

Other fishers used nets for fishing in the bay. Nets usually target schooling pelagic species, hence catching large volume of fish at a time. This may explain the relatively low percentage of catch of *lapu-lapu* in the bay compared to other species. Only hand line and traps are effective gears to catch good quality live fishes.

Although the figures on *lapu-lapu* live fish catch was relatively low, its market value was high, so that many fishers were engaged in Kawil. Good size (0.5 to 1 kg) fish usually gets the highest price, undersize gets (0.4 kg and below) the lowest price, while oversize fish (> 1 kg) were paid as fresh fish. Regardless of the size and the species, the amount drastically drops to 10 per cent of the prevailing price when imperfections such as slight discoloration or damage on the scales are observed (Padilla et al 2003). Attracted to quick financial gain, LRF became a popular source of income to the majority of fishers in Taytay Bay (WWF 2011). An average household in Taytay engaged in LRFT earned PhP 382,940 (US$ 9,300) per year and almost 54 percent of the LRFT producer's household income was from LRFT (Salao et al 2013).

The low catch may mean that the *lapu-lapu* resource in the bay may not be viable anymore. In addition, the dominance of relatively small-sized *lapu-lapu* observed in the catch indicates species under pressure. This is alarming since so many fishermen were competing to catch the same depleting resource of *lapu-lapu*, which will eventually end up in the collapse of *lapu-lapu* resources/populations in the bay if no immediate management schemes are introduced.

Conclusions and recommendations. There were nine fishing gears identified to operate in Taytay Bay. Pamo-lambat (drift gillnet) has the highest fish catch in terms of biomass landed, followed by Pana-compresor (hookah with spear gun). Pana-manomano (skin dive spear gun) and Kawil-pampusit (jigger) have the lowest catch, respectively. Hookah with speargun landed fishes second to driftnet is unusual. Thus fishes landed by compressor fishers should be evaluated.

The Pamo-lambat (drift gillnet) has the highest effort (no. of fishers x fishing time), followed by Kitang (bottom long line), while Kawil-pampusit (jigger) and Basnig (bagnet) have the lowest effort. The high fishing effort of driftnet (Pamo lambat) and hookah (pana compressor) supported the high volume of landings by these gears.

Basnig (bag net) has the highest CPUE followed by Panti-palubog (bottom gillnet), while the fishing gears with lowest CPUE were Kawil–pampusit (jigger), Kitang (bottom longline) and Pana-mano-mano (skin dive spear gun). Bag net and bottom gillnet fishing methods were the most efficient gears in terms of catching fish by volume (weight) per fisherman per hour. The CPUE of Basnig catch tends to decrease in the area. The catch per unit effort of pana-compressor users was 2.3 kg fisher^{-1} hr^{-1}, following the panti-panlubog at 3.8 kg fisher^{-1} hr^{-1}.

The gear with most number of fishermen was Kawil (hook and line), followed by Panti-palubog (bottom gillnet) and Pana-compressor (hookah with spear gun). Most of the fishers in the bay were in Kawil (hook and line) fishing. Kawil has become a priority source of income by the local fishermen that the total fishing effort would soon put pressure to the red grouper resources.

The total catch of fish in Taytay Bay for a month during Southwest Monsoon period is estimated to 337.2 tons. Family Serranidae (*lapu-lapu*) consist only 5% of the total fish catch of the bay. Of this, 40% were *Suno*, and the rest were mostly composed of 3rd class serranid species (aswang) and tiger grouper. Of the serranid species caught, 13% were sold in live state, while the rest were sold fresh.

The low catch of target live fish species in the bay may indicate that LRF may not be viable anymore. The dominance of relatively small-sized *lapu-lapu* casually observed in the catch further implies that the species is under pressure. This is alarming since so many fishermen were competing to catch the same depleting resource of *lapu-lapu*, which will eventually end up to the collapse of the resources/populations in the bay if no immediate management schemes should be introduced.

Since Kawil fishers composed more than half of the fisher's population of the bay, the government should encourage or find means to let fishers indulge in diverse fisheries in order to have a stable fishing industry in the bay. A management regime regarding this aspect should be in place.

Since this survey represents fisheries information on the Southwest Monsoon, survey must also be conducted during the Northeast Monsoon period. In addition, adjacent fishing grounds of Taytay Bay should also be assessed for this might have an effect latter on, in terms of integrated management of the area.

The study on the spawning, and size at maturity of each species caught in Taytay Bay is necessary. For monitoring the grouper stocks, the size, age-class, and recruitment should be considered.

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