CATCH-PER-UNIT EFFORT OF EXPLOITED FINFISHES AND CRUSTACEANS IN ILOG RIVER ESTUARY, NEGROS OCCIDENTAL, PHILIPPINES

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Abstract

This paper reports the catch-per-unit effort (CPUE) of the finfish and crustacean fishery in Ilog River Estuary in Negros Occidental. We monitored catch data of fishing gears, mainly trawl (small type), beach seine and mud crab pot from April, May, September, October, December 2013 and January 2014.We estimated at least 37.82 metric tonnes of annual fishery yield (fishes and crustaceans combined) for the entire Malabong estuarine area. Two gears (liftnet and fish corrals) were used by the local fishers since the 1980s. Based on the baseline annual yield of 21 tonnes, the annual yield for these gears (at present ~7.5 tonnes) combined has declined by 13.5 tonnes (~65%) since the early 1980s (~30 years). This decline might be due to habitat degradation (including conversion of original mangrove forests into fish ponds and nipa plantations), over-exploitation, and organic pollution (resulting to recurring fish kill events) in the area.

Key words: estuary, exploitation, fishery, mud crab, pollution

Introduction

An estuary is defined by Pitchard (1967) as "a semi-enclosed coastal body of water with free connection with the open sea and within which sea water is usually diluted with freshwater derived from land drainings." Pritchard defined four types of estuaries from the geomorphological standpoint but Odum (1971, p. 352-354) added a distinct type which he called "river delta estuaries" found at the mouths of large river systems. Our study areas may belong to this type, even though the river systems in our case are small.

Estuaries have long been the focal point for much human activity (Blaber 1997). As the meeting place of river and sea, they provided quiet waters for harbours and port cities to flourish elsewhere in the world (Blaber 1997). In most cases, however, port cities attract industries that may dump effluents directly into the estuary resulting to pollution. Despite this problem, estuaries are still an important source of fish, especially to the local people. They are also well-known for their major nursery function, for example, juvenile fishes congregate in these areas and benefit from the availability of food and protection from predators (McErlean et al. 1973; Pinto 1987). This function is important for the maintenance of fisheries (Barbier et al. 2011). Certain commercially important reef fishes, such as snappers (Family Lutjanidae) and trevallies (Carangidae) spend part of their life cycle in the estuary and thus, overfishing of their juveniles when they are concentrated in these areas could have negative implications on their stocks (Blaber and Milton, 1990; Russell and McDougall, 2005; Honda et al. 2013).

The direct human-induced impact on estuarine health may be exacerbated by the effects of climate change, including increased water temperature (Blaber2002). One of the predicted effects of climate change is increased precipitation and intensity of tropical cyclones or typhoons (IPCC, 2010), which may affect estuaries and associated fauna in two ways according to Blaber (1997): 1) rise in sea level at high tide can change the physical configuration of the mouth; and 2) vast amount of rainfall can cause massive flooding

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resulting to reduced salinity, high flow rates and destruction of aquatic vegetation and mangroves.

Studies on estuarine ecology in the third-world countries like the Philippines are scanty, often included only as part of short-term river assessments (e.g. Alcala E. et al. 2010; Pacalioga et al. 2010).

Methodology

Study site

Ilog River (Figure 1) is one of the largest river systems in Negros Island. It has an estimated length of 90 km with the lower 25 km navigable by small boats. There are two main tributaries of the river, the main Ilog River and the Hilabangan River, which drains the northwestern part of the river basin. Just a few kilometers below a densely populated Kabankalan City, the river bifurcates into two estuaries; 1) Bocana estuary which is narrower and lined with nipa plantations and 2) Malabong or the main Ilog River-Estuary. This study focused on the second estuarine site, in sitio Malabong. Along the river banks are fish ponds and nipa (*Nypa fruticans*) grooves, thelatter regularly supplies the local nipa shingles industry. Mangrove patches of the genera *Rhizophora* and *Sonneratia* remain near the river mouth.

Fishery Assessment

To assess the fishery (fin fishes and macroinvertebrates) of Ilog River-Estuary,fishing gears (e.g. small-scale trawling) were monitored in terms of catch-per-unit effort. Trawling traverses several stations (for the determination of physic-chemical parameters) during every fishing operation in one hour. During each sampling, a trawl operator was hired to conduct at least 3-5 hr trawls in the estuary. Also, at least 3 hauls (each considered one trial) using a two-person beach seine (*sigin*) was also employed during each sampling, traversing a 100-m

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length in the shallow portions of the estuary. Beach seine operations were conducted in these pre-determined segments of the estuary. Samplings of both trawl and beach seine were conducted during the months of April, May, September, October, December 2013, and January 2014.

The catch-per-unit effort (CPUE) of trawl was expressed as kg/trawl-hr while those of beach seine was expressed as kg/100m-haul. In addition, the catch composition of other gears such as lift net (surambaw), gillnets (pukot), and lapak are also briefly mentioned. It should be noted that these gears were not used in the monitoring because these were used only occasionally in the estuary.

The local catches of the mud crab (*Scylla spp*) using local traps called *bintol* were also monitored with the help of a local buyer in Malabong where all catches from traps are sold. Based on the daily record of the local buyer (from September 2013 to January 2014), CPUE and IPUE values were determined (per fisher and not per crab pot).The data gathered included buying price (in Phil pesos), daily catch (to the nearest 100g) per fisher, and the number of individuals for small crabs (priced 1-3 Php each), usually allowed to grow by local growers. To determine total weight (kg), we included these small crabs using their average weight (30g for those priced at 1.00 Php and 70g for those priced at 3.00 Php).

Species identification was based on available taxonomic references such as those by Allen (1991, 1999), Harrison and Senou (1999), and Larson and Murdy (2001) and others found in Carpenter and Niem (1999) *Guide to the Fishery Identification: Indo-Pacific* and the online version of FishBase (www.fishbase.org) by Froese and Pauly (2012) for fishes, Chase and Bruce (1993) for shrimps, and Serène and Soh (1970) and Ng *et al*., (2008) for crabs.

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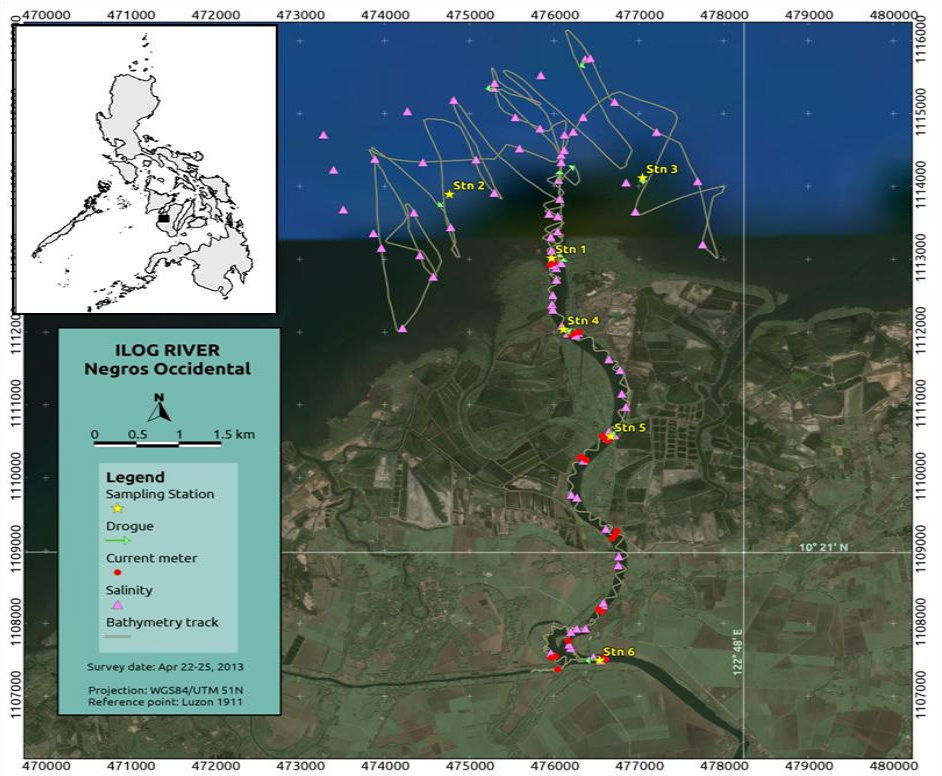

Figure 1. Map of Ilog River-Estuary showing the locations of the sampling stations for physico-chemical and cruise tracks for the bathymetric surveys (Map by J. Maypa of SUAKCREM).

Results

A total of 85 fish species is known in Ilog River Estuary belonging to 49 Families and 9 Orders. The details of the fish species diversity and certain taxonomic aspects will be treated in a separate paper (in prep).

The lowest CPUE (catch-per-unit effort) values of only 0.76 kg/trawl/hour±0.23 (SE) for fish and only 0.28±0.27 kg/trawl/hour for crustaceans were determined in December 2013 (Figure 2). It should be noted that during the occurrence of the "fish kill" in April, 2013 mean CPUE for fish was higher (1.22±0.24 S.E. kg/trawl-hr) compared during the May 2013 sampling with 0.66±0.20 S.E. kg/trawl-hr. Although mean fish CPUE increased slightly in September (1.71±0.29 kg/trawl-hr), the subsequent samplings for crustaceans (crabs and shrimps), however, showed a declining trend, which might suggest a prolonged effect of decreased DO and BOD among crustaceans than on fish.

Based on the above CPUE values and number of observed trawlers (10), it was estimated that during the first two days of trawling operation, 439.2 kg of fish and 396 kg of crustaceans (mainly edible shrimps and crabs) for a total of 835.2 kg were harvested and sold to the local markets while an estimated 334 kg of decaying fishes and crustaceans (based on an initial estimate of 40% of the total catch) may be considered wasted during the third day and onwards. Assuming that most of the fishes and crustaceans affected by the fish kill were harvested due to intensive trawling on the first two days, the fish kill event on April 19, 2013 damaged at least 1.2 tons of the local fishery production.

CPUE of fishes and crustaceans from beach seines are shown in Figure 3. The highest CPUE for this gear was during the fish kill event in April 2013, probably because of the abundance of dying fishes near the littoral zone. It should be noted that in December, CPUE of crustaceans increased to 3.31±2.18 kg/100m-haul which was comparably unusual (all previous CPUE values were below 1kg). This was attributed to juvenile shrimps (locally called hipon of the Family Penaeidae, often with mixed larvae of engraulids, scatophagids, and snappers) that form relatively large groups near the littoral portion of the estuary. However, for presentation purposes we omitted the CPUE value of this crustacean.

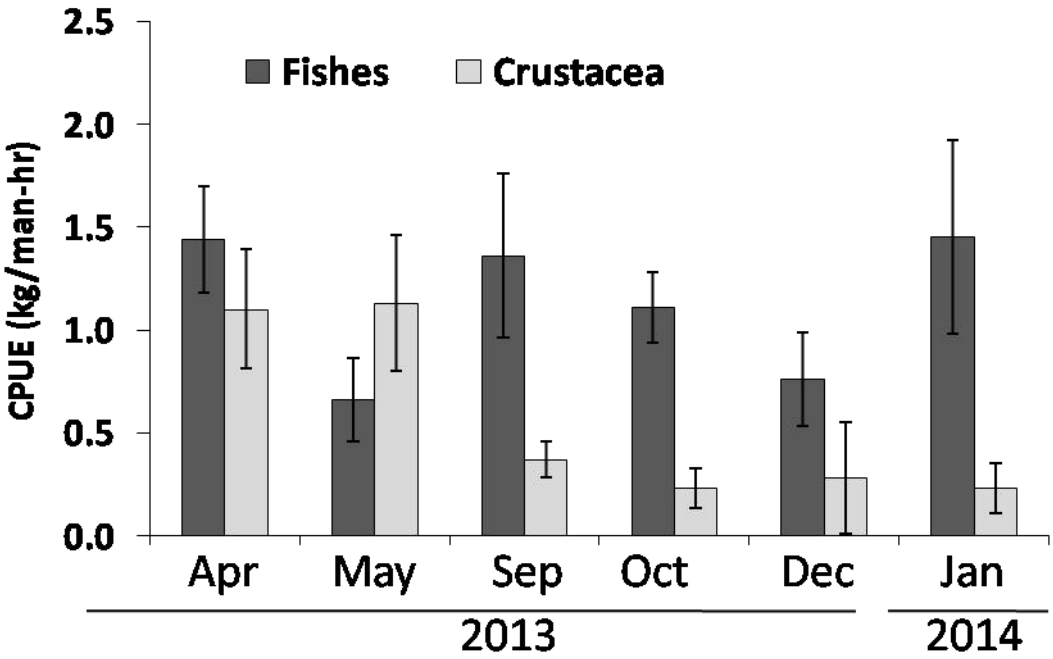

Figure 2. CPUE values of fishes and crustaceans from trawl fishing in Ilog River Estuary. N=September (35), October (32), November (85), December (231), January 2014 (143).

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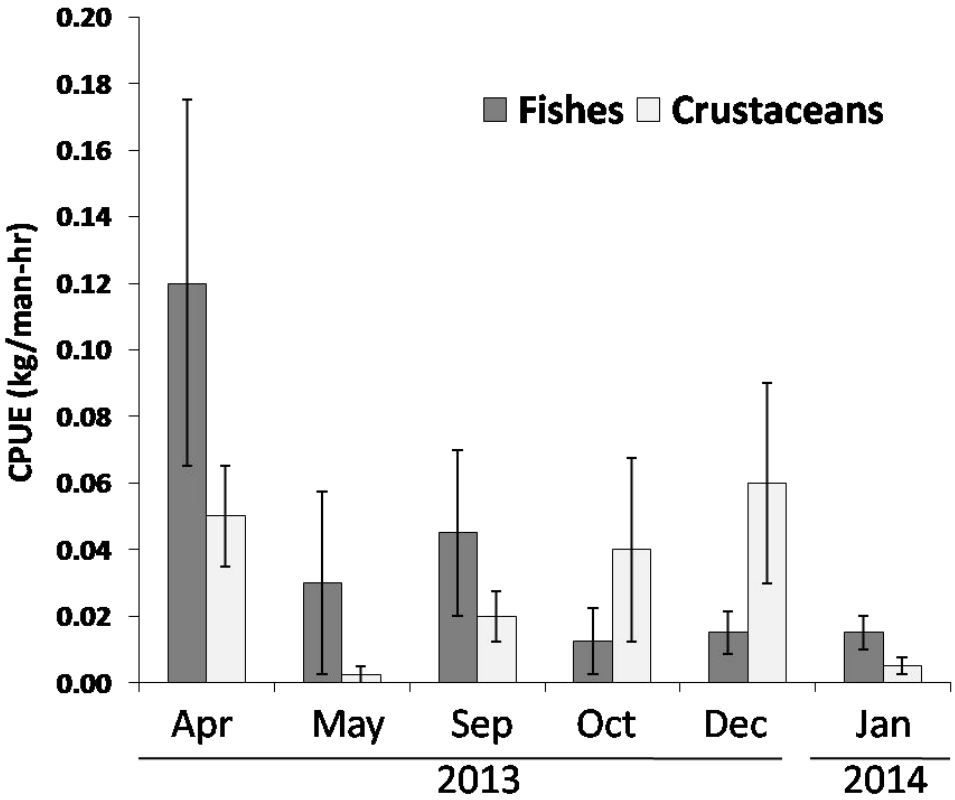

Figure 3. CPUE values of fishes and crustaceans from beach seine in Ilog River Estuary.

The trend in CPUE and IPUE values from September to January are presented in Figures 3 and 4.CPUE values ranged from 2.25±0.21 kg/person/trip in September 2013 to 4.12±0.53 kg/person/trip in October 2013, with income-per-unit effort (IPUE) of 106.81±10.32 Php/person/trip and 236.1±29.18 Php/person/trip, respectively.

Local prices varied depending on the category (size, sex and condition). The so-called "regular" mud crabs are priced Php 70-80/kg, small (ca 70 grams) Php 3.00/pc, crablets or semilya (30-50 grams) Php 1-1.50/pc, undersized female (150-300 grams) Php 120.00/kg, Large-3 (301-390 grams) Php 120.00/kg, Large-4 (400-490 grams) Php 150.00/kg, Extra Large (500 grams) Php 250.00/kg. The total catch of these categories are presented in Figure 5. It should be pointed out that "regular-sized crabs" and crablets are the two groups that are

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heavily exploited, with the highest peaks in December 2013 with 247 kg and 252 kg, respectively. From September 2013 to January 2014, the total catch of *Scylla* spp on a monthly basis ranged from 75 kg to 671.76 kg (mean: 317 kg/month). Based on CPUE values of 5 regular mud crab fishers, an annual production of 5,607 kg or 5.6 metric tonnes a year and an equivalent overall income of Php 342,090/year (Php 358,426/year if a monthly gross income of Php 29,868.83 is used). The present total annual yield per fisher (1,146 kg/year/fisher based on mean CPUE of 3.18 kg/fisher/day) for *Scylla* spp. in Ilog River Estuary appears higher than it was in the 1980s when local fishers were not yet using crab pots (177.33 kg/year/fisher based on Alcala, unpub.report).

There are at present 5 regular mud crab fishers in Malabong village. In the 1980s, there were about 60 persons associated with mud crab fishing in Malabong. This decline in the number of fishers might be due to two possible reasons:1) availability of other job opportunities such as fishpond construction (each person paid Php 300/day) and nipa shingle making; and 2) reduced catch. The second factor, in turn, might also be influenced by over-exploitation or by the recurring fish kill events.

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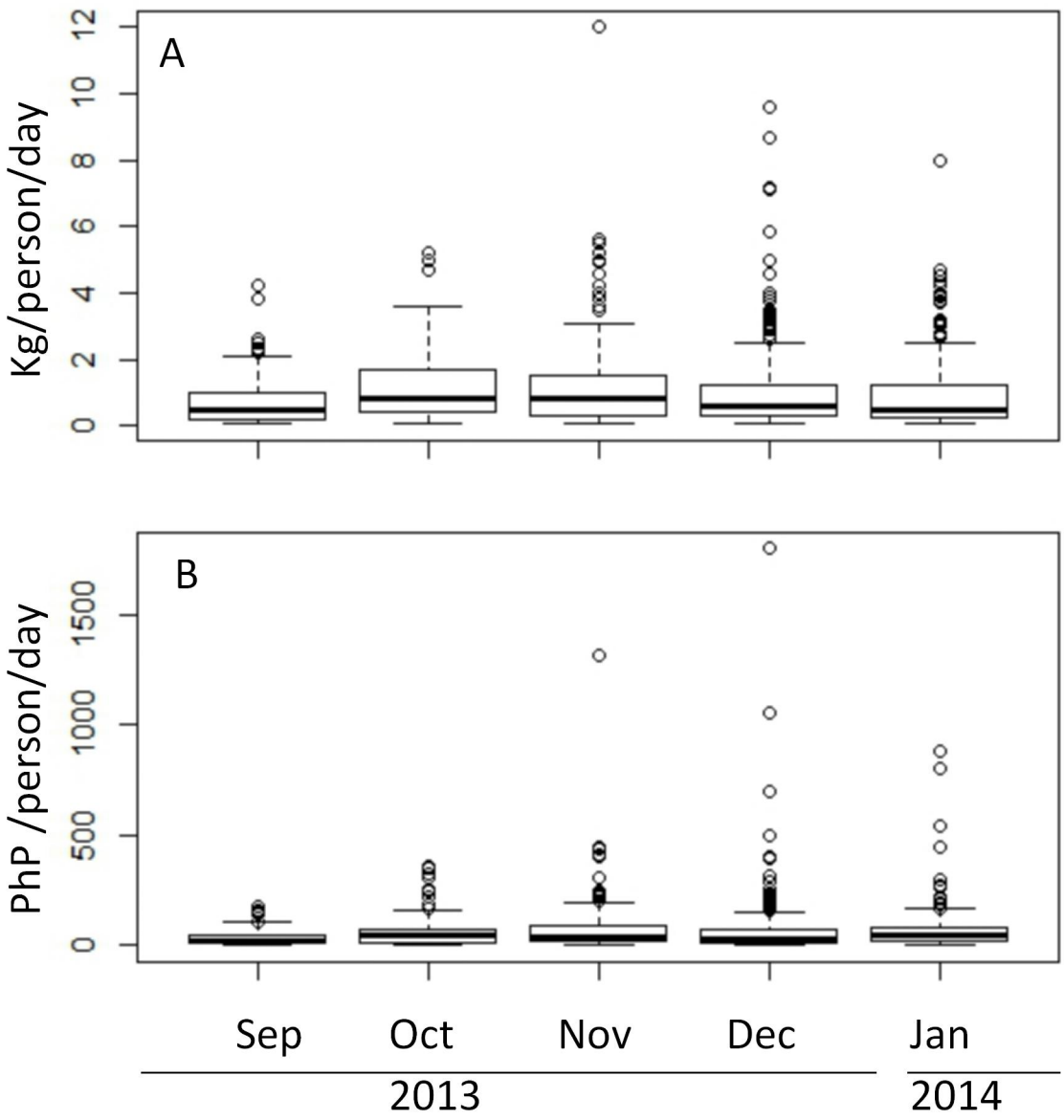

Figure 4. Mudcrab (*Scylla* spp) CPUE (A) and IPUE (B) values obtained in 5 months in Ilog River Estuary. N=September (35), October (32), November (85), December (231), January 2014 (143).

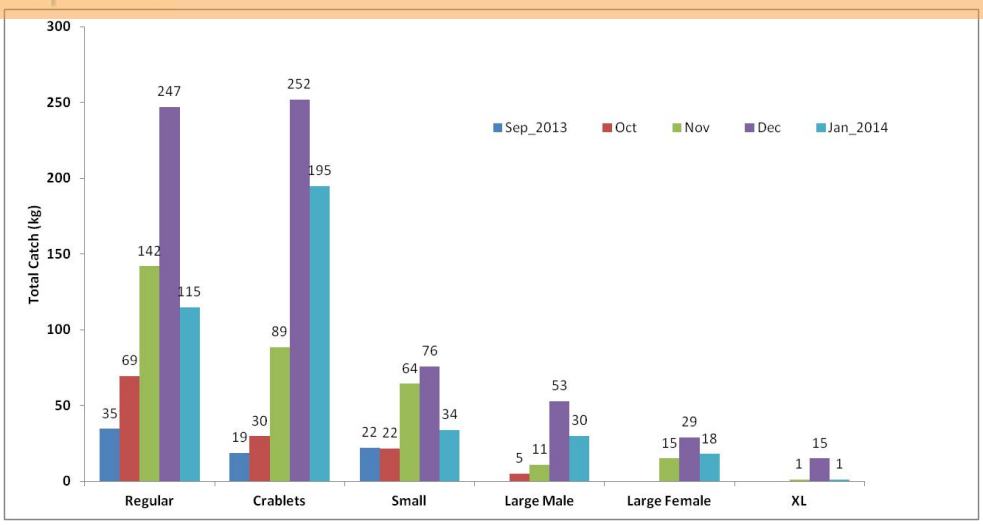

Figure 5. Total catch data (in kg) of *Scylla* spp. in Ilog River Estuary from September 2013 to January 2014.

Table 2. CPUE and IPUE of other gears occasionally used by the local fishers of Ilog.

Gear	N	CPUE Mean± S.E.	IPUE Mean± S.E.
Cast net	6	0.87±0.15	78.75±13.93
fish corral (small)	2	0.32±0.02	21.61±8.36
Gillnet	7	0.29±0.10	18.51±6.25
Lapak (set fine net)	2	0.31±0.12	21.22±7.18
trawl (for shrimps)	4	0.38±0.07	42.50±7.50

A local fisher was hired as fish enumerator for at least a week of monitoring local landing sites in Malabong. Based on this short duration of fish catch monitoring, there were at least 5 gears used by the local fishers (Table 2). Mean CPUE values from these gears, however, were apparently low, ranging only from 0.29-0.87 kg/trip.

The afore-mentioned CPUE values were used to determine daily catch (kg) for the calculation of annual fishery production (finfishes and crustaceans) in Malabong outlet of Ilog River Estuary. At least 37.82 metric tonnes of annual fishery yield (fishes and crustaceans combined) were estimated for the entire Malabong area. Of this figure, ~7.5 tones were derived from two gears (liftnet and fish corral) which were used mainly by the local fishers since the time of A.C. Alcala's survey from 1981-1983.Based on the baseline annual yield of 21 tonnes, the annual yield for these gears (at present ~7.5 tonnes) combined has declined by 13.5 tonnes (~65%) since the early 1980s (~30 years).The remaining 30.32 tonnes were derived from other fishing gears such as trawl and mudcrab pots that were adopted by the locals probably recently. Because these gears were recently used by the locals, very little historical comparison can be made.

Discussion

In both fin fish and crustacean fisheries, we observed apparent declines in terms of catch-per-unit effort and total annual yield based on the unpublished baseline data in the 1980s by A.C. Alcala of Silliman University. In addition, the fishery of the mollusk *balisala* (Family Tellinidae) which used to be gleaned 20 days/month having a CPUE of 29.4 kg/person (monitored from 1980-1982 by Alcala's team) no longer exist in Ilog River Estuary. While it is too early to pinpoint the major cause(s) of the apparent decline in fish catch over a 30 year period and the collapse of "balisala" fishery, several factors such as over-exploitation and pollution from neighboring industries might be considered. In fact, in 1981, local fishers and local oyster culturists complained on the recurring fish kill events, by which they claimed as due to dumping of effluents from sugarmills into the river.

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On the other hand, the present total annual yield per fisher for *Scylla* spp. (probably of two species: *Scylla serrata* and *S. oceanica*) in Ilog River Estuary appears higher than it was in the 1980s (only as by-catch of gillnets) when local fishers were not yet using crab pots (177.33 kg/year/fisher).Such a shift in fishing gear into a more efficient one might be due to increasing demand for mudcrab. In Bais Bay, Alcala (1985) reported a mean monthly harvest of *Scylla* at 196.3 kg/month (~2.3 tonnes/year), about half of the present catch in Ilog River Estuary (467.33 kg/month or 5,607 tonnes/year). In Buswang, Aklan, Walton et al. (2006a) reported a monthly yield of 411.2 kg/month in a replanted mangrove forest.

One negative features of the fishing gears used to capture crabs is the ability to catch immature individuals. The high number of immature individuals caught by this present study using crab pots is not surprising. In another exploited species, the Blue Crab (*Portunus pelagicus*), Ingles (2004) reported that 8-27% of the crab pot catches consist of immature individuals. In certain localities of the Philippines, such as in Panguil Bay, over-exploitation of mud crab (*Scylla* spp) in about 5 years caused a 95% decline in catch from 125 tonnes in 1991 to 11.69 tonnes in 1995-1996 (Tumanda 2004).

To reduce exploitation, establishment of marine reserves has been recommended by several authors. For example, Pillans et al. (2005) showed that inside the marine reserves, *Scylla serrata* supported higher catch rates and mean size after five years of protection. Walton et al. (2006a,b) showed that replanted mangroves may also serve as habitat for juvenile mud crab (*Scylla* spp) and at the same time sustained the local mud crab fishery.

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Conclusion

Several factors may have influenced the apparent decline in CPUEs of both finfishes and crustaceans in Ilog River Estuary. One such factor is over-exploitation. This problem can be addressed by establishing marine reserves or similar interventionssuch asregulations to exclude gravid female crabs and juvenile crabs "crablets", and enforcement of existing fishery laws (RA 8550).Re-planting of mangroves that may serve as nursery habitats for mud crabs and fishes should be pursued. In addition, alternative livelihood programs should be likewise discussed and provided by concerned government agencies (local government units or LGUs, Bureau of Fisheries & Aquatic Resources or BFAR) and non-government organizations (NGOs) and the academe.

In the case of the recurring fish kill events, BFAR and LGUs of Kabankalan City and Ilog municipality should investigate further as to the primary cause of this event.

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