A Study on the Invertebrate and Vertebrate Biodiversity of the Jalaur River System of Iloilo, Panay, Philippines

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This study, conducted from July to November 2009, aimed to explore the diversity of large aquatic and terrestrial organisms found in microhabitats along the Jalaur River System on Panay Island, Philippines. We adopted a purposive sampling approach using several collection techniques appropriate to particular taxa or group of taxa. These include the netting method for birds and bats, cruising and transect methods for herpetofauna, gill-net fishing for aquatic vertebrates and quadrat method for macro-invertebrates. Data were analyzed for species richness (S) and relative abundance, and for fish, catch per unit effort (CPUE) and income per unit effort (IPUE). Three areas, representing the upper, middle, and lower portions of the river, served as the sampling sites. The results of the study show that there are at least 106 species of terrestrial vertebrates and about 71 species of aquatic vertebrates and macro-invertebrates in the area. These include 22 endemic species of terrestrial vertebrates, a new Philippine record of the goby *Trypauchenopsis intermedia* and an undescribed goby of the genus *Rhinogobius*. Of the 51 species of fish observed in the area, 36 species (70.59%) are known to inhabit marine and brackish water habitats, while 14 species (27.45%) inhabit freshwater. Only one catadromous species of fish, *Anguilla marmorata*, was observed in the area. The study also identified nine exotic species of fish and two species of freshwater mollusks are harvested in the area. The terrestrial vertebrate species diversity appears to be depauperate.

KEYWORDS: Jalaur River, biodiversity, vertebrate fauna, aquatic macro-invertebrate fauna

INTRODUCTION

Freshwater communities display significant biodiversity despite the small area occupied by freshwaters in the hydrosphere (Groombridge, 1992). Conservative estimates place at least 12% of all animal species in freshwater environments (Abramovitz, 1996). The fresh water habitats are estimated to have an area-species richness (% species/% area) of 3.0, which is comparatively higher than those of terrestrial and marine environments, which are 2.7 and 2.0, respectively (Reaka-Kudla, 1997). Some scientists estimate that of the several hundred new species of fish discovered each year; about 80% are expected to come from fresh waters (McAllister et al., 1997). This is probably because of the relative ease of sampling freshwater habitats compared to marine habitats.

The Philippines is well known for its terrestrial vertebrate megadiversity (Heaney, 1998; Brown & Diesmos, 2009). In contrast, the diversity of freshwater life forms is poorly known. Information on Philippine wetland inventories (DENR, 1997) indicates about 1,616 species of aquatic plants and 3,675 species of aquatic (marine, freshwater and brackish water) fauna. Whether these figures reflect the reality is not known. It is probably safe to say that in the Philippines much more effort is currently being devoted to studying marine species compared to that devoted to freshwater species. This could result in gross underestimates of the number of freshwater animal species, especially those in the geographically diverse and unexplored wetlands in the country (Borja, 2002). Thus, studies such as the present one need to be given more priority. In the case of terrestrial vertebrates, the prospect of discovering more new species in less explored mountain areas has been repeatedly underscored by vertebrate zoologists (e.g. Heaney, 1998; Brown & Diesmos, 2009). However, the land vertebrate fauna of the Philippines appears to be relatively well studied.

This report on the fauna of Jalaur River on the island of Panay is a contribution to the inventory of animal groups associated with river systems as part of a larger study of the river. The inventory is presented to serve as a baseline for measuring future qualitative and quantitative changes in the animal communities in the area. Reports on the other aspects of the study of Jalaur River (i.e., socio-economic, physico-chemical, water quality, riparian vegetation) are reported by their respective research teams.

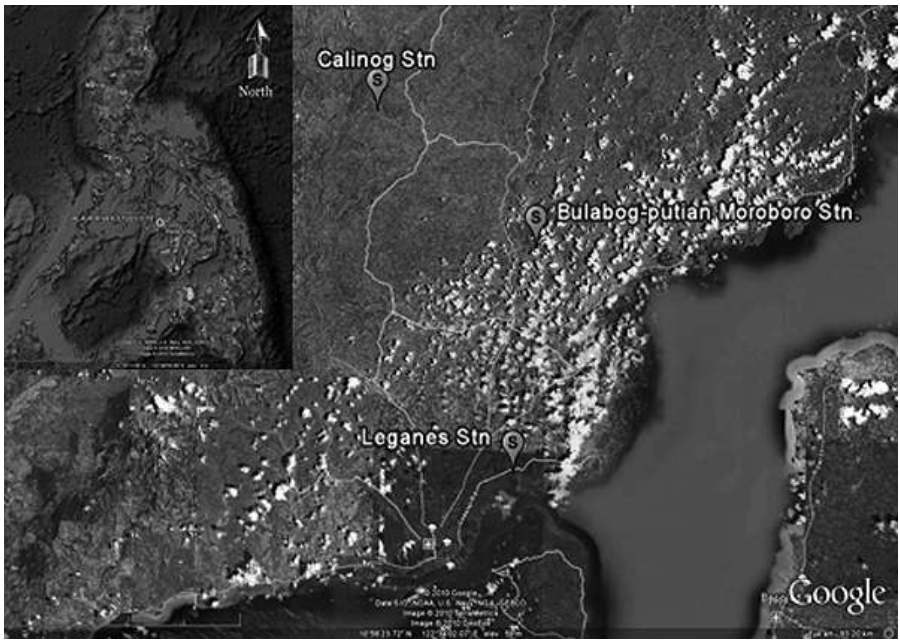

Figure 1. Satellite image of northeastern Iloilo showing the position of the three stations along Jalaur River on Panay Island. Upper left hand corner is an inset map of the Philippines showing Panay Island and encircled study site (Source: Google Earth, 2010).

DESCRIPTION OF THE STUDY AREA

This initial study on terrestrial vertebrates and on aquatic vertebrates and macro-invertebrates of the Jalaur River was conducted along selected portions of the Jalaur River Basin (Figure 1). These include the river channel, the riparian sections of the river, and adjoining farmlands and terrestrial habitats that often extend up to two kilometers from the river banks. Three study sites were selected based on the requirement that the whole river system is surveyed but within the limitations of budget, time availability, and number of competent research workers. The stations and their corresponding coordinates or base reference points, starting from the upper stretch of the river, are the upper Calinog Station (11° 09' 12.5" N, 122° 29 0.7" E), the mid-stream Moroboro-Bulabog-Putian Station at Dingle (11° 01' 42 N, 122° 39' 26" E), and the lowermost estuarine station at Leganes (10° 47' 20.59" N, 122° 38' 08.69" E). The distance between the upper station and lowermost station is about 90 km. The basin has a total area of 1,827 square kilometers and is located at the eastern part of Panay

Island (Gonzales, 1984).

The first station at an elevation of about 80 m above sea level, is an agricultural area located at Barangay Banban-Pequeño, municipality of Calinog, in central Panay. It is a 30-minute ride from the main town to Banban-Pequeño-Alibunan Bridge (Figure 2). A farm house located 1.5 km northwest of the bridge served as base camp for the duration of the study. The sampling sites included the river and its surrounding environs (i.e., rice and sugarcane farmlands and woodlands). The farm area is predominantly planted with rice and sugarcane while the hilly woodland area covering the northwest part of the study site is planted with tree species such as mahogany (*Sweitenia macrophylla*), Yemane or Gmelina (*Gmelina arborea*), and mango (*Mangifera indica*) trees. The Calinog station has a narrow riparian strip that is contiguous with rice and sugarcane farmlands. The portion of the river flowing through this area is characterized by a shallow braided type of channel that occasionally splits into two or more channels before reconnecting downstream. The thin riparian section has been attributed to river scouring and effects of flooding brought about by Typhoon Frank in 2008. A rice farmer operating close to the river showed us a section of the river that was once part of his farmland but is presently traversed by river water. The "re-channeling" of river sections has caused some farmers along the river to lose as much as 10% of their farmland areas.

The second station was established at the Moroboro River Dam in Barangay Moroboro, north of Dingle town. The study area included the Bulabog-Putian Natural Park where our base camp was set up. At least two distinct habitats, a riverine habitat and a protected forest habitat, were studied in this station. The riverine habitat is characterized by steep banks with homogenous vegetation (predominantly bamboo) and had a deep body of river water impounded by the Moroboro Dam (Figure 3). The park is a mixed lowland forest with Mahogany and Gmelina plantations growing on karst limestone. Several caves, including the historic Maestranza Cave, are located within the park. The two habitats, which are about one kilometer apart, are accessible via the Dingle-San Enrique provincial road. The Bulabog-Putian Station in Moroboro, Dingle is predominantly residential area with several houses and residential lots lining the riverbank and the peripheral park boundaries.

The third station in Barangay Nabitasan, Leganes is an estuarine area located near the Iloilo coastal road (Figure 4). The study sites included the Jalaur-Nabitasan bridge area, the surrounding fish ponds, and the University of the Philippines-Visayas Brackish Water

Research Station. This station is predominantly a mangrove wetland converted into a fishpond area with remnants of mangrove vegetation (e.g. the tree species, *Exoecaria agallocha* and the nipa palm, *Nypa fruticans*) growing along the riverbank.

MATERIALS AND METHODS

The general method used in the survey of the species of animals occurring in the stations consisted of intensive search of the microhabitats and the environmental spaces they were likely to occur in the course of their activities. The study adopted a purposive sampling approach, which followed several collection techniques appropriate to a particular taxon or group of taxa. Terrestrial vertebrate sampling followed E. Alcala (2009) for amphibians and reptiles, MacKinnon & Philips (1993) and Bibby et al. (1998) for birds. It also covered as many representative habitat types in the study area, often extending as far as two kilometers from the established reference points.

Stationary sampling of birds and volant mammals was carried out using mist nets (Figure 5) set along flight paths in typical/representative habitats (forest and agricultural habitats). This was supplemented with direct observations employing mobile transect walks during day time. Similarly, herpetofaunal sampling was done using cruising method during night time with the aid of flashlights. For ground rodents, snap traps baited with coconut meat and peanut butter was used. Animals caught by our methods, except rodents caught by snap traps, were all released after data about them were recorded. Data on fish and macro-invertebrates were based on local fish catches. Some fishing methods, which included the traditional pahubas (stream drying), panulo (night-gleaning), and gill-netting, were replicated by the research team and local fisherfolk to verify their effectiveness (Figures 6—8). Catch per unit effort (CPUE) and income per unit effort (IPUE) were also computed for target and commercial fishery species. For mollusks, quadrat sampling was done to determine the species and their densities.

Taxonomic identification was based on the taxonomic keys and field guides published by experts: Brown and Alcala (1978, 1980), Alcala (1986), Alcala and Brown (1998), Rösler et al. (2006), Siler et al. (2009) for herpetofauna; Kennedy et al. (2000) for birds; Ingle and Heaney (1992) for bats; Heaney et al. (1998) for both bats and non-

volant mammals; Allen (1994), Larson and Murdy (2001), Parenti (2001), Harrison and Senou (2001), Poss (2001) for fishes; Ng and Takeda (1993a, b), Ng (2001) and Ng et al. (2008) for crabs, and Chace and Bruce (1993) for shrimps.

To determine the capture effort of mist nets, net-nights (for bats) and net-days (for birds) were monitored and species discovery curves were constructed to determine the optimum sampling effort. Netting success rate for bats was measured by dividing the total number of individuals captured by the total number of nets used. Similarly, success rate for trapping ground rodents was measured by dividing the total number of catch by the total number of traps used. Sampling effort for herpetofauna was determined by multiplying the number of hours spent in the cruising run by the number of individuals involved to get the hours of capture effort. A total of 102 net nights for bats and 98 net days for birds were accumulated during the study while 53 trap-days were accumulated for the snap-trap method for rodents. The total search effort accumulated for the herpetofauna transect walks and the cruising method was 68 hours. We did not employ the species discovery curve for aquatic organisms because of the opportunistic nature of collection and the erratic natural conditions (intermittent flood), which made it difficult to continuously sample during the wet season run. Instead, catch per unit effort (CPUE) and income per unit effort (IPUE) were used to quantify the capture effort for fishery species. In addition to this, fish species richness was calculated relative to the area sampled (area-species richness).

To calculate the relative density of bats captured in net lines, the total number of individuals representing the species was divided by the total number of bats captured. For cave-dwelling bats, population estimates were made by determining the number of individuals occupying an area of one square meter and multiplying this number by the number of one-square meter roosts inside the cave. To get the index of relative abundance (IRA) of birds, MacKinnon listing method was used (MacKinnon & Philips 1993, Bibby et al., 1998). Frog density was estimated by multiplying the number of frogs heard/recorded calling, then multiplied by 2 to account for the females (which do not call), in a given area in square meters.

Furthermore, the study employed relative species richness (S) to compare diversity among taxa relative to the homogeneity of the environment. The formula is a modification of S which is computed by dividing the sum of species per taxon (e.g. Mammal) found per

station by the total number of species represented by the same taxon found in all three stations and then multiplying this by a heterogeneity factor h. The heterogeneity factor is a qualitative approximation of the number of habitats covered by the study and assumes equal weight for all types of habitats. In this case the h ranges from 0.2 to 1.0 with the latter covering the maximum five types of habitats (riverine, agricultural, forest/woodland, residential, and fishpond) and 0.2 representing one habitat type. This formula was adapted to determine the sensitivity (in terms of habitability) of terrestrial ecosystems and their resident species.

The study was conducted in two runs representing dry and wet sampling periods. The first run was conducted from July 27 to August 5, 2009 while the second run was conducted from October 31 to November 9, 2009.

RESULTS

There were 13 species (with four endemic species) of mammals belonging to five Families found in the area (Table 1 and Figure 9). A total of 24 species of herpetofauna (nine species of amphibians and 15 species of reptiles) belonging to 11 Families were found in the area (Figure 10). Most of these are non-forest forms, and only two species of amphibians (Platymantis dorsalis and Limnonectes visayanus) and two reptiles (Gekko mindorensis and Hydrosaurus pustulatus) are forest forms. Of these 24 species, six are endemic to the Philippines. The total number of birds observed and captured was 82 species and was represented by 44 resident, 26 migratory, and 12 endemic species (Figure 11). The total number of aquatic vertebrates identified were 51 species (in 34 Families) while aquatic macro-invertebrates totaled about 30 species, including one barnacle (Balanus sp.). New records for birds were noted in all three stations while possibly new records for fishes were also noted in Stations 1 and 3 (Table 2).

Mammal relative species richness for Stations 1, 2, and 3 were 0.415, 0.369, and 0.154, respectively (Table 3). Herpetofauna relative species richness for stations 1, 2, and 3 were 0.375, 0.325, and 0.15, respectively while bird relative species richness (based on habitability) was 0.315, 0.337, and 0.249. Population estimates of Platymantis dorsalis conducted during the wet season (at almost 100% relative humidity) ranged from 24 to 40 individuals per 100 square meters with maximum densities reaching up to 4 individuals /100m2

(Mean=31.33, SD=±5.78) on a rainy night while counts made during non-rainy conditions during the later part of the year, ranged from 6 to 10 individuals/100m2(Mean=9.33, SD=±2.22) at the Bulabog-Putian Natural Park.

Table 3.

Comparison of Relative Species Richness per Taxon in Three Jalaur River Stations.

Taxon	Station			Total No. of Species Per Taxon
	1	2	3	
Mammals	0.415 (9)	0.369 (8)	0.154 (5)	13
Herpetofauna	0.375 (15)	0.325 (13)	0.15 (9)	24
Birds	0.315 (43)	0.337 (46)	0.249 (51)	82

Note: Heterogeneity factors of station 1= 0.6 (riverine, agriculture and woodland), station 2= 0.6 (riverine, woodland, and residential), station 3=0.4 (riverine and fishpond). (Figures in parentheses represent number of species observed per station)

The average netting success rates of bats and birds were 0.73 and 0.07, respectively, while the average trapping success rate for ground rodents was 0.04 with only two species captured. Average bat capture rate in Station 1 was 0.36 (SD=±0.51) while the capture rates in Stations 2 and 3 were 0.34 (SD=±0.34) and 0.21 (SD=±0.27), respectively. Details of the netting success rates and relative abundance of bat species are elaborated upon in the Discussion section (see Table 8).

The relative species richness (based on sampling area) of fish was 0.44, 1.11, and 2.48 for Stations 1, 2, and 3, respectively while relative species richness of macro-invertebrates was 0.52, 1.38, and 1.95 for Stations 1, 2, and 3, respectively (Table 4 and Figures 12—

14). In addition, mean (average) densities of two species of mollusks, *Corbiculla manillensis* and *Cristaria plicata*, were computed at 809 individuals/m2 and 2.33 individuals/m2, respectively in station 2 (Table 5).

Table 4.

Relative species richness (area-species richness) of fish and macro-invertebrates in the three Jalaur River Stations.

Station	No. of Species		Est. Area (m2)	% species		% area		Relative S	
	Fish	Macro-inverts		Fish	Macro-inverts	Fish	Macro-inverts	Fish	Macro-inverts
1	9	6	300000	17.65	20.69	40	40	0.44	0.52
2	17	12	225000	33.33	41.38	30	30	1.11	1.38
3	38	17	225000	74.51	58.62	30	30	2.48	1.95
Total	**51**	**29**	**750000**						

Note: S = % species/ % area

The study identified 51 species of fish (Table 6). Of the 51 species, 36 species (70.59%) are either marine or brackish water species while 14 species (27.45%) are known to live in freshwater habitats. At least three species were observed in all three stations. These are the *Oreochromis niloticus*, *Anguilla marmorata*, and *Clarias batrachus*. The freshwater eel Anguilla marmorata, is known to inhabit both marine and freshwater habitats, being a migratory species while *Oreochromis niloticus* or Nile Tilapia appears to be the most prevalent and successful species to colonize freshwater habitats.

CPUE and IPUE

Fishing methods commonly used in the area (Table 7) included the indigenous *pahubas* (stream drying), gleaning or *panulo*, bamboo traps, electro-fishing (Figure 8), fishnet (gill-netting and cast-netting), hook-and-line, and "pahubas-netting". The latter method, which makes use of fine-mesh net and operated near the mouth of the river, has the highest catch-per-unit effort (1.5 kg/per/hr) and income-

per-unit effort (180 Philippine pesos). This was followed by electro-fishing method which can reach as high as 1.2 kg/person/hr. The most commonly captured species in Station 1 was *Ovitamon tomaculum* (0.225 kg/person/hr using panulo) while in Station 2, *Cyprinus carpio* was commonly captured (1.2 kg/pers/hr using electro-fishing). The study also showed that the IPUEs of certain gears in station 1 are unvalued. Selling of fish catch in this particular area is seldom done because of limited catch and predominance of non-commercial and recreational fishing.

DISCUSSION

Terrestrial vertebrate relative species richness (S) and species count

Relative species richness for terrestrial vertebrates indicates that station 1 has the highest species richness (0.415) for mammals while station 2 has the highest species richness for birds (Table 3). Although bird species richness is highest in station 2, its actual number of birds observed is less than that of station 3 (Table 3). This can be explained by the low habitat heterogeneity of the area which tends to reduce the value of species richness. Station 3 is a homogenous wetland which is periodically visited by migratory species during the northern winter season (November to March) migratory season and has comparatively less resident species compared to the upper stations. Habitat heterogeneity and area are key factors which influence species diversity in landscape ecology (Forman & Godron, 1986).

The study showed that only 26% of the known herpetofauna and 45% of the avifauna of Panay are present in the Jalaur River study sites. The low counts reflected in individual stations and collectively in all three stations indicate a depauperate terrestrial vertebrate fauna. This is expected because the habitat types represented in all three stations are disturbed by anthropogenic activities and less diverse compared to those in primary forests.

Terrestrial vertebrate species distribution and capture rates

The number of bat species recorded in Stations 1 and 2 were eight and nine, respectively. Fruit bats (6 species) dominated the number of species captured in Station 1 while insectivorous bats dominated

Station 2 (refer to Table 8 and Table 1). The insectivorous bats were commonly captured in Station 2 primarily because of the presence of cave habitats in the Bulabog-Putian Natural Park. The cave-dwelling bats sampled during the study included the insect-eating bats belonging to the Genera *Rhinolophus*, *Saccolaimus* and *Myotis* and the cave-dwelling fruit bat species, *Eonycteris spelaea*. The latter species was observed roosting in several clusters in Guiso Cave and was estimated close to 4,000 individuals. On the other hand, insect bat estimates ranged between 300 to 1,000 individuals in three major caves visited. They were observed roosting in several small clusters and were mostly represented by the species *Saccolaimus saccolaimus*. The highest netting success rate was recorded in Station 1 where some 161 individuals were captured over a period of 64 net-nights. This group was represented by *Cynopterus brachyotis*, which had a capture rate of 2.156 or two individuals per net in one night. This pattern was observed in the other two stations, making it the most common or prevalent species captured in all three sites (Table 8). *C. brachyotis* is found throughout the Philippines and most parts of Southeast Asia (Heaney et al., 1998; Sedlock, 2001). Although the species has an altitudinal range of sea level to 1,250 meters above sea level, it is commonly found in agricultural areas (Heaney et al., 1998). Furthermore, four Philippine-endemic species of bats, *Pteropus pumilus, Ptenochirus jagori, Rhinolophus virgo*, and *Rhinolophus inops*, were also captured in the area (Table 1). These four species exhibited relatively low capture rates, especially P. pumilus, which was captured only in Station 1. The captured endemic mammals represent at least 31% of the mammals observed in the area.

Table 8.

Netting Success Rate and Relative Abundance of Seven Bat Species in Three Jalaur River Stations.

Species	Station 1		Station 2		Station 3	
	Capture Rate	Relative Abundance	Capture Rate	Relative Abundance	Capture Rate	Relative Abundance
Cynopterus brachyotis	2.156	0.847	1.500	0.857	1.000	0.688
Macroglossus minimus	0.094	0.037	0	0	0.364	0.250

Continued in the next page...

Table 8. (Continued...)

Netting Success Rate and Relative Abundance of Seven Bat Species in Three Jalaur River Stations.

Species	Station 1		Station 2		Station 3	
	Capture Rate	Relative Abundance	Capture Rate	Relative Abundance	Capture Rate	Relative Abundance
Ptenochirus jagori	0.156	0.061	0.250	0.143	0	0
Eonycteris spelaea	0.031	0.012	0.250	0.143	0	0
Rousettus amplexicaudatus	0.031	0.012	0	0	0.091	0.063
Pteropus pumilus	0.031	0.012	0	0	0	0
Rhinolophus virgo	0.016	0.006	0.375	0.214	0	0

The species discovery curves for birds, mammals and herpetofauna reached their plateau on the 14th day of sampling for birds and the 13th day of sampling for mammals and herpetofauna. It took 13-14 days of sampling to obtain a reasonable estimate of the number of species found in the study stations.

The bird species sampled represent resident and some migratory species which were present during the period. The sampling period for the migratory species only reflected the earlier part of the migration, which started as early as August. More species may be encountered during the later part of the migratory period, which extends to March.

Aquatic species richness

Station 1 had the lowest number of species (despite the large sampling area) and is predominantly represented by the freshwater species belonging to the Family Cyprinidae (Tables 4 and 2). This station has low diversity and volume for fish species (15%) and macroinvertebrates (17%) species. The relatively low fish yield (as reflected in the CPUE in Table 7) and diversity in the area may be due to three factors: [1] nonselective fishing, [2] low habitability and, [3] contamination of river water by pesticides and other pollutants. Although all three factors are involved, observations indicate that non-selective fishing is a major contributory factor. Electro-fishing appears to be a common practice that captures both mature and immature fish. In addition to this, poison is purportedly used by locals on certain species (e.g., eel). The low habitability of Station 1 can be

attributed to the inherently shallow and shifting channel that makes it less favorable for organisms to settle and reproduce. On the other hand, fish mortalities along the river could not be confirmed during the course of the study despite local accounts of fish kills during the spray season. Because of the low fish yield in the area, local residents rely on other sources for their food fish needs while those involved in fishing activities do so for either subsistence or recreational reasons.

Station 3 had the highest relative species richness (1.95) for fish and macro-invertebrates (Table 4). At least 58% of the fish species and 50% of the macro-invertebrates listed were observed in this estuarine station. It was also in this area where the highest number of marine species was captured and observed. The high diversity is expected in this station because of the mixture of seawater and freshwater, which allows marine and freshwater species to survive.

New records and findings

New records of birds and fishes have been noted by the study. These include *Ardea cinerea, Ardeola speciosa, Charadrius alexandrinus, Gelochelidon nilotica, Limnodromus semipalmatus, Locustella ochotensis, Numenius arcuata, Motacilla alba, Halcyon coromanda* and *Chlidonias hybridus* (Table 1). Although the latter two species were earlier recorded in Guimaras, these species have not been reported on mainland Panay, following Dickinson et al. (1991) and Kennedy et al. (2000) as baseline.

One goby species, *Trypauchenopsis intermedia*, collected in Station 3, is presently being considered as a new Philippine record as confirmed by Dr. Edward Murdy, an authority on gobioid-fishes. This cryptic species has not been reported in the Philippines, despite its widespread distribution in the Indo-Pacific and extended range that includes South Africa and the Ryukyu Islands of Japan (Froese & Pauly, 2010). A possibly new species of goby, apparently belonging to the genus *Rhinogobius* (confirmed by a goby specialist Dr. Ronald Watson) was collected from Station 1. The genus *Rhinogobius* has been recorded on the islands of Luzon, Negros (Herre, 1927) and recently Mindanao (Watson pers. comm.) but none on Panay.

Our study also observed four exotic species likely introduced through the aquarium trade or even intentionally introduced for aquaculture purposes. These are *Poecilia sphenops, Poecilia reticulata, Anabas testudineus* and *Trichogaster trichopterus*. This record serves as an addition to the earlier introduced species that includes

Clarias batrachus, Cyprinus carpio (see early accounts by Herre 1924), *Oreochromis niloticus, Oreochromis mossambicus*, and *Cristaria plicata*. The latter five species were purposely introduced to augment the fishery and provide livelihood for local residents (Quicoy of Dingle-DA, pers. com.).

Effects of river channeling and farming

The low species richness and density in Station 1 (Calinog Station), as earlier discussed, has been partly attributed to the low habitability as a consequence of river shallowness and its re-channelized condition. This observation appears to be confirmed by studies on highly re-channelized river sections in northern Spain that show lower fish density and biomass compared with unaltered sections of the river (Ozcoz et al. 2005). The reduced available shelter in the channelized river sections and lack of bank vegetation plus other factors contributing to substratum instability probably reduced the biomass and density of European Minnow (*Phoxinus phoxinus*). Moreover, intensive cultivation along riparian areas has been known to alter the natural riparian vegetation, cause erosion and sedimentation, and reduce water quality (Arthington & Welcomme, 1995). This could have contributed significantly to our findings of low fish density as well as low species diversity in the area.

The mid-station channel at the Moroboro Dam site has deep impounded water upstream and a relatively shallow and fast flowing channel downstream (base of the dam). The deep channel, containing the impounded water, has been observed to provide habitats for tilapia and carp and is regularly fished by local fisherfolk. The presence of the dam does not appear to inhibit upstream movement of species like the eel (*Anguilla marmorata*), still observed in areas above the dam. It is however noted that certain marine species like the fishes, *Scatophagus argus* and carangids, were not observed in areas above the dam and were only collected below the dam, indicating the inability of the species to cross the dam and colonize the upstream portion.

SUMMARY AND CONCLUSIONS

The invertebrate and vertebrate biodiversity component of the Jalaur River study is an inventory of terrestrial and aquatic species in the three study stations (upper Calinog, middle Dingle, and lowermost

Leganes Stations) along the river from July to November, 2009. The results showed that there are about 106 species of terrestrial vertebrates and about 81 species of aquatic vertebrates and macro-invertebrates found in the area. These include 22 endemic species of terrestrial vertebrates and a possible new species of goby. Of the 51 species of fish observed in the area, 36 species (70.59%) are marine-brackish water inhabitants while 14 species (27.45%) are known to inhabit freshwaters as adults. Only one migratory species of fish, *Anguilla marmorata*, was observed in the area. In addition, nine exotic species of fish and two species of freshwater mollusks were observed in the area.

In terms of species richness, stations 1 and 2 topped the list for mammals and birds, respectively, while Station 3 topped the list for aquatic organisms. The list of terrestrial organisms found along the river is relatively low compared to the known Panay terrestrial diversity. The low diversity is attributed to the less complex and disturbed habitats in the area, which is generally agricultural. On the other hand, the low aquatic species richness observed in Station 1 may be due to the compounding effects of low river habitability, non-selective and destructive fishing in the area, and contamination by pesticides. The conclusion of this report may be further strengthened by incorporating the results of the other components of the study (refer also to the final report on the biological, physico-chemical, and socio-economic assessment of the Jalaur River system).

ACKNOWLEDGMENTS

The research team would like to extend their gratitude to the Barangay captains and councilors of the Banban-Pequeno, Moroboro, and Nabitasan barangays and to the DENR PASU of the Bulabog-Putian Natural Park for their hospitality and project support. We also thank the following fish experts, Drs. Edward Murdy, Helen Larson, Lynne Parenti, Jeff Williams, and Ronald Watson for their invaluable help in confirming identities of some taxonomically confusing species. We thank the CPU hostel management who sheltered us during the Jolina Storm and the Zante and Quinoveva families who accommodated us during our stay in their area. We also thank the many individuals who did not only provide field assistance but also shared their valuable time and experiences with us. Last but not the least, we are indebted to the SU-CHED Zonal Research Center for their funding and support of this project.

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Table 1.

Checklist of terrestrial organisms observed and collected in the three Jalaur River sampling stations.

Family	Species	Common Name	Station 1 (Calinog)	Station 2 (Dingle)	Station 3 (Leganes)
MAMMAL					
Pteropodidae	*Cynopterus brachyotis*	Common Short-nosed Fruit Bat	XXX	X	XXX
	Macroglossus minimus	Dagger-toothed Flower Bat	X		X
	Ptenochirus jagori	Musky Fruit Bat	XX		
	Eonycteris spelaea	Common Nectar Bat	X	XXX	
	Rousettus amplexicaudatus	Common Rousette	X		X
	Pteropus pumilus	Little Golden-mantled Flying Fox	X		
Emballonuridae	*Saccolaimus saccolaimus*	Pouched Bat	X		
Rhinolophidae	*Rhinolophus inops*	Philippine Forest Horseshoe Bat		XXX	
	Rhinolophus philippinensis	Enormous-eared Horseshoe Bat		XXX	
	Rhinolophus virgo	Yellow-faced Horseshoe Bat	X	XX	
	Myotis horsefieldii	Common Asiatic Myotis	XX		
Muridae	*Rattus tanezumi*	Oriental House Rat	X	X	X
Soricidae	*Suncus murinus*	Asian House Shrew	X		X
5 Families	**13 species**		**9 sp.**	**8 sp.**	**5 sp.**
LEGEND: x=sighted or captured once or twice as single individual or few individuals (2-4), xx=sighted or captured 3 to 5 times a day as few individuals (5-10) , xxx=sighted frequently (> 5x) as individual or found in group/ flock (>10 individuals)					
HERPETOFAUNA					
Bufonidae	*Rhinella marina (Bufo marinus)*	Giant Marine Toad	XXX	X	X
Ranidae	*Rana erythraea*	Common Green Frog	XX	X	
	Occidozyga laevis	Puddle Frog	X		X
	Limnonectes visayanus	Giant Philippine Frog			
	Fejervarya cancrivora	Asian Brackish Water Frog			XXX
	Fejervarya vittigera	Common Pond Frog	XX		

Continued in the next page...

Table 1. (Continued...)

Checklist of terrestrial organisms observed and collected in the three Jalaur River sampling stations.

Family	Species	Common Name	Station 1 (Calinog)	Station 2 (Dingle)	Station 3 (Leganes)
Ceratobatrachidae	*Platymantis dorsalis*	Common Forest Frog		XX	
Rhacophoridae	*Polypedates leucomystax*	Common Tree Frog	X		
Microhylidae	*Kaloula picta*	Slender-digit Chorus Frog			
Bataguridae	*Cuora amboinensis*	Malayan Fresh-water Turtle	X	X	
Agamidae	*Bronchocela cristatella*	Green Crested Lizard		X	
	Draco spilopterus	Common Flying Lizard		X	
	Hydrosaurus pustulatus	Sailfin Lizard	X		
Gekkonidae	*Cosymbotus platyurus*	Flat-bodied House Gecko	X	X	X
	Hemidactylus frenatus	Common House Gecko	XX	XX	XX
	Gekko gecko	Common Narrow-disked Gecko	X	X	X
	Gehyra mutilata	Tender-skinned House Gecko	XX	X	XX
	Cyrtodactylus philippinicus	Philippine Bent-toed Gecko	X	XX	
	Gekko mindorensis	Mindoro Narrow-disked Gecko			
Scincidae	*Mabuya multifasciata*	Common mabouya	X	X	X
	Sphenomorphus steerei	Steere's Sphenomorphus			
Boidae	*Python reticulatus*	Reticulated Python	X		
Colubridae	*Ahaetulla prasina preocularis*	Green whip snake		X	
	Cerberus rynchops	Dog-faced Water snake	X		XXX
11 Families	**24 species**		**15 sp.**	**13 sp.**	**8 sp.**

LEGEND: x=sighted or captured once or twice as single individual or few individuals (2-4), xx=sighted or captured 3 to 5 times a day as few individuals (5-10) , xxx=sighted frequently (> 5x) as individual or found in group/ flock (>10 individuals)

AVIFAUNA					
Anatidae	*Dendrocygna arcuata*	Wandering Whistling Duck			XX
Ardeidae	*Ixobrychus sinensis*	Yellow Bittern	X	X	X

Continued in the next page...

Table 1. (Continued...)

Checklist of terrestrial organisms observed and collected in the three Jalaur River sampling stations.

Family	Species	Common Name	Station 1 (Calinog)	Station 2 (Dingle)	Station 3 (Leganes)
	Ixobrychus cinnamomeus	Cinnamon Bittern	X		
	Nycticorax caledonicus	Rufous Night-Heron			X
	Butorides striatus	Striated Heron			XX
	Bubulcus ibis	Cattle Egret	XXX	X	XXX
	Ardea cinerea	Grey Heron			X
	Ardea purpurea	Purple Heron			XX
	Ardeola speciosa	Javan Pond-Heron			XX
	Egretta (Casmerodius) alba	Great Egret			XX
	Egretta intermedia	Intermediate Egret			XX
	Egretta garzetta	Little Egret	X	X	XXX
Sternidae	*Chlidonias hybridus*	Whiskered Tern	X	X	XXX
	Gelochelidon nilotica	Gull-billed Tern			XX
	Accipitridae Haliastur indus	Brahminy Kite		X	
	Haliaeetus leucogaster	White-bellied Sea Eagle			X
Rallidae	*Gallirallus torquatus*	Barred Rail	X	X	XXX
Recurvirostridae	*Himantopus himantopus*	White-winged Stilt			X
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	XX		XXX
	Heteroscelus brevipes	Grey-tailed Tattler			XX
	Limnodromus semipalmatus	Asian Dowitcher			X
	Numenius phaeopus	Whimbrel			XX
	Numenius arcuata	Eurasian Curlew			X
	Tringa glareola	Wood Sandpiper			XX
	Tringa nebularia	Common Greenshank			X
	Tringa totanus	Common Redshank			XX
Turnicidae	*Turnix suscitator*	Barred Buttonquail	XX(3)		
Charadriidae	*Charadrius dubius*	Little Ringed Plover	X		XX
	Charadrius alexandrinus	Kentish Plover			XXX

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Table 1. (Continued...)

Checklist of terrestrial organisms observed and collected in the three Jalaur River sampling stations.

Family	Species	Common Name	Station 1 (Calinog)	Station 2 (Dingle)	Station 3 (Leganes)
	Charadrius mongolus	Lesser sand Plover			X
	Pluvialis squatarola	Grey Plover			XX
	Pluvialis fulva	Asian Golden-Plover			XXX
Columbidae	*Geopelia striata*	Zebra Dove	XXX(1)	XX	XX
	Streptopelia chinensis	Spotted Dove	XX		
	Chalcophaps indica	Emerald Dove	X	X	
	Phapitreron leucotis	White-eared Brown Dovex	XX		
	Ptilinopus leclancheri	Black-chinned Fruit Dove		XX	
Cuculidae	*Cacomantis merulinus*	Plaintive Cuckoo	X		X(1)
	Centropus viridis	Philippine Coucal	X	X	
Strigidae	*Ninox philippensis*	Philippine Hawk-Owl	X	X	
Podargidae	*Batrachostomus septimus*	Philippine Frogmouth		X	
Caprimulgidae	*Caprimulgus manillensis*	Philippine Nightjar	X	X	
Apodidae	*Collocalia esculenta*	Glossy Swiftlet	XX	XXX(12)	
	Collocalia troglodytes	Pygmy Swiftlet		XXX	
Alcedinidae	*Todiramphus chloris*	Collared Kingfisher	XXX(1)	XX	XX
	Halcyon coromanda	Ruddy Kingfisher	X(1)	X	
	Alcedo atthis	Common Kingfisher	XX		XX
Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	XX	XX	XX
Ramphastidae	*Megalaima haemacephala*	Coppersmith Barbet		X	
Pittidae	*Pitta erythrogaster*	Red-bellied Pitta		X	X
	Pitta sordida	Hooded Pitta		XX	
Acanthizidae	*Gerygone sulphurea*	Golden-bellied Gerygone			XX
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow	XX	X	
Campephagidae	*Lalage nigra*	Pied Triller	X	X	X
Pachycephalidae	*Pachycephala homeyeri*	White-vented Whistler		X	
Laniidae	*Lanius cristatus*	Brown Shrike	X	X	X(2)

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Table 1. (Continued...)

Checklist of terrestrial organisms observed and collected in the three Jalaur River sampling stations.

Family	Species	Common Name	Station 1 (Calinog)	Station 2 (Dingle)	Station 3 (Leganes)
Oriolidae	*Oriolus chinensis*	Black-naped Oriole	X	X	
Dicruridae	*Dicrurus balicassius*	Balicassiao		XX	
Rhipiduridae	*Rhipidura javanica*	Pied Fantail	XX	X	XX
Motacillidae	*Motacilla flava*	Yellow Wagtail	XX		
	Motacilla alba	White Wagtail		X	
	Motacilla cinerea	Grey Wagtail	X	X	
	Anthus richardi	Richard's Pipit		X	
Monarchidae	*Hypothymis azurea*	Black-naped Monarch		XX	
Hirundinidae	*Hirundo tahitica*	Pacific Swallow	XXX	XX	XXX
	Hirundo rustica	Barn Swallow	X	X	XX
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	XX		
Sylviidae	*Orthotomus castaneiceps*	Philippine Tailorbird	X	X	X
Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented Bulbul	XXX	XXX	XX(2)
	Ixos philippinus	Philippine Bulbul	XX	XX	
Sylviidae	*Megalurus palustris*	Striated Grassbird	X	X	X(1)
Sturnidae	*Aplonis panayensis*	Asian Glossy Starling	XXX	XXX	XX
Turdidae	*Copsychus saularis*	Oriental Magpie-Robin	X	X	X
	Copsychus luzoniensis	White-browed Shama		XX	
	Saxicola caprata	Pied Bushchat	X		
Dicaeidae	*Dicaeum haematostictum*	Visayan Flowerpecker	X	X	
	Dicaeum trigonostigma	Orange-bellied Flowerpecker		XX	
Nectariniidae	*Nectarinia (Cinnyris) jugularis*	Olive-backed Sunbird	X	XX	XX
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	XXX	XX	XXX
Estrildidae	*Lonchura punctulata*	Scaly-breasted Munia			XXX
	Lonchura malacca	Chestnut Munia	XX	XX	XXX
	Padda oryzivora	Java Sparrow		XX	
39 Families	**82 species**		**43 sp.**	**46 sp.**	**51 sp.**

Legend: x=sighted or captured once or twice as single individual or few individuals (2-4), xx=sighted or captured 3 to 5 times a day as few individuals (5-10) , xxx=sighted frequently (> 5x) as individual or found in group/ flock (>10 individuals)

Table 2.

Checklist of aquatic organisms observed and their corresponding relative (qualitative) abundance in three Jalaur River sampling stations.

Group	Family	Species	Relative abundance	Station		
				1	2	3
Fish	Dasyatidae	*Dasyatis kuhlii*	Low			X
	Megalopidae	*Megalops cyprinoides*	Moderate		X	
	Angullidae	*Anguilla marmorata*	Low to moderate	X	X	X
	Polynemidae	*Eleutheronema tetradactylus*	Moderate			X
	Sillagidae	*Sillago sihama*	Moderate			X
	Engraulidae	*Stolephorus indicus*	Low to moderate			X
	Kuhliidae	*Kuhlia marginata*	Moderate to high		X	
	Chanidae	*Chanos chanos*	Moderate			X
	Plotosidae	*Plotosus canius*	Low to moderate			X
	Hemiramphidae	*Zenarchopterus sp.*	Moderate			X
	Syngnathidae	*Microphis sp.*	Low to moderate		X	
	Chandidae	*Ambassis miops*	Moderate to high			X
		Ambassis interruptus	Moderate to high			X
	Terapontidae	*Terapon jarbua*	High			X
	Apogonidae	*Apogon hyalosoma*	Moderate			X
	Carangidae	*Caranx sexfasciatus(juv)*	Low		X	X
		Carangiodes ferdau	Low to moderate			X
		Alectes sp. (juv)	Low			X
	Leiognatidae	*Leiognathus equulus*	Moderate to high			X
	Centropomidae	*Lates calcarifer*	Moderate			X
	Lutjanidae	*Lutjanus argentimaculatus*	Low to moderate		X	X
		Lutjanus russelli	Low			X
	Gerreidae	*Gerres filamentosus*	High			X
	Sciaenidae	*Nibea sordado*	Low to moderate			X
	Monodactylidae	*Monodactylus argentus*	Low			X
	Scatophagidae	*Scatophagus argus*	Moderate		X	X
	Mugilidae	*Liza subviridis*	Moderate		X	X
		Liza vaigensis	Low to moderate			X
		Valamugil seheli	High			X

Continued in the next page...

Table 2. (Continued...)

Checklist of aquatic organisms observed and their corresponding relative (qualitative) abundance in three Jalaur River sampling stations.

Group	Family	Species	Relative abundance	Station		
				1	2	3
	Eleotrididae	*Butis amboinensis*	Low to moderate			X
		Bostrychus sinensis	Low		X	
		Ophiocara porocephala	Low to moderate			X
		Ophieleotris aporos	Low		X	
	Gobiidae	*Glossogobius giuris*	Moderate			X
		Glossogobius aureus	High		X	
		Periopthalmus argentilineatus	High			X
		Periopthalmodon freycineti	Moderate to high		X	
		Scartelaos histophorus	High			X
		Rhinogobius n. sp.	Low	X		
		Trypauchenopsis intermedia	Very low			X
	Ryacichthyidae	*Ryacichthys aspro*	Low		X	
	Siganidae	*Siganus guttatus (juv)*	Low			X
	Scorpaenidae	*Choridactylus multibarbus*	Moderate			X
	Clariidae	*Clarias batrachus*	Moderate	X	X	X
	Poeciliidae	*Poecilia reticulata*	Moderate	X		
		Poecilia sphenops	Moderate	X	X	
	Cichlidae	*Oreochromis niloticus*	High	X	X	X
		Oreochromis mossambicus	Moderate to high			X
	Anabantidae	*Anabas testudineus*	High	X	X	
	Belontidae	*Trichogaster trichopterus*	Moderate	X		
	Cyprinidae	*Cyprinus carpio*	Moderate to high	X	X	
	Channidae	*Channa striata*	Moderate to high		X	
	No. of species:	**51**		**9**	**17**	**38**
Shells	Gastropoda Neritidae	*Nerita polita*	Moderate			X
	Terebridae	*Terebra granifera*	Moderate		X	

Continued in the next page...

Table 2. (Continued...)

Checklist of aquatic organisms observed and their corresponding relative (qualitative) abundance in three Jalaur River sampling stations.

Group	Family	Species	Relative abundance	Station		
				1	2	3
		Plicaria porcellana	Moderate			X
	Thiaridae	*Thiara scabra*	Low to moderate		X	
		Pomacea cananiculata	High	X	X	
	Littorinidae	*Littorina scabra*	High			X
	Pelecypoda	*Ostrea sp.*	Moderate			X
		Crassostrea cucullata	High			X
		Corbicula manillensis	Very High		X	
		Cristaria plicata	Moderate	X		
Crustaceans	Palaemonidae	*Macrobrachium latidactylus*	Moderate	X	X	
		Macrobrachium jaroense	Moderate	X	X	
		Macrobrachium mammillodactylus	Low to moderate		X	
		M. australe	Moderate	X	X	
		M. placidulum	Low to moderate	X	X	
		M. equidens	Moderate to High		X	X
		Conchodytes maculatus	Low			X
	Penaedae	*Penaeus monodon*	Moderate to high			X
		Metapenaeus spp.	Moderate to high			X
	Ocypodidae	*Uca dussumieri*	High			X
	Xanthidae	*Lophozozymus pictor*	Low to moderate			X
	Varunidae	*Eriocheir japonicus*	Low			X
		Ptychognathus altimanus	Moderate			X
		Varuna litterata	Moderate		X	X
	Macrophthalmidae	*Macrophthalmus sp.*	Moderate to high			X
	Sesarmidae	*Labuanium politum*	Moderate			X
	Sesarmidae	*Sesarma sp.*	Moderate			X
	Potamidae	*Ovitamon tomaculum*	Moderate	X		
	Balanidae	*Balanus spp.*	Moderate			X
	No. of species:	**29**		**6**	**12**	**17**

Table 5.

Mean Densities of Mollusks in Two River Stations in Jalaur River.

STATION 2

Species	Quadrat No. 1	2	3	Total	Mean density (individuals/m.sq)
Corbicula manilensis	1524	590	313	2427	809.00
Cristaria plicata	3	1	3	7	2.33
Melanoides granifera	3	0	0	3	1.00
Thiara scabra	5	0	8	13	4.33
Total	**1535**	**591**	**324**	**2450**	**816.67**

STATION 3

Species	Quadrat No. 1	2	3	4	5	6
Nerita polita	0	0	1	0	2	0
Littorina scabra	0	0	0	2	1	0
Patella sp.	0	0	0	0	1	4
Crassostrea cucullata	0	0	0	0	0	50
Ostrea sp. (to be confirmed)	0	0	0	0	0	20

Table 6.

Habitat distribution of captured fishes in the Jalaur River System.

Family	Species	Habitat Type		
		Freshwater	Marine/Brackish	Multiple Habitat (Migratory)
Dasyatidae	*Dasyatis kuhlii*		X	
Megalopidae	*Megalops cyprinoides*		X	
Angullidae	*Anguilla marmorata*			X
Polynemidae	*Eleutheronema tetradactylus*		X	
Sillagidae	*Sillago sihama*		X	
Engraulidae	*Stolephorus indicus*		X	
Kuhliidae	*Kuhlia marginata*		X	
Chanidae	*Chanos chanos*		X	
Plotosidae	*Plotosus canius*		X	
Hemiramphidae	*Zenarchopterus sp.*		X	
Syngnathidae	*Microphis sp.*		X	
Chandidae	*Ambassis miops*		X	
	Ambassis interruptus		X	
Terapontidae	*Terapon jarbua*		X	
Apogonidae	*Apogon hyalosoma*		X	
Carangidae	*Caranx sexfasciatus* (juv)		X	
	Carangiodes ferdau		X	
	Alectes sp. (juv)		X	
Leiognatidae	*Leiognathus equulus*		X	
Centropomidae	*Lates calcarifer*		X	
Lutjanidae	*Lutjanus argentimaculatus*		X	
	Lutjanus sp.		X	
Gerreidae	*Gerres filamentosus*		X	
Sciaenidae	*Nibea sordado*		X	
Monodactylidae	*Monodactylus argentus*		X	
Scatophagidae	*Scatophagus argus*		X	
Mugilidae	*Liza subviridis*		X	
	Liza vaigensis		X	
	Valamugil seheli		X	

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Table 6. (Continued...)

Habitat distribution of captured fishes in the Jalaur River System.

Family	Species	Habitat Type		
		Freshwater	Marine/Brackish	Multiple Habitat (Migratory)
Eleotrididae	*Butis amboinensis*		X	
	Bostrychus sp.	X		
	Ophiocara porocephala		X	
	Ophieleotris aporos	X		
Gobiidae	*Glossogobius giuris*	X		
	Glossogobius aureus	X		
	Periopthalmus argentilineatus		X	
	Periopthalmodon freycineti		X	
	Scartelaos histophorus		X	
	Rhinogobius sp.	X		
	Trypauchenopsis intermedia		X	
Siganidae	*Siganus guttatus* (juv)		X	
Scorpaenidae	*Choridactylus multibarbus*		X	
Clariidae	*Clarias batrachus*	X		
Poeciliidae	*Poecilia reticulata*	X		
	Poecilia sphenops	X		
Cichlidae	*Oreochromis niloticus*	X		
	Oreochromis mossambicus	X		
Anabantidae	*Anabas testudineus*	X		
Belontidae	*Trichogaster trichopterus*	X		
Cyprinidae	*Cyprinus carpio*	X		
Channidae	*Channa striata*	X		
Total	**51**	**15**	**36**	**1**

Table 7.

CPUE and IPUE of Commonly Collected Species in Jalaur River.

Station	Collection Gear	Capture Species	Price/Kg (Php)	Weight (Kg)	No. of Hours	No. of Person	CPUE (kg/pers/hr)	IPUE (buying price X/CPUE)
Station 1 Banban Pequeno	Panulo	*Macrobrachium australe*	Unvalued	0.047	1.5	5	0.0063	
	Panulo	*Ovitamon tomaculum*	Unvalued	0.45	2	1	0.2250	
		Mix catch/species: *Clarias batrachus* *Anabas testudineus* *Oreochromis niloticus* *Channa striata* *Cyprinus carpio*	Unvalued	0.348	1.5	5	0.0464	
	Pahubas (Stream Drying)	*Macrobrachium jaroense*	Unvalued	0.29	4	6	0.0012	
		Rhinogobius sp.	Unvalued	0.26	4	6	0.0011	
	Electro-fishing	Mixed catch/species : *C. batrachus* *Rhinogobius sp.* *P. sphenops*	Unvalued	0.23	1	2	0.12	
	Cast-netting	*Cyrpinus carpio*	30	0.3	1	2	0.15	4.5
	Gillnet	*Varuna litterata*	30.00	0.080	12	1	0.0011	0.0325
		Anguilla marmorata (small, maturing)	150.00					
		Liza sp.	30.00					
		Glossogobius giuris	30.00					
		Cyprinus carpio	50.00					
Station 2 Moroboro Dam	Electro-fishing	*C. batrachus*	50.00	0.22	1	1	0.22	11
		P. sphenops	Unvalued					
		C. carpio	50.00	0.218	1	1	0.22	10.9
		Kuhlia marginata	50.00	0.008	1	1	0.01	0.4
		O. niloticus	50.00	0.155	1	1	0.16	7.75

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Table 7. (Continued...)

CPUE and IPUE of Commonly Collected Species in Jalaur River.

Station	Collection Gear	Capture Species	Price/Kg (Php)	Weight (Kg)	No. of Hours	No. of Person	CPUE (kg/pers/hr)	IPUE (buying price X/CPUE)
		Glossogobius spp.	50.00	0.45	1	1	0.45	22.5
		Shrimps:						
		Macrobrachium spp.	30	0.88	1	1	0.88	26.4
	Bamboo trap	Shrimps:						
		Macrobrachium spp.	30	0.218	10	1	0.02	0.654
		Crabs:						
		V. litterata	30	0.49	10	1	0.05	1.47
	Electro-fishing	*C. carpio*	50.00	1.2	1	1	1.20	60
		O. niloticus	50.00	0.25	1	1	0.25	12.5
		Liza sp.	50.00	0.93	1	1	0.93	46.5
Station 3 Leganes	Hook-and-line (observed)	*Nibea sordado* and *E. tetradactylus*	120	0.3	2	3	0.05	6
	Pahubas-netting	Mix-catch/species	120	30	4	5	1.50	180
		Lutjanus spp.						
		Apogon hyalosoma						
		Lates calcarifer						
		Liza subviridis						
		Scatophagus argus						
		Gerres filamentosus						
		Monodactylus argenteus						
		Sillago sihama						
		Clarias batrachus						
		Dasyatis kuhlii						
		Carangoides ferdau						
		Caranx spp.						

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Table 7. (Continued...)

CPUE and IPUE of Commonly Collected Species in Jalaur River.

Station	Collection Gear	Capture Species	Price/Kg (Php)	Weight (Kg)	No. of Hours	No. of Person	CPUE (kg/pers/hr)	IPUE (buying price X/CPUE)
	Cast-netting	*Leiognathus equulus* *Terapon jarbua* Mix catch/species *Gerres filamentosus* *Valamugil seheli* *Terapon jarbua* *Oreochromis niloticus* *Leiognathus sp.* *Glossogobius giuris* *Sillago sihama*	80	2	1	2	1.00	80

Figure 2. Station 1 (Calinog Station). Taking Dissolve Oxygen Measurements close to the Banban-Pequeño-Alibunan Bridge in Calinog, Iloilo.

Figure 3. Station 2 (Bulabog-Putian Moroboro Station). View of the dam and impounded water from the upstream hanging bridge in Dingle, Iloilo.

Figure 4. (Leganes Station). View of the Jalaur river estuarine sampling site from the Jalaur Bridge in Leganes, Iloilo.

Figure 5. Setting up mist nets for capturing birds and bats.

Figure 6. Preparing the riverbed for pahubas, an indigenous fishing method that involves drying up river sections.

Figure 7. Gillnet fishing at Calinog station.

Figure 8. Specialized electro-fishing gear. Electrodes are attached to the fine net. The contraption operates like an electrified scoop-dredger.

Figure 9. Feeding sugar solution to a captured nectar-feeding bat, *Rousettus amplexicaudatus*. This species is relatively common in agricultural areas.

Figure 10. A captured migrant kingfisher, *Alcedo atthis*.

Figure 11. Varuna litterata, a common freshwaster crab in Jalaur River.

Figure 12. Macrobrachium jaroense, a common freshwater shrimp in Jalaur River.

Figure 13. A possibly new species of goby *Rhinogobius* sp. from Staion 1.

Figure 14. The goby *Trypauchenopsis intermedia* (previously unreported in the Philippines) from Station 3.