Research Paper

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# Diversity and Community Structure of Reef Fishes in Albay, Southern Luzon Island, Philippines

Fisheries

KEYWORDS : Community structure, diversity, reef fishes, Albay - Philippines

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## ABSTRACT

*Forty-six transects from five municipalities were surveyed of which 277 reef fish species in 32 families were recorded. Oas with 136 species, 23 families, Rapu-rapu 131 species, 22 families, Pio Duran 128 species, 20 families, Ligao 127 species, 20 families and Libon 101 species, 17 families. Fish biomass in Ligao was 11.08 kg/250m2, Rapu-rapu - 9.70 kg/250m2, Oas - 9.58 kg/250m2, Libon - kg/250m2, and Pio Duran - kg/250m2. For index of diversity H , Oas is highest with 2.40 and the least is Ligao with 2.11. Dominance index showed Ligao as the highest (0.20) and least is Rapu-rapu with 0.15. Evenness index revealed Libon is highest, 0.51 and least is Ligao with 0.41. ANOVA revealed significant differences among stations for abundance ($p = 0.0003$, $\alpha = 0.05$) and biomasses ($p = 0.010$, $\alpha = 0.05$) but no significant differences in the sizes ($p = 0.1880$, $\alpha = 0.05$).*

## INTRODUCTION

Reef fishes are important biological indicator in a coral reef ecosystem. They are usually correlated to the health status of coral reef (Syms and Jones 2000, Bell and Galzin 1984, Bell et al., 1985). Their close association to coral reefs is brought about by several factors ranging from shelter, foraging and spawning areas.

However with the increasing pressure related to fishing and pollution, coral reef areas are rapidly deteriorating reducing its ecological functions and services resulting to loss of reef fish biodiversity.

Coral reefs are amongst the most productive ecosystem on earth. They contain almost 25% of all marine organisms and contribute around 10-25% of the fish production worldwide. They also provide important goods and services and offer livelihood to coastal communities. It is estimated that good to excellent coral reefs can produce 20 tons or more of fish and other edible products per $km^2$/year, however, once destroyed, they produce less than 4 tons $km^2$ per year (Rivera-Guieb et al, 2002).

In the Philippines, studies showed that less than 5% of the reefs are in excellent condition (Licuanan and Gomez 2000). Sedimentation, overfishing, and destructive fishing are the three most common factors significantly affecting coral reefs. It is estimated that 98% of coral reefs in the Philippines were at risk from human activities with 70% at high or very high risk (WWF 2005).

In Bicol Region, reef condition ranges from fair (25-49 %) to good (50-74%) with very minimal sites that have excellent coral cover (Mendoza et al., 2002), with sedimentation and destructive fishing as the main source of reef degradation. In Albay, most of the reefs are in the eastern part of the Province, while on the western side, thin strips of reefs fringing on the coastline can be found. Studies conducted in the Region have shown that coral reef conditions are declining (Mendoza et al., 2002). While it shows that coastal resource management are weak and inadequate, it was observed that establishing marine protected areas (MPAs) is the only management strategy employed.

In Albay, five selected municipalities were assessed of their reef fishes to verify their community structure.

**Specifically this research aims to:**

- Assess the species composition of reef fishes in the area, and
- Estimate the abundance, biomass and diversity indices of reef fishes in the area.

## METHODOLOGY

The study was conducted in Albay Province, Southern Luzon Island, Philippines. A total of 46 transects were surveyed in five selected municipalities in Albay – specifically 4 municipalities in the west coast, namely Pio Duran, Ligao,Oas and Libon, and one municipality in the east coast which is Rapu-rapu. Reef Fish Visual Census (modified from English et al 1997) was used in the study. All reef fishes encountered at 2.5m both sides and 5m above the 50m line were identified, counted and their sizes estimated. The biomass of the fishes were estimated using the *a* and *b* values of each respective species listed in fishbase (www.fishbase.org), following the formula $W = aL^b$, where W = weight, L = length. Diversity indices computed were as follows: relative abundance, Shannon-Weiner diversity index, Simpson's dominance index, Shannon's evenness index, and similarity. ANOVA was also used to test any significant difference in terms of the number of fish individuals among sampling stations.

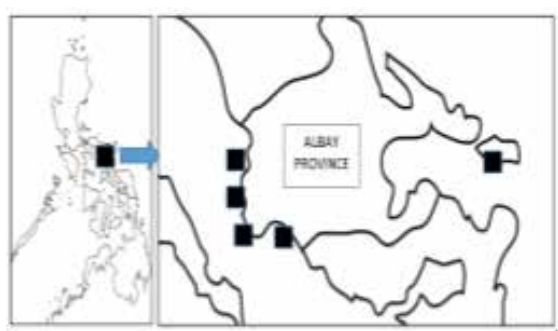



**Figure 1. Location of study areas.**

## RESULT AND DISCUSSION

A total of 277 reef fish species were recorded in all five stations belonging to 32 families (Tables 1), Oas has the highest number of species and families that were recorded with 136 reef fish species and 23 families, followed by Rapu-rapu with 131 species and 22 families, then by Pio Duran with128 species and 20 families, then by Ligao with 127 species and 20 families and the last is Libon with 101 species and 17 families. In Libon the most dominant family in terms of number of representative species were Pomacentrids with almost 33% of the total species, second were the Labrids with a total contribution of 19%, then by Chaetodontids having 11% and the Apogons with 10%. The rest of the 13 families ranged from 6% to 1% contributions. In Ligao, Pomacentrids and Labrids were the top species recording 36% and 24% respectively; they were followed by Nemipterids, Chaetodontids and Apogonids with 7%, 6% and 5.5% respectively. The remaining 15 families accounted for the 22% of the total species. In Oas, Pomacentrids tallied 33% of the total species found, second were the Labrids with 17%, followed by the Apogons and Scarids with both 7% and the Chaetodontids shared around 6%. The remaining 30% of the species were credited to the remaining 18 families. In Pio Duran, Pomacentrids, Labrids and Chaeto-

dontids accounted for almost 70% of the total number of species and the rest of the families accounted for the 30% of the species record. In Rapu-rapu, Pomacentrids, Labrids, Chaetodontids, Scarids and Acanthurids tallied for 70% of the species in the area, and the 30% of the species were accounted for the remaining 17 families.

**Table 1. Number of reef fish families found in Albay Province, Philippines**

| Study Area | No. of families | No. of species | Biomass (kg/250m$^2$) |
|---|---|---|---|
| Libon | 17 | 101 | 3.126 |
| Ligao | 20 | 127 | 11.078 |
| Oas | 23 | 136 | 9.578 |
| Pio Duran | 20 | 128 | 2.049 |
| Rapu-rapu | 22 | 131 | 9.695 |

With respect to biomass (see Table 1), In Libon, Caesios weighed 28% of the total weight for the area which is around 3 kg/250m2, it was followed by the Siganids, Chaetodons and Labrids with 9% each, and the Fistularia with 8%. The remaining 12 families were responsible for the 37% of the biomass. In Ligao, Pempherids totalled almost half of the whole biomass and was followed by the Mugils with 15%, then by the Caesios with 11%, while the remaining 17 families in the area contributed to the 24% of the total biomass. In Oas, 36% of the biomass of the total weight were from the Plotosids, while the Caesios, Pempherids and Mullids accounted for 29%. The remaining 19 families accounted for the 35% of the total biomass. In Pio Duran, the top 5 families, which consisted more than 50% of the biomass, in descending order were Apogons, Diodontids, Haemulids, Pomacanthids and Plotosids with 13%, 12, 11, 9 and 9 percent respectively, and the remaining 15 families shared the rest of the half of the area's biomass. In Rapu-rapu, almost 75% of the total biomass was attributed to the top five families namely Acanthurids, Labrids, Scarids, Pomacentrids, and Chaetodontids, and the remaining ¼ of the total weight were shared by the rest of the 17 families.

Reef fish communities in selected areas of Albay mainly manifest function of habitat and niche. That is, reef fishes observed are associated with reef structure, status and ecological role of reef fishes. This may explain the abundance of the Pomacentridae, Labridae, Chaetodontidae and Scaridae as the major components in the reef fish population in the area. These species are considered reef attached which can also indicate the health and/or structure of the reef system. Furthermore, their presences also describe their roles in the reefs' ecosystem.

Table 2. Diversity indices of reef fish community in Albay Province, Philippines

| | Libon | Ligao | Oas | Pio Duran | Rapu rapu |
|---|---|---|---|---|---|
| **Dominance** | 0.17 | 0.20 | 0.16 | 0.20 | 0.15 |
| **Simpson** | 0.83 | 0.80 | 0.84 | 0.80 | 0.85 |
| **Shannon** | 2.16 | 2.11 | 2.39 | 2.13 | 2.38 |
| **Evenness** | 0.51 | 0.41 | 0.47 | 0.42 | 0.49 |

Diversity indices of the reef fish communities in the Province of Albay (Table 2) showed that Ligao and Pio Duran have dominant families in terms of their representative species, while Simpson's and Shannon's values for general diversity indicate that Oas and Rapu-rapu are the areas with relatively high species diversity and Libon and Pio Duran with the lowest values. Evenness index on the other hand would show that Libon is the area with a relatively more even species distribution while Ligao has the least evenness value.

Analysis of Variance (ANOVA) (Table 3), revealed significant differences among stations in terms of frequency or reef fish abundance (p value = 0.0003 at $\alpha$ = 0.05) and biomasses (p value = 0.010 at $\alpha$ = 0.05). However in terms of sizes of the observed reef fishes, no significant differences was noted (p value = 0.1880 at $\alpha$ = 0.05).

Table 3. *p values* of ANOVA on the abundance, biomass and sizes of the reef fishes in selected sites in Albay Province, Philippines

| variable | p value @ 0.05 |
|---|---|
| abundance | 0.0003* |
| biomass | 0.0100* |
| sizes | 0.1880$^{ns}$ |

* = significant
ns = not significant

Correlation coefficient (Table 4) revealed that there is very high relationship between number of species and number of families, while a moderate relationship was observed between biomass and family and species, and on the other hand, number of families and biomass have very weak relationships with coral cover, while number of species poor relationship with living coral cover.

Table 4. *Correlation coefficient* between family, species, biomass and cover of the reef fishes in Albay Province, Philippines.

| | family | species | biomass | cover |
|---|---|---|---|---|
| family | 1 | | | |
| species | 0.937 | 1 | | |
| biomass | 0.637 | 0.574 | 1 | |
| cover | 0.170 | -0.029 | 0.342 | 1 |

**CONCLUSION**

Reef fishes in the surveyed sites were of low density and species composition as compared to the nationwide coral reef fishes. However, they can be considered highly diverse and dense relative to the reef's health and status of the surveyed sites. The few Chaetodontidae and other coralivores indicate the poor living coral cover in the surveyed areas. Presence of large carnivores suggests that the reef area is functioning as shelter, nursery and foraging areas. However, presence of herbivores denotes the abundance of micro and macro algae which is a good sign for a recovering coral reef. Marine protected areas were observed to be effective in protecting the critical habitats by the presences of small coral colonies and carnivores (target fishes).

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