# Chapter 4
# NATURAL RESOURCES

This chapter provides background information on the status of the mineral resources, forest resources, and coastal resources in the profile area, which help determine the best resource use and approach to resource management.

## MINERAL RESOURCES

The province of Negros Oriental has a variety of mineral resources of important economic value with copper topping the list. In the profile area, minor deposits of copper are found in the Manjuyod, Sibulan, Bacong, and Dauin area (OPA 1990). Iron and its related compounds of magnetite, pyrite, and marcasite are also found in Sibulan. Solar salt is made in Tanjay, Bais City, and Manjuyod. Other deposits include limestone, dolomite, diatomite, manganese, galena, gypsum, phosphate, and china clay (OPA 1990). Commercial deposits of red burning clay are mostly found in the southeastern portion of Negros Oriental; however, some deposits are spread throughout the profile area. Sand and gravel is also extracted from municipalities in the province and in the profile area. A total of 103,000 $m^3$ of sand and gravel has been extracted in recent years (PPDO 1999).

## UPLAND FOREST RESOURCES

Total good forestland in the province of Negros Oriental is believed to be only 5 percent (27,011 ha) of the total land area of the province (540,230 ha). This low forest cover is due to illegal logging activities that are difficult to stop despite government efforts to formulate laws and enforce prohibition. According to PPDO (1992), forestland is 281,386 ha and is broken down into 5 categories. The categories and the respective areas are summarized in Table 4.1.

**Table 4.1. Forestland categories and their corresponding areas.**

| Forestland categories | Area (ha) |
|---|---|
| Unclassified | 63,091 |
| Established for reserves | 8,570 |
| Established for timberland | 207,718 |
| National Parks GRBS/WA | 1,906 |
| Fishponds | 101 |
| **Total** | **281,386** |

*Source: PPDO (1992)*

Since the late 1800s, forested areas in the province have been exploited. A series of maps shows the dramatic decline in forested areas (primary forest) on Negros Island from 1890 to 1984 (Tiempo 1994). In connection with the provincial government's thrust to rehabilitate forest cover and restore forest habitats, different agencies in the province have undertaken reforestation projects (Table 4.2).

**Table 4.2. Total area covered and planted by reforestation projects.**

| Reforestation projects | Total area covered (ha) | Total area planted (ha) |
|---|---|---|
| Mabinay reforestation | 4,035.00 | 7,173.00 |
| New Talinis reforestation | 11,507.00 | 1,156.00 |
| Contract reforestation | 9,864.00 | 8,335.10 |
| **Total** | **25,406.00** | **16,664.10** |

*Source: PPDO (1992)*

## COASTAL RESOURCES

### Mangroves

Ecologically, mangroves are an important resource because they help sustain the coastal fisheries in the province. The following are some of the ecological functions of mangrove communities:

- providing shelter, breeding and nursery grounds for fish and other invertebrates that inhabit the mangrove area;
- providing nutrients as well as detritus that accumulate from decaying plant matter and are exported by tides to the nearby communities (seagrass and coral reefs); and
- protecting the coastline by preventing erosion that brings about siltation and sedimentation.

Mangrove habitats also support wildlife such as birds and reptiles. Mangrove trees are utilized by the local resource users for firewood and lumber, while mangrove areas are often cleared for settlement and conversion to fishponds.

Total mangrove area for the whole province of Negros Oriental is 5,030 ha, including mangrove areas mixed with cropland, fishponds derived from mangrove areas, and mangrove

areas in combination with built-up areas or settlements (PPDO 1999). Silliman University Marine Laboratory (SUML) conducted a survey within the profile area in which 3 sites were selected based on the concentration of mangrove species there. The 3 sites are Apo Island, Dauin; Dumaguete City; and Bais Bay, Bais City. The total mangrove area within the profile area based on the 3 sites was approximately 265 ha: 264 ha in Bais, 0.30 ha in Apo Island, and 0.25 ha in Dumaguete. (Calumpong *et al*. 1997). The Talabong Mangrove Reserve in Bais Bay has the largest mangrove cover in the province of Negros Oriental.

There has been a drastic decrease of mangrove area within this century. In the 1920s, the coastline of Dumaguete from Banilad to Sibulan was fringed with lush mangroves, but due to land reclamation only small patches remain in Banilad and Bantayan. In 1979, the mangrove area in the Bais Bay area was estimated at 811.6 ha (Biña *et al*. 1979; De Leon *et al*. 1991). This declined to 250 ha due to fishpond conversion (Calumpong and Serate 1994). However, the coverage has increased to 265 ha as a result of reforestation. There were efforts in 1993-95 to enhance mangrove areas on Apo Island, but they were met with limited success due to substrate unsuitability (Calumpong *et al*. 1997).

There are 25 different species of mangroves and associated species in the sites sampled by the SUML (Table 4.3). Apo Island, Dauin has the least number of species, 8. Due to reforestation efforts of the Philippine Coast Guard (PCG) and the Department of Environment and Natural Resources (DENR), *Rhizophora mucronata* is the dominant species there. In Bantayan, Dumaguete City, there are 16 species of mangroves, 5 of which are natural growth and the rest had been planted under the Environmental Resource Management Project (ERMP) of Silliman University. Bais Bay has the most number of species, 22, including 10 families of mangrove-associated species (Calumpong *et al*. 1997).

The CRMP conducted a survey within the profile area in 3 selected sites. The sites are the municipalities of Amlan, Manjuyod and the city of Tanjay.

The municipality of Amlan has a total of 23 mangrove and associated species which can be found in Barangay Tandayag (which has 8 species), Jugno (15 species), and Bio-os (17 species). *Rhizophora stylosa*, *Sonneratia alba*, *Avicennia lanata*, *Ceriops decandra*, and *Lumnitzera racemosa* are the more common species in the municipality.

The mangroves in the city of Tanjay are found in the coastal *barangays* of Polo down to Sta. Cruz Viejo. The city has a total of 29 mangrove and mangrove-associated species. *Avicennia marina*, *A. officinalis*, *Sonneratia alba*, and *Rhizophora* spp. are the commonly encountered species. The largest and most diverse mangrove community is in Barangay Polo which has 24 species. The total mangrove area of the city, including *nipa* (*Nypa fruticans*) plantations, covers approximately 112 ha. Reforestation efforts in Tanjay are carried out (by fishpond operators and some coastal residents) primarily to protect fishponds and property from erosion especially during *amihan* (north east monsoon) months.

**Table 4.3. List of mangrove and associated species in Manjuyod, Bais, Tanjay, Amlan, Dumaguete, and Dauin.**

| Species Name | Common Name | Manjuyod | Bais | Tanjay | Amlan | Dumaguete | Dauin |
|---|---|---|---|---|---|---|---|
| 1.**RHIZOPHORACEAE** | | | | | | | |
| *Rhizophora apiculata* | *Bakauan-lalake* | + | + | + | + | + | -- |
| *Rhizophora mucronata* | *Bakauan-babae* | + | + | + | + | + | + |
| *Rhizophora stylosa* | *Bakauan-bato/bankau* | + | + | + | + | + | -- |
| *Bruguiera cylindrica* | *Pototan-lalake* | + | + | + | + | + | -- |
| *Bruguiera gymnorrhiza* | *Busain* | -- | + | + | + | + | -- |
| *Bruguiera sexangula* | *Pototan* | -- | + | + | + | + | -- |
| *Ceriops decandra* | *Hangalay/Malatungog* | + | + | + | + | + | -- |
| *Ceriops tagal* | *Tungog* | -- | + | + | -- | + | -- |
| 2.**AVICENNIACEAE** | | | | | | | |
| *Avicennia alba* | *Bungalon puti* | + | + | -- | + | -- | + |
| *Avicennia lanata* | *Bungalon* | + | + | + | + | -- | -- |
| *Avicennia marina* | *Piapi* | + | + | + | + | + | + |
| *Avicennia officinalis* | *Api-api* | + | + | + | + | -- | -- |
| 3.**SONNERATIACEAE** | | | | | | | |
| *Sonneratia alba* | *Pagatpat* | + | + | + | + | + | -- |
| *Sonneratia caseolaris* | *Pedada* | -- | | -- | | -- | -- |
| 4.**COMBRETACEAE** | | | | | | | |
| *Lumnitzera littorea* | *Tabau* | + | + | -- | + | + | + |
| *Lumnitzera racemosa* | *Sagasa/Baras-baras* | -- | | + | + | -- | -- |
| *Terminalia catappa* | *Talisay* | -- | | + | | + | -- |
| 5.**MELIACEAE** | | | | | | | |
| *Xylocarpus granatum* | *Tabigi* | -- | -- | + | + | -- | -- |
| *Xylocarpus moluccensis* | *Piagau* | -- | -- | + | + | -- | -- |
| *Xylocarpus rumphii* | | + | | + | -- | -- | -- |
| 6.**MYRSINACEAE** | | | | | | | |
| *Aegiceras corniculatum* | *Saging-saging* | -- | + | + | -- | + | -- |
| 7.**RUBIACEAE** | | | | | | | |
| *Scyiphiphora hydrophyllacea* | *Nilad* | -- | -- | + | + | -- | -- |
| 8.**EUPHORBIACEAE** | | | | | | | |
| *Excoecaria agallocha* | *Alipata* | + | + | + | + | + | + |
| 9.**PALMAE** | | | | | | | |
| *Nypa fruticans* | *Nipa* | + | + | + | + | + | -- |
| 10. **MYRTACEAE** | | | | | | | |
| *Osbornia octodonta* | *Tualis* | -- | -- | + | + | -- | -- |
| 11. **ACANTHACEAE** | | | | | | | |
| *Acanthus ilicifolius** | *Diliuario* | + | + | + | + | + | -- |
| 12. **BIGNONIACEAE** | | | | | | | |
| *Dolichandrone spathacea** | *Tui/Bito-bitoon* | -- | + | + | + | + | + |
| 13. **STERCULIACEAE** | | | | | | | |
| *Heritiera littoralis** | *Dungon* | -- | -- | + | + | -- | -- |
| 14. **FABACEAE** | | | | | | | |
| *Derris trifoliata** | *Tuble* | -- | -- | + | -- | -- | -- |
| *Prosopis vidaliana** | *Aroma* | + | | + | + | -- | -- |
| 15. **BARRINGTONIACEAE** | | | | | | | |
| *Barringtonia* sp.* | *Bito-on* | + | -- | + | + | -- | -- |
| 16. **TILIACEAE** | | | | | | | |
| *Brownlowia* sp.* | *Amagos* | -- | -- | + | -- | -- | -- |
| 17. **CAESALPINIACEAE** | | | | | | | |
| *Intsia bijuga** | *Ipil* | -- | -- | + | -- | -- | -- |
| 18. **ASCLEPIADACEAE** | | | | | | | |
| *Finlaysonia maritima** | *Balagon* | + | -- | + | -- | -- | -- |

*Legend: + = present; -- = absent; * = mangrove associated species*
*Source: Calumpong* et al. *(1997)*

*Rhizophora stylosa* and *R. mucronata* are commonly used for planting because they are easy to plant and propagules are easily obtained.

A total of 16 mangrove and mangrove-associated species can be found in the municipality of Manjuyod. Commonly encountered species in the municipality are *Avicennia marina*, *Sonneratia alba*, and *Rhizophora stylosa*. Barangay Suba has the highest number of species (13) while the rest of the *barangays* in Manjuyod have 5-7 species each. The total mangrove area in the municipality covers 47.04 ha (MPDO 1999). Most mangrove plantations (*Rhizophora* spp.) in Manjuyod were initiated by the Central Visayas Regional Project-I (CVRP-I) which provided residents with planting materials. Seventy-four coastal residents hold Certificate of Stewardship Contracts (CSCs issued by the DENR). Approximately 33 ha was allocated to them, according to the 1999 DENR CENRO I Report.

On Apo Island, the mean density of saplings is 5,000 stems per ha but with very patchy distribution. Due to massive reforestation efforts in the Talabong Mangrove Reserve, Bais Bay, the distribution of saplings is higher there, with average densities of 11,250 + 8,954.54 for *R. mucronata* and 22,187 + 3,437.50 for *Avicennia marina*. Luca, Canlargo, Bais has a density of 4,000 stems per ha with *Sonneratia alba* as the dominant species. Dunggu-an, Manjuyod has a density of 2,000 stems per ha with the dominant species being *Rhizophora* (Calumpong *et al*. 1997).

The mangrove soil in Apo Island, Dauin is primarily composed of a range from fine sand to coarse sand. This soil composition favors the growth of *Avicennia*, *Sonneratia,* and *Exocoecaria*. In Bais Bay, major soil composition varied from very fine sand to fine sand. This substrate favors the growth of *Rhizophora* species. De Leon *et al*. (1991) report the predominance of medium sand attributed to the high organic matter in the mangrove area in Bais Bay. Contrary to the soil composition in Apo Island and Bais Bay, the soil composition of the mangrove area in Bantayan, Dumaguete City is clay (Calumpong *et al*. 1997).

**Seagrass and Algal Beds**

Seagrass and algal beds are a common resource found in the nearshore areas of the profile area. They form an important shallow water marine ecosystem because:

- they reduce current velocity and erosion by binding the sediments;
- they provide food directly and indirectly to the nearby ecosystems; and
- they also provide a high diversity of habitats and substrata to numerous marine organisms (Thayer and Phillips 1977; Thayer *et al*. 1978).

A strong positive correlation exists between the dominant substrate and the dominant vegetation. In Bais Bay and Dumaguete, where the substrate type is sand, sand/silt or sand/mud, the dominant vegetation is seagrass, while on Apo Island, where the substrate type is limestone and hard or soft coral, the dominant vegetation is turf algae.

There are 8 species of seagrasses belonging to 6 genera that were identified within the profile area as shown in Table 4.4. Seagrass areas cover about 140 km of coastline stretching from Bais Bay in the north to Dauin in the south. Based on the survey in 3 sites (Bais, Dumaguete, Apo Island), Bais Bay has the most seagrass cover, 200 ha. In contrast, seagrass in Dumaguete covers only 26.9 ha and Apo Island has no seagrass cover. Mats of *Gracilaria* and *Laurencia* seasonally cover the seagrass beds fronting Talabong, Bais Bay (Calumpong *et al*. 1997).

**Table 4.4. Seagrass species identified within the profile area.**

| **DIVISION ANTHOPHYTA** |
|---|
| **Family Potamogetonaceae** |
| *Cymodocea rotundata* |
| *Cymodocea serrulata* |
| *Halodule pinifolia* |
| *Halodule uninervis* |
| *Syringodium isoetifolium* |
| **Family Hydrocharitaceae** |
| *Enhalus acoroides* |
| *Halophila ovalis* |
| *Thalassia hemprichii* |

*Source: Calumpong* et al. *(1997)*

A total of 103 algal species belonging to 65 genera were identified within the profile area. These algal species are grouped into 4 divisions with the red algae group dominating (Calumpong *et al*. 1997):

- *Rhodophyta* (red algae) - 53 species
- *Chlorophyta* (green algae) - 33 species
- *Phaeophyta* (brown algae) -16 species
- *Cyanophyta* (blue green algae) -1 species

Apo Island has the greatest algal diversity, 83 species, while in Bais Bay there are only 44 species. On Apo Island, there is a mixed algal bed in the first 10 m consisting of green alga *Enteromorpha clathrata*, the red alga *Gellidiella acerosa*, and the brown alga *Sargassum*. Algal beds extending from 20-25 m shoreward occupy 0.3 ha (Calumpong *et al*. 1997).

**Coral Reefs**

Coral reefs are one of the nation's most valuable natural resources, serving as an important source of food and providing opportunities for jobs, business, and support to the tourism industry. In Negros Oriental, coral reefs are estimated to cover an area of 26.5 $km^2$ and are distributed non-continuously along 186 km of coastline with an average width of 143 m (Montebon 1995).

A total of 121 scleractinian species and genera of corals belonging to 14 families and 4 species of non-scleractinian corals were identified in 3 survey stations (Bais, Dumaguete, and Apo Island) (SUML 1997) (Table 4.5). Taxonomic studies in marine reserve areas conducted by the Centre for the Establishment of Marine Reserves in Negros Oriental (CEMRINO, Inc.) in 1995-1996 show that Apo Island has the highest number of coral species throughout Negros Oriental.

**Table 4.5. Coral species in Negros Oriental.**

| | |
|---|---|
| **HARD CORALS** | |
| Scleractinian Corals | |
| *Order Scleractinia* | |
| Family Acroporidae | Family Mussidae |
| Family Agariciidae | Family Oculinidae |
| Family Caryophyllidae | Family Pectiniidae |
| Family Dendrophylliidae | Family Pocilloporidae |
| Family Faviidae | Family Poritidae |
| Family Fungiidae | Family Siderastreidae |
| Family Merulinidae | Family Trachyphylliidae |
| Non-Scleractinian corals | |
| *Order Coenothecalia* | |
| Family Helioporidae | |
| *Order Milleporina* | |
| Family Milleporidae | |
| **SOFT CORALS** | |
| *Order Alcyonacea* | |
| Alcyonium | Paralemnalia |
| Asterospicularia | Sarcophyton |
| Cespitularia | Sinularia |
| Lemnalia | Xenia |
| Lobophyton | |
| Nephthea | |

*Source: Calumpong* et al. *(1997)*

Wide area surveys of the coral reefs in Negros Oriental using the manta tow reconnaissance technique were conducted by Montebon in 1995 to assess shallow water reefs along the coastline of the province. The results of the manta tow survey for the profile area are presented in Figure 4.1. The results show that only 5 percent of the total area of coral reefs in Negros Oriental have "excellent" coral cover (with a score of 5) while more than 50 percent of the reefs (cumulative of categories 0, 1, and 2) are in "poor" condition (Montebon 1995). Table 4.6 presents the relative proportion of percent cover with their corresponding area per category score. Table 4.7 shows a comparison between live coral cover from 103 transect-quadrat stations by Gomez *et al*. (1981) of Negros Oriental in the past (1981) and recent results of the manta tow cover data.

Mean percent cover of benthic categories using random quadrat (RQ) method in each station in the 3 sites conducted by the SUML is shown in Table 4.8. From the results of the random quadrat method, Apo Island has the highest mean total coral cover (82.9 percent) in all of the sites.

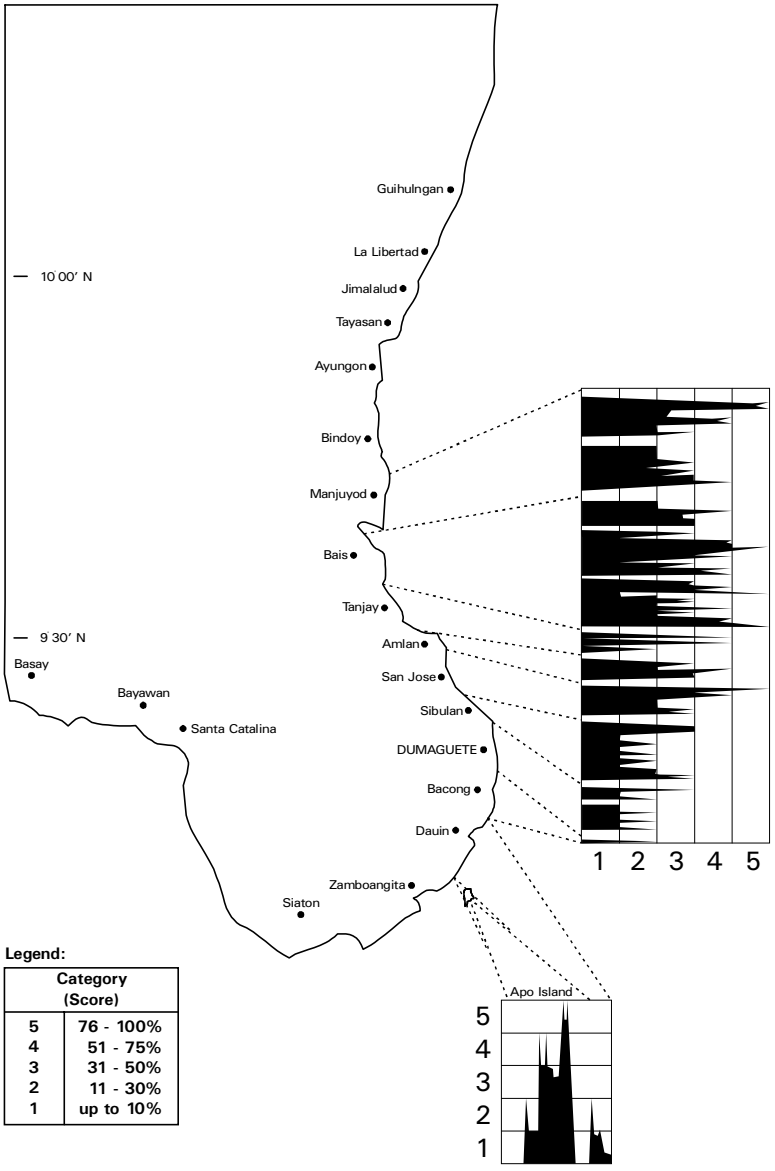


**Figure 4.1. Coral cover based on the large scale survey (manta tow).**
*Source: Montebon (1995)*

**Table 4.6. Relative proportion (percent cover) with corresponding area per category score of the different benthos for the Negros Oriental province.**

| Category (Score) | | Hard coral | Area ($km^2$) | Soft coral | Area ($km^2$) | Dead coral | Area ($km^2$) |
|---|---|---|---|---|---|---|---|
| 5 | 76 - 100 % | 5 % | 1.33 | 0 % | 0 | 0 % | 0 |
| 4 | 51 - 75 % | 14 % | 3.71 | 2 % | 0.53 | 0 % | 0 |
| 3 | 31 - 50 % | 25 % | 6.63 | 6 % | 1.59 | 0 % | 0 |
| 2 | 11 - 30 % | 30 % | 7.95 | 12 % | 3.18 | 0 % | 0 |
| 1 | up to 10 % | 23 % | 6.1 | 46 % | 12.19 | 11 % | 2.92 |
| 0 | none % | 3 % | 0.8 | 34 % | 9.01 | 89 % | 23.59 |
| **Total** | | 100 % | 26.5 | 100 % | 26.5 | 100 % | 26.5 |

*Source: Montebon (1995)*

**Table 4.7. Live coral cover for Negros Oriental for 1981 and 1995.**

| Coral cover | 1981[1] | 1995[2] |
|---|---|---|
| 50 - 100 % | 31 % | 19 % |
| 30 - 50 % | 29 % | 25 % |
| 10 - 30 % | 29 % | 30 % |
| 0 - 10 % | 11 % | 26 % |

*Source: [1]103 transect-quadrat stations by Gomez* et al. *(1981)*
*[2]Manta tow data of 186 km of coastline (Montebon 1995)*

**Table 4.8. Mean percent cover of benthic categories using random quadrat method at 3 Negros sites.**

| Stations | Corals | | | | Flora | Other fauna | Abiotic | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hard | Soft | Dead | Total | Algae | | Rubble | Sand | Silt | Rock |
| Apo Island | 28.75 | 53.5 | 0.63 | 82.92 | | | 4.06 | 3.23 | | 9.79 |
| Bais Bay | 36.56 | 12.2 | 7.5 | 56.25 | | 0.94 | 14.84 | 17.19 | 1.88 | 8.91 |
| Dumaguete | 43.33 | 3.75 | 8.96 | 56.04 | 2.6 | 4.79 | 14.13 | 19.24 | | 3.19 |
| **Mean** | 36.22 | 23.2 | 5.69 | 65.07 | 0.87 | 1.91 | 11.01 | 13.22 | 0.63 | 7.3 |

*Source: Calumpong* et al. *(1997)*

Negros Oriental is known for its marine sanctuaries or reserves. Apo Island marine reserve is one of the known sanctuaries not only in the country but in the Southeast Asian Region. It serves as a model to other areas in the country. Table 4.9 shows the marine sanctuaries/reserves found in the profile area.

**Table 4.9. Marine sanctuaries/reserves in the profile area.**

| Municipality/ City | Name of sanctuary | Location | Area covered (ha) | Year established |
|---|---|---|---|---|
| Amlan | Bio-os Marine Reserve | Brgy. Bio-os | 8.87 | 1999 |
| | Tandayag Marine Reserve | Brgy. Tandayag | 6 | 1996 |
| Bais | Okiot/Sanlagan Marine Reserve | Brgy. Okiot | 1 | 1994 |
| Tanjay | Polo Marine Reserve | Brgy. Polo | 2 | 1995 |
| Sibulan | Cangmating Marine Reserve | Brgy. Cangmating | 6 | 1997 |
| | Agan-an Marine Reserve | Brgy. Agan-an | 6 | 1998 |
| San Jose | Poblacion Marine Reserve | Brgy. Poblacion | 4 | 1994 |
| Dauin | Apo Island Marine Reserve | Brgy. Apo Island | 17 | 1986 |
| | Masaplod Norte Marine Reserve | Brgy. Masaplod Norte | 6 | 1997 |
| Manjuyod | Campuyo Marine Reserve | Brgy. Campuyo | 25 | 1994 |
| | Bolisong Marine Reserve | Brgy. Bolisong | 10 | 1995 |
| Siaton | Tambobo Fish Sanctuary | Brgy. Siit | 6.4 | 1993 |
| | | Brgy. Bonbonon | 8 | 1994 |
| Bacong | Buntis Marine Reserve | Brgy. Buntis | 6 | 2000 |

**Fisheries**

SUML conducted fish visual censuses at 3 to 5 stations in 3 sites: Bais Bay, Dumaguete, and Apo Island. In all of the stations except 1, Family *Pomacentridae* (damsel fishes) had the most abundant number of individuals and in 8 out of 12 stations, Family *Pomacentridae*

also had the most number of species (Table 4.10). Also, in 8 out of 12 stations, Family *Labridae* had the second highest number of species. Other families prominently represented are *Chaetodontidae* and *Serranidae*. In Bais Bay, there were 99 fish species belonging to 22 families. In Dumaguete City, 112 species belonging to 23 families were counted, and on Apo Island, 146 species belonging to 27 families were identified (Calumpong *et al*. 1997).

Table 4.11 represents the mean species richness and mean density for the 3 municipalities surveyed. Overall, the sites in Dumaguete have both the highest mean species richness and the highest mean density. Of the stations surveyed on Apo Island, it is not surprising to note that mean species richness is highest in the marine sanctuary ($33 \pm 2$ species/500 $m^2$). Protection from fishing and disturbance may be the cause for the high species richness (Calumpong *et al*. 1997). In Campuyo, Bais, compared to previous surveys (Luchavez and Alcala 1992; Luchavez and Divinagracia 1994), there is a reduction in the total number of species and families, as well as lower species richness and density values.

SUML conducted biomass surveys at 3 to 5 stations at each of the 3 sites. These surveys included only fish that are targeted by fishers, can be identified to the species level, and are non-juveniles. Table 4.12 presents the estimated biomass of the fish from all 3 sites. SUML identified 18 species of target fish belonging to 8 families in Bais Bay and 19 target species belonging to 9 families in Dumaguete (SUML 1997). Apo Island has the greatest diversity of species, registering 23 target species belonging to 9 families.

Total biomass for Apo Island (15,219 g/500 $m^2$) is high compared to other sites. These results agree with the previous study of Russ and Alcala (1993) which revealed increasing mean biomass of large predatory fishes there.

The surveys also identified the number of large predatory fish. Species density, species richness, and estimated biomass of large predatory fish are indices of fishing pressure on coral reefs (Russ and Alcala 1993). Apo Island has the greatest number of species of large predators, 6, and Dumaguete has the least number of species observed, only 1. In Bais Bay, 4 large predatory species were encountered. Based on the indices of fishing pressure, Dumaguete has the highest fishing pressure and Apo Island has the lowest fishing pressure (Calumpong *et al*. 1997).

**Table 4.10. List of fish, crustaceans, and mollusk species harvested in Bais Bay, Dumaguete, and Apo Island.**

| Species | Local name |
|---|---|
| **A. Fish** | |
| Family Acanthuridae (surgeon fishes) | |
| *Acanthusurs* sp. | *Indangan* |
| Naso spp. | *Bagis* |
| Family Ambassidae (glassy fishes) | |
| *Ambassis* sp. | *Palangan* |
| Family Apogonidae (cardinal fishes) | |
| *Clienlodipterus macrodon* | *Ibis/Mongaw* |
| *Apogon* ssp. | *Ibis* |
| *Sphaeramia nemetoptera* | *Ibis* |
| Family Antherinidae (silversides) | |
| *Atherina* sp. | *Guno* |
| Family Balistidae (trigger fishes) | |
| *Balistapus undulatus* | *Pugot* |
| *Balistapus* sp. | *Pakol* |
| *Stephanolepis* sp. | *Bulaknita* |
| *Pseudotriacanthus* sp. | *Bulaknita* |
| Family Belonidae (needle fishes) | |
| *Strongylura* sp. | *Balo* |
| Family Blenniidae (blennies) | |
| *Salarias fasciatus* | *Palog* |
| *Salarias* sp. | *Palog* |
| Family Carangidae (scads and jacks) | |
| *Megalaspis cordyla* | *Bakulan* |
| *Alepes vari* | *Kabalyas* |
| *Alectis indicus* | *Samin-samin* |
| *Alectis ciliaris* | *Samin-samin* |
| *Carangoides armantus* | *Badlon* |
| *Carangoides* sp. | *Malapati* |
| *Selar* sp. | *Tamarong* |
| *Scomberoides tol* | *Lapis* |
| *Caranx* sp. | *Baha-ulo* |
| *Decapterus* sp. | *Pulag-ikog* |
| *Atule mate* | *Lambayawan* |
| Unidentified sp. | *Talikitok* |
| Family Caesionidae (fusiliers) | |
| *Caesio erythrogaster* | *Ulan-ulan* |
| *Caesio caerulaureus* | *Solid* |
| *Pterocaesio pisang* | *Lokihok* |
| Family Chaetodontidae (butterfly fishes) | |
| *Chaetodon octofasciatus* | *Kulampiros* |
| Family Chanidae (milkfish) | |
| *Chanos chanos* | *Awa* |
| Family Chirocentridae (wolf herring) | |
| *Chirocentrus dorab* | *Balila* |
| Family Cichlidae (cichlids) | |
| *Tilapia* sp. | *Tilapia* |
| Family Clupeidae (sardines and herrings) | |
| *Sardinella albella* | *Lilang* |
| *Sardinella* sp. | *Malangsi* |
| *Nematalosa cone* | *Kabase* |
| *Spratelloides* sp. | *Bolinabid* |
| *Dussumieria elopsoides* | *Balantiyong* |

continued

**Table 4.10. continued**

| | | |
|---|---|---|
| | Unidentified sp. | *Molobgas* |
| | Unidentified sp. | *Hawol-hawol* |
| Family | Dasyatidae (stingray) | |
| | *Dasyatis* sp. | *Kiampao* |
| Family | Engraulidae (anchovies) | |
| | *Stolephorus* sp. | *Bolinao* |
| | *Thrissina baelama* | *Tigue* |
| | Unidentified sp. | *Tugnos* |
| Family | Elopidae (tarpons) | |
| | *Megalops cyprinoides* | *Bulan-bulan* |
| | *Elops* sp. | *Bid-bid* |
| Family | Ephipidae (batfishes) | |
| | *Platax orbicularis* | *Dalapugan* |
| Family | Fistularidae (flutemouths) | |
| | *Fistularia petimba* | *Tubo-tubo* |
| Family | Gerreidae (mojarras) | |
| | *Gerres* sp. | *Kasbo* |
| | *G. abbreviatus* | *Bag-angan/Samulok* |
| | *G. filamentosus* | *Bag-angan/Lawihan* |
| Family | Gobiidae (gobies) | |
| | *Ptereleotris* sp. | *Ananambo* |
| | *Cryptocentrus* sp. | *Balanghutin* |
| | *Oxyurichthys* sp. | *Wakli-wakli* |
| | Unidentified sp. | *Watlay-watlay* |
| | Unidentified sp. | *Bunog* |
| Family | Haemulidae (sweetlips and grunts) | |
| | *Pomadasys hasta* | *Ulibalay* |
| | *Plectorhyncus pictus* | *Lipte* |
| | *P. chaetodontoides* | *Lipte* |
| Family | Hemiramphidae (halfbeaks) | *Balanban/Salasa* |
| | *Hemiramphus* sp. | |
| Family | Holocentridae (squirrel fishes) | |
| | *Adioryx ruber* | *Ganting* |
| | *Myripristis berndti* | *Ganting* |
| Family | Kyphosidae (sea chubs) | |
| | *Kyphosus* sp. | *Ilac* |
| Family | Labridae (wrasses) | |
| | *Cheilinus celebicus* | *Ipos-ipos* |
| | *C. tribatus* | *Ananapan* |
| | *Halichoeres scapularis* | *Labayan* |
| | *Choerodon* sp. | *Lupit* |
| | *Thalassoma lunare* | *Tanlaron* |
| Family | Leiognathidae (slipmouths) | |
| | *Leiognathus splendens* | *Danglay* |
| | *L. fasciatus* | *Dagoldol* |
| | *L. elongatus* | *Tabilos* |
| | *L. bindus* | *Sap-sap* |
| | *Gazza minuta* | *Piampe* |
| | *Gazza achlamys* | *Piampe* |
| | *Secutor ruconius* | *Palotpot* |
| | *S. insidiator* | *Palotpot/Sape-sape* |
| Family | Lethrinidae (emperor breams) | |
| | *Lethrinus lentjan* | *Katambak* |
| | *Lethrinus ornatus* | *Katambak* |
| | *Lethrinus* sp. | *Dogso* |
| Family | Lobotidae (tripletails) | |
| | *Lobotes surinamensis* | *Ligad* |

continued

**Table 4.10. continued**

| | | |
|---|---|---|
| Family | Lutjanidae (snappers) | |
| | *Lutjanus argentimaculatus* | *Mangagat* |
| | *L. fulviflamma* | *Lalagan* |
| | *L. rivulatus* | *Panta-an* |
| | *L. monostigma* | *Aluman* |
| | *L. russelli* | *Labungan* |
| | *L. gibbus* | *Maya-maya* |
| | *L. caeruleovittatus* | *Bangalao* |
| | *Lutjanus* sp. | *Kalambangis* |
| Family | Mugilidae (mullets) | |
| | *Liza* sp.1 | *Gisaw* |
| | *Liza* sp. 2 | *Balanak* |
| | *Liza* sp. 3 | *Yakmo* |
| Family | Mullidae (goatfishes) | |
| | *Upeneus sulphureus* | *Hinok 1* |
| | *U. vittatus* | *Hinok 2* |
| | *U. tragula* | *Hinok 3* |
| | *Parupeneus barberinus* | *Timbungan* |
| | *Upeneus* sp. | *Salmonete* |
| Family | Muraenidae (moray eels) | |
| | *Evenchelys marchuris* | *Ubod* |
| | *Gymnothorax* spp. | *Bakasi* |
| Family | Nemipteridae (threadfin breams and spinecheeks) | |
| | *Nemipterus* spp. | *Bakay* |
| | *Scolopsis cancellatus* | *Budlat* |
| | *Scolopsis ciliatus* | *Gapas-gapas* |
| | *Pentapodus* spp. | *Sulong/Salinggukod* |
| Family | Platycephalidae | |
| | *Platycephalus* sp. | *Sunoga* |
| Family | Plotosidae (marine catfishes) | |
| | *Plotosus lineatus* | *Ito* |
| Family | Priacanthidae (big eyes) | |
| | *Priacanthus* sp. | *Bungo/Bulgan* |
| Family | Pomacentridae (damselfishes) | |
| | *Dischistodus fasciatus* | *Palata* |
| | *Chrysiptera* sp. | *Palata* |
| | *Chromis* spp. | *Kibang* |
| | *Dascyllus* spp. | *Bica-bica* |
| | *Abudefduf* | *Kapal* |
| | *Amphiprion clarkii* | *Bantay bot-bot* |
| Family | Rachycentridae (cobia) | |
| | *Rachycentron canadum* | *Halo-antasik* |
| Family | Scaridae (parrotfishes) | |
| | *Scarus* spp. | *Mol-mol/Kuyog-kuyog* |
| Family | Scatophagidae (scats) | |
| | *Scatophagus* argus | *Kikilo* |
| Family | Scombridae (mackerels and tunas) | |
| | *Rastrelliger kanagurta* | *Anduhaw* |
| | *Scomberomorus* sp. | *Tangige* |
| | Unidentified spp. | *Pirit-pirit/Ihalason* |
| Family | Scorpaenidae (scorpion fishes) | |
| | *Pterois volitans* | *Lalong* |
| | *Sebastes* sp. | *Bantol* |
| Family | Serridae (groupers) | |
| | *Cromileptis altivelis* | *Milo-milo* |
| | *Epinephelus suillos* | *Manalho* |

continued

**Table 4.10. continued**

| | | |
|---|---|---|
| | *E. macrospilus* | *Lapu-lapu* |
| | *E. caeruleopunctatus* | *Manan-aw* |
| | *E. fuscoguttatus* | *Bantolon* |
| | *E. microdon* | *Bantolon* |
| | *E. summana* | *Pugapo* |
| | *Cephalopholis* | *Pugalo* |
| | *C. pachycentron* | *Tangka-an* |
| | *Anyperodon leucogrammicus* | *Lapu-lapu* |
| Family | Siganidae (rabbitfishes) | |
| | *Siganus canaliculatus* | *Danggit* |
| | *S. guttatus* | *Kitong* |
| | *S. punctatus* | *Lalap* |
| | *S. virgatus* | *Talagbago* |
| | *S. vulpinus* | *Talagbago* |
| | *S. spinus* | *Ngis-ngis* |
| Family | Sillaginidae (whitings) | |
| | *Sillago* sp. | *Aso-os* |
| Family | Soleidae (soles) | |
| | *Dexillichthys* sp. | *Dali-dali/Palad* |
| Family | Sphyraenidae (barracudas) | |
| | *Sphyraena barracuda* | *Rompe/Tabangko* |
| | *Sphyraena* sp. | *Bat-og* |
| Family | Synodontidae (lizardfish) | |
| | *Synodus variegatus* | *Tambod* |
| | *Saurida* ssp. | *Tambod* |
| Family | Teraponidae (tigerfishes) | |
| | *Terapon jarbua* | *Buga-ong* |
| | *Pelates quadrilineatus* | *Gong-gong* |
| Family | Tetraodontidae (pufferfishes) | |
| | *Chelonodon patoca* | *Botete* |
| Family | Trichiuridae (hairtails) | |
| | *Trichiurus haumela* | *Diwit* |
| **B. Crustaceans (crabs, prawns, shrimps, and lobsters)** | | |
| Family | Portunidae (Portunid crabs) | |
| | *Scylla serrata* | *Alimango* |
| | *Portunus pelagicus* | *Lambay* |
| | *Thalamita* sp. | *Kasag* |
| | *Charybdis cruciata* | *Krusan* |
| | *Podophthalmus vigil* | *Kasway* |
| Family | Peraeidae (penaeid shrimps) | |
| | *Penaeus monodon* | *Pantat* |
| | *P. japonicus* | *Pantat* |
| | *P. merguiensis* | *Boktutay* |
| | *Trachypenaeus fulvus* | *Bagulan* |
| | *Metapenaeus ensis* | *Mestisa* |
| | *M. endeavouri* | *Mestisa* |
| Family | Sergetidae | |
| | *Acetes* sp. | *Uyap* |
| Family | Palinuridae (lobsters) | |
| | *Panulirus* sp. | *Banagan* |
| **C. Mollusks** | | |
| Cephalopoda (squid, cuttlefish, octopus) | | |
| | *Sepioteuthis* sp. | *Nokos* |
| | *Loligo* sp. | *Talostos* |
| | *Sepia* sp. 1 | *Kulabutan* |
| | *Sepia* sp. 2 | *Buko-buko* |
| | *Octopus* sp. 1 | *Kugita* |
| | *Octopus* sp. 2 | *Tabugok/Tamal* |

continued

**Table 4.10. continued**

| | | |
|---|---|---|
| Family | Lucinidae (Lucines) | |
| | *Phacoides philippinarium* | *Embao* |
| Family | Mytilidae (mussels) | |
| | *Modiolus metcalfei* | *Tahong* |
| Family | Ostreidae (oysters) | |
| | *Crassostrea* sp. | *Talaba* |
| | *Crassostrea cucullata* | *Sisi* |
| | *Ostrea* sp. | *Kuya* |
| Family | Arcidae (ark shells) | |
| | *Anadara* sp. | *Litub* |
| Family | Corbiculidae | |
| | *Geloina suborbicularis* | *Tuway* |
| Family | Veneridae (Venus clams) | |
| | *Tapes litterata* | *Kandiis* |
| | *Paphia sulcosa* | |
| | *Circle scripta* | *Pisos-pisos* |
| | *Grafrarium tumidum* | *Bisala* |
| | *Periglypta* sp. | *Bug-atan* |
| | *Pitar citrina* | *Tikod-tikod* |
| | Unidentified sp. | *Punao* |
| | Unidentified sp. | *Punao* |
| | Unidentified sp. | *Puti-an* |
| | Unidentified sp. | *Punyete* |
| Family | Cardiidae (cockles or heart shells) | |
| | *Vepricardium* sp. | *Sulod-sulod* |
| Family | Mactridae (surf clams) | |
| | *Mactra* sp. | *Bulok-bulok* |
| Family | Anomiidae (jingle shells) | |
| | *Placuna placenta* | *Lampirong/Tipay* |
| Family | Pinnidae (fan mussels) | |
| | *Atrina* sp. | *Talab/Atsa-atsa* |
| Family | Malleidae (hummer oyster) | |
| | *Malleus* sp. | |
| Family | Pterridae (pearl oysters) | |
| Family | Aplyssidae (seahares) | |
| | *Dolabella auricularia* | *Lucot* |
| Family | Strombidae (true conch) | |
| | *Strombus canarium* | *Bungkawil* |
| | *S. urceus* | *Aninikad* |
| Family | Potamididae (mud whelks) | |
| | *Telescopium telescopium* | *Bagongon* |
| | *Terebralia* sp. | *Dalu-dalu* |
| Family | Volutidae (volutes) | |
| | *Melo* sp. | *Bilong* |
| | *Voluta* sp. | *Kibol* |
| Family | Muricidae (murex or rock shells) | |
| | *Murex* sp. | *Sangka-sanka* |
| Family | Haliotidae (abalones) | |
| | *Haliotis* sp. | *Kapinan* |
| Family | Trochidae (topshells) | |
| | *Thocus* sp. | *Tandok-tandok* |

*Source: Luchavez and Abrenica (1997)*

**Table 4.11. Mean fish species richness and mean density at Bais Bay, Dumaguete, and Apo Island.**

| Sites | N | Mean species richness (no. of species/500m$^2$) | Mean density (no. of individuals/500m$^2$) |
|---|---|---|---|
| Bais Bay | 10 | 32 $\pm$ 2 | 9,167 $\pm$ 4,904 |
| Dumaguete | 6 | 44 $\pm$ 1 | 11,005 $\pm$ 2,097 |
| Apo Island | 14 | 33 $\pm$ 2 | 7,805 $\pm$ 2,064 |

*Note: $\pm$2 = Standard error; N= number of replicates*
*Source: Calumpong* et al. *(1997)*

**Table 4.12. Estimated biomass of target species in Bais Bay, Dumaguete and Apo Island.**

| Species names | Biomass (g/500m$^2$) | | |
|---|---|---|---|
| | Bais | Dumaguete | Apo Island |
| Acanthuridae | 75 | 868 | 6,270 |
| Caesionidae | 9,897 | 2,379 | 5,251 |
| Haemulidae | - | 34 | - |
| Kyphosidae | - | 290 | - |
| Labridae | 150 | 355 | - |
| Lethrinidae | - | | 45 |
| Lutjanidae | 163 | 700 | 1,900 |
| Mullidae | 189 | 313 | 961 |
| Nemipteridae | 60 | 630 | 40 |
| Scaridae | 301 | - | 542 |
| Serranidae | - | - | 30 |
| Siganidae | 213 | 168 | 180 |
| **TOTAL** | **11,048** | **5,737** | **15,219** |

*Source: Calumpong* et al. *(1997)*

**SUMMARY**

Deposits of copper, iron, limestone, dolomite, manganese, galena, gypsum, and phosphate have been reported as present in the profile area. Quarrying has been concentrated on sand and gravel for construction purposes. Meanwhile, Negros Oriental has a low forest cover due to much illegal logging although the government and other institutions are undertaking forest rehabilitation and restoration efforts.

The Negros Oriental coast is known in the Philippines for having rich coastal resources but as in most areas, they are under threat. Mangroves have been depleted and cover less than 1,000 ha but protection and reforestation efforts are now underway. Nearshore, areas are mostly seagrass and algal beds fringed by coral reefs. The best reefs are found on Apo Island, Bais Bay area and selected sites along the coast. There are more than 20 functioning marine reserves in the province covering about 200 ha of reef. Most reefs are overfished but some sanctuaries have shown documented increases in fish species diversity and abundance per 500m$^2$ through periodic reef monitoring.