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**Research article**

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**A survey and study on food habits of migratory waterbirds along Naujan Lake, Oriental Mindoro Province, Philippines****Grace B. VILLAMOR\****ASEAN Regional Centre for Biodiversity Conservation (ARCBC) Los Baños, Laguna 4031 Philippines.**Current address: World Agroforestry Centre (ICRAF), Philippines*

**ABSTRACT.** This survey showed that Naujan Lake is an important stop-over for migratory birds. A total of 9,225 counts of waterbirds belonging to 14 species and six families were recorded and identified along Naujan Lake. The counts were obtained using a combination of survey techniques, namely: imaginary transect counts, actual headcounts, ethnobiological interviews, and general observation. For food-habit analysis, three waterbirds, *Aythya fuligula* (Tufted duck), *Egretta alba* (Great egret), and *Sterna hirundo* (Common tern) were selected to undergo stomach analysis and actual observation. In this way, their food preferences were determined. Through local interview and actual observation, the movement of the tufted ducks around the lake as well as their time of arrival and departure were described. The lake still possesses diverse amphibious and aquatic plants which are believed to sustain the seasonal visitation of these bird migrants. However, the vigorous fishing activities in the area pose a serious threat for them.

**INTRODUCTION**

For many centuries people have observed the regular seasonal arrivals and departures of birds. Asia and the western Pacific are vast route-maps of waterbird migration paths, covering tens of thousands of kilometers. As autumn approaches, the many millions of waterbirds in the northern area depart on long journeys southwards. They pass through many Asian countries between August and November to spend the cold northern winter in milder climates on the tropical and warm temperate wetlands of eastern and southern Asia (Sonabe, 1993).

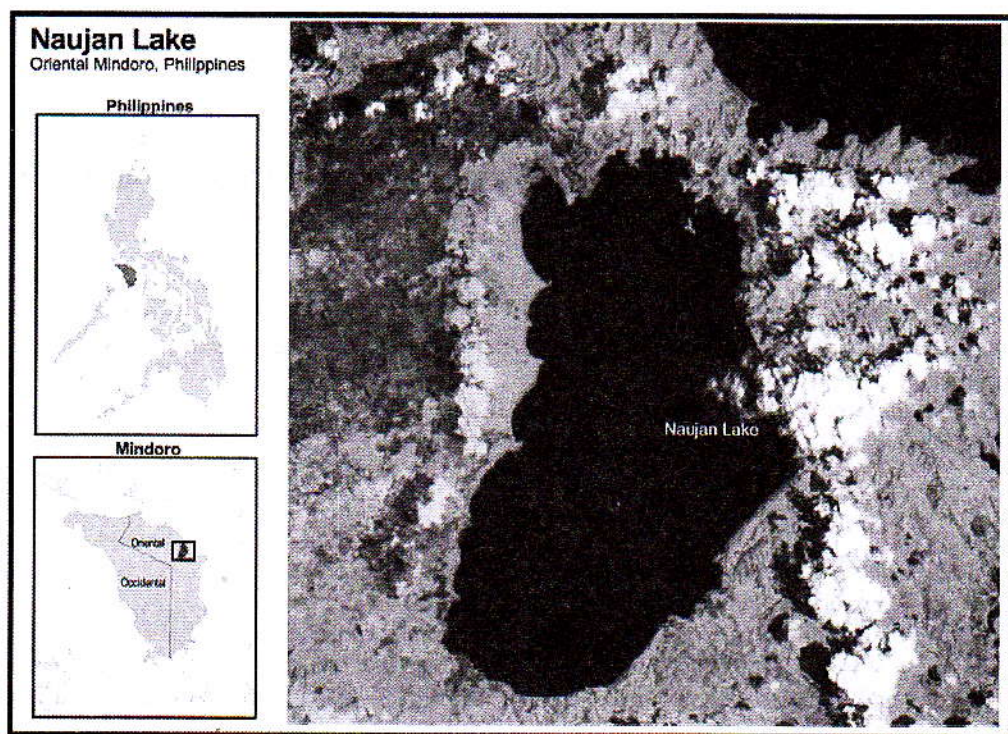
The Philippines with about 7,100 islands and 186,000 km<sup>2</sup> of land scattered over 800,000 km<sup>2</sup> of the western Pacific Ocean is the southern terminal for most of the migrants moving south east along the east Asian flyway. It is perhaps the multiplicity of small islands, reefs and shoals and the immense length of the coastline and wetlands that make it so spectacular. Of the 556 species that are on the Philippine list, 171 (30.8%) are migrants (Dickinson *et al.*, 1991). There are three major known sites in the Philippines harbouring bird migrants, namely: Na-awan, Misamis Oriental,

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**Figure 1.** Map of Naujan Lake, Oriental Mindoro, Philippines  
(Scale: 1:100,000)

Minadano; at Dalton pass, Nueva Viscaya, Luzon; and Iwahig, Palawan. Another province in the Philippines that possesses potential habitats for these migratory waterbirds is Mindoro.

Why birds migrate is still one of the most challenging questions. Very little has been published about migration in the Philippines, except what has been learned through ringing, which was described by McClure in an unpublished report, *Migration and Survival of the Birds of Asia*. Because we do not fully understand the evolutionary origins of migration and have not been able to document the behaviour of long-distance migrants enroute, there is a big need to study these birds.

Migration flights of any distance require the use of much energy in a very short time. For

this reason, there must be wetlands at either end of the flight, which can provide sustenance for waterbirds on the move. But the wetlands in Naujan Lake, although it is said to be a protected area, is endangered, due to the conversion of forest lands into agricultural lands and hampered by modern technology (such as application of fertilizers and herbicides that flow into the lake). The birds inhabiting the area are not fully recorded. Thus, before conversion of the study area proceeds, there is an immediate need for a survey. Another problem in the area concerns netting (done by fishermen as source of livelihood) and unregulated hunting during visiting season. Therefore, before these lowland habitats and waterbirds completely disappear, records must be secured. Moreover, the data and information from this study will serve as baseline information for the



preparation of a master plan and/or management plan for the protection of the lake as well as for understanding the behavior and pattern of migration in the lake.

The objectives of this study are (1) to identify the migratory waterbirds in the study site; (2) to record the food habits of the selected migratory waterbirds; (3) to determine the time of their arrival and departure in the study site; (4) to assess the effect of conversion of forested areas; (5) to know the extent of hunting; and (6) to make recommendations for their management.

## MATERIALS AND METHODS

### Study Site

Naujan Lake is the largest freshwater lake in Oriental Mindoro Province with an area of about 8,000 ha and is the 5<sup>th</sup> largest lake in the Philippines. It is located in the northeastern section of the province and is bordered by the municipalities of Naujan, Pola, Victoria and Socorro (Fig. 1). The lake is categorized by the Integrated Protected Areas System (IPAS) as wildlife sanctuary and resource reserve and is designated as "Wetland of International Importance" (see <http://www.worldlakes.org>). It is a primary lake habitat where famous freshwater fish such as "bangles", "simbad", and "langaray" can be found that serve as a possible food source of visiting waterbirds. The types of wetland ecosystem found in Naujan Lake are swamp forest, marshland, and estuaries.

### Time of the Study

The study was conducted between October 26, 1997 and February 28, 1998. Observation was done every Saturday and Sunday from 6:00 a.m. to 10:00 a.m. and 4:00 p.m. to 6:00 p.m.

### Survey techniques

A combination of survey techniques was employed in the study site to assess the presence of the migratory birds and their frequency. These were imaginary transect counts, actual headcount, general observation using field binoculars (8 × 21; 7 × 50) and ethnobiological interviews with the residents, fishermen and other stakeholders along the study site. Actual headcounts and observation were done at daylight hours between 6:00 am and 9:00 am, counting all the adults and juveniles. Identification was done based on the monographs of DuPont (1971) and Sonabe (1993) while taxonomy and nomenclature were based on Dickinson *et al.* (1991).

The food habits of selected waterbirds were determined through stomach analysis and direct observation while selection of birds was based on population size and frequency. Movement and time of arrival and departure was observed during the study period with the guidance of local fishermen in the area. Vegetation was determined by ground survey, community map sketching, and map overlays from the Department of Environment and Natural Resources (DENR) Municipal Office.

## RESULT AND DISCUSSION

### Survey

A total of 9,225 counts of waterbirds belonging to 14 species and six families was recorded and identified in the study site (Table 1). Five species were winter visitors; one as passage visitor and the rest were non-endemic resident birds which are present all year round. Based on interviews, two species (*Anas luzonica* [Philippine Mallard] and *Threskioruis melanocephalus* [Black-headed Ibis]) were present in the area, but were not encountered during the survey period.

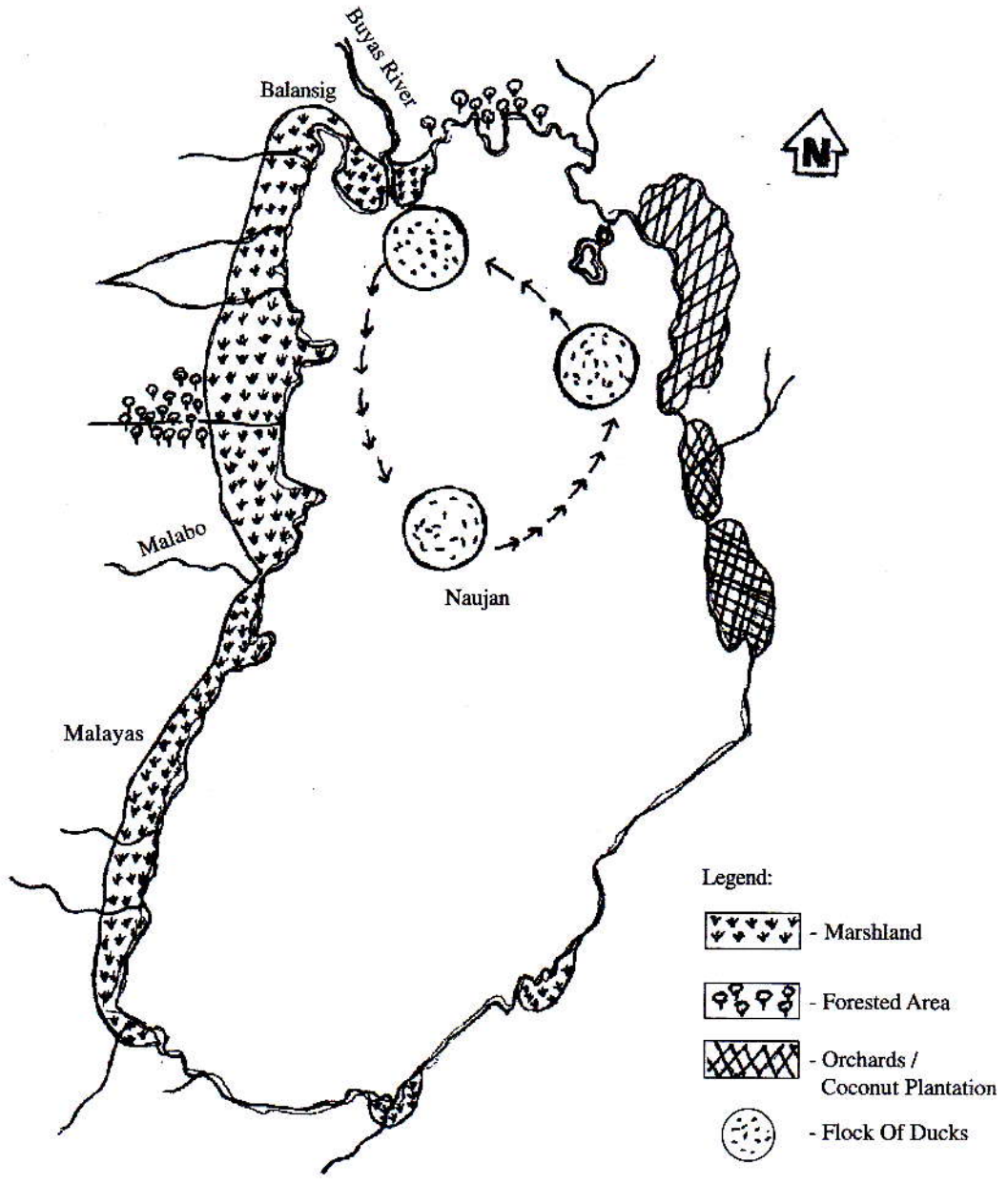


Figure 2. Movement of the *Aythya fuligula* by flocks in Naujan Lake

**Table 1.** List of birds observed and recorded from Naujan Lake, Oriental Mindoro Province, during the period of October 1997 - February 1998

Family/Scientific Name	Common Name	Counts	Mode	Status
<b>Alcenidae</b>				
<i>Halcyon chlorosts</i>	White collared kingfisher	11	Sightings	resident
<b>Anatidae</b>				
<i>Aythya fuligula</i>	Tufted duck	8944	Sightings/ caught	winter visitor
<i>Dendrocygne arcuata</i>	Wandering whistling duck	15	Sightings	resident
<b>Ardeidae</b>				
<i>Ardea sumatrana</i>	Giant-billed heron	11	Sightings	resident
<i>A. purpurea</i>	Purple heron	5	Sightings	resident
<i>Egretta alba</i>	Great egret	38	Sightings	winter visitor
<i>Ixobrychus sinensis</i>	Yellow bittern	12	Sightings	resident
<i>I. cinnamomeus</i>	cinnamon bittern	7	Sightings	resident
<b>Pycnonotidae</b>				
<i>Pycnonotus goiavier</i>	Yellow-vented bulbul	38	Sightings	resident
<b>Rallidae</b>				
<i>Gallinula chloropus</i>	Common moorhen	24	Sightings	resident
<i>Gallinula cinerea</i>	Watercock	3	Sightings	resident
<b>Rostratulidae</b>				
<i>Rastratula bengalensis</i>	Great Painted-Snipe	2	Sightings	resident
<b>Scolopacidae</b>				
<i>Gallinago megala</i>	Swinhoe's snipe	6	Sightings	winter visitor
<i>G. gallinago</i>	Common snipe	9	Sightings	winter visitor
<b>Sternidae</b>				
<i>Chlidonias hybridus</i>	Whiskered tern	32	Sightings	winter visitor
<i>Sterna hirundo</i>	Common tern	98	Sightings	winter visitor
<b>Species sighted by fishermen</b>				
<b>Anatidae</b>				
<i>Anas luzonica</i>	Philippine mallard			endemic
<b>Threskiornithidae</b>				
<i>Threskiornis melanocephalus</i>	Black-headed Ibis			winter visitor



**Table 2.** Food-habits of sample specimen from Naujan Lake, Or. Mindoro

Species	Foods	Food Guilds
<i>Aythya fuligula</i>	<i>Venus</i> sp.	Carnivore
<i>Sterna hirunda</i>	<i>Ctenogobius criniger</i>	Piscivore
<i>Egretta alba</i>	<i>C. cringer</i>	Piscivore

**Table 3.** List of important amphibious and aquatic plants still found in the Naujan Lake (Davis, 1991).

Position/mode of growth	Species
<b>Landward</b>	
Amphibious	<i>Ludwigia octovalis</i>
Emergent creeping	<i>Echinochloa stagnina</i> <i>Ludwigia adscendens</i>
Emergent	<i>Saccharum spontaneum</i> <i>Scirpus grossus</i> <i>Nelumbo nucifera</i>
Free floating	<i>Eichhornia crassipes</i> <i>Azolla pinnata</i>
Floating leaved	<i>Nymphaeae nuochali</i>
Submerged, rooted	<i>Najas indica</i> <i>Vallisneria gigantea</i> <i>Hydrilla verticillata</i> <i>Potamogeton</i> sp.
<b>Lakeward</b>	
Submerged, unrooted	<i>Ceratophyllum demersum</i>

The most abundant bird species observed in the lake was *Aythya fuligula* (Tufted duck). A total of 8,944 individuals of tufted duck were recorded on the waters of Naujan Lake. As shown in Fig. 2, three flocks of *Aythya fuligula* were often observed. The flocks were located near Barangay Malabo and Barangay Balansig, while the other was found at the northeastern portion of the lake. They were observed circling in groups at a certain time of the day around the said locations. These birds are good divers and stay throughout the day on the water.

Other interesting waterbirds observed were the terns. Two species were identified, *Sterna hirundo* (Common tern) and *Chlidonias hybridus* (Whiskered tern). They were the most active waterbirds in the area, often seen at the mudflats and grassbeds.

*Aythya fuligula*, *Sterna hirundo*, *Chlidonias hybridus*, *Egretta alba* (Great egret), *Gallinago megala* (Swinhoe's snipe) and *G. gallinago* (Common snipe) are winter visitors from either northern or southern hemisphere. They arrived at the lake and stayed for more than five months – from the first week of October to the first week of March.

### Food Habits Analysis

Three species were selected for food habit analysis: *Aythya fuligula*, *Sterna hirundo*, and *Egretta alba*. Selection was determined by their population size and frequency. Table 2 shows their specific food preference.

A whole body of fish (*Glossogobius* sp.) was recovered from the gizzard of *Sterna hirundo*. This could be the reason why most of the terns were found in shallow waters especially near the fish pen where they dive for fish. The same species of fish was found in the gizzard of *Egretta alba*. These suggest that the two species are piscivores.

Among the three, the food habit of *Aythya fuligula* is different, as indicated by gizzard content, a certain species of bivalve is the preferred food.

### Habitat Condition

The lake displays a rich diversity in terms of amphibious and aquatic plants (Davis, unpublished report), which were observed existing during the survey (Table 3). The presence of these relatively diverse aquatic plants in the lake is believed to be essential for maintaining the water quality and fish diversity that support waterbirds in the area.

Flocks of waterbirds and openland birds were often observed in the northern portion of the lake, where marshlands and associated vegetation exist. Only low numbers of birds were observed in the southern portion of the lake, where there are limited areas of marsh due to human habitation and land conversion. Most of the forest land had been converted to coconut plantation and orchards, which can be seen in the eastern and southern portion of the lake. Threat is alarming on the landward side. According to the residents, the western portion of the lake was once thickly forested, until logging concessionaires cut the trees and left only a small portion of the forest. The isolated forest is dominated by species of *Terminalia*, *Nauclea*, and *Ficus*. The whole area is covered by numerous claims (Rights or ownership of the land around the lake) despite the declaration as a National Park. Some orchard plantations are now being planted with annual crops on steep slopes, which consequently may cause siltation and eutrophication. Electrofishing is still a practice which affects the food source of waterbirds. Unfortunately, the assessment on the effect of forest conversion was not achieved due to limited data and resources.



### Bird Hunting and Trapping

Based on local interviews, from previous years, amateurs and professional hunters from neighboring municipalities and provinces made Naujan Lake a favorite spot for hunting ducks, and almost 20,000 ducks were shot in just one week of hunting. On the other hand, during the study period, waterbirds, especially the tufted ducks, were highly disturbed due to vigorous fishing activities. The use of gill nets trapped these diving ducks and killed them by drowning. Approximately 20 diving ducks every day were killed by nets and brought to the market to sell for Php 20.00/duck.

### Recommendation

The marsh and the western portions are of great value for migratory birds. Thus, protection should be focused on these areas. Following are some recommendations for the protection of migratory birds in the area: Annual monitoring and inventory of waterbirds, particularly during visitation period. Electrofishing is a destructive fishing practice in the area and should be strictly prohibited. While during visitation period of migratory bird (Oct – Mar), the use of gillnets for fishing should be avoided, particularly in the northern and western portion of the lake. Since most of the residents depend on fishing and farming as source of income, livelihood activities that will not depend on nearby resources (e.g. handicraft making) should be introduced. Swamp forest in the marshland should be rehabilitated with original flora.

Naujan Lake is a National Park, its regulations must be strictly implemented including regular monitoring and inspection. It is also suggested that a more rigorous study on the whole ecological profile of the lake must be undertaken to better describe the conservation measures for the whole lake including the use of GIS tools (as one possible way) to address the effect of forest conversion on the lake.

### SUMMARY AND CONCLUSION

The survey shows that Naujan Lake is an important stop-over for migratory birds. Its dense marshland and weed beds attracted thousands of waterbirds, especially *Aythya fuligula*. The lake still has good water quality due to the diverse amphibious and aquatic plants where fishes and other water resources are abundant for the sustenance of these migratory birds. This should not be neglected, but rather must be maintained to support the biodiversity living therein. This study suggests to conduct a more rigorous study on the whole ecological profile of the lake including its biophysical and socioeconomic profiles, to describe the conservation measures better.

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