

Full Length Research Paper

Conservation threats of cotton pygmy-goose in Assam, India

S. Upadhyaya^{1,2*} and P. K. Saikia¹

¹Department of Zoology, Gauhati University, Assam, India.

²T. H. B. College, Karchantola, Sonitpur (Assam), PIN-784189, India.

Accepted 7 May, 2010

The cotton pygmy-goose (CPG) *Nettapus coromandelianus coromandelianus* Gmelin is an environmental indicator species among the anatids. Its population is going to be more or less vulnerable when threatened from the chance events such as severe weather, diseases and other natural as well as anthropogenic factors. The present study was conducted to have a detailed look over the factors responsible for the population decline in certain wetlands in Assam, India, from June 2006 to January 2009. Various factors have been recognized to have effects over the CPG population and are categorized as biological, social, natural, political and perceptual factors. The most affecting forces are found to be the social factors which have both direct and indirect effects. Of the direct threats, it was observed that 88.4% of the hunting cases were done for consumption, 3 for fun, 8.2 for selling and 0.4 for associated economic loss. Economic hardship has led to felling of nesting trees in 37.2% of the cases, while about 48.1% of the people use these as their source of income. About 13% exploit them for fuel and about 1.7 percent of them who cut the nesting trees for construction purposes are the major indirect threats for Cotton Pygmy-goose conservation. A compelling rational and effective strategy for the least concern species will require an increasing recognition that most of the contemporary extinction problems are associated with socio-economic and political forces.

Key words: Anthropogenic, biological, cotton pygmy-goose, *Nettapus coromandelianus* gmelin, natural, perceptual, political, social.

INTRODUCTION

Many ecological factors affect waterfowl breeding, such as climate, hydro-period and temporal availability of suitable food (Baldassarre and Bolen, 1994). The Cotton Pygmy-goose (CPG) is a cavity-nester that uses hollows of mature trees at close proximity to the wetland. The CPG ducklings are precocial and leave the nest on the day of hatching (Ali and Ripley, 1983).

The serious fluctuation and decline of CPG population throughout its range is attributed to poaching, human disturbance, habitat destruction, etc. A compelling rational and effective strategy for the least concern (Birdlife International, 2004) species will require an increasing recognition that most of the contemporary extinction problems are associated with socio-economic and

and political forces. This socio-economic basis of the problem is evident while assessing the causes of most species declination and should essentially constitute an important consideration in the formulation of species recovery efforts (Saikia, 1995). The majorities of causes are associated with human related factors and are the primary causes for the decline of this species. The objective of this paper is to analyze and evaluate the various biological, social, political, perceptual and natural factors contributing in life threat and decline of the species. Moreover, both new and previous studies of Cotton Pygmy-goose were synthesized and summarized.

Study area

Assam, the North-Eastern part of India, is located within 24°09' to 27°58' N latitudes and 89°42' to 96°01' E

*Corresponding author. E-mail: sanjib1970@sify.com.

Table 1. List of wetlands selected from the studied conservation threats of the CPG in Assam.

Wetlands	District	Area (in hectares)	Wetland type
Samarajan	Dhemaji	45.00	Open water
Bordoibam-Bilmukh	Dhemaji-Lakhimpur	1,124.78	Ox-bow
Satajan-Pahumara	Lakhimpur	16.36	Open water
Dhandi	Sonitpur	15.70	Open water
Sahala	Sonitpur	100.00	Open water
Kankati	Sonitpur	97.50	Open water
Kadamani	Sonitpur	15.00	Ox-bow
Dighali	Sonitpur	165.00	Open water
Ajala suti	Sonitpur	24.00	Open water
Ouguri	Sonitpur	14.00	Open water
Kuwari	Sonitpur	6.64	Open water
Borsola	Sonitpur	115.00	Ox-bow
Belsiri	Sonitpur	452.00	Open water
Rikamari	Sonitpur	57.00	Ox-bow
Boalmari	Sonitpur	155.00	Ox-bow
Gajalmari	Sonitpur	90.00	Ox-bow
Total area =		2,492.98	

longitudes, and covered an area of 78,523 km². Sixteen wetlands of Sonitpur, Lakhimpur and Dhemaji districts were selected for the study on conservation of Cotton Pygmy-goose (Table 1). Physically, a massive part of the state is covered with evergreen and semi-evergreen type of forests accounting for less than 20.52% of its area. The state has the tropical semi-evergreen forest along the 'bhabar' tract in the 'duars'. A speciality of this type of forest is the domination of the Sal tree (*Shorea rubusta* Gaertn.). These forests can be described as 'Eastern Hill Sal Forest', 'Eastern Bhabar Sal Forest' and 'Kamrup Sal Forest' (Champion and Seth, 1964). In Assam, there are 3,513 (both registered and unregistered) wetlands (area covered 101,231.60 ha) with the maximum number (379) in Nagaon, followed by 352 in Kamrup, 340 in Cachar, 330 in Golaghat, 233 in Dhubri and so on and with the minimum (10) in N.C. Hills. There are a large number of 'beels' (ox-bow lakes) and 'haors' (wetland complex in Barak Valley) with swamps and marshes in the fringe areas throughout the Brahmaputra and Barak Valleys.

METHODOLOGY

Monitoring for conservational studies of CPG was made in each selected wetlands of the study area from 2006 to 2009. The threats of the species in the study area were investigated and noted down in tabular form. The factors responsible for the survival of the CPG were investigated and noted down and they were ranked as per intensity. The criterion for level of threat (LT) is based on Collar et al. (1994). Data on uses and threats at each wetland sites were collected on a standardized form prepared for the purpose. The data on conservation of CPG were reported in graphical form in each wetland. The frequency of the threat factors and population size of the Cotton Pygmy-goose was correlated to evaluate the impact of the threats. The conservation measures were proposed

for the species with prior discussion to the local community.

RESULTS

The breeding success of CPG was found to vary from year to year during the study period. The conservation problems, its nature and intensity are related to the traditions of the various ethnic groups inhabiting the various habitat types in the species' distribution range. Most of the basic patterns look extremely similar, but rates differ significantly in various localities, resulting in a local decline or extinction of the species from several places. The basic conservation problem is almost identical all over South Asia, but tradition and social psychology of the wildlife conservation in regional societies is found to be significantly different in Assam, India, from other countries of South Asia. The problems, which are related with the threats, are sub-divided into five major types and each of which was a combination of several interacting factors (Table 2).

Biological factors

The permanency, durability (life of the wetland) and food potentiality of the wetland habitats basically depend on water discharge and flow of water through the wetland, which help the self purification and fertility of land and habitat. The existing wetlands are over-exploited by ever increasing human population especially from extensive agricultural practices.

The CPG suffers food shortage in different seasons of the year and in different habitat types in the region. The

Table 2. Different threats of Cotton Pygmy-goose in the study area, 2006 - 2008.

Biological threats	Political threats	Social threats	Natural threats	Perceptual threats
*Loss of feeding habitat	*Conversion of wetlands for other purposes	*Hunting	*Social interaction of CPG	*Lack of perception of the species
*Loss of nesting habitat	*Minimum effort to conserve the species	*Trapping	*Low parental care	*Inadequate evaluation of social benefits of the species
*Food shortage	*Lack of well defined	*Killing of the adults and goselings	*Starvation	*Lack of empirical and numerical assessment of their value etc.
*Competition	*Protective measures	*Egg poaching	*Drop out from nest after hatching	
*Lack of scientific study etc.	*Lack of specific conservation related works etc.	*Disturbance etc.	*Predators * Diseases *Environmental digesters etc.	

loss of feeding ground coupled with drastic changes of prey species has eliminated several past nesting sites. These factors are responsible for CPG's food shortage in the wetland habitats. The nesting habitat and old nesting trees such *Dillenia indica*, *Albizia lebbek*, *Barringtonia acutangula* and *Bombax ceiba* are alarmingly declining from rural and privately owned lands. The growing match factory, plywood industry, saw mills, fire wood essentials and aiding materials of building construction consumed most of the nesting trees. Widespread poverty and need to exploitation of these resources are major income sources of rural people. The low per capita income and hard financial crisis often render species preservation efforts as an impractical luxury. While renewal of these nesting trees require several years, the life span of the CPG is less than that.

The lack of proper scientific study regarding the

ecology and biological requirements of the species are completely in dark and as a result, unknowingly eroded some of their major resources.

Political factors

The political aspect of CPG conservation is a major hindrance throughout the study area. Except a few, most conservation efforts have elements of vested interests. The conservation approach that motivated people was master-minded by influential political people of a specific political orbit (Saikia, 1995). The real solution of the problem of endangered species is suppressed and ultimately, is greatly suffered by the species in question. However, the CPGs are no exception. In view of the development, most of the ecologically viable landscape and wetland resources have

been altered drastically in the study area and the Brahmaputra valley as a whole, and as a result, they often disregard public sensitivity. A few wetlands are converted to fish culture ponds under NREGA (National Rural Employment Guarantee Act, 2005) with strong political backing. Notably, the Kadamani and Ouguri wetlands are already in the process of conversion. Strong protest by the public in this regard has delayed the process, which is a supposed good sign for conservation of CPG.

Social factors

Several social factors are found to have some strong impact on the conservation of CPG in Assam. The author has identified six main causes that have contributed to the conservation problem such as economic hardship, family requirement,

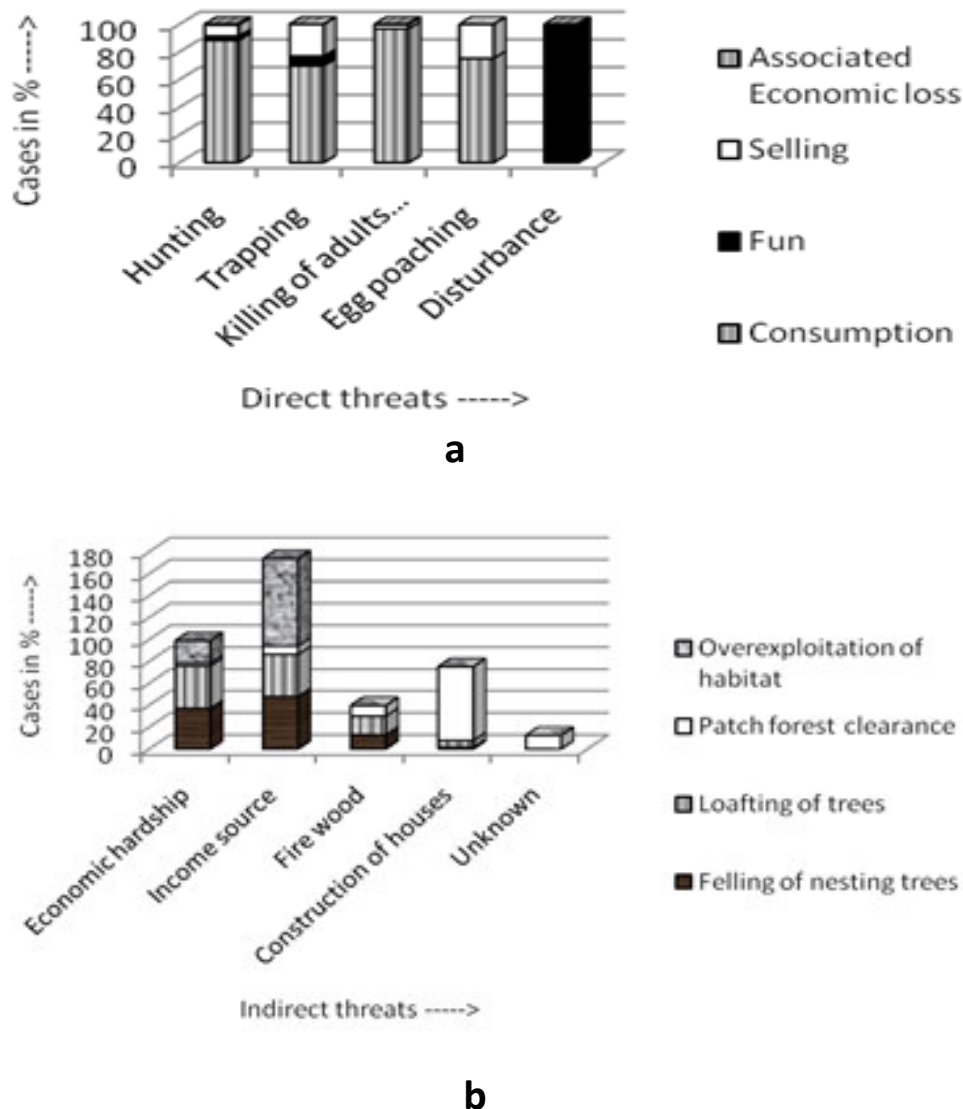


Figure 1(a). Direct and (b) indirect threats of CPG in Assam, 2006–2009.

lack of awareness for conservation of the species, killing the birds as well as destruction of their nesting habitats together with trapping, hunting, etc. The direct threats of CPG conservation are identified as: (i) hunting, (ii) trapping, (iii) killing the adults and chick, (iv) taking out eggs from the nest (egg poaching) and (v) disturbance (Figure 1a and b).

Direct threats

Hunting

Hunting of adult and goslings of CPG in feeding habitats are found to be a major threat in the study area. The most serious threat is from indigenous tribal people and

Nomadic tribes of the areas. Groups of (middle and young aged) Miri, Bodo, Mishing and Santal communities were found to engage in group hunting in the study areas. It was observed that 88.4% of hunting cases were done for consumption, 3 for fun, 8.2 for sales and 0.4 for associated economic loss as they were found to feed on the Boro rice (a local variety of rice).

Trapping

Trapping of CPG is found to be prevalent among the local tribes of Sonitpur and Dhemaji districts. About 55% trapping activities by the local tribal people were observed from Sonitpur district alone and was done by netting (Tangi jal). The statement made by the local

Table 3. Factors affecting mortality rate of CPG in Assam, 2006-2009.

Mortality factors	Examples	Wetland areas under effect	Intensity
Anthropogenic	Poaching (adult, goselings and eggs)	ABCDEFGHIJKLMNP	+++
	Cutting of nesting trees	ABCDEFGHIJKLMNOP	+++
	Habitat exploitation	ABCDEFGHIJKLMNOP	++
Natural	Physical injury during dropout	AFGIL	+
	Rainstorms, cyclones	BCN	+

*A = Ajalasuti, B = Belsiri, C = Boalmari, D = Bordoibam, E = Borsola, F = Dhandi, G = Dighali, H = Gajalmari, I = Kadamani, J = Kankati, K = Kuwari, L = Ouguri, M = Rikamari, N = Sahala, O = Samarajan and P = Satajan. Intensity: + low, ++ medium, +++ high.

people also confirms that the decline of CPG population in Sonitpur district is due to trapping of the bird by the local tribes.

Killing of adults and goslings

Killing of adults and goslings in wetlands are done by the local tribal people (including Santals) during winter season. They use tactic spear and air gun for this purpose. About 53% of killings were done by the Santals and a total of about 96.8% goselings and adults were collected for consumption. Other indigenous nomadic tribes and tribal people, such as Bodo, Mishing, etc. are also found to kill adults as well as goselings in the wetlands. The main purpose of these killings is consumption.

Indirect threats

Four indirect threat factors were found to affect the CPG population seriously such as felling of nesting trees, clearance of forest patches, loafting of trees and overexploitation of the habitat area. Most of the rural people cut down the nesting trees for several unavoidable reasons. Economic hardship has led to felling of trees in 37.2% of the cases, while about 48.1% of the people use these as their source of income. About 13% exploit them for fuel and about 1.7% of them cut the nesting trees for construction purposes (Figure 1b). However, there are some other unknown factors which also contribute to this overall scenario.

Natural factors

Various natural factors such as social interaction of CPGs, storms, low parental care in the wetland and starvation deaths have accelerated the intensity of conservation threats. Occasional hailstorms during nesting season of CPG destroy nesting tress and eggs. The death of goselings during drop out from the nest on

the day of hatching is another major natural cause of population decline.

Perceptual factors

The lack of perception regarding importance of the conservation of wildlife among the people has been found to be a major hindrance in the conservation movement. Proper valuation of the species in regards to human benefits, anthropomorphic and psychological factors were found to be extremely important for the conservation of the species. The species is least concern, not because of its biological inadequacy, but because global population trends have not been quantified and the species is not believed to approach the thresholds for the population decline criterion of IUCN Red List.

DISCUSSION

Eight threat factors identified so far during the present observation are affecting the wetlands, thereby affecting the survival of CPG (Table 3). Their extinction, though a long term event, can be considered a two phase process and the primary factors can cause initial population reductions at broad spatial scales. The finding of the present study shows that the primary factors were already affecting the survival of the CPG. If the population have declined, secondary threats are likely to affect the species. Again, with a longer life-span and reduced reproductive rate, ecological naivety and lower resistance to new diseases will take place (Temple, 1985).

As per the level of effect of a particular wetland is concerned, the mostly affected wetland is Borsola which is affected by almost all the factors except sedimentation. The cutting of the nesting trees and human exploitation of the wetland is in the highest level in 2007. The wetlands, Belsiri, Boalmari, Bordoibam, Dighali, Kadamani and Ouguri are the second highest affected wetlands (Figure 2). However, the factors affecting the wetlands varied with different intensity levels. The Ajalasuti, Dhandi, Gajalmari, Kankati and Sahala wetlands are in third

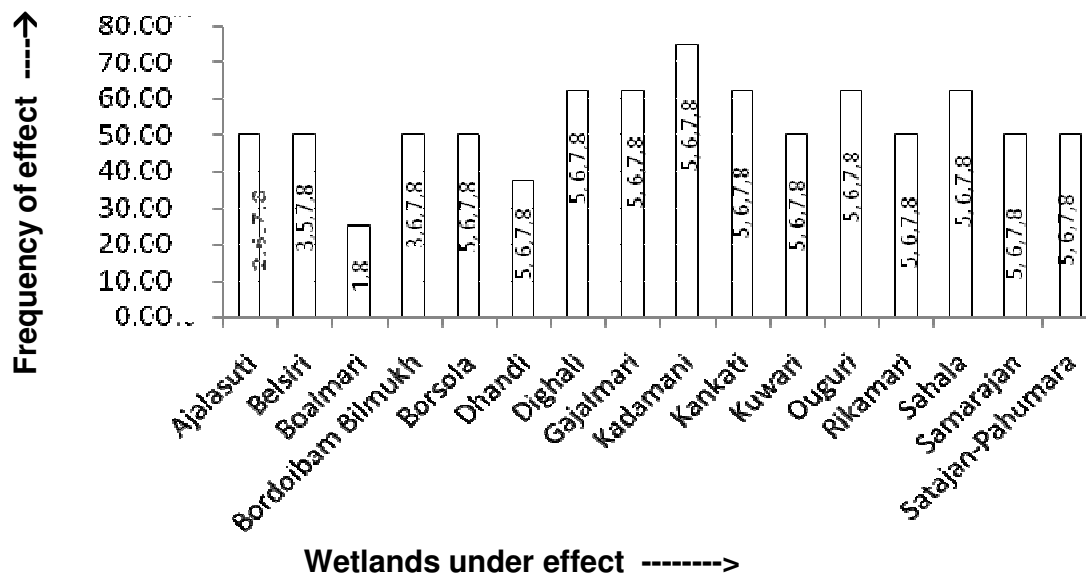


Figure 2. Frequency of threat effect on different wetlands of Assam, 2006 – 2009. (Numbers in blocks indicate the individual factors, such as 1 = Sedimentation, 2 = Excessive growth of vegetation, 3 = Cutting/clearance of vegetation, 4 = Eutrophication, 5 = Excessive cattle grazing, 6 = Poaching, 7 = Human exploitation and 8 = Cutting of nesting trees).

Table 4. Intensity of threats on wetlands of Assam, 2006 - 2009.

Threats/Wetlands*	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1. Sedimentation	-	-	+++	++	+	-	++	++	-	-	-	-	++	-	-	-
2. Excessive growth of vegetation	+	+	-	-	+	++	-	-	++	+	-	+	-	+	+	+
3. Cutting/clearance of vegetation	-	+	+++	++	++	-	+	-	++	-	-	-	-	-	-	-
4. Cutting of nesting trees	+++	++	+++	+++	+++	+	+++	++	+++	++	+	+++	+++	+	+	+
5. Eutrophication	-	-	-	-	-	-	-	-	-	-	+++	+	-	-	-	-
6. Excessive cattle grazing	+	++	+++	+++	++	++	+++	+	+++	++	-	++	-	++	+	-
7. Poaching	+++	++	++	+	++	++	+++	+	+++	++	+	++	+++	+++	-	+
8. Human exploitation	+++	+++	+++	+++	+++	+++	+++	++	+++	+++	++	+++	+++	++	+	+
Wetland category as per threat effect	III	II	II	II	I	III	II	III	II	III	IV	II	IV	III	IV	IV

*A = Ajalasuti, B = Belsiri, C = Boalmari, D = Bordoibam, E = Borsola, F = Dhandi, G = Dighali, H = Gajalmari, I = Kadamani, J = Kankati, K = Kuwari, L = Ouguri, M = Rikamari, N = Sahala, O = Samarajan and P = Satajan. Intensity: + low, ++ medium, +++ high, - no affect.

position, while the Kuwari, Rikamari, Samarajan and Satajan wetlands are less affected by the factors mentioned above (Table 4).

The conservation threats appear to be almost similar in different wetlands and nearby places of the study area. There is absence of a well defined conservation ethic in the study area. The local Assamese people inhabiting in the areas has long tradition of wildlife conservation. Majority of wild animals are linked with religion and social psychology and therefore, they protect all wild animals. In the rural area, people morally support and protect the CPGs from the hunters and trappers, but this psychological bondage is gradually being lost due to

involvement of a separate psychologically dominant immigrant culture. Rapid change in social psychology towards the destruction of natural resources has broken at the long existing conservation ethics. The economic imbalance among different classes of people and population explosion in recent years has led to overexploitation of ecologically viable natural habitats and landscapes. The people that inhabit in such a situation systematically cleared huge patches of forest and sell them in the market and utilize the land for settlement. The same is true for the old-aged trees in the nearby areas of wetlands. The small scale industry like brick factory in the vicinity of wetlands and match factory has eliminated

Bombax and *Ficus* trees (Saikia, 1995; Talukdar, 2003).

To mitigate the problems of conservation of CPGs in the study area, there must be some limitations in the utilization of natural resources. The success of CPGs species efforts in the species distribution area will also depend on the emotional conviction of the general population. Local support potentiality can be enhanced by active public involvement in the management of species preservation.

The present findings on threat factors are more or less similar to the factors classified by Diamond (1984). The reason behind the decreased number of population of CPG during the recent years might be: (i) human exploitation, (ii) cutting of old aged trees which they use for nesting, and (iii) habitat loss. Moreover, predatory activities of common myna (*Acridotheres tristis*), barn owl (*Tyto alba*) and certain egg eating snakes (such as *Naja naja*, *Python molurus* etc.) also increases the natural loss of their population. The present findings were more or less similar to the findings of Diamond (1984). Once the population is sufficiently reduced or isolated, it becomes increasingly vulnerable to secondary threats. These threats are primarily stochastic ones, in that acting on even large population can lead to extirpation. The CPG is highly vulnerable to demographic and environmental stochasticity and catastrophes (Upadhyaya, 2010). All these threats must be adequately addressed to ensure species viability. About 50% of the studied area is suffering from poaching activities, while habitat loss is the main cause for its destruction in 93.8% of the area.

Demographic stochasticity is the effect of random events on the reproduction and survival of individuals. It is usually considered that it would affect only a small population (Meffe and Carroll, 1997). Both the demographic and environmental stochasticity may have important influences on viability of CPG. Disease, environmental disasters, and anthropogenic threats also pose serious risks. These catastrophic threats can be reduced by: (1) having many populations that are geographically spaced to decrease the chance of a catastrophe affecting all populations; (2) having birds on other wetlands or lakes that provide more protection from storms and (3) developing post-disaster contingency plans to restore populations affected by catastrophes. Again, the recovery strategies may include the habitat restoration, translocations to other wetlands of geo-graphically isolated region and prevention of any harmful alien species introduction to the habitats supporting CPG.

Habitat restoration

Due to recent developmental activities and other activities like agriculture, jhuming cultivation, etc., the nesting and foraging areas of the CPG has decreased abruptly, and can only be restored with the proper awareness of the people in response to the ecological benefits of the

species. The mass public of the areas should be informed with the value of the species as bio-indicator for the wetland condition. However, the people of the studied area had participated in several public meetings for their awareness.

Translocation

Habitat restoration and the establishment of additional wild CPG populations on the wetlands of other regions will not only reduce the geese's risk of extinction, but also help to restore missing components of the Assam's ecosystem. Translocation of CPG to the wetlands of other regions may;

- (1) Reduce overcrowding during periods of high density.
- (2) Reduce the risk of extinction due to random stochastic events.
- (3) Restore the goose to ecosystems where CPG previously existed.
- (4) Act as temporary safeguards in areas free of threats.

The CPG is adapted to a very harsh environment and flexible in its foraging behavior, which helps in translocation of the species easily, if required. Translocation success is highest with wild-caught animals from high density and increasing source populations (Griffith et al., 1989). These conditions are normalized for the CPG population. Birds should be removed when populations are increasing. Taking juvenile birds will probably have the least significant impact on the population, while removal of older birds, especially adult females, could cause a decline in the source population by decreasing production. Additional research work is needed to determine the causes for the low number of females breeding successfully, and for duckling mortality. Notwithstanding, management to increase duckling survival should be explored.

For a successful translocation, the primary threats that led to the species' initial extirpation must be controlled. Poor habitat quality is the most common reason for the failure of translocations (Griffith et al., 1989). In the case of CPG, mammalian predators in remote places of the study area has been identified as the primary limiting factor and will need to be controlled at proposed translocation sites. Sufficient food, water, vegetation cover and breeding sites must be available at the release location.

The present study and observation indicates that despite a wide range of wetland habitats, CPG uses select only a few generalized wetlands with vegetation cover as well as an open area with submerged vegetation. The CPG is a habitat and diet generalist (Upadhyaya and Saikia, 2010) that is perhaps specialized opportunistically. The general requirements of the CPG include vegetative cover, an abundant prey base (during

breeding season), an open area with clear and transparent water and the absence of mammalian predators. Extirpations on its habitat area were, most likely, due to introduced mammalian predators, and mammalian predators may be the most important factor limiting their population.

Steps like habitat improvements and increasing their carrying capacity as well as their brood rearing habitats (the nesting trees close to the wetlands) should be taken to minimize the risks. Nest box utilization can be introduced in certain cases like the other wood ducks so as to provide maximum breeding grounds. Translocation of wild fledged juveniles can be one of the most desirable and feasible method for establishing new populations to reduce the extinction risk if the species limits its dispersal. Removal of wild eggs and captive propagation may also be applied for conservation with minimal impact on the source population.

During the present study, the following measures were taken to strengthen the conservation of CPG in the wetlands of the study area:

- (i) Several public meetings were arranged to give awareness to the local people.
- (ii) Leaflets/brochures were published and distributed in the study area. Leaflets were also distributed in other places of Assam.
- (iii) The local people were categorized as cultivators, service holders, senior citizens, etc., and conservation measures were tried at each group at their group level. Habitat restoration was preferred as it keeps the habitat quality for CPG population.

ACKNOWLEDGEMENTS

The authors thank the State Forest Department, Assam, for their cooperation and support. Also, they thank Mr. Homnath Pokhrel and Mr. Biren Sahani for their help during data collection.

REFERENCES

- Ali S, Ripley SD (1983). Handbook of the Birds of India and Pakistan. Compact Edition. Oxford Univ. Press, New Delhi (Revised Edn.) 42: 737.
- Baldassarre GA, Bolen EG (1994). Waterfowl Ecology and Management. John Wiley and Sons, Inc., New York 49: 342.
- Birdlife International (2004). *Nettapus coromandelianus*. In IUCN 2007. 2007 IUCN Red List of Threatened Species. CD ROM.
- Collar NJ, Crosby MJ, Satterfield AJ (1994). Birds to watch 2: The world list of Threatened Birds. Birdlife International, Cambridge.
- Diamond J (1984). Historic extinctions: a Rosetta stone for understanding prehistoric extinctions, in PS Martin and RG Klein, (Eds.). *Quaternary Extinctions: A prehistoric Revolution*. University of Arizona Press, Tucson, AZ.
- Griffith B, Scott JM, Carpenter JW, Reed C (1989). Translocation as a species conservation tool: status and strategy. *Science* 245: 477-480.
- Meffe GK, Carroll CR (1997). Principles of Conservation Biology. 2nd Edn. Sinaur Associates, Sunderland, MA pp. 1-134.
- Saikia PK (1995). Ecobiology of Adjutant Storks with Special reference to *Leptoptilos javanicus* (Horsfield) in The Brahmaputra valley Assam. Ph. D. Thesis, Gauhati University, Guwahati, Assam, India. pp. 1-357.
- Talukdar BK (2003). Food and Feeding Habitat of the White-winged Duck in Assam. *TWSG News* 14: 77-78.
- Temple SA (1985). Why endemic island birds are so vulnerable to extinction. in S. A. Temple, (Ed.) *Bird Conservation 2*. University of Wisconsin Press, Madison, WI pp. 3-6
- Upadhyaya S (2010). Eco-Biology of Cotton Pygmy-goose (*Nettapus coromandelianus coromandelianus* Gmelin) in some wetlands of Assam, India. Ph.D. Thesis, Gauhati University, India. Unpublished.
- Upadhyaya S, Saikia PK (2010). Food and feeding in Cotton Pygmy-goose. Presented at 55th Technical Session, Assam Science Society, Assam, India.