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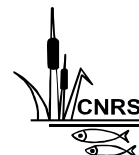


RRRC

Wildlife Baseline Survey of Madhur Chhara Watershed in Ukhiya, Cox's Bazar



In Collaboration with



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ACRONYMS

VC= Very Common

UC= Uncommon

C= Common

R= Rare

Rs= Resident

SM= Summer migrant

WM= Winter migrant

IUCN red list categories:

CR= Critically Endangered

EN= Endangered

VU= Vulnerable

NT= Near Threatened

LC= Least Concern

DD= Data Deficient

NE= Not Evaluated

IUCN= International Union for Conservation of Nature

BD= Bangladesh

Z1= Zone 1

Z2= Zone 2

Z3= Zone 3

Z4= Zone 4

Z5= Zone 5

SL= Serial Number

TN= Transect

WS=Wildlife Sanctuary

NP= National Park

ha= hectares

UN = United Nations

EXECUTIVE SUMMARY

Historically, much of the Teknaf Peninsula was covered in forests rich in wildlife. In this area recent surveys still reported a high diversity of wildlife in Teknaf Wildlife Sanctuary and Sheikh Jamal Inani National Park. The Madhur Chhara basin near to these two protected areas was previously forested but forests had been degraded by local human pressures, and this forest has largely disappeared due to an influx of over 742,000 Rohingya refugees in 2017-18¹, who continue to live here in large camps. The Madhur Chhara originates from the forested hills of Ukhiya upazila, and flows through cropland, wetlands, settlements, and refugee camps before joining the tidal Naf River. Along its 8 km course the Madhur Chhara is fed by several smaller tributaries. The upper part of the catchment comprises remnant forest, wetlands, cropland and settlements; the middle reach falls under the refugee camps; while the downstream section is dominated by settlements including markets, cropland, and fishponds in tidal zone. The middle reach of Madhur Chhara cuts across 12 refugee camps (camp-1W, camp-1E, camp-2W, camp-2E, camp-3, camp-4, camp-4 ext., camp-5, camp-6, camp-7, camp-8W and camp-8E) where over 600,000 refugees now live, and hence this part of the catchment is denuded and affected by anthropogenic pressures such as pollution.

With support of UNHCR, CNRS conducted a brief baseline wildlife survey in October 2020. The basin was divided into five zones (two within refugee camps, one large zone upstream of the camps and two smaller zones downstream), and nine transects with a combined length of 20.7 km were surveyed along a mix of existing paths and streams at locations purposively selected to represent the range of habitats from remnant forest and wetland to recently restored riparian vegetation to dense refugee settlement to farmland and the Naf River estuary. Amphibians, reptiles, birds and larger mammals were selected as the most readily monitored faunal groups that could be directly observed by walking each transect two times (early morning between 6h00 and 10h00) and in the evening/early night between 18h00 and 21h00). Except that amphibians and reptiles were searched for in 23 purposively selected 10x10m patches near these transects. Observations were supplemented by information on species reported in group discussions to have been recently seen or heard by refugee and host communities. The study aimed to develop a wildlife profile for Madhur Chhara basin, to compare zones, and to identify threats and ways forward for rejuvenating degraded ecosystems and biodiversity.

The survey resulted in species lists for each transect, zone and the overall basin. From this type of brief survey population estimates were not possible, but some subjective assessments of abundance were made. A total of 135 species of vertebrate wildlife (amphibians, reptiles, birds and mammals; fish were not covered as this would have required different surveys and longer-term monitoring) were recorded from Madhur Chhara basin, where 63% (86) were birds, 16% (21) reptiles, 12% (16) amphibians and 9% (12) mammals. Most of the species recorded are widespread and common within Bangladesh, but 16 are considered notable including two threatened and five near-threatened species for Bangladesh (two are globally threatened), the other nine species are less common and restricted to forest or bushy-thickets. None of these species were recorded in Zone 3 (main camp area). Asian Elephant was reported to occur although its regular routes have been blocked by the camps and it may be lost from the basin. Records of species such as Bengal Monitor, Golden Jackal, Jacobin Cuckoo, Large-tailed

¹ UNHCR, 2019, <https://www.unhcr.org/rohingya-emergency.html>

Nightjar and Puff-throated Babbler indicate that remaining bushy-thickets are of wildlife value and their presence in Zone 2 in the riparian restoration area is an early indication that this is preserving or even attracting back wildlife to the camp extension area. The highest numbers of wildlife species were recorded in Maskaijja area (Zone-1) in the upper reach of the Madhur Chhara basin (better forest cover and wetlands) followed by the downstream tidal reach (Zone 5) - both forested and non-forested areas. The lowest zone is in a tidal area with mangrove patches, cropland and wetland inhabited by saline and fresh water species, . Both these zones are located away from the camps and have a higher diversity of habitats, low settlement density and lower human disturbance.

Riparian and stream ecosystem rehabilitation activities of UNHCR-CNRS aimed at restoring tree cover and protecting shrubs and bushes on the bank sides of streams and storing surface water had been taken up in Zone 2 for about a year before the survey. The results suggest there has already been some recolonization of this area since there was a higher diversity of wildlife within camps where stream and riparian ecosystems are being restored along Kalam Chhara (tributary of Madhur Chhara). Along Kalam Chhara restoration site (Zone 2) 76 species were recorded, while only 34 and 36 species were observed in the camp areas (Zone 3) and immediate downstream area (Zone 4) respectively. The highest amphibian diversity (15 species) was recorded in Kalam Chhara area.

Hunting, direct persecution of wildlife, habitat degradation, heavy road traffic, pollution, clearing of undergrowth, and weak law enforcement are the main threats to wildlife in the basin. The following urgent measures are recommended to protect and enhance wildlife: continuing habitat restoration with planting of native trees, including vegetative bank stabilization rather than concrete channels; restoration and protection of shrub-bush habitat and undergrowth in forest patches; awareness building and environmental education among children and adults of both refugee and host communities; pollution control; limiting night-time traffic movement; and stronger law enforcement.

Based on the comparative results, it is also recommended to restore/create “wildlife/biodiversity corridors” along streams to connect fragmented forest patches, using undergrowth-shrub vegetation and saplings, within camps and between camps and adjacent forest areas. This would enlarge wildlife habitats and enable movement and re-colonisation of diverse wildlife species. Separately, or within these corridors some areas could be designated and transformed into “biodiversity parks” with the aim of encouraging local communities and refugees to visit responsibly and learn about conservation and protection of natural ecosystems and biodiversity. Lastly the surveys form a comparative baseline for wildlife diversity within and outside the camps, and the same transects should be monitored annually to track changes in wildlife diversity.

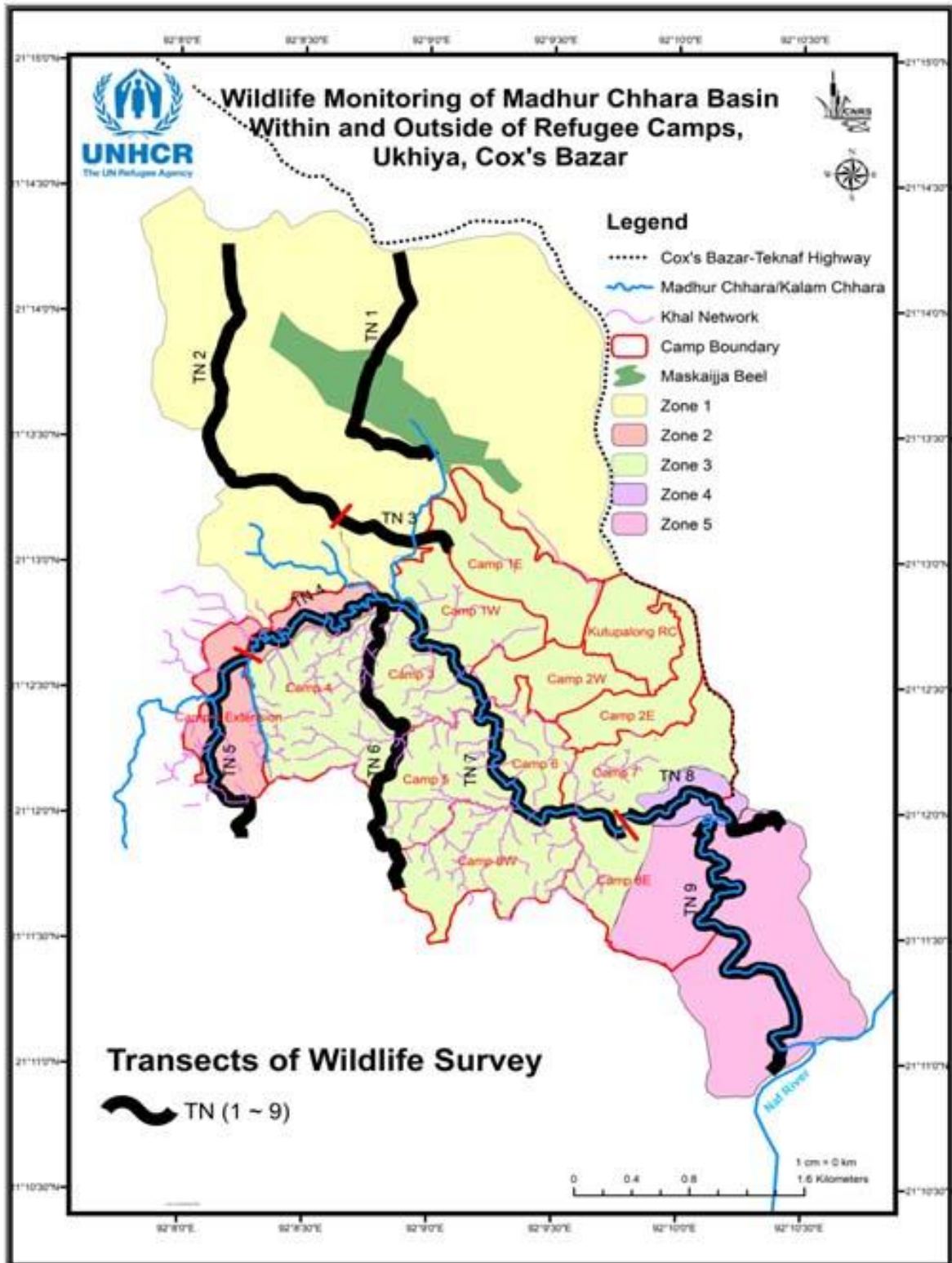


Figure 1: Madhur Chhara Basin with Transect Survey Line Locations

1. BACKGROUND

The forest land in Ukhiya and Teknaf upazilas was covered by tropical evergreen and semi-evergreen forests dominated by Garjan (*Dipterocarpus* spp.) occurring in deep valleys and shaded slopes (IUCN Bangladesh 2002). Despite degradation, this forest area is still biodiverse with many different wildlife species including megafauna like Asian Elephant (*Elephas maximus*). It is claimed that more than 50% of the country's wildlife species live in the forests of Ukhiya, Teknaf, Inani and Himchari within Cox's Bazar South Forest Division (UNDP and UN Women, 2018). The entire Madhur Chhara basin was included within reserve forest adjoining Teknaf Wildlife Sanctuary (WS) in the southwest and Sheikh Jamal Inani National Park (NP) in the west.

Teknaf WS covers 11,614 ha, it is a tropical ecosystem classified as hill forest consisting of evergreen and semi-evergreen species (IUCN Bangladesh 2002). The sanctuary is home to 27 species of amphibians, 54 species of reptiles, 243 species of birds and 43 species of mammals (Feeroz, 2013), including ten nocturnal terrestrial mammal species (Feeroz et al. 2012). Although Ahsan and Haidar (2017) reported 210 bird species from Teknaf WS. However, it should be noted that in these publications and those for Sheikh Jamal Inani NP (see next paragraph) some records come from coastal areas outside of the protected areas, some species reported have not been verified, and no attempt has been made to consolidate authoritative species lists from a range of sources. Uddin et al. (2013) recorded 535 angiosperm plant species, comprising 178 herbs, 110 shrubs, 150 trees, 87 climbers and 10 epiphytes from the sanctuary.

The Sheikh Jamal Inani NP covers 7,085 ha also falls under the evergreen and semi-evergreen tropical forest zone. However, the area considered to be "high" (mature) forest has shrunk from 70% to less than 30% of the NP in the last three decades (Feeroz 2016). So far 443 plant species from 93 families have been identified from the park comprising 140 herbs, 85 shrubs, 151 trees, 60 climbers and seven epiphytes (Feeroz 2016). This forest is reported to be home to 29 species of amphibians, 58 species of reptiles, 253 species of birds and 39 species of mammals (Feeroz 2016). However, Ahsan and Haidar (2017) recorded 187 species of birds from the park, while Kabir et al. 2017 confirmed the occurrence of the Indian Leopard (*Panthera pardus*) from the park. Furthermore, Kabir et al. (2019) reported 29 species of mammals and 251 species of birds from the NP.

Some 871,924 Rohingya refugees now live in Cox's Bazar District, Bangladesh, with the main influx since August 2017². In addition to pre-existing drivers of forest degradation, accommodating this mass influx of refugees, forests have been razed, resulting in an enormous loss of wildlife habitats, biodiversity, and entire ecosystems in the district (Hassan et al. 2018). Potentially, and in the long-term, more than 61% of plantations and remnants of natural forest in the area may be degraded and converted to shrub land due to the influx (UNDP Bangladesh and UN WOMEN Bangladesh 2018). Due to settlements of refugees the diversity of wildlife of Madhur Chhara basin is believed to have been greatly affected (Figure 2).

Madhur Chhara hill stream originates in the hill forests of Ukhiya Upazila where various small tributaries merge and then passes through settlements, crop land, Rohingya refugee camps and finally

² Joint Government of Bangladesh – UNHCR Population Factsheet 2021, <https://data2.unhcr.org/en/documents/details/85032>

flows into the estuarine Naf River to the southeast (Figure 1). Altogether 12 Rohingya refugee camps are located within the watershed of Madhur Chhara (camps 1W, 1E, 2W, 2E, 3, 4, 4ext., 5, 6, 7, 8W and 8E), all these camps accommodate 77,568 families with a total population of 349,814 (Table 1). The camps vary in size with the largest (by population) in the watershed being camps 1E, 1W, 3, and 7; while camp-4 ext. has a population of only 7,745 comprising 2.2% of the total population in the Madhur Chhara catchment (Table 1). Camp 4 ext., is newly constructed with planning and development on-going, so it is likely to grow in population.

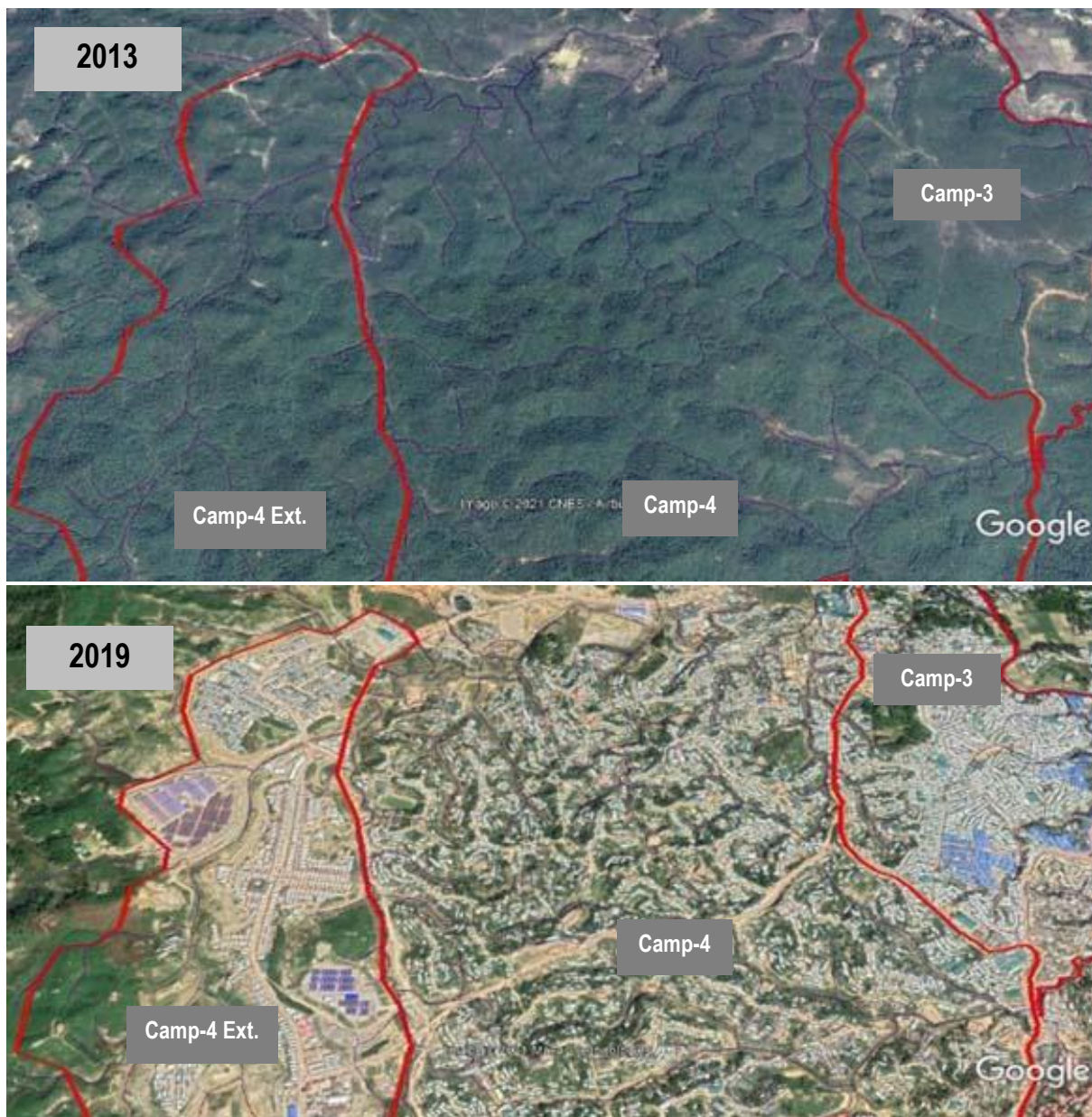


Figure 2: Kalam Chhara basin pre- and post-influx; Top - 2013: Kalam Chhara basin covered with forest (green) before Rohingya influx. Bottom - 2019: after 3 years of refugee presence the entire basin is replaced by camps with complete loss of forest. (Source: Google Earth, 2020)

The main Madhur Chhara is formed by the merger of two major sub-streams/chharas and many micro-streams. The two main tributaries (water courses/sources) join together within Camp-3 to form the Madhur Chhara. One tributary is Maskaijja Chhara that originates from within Maskaijja Beel (wetland) north of the camps in an area surrounded by high lands covered with hill forests, village forests, cropland and settlements; Maskaijja Chhara enters the camps at Boroitali. Kalam Chhara is the other tributary that originates from hill forests to the northwest, it enters Camp 4 extension and then flows through Camp-4 into Maskaijja Chhara in Camp 3. From this point the stream takes the name of Madhur Chhara. Madhur chhara flows southeasterly through 12 refugee camps and then flows through host community areas, finally ending in the Naf River. The middle reach of the stream is most degraded and polluted due to the establishment of Kutupalong Mega Refugee Camp housing 711,210 refugees in 26 constituent camps³.

Table 1: Refugee population in Madhur Chhara watershed

Camps	Families	Population (No.)	Population (%)
1E	8,521	38,577	11.03
1W	8,375	37,988	10.86
2E	6,159	26,513	7.58
2W	5,514	24,276	6.94
3	8,145	36,878	10.54
4	7,189	31,063	8.88
4 Ext.	1,821	7,745	2.21
5	5,610	25,183	7.20
6	4,921	23,403	6.69
7	8,384	37,367	10.68
8E	6,277	29,500	8.43
8W	6,652	31,321	8.95
Total	77,568	349,814	100.00

Before the Rohingya influx in 2017, the major part of the Madhur Chhara watershed (middle and upstream) was reserved forest managed by the Bangladesh Forest Department (BFD). Although this had become degraded due to over-extraction of forest products by local communities and Rohingyas who arrived before the recent influx in 2017, the area was still recorded as forest land and had substantial cover of trees and shrubs (Figure 2). This forest also provide home for a wide array of wildlife including the Asian Elephant. Forests in this area used to provide corridors for elephants to migrate seasonally between different parts of their extensive ranges using both Bangladesh and Myanmar. Local communities reported that Kalam Chhara was one of the places where groups of elephants used to visit every year. Being located close to protected areas (Teknaf Wildlife Sanctuary, Sheikh Jamal Inani National Park (SJINP) and Himchari National Park), forest cover in the Kutupalong area including Madhur Chhara was also rich in diverse wildlife species. However, after the Rohingya influx in 2017, the natural environment of the area abruptly changed, the entire forests of Madhur Chhara area were denuded and replaced by camps (Figure 2). During 2018-19 some elephants tried to cross the camps to reach their preferred habitats resulting in the death of some refugees. Besides loss of mega-fauna like elephants, other wildlife also disappeared from the area due to construction of refugee settlements and related infrastructure.

The UNHCR-CNRS project on Madhur Chhara Watershed Restoration is aimed at restoring the degraded natural ecosystem (streams and forest) and biodiversity) thereby creating an enabling environment to facilitate peaceful co-existence of refugees and host communities in the basin. The wildlife monitoring activity has been designed to document the wildlife fauna of the Madhur Chhara basin as a baseline which can be the basis for future monitoring of changes in wildlife diversity and abundance as an indicator of the effectiveness of environmental restoration interventions along the Madhur Chhara basin.

³ Joint Government of Bangladesh – UNHCR Population Factsheet 2021, <https://data2.unhcr.org/en/documents/details/85032>

2. OBJECTIVES

The objectives of the study were:

- a) To understand the current wildlife diversity (amphibians, reptiles, birds and mammals) and status of their habitats in the different zones of the Madhur Chhara basin.
- b) To provide a baseline for assessing the effects of current environmental restoration activities on wildlife re-colonization in restored landscapes particularly within degraded camp areas
- c) To identify major threats and suggest management actions for the conservation of wildlife biodiversity in Madhur Chhara basin.

3. STUDY AREA

The wildlife survey was conducted along the entire Madhur Chhara basin both within and outside Rohingya refugee camps within Ukhiya Upazila, Cox’s Bazar District. For management purposes, the Madhur Chhara basin is divided into five zones and the survey covered all these five zones (Table 1 and Figure 1). Accordingly, sample transect lines were surveyed within all five zones covering both refugee camps and host community areas in the upstream and downstream parts of the basin down to the Naf River.

Table 2: Zones of Madhur Chhara basin

Zone	Locations covered, habitat types and human pressures
Zone – 1:	Outside camps: 723 ha upstream Madhur Chhara, Maskaijja Beel and adjoining areas, wetlands, forests, village forests, cropland. Moderate human disturbance except in Folia Para area where traffic movement is high for entering and exiting camps. Zone starts from Maskaijja (Maskaria) Beel and extends to the edge (starting point) of Rohingya Camps 3 and 1East, and includes part of Maskaria Chhara.
Zone – 2:	Within camps: 165 ha Kalam Chhara and Banurma Chhara, both of which are CNRS-UNHCR stream and riparian ecosystem restoration sites, water reservoirs ⁴ along Kalam Chhara which are expected to lead to rejuvenating ecosystems. Located at the north edge of Camp-4, and newly built Camp-4 ext., moderate human disturbance but high traffic movement, massive hill cutting for making refugee homes and infrastructure, this has part filled and narrowed the streams.
Zone – 3:	Within camps: 537 ha middle reach of Madhur Chhara, highly degraded with least habitat diversity of the basin, high pollution and human disturbance due to congested refugee settlements, markets and other infrastructure, prone to flooding and landslides. Madhur Chhara passes through refugee Camps 1W, 2W, 3, 4, 4E, 5, 6, 7, 8E and 8W – the most densely populated part of the basin.
Zone – 4:	Outside camps: 22 ha immediate downstream of camps, intensive land use, non-tidal, high pollution load, small area, low habitat diversity, high mobility of refugees and host communities, human disturbance.
Zone – 5:	Outside camps: 219 ha lower most part of Madhur Chhara under tidal influence of Naf River, soil and water salinity, fish and shrimp ponds, mangrove patches, crop land, diverse habitats, prone to tidal flooding, low human disturbance.

⁴ Low lying areas adjacent to the stream were excavated and enclosed with earthen bunds under UNHCR-CNRS stream restoration project in 2019 to store rainwater round the year

4. METHODOLOGY

4.1 Transects and Zones

The wildlife survey was based on direct field observation during periods when the selected faunal groups are more active (morning, afternoon and/or night sessions) for ten survey days: (28 September-2 October, 2020 and 17 -23 October, 2020) using existing walking trails. Nine existing trails/paths, larger tracks and streams were purposively selected as transect lines for the survey to represent the diversity of habitat types found within Madhur Chhara basin (Figure 1, Table 2).. The starting point of each transect was a place close to human habitation or another trail. Three transects were selected in Zone 1, the largest and most diverse zone, an upstream area used by host communities for fishing and farming but not directly affected by refugees . Two transect lines were surveyed in Zone 2 (UNHCR-CNRS restoration site in 2019, 2020), and two transects were surveyed in Zone 3 (within congested and disturbed areas of the Kutupalong mega camp). One transect was surveyed in each of Zones 4 and 5 because these are relatively small areas in the downstream sections of the basin and lie outside of the Rohingya camps (Figure 1).

Table 3: Details of transects surveyed for wildlife in the Madhur Chhara basin.

Transect	Zone	Location description	GPS coordinates		Length (km)
			Start Point	End Point	
TN 1	Zone 1	Cox's Bazar Teknaf Highway-Maskaijja Beel-Maskaijja Chhara	21° 14' 13.78" N 92° 08' 51.90" E	21°13'24.50" N 92°09'01.00" E	2.10
TN 2	Zone 1	Near Foliapara Community Center- Camp 1 E checkpoint	21°14'15.90" N 92°08'11.10" E	21°13'10.10" N 92°08'38.30" E	2.75
TN 2	Zone 1	Camp 1 E checkpoint-CNRS Bacteria Treatment Plant-East side of 1 E	21°13'10.10" N 92°08'38.30" E	21° 12' 53.57" N 92° 09' 26.50" E	1.77
TN 4	Zone 2	Boroitali-Kalam Chhara end point (Camp 4) to CNRS Eco-shed restoration site	21° 12' 50.39" N 92° 08' 49.12" E	21°12'39.70" N 92°08'17.00" E	1.54
TN 5	Zone 2	Camp 4 extension- upstream of Kalam Chhara to Near CNRS Eco-shed	21° 11' 53.70" N 92° 08' 15.32" E	21°12'37.80" N 92°08'15.50" E	1.77
TN 6	Zone 3	Boroitali- Camp 4 CIC office-Mochra Bazar-Camp 8W CIC office to Camp 18 CIC office (Camp 3 and 5 army road side) congested camp area	21° 12' 50.39" N 92° 08' 49.12" E	21°11'41.70" N 92°08'53.50" E	2.55
TN 7	Zone 3	Boroitali -Madhur Chhara (Camp 3, 6, and 7) to North side of camp 8E congested camp area	21° 12' 50.39" N 92° 08' 49.12" E	21°11'55.90" N 92°09'46.60" E	3.25
TN 8	Zone 4	Located downstream of Madhur Chhara outside camps, started from the east side of Cox's Bazar-Teknaf Highway but the major portion lies west of the highway	21°11'57.00" N 92°10'25.50" E	21°12'00.20" N 92°09'48.10" E	1.56
TN 9	Zone 5	Located downstream of Madhur Chhara with tidal influence, started from west side of Cox's Bazar-Teknaf Highway but the major portion lies east of the highway	21°11'56.40" N 92°10'04.20" E	21°10'58.20" N 92°10'22.60" E	3.37

Transect lines are shown in Figure 1. Habitat features relevant to wildlife assemblages along the transect lines by zones are presented in Appendix-1. The schedule of surveys of transects and total survey effort by transect is given in Table 3.

Table 4: Field survey days and timings by transect

Transect	Dates of survey	Period of day surveyed
TN1	29/09/2020	6:00-10:00 h and 18:00-21:00 h
	17/10/2020	6:00-11:00 h and 17:00-20:00 h
TN 2	18/10/2020	6:00-10:00 h and 18:00-21:00 h
TN 3	30/09/2020	6:30-9:30 h and 18:00-20:00 h
TN 4	19/10/2020	6:30-9:30 h and 17:00-20:00 h
TN 5	21/10/2020	6:30-10:00 h and 17:00-20:00 h
TN 6	20/10/2020	6:30-10:00 h and 17:00-19:00 h
TN 7	22/10/2020	6:30-11:00 h and 17:00-20:00 h
TN 8	02/10/2020	6:20-10:00 h and 18:00-20:00 h
TN 9	01/10/2020	6:20-10:00 h and 18:00-20:00 h

4.2 Survey Methodology

4.2.1 Survey of amphibians and reptiles

The transect system was not strictly followed for surveying herpetofauna. The “Direct Area Search Method” was used as this was considered more suitable for developing an inventory of amphibians and reptiles. Convenient locations whether near transects or in adjacent places, considered to be representative of habitats in that zone were searched, with each survey spot covering 10 m × 10 m, in total 23 such spots were surveyed distributed as follows between zones: nine spots in zone 1, five spots in zone 2, four spots in zone 3, two spots in zone 4 and three spots in zone 5., the locations of all herpetofauna survey spots are given in Table 4. Active searching methods have been used such as turning logs, rocks, and debris for more accurate estimates of sedentary species occurrence and abundance (Bury and Raphael 1983). Besides the method described above, opportunistic observations have also been included to develop a species profile of amphibians and reptiles in the selected areas.

Table 5: List of spots surveyed for herpetofauna

Zones	Transects	Spots	GPS Coordinates
Zone 1	TN 1	1	21°13'57.7"N and 92°08'39.1"E
		2	21°13'46.8"N and 92°08'48.7"E
		3	21°13'22.6"N and 92°08'41.3"E
		4	21°13'25.5"N and 92°08'56.0"E
	TN 2	5	21°14'00.0"N and 92°08'13.9"E
		6	21°13'38.9"N and 92°08'09.2"E
		7	21°13'19.4"N and 92°08'20.0"E
	TN 3	8	21°13'09.7"N and 92°08'41.1"E
		9	21°13'14.5"N and 92°09'04.2"E
Zone 2	TN 4	10	21°12'48.6"N and 92°08'44.0"E
		11	21°12'45.1"N and 92°08'27.2"E
		12	21°12'40.2"N and 92°08'18.0"E
	TN 5	13	21°12'19.2"N and 92°08'09.2"E
		14	21°12'12.1"N and 92°08'06.4"E
	Zone 3	TN 6	15
16			21°12'02.5"N and 92°08'48.2"E
TN 7		17	21°12'45.7"N and 92°08'58.7"E
		18	21°12'32.1"N and 92°09'10.5"E
Zone 4	TN 8	19	21°12'01.5"N and 92°10'10.8"E
		20	21°11'56.5"N and 92°10'20.2"E
Zone 5	TN 9	21	21°11'57.9"N and 92°10'09.3"E
		22	21°11'40.9"N and 92°10'13.8"E
		23	21°11'29.5"N and 92°10'15.1"E

4.2.2 Survey of birds

Bird species were recorded following the line transect method, this is a popular bird census method used by wildlife biologists and wildlife managers, for example to determine the health of a forest (Buckland et al. 1993). Observations were made by walking along the fixed transect line. Birds were identified through direct sightings and calls.

4.2.3 Survey of mammals

Mammals were surveyed following the same line transect method, as described by Ahsan (1984), and Harris and Burnham (2002). Animals were observed when crossing the trail (transect line) or entering nearby open spaces. Opportunistic observations and information (scats, signs and calls) have also been used in confirming the presence of species.



Interview with host communities (above)
and refugees (below)

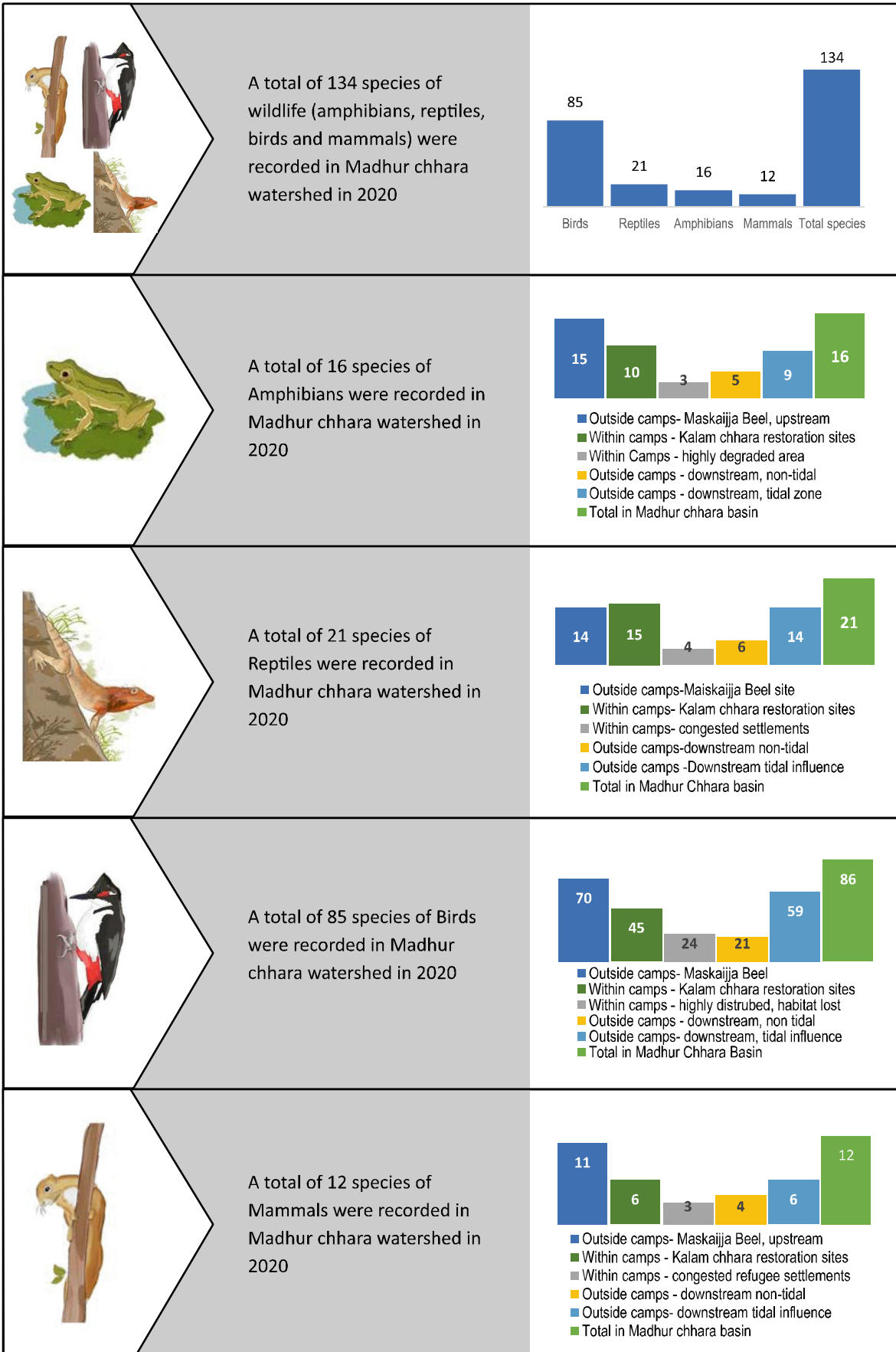
4.2.4 Community participation

The local people living in the survey zones were engaged to investigate knowledge and observations of existing wild animals and past status of species in their respective areas. Participants were selected from the host community (Image 1) and from refugees (Image 2) for separate group discussions. Three age groups (20-40 years, 41-60 years, 61-80 years) have been maintained while selecting participants. Photographs and vocal recordings were shown and played to participants to determine if they knew those species and had seen or heard them in the study area. To be accepted for this study a species had to be confirmed by at least three participants.

4.2.5 Data analysis

A species list for each faunal group was prepared for each transect, with records of reptiles and amphibians allocated to the nearest transect. The status of each species was categorized subjectively based on the numbers observed as: very common (VC) ; common (C); uncommon (UC) ; and rare (R)-. The global and national threat status of each species was taken from IUCN Bangladesh (2015a, b, c).

Monitoring Results



5. MONITORING RESULTS

5.1 Overall Wildlife Diversity

A total of 134 species of wildlife were recorded from Madhur Chhara basin both from within and outside of refugee camps (Appendix 2a,b,c,d). Among them, 63% were birds, 16% were reptiles, 12% were amphibians and 9% were mammals (Figures 2 and 3). Of the total species, 83% were recorded through direct observation by the surveyor and the remaining 17% were reported by the local community.

Of the five zones, three fall within host community areas outside refugee camps (zone 1, zone 4, and zone 5) and two fall within refugee camps (zone 2 and zone 3). More wildlife species were found in the host community areas (outside refugee camps), although a low diversity of wildlife was recorded in zone-4 (despite being located outside camps this is a small area just downstream of camps where human disturbance is high, land use is intense, pollution is high, and habitat diversity is low). The lowest diversity was in the congested camp zone-3, while relatively higher wildlife diversity was recorded in the other camp zone-2 (Kalam Chhara) where environmental restoration activities have been implemented by CNRS-UNHCR since 2019.

Figure 4 shows that Maskaijja Beel area (zone 1) housed the highest number of wildlife species (110) recorded during the study followed by 88 species in zone 5 (tidal downstream zone of Madhur Chhara), then 76 in zone 2 - the camp extension area of Kalam Chhara where there is habitat restoration. The lowest number of wildlife species (34) were recorded within the camps (zone 3) where human disturbance is highest and diversity of habitats is least, but zone 4 just downstream of the camps was almost the same with 36 species probably also because this is a small area (22.2 ha) where only one transect was surveyed.

Zone 1 (Maskaijja Beel area) with the highest number of species (110) comprises of a large seasonal wetland basin upstream of Madhur Chhara surrounded by forest and cropland with relatively low human disturbance. The area has more diversity of habitats: wetland, cropland, village forest and degraded hill forests. In this zone the highest numbers of wildlife species of three faunal groups were recorded: 15 species of amphibians, 70 species of birds and 11 species of mammals, while 14 species of reptiles was joint second, giving a total of 110 species (Figure 4). Another host community area (zone 5) where Madhur Chhara falls under the tidal influence of Naf River also has more diverse

Figure 2: Number of wildlife species observed in Madhur Chhara basin, October 2020

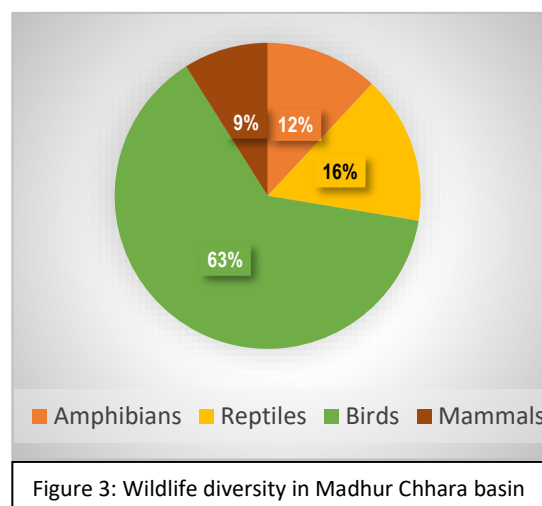
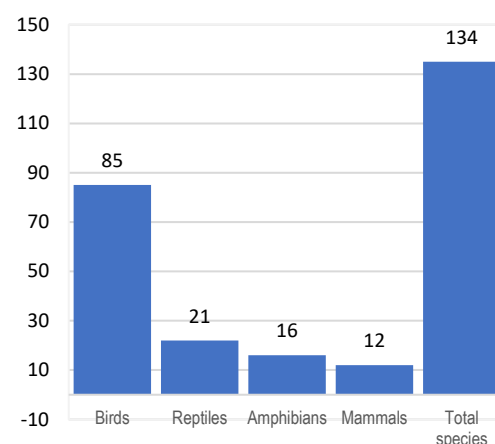
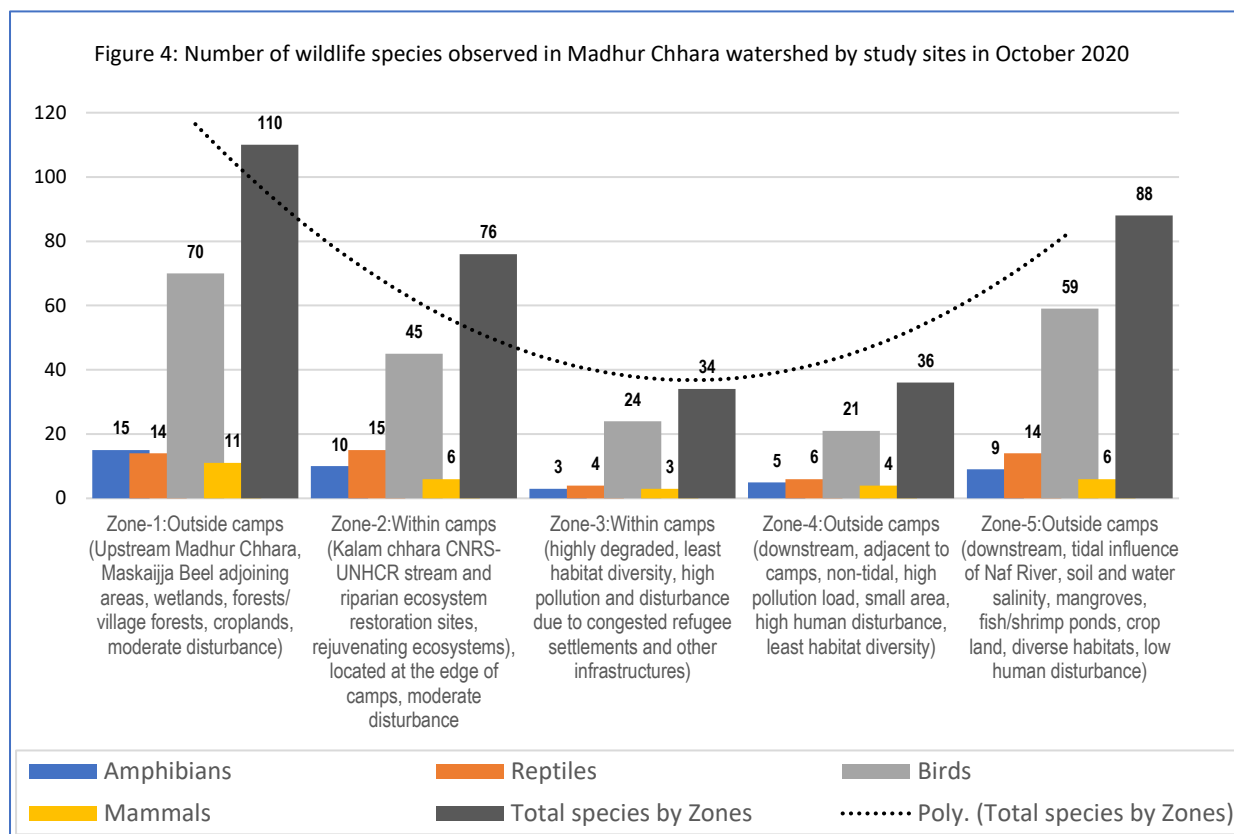


Figure 3: Wildlife diversity in Madhur Chhara basin

habitats (tidal mudflats, saline water, fish/shrimp ponds, cropland, mangrove patches and homestead vegetation), and had the second highest total of wildlife species with 88 (Figure 4).

Two areas (zone 2 and zone 3) within the camps were surveyed, of which zone 3 comprises of densely populated refugee settlements (highly impacted area), while zone 2 although located within a camp setting (camp 4 and camp 4 extension) already had multiple environmental restoration activities of CNRS-UNHCR (stream restoration, riparian and hill slope plantation, vetiver and grass hedging along streams, understory vegetative cover, and water reservoir creation) implemented in 2019 and in 2020. Restoration interventions in Kalam chhara upstream within camp 4ext. includes stream rehabilitation done in early 2020 and tree planting along the banks in August 2020.



Hence zone 2 was expected to represent a better environment with more surface water and denser vegetation cover which even in 20 months of restoration work could provide suitable habitats for wildlife. Besides, zone-2, although within camps is located at the edge of the camps making it less disturbed than locations at the center of Kutupalong Mega camp (KMC), while the upper part of Kalam Chhara is adjacent to reserved forest which would be expected to have a higher abundance of wildlife species that could move into the adjacent camp zone.

The survey findings were consistent with these expectations. Fewer wildlife species (34, comprising of three species of amphibians, four reptile species, 24 bird species and three mammal species) were recorded in the dense camp area of Kutupalong Mega camp (zone 3). Whereas more wildlife species (76, comprising 10 species of amphibians, 15 reptile species, 45 bird species, and six mammal species) were found in the Kalam Chhara restoration site (zone 2) – 124% higher species diversity. The previous

species diversity is unknown for these zones, nevertheless this indicates that restoration is likely to contribute to greater wildlife diversity within camps.

Hence Zone-1 had the highest diversity of species among the surveyed zones, and 82 % of all species recorded were found here. By comparison, in Zone 3 only 25% of recorded species were found, and Zone-4 immediate downstream of the camps was similarly poor with 27% of recorded species (Figure 4). Although zone-4 is outside of the camps it is just adjacent to them and is also highly disturbed by the refugees (movements to nearby market) and host communities, and also receives pollution from camps, here streams are silted up, land use is intense, and habitat diversity is low in this small zone where it was possible to survey only one transect.

However, the zones are not of similar areas, and the survey effort (taking length of transects as a proxy although herpetofauna were surveyed differently) was neither similar for each zone nor proportional to the zone area (see Table 5), so simple comparisons of species counts between zones have limitations. Thus Zone 4 had a high survey effort with just over a quarter of the zone covered by the one transect, whereas in the other zones transects covered under 10% of the zone area. Considering species count relative to survey effort in terms of transect length, confirms how poor Zone 3 (main camps) is for wildlife (about six species per km), while Zones 2, 4 and 5 all had 23-26 species per km surveyed, but Zone 1 had a somewhat less species rich fauna when the higher survey effort there is taken into account.

Table 6: Summary of area, survey effort and total species recorded by zone

Zone	Transect length (km)	Survey area (ha)*	Zone area (ha)	Effort as % of area	Species count	Species per transect km
1	6.62	26.48	723.0	3.7	110	16.6
2	3.31	13.24	165.5	8.0	76	23.0
3	5.80	23.20	537.2	4.3	34	5.9
4	1.56	6.24	22.2	28.1	36	23.1
5	3.37	13.48	219.0	6.2	88	26.1

* Assuming that the surveys covered 20m either side of the transect lines

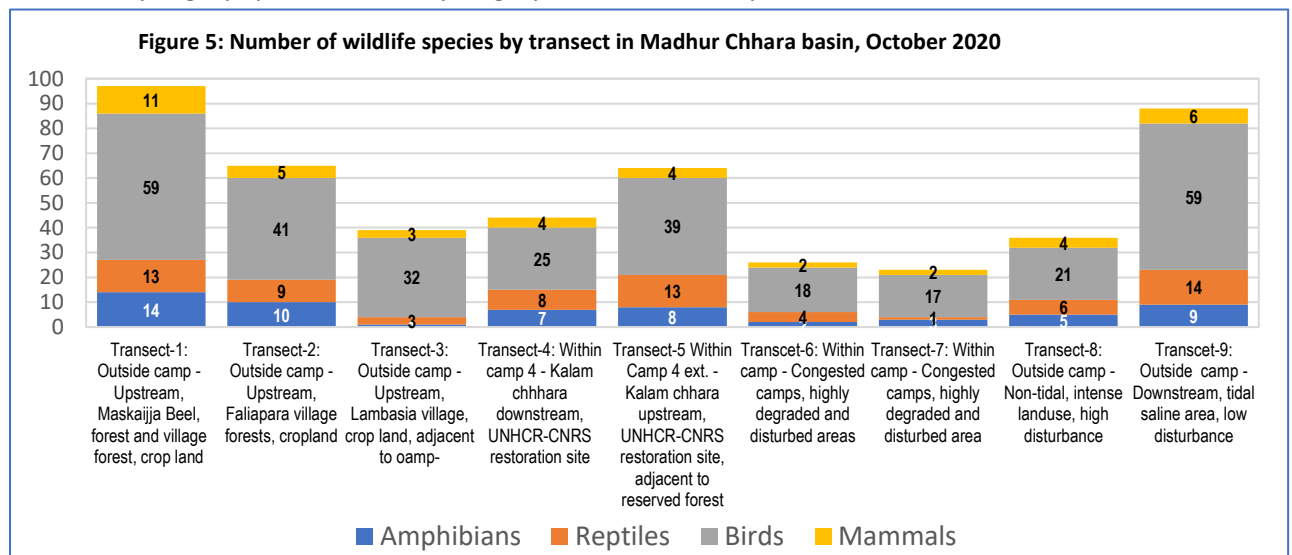
With regard to transect-wise diversity of wildlife species, wide variation was observed among nine transect lines surveyed (Figure 5). Transects 1, 2 and 3 lie within Zone-1 (Maskaijja Beel area) where habitat diversity is richer than other zones and bordering Reserved Forest and hence an ecotone with less human disturbance. Transects 4 and 5 (Zone 2) follow the Kalam Chhara which flows along the edge of refugee camps and thus have moderate to low human disturbance, while ecosystem restoration activities of CNRS-UNHCR have been ongoing here since 2019.

Transects 6 and 7 (Zone 3) fall within the highly congested refugee settlements, this is a highly disturbed area. Zones 4 and 5 had single transects (8 and 9 respectively) and therefore no within-zone variation in survey results, representing respectively downstream non-tidal conditions with intense human use and tidally influenced estuarine fringe with diverse land uses.

Of the nine transects, the richest wildlife diversity (97 species that comprised of over 72% of the total species recorded in the survey) was found in transect-1 (which cut across Maskaijja wetlands and also forested areas). Transect-2 (65 species) also in Zone-1 had high diversity reflecting a mainly village forest environment, but in transect-3 (also in this zone) only 39 species were recorded reflecting its proximity to the camps (Figure 5).

Transect-9 (Zone 5) had the second highest wildlife diversity (88 species comprising of 66% of all species observed in the study), being somewhat further from the camps and having a mix of tidal influenced habitats. Being a coastal site with regular Border Guard patrolling, human disturbances are also very low in the catchment of Transect 9.

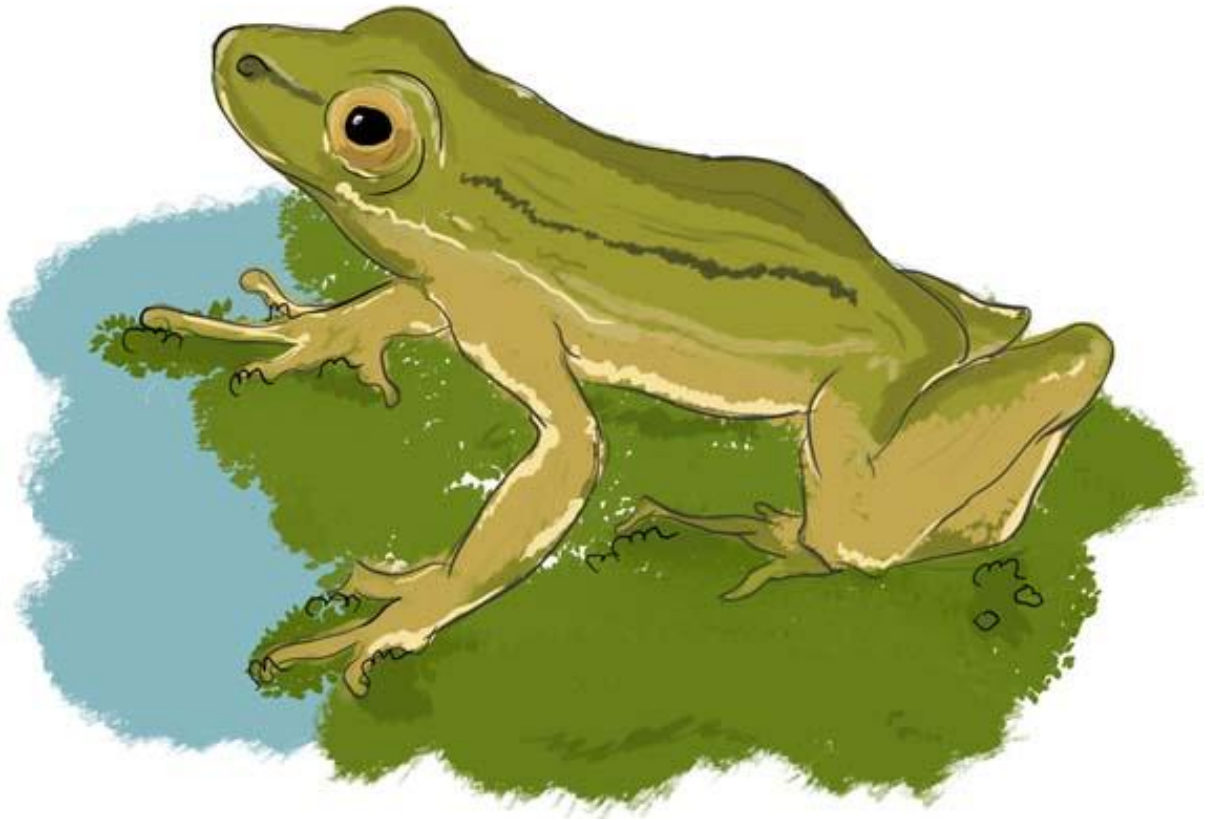
The two transects (4 and 5) in Zone-2 showed some substantial differences in the number of species recorded (respectively 44 and 64), with more bird and reptile species on the transect closer to forest land; both are along Kalam Chhara where wetland and riparian ecosystems have been restored since 2019. Not surprisingly both transects within the congested camps (6 and 7) of Zone 3 had similar and very low species counts. This area lacks natural habitats and is dominated now by refugee settlements with a very high population density, high pollution and frequent movement of traffic. Moreover,



restoration initiatives in place have so far targeted planting trees and lack focus on ecosystems and biodiversity restoration and conservation. Considering the diversity of wildlife species in transects, transects 4 and 5 within camps can be considered to represent planned environmental restoration sites while the other transects 6 and 7 also within camps may be treated as control sites where restoration activities are limited and have not focused on biodiversity conservation.

The connecting bridges between the biodiversity poor refugee camp area (Zone 3) and host community areas are transects 3 and 8, and these were similar supporting 39 and 36 species of wildlife respectively, indicating a strong influence of camps on these adjacent areas that negatively impact upon wildlife. Transect-8 is used as pathway by refugees and host communities to the nearest market, warehouse and developmental program sites, so human disturbance is high along this transect.

Amphibians



5.2 Amphibians

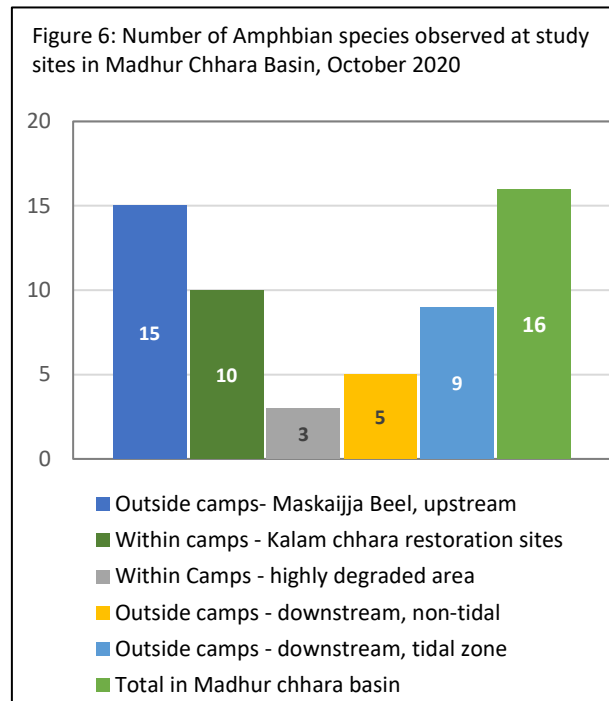
Amphibians are highly sensitive to qualitative features of their habitats and respond to minor environmental changes, making them good indicators particularly of wetland conditions. A total of 16 amphibian species were recorded in this survey, representing five families (Appendix 2a), this constitutes 25% of the country's known amphibian diversity (Khan 2018).

Almost all (15 species) were recorded in Zone-1, with the lowest number in the camps (Zone 3) (Figure 6). The high amphibian diversity in Zone-1 is due to the presence of a range of suitable habitats such as water bodies, streams, marshland, and crop fields. This zone was the only one where the Ornate Microhylid Frog was recorded (see Appendix 2a, b, c, d for scientific names and a full list of all species recorded).

The low diversity of amphibians in Zone 3 reflects the extensive degradation of suitable habitats for amphibians within camps. The Asian Common Toad was the only species found in all nine transects (Appendix 2a) because it is able to survive in a wide range of habitats.

Zone-2, the Kalam Chhara restoration site, had the second highest amphibian diversity (10 species), more than all three downstream zones. The survey suggests that habitat restoration, particularly stream rehabilitation, reservoir creation and riparian vegetation provided suitable habitat enabling amphibian species to survive in or re-colonize the restored habitats.

Based on frequency of observation, five species (31%) were very common, three (19%) common, four (25%) uncommon, and four (25%) were rare (Appendix 2a). All four locally rare species of amphibians were only found in transect-1 (Zone-1) these comprise Asmat's Cricket Frog, Puddle Frog, Two-stripped Grass Frog and Two-stripped Pigmy Tree Frog, while Jerdon's Bullfrog which is globally vulnerable and nationally near-threatened was recorded in both Zones 1 and 5 (Appendix 2a). These rarer species need local protection measures to save them from extirpation.



Pierre's Cricket Frog



Common Toad



Nepal Cricket Frog



Asmats Cricket Frog



Idina Bull Frog



Ornet Microhylid Frog



Coastal Bullfrog



Two-striped grass frog



Puddle frog



Terai Cricket Frog



Skipper Frog

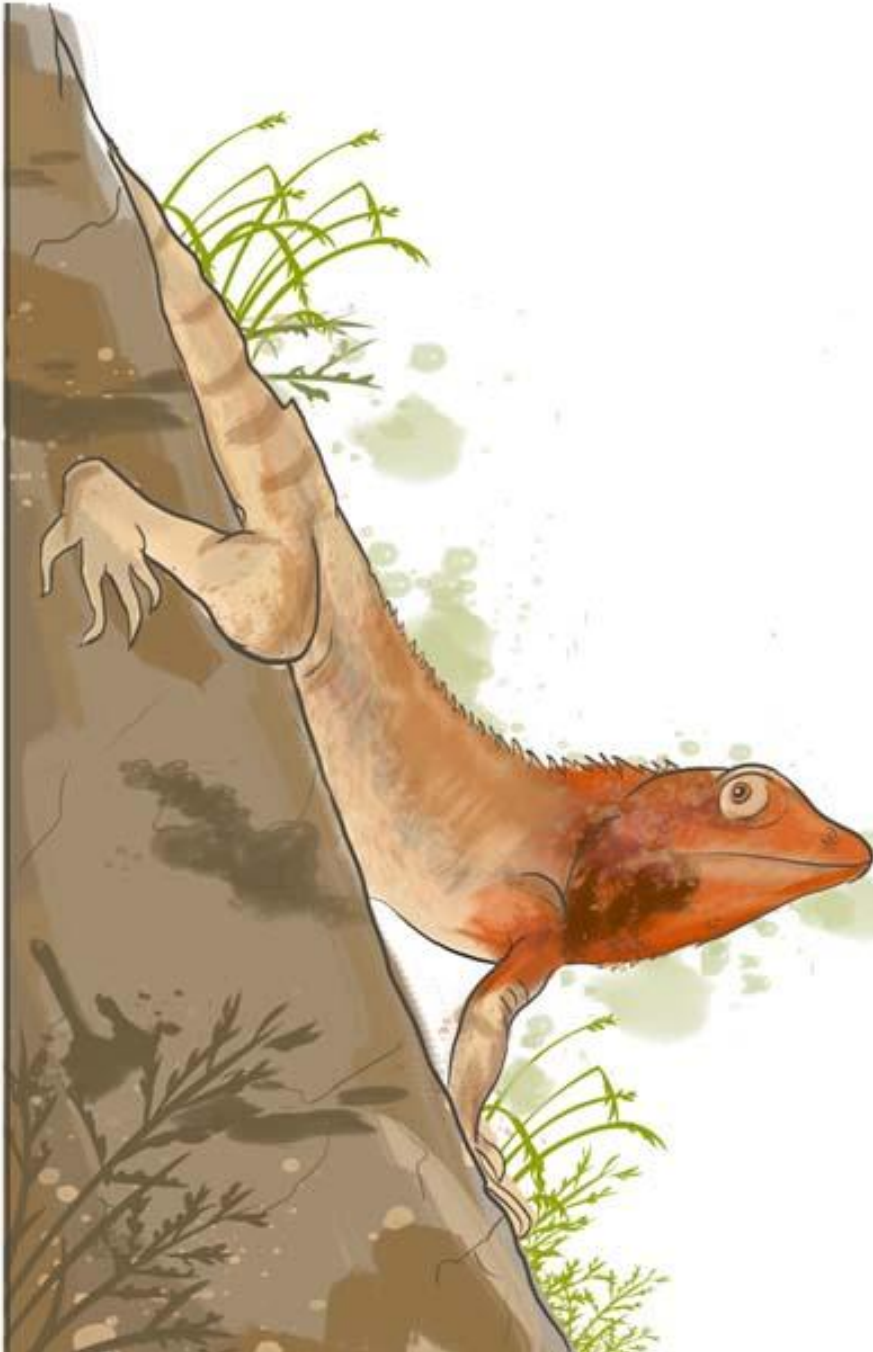


Jerdons Bullfrog



Syhadra cricket frog

Reptiles



5.3 Reptiles

A total of 21 species of reptiles were recorded from the study area belonging to two orders and nine families (Appendix 2b) which constitutes 12% of the country's total reptile diversity (Khan 2018). The reptiles recorded were composed of two species of turtle and tortoise, seven species of lizards, and 12 species of snakes. The presence of 10 species was confirmed only by local communities, and 11 species were directly observed by the surveyor.

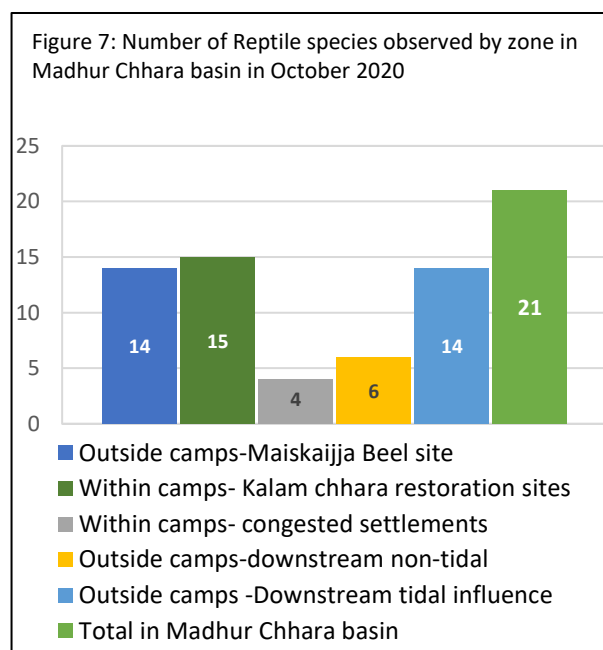
Zones 1, 2 and 5 all had similar higher levels of diversity (14 or 15 species of reptiles), whereas Zones 3 and 4 both had much lower diversity (Figure 7). Habitat diversity and quality are the likely explanations for this pattern. Despite being within the camps, UNHCR-CNRS has been working on wetland and forest ecosystem restoration in Kalam Chhara (Zone 2) and the upper reach of Kalam Chhara is adjacent to Reserved Forest. Zone-1 and Zone-5 are both outside the camps and have less human disturbance, and these are the two zones with the greatest habitat diversity as already explained. In contrast Zones 3 and 4 have the highest levels of human disturbance and negative impacts



Garden Lizard

Some species of reptiles were only found in one transect/location (Appendix 2b), presumably due to location specific habitat features, although the survey effort was limited and more effort over more spots and different months might reveal these species to be more widespread. For example, Bronze Grass Skink was only observed in Kalam Chhara restoration site (downstream) and Red-necked Keelback (near threatened in Bangladesh) was only found in Kalam Chhara restoration site (upstream). Similarly, Zaw's Wolf Snake was only found in Zone-1 and Painted Bronzeback Tree Snake in Kalam Chhara restoration (upstream).

Out of the two turtle species recorded Spotted Flapshell Turtle was found in Kalam Chhara (as well as in Zones 1 and 5), indicating that restoration of Kalam Chhara has provided habitats for specialist species and supports as high a diversity of reptiles as less disturbed locations outside of the camps, and may also indicate benefits of re-establishing blue-green connectivity by restoring Kalam Chhara and linking it with the reserved forest to the west.





Checkedred Keelback



Red necked keelback



Blind snake



Common Garden Lizard



Spotted Flapshell Turtle



Common Skink

Birds

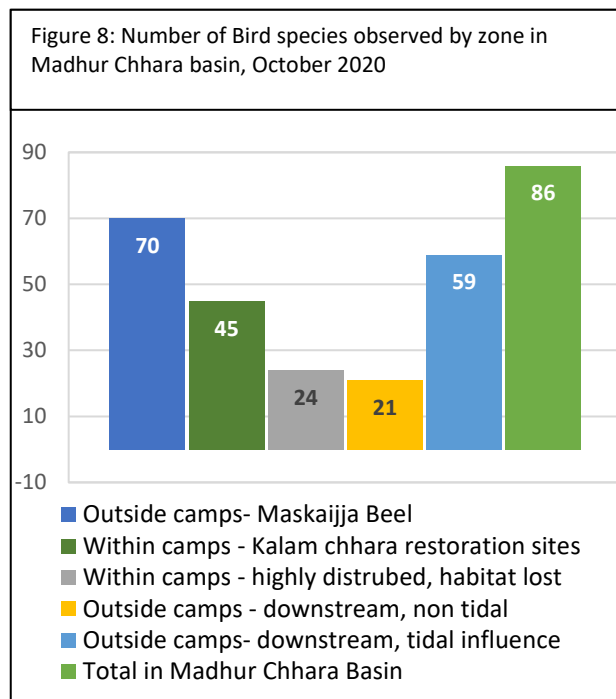


5.4 Birds

A total of 86 species of birds were recorded in Madhur Chhara basin during the survey belonging to 17 orders and 46 families (Appendix 2c) which constitutes 12% of the country's total avian diversity. Most of the species (77) were observed by the surveyor, but the presence of nine species was only reported by the local communities. Out of these species, 40 (47%) are passerines and 46 (53%) non-passerines; 70 species are resident in Bangladesh, two are summer migrants, one is a passage migrant and 13 are winter migrants. Zone-1 had the highest diversity of birds (70 species) while Zone-4 had the lowest avian diversity (21 species) closely followed by Zone 3 (24 species) (Figure 8), reflecting degraded habitats and high human disturbance.

Although none of the birds recorded are threatened, five can be considered forest dependent. Of these a Green Imperial Pigeon in Zone 1 is the most remarkable – a species dependent on fruiting forest trees, the others (Red Junglefowl, Chestnut-headed Bee-Eater, Puff-throated Babbler and Scarlet-backed Flowerpecker) are all more adaptable and use forest edges, or in the case of the babbler can survive in bushy thickets. Three other species mainly depend on scrub/bushy areas (Jacobin Cuckoo, Pied Bushchat and Grey-breasted Prinia). Observation of Large-tailed Nightjar, Jacobin Cuckoo and Puff-throated Babbler from Kalam Chhara restoration sites indicates sufficient growth of thickets to support these species. A further 12 species mainly use trees, including homestead and scattered trees, which are important to maintain and restore in the area. In the long-term restoration and protection of riparian vegetation may develop a forest structure and attract back forest species.

Overall, 27 species (32%) were categorized as very common, eight (9%) as common, 19 (22%) as uncommon, and 32 (36%) as rare. The high percentage in the rare category may arise from limited suitable habitat and recording birds passing through the study area (which does not occur so obviously among other faunal groups). Proper conservation steps to restore habitats and reduce disturbance would help birds currently using the area and might attract back other species.





Owlet



Treepie



Plain Martin



Chestnut Munia



Gray Wagtail



Spotted Dove



Common Kingfisher



Common Sandpiper



Wood Sandpiper

Mammals



5.5 Mammals

Altogether 12 species of mammals were recorded from the Madhur Chhara basin belonging to seven orders and 11 families (Appendix 2d) which constitutes 9% of the country's total mammal diversity (Khan 2018). The presence of four species was reported by the local communities while eight were directly observed during surveys. The highest number of mammal species - 11 were recorded from Zone-1 (all on transect 1) which constitutes 92% of recorded mammal species in the entire Madhur Chhara basin. In contrast, only three species were recorded in the congested camps of Zone 3 (and only two species on each transect (5 and 6) there (Figure 9).

The diversity of mammals was also very poor in Zone 4 which although located in host community areas is prone to high disturbance and has low habitat diversity. The Kalam Chhara restoration site (Zone 2) was somewhat better with six mammal species found including Golden Jackal and Small Indian Mongoose. This suggests that the restoration activities have helped restore habitats for mammals. Five species (42%) were considered very common, three (25%) uncommon and four (33%) rare.

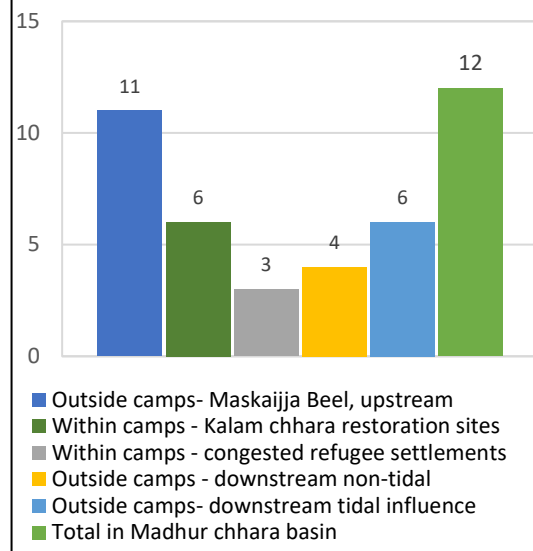
Asian Elephant was reported near transect-5 (Kalam Chhara upstream – Zone 2) and adjoining areas by the refugees but there were no reports from other zones. Two species (Himalayan Crestless Porcupine and Eurasian Wild Boar) were only found in Zone-1 which may be due to relatively better forest-based habitats and being located adjacent to natural forest (reserved forest). Rhesus Macaque and Least Pipistrelle were found in the two less impacted zones (Zone-1 and Zone-5) but were not reported in other zones.

5.6 Notable Wildlife

Sixteen species of wildlife among those recorded in this survey are considered to either be notable or potential indicators of habitat quality and restoration, comprising of three species of amphibians, three reptile species, five bird species and five mammal species (Table 5). Seven of these are nationally threatened or near-threatened. Some of the listed species are indicators of habitat quality and some are threatened by extinction in the country and even globally.

Coastal Bullfrog, Jerdon's Bullfrog and Two-striped Grass Frog all prefer vegetated marshy habitats (ditches, wet grasslands, paddy fields with stagnant water and ponds). In addition to being present in Zone 1 and Zone 5 which have these habitats, the records of one of these species in Zone 2 suggests

Figure 9: Number of Mammal species observed by zone in Madhur Chhara basin, October 2020



Irrawady Squirrel



Feces of Golden Jackal

that restoration of Kalam Chhara through excavation may have transformed the area enabling frogs to colonize. Bengal Monitor and Monocellate Cobra prefer diverse habitats associated with water and their presence in Zones 1, 2 and 5 is encouraging. Red-necked Keelback was only found in Kalam Chhara either a consequence or coincidence with habitat improvement.

Green Imperial Pigeon is a bird of the forest canopy, and although good quality forest is absent from Zone 1 it is closer to forest than the other zones, and is a reminder that frugivorous forest birds can wander. The presence of Jacobin Cuckoo, Large-tailed Nightjar, Pied Bushchat, Puff-throated Babbler and Grey-breasted Prinia along Kalam Chhara restoration area indicates the presence of bushy thickets and leaf litter. This habitat is the output of planting here trees, herbs and shrubs implemented by CNRS-UNHCR joint venture. Continued restoration and protection of bushy thickets will be important for wildlife in this degraded area.

Among the notable species Asian Elephant is Critically Endangered in Bangladesh and globally Endangered; Rhesus Macaque is nationally Vulnerable, and Jerdon's Bullfrog is globally Vulnerable. Two-striped Grass Frog is nationally Data Deficient which means that the population and range are poorly known, but it is widely distributed, presence in Zone 1 adds to our knowledge. Four species (Coastal Bullfrog, Bengal Monitor, Red-necked Keelback, and Monocellate Cobra) are Near Threatened for the country. More targeted conservation measures within this area are a pressing need to support national efforts to protect these threatened and near-threatened species.

Table 7: Notable wildlife found in and around Madhur Chhara basin.

SL	Group	Scientific Name	English Name	Threat Category	
				BD	Global
1	Amphibians	<i>Hoplobatrachus litoralis</i>	Coastal Bullfrog	NT	NE
2		<i>Hoplobatrachus crassus</i>	Jerdon's Bullfrog	NT	VU
3		<i>Hylarana taipehensis</i>	Two-striped Grass Frog	DD	LC
4	Reptiles	<i>Varanus bengalensis</i>	Bengal Monitor	NT	LC
5		<i>Rhabdophis subminiatus</i>	Red-necked Keelback	NT	LC
6		<i>Naja kaouthia</i>	Monocellate Cobra	NT	LC
7	Birds	<i>Clamator jacobinus</i>	Jacobin Cuckoo	LC	LC
8		<i>Caprimulgus macurus</i>	Large-tailed Nightjar	LC	LC
9		<i>Ducula aenea</i>	Green Imperial Pigeon	LC	LC
10		<i>Anastomus oscitans</i>	Asian Openbill	LC	LC
11		<i>Pellorneum ruficeps</i>	Puff-throated Babbler	LC	LC
12	Mammals	<i>Elephas maximus</i>	Asian Elephant	CR	EN
13		<i>Hystrix brachyura</i>	Himalayan Crestless Porcupine	LC	LC
14		<i>Canis aureus</i>	Golden Jackal	LC	LC
15		<i>Macaca mulatta</i>	Rhesus Macaque	VU	LC
16		<i>Sus scrofa</i>	Eurasian Wild Boar	LC	LC

Threat categories: LC=least concern, DD=data deficient, NT=near threatened, VU=vulnerable, EN=endangered, CR=critically endangered.

5.7 Extirpated Wildlife

Thirteen species of wildlife were identified as having occurred previously in the study area but were reported to have disappeared based on consultations with local communities (Table 6). Half (seven) of the extirpated species are forest floor dwellers: Elongated Tortoise, Burmese Python, Reticulated

Python, Kalij Pheasant, Indian Hare, Chinese Pangolin, and Crab-eating Mongoose. Destruction of habitats of these wildlife species through removal of undergrowth, leaf litter and bushy areas are the main causes of local extirpation of these species, although direct hunting may also have played a part for several of them. These findings are also supported by published sources. Khan (2008) and Feeroz *et al.* (2012) reported the presence of Crab-eating Mongoose in mangrove patches in Teknaf. Burmese Python and Reticulated Python were reported to be found in hilly areas of Cox's Bazar and adjacent forested areas (Wildlife Conservation Society, 2018).

The ethnic communities of this area in recent interviews reported the presence of three threatened primates: Western Hoolock Gibbon (*Hoolock hoolock*), Phayre's Leaf Monkey (*Trachypithecus phayrei*) and Capped langur (*Trachypithecus pileatus*) in the Reserve Forest of Cox's Bazar area (Wildlife Conservation Society, 2018). In this study in addition Oriental Pied Hornbill, Common Hill Myna, Capped Langur, and Large Indian Civet were reported to have occurred in the past, these are middle and higher canopy forest dwellers. Cutting of all trees to create camp settlement and illegal felling by refugees and host communities have triggered these species leaving the area or facing unwanted deaths.

Table 8: Wildlife species reported to have been locally extirpated since the Rohingya influx

SL	Scientific Name	English Name	Local Name	Extirpated Area	Causes of Extirpation
1	<i>Indotestudo elongata</i>	Elongated Tortoise	Halud Pahari Kasim	Zone 2, Zone 3	Hunting, Poaching, Degradation
2	<i>Python molurus</i>	Burmese Python	Azagar	Zone 1, Zone 2, Zone 3, Zone 4, Zone 5	Poaching, Degradation, Fragmentation
3	<i>Python reticulatus</i>	Reticulated Python	Golbahar	Zone 2, Zone 3	Poaching, Degradation, Fragmentation
4	<i>Lophura leucomelanos</i>	Kalij Pheasant	Mothura	Zone 2, Zone 3, Zone 4, Zone 5	Hunting, Poaching, Degradation, Fragmentation, Lack of understory vegetation
5	<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill	Dhanesh	Zone 2, Zone 3	Poaching, Degradation, Fragmentation, Absence of higher canopy and large trees
6	<i>Gracula religiosa</i>	Common Hill Myna	Myna	Zone 2, Zone 3, Zone 4	Hunting, Poaching, Degradation, Fragmentation, Absence of higher canopy and large trees
7	<i>Prionilurus viverrinus</i>	Fishing Cat	Meso Biral	Zone 1, Zone 4, Zone 5	Fragmentation, Reduction of habitat and food sources,
8	<i>Lepus nigricolis</i>	Indian Hare	Khargosh	Zone 1	Hunting, Poaching and loss of habitat
9	<i>Manis pentadactyla</i>	Chinese Pangolin	Banrui	Zone 1	Hunting, Poaching and loss of habitat
10	<i>Viverra zibetha</i>	Large Indian Civet	Baro Bagdash	Zone 1, Zone 3, Zone 4	Loss of habitat and food sources
11	<i>Elephas maximus</i>	Asian Elephant	Hati	Zone 2, Zone 3	Fragmentation, Loss of habitats and corridors
12	<i>Herpestes urba</i>	Crab-eating Mongoose	Boish Benji	Zone 1	Degradation, Fragmentation, Loss of habitats, loss of food sources
13	<i>Trachypithecus pileatus</i>	Capped Langur	Mukhpora Hanuman	Zone 1, Zone 2, Zone 3	Fragmentation, Loss of habitats, Absence of higher canopy and large trees

5.8 Wildlife Rich Areas

There are no well-defined wildlife hotspots in the study area, but some locations were relatively richer in wildlife and are here termed as “wildlife rich areas”.

A) Within Camp Area:

- Kalam Chhara upstream section in Zone 2 (Transect 5) held abundant Skipper Frog, and Large-tailed Nightjar was also recorded. The stream can be considered a hotspot for frogs. In the year before the survey restoration activities of CNRS-UNCHR here created a water reservoir, rehabilitated the stream, and involved planting herbs, shrubs and trees thereby developing undergrowth suitable for frogs and ground dwelling birds.
- Kalam Chhara downstream section in Zone 2 (Transect 4) held several species that prefer scrubby habitats such as Puff-throated Babbler, Jacobin Cuckoo and Golden Jackal. So the area can be considered a hotspot for scrub-dependent species, and with water reservoir-1 excavated in 2019 by CNRS may also suit Skipper Frog.

B) Outside Camp Area:

- The open cropland area north of Balukhali Bridge on the Cox’s Bazar-Teknaf highway (Zone 5) is notable for “grassland” species being home to Striated Grassbird and Baya Weaver.
- Cattle Egret, Little Egret and Indian Pond Heron were more numerous in Transect 1 of Zone 1 and in Zone 5. However, hunting of these birds by local people is reducing their population, and Rohingya refugees are reported to be the major buyers of these birds.

5.9 Elephant Corridor

An elephant movement monitoring tower indicates that there was an elephant movement route and/or corridor through camp 4 extension (transect 5), camp 4 (transect 4) and camp 3 towards Gungdhum. But possibly this corridor is not used by elephants now due to establishment of camps as the Rohingya refugee community confirmed that they did not see any elephant in the previous 18 months.

It was reported by local inhabitants that some elephant migration routes have been blocked by host communities, infrastructure and by the Rohingya camps. The elephants’ habitat and corridors have become fragmented as a result of the refugee settlement. The splitting of the small elephant population and its habitats in the wider region, and associated shrinkage of their genetic pool makes the extirpation of elephants from the area increasingly likely.

5.10 Floral Diversity

Forest patches provide several ecosystem services, such as prevention of soil erosion and are habitats for diverse species of animals. The vegetation of Madhur Chhara basin is under great anthropogenic pressure and is no longer forest, the area requires interventions to restore and maintain forest ecosystems and wildlife. Long-term biodiversity conservation depends basically on understanding of vegetation of each terrestrial ecosystem. A total of 87 plant species belonging to 37 families were identified in the Madhur Chhara basin within and outside of refugee camps (Appendix 3). Trees were

the majority (63%) of the species identified in the study area followed by shrubs (18%), herbs (14%), and climbers (5%). The highest number of plant species (70% of those recorded) were found along transect 3 (Zone 1) due to good patches of homestead vegetation in the area. On the other hand, the lowest number of species (15) were observed along transect 5 due to ongoing developmental activities.

Overall the highest number of plant species recorded (71 species) was in Zone 1, while Zones 3 and 4 were the least diverse with 15 species only. Zone 4 is a small area and located near camps where high human disturbance and intense land use including cultivation reduce the number of plant species (which helps to explain the low wildlife diversity (lowest among other zones).

The commonest plant species (see Appendix 3 for scientific names) recorded were: Asar, Aam, Kanthal, Lantana, Kadam, Akashmoni, Peyara, Supari, Boroi, and Kola. Some species of plants were restricted to specific areas: Hargoza, Bonokra, Keora, Kalkasunda, and Nypa palm were found in the saline influenced Zone 5 (transect 9); Sajina, Biskatali, Telsur, Bohera, Hartaki, Basantilata, Deua, Bon Lebu, Musenda, and Chalta were found in Zone 1 (transect 3); Tal, Chapa, and Sonalu were found in Zone 4 (transect 8); and Kelikadam in Zone 3 (transect 6).

6. THREATS TO WILDLIFE

Threats to wildlife in Madhur Chhara basin were evaluated through visual observation and consulting with community people. Some of the significant threats are summarised here.

Hunting: Hunting is a major problem for wildlife in the Madhur Chhara basin especially Maskaria Beel area. Species that are hunted for meat and body parts include: Indian Pond Heron, Little Egret, Cattle Egret, and Black-crowned Night Heron (Images 1 and 2). Hunting is done using traps and nets. Hunting is commercial to supply local markets where a pair of egrets or herons sell for Tk 250.

Habitat degradation: Degradation of habitat has been large scale due to the expansion of agricultural lands, construction of roads and other developmental activities, and the Rohingya influx (Image 3). Natural forest was destroyed for the refugee camps. There are no remaining large trees in Zones 2, 3, 4 and 5. Another problem is cutting the undergrowth where the few forest patches still exist in Zone 1. Furthermore, monoculture of exotic trees (*Acacia*, *Mangium*, *Eucalyptus*), particularly in places where natural forests are replaced by social forestry schemes, and Betel nut orchards has replaced forest in the past and these are poor low diversity habitats unsuitable for most wildlife species (Image 4).

Wildlife persecution: People are killing wildlife species without any cause and sometimes due to fear or superstitions (Image 5). For example, they kill snakes due to fear, especially Indian Rat Snake, although snakes are beneficial by preying rodents and many species are not poisonous. The local people believe, falsely, that the Indian Rat Snake is venomous and mates with cobra species, so they try to kill them in any encounter.

Harvesting: Local people harvest frogs in Maskaria Beel illegally (Image 6). They use these frogs as bait for catching fish and in traps for herons. They also harvest frogs (e.g. Indian Bullfrog) to consume their meat.

Road traffic: There is a heavy pressure of motor vehicles along the main army-built brick road (which falls within settlements of Zone-1) from Foliapara to the entry points of Camp-3 and Camp-4 (Image 7). Several amphibian and reptile species are regularly killed by vehicles when crossing the road (Image 8).

Pollution: The camps generate large amounts of garbage and the resulting environmental pollution affects water and land. This has multiple impacts: crops such as paddy are damaged (Image 9), habitats



Image 1- Top: A villager with hunted Cattle Egrets at Maskaijja Beel and Image 2- Bottom: A boy with a hunted Indian Pond Heron at Maskaijja Beel

used for foraging by species as diverse as herons, egrets and snakes are lost, and wildlife and people (host and refugee communities) become more vulnerable to zoonotic diseases. For example, water and soil pollution at Madhur Chhara near Balukhali Bazar has deprived birds of foraging grounds (Image 10).

Cutting and damage of undergrowth and bushes: Undergrowth is a vital component of a forest ecosystem, while bushy thickets are a habitat in their own right. In both cases this forms habitat for several amphibian, reptile, bird, and mammal species (for example, Red Junglefowl, Large-tailed Nightjar, and Golden Jackal). In addition to providing food and shelter, some birds make their nest in the undergrowth. Cutting down undergrowth and bushy thickets has resulted in several wildlife species disappearing from the area (Image 11).

Concrete stream banks (concrete pilot channel): The banks of Madhur Chhara (in some places also the stream bed) have been covered with concrete blocks intended to protect the banks in Zone 4 and Zone 5 (Image 12), this removes vital stream-side vegetation and means there is no mud deposited here (which explains why wading birds were found only on the northside of Balukhali bridge which is free of concrete channelization. Ultimately this may adversely affect stream morphology within the concrete reach, and even up and downstream of it.



Image 3: Degradation of natural hill forest in Zone 1



Image 4: Monoculture of Betel Nut in Zone 4



Image 5: Deliberately killed Red-necked Keelback in Zone 2



Image 6: Capturing frogs at Maskaijja Beel



Image 7: Heavy traffic movement on Folia para army road



Image 8: A road killed Skipper Frog on Folia para army road



Image 9: Garbage dumped near CNRS bacteria water treatment plant causing soil and water pollution adjacent to camp-1E



Image 10: Water and soil pollution near Balukhali Bazar.



Image 11: Cleared undergrowth of a remnant forest patch.



Image 12: Concrete bank and slope of Madhur Chhara near Balukhali Bazar

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Although this survey was brief and covered only one season, it provides a baseline for monitoring local trends in wildlife diversity. Importantly comparisons can be made between the camp environment and host areas up and downstream. Wildlife diversity is shown to be considerably higher in the host community areas located further away from refugee camps, whereas the camps and locations close to the camps have low diversity. Even the host areas have degraded ecosystems and wildlife diversity that is much reduced from that of protected forest areas in the district, but in the camp zone very few wildlife species remain and these are limited to widespread species tolerant of human settlements. However, riparian ecosystem restoration and re-greening activities in camp areas appear to have attracted some wildlife species enabling them to recolonize the restored habitats and offering the prospect of at least a partial reversal of the biodiversity damage done by the refugee influx. Within camps where holistic ecosystem restoration activities coupled with stream rehabilitation and creation of water reservoirs, there has been some regrowth of understory/bushy vegetation and here several species were recorded which were absent from camp areas lacking ecosystem restoration.

7.2 Recommendations

Protection and recovery of undergrowth: Undergrowth and lower canopy of remaining forest patches (adjacent to camps), and new plantations (within and outside of camps), and any other bushy-thickets (within and outside of camps) should not cut down or cleared. This habitat is important for a range of species, and where it could be found in the present survey it was home to species dependent on this habitat such as Bengal Monitor, Red-necked Keelback, Jacobin Cuckoo, Large-tailed Nightjar, Grey-breasted Prinia and Golden Jackal. Along the Kalam Chhara basin UNHCR-CNRS is striving to develop a mix of forest patches with due consideration to developing and maintaining undergrowth. However, recovery and protection of undergrowth should be done in other planting sites within the camps.

Habitat restoration: This should be continued and expanded, particularly using natural protection and vegetation along steam banks, rather than concrete, to establish corridors of wildlife habitat (see later). Establishing nurseries would support this program and should focus on native trees and plants that have high value for scarce and extirpated wildlife species – for example fruiting forest trees (Appendix 4).

Awareness and school education programs: Awareness raising activities on the value of natural forests, waterways and vegetation and their wildlife, and to discourage wildlife hunting/persecution, should be undertaken for the host community, Rohingya refugees and other relevant stakeholders. A school education program about conservation and the importance of wildlife and forests for the children of the same stakeholder groups would be a great addition. Under the UNHCR-CNRS project, some school children awareness programs were organized. However, due to the Covid-19 pandemic, social gatherings are being avoided and plans to conduct awareness events need to be modified to formats in line with the new normal (covid) situation.

Distribution of awareness materials: Visual materials with text in appropriate languages, should be developed including banners, posters, biodiversity atlas and leaflets. These should be freely distributed among host and refugee communities to support the awareness and school education

programs. These activities should be conducted within and adjacent to camps areas with a view to change attitudes among the wider society in favour of nature conservation.

Courtyard meetings: Courtyard meetings with host and refugee communities and relevant stakeholders should be held to discourage hunting, harvesting of wild resources, wildlife persecution, and destruction of natural habitats.

Reducing traffic load: The huge movement of vehicles in the area results in road-kill of wild animals especially amphibians. Limiting vehicle movement would reduce these losses, particularly if road traffic can be minimized from dusk to dawn.

Halt pollution: Steps to halt environmental pollution (e.g., education, waste collection points, garbage treatment plant) would not only reduce pollution but also improve natural habitats and reduce the risk of zoonotic diseases.

Law enforcement: Education on and enforcement of existing wildlife and environmental laws among refugee and host communities would improve the condition of the environment and wildlife. Local policies appropriate to the camps and also for notable species in the area may need to be developed. A set of agreed do's and don'ts needs to be developed with proper endorsement by the camp-in-charges (CiCs) and relevant UNOs.

Management plan: A management plan for Madhur Chhara basin should be developed to address environmental, ecological, agricultural, demographic and climate change issues in both the short term and long-term, and should also focus on wildlife conservation activities.

Biodiversity corridors and nature parks: Biodiversity corridors need to be established to connect remnant and restored wildlife habitats in and around the camps as part of mitigating recent clearance of forest. There are areas within camps where plantation and stream restoration activities have started to improve the ecosystems and wildlife, fish and pollinators have started colonizing such habitat patches. These segmented patches of greenery should be linked to one another by planned planting in future (from 2021 onwards) to improve and enhance habitats, and enable wildlife to move between adjacent natural forests and these habitat patches. Since the areas within camps are highly exposed to anthropogenic disturbances, we also recommend piloting and demonstrating "nature parks" within the camps. These would restore patches of habitat but also would be used by schools and low impact recreation to generate awareness and educate the refugee communities about ecosystems and wildlife protection and management.

Monitoring: The same transects and method should be used to monitor wildlife trends within and outside the camps. This might be better timed in the spring (March-April) when for example resident birds are singing and breeding. Annual monitoring would be preferable since there is the potential for rapid changes (negative and positive) in the basin.

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9. APPENDICES

Appendix-1: Habitat features of the Zones and along Transects

Habitat features relevant to wildlife assemblages along the transect lines are briefly described here.

Zone-1

The zone is located in the upstream reach of Madhur Chhara comprising of 723 ha with a large depressed basin in the middle (Maskaijja Beel) surrounded by reserved forests, settlements, village forests, and cropland. Water from Maskaijja Beel drains through Maskaria Chhara to Madhur Chhara (Photo 1). Wetlands, forests, cropland supports good biodiversity of fauna in this zone including migratory birds in the winter. Three transects lines have been drawn in this zone to study the wildlife diversity.



Photo 1: Partial view of Transect-1, Zone-1

Transect-1: Crosses the ecotones between several habitats: hilly forest, wetlands (Photo 1), marshland, cropland and village forest with a diverse assemblage of species. Dominant plants in village forests include Bamboo, Akashmoni, Kadam, Guava, Jackfruit, and Mango.



Photo 2: Partial view of Transect-2, Zone-1

Transect-2: Crosses a hilly plantation patch where *Acacia* are dominant (Photo 2), and an area of level cultivated land located between two hillocks. The cropland has an accumulation of garbage/solid wastes from camps.

Transect-3: Crosses village forests along a brick built road (main road to access the Rohingya camps) with relatively higher human disturbance. Roadside vegetation (Mango, Banana, Betel Nut, Bon Okra, Jolpai, Chatim, etc.) are dominant, also cropland on both sides of road (Photo 3) and then a hillock with regenerating forests and plantations at the end of the transect.



Photo 3: Partial view of transect-3, Zone-1

Zone-2

This zone covers 165.5 ha around Kalam Chhara and a smaller stream, Banurma Chhara, which feed into Madhur Chhara. These two streams originate from hill forests (degraded now) and join together and run through refugee Camp 4 Extension and Camp-4. As these are newly built refugee camps they are less populated than other camps, but massive hill and forest cutting was done to make the refugee settlements. This zone is adjacent to natural hill forest on the northern and western sides. Two transects followed Kalam Chhara which is a CNRS-UNHCR restoration site.

Transect 4: Follows CNRS-UNHCR stream restoration which created water reservoirs, restored riparian vegetation and protects stream banks with grass hedging; and hence the area has a green landscape (photo 4). Undergrowth has been regained, grassland regenerated and the canopy is growing. This area near the transect comprises infrastructure, grassland, playgrounds, water reservoirs, and refugee settlements, but the transect is on the edge of the camps and so less congested than the majority of this zone.



Photo 4: Transect-4, partial view, Zone-2

Transect 5: Starts from the southern end of Camp-4 extension and follows Kalam Chhara downstream ending near “CNRS Eco-shed” at Camp-4. The transect covers the banks of Kalam Chhara, a newly built camp and other facilities in the east, and bare hillocks on the west of Kalam Chhara. CNRS-UNHCR planted trees in the bare hillocks and rehabilitated Kalam Chhara in 2020 (photo 5). There is no middle canopy or higher canopy remaining in the area rather remnants of undergrowth on a few hillocks are visible.



Photo 5: Transect 5, partial view, Zone-2

Zone 3

Zone 3 covers 537.2 ha area and is fully located within the degraded land of Rohingya Camps. Madhur Chhara passes through several refugee camps (Camps 1W, 2W, 3, 4, 4E, 5, 6, 7, 8E and 8W) in this zone and hence the basin is densely populated by the Rohingyas. Forest clearing was done in this zone to establish Rohingya camps and to provide various other facilities. Plantation activities are being carried out in this zone. Three transects were surveyed for the study of wildlife in this zone.



Photo 6: Partial view of Transect 6, Zone-3

Transect 6: Runs through Camp 3, Camp 6 and Camp 7, and ends on the north side of Camp 8E near Balukhali. Natural habitats along this transect are highly degraded, no large trees and undergrowth exist, but there is some annual growth of different species. The chhara is highly polluted due to dumping of garbage, seepage from toilets, and high soil erosion (photo 6).



Photo 7: Partial view of transect 7, Zone-3

Transect 7: Runs towards the south along a brick-built road (army road) and runs alongside the Camp 4 commander-in-chief office, Mochra Bazar, Camp

8W commander-in-chief office, and ends near Camp 18 commander-in-chief office. It passes through Camp 3, Camp 4, Camp 5, and Camp 8W. There is no natural vegetation along this transect just annual plantations of different species (photo 7).

Zone 4

This is the smallest zone in the Madhur Chhara basin and is located downstream of camp areas but above tidal influence of the Naf River. The zone mainly comprises crop lands, settlements, growth centers, ponds and a patch of hillock. Camp 7 is to the west of the zone and Zone 5 is to the north. The Cox's Bazar-Teknaf highway forms the eastern side of the zone.

Transect 8: Runs along the Madhur Chhara and ends at south side of Camp 7. The transect is 1.56 km long and passes through a forest patch, cropland, a pond, and homestead vegetation (photo 8). Rohingya people use the bank of Madhur Chhara as a road to move from the camp to the market place nearby.



Photo 8: Partial view of transect-8, Zone-4

Zone 5

This zone is the lower most reach of Madhur Chhara within the tidal influence of the Naf River and the basin comprises of crop lands, fish/shrimp ponds and settlements. The zone is bounded by the Bangladesh-Myanmar international border to the north-east, Camp 8E and Camp 9 to the west, and Zone 4 to the north. The Cox's Bazar-Teknaf highway bisects the zone.



Photo 9 Partial view of transect-9, Zone 5

Transect 9: Runs along the Madhur Chhara as it flows downstream and ends at the bank of the Naf River. The transect covers mudflats, saline water, fish/shrimp ponds, and homestead vegetation east of the highway and the brick constructed bank of Madhur Chhara; also croplands, and homestead



Photo 10: partial view of Transect-9, Zone 5

vegetation on the edge of a camp area on the west side of the highway (photo 9) and supports few waders. In addition, a bee-eater nesting site is located in the bank of Naf River (photo 10).

Appendix 2a: Amphibian species recorded in Madhur Chhara Basin

SL	Scientific Name	English Name	Status	IUCN BD Status	IUCN Global Status	Transects														
						Z1			Z2		Z3		Z4	Z5						
						1	2	3	4	5	6	7	8	9						
ORDER: ANURA																				
Family Bufonidae																				
1	<i>Duttaphrynus melanostictus</i>	Asian Common Toad*	VC	LC	LC	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Family Dicroglossidae																				
2	<i>Euphlyctis cyanophlyctis</i>	Skipper Frog*	VC	LC	LC	√	√		√	√	√	√	√	√	√	√	√	√	√	√
3	<i>Fejervarya asmati</i>	Asmat's Cricket Frog*	R	LC	NE	√														
4	<i>Fejervarya cancivora</i>	Crab-eating Frog*	UC	LC	LC					√										√
5	<i>Fejervarya nepalensis</i>	Nepal Cricket Frog*	C	LC	LC	√	√		√											√
6	<i>Fejervarya pierrei</i>	Pierre's Cricket Frog*	VC	LC	LC	√	√		√	√									√	√
7	<i>Fejervarya syhadrensis</i>	Syhadra Cricket Frog*	VC	LC	LC	√	√		√	√									√	√
8	<i>Fejervarya teraiensis</i>	Terai Cricket Frog*	C	LC	LC	√	√			√										
9	<i>Hoplobatrachus litoralis</i>	Coastal Bullfrog*	C	NT	NE	√	√			√										√
10	<i>Hoplobatrachus tigerinus</i>	Indian Bullfrog*	VC	LC	LC	√	√		√	√					√	√				√
11	<i>Hoplobatrachus crassus</i>	Jerdon's Bullfrog*	UC	NT	VU		√													√
12	<i>Occidozyga lima</i>	Puddle Frog*	R	LC	LC	√														
Family Microhylidae																				
13	<i>Microhyla ornata</i>	Ornate Microhylid Frog*	UC	LC	LC	√	√													
Family Ranidae																				
14	<i>Hylarana taipehensis</i>	Two-striped Grass Frog*	R	DD	LC	√														
Family Rhacophoridae																				
15	<i>Chiromantis vitatus</i>	Two-striped Pigmy Tree Frog*	R	LC	LC	√														
16	<i>Polypedates leucomystax</i>	Common Tree Frog*	UC	LC	LC	√			√											
Transect Total						14	10	1	7	8	2	3	5	9						
Zone Total						15			10		3		5		9					

N. B.: *Directly observed by surveyor, No asterisk = reported by local community informants only

Status (in survey): VC=very common, C=common, UC=uncommon, R=rare.

IUCN BD and Global (threat) status: NE=not evaluated, LC=least concern, DD=data deficient, NT=near threatened,

V=vulnerable, EN=endangered, CR=critically endangered.

Appendix 2c: Bird species recorded in Madhur Chhara Basin

SL	Scientific Name	English Name	Status	IUCN BD Status	IUCN Global Status	Type	Transects								
							Z1			Z2		Z3		Z4	Z5
							1	2	3	4	5	6	7	8	9
ORDER: GALLIFORMES															
	Family Phasianidae														
1	<i>Gullus gullus</i>	Red Junglefowl	R	LC	LC	Rs	√					√			
ORDER: ANSERIFORMES															
	Family Anatidae														
2	<i>Dendrocygna javanica</i>	Lesser Whistling Duck	R	LC	LC	Rs	√								
ORDER: PICIFORMES															
	Family Picidae														
3	<i>Dendrocopos macei</i>	Fulvous-breasted Woodpecker*	R	LC	LC	Rs	√	√							
4	<i>Dinopium benghalense</i>	Black-rumped Flameback*	UC	LC	LC	Rs	√	√				√			
	Family Megalimidae														
5	<i>Psilopogon lineatus</i>	Lineated Barbet*	UC	LC	LC	Rs	√	√							
ORDER: BUCEROTIFORMES															
	Family Upupidae														
6	<i>Upupa epops</i>	Common Hoopoe*	UC	LC	LC	Rs			√			√			
	Family Meropidae														
7	<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater*	UC	LC	LC	Rs				√		√			
8	<i>Merops philippinus</i>	Blue-tailed Bee-eater*	R	LC	LC	SM						√			
ORDER: CORACIFORMES															
	Family Alcedinidae														
9	<i>Alcedo atthis</i>	Common Kingfisher*	VC	LC	LC	Rs	√		√	√	√	√			
10	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher*	VC	LC	LC	Rs	√	√	√	√	√	√			
ORDER: CUCULIFORMES															
	Family Cuculidae														
11	<i>Cuculus micropterus</i>	Indian Cuckoo*	UC	LC	LC	Rs	√				√	√			
12	<i>Cuculus canorus</i>	Eurasian Cuckoo	R	LC	LC	PM						√			
13	<i>Cacomantis merulinus</i>	Plaintive Cuckoo*	R	LC	LC	Rs						√			
14	<i>Centropus sinensis</i>	Greater Coucal	UC	LC	LC	Rs	√		√			√			
15	<i>Clamator jacobinus</i>	Jacobin Cuckoo*	R	LC	LC	SM			√			√			
ORDER: GRUIFORMES															
	Family Rallidae														
16	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen*	C	LC	LC	Rs	√			√		√			
17	<i>Zapornia fusca</i>	Ruddy-breasted Crake	R	LC	LC	Rs						√			
18	<i>Gallinula chloropus</i>	Common Moorhen	R	LC	LC	Rs				√		√			
ORDER: PSITTACIFORMES															
	Family Psittacidae														
19	<i>Psittacula alexandri</i>	Red-breasted Parakeet*	R	LC	NT	Rs						√			
20	<i>Psittacula krameri</i>	Rose-ringed Parakeet*	UC	LC	LC	Rs	√	√							
ORDER: STRIGIFORMES															
	Family Tytonidae														
21	<i>Tyto alba</i>	Common Barn-owl*	R	LC	LC	Rs	√					√			
	Family Strigidae														
22	<i>Otus lettia</i>	Collared Scops-owl*	C	LC	LC	Rs	√	√		√					
23	<i>Athene brama</i>	Spotted Owlet*	VC	LC	LC	Rs	√	√	√	√		√			
24	<i>Glaucidium cuculoides</i>	Asian Barred Owlet*	R	LC	LC	Rs	√								
ORDER: ACCIPITRIFORMES															
	Family Accipitridae														
25	<i>Spilornis cheela</i>	Crested Serpent-eagle	R	LC	LC	Rs			√	√					
ORDER: CAPRIMULGIFORMES															
	Family Caprimulgidae														
26	<i>Caprimulgus macurus</i>	Large-tailed Nightjar*	VC	LC	LC	Rs	√			√					
	Family Apodidae														
27	<i>Apus nipalensis</i>	House Swift*	VC	LC	LC	Rs	√	√	√	√	√	√			
ORDER: COLUMBIFORMES															
	Family Columbidae														

SL	Scientific Name	English Name	Status	IUCN BD Status	IUCN Global Status	Type	Transects								
							Z1			Z2		Z3		Z4	Z5
							1	2	3	4	5	6	7	8	9
28	<i>Columba livia</i>	Rock Dove*	UC	LC	LC	Rs	√	√				√			√
29	<i>Spilopelia chinensis</i>	Eastern Spotted Dove*	VC	LC	LC	Rs	√	√	√	√	√	√		√	√
30	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	R	LC	LC	Rs	√				√				√
31	<i>Streptopelia tranquebarica</i>	Red Turtle Dove	R	LC	LC	Rs	√								√
32	<i>Treron phoenicopterus</i>	Yellow-footed Green - pigeon*	R	LC	LC	Rs	√								√
33	<i>Ducula aenea</i>	Green Imperial Pigeon*	R	LC	LC	Rs	√								
ORDER: CHARADRIFORMES															
	Family Charadriidae														
34	<i>Pluvialis fulva</i>	Pacific Golden Plover*	C	LC	LC	WM									√
35	<i>Charadrius mongolus</i>	Lesser Sand Plover*	C	LC	LC	WM	√		√						√
36	<i>Vanellus indicus</i>	Red-wattled Lapwing*	UC	LC	LC	Rs	√				√				√
	Family Scolopacidae														
37	<i>Actitis hypoleucos</i>	Common Sandpiper*	VC	LC	LC	WM	√		√						√
38	<i>Gallinago gallinago</i>	Common Snipe*	C	LC	LC	WM									√
39	<i>Tringa glareola</i>	Wood Sandpiper*	C	LC	LC	WM									√
	Family Laridae														
40	<i>Chlidonias hybrida</i>	Whiskered Tern*	R	LC	LC	WM	√		√						√
ORDER: SULIFORMES															
	Family Phalacrocoracidae														
41	<i>Microcarbo niger</i>	Little Cormorant*	UC	LC	LC	Rs	√	√			√				√
ORDER: CICONIIFORMES															
	Family Ciconiidae														
42	<i>Anastomus oscitans</i>	Asian Openbill	R	LC	LC	Rs	√								√
ORDER: PELECANIFORMES															
	Family Ardeidae														
43	<i>Egretta garzetta</i>	Little Egret*	VC	LC	LC	Rs	√	√	√		√				√
44	<i>Bubulcus ibis</i>	Cattle Egret*	VC	LC	LC	Rs	√	√		√	√				√
45	<i>Ardeola grayii</i>	Indian Pond-heron*	VC	LC	LC	Rs	√	√	√		√				√
46	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron*	R	LC	LC	Rs	√								√
ORDER: PASSERIFORMES															
	Family Laniidae														
47	<i>Lanius cristatus</i>	Brown Shrike*	VC	LC	LC	WM	√	√	√	√	√	√	√	√	√
48	<i>Lanius schach</i>	Long-tailed Shrike*	VC	LC	LC	Rs	√	√	√	√	√	√	√	√	√
	Family Corvidae														
49	<i>Dendrocitta vagabunda</i>	Rufous Treepie*	UC	LC	LC	Rs	√	√	√		√				
50	<i>Corvus macrorhynchos</i>	Large-billed Crow*	VC	LC	LC	Rs	√	√			√		√		√
51	<i>Corvus splendens</i>	House Crow *	VC	LC	LC	Rs	√	√		√	√		√	√	√
	Family Artamidae														
52	<i>Artamus fuscus</i>	Ashy Woodswallow*	VC	LC	LC	Rs	√	√		√	√	√	√		√
	Family Oriolidae														
53	<i>Oriolus xanthonus</i>	Black-hooded Oriole*	VC	LC	LC	Rs	√	√	√	√					√
	Family Campephagidae														
54	<i>Pericrocotus cinnamomeus</i>	Small Minivet*	R	LC	LC	Rs			√						
55	<i>Coracina macei</i>	Large Cuckooshrike*	UC	LC	LC	Rs	√				√				√
	Family Dicruridae														
56	<i>Dicrurus macrocercus</i>	Black Drongo*	VC	LC	LC	Rs	√	√	√	√	√	√	√	√	√
	Family Aegithinidae														
57	<i>Aegithina tiphia</i>	Common Iora*	UC	LC	LC	Rs	√	√	√						
	Family Rhipiduridae														

SL	Scientific Name	English Name	Status	IUCN BD Status	IUCN Global Status	Type	Transects								
							Z1			Z2		Z3		Z4	Z5
							1	2	3	4	5	6	7	8	9
58	<i>Rhipidura albicollis</i>	White-throated Fantail*	R	LC	LC	Rs		√							
Family Muscicapidae															
59	<i>Copsychus saularis</i>	Oriental Magpie-robin*	VC	LC	LC	Rs	√	√	√	√	√	√	√	√	√
60	<i>Saxicola caprata</i>	Pied Bushchat*	R	LC	LC	Rs				√					
61	<i>Ficedula albicilla</i>	Red-throated Flycatcher*	UC	LC	LC	WM		√		√			√		
Family Sturnidae															
62	<i>Gracupica contra</i>	Asian Pied Starling*	VC	LC	LC	Rs	√	√	√	√	√	√	√	√	√
63	<i>Sturnia malabarica</i>	Chestnut-tailed Starling*	VC	LC	LC	Rs	√	√	√		√	√	√		√
64	<i>Acridotheres fuscus</i>	Jungle Myna*	UC	LC	LC	Rs				√					√
65	<i>Acridotheres tristis</i>	Common Myna*	VC	LC	LC	Rs	√	√	√	√	√	√		√	√
Family Paridae															
66	<i>Parus major</i>	Great Tit*	R	LC	LC	Rs			√						
Family Hirundinidae															
67	<i>Riparia chinensis</i>	Plain Martin*	R	LC	LC	Rs	√					√			
68	<i>Hirundo rustica</i>	Barn Swallow*	C	LC	LC	WM	√		√						√
Family Pycnonotidae															
69	<i>Pycnonotus cafer</i>	Red-vented Bulbul*	VC	LC	LC	Rs	√	√	√	√	√	√		√	√
70	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul*	VC	LC	LC	Rs	√	√	√		√			√	√
Family Cisticolidae															
71	<i>Cisticola juncidis</i>	Zitting Cisticola*	UC	LC	LC	Rs		√							√
72	<i>Prinia hodgsonii</i>	Grey-breasted Prinia*	R	LC	LC	Rs					√				
Family Sylviidae															
73	<i>Orthotomus sutorius</i>	Common Tailorbird*	VC	LC	LC	Rs	√	√	√	√	√		√	√	√
Family Phylloscopidae															
74	<i>Phylloscopus fuscatus</i>	Dusky Warbler*	UC	LC	LC	WM	√	√			√				√
75	<i>Phylloscopus trochiloides</i>	Greenish Warbler*	R	LC	LC	WM		√							
Family Locustellidae															
76	<i>Megalurus palustris</i>	Striated Grassbird*	VC	LC	LC	Rs	√		√	√	√				√
Family Pellorneidae															
77	<i>Pellorneum ruficeps</i>	Puff-throated Babbler*	UC	LC	LC	Rs	√	√	√	√					
Family Dicaeidae															
78	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker*	R	LC	LC	Rs			√						√
Family Nectariniidae															
79	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird*	R	LC	LC	Rs		√							
Family Passeridae															
80	<i>Passer domesticus</i>	House Sparrow*	VC	LC	LC	Rs	√	√	√	√	√	√	√	√	√
Family Motacillidae															
81	<i>Motacilla alba</i>	White Wagtail*	VC	LC	LC	WM	√	√	√		√	√	√	√	√
82	<i>Motacilla cinerea</i>	Grey Wagtail*	UC	LC	LC	WM			√	√			√		√
83	<i>Anthus rufulus</i>	Paddyfield Pipit*	C	LC	LC	Rs	√	√			√			√	√
Family Ploceidae															
84	<i>Ploceus philippinus</i>	Baya Weaver*	R	LC	LC	Rs									√
Family Estrilidae															
85	<i>Lonchura atricapilla</i>	Chestnut Munia*	R	LC	LC	Rs	√								
86	<i>Lonchura punctulata</i>	Scaly-breasted Munia*	R	LC	LC	Rs		√							
Transect Total							59	41	32	25	39	17	18	21	59
Zone Total							70			45		24		21	59

N. B.: *Directly observed by surveyor, No asterisk = reported by local community informants only

Status (in survey): VC=very common, C=common, UC=uncommon, R=rare.

IUCN BD and Global (threat) status: LC=least concern, DD=data deficient, NT=near threatened, V=vulnerable, EN=endangered, CR=critically endangered.

Type: Rs=resident, WM=winter migrant, SM=summer migrant, PM=passage migrant.

Appendix 2d: Mammal species recorded in Madhur Chhara Basin

SL	Scientific Name	English Name	Status	IUCN BD Status	IUCN Global Status	Transects								
						Z1			Z2		Z3		Z4	Z5
						1	2	3	4	5	6	7	8	9
ORDER: PROBOSCIDEA														
	Family Elephantidae													
1	<i>Elaphas maximus</i>	Asian Elephant	R	CR	EN					√				
ORDER: RODENTIA														
	Family Muridae													
2	<i>Bandicota bengalensis</i>	Lesser Bandicoot Rat*	VC	LC	LC	√			√	√		√		
3	<i>Rattus rattus</i>	House Rat*	VC	LC	LC	√		√	√		√	√		
	Family Hystricidae													
4	<i>Hystrix brachyura</i>	Himalayan Crestless Porcupine	R	LC	LC	√		√						
	Family Sciuridae													
5	<i>Callosciurus pygerythrus</i>	Irrawaddy Squirrel*	VC	LC	LC	√	√	√				√		
ORDER: SORICOMORPHA														
	Family Soricidae													
6	<i>Suncus murinus</i>	Asian House Shrew*	VC	LC	LC	√		√	√		√	√		
ORDER: CHIROPTERA														
	Family Pteropodidae													
7	<i>Pteropus giganteus</i>	Indian Flying Fox*	UC	LC	LC	√						√		
	Family Vespertilionidae													
8	<i>Pipistrellus tenuis</i>	Least Pipistrelle*	UC	LC	LC	√						√		
ORDER: CARNIVORA														
	Family Canidae													
9	<i>Canis aureus</i>	Golden Jackal*	VC	LC	LC	√	√	√	√	√				
	Family Herpestidae													
10	<i>Herpestes auropunctatus</i>	Small Indian Mongoose*	UC	LC	LC	√	√			√				
ORDER: PRIMATES														
	Family Cercopithecidae													
11	<i>Macaca mulatta</i>	Rhesus Macaque	R	VU	LC	√						√		
ORDER: ARTIODACTYLA														
	Family Suidae													
12	<i>Sus scrofa</i>	Eurasian Wild Boar	R	LC	LC	√								
Transect Total						11	3	5	4	4	2	2	4	6
Zone Total						11			6		3		4	6

N. B.: *Directly observed by surveyor, No asterisk = reported by local community informants only

Status (in survey): VC=very common, C=common, UC=uncommon, R=rare.

IUCN BD and Global (threat) status: LC=least concern, DD=data deficient, NT=near threatened, V=vulnerable, EN=endangered, CR=critically endangered.

Appendix 3: List of plants recorded from Madhur Chhara basin

Sl	Family	English name	Vernacular name	Scientific name	Plant type	Zone 1			Zone 2		Zone 3		Zone 4	Zone 5
						1	2	3	4	5	6	7	8	9
1	Lythraceae	Queen crape myrtle	Jarul	Lagerstroemia speciosa (L.) Pers.	T	√		√			√	√		√
2			Keora	Sonneratia apetala Buch. - Ham										√
3	Apocynaceae	Kurchi tree	Kuruji	Holarrhena antidysenterica (Roxb. ex Fleming) Wall. ex A.DC.	T	√		√						
4		Wax flower	Tagar	Tabernaemontana divericata(L.) R.Br. ex Roemer & J Schult.	S	√		√	√	√				
5		Devil's tree	Chattim	Alstonia scholaris (L.) R.Br.	T	√	√	√			√			√
6	Dipterocarpaceae	Rock dammar	Telsur	Hopea odorata Roxb.	T			√						
7			Garjan	Dipterocarpus alatus Roxb. ex G. Don	T	√					√	√		√
8	Tiliaceae		Asar	Grewia nervosa (Lour.) Panigrahi	T	√	√	√			√	√	√	√
9			Moss	Brownlowia elata Roxb.	T	√					√	√		
10	Anacardiaceae	Mango	Aam	Mangifera indica L.	T	√	√	√			√	√	√	√
11		Hog-plum	Amra	Spondias pinnata (L.f.) kurz	T	√		√					√	√
12			Kamila	Lannea coromandelica	T			√				√		
13	Combretaceae	Belaricmyrobalan	Bohera	Terminalia bellirica (Gaertn.) Roxb.	T			√						
14		Arjun	Arjun	Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	T				√	√	√	√		
15		Black myrobalan	Hartaki	Terminalia chebula (Gaertn.) Retz.	T			√						
16		Rangoon-creeper	Basantilata	Quisqualis indica L.	C			√						
17	Meliaceae		Pitraz	Dysoxylum excelsum Blume	T			√					√	
18		Chittagong wood	Chikrassi	Chukrasia tabularis A. Juss.	T						√			
19		Small-leaved Mahogany	Mehogini	Swietenia mahagoni (L.) Jacq.	T			√			√	√		√
20		Neem tree	Nim	Azadirachta indica A. Juss.	T	√		√			√			
21	Asteraceae	Jack in the bush	Assamlata	Chromolaena odorata (L.) R.M. King & H. Rob.	H	√				√				
22		Cing hempweed	Toofainna lata	Mikania micrantha Kunth	C			√		√				√
23	Moraceae	Jack-fruit	Kanthal	Artocarpus heterophyllus Lam.	T	√	√	√	√		√	√	√	
24		Monkey jack	Chapalish	Artocarpus chama Buch.-Ham. ex Wall.	T	√	√	√						√
25		Monkey jack	Deua	Artocarpus lacucha Buch.-Ham.	T			√						
26		Rough-leaved stem fig	Dumur	Ficus hispida L.f.	T						√			
27		Java fig	Pakur	Ficus benjamina L.	T	√								
28		Banyan tree	Bot	Ficus benghalensis L.	T	√	√	√						
29		Siamese roughbush	Shaora	Streblus asper Lour.	T		√	√						
30	Verbenaceae	White teak	Gamari	Gmelina arborea Roxb.	T		√		√		√			√
31		Teak	Segun	Tectona grandis L.f.	T	√	√	√						√
32		Lantana	Lantana	Lantana camara L.	H	√		√	√	√	√			√

SL	Family	English name	Vernacular name	Scientific name	Plant type	Zone 1			Zone 2		Zone 3		Zone 4	Zone 5
						1	2	3	4	5	6	7	8	9
33			Bon-lebu	<i>Merope angulate</i> (Willd.) Swingle	S			√						
34			Bhat	<i>Clerodendrum viscosum</i> Vent.	S			√	√	√				√
35	Clusiaceae	Cow tree	Kau	<i>Garcinia cowa</i> Roxb. ex DC.	T			√						
36	Poaceae	Love grass	Premkata	<i>Chrysopogon aciculatus</i> (Retz.) Trin.	H	√	√	√	√	√			√	√
37		Common bamboo	Bahini	<i>Bambusa vulgaris</i> Schrad.	H		√	√				√		
38		Hairy finger-grass	Anguli ghas	<i>Digitaria sanguinalis</i> (L.) Scop	H	√	√	√				√		
39			Lathibash	<i>Dendrocalamus longispathus</i> (Kurz) Kurz	H	√								
40	Convolvulaceae	Pink Water Lily	Dholkalmi	<i>Ipomoea fistulosa</i> Mart. ex Choisy	S	√				√				√
41	Piperaceae	Betel-leaf	Pan	<i>Piper betle</i> L.	C	√								
42	Araceae	Taro	Kochu	<i>Colocasia esculanta</i> (L.) Schott	H	√		√		√		√		√
43	Rubiaceae		Kelikadam	<i>Mitragyna parvifolia</i> (Roxb.) Korth. var. <i>microphylla</i> (Kurz) Ridsdale	T							√		
44			Kadam	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	T	√	√	√	√	√	√	√	√	√
45		Crab's claw	Musanda	<i>Mussaenda macrophylla</i> Wall.	H			√						
46		Gardenia	Gondhoraj	<i>Gardenia jesminoides</i> J. Ellis	H									√
47	Magnoliaceae	Golden champa	Chapa	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	T								√	
48	Mimosaceae	Ear-pod wattle	Akashmoni	<i>Acacia auriculiformis</i> Benth.	T	√	√	√	√		√	√		√
49		Sensitive plant	Lajjabati	<i>Mimosa pudica</i> L.	H			√	√					√
50		Monkey pod	Rain tree	<i>Albizia saman</i> (Jacq.) Merr.	T	√		√			√	√		√
51		Iron wood tree	Lohakat	<i>Xylocarpus xylocarpa</i> (Roxb.) Taub. var. <i>kerrii</i> (Craib & Hutch.) I.C.Neilsen	T	√					√			
52	Euphorbiaceae	Indian gooseberry	Amloki	<i>Phyllanthus emblica</i> L.	T		√	√						
53		Castor	Verenda	<i>Ricinus communis</i> L.	S			√		√	√			
54	Elaeocarpaceae	Indian Olive	Jalpai	<i>Elaeocarpus floribundus</i> Blume	T	√	√	√					√	
55	Caesalpiniaceae	Peacock flower	Krishnachura	<i>Delonix regia</i> (Hook.) Raf.	T	√			√		√			√
56		Tamarind tree	Tentul	<i>Tamarindus indica</i> L.	T	√							√	
57		Thailand cassia	Minjiri	<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	T						√	√		√
58		Prpper-leaved Senna	Kalkasunda	<i>Senna sophera</i>	S									√
59		Metal Seed	Teraj	<i>Senna tora</i>	S			√						√
60			Sunalu	<i>Cassia fistula</i> L.	T									√
61	Myrtaceae	Timor white gum	Eucalyptus	<i>Eucalyptus alba</i> Reinw.	T			√			√		√	
62			Dhaki jam	<i>Syzygium grande</i> (Wight.) Walp.	T	√	√	√			√	√		
63			Gutijam	<i>Syzygium amplexicaule</i> (DC.) N.P.Balakr.	T	√		√						√
64			Butijam	<i>Syzygium balsameum</i> (Wight) Wall. Ex Walp	T	√		√					√	
65			Indian Black-berry	Jam	<i>Syzygium cumini</i> (L.) Skeels	T	√	√	√			√	√	

SL	Family	English name	Vernacular name	Scientific name	Plant type	Zone 1			Zone 2		Zone 3		Zone 4	Zone 5
						1	2	3	4	5	6	7	8	9
66		Guava	Peyara	Psidium guajava L.	T		√	√	√		√	√	√	√
67	Arecaceae	Rattan	Bet	Calamus tenuis Roxb.	C	√	√	√						
68		Viagra Palm	Supari	Calamus erectus Roxb.	T	√	√	√	√			√	√	√
69		Coconut	Narikel	Cocos nucifera L.	T	√		√						√
70		Indian wild plam	Khajur	Phoenix rupicola T.Anderson	T		√						√	√
71			Gol pata	Nypa fruticans Wurbmb	S									√
72		Tal	Borassus flabellifer L.	T								√		
73	Dilleniaceae	Elephant apple	Chalta	Dillenia indica L.	T			√						
74	Polygonaceae	Knotweed	Bishkatali	Persicaria barbata (L.) Hara.	H			√						
75	Melastomataceae	Indian rhododendron	Bontejpata	Melastoma malabathricum L.	S	√	√	√	√	√				√
76	Rhamnaceae	Indian jujube	Boroi	Ziziphus mauritiana Lam.	T	√	√	√	√		√	√	√	√
77	Moringaceae	Drumstick tree	Sajina	Moringa oleifera Lam.	T			√						
78	Musaceae	Banana	Kola	Musa paradisiacal var. sapientum (L.) Kuntze	S	√	√	√	√	√	√	√		√
79	Lamiaceae	Hyptis	Tokma	Hyptis suaveolens (L.) Poit.	S	√		√		√				
80	Nymphaeaceae	Red water lily	Lal shapla	Nymphaea rubra Roxb. ex Andrews	H	√		√						
81	Pandanaceae	Screw pine	Keyakata	Pandanus foetidus Roxb.	S	√		√						√
82	Thymelaeaceae	Agar	Agar	Aquilaria agallocha Roxb.	T	√		√			√			
83	Malvaceae	Congo jute	Banokra	Urena lobata L.	S			√	√		√	√		√
84			Banokra	Urena sinuata L.	S									
85	Caricaceae	Papaw	Pepe	Carica papaya L.	S	√	√	√	√	√	√			
86	Acanthaceae		Hargoza	Acanthus ilicifolius	S									√
87	Oxalidaceae		Kamranga	Averrhoa carambola L.	T			√						
				Transect Total		45	26	61	18	15	29	25	20	37
				Zone Total		71		24		37		20		37

Plant type: T = Tree, S = shrub, C = Climber, H = Herb

Appendix 4: Recommended fruiting tree and other plant species for habitat restoration in the camps.

SL	Local Name	Scientific Name	English Name
1	Pakur	<i>Ficus benjamina</i> L.	Java Fig
2	Jhuri Bot	<i>Ficus benghalensis</i> L.	Banyan Tree
3	Assawath	<i>Ficus religiosa</i> L.	Peepul Tree
4	Ranga Dumur	<i>Ficus tinctoria</i> Forst.f.	Humped Fig Tree
5	Jog Dumur	<i>Ficus racemosa</i> L. var. <i>racemosa</i>	Indian Fig
6	Kak Dumur	<i>Ficus hispida</i> L.f.	Rough-leaved Stem Fig
7	Rangila Dumur	<i>Ficus variegata</i> Blume	Common Red Stem Fig
8	Uri-am	<i>Mangifera sylvatica</i> Roxb.	Wild Mango
9	Deua	<i>Artocarpus lacucha</i> Buch.-Ham	Monkey Jack
10	Chapalish	<i>Artocarpus chama</i> Buch.-Ham. Ex Wall	Monkey Jack
11	Jalpai	<i>Elaeocarpus tectorius</i> Blume	Indian Olive
12	Kaloram	<i>Syzygium cumini</i> (L.) Skeels	Indian Blackberry
13	Khudijam	<i>Syzygium fruticosum</i> (Roxb.) DC.	-
14	Goda Jam	<i>Syzygium nervosum</i> A.Cunn. ex. DC.	-
15	Neul/Gutgutia	<i>Protium serratum</i> (wall. ex Coelbr.) Engl.	Indian Red Pear
16	Hargaza	<i>Dillenia pentagyna</i> Roxb.	-
17	Amra	<i>Spondias pinnata</i> (L.f.) Kurz	Hog-plum
18	Haritaki	<i>Terminalia chebula</i> (Gaertn.) Retz.	Black Myrobalan
19	Amloki	<i>Phyllanthus emblica</i> L.	Indian Gooseberry
20	Bohera	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Beleric Myrobalan
21	Latkan	<i>Baccaurea ramiflora</i> Lour.	Burmese Grape
22	Jarul	<i>Lagerstroemia speciosa</i> (L.) Pers.	Queen Crape Myrtle
23	Garjan	<i>Dipterocarpus</i> spp.	-
24	Kau	<i>Garcinia cowa</i> Roxb. ex DC.	Cow Tree
25	Kadam	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	-
26	Peyara	<i>Psidium guajava</i> L.	Guava
27	Pepe	<i>Carica papaya</i> L.	Papaya
28	Palas	<i>Butea monosperma</i> (Lam.) Taub	Parrot Tree
29	Mandar	<i>Erythrina variegata</i> L. var. <i>variegata</i>	Indian Coral Tree
30	Gab	<i>Diospyros malabarica</i> (Desr.) Kostel	Wild Mangosteen
31	Kamranga	<i>Averrhoa carambola</i> L.	Chinese Gooseberry