

Acknowledgement

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Abstract

The *Crocodylus palustris* (Mugger Crocodile) is one of species under the vulnerable list of the CITES. It is semi aquatic, keystone species and top carnivores of wetland ecosystem. Due to habitat destruction and other causes it is threatening in population. So, particular research to get near its condition is necessary. The present study entitled "Status of *Crocodylus palustris* at Rani Tal inside Shuklaphata Wildlife Reserve, Kanchanpur, Nepal " was conducted from June 1st 2008 to June 15th 2009. The main objective of study was to know the status of Mugger Crocodile by assessing water quality and other factors.

The population of Mugger Crocodile was identified by field survey with visual observation along with the questionnaire survey. Continuous survey about 15 days was made in Rani Tal. Impact of surrounding vegetation, Marsh/ floating vegetations and bottom and site soil in Rani Tal also studied together with water quality status. Almost 18 wetlands are found to be main regions for occurrence of Mugger Crocodiles. Total number of Mugger Crocodiles in SWR was estimated to be 59-98 in number. In aspect of Rani Tal, 4 Mugger Crocodiles were found which was decreased number than previous observed according to respondents. The estimated population of Rani Tal dependent Mugger Crocodile from questionnaire survey also was noted to be 2-4. The dam site and inflow site of lake together with laden trees and logs was found to be good habitat for Mugger Crocodile due to winter easier for basking and easier to search food. But nowadays, the area were found to be covering highly with surrounding Marsh vegetation like *Phragmites karka*, *Sachhrum spontanium* etc. The eastern side of lake which was previously major basking place of Crocodile now was fully encroached by *Phragmites karka* and other species. It was reported from questionnaire survey that about 50 years ago, approximately 10-20 Mugger Crocodiles used to occur frequently in study area. Regarding to Mugger Crocodiles in study area, no event of the hunting and poaching was reported. Rani Tal was in safe security but some illegal activities for fishing and other resource collection performed was detected. Poor water quality was detected in Rani Tal which was not appropriate for survival of many aquatic and semi aquatic animals including *Crocodylus palustris*. The data revealed from the water quality showed the hypereutrophic condition of the lake on the basis of the Nitrogen/Phosphorous and Alkalinity content in the lake. Parameters like seasonal depression in Oxygen, High Total Hardness, High Carbon dioxide, High Orthophosphate High BOD and Ammonia was found to be threat to Mugger Crocodile. Mugger Crocodile here was not only harm by water quality. Here in study site, the blocking free movements of Mugger to downward side of dam toward other wetlands, Encroachment in major habitat like muddy and sandy bank by *Phragmites karka*, Seasonal drying

of Lake, Illegal fishing, Animal hunting and collection for eggs of animals have been recorded as threats to Mugger Crocodile.

The major problem in the lake was addition of the nutrients and sediment from the surroundings which was leading the extensive growth of the macrophytes. Addition of the nutrients from the flooding, sedimentation, siltation, and the leaching from Phosphate and Nitrogen rich bottom and surrounding soil seemed to have caused the eutrophication problem in the lake. Surrounding soil and bottom soil were also responsible in adding nutrients in lake. Closed dam construction at outflow has seemed to aggravate the siltation and helped in vegetation succession in Rani Tal by adding the nutrients, day by day. The siltation and vegetation succession highly by *Phragmites Karka*, *Erianthus ravennae* and *Sachhrum spontanium* was found to have decreased the area of lake. From study, it was also reported that the lake depth has been decreased by 4-6 ft from last 60 years due to high rate of siltation and sedimentation. The area was found to be decreased from 220 ha to 6-7 ha from literature review. The high coverage of native encroaching species *Phragmites karka* had covered whole marginal area of lake, above 80% coverage without leaving of sandy soil bank, as it is major habitat for *Crocodylus palustris*. *Phragmites karka* also had highest relative density among all vegetation in the marsh. The vegetation like *Phragmites karka*, *Erianthus ravennae* and *Sachhrum spontanium*, these three contained of 100% frequency. It's also reported that about 10-15 years had gone for the invasion of the alien species like *Pistia*, *Alternanthera* etc. on the lake. More than 90% coverage of free floating plants with highest coverage of *Pistia straiotes* was noticed on lake body. The lake surrounding was found to be dominated by the species *Shorea robusta* together with *Dalbergia sisso*, *Terminalia alata*, *Cleistocalyx operculata*, *Garruga pinnata*, *Syzygium cumini* and *Sclerchera oleosa* with large number of climbers like *Bahunia verigata*. Similarly surrounding vegetation was also contributing in deteriorating water quality with high litter fall amount.

As we know Crocodiles are the top carnivores of ecosystem, the water quality if not in permissible limit, it will directly degrade the lake effecting the flora and fauna. It will disturb the food web structure and directly harm the lake dependent Crocodiles by declining in number of food materials. Therefore proper management of Rani Tal and Rani Tal dependent Mugger Crocodiles should be done in proper time by improving water quality and other factors.

Key words: *Population, Eutrophication, Threats, Water quality, Invasive species, Vegetation analysis, Bottom and site soil analysis.*

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Acronyms and Abbreviations

Ag ₂ SO ₄	Silver sulfate
APHA	American Public Health Association
AWWA	American Water Work Association
BNP	Bardia National Park
BOD	Biological Oxygen Demand
BPP	Biodiversity Profile Project
Ca ⁺²	Calcium ions
CaCO ₃	Calcium carbonate
CBIP	Central Board of Irrigation and Power of the India
CDES	Central Department of Environmental science
CEDA	Central for Economic and Development Administration
CITES	Convention on the International Trade on the Endangered species
Cl ⁻	Chloride ion
CM	Centimeter
CNP	Chitwan National park
COD	Chemical Oxygen Demand
CO ₃ ⁻³	Carbonate ion
CSUWN	Conservation and Sustainable use of Wetlands in Nepal.
CuSO ₄	Copper sulfate
DHM	Department of Hydrology and Meteorology
DNPWC	Department of National Parks and Wildlife Conseravation
DO	Dissolved Oxygen
DoFD	Directorate of Fishery Development
EDTA	Ethyl- Diamine Tetra Chloride
EIA	Environmental Impact Assessment
EISP	Environment Impact Study Project
ENPHO	Environmental and Public Health Organization
EPA	Environmental Protection Act
EPA	Environmental Protection Agency

FAO	Food Association Organization
ft	Feet
GoN	Government of Nepal
GPP	Gross Primary Productivity
GPP	Gross Primary Productivity
GPS	Global Positioning System
H ⁺	Hydrogen ion
HCO ³⁻	Hydrogen bicarbonate
Ha	Hectare
H ₂ SO ₄	Sulfuric acid
H ₂ CO ₃	Carbonic acid
HCl	Hydrochloric acid
IAS	Invasive Alien Species
IAPS	Invasive alien plant species
ICIMOD	International Centre for Integrated Mountain Development
IETC	International Environmental Technology Centre
INGO's	International Non Governmental Organizations
INS	Invasive native species
IUCN	International Union for Conservation of Nature and
K ⁺	Potassium ion
K ₂ Cr ₂ O ₇	Potassium dichromate
KCl	Potassium Chloride
KI	Potassium iodide
KH ₂ PO ₄	Potassium Hydrogen Phosphate
KWR	Koshi Tappu Wildlife Reserve
M	Metre
MFSC	Ministry of Forest and Soil Conservation
Mg ⁺²	Magnesium ion
mg/l	Milligram per litre
MnSO ₄	Magenese Sulfate
msl	Mean sea level

N	Normality
Na ⁺	Sodium ion
NaCl	Sodium Chloride
NaOH	Sodium hydroxide
NARC	National Agricultural Research Council
NAST	National Institute of Science and Technology
Na ₆ (PO ₃) ₆	Sodium hexaphosphate
NGO	Non Governmental Organization
NPC	National Planning Commission
NPP	Net Primary Productivity
NTFP	Non Timber Forest Product
NTNC	National Trust for Nature Conservation
nm	Nanometre
μ s/cm	Microsiemen per Centimetre
OECD	Organization for economic co- operation and Development, Paris and France.
OM	Organic Matter
PCP	Participatory Conservation Programme
pH	Hydrogen ion concentration
Pl/ha	Plant per hector
pl/m ²	Plant per meter square
PPM	Parts Per Million
PPP	Park People Project
SO ₄ ⁻²	Sulphate ion
SnCl ₂	Stannous Chloride
SWR	Shuklaphanta Wildlife Reserve
TAL	Terai Arc land Scape
TDS	Total Dissolved solids
TS	Total Solids
TSS	Total Suspended Solids
TU	Tribhuvan University

TUCL	Tribhuvan University Central Library
UN	United Nation
UNEP	United Nation Environmental Programme
USAID	United States Aid for International Development
UNESCO	United Nation Environmental, Scientific and Cultural organization
USEPA	United Nation Environmental Protection Agency
WBC	Wetland Biodiversity Conservation
WECS	Water and Energy Commission Secretariat
WHC	Water Holding Capacity
WHO	World Health Organizations
WWF	World Wide Fund for Nature