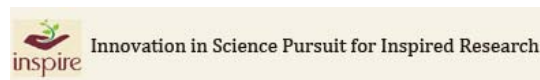


DST INSPIRE FACULTY AWAD PROJECT, SACON
(2016 – 2022)



ECOLOGICAL EXPLORATION AND SOCIOECONOMIC VALUATION OF PIT LAKES IN
EASTERN COAL FIELDS, INDIA:
IMPLICATIONS FOR CONSERVATION AND SUSTAINABLE USE

FINAL TECHNICAL REPORT



Submitted To
INSPIRE Division, Department of Science and Technology, Government of India

Submitted By

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Under Supervision of

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Sálim Ali Centre for Ornithology and Natural History

(A Centre of Excellence under the Ministry of Environment, Forest and Climate Change, Government of India)
Anaikatty (Post), Coimbatore – 641108, Tamil Nadu, India

2022

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Sálim Ali Centre for Ornithology and Natural History

Citation

Gupta, S., Quadros, G, Mukherjee, A, Das, S & Naik, A (2022) Ecological exploration and Socioeconomic valuation of Pitlakes in Eastern Coalfields, India: Implications for Conservation and Sustainable use. Technical Report. Submitted to INSPIRE Division, Department of Science and Technology, Government of India. Pp – 1-

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Cover design: Dr. Santanu Gupta, DST INSPIRE Faculty Fellow, Division of Wetland Ecology, (SACON)

Photographs in the report: All are camera images from the current study or developed using GIS software and survey data on Pitlakes.

"Science knows no country, because knowledge belongs to humanity,
and is the torch which illuminates the world."

-Louis Pasteur

PREFACE

The state of world's wetlands and aquatic ecosystems has deteriorated in the last 50 years. The Global Wetland Outlook (Ramsar Convention on Wetlands 2018), illustrates "natural wetlands are in long-term decline around the world; between 1970 and 2015, inland and marine/ coastal wetlands both declined by approximately 35%". It also summarizes that "wetlands are in serious trouble, declining in area and quality, and under mounting pressure". This was confirmed in the Global Assessment of the Intergovernmental Platform on Biodiversity and Ecosystem services (IPBES 2019) and also reported by Bridgewater and Kim 2021a, b as "over 85 per cent of wetlands (area) has been lost". Recent studies revealed that "global fresh water demand will be increased (50%) by 2030 (IUCN 2021) under changing climate paradigm (IPCC 2022).

Ramsar Convention defines "Wise use of Wetlands" as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, with in the context of sustainable development". Wise use therefore has at its heart the convention and sustainable use of wetlands and their resources, for the benefit of people and nature. The fourth Strategic Plan is designed to support all stakeholders' efforts to ensure that Wetlands are conserved wisely used, restored and their benefits recognized and valued by all (RAMSAR 2016).

In India, open cast mining has become increasingly common over the last few decades through changes in excavation technology and ore economics. Coal India Limited (CIL) mines produce 83% of India's coal for the country and operates through 7 subsidiary companies in 8 states. CIL runs 345 coal mines (151 undergrounds, 172 open cast and 22 mixed mines) in coal bearing areas of India. Moreover they have 293 closed mines under its official lease holding areas (Joshi P 2022). However, such operations frequently leave a legacy of open mine pits creating huge voids once mining ceases. Decades of Natural reclamation creates a unique aquatic landscape feature in surface of coal bearing areas, commonly known as "Quarry lakes, Mine Lakes or Pitlakes" which are included under RAMSAR wetland category 7 i. e Excavations. By definition a pit lake is a lake that forms by flooding of an excavated mining pit. Physically, pit lakes have unique bathymetries, are often strongly wind sheltered and have very small catchments. Water in pit lakes has the potential to be useful for a range of purposes in characteristically hot, dry climatic regions in India with relatively few natural water bodies (Schultze et al 2022).

Considering these aspects present investigator (SG) and his team (GQ, AM, AN and SD) took the responsibility to assess the unique aquatic ecosystems - Pitlakes in Eastern coalfields (ECL) region in the state of West Bengal and Jharkhand, India during 2016 – 2022 under INSPIRE Division, Department of Science and Technology, Government of India sponsored long term research project from Salim Ali Centre For Ornithology and Natural History, Coimbatore, Tamil Nādu. ECL operates in Raniganj Coalfield in West Bengal, Mugma field (in Dhanbad district), Rajmahal Coalmines Projects (in Godda district) and Saherjuri Coalfield (in Deoghar district) in the state of Jharkhand. We included the pitlakes in Eastern Coalfields which are presently spreading over the districts of Paschim Bardhaman (formerly known as Burdwan), Birbhum, Bankura and Purulia (last three districts are drought prone and economically downtrodden) in West Bengal followed by Dhanbad and Bokaro District in Jharkhand. This empirical and multi season study can be broadly put into two scientific or thematic expeditions which include a) **Ecological Exploration** (inventory, assessment and monitoring of Pitlakes' ecology, biodiversity (with a focus on waterfowls) - ecosystem services and climate change followed by b) **Sustainable Governance** (restoration, management and conservation of Pitlakes especially for habitat of waterfowls to promote sustainable use). This scientific research is conceived and implemented under "Convention on Wetlands" (RAMSAR 1971) principle, framework and philosophy followed by the recent guidelines of National Plan for Conservation of Aquatic Ecosystems (MoEF&CC 2019).

This extensive multi season scientific study of six years includes five essential components which are as follows: inventory and ecological characterization of Pit lakes in Eastern Coalfields followed by quantitative assessment of biodiversity (waterfowls); valuation of ecosystem services; modelling of Pitlakes in respect to their ecological, socioeconomic and climate change aspect for better decision support systems and development of suitable restoration, conservation and management plans for sustainable wise use of these aquatic ecosystems, respectively.

The present scientific investigation is probably one of the very few initiative under NPCA (MoEF&CC 2019) and RAMSAR IV strategic plan (2016- 2024) in India encompassing research on human made freshwater ecosystems, that documented the national / regional importance of Pitlakes in Coal Bearing Areas (CBAs) and dry landscapes of Eastern Coalfields region. This may include in conservation planning as well as socioeconomic upliftment of the concerned region under sustainable development scenario during the third triennia of 4th RAMSAR Strategic Plan (2021 – 2024), adding strength to the key international multilateral agreements, notably "Sustainable Development Goals", "Transforming our world: the 2030 Agenda for Sustainable Development", "Decade of Ecosystem Restoration" (2021- 2030) and Post2020 Framework of UN system in modern times. This study assimilated a strong focus on returning to the convention on wetlands' origins and alluded better Pit Lake conservation for feeding and breeding spaces of waterbird species in Eastern India.

Dr. Santanu Gupta, Ph.D.

Dedicated
To
The Convention of Wetlands of
International Importance especially as
Waterfowl Habitat
(Ramsar, Iran, 02.02.1971)



ACKNOWLEDGEMENT

This report is an outcome of the primary research conducted by the undersigned and his team under INSPIRE Faculty Award scheme of Department of Science and Technology, Government of India. The Financial support from DST, Government of India is acknowledged with gratitude.

I would like to thank competent authorities of Government of India, Govt of Tamil Nadu, Govt of West Bengal and Govt of Jharkhand; Ministry of Home Affairs, Ministry of Jalshakti, Ministry of Mines, Ministry of Coal, Ministry of Science and Technology, Ministry of Environment, Forest and Climate Change, Ministry of Rural Development for help, governance, resources and support during my research tenure in SACON (2016 -2022). Special thanks to the officials of CIL, ECL, BCCL and CCL for their support, resources and cooperation.

I specially acknowledge the heartily encouragement received from our respected Sir Dr S. Muralidharan, Director in Charge, SACON and Dr. K Sankar, Former Director, SACON since my joining to Salim Ali Centre for Ornithology and Natural History – A Centre of Excellence under the Ministry of Environment, Forest and Climate Change, Government of India. Special thanks to Professor (former) Sushil Dutta, North Odisha University for his blessings and suggestions during SACON annual review meeting (2018).

I would like to thank Dr. Srivari Chandrasekhar, Secretary, DST; Dr. M. Ravichand, Former Secretary, Department of Science and Technology; Dr Renu Swarup, Former Secretary, Department of Science and Technology, Prof. Ashutosh Sharma, Former Secretary, Department of Science and Technology, Government of India, Dr. Praveer Asthana, Head, Scientist G, DST; Dr Bipin Joshi, Scientist E, DST; Dr Rukmani Arunachalam, Scientist B, DST; Sunit Minz, Scientist B, DST; DST INSPIRE Programme Division for directions, guidance and support towards successful implementation of this award from SACON.

I would like to thank Dr. Amalesh Mukherjee, former HEAD and Scientist G, INSPIRE Programme, DST Government of India, Late Dr. Ambarish Mukherjee, former Professor, Department of Botany, The University of Burdwan, Dr Gautam Kr Saha, Professor, Department of Zoology, University of Calcutta, Dr Sudip Chattopadhyay, Professor, Department of Biotechnology, NIT Durgapur, Dr. Sovan Roy, Senior Scientific Officer, DST-WB, Dr Gautam Aditya, Professor, Department of Zoology, University of Calcutta, Dr Utpal Singha Roy, former Assistant Professor, Durgapur Government College, Dr Arnab Banerjee, former Assistant Professor, Durgapur Government College for their care, suggestions and help during my INSPIRE Fellowship period (2011 -2016, Date).

I would like to thank Prof. Kevin J Murphey, Institute of Biodiversity, Animal Health and Comparative Medicine, University of Glasgow, United Kingdom; Prof. Georg A. Janauer, Department of Limnology and Oceanography, University of Vienna, Austria; Dr Zsolt Török, Danube Delta National Institute for Research and Development, Romania; Dr. Christopher Hassal, Lecturer, School of Biology University of Leeds for their blessings since my INSPIRE Fellowship days through their continuous motivation, encouragements and unconditional support.

I would also like to thank Dr P Bala Subramanian, former Research Coordinator, SACON; P.R. Arun, Research Coordinator, SACON; R. Jayakumar, The Administrative Officer, SACON; Aneesh Abraham, The Finance Officer, SACON; My Colleagues and all the Scientific and Support Staff and Scholars of SACON for their unconditional help and support.

Thanks to Secretariats and officials of RAMSAR, UN, UNESCO, UNSDG, UNCBD, UNFCCC, UNCCD, UNEP, IPBES, IPCC, GEF, WMO, FAO, USGS, CMS, WHO, IUCN, CITES, IMF, ADB, WWF, WWT World Bank, Conservation International, Birdlife International, Wetland International, IWMI, WRI, WII, BNHS, ATREE, WCS, WILEY, ELSEVIER, PubMed, Springer Nature, Clarivate Analytics, Scopus, ORCID, Addinsoft, Google, Microsoft, QGIS, MAXENT and R Core Teams for resources, literatures, reports, documents, guidelines, materials, policy frameworks, softwares and updates without which this report wouldn't have been possible. Thank you, State Bank of India and Central Bank of India, for services.

ACKNOWLEDGEMENT

Thank you, John Wiley & Sons, Inc, USA for publishing and waving publication charges (full) for our first open access article under this project. Special Thanks to Nature Asia and Ms Richa Malhotra, Nature India for scientific reporting of our work in Nature India Annual Volume 2020.

Special thanks to Martin Schultz (Helmholtz-Zentrum für Umweltforschung GmbH – UFZ, Germany); Jerry Vanderberg (Vandenberg Water Science Ltd, Canada); Cherie D. McCullough (Mine Lakes Consulting, Australia) and Devin Castendyk (Golder Associates, USA) for resources and technical communications on Pitlakes in “Mine Water and the Environment”.

I would be failing in my duties if I do not mention the love, encouragement and blessings I have received from Dr. P A Azeez – Former Director, SACON to pursue this scientific research career under DST INSPIRE Faculty Award scheme of Department of Science and Technology, Government of India from Division of Wetland Ecology, Salim Ali Centre for Ornithology and Natural History, Coimbatore, Tamil Nadu, India. I will be eternally grateful to him.

I am indebted to my departmental head and mentor Dr. Goldin Quadros, Principal Scientist and Head, Division of Wetland Ecology, SACON for his kind supervision, motivation and encouragement during the course of this entire project work since my joining to SACON. I will be eternally grateful for his unconditional love for me, my work and my family.

Special thanks Mrs Tanulata Gupta, SNARC Foundation, Durgapur and Jasyasri Mukherjee, former Teacher, DGHS, Govt. of West Bengal for their care, suggestions, logistic support and blessings.

I wish to specially thank Dr. Aparajita Mukherjee, SACON, Mr. Snehangshu Das, Shivaji University, Kolhapur and Mr Akshay Naik, SACON for their contributions, sweat and hard works in this project and unconditional support. I will be eternally grateful to all of you.

Thanks to Sutherland et al (2020) for their editorial in Conservation Biology (Volume 34, No- 4) which empowers the undersigned over times by “extending the vision that comes from standing on the shoulders of the giants”

Special thanks to Dr. Debnath Palit, Principal, Durgapur Government College, West Bengal, India.

Bless you my child “Hrishita”. You are now my inspiration to pursue scientific research on “WETLANDS”.

Thank you, Society for Conservation Biology (SCB) and Society for Wetland Scientist (SWS).

Thank you SACON Thank you WWF- India

*Thank You “Convention on Wetlands of International Importance
especially as Waterfowl Habitat (1971)”*

(Dr. Santanu Gupta)

20th June 2022, Coimbatore, Tamil Nadu

INSPIRE Faculty, SACON

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Executive Summary

Fresh water resources of the world are a repository of rich biodiversity (Mitsch and Gosselink, 2000; Murphy et al., 2003; MA 2005, Dudgeon et al., 2006; Schmidt-Mumm and Janauer, 2014; Clarke 2015, Gopal 2013; Bridgewater and Kim 2021a, Aditya 2021, Roy et al 2021). They support many key ecological processes (Wetzel 2001, Céréghino et al., 2014), and provide a number of benefits free of cost to human society (De Groot et al., 2006, Malby and Acreman 2011, Ruiz et al., 2021, Schultze et al 2022). Studies on freshwater resources in connection with their ecology, biodiversity, multipurpose usages and conservation have been investigated in different parts of the world (e.g. Finlayson 2012, 2014; Janauer et al., 2012; Martins et al., 2013, Bridgewater and Kim 2021b) since decades. However, recent investigations on aquatic systems have highlighted the fact of continued decline in aquatic species and degradation of wetland and freshwater habitats across the world (Maltby 2009, Hassall 2014, Chiu et al., 2017, WWF 2020, Kim 2021). It is expected that global fresh water demand will be increased (50%) by 2030 as per recent report by IUCN (2021).

All surface mining processes create drastic changes in the landscape (Down and Stocks, 1977; Tiwary and Shukla, 2012; Pietrzyk-Sokulska et al., 2015; Pandey et al., 2016). They result in the formation of large overburden dumps, huge voids, and pit lake ecosystems in the mining sites. By definition a pit lake (hereafter lake) is a deep-water aquatic habitat, that forms by flooding of an excavated mining pit. Physically, these lakes have unique bathymetries, are often strongly wind sheltered and have very small catchments.

Water in this special type of lakes has the potential to be useful for a range of purposes in characteristically hot, dry climatic regions in India with relatively few natural water bodies. Especially, the value of these freshwater habitats in Eastern Coalfields region (especially in rural and tribal areas) historically has been overlooked, but pioneering study by Gupta et al., 2013 and Palit et al., 2014, 2016 have demonstrated that these critical habitats contribute a great deal to both) biodiversity support and rural livelihood at a regional level. Notwithstanding, intense, comprehensive and empirical scientific enquiries under international framework (e.g. Convention on Wetlands, RAMSAR 1971, UNCBD, UNFCCC, CMS etc) on ecology, biodiversity, climate change and conservation priorities for waterfowls remain scanty on abandoned coal mine generated quarry lakes in coal fields region of eastern India.

With this in background, the present investigation through multi season survey approach and with a focus on 'waterfowl habitat conservation and coexistence' (adapted after WWF) in lakes formed due to open cast coal mining process in Eastern Coalfields Limited (ECL) of India, revealed a total of 62 numbers of lakes which are distributed in 11 coal mining areas of ECL (a subsidiary company of Coal India Limited). They are located in the administrative regions of West Bengal (48 lakes, 77.4%) and Jharkhand (14 lakes, 22.6%) respectively. They are distributed in the elevation gradient (mean = 110.8m ± 23.1), encompassing a total area of 354 ha open water as revealed during the present investigation during a period of six years (2016 – 2022). More over LANDSAT 8 search over six years confirms presence of 121± lakes in the command and adjoining areas of ECL, BCCL and CCL.

This study assessed, affirms and report that 36 lakes (58.1%) are mesotrophic, 17 lakes (27.4%) are Oligotrophic and only 9 lakes (14.5%) are characterized as Eutrophic lakes as per physical verification, biomonitoring and water quality surveillance during the study period. 92% lakes are functioning naturally in the studied region without any immediate anthropogenic threats except climate change in upcoming years. This study finds contemporaneous land use pattern around lakes in Eastern Coal Fields region which indicates more concentration of urban/sub urban built up around lakes in western sector, a key outcome for implementation of socioeconomic development planning, execution and management.

Scientific research during the study period of six years isolated and prioritized a total of Seventeen (17, 85%) lakes in West Bengal and three (03, 15%) lakes in the state of Jharkhand under the command areas of Eastern Coalfields Limited for ecological assessment, biodiversity – ecosystem service exploration, and implementation of restoration, management and conservation planning under National Plan for Conservation of Aquatic Ecosystems (MoEF &CC, 2019) on high priority. Area of the prioritized lakes ranged from 2 – 18 ha with a mean value of 8.3 ha. Lakes are located at an altitude of 78 – 147 meters in the command area of Eastern Coalfields Limited (a subsidiary of Coal India Limited, Govt. of India). Basic physico chemical properties of water of twenty (20) prioritized lakes (233.5 ha) illustrates quality condition for propagation of wild life and fisheries.

During the four cycles of water bird survey (March 2017- February 2021) of prioritized lakes revealed a total of 76 bird species belonging to 64 genera and 41 families, adding the very first literature base on scientific estimation of water birds from Coal Bearing Areas (CBAs) of Eastern India. Observed birds included 56 resident species, 18 winter migratory species and only 2 summer migratory species from all the studied lakes (n = 20). A total of 4728 individual water birds and



The Salim Ali Centre for Ornithology and Natural History (SACON) is a national institution devoted to the cause of conservation of India's biodiversity with focus on birds. SACON is situated in the sylvan surroundings of Anaikatty, 24 km northwest of Coimbatore city, within the Nilgiri Biosphere Reserve. It is a Centre of Excellence of the Ministry of Environment and Forests, Govt. of India.

SACON's mission is to help conserve India's biodiversity and its sustainable use through research, education and peoples' participation with birds at the centre stage.

(Source: Quadros et al. 2014)

