



Government of Goa

A periodical by Department of Environment & Climate Change, Government of Goa

DUDHSAGAR

• December 2020 • Volume 1 • Issue 1 •

**Sustainable Use of
Goa's Microbial Diversity
for Economic Prosperity and
Employment Generation**

Chicalim Bay:

A Window to sustainable livelihoods

**Green Heritage & Knowledge
V/s Lifestyle Addiction**

Socorro Plateau

– Pristine plateau of Bardez

Department of
Environment &
Climate Change



Goa State
Biodiversity
Board

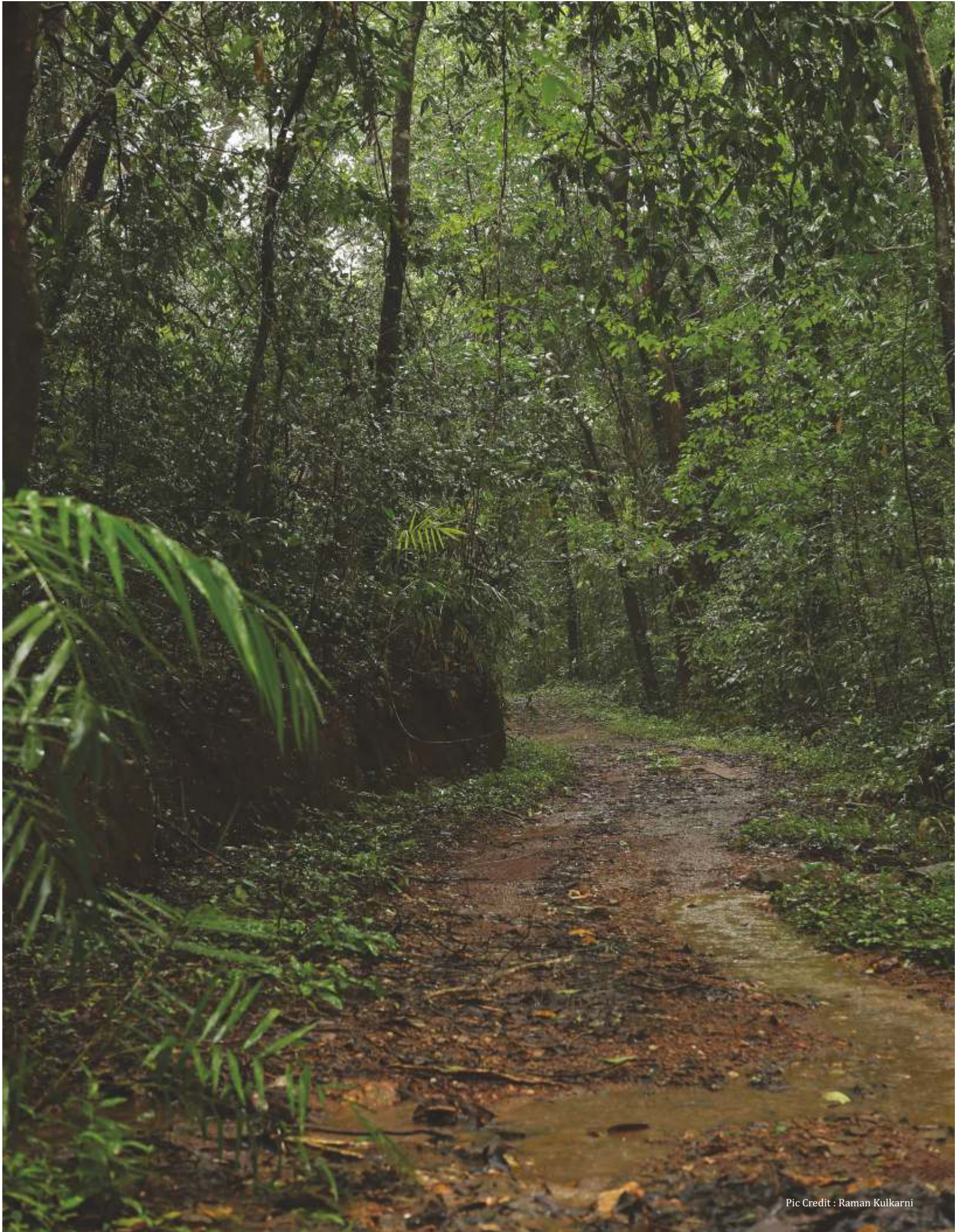


Goa State
Wetland
Authority



Goa State
Pollution
Control Board

Pic Credit : Raman Kulkarni





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Goa State
Biodiversity
Board



Goa State
Wetland
Authority



Goa State
Pollution
Control Board



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• December 2020 • Volume 1 • Issue 1 •

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Department of Environment &
Climate Change, Government of Goa

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auspicious Goa Liberation Day**

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the contents in the article are solely the view of
the authors and the editorial committee,
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and Government of Goa may not necessarily
agree with all the contents of articles
contributed.

The award winner for suggesting name of this
publication is Dr. Nandkumar Kamat (Selected
through State competition)



Dr. Pramod Sawant
Hon. Chief Minister of Goa State

It gives me profound pleasure to launch the publication of - "Dudhsagar" a periodical by the Department of Environment & Climate Change, Government of Goa.

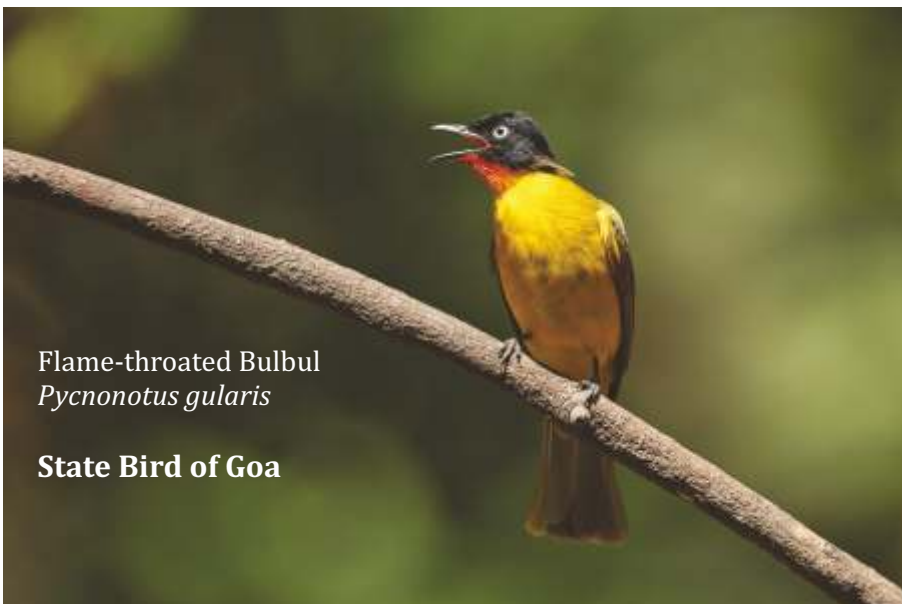
This is one of the most important initiative which will not only allow us to popularize initiatives by Government, but will also provide platform to the experts, talented environmental enthusiasts and researchers.

Indian lifestyle by default is in tune with nature. We worship and conserve nature as part of our ethos. The Periodical is designed to create awareness motivate and promote a sense of ecological sensitivity and balanced outlook towards ecology and economy by the the masses of Goa. The Periodical will bring forth articles not only from the academicians but also provide a platform to experts and nature lovers at large to put forth the experience, ideas and traditional knowledge of the non-academic experts who largely contribute to our ecology. The traditional knowledge holders often shy away from public and their exquisite knowledge remains hidden and in many cases, subsequently lost.

The need of the hour is to imbibe the concept of sustainable development in the minds of our generations, for which there is no better way than having a state's own periodical, which I am sure, shall intrigue the interests of the nature enthusiasts. I deeply appreciate the approach of the publishers by not limiting the periodical to just scientific community. I wish the editorial team and the publishers a great success.

Warm Regards,

Dr. Pramod Sawant
Chief Minister of Goa State



Pic Credit : Raman Kulkarni

Flame-throated Bulbul
Pycnonotus gularis

State Bird of Goa



Shri Nilesh Cabral

MLA Curchorem Constituency;
Hon. Minister for Power, Environment & Climate Change,
Non-Conventional Sources of Energy, Law and Judiciary,
Chairperson – Goa State Biodiversity Board &
Goa State Wetland Authority, Government of Goa.

It gives me a great pleasure to present first issue of first periodical "Dudhsagar" by Department of Environment & Climate Change, dedicated to the cause of initiatives towards ecology and inclusive sustainable development of our State, on auspicious Goa Liberation Day.

The name "Dudhsagar" itself was selected through wide publicity at State level and committee selected the name "Dudhsagar" ---- famous waterfall of our State which is indicative of prosperous watershed in the evergreen forests lining the western ghats in Goa. This name will always reflect purity, serene life support ecosystems and our commitment towards Mhadei, Western Ghats. "Dudhsagar" resembles overflowing positivity towards inclusive conservation efforts along with sustainable livelihoods to the communities dwelling in the forested areas and depend on them.

Coincidentally this name has been suggested by Dr. Nandakumar Kamat, a senior academician and scientist who spearheaded first State Biodiversity Action Plan prior to the notification of Biodiversity Act, 2002.

While we are committed to the conservation of nature, we will also take steps to ensure equal opportunities and sustainable as well as quality livelihoods to unreached people in remote areas of our State. Striking equilibrium between sustainable development and conservation is the best strategy and we cannot achieve the upliftment of last person aspiring the fruits of development by extremists approach.

This periodical publication "Dudhsagar" will not only have articles by intellects but will also provide platform to everyone to share best practices, success stories and all positive things worth sharing. "Dudhsagar" should be messenger of hope and also source of all authentic news pertaining to initiatives of Environment Dept., all the associated bodies and everyone connected with ecology and environment.

I am sure that the editorial committee and contributors to "Dudhsagar" will take this publication to greater heights.

Best wishes,

Nilesh Cabral,
Minister Environment and Climate Change
Chairperson, GSBB, GSWA



Shri Kunal IAS (2005)

Chief Electoral Officer, Govt. of Goa

Portfolios

- 1) Secretary (Elections)
- 2) Chief Electoral Officer
- 3) Power
- 4) Environment & Climate Change
- 5) Non-Conventional Energy

Secretary (Election/Power/Environment & Climate Change /GEDA) since September, 2020

It gives me immense pleasure to welcome you all to the first issue of Dudhsagar, a Periodical of The Department of Environment & Climate Change (DoE & CC), Government of Goa. Dudhsagar intends to publish high quality articles, reviews, reports, commentaries, research papers and viewpoints from various line departments and bodies under DoE & CC. Dudhsagar will publish articles in but not limited to fields of environment, biodiversity conservation and management, pollution, and biodiversity aspects and services of marine ecosystem, wetland and fresh water ecosystem, riverine ecosystem, forest ecosystem, urban ecosystem, agro-ecosystem, coastal ecosystem, , mangroves, sand-dunes, etc. in the state of Goa. I believe that the periodical will thrive to become an invaluable source for the environmental lovers, enthusiasts, research scientist, experts, academicians and students along with other traditional knowledge holders, interested in doing further research and contribute to the arena of knowledge-based wisdom.

I am sure that the articles published in Dudhsagar will boost the researchers to undertake new research ventures and local knowledge holders to share the invaluable traditional knowledge for the betterment of local community and society at a large.

With best regards,

Kunal, IAS

Secretary (Environment and Climate Change)
Patron

Pics by Shri. Kunal - IAS



Moth Mimicking Wasp
Painted Handmaiden Moth
(*Euchromia Polymena*)



Hoopoe
(*Upupa epops*)



Ganesh B. Shetgaonkar
Chairman, GSPCB

It gives me an immense pleasure to welcome you all to this first Issue of Environment related periodical “DUDHSAGAR” by the Department of Environment & Climate Change, Government of Goa. This knowledge based periodical will serve the purpose of all Knowledge seekers in the field of Environment related issues and will not be limited to the fields of Environment, Biodiversity conservations, Pollution related issues, Marine ecosystem, wetland and fresh water ecosystems etc in the state of Goa. I wish all the best to this Periodical for its first and future Journey.

With Warm Regards

Ganesh B Shetgaonkar
CHAIRMAN
GSPCB



Guchchha Irid Amri
Smithonia viridiflora

Pic Credit : Raman Kulkarni

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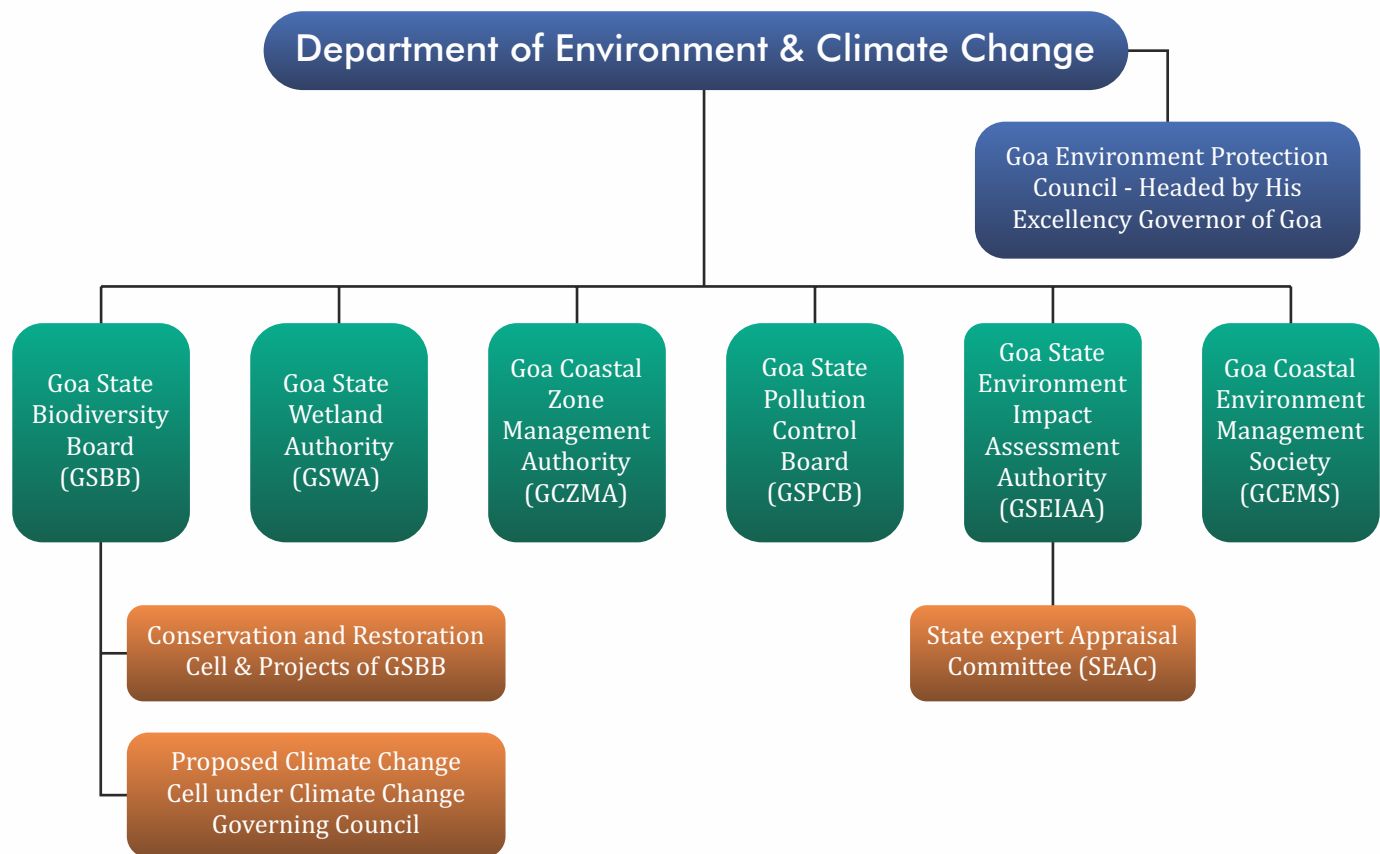


Brief about **Dudhsagar**

Dudhsagar is a multi-disciplinary journal published by Department of Environment and Climate Change along with all the associated bodies and stakeholders which will include various aspect related to ecosystem conservation and activities specific to Goan context. It will cover broad topics, including but not restricted to, biodiversity aspects and services of Marine ecosystem, Wetland and freshwater ecosystem, Riverine ecosystem, Forest ecosystem, Urban ecosystem, Agro-ecosystem, Mangroves, sand dunes and Corals, activities of GSBB, GSWA, GCZMA, GCZMS, GSPCB, GSEIAA etc. It will also include Traditional Knowledge, and about current as well as historic traditional practices.

Periodical will also enable allied departments to create wide awareness about schemes, activities, success stories, achievements of Govt. sector and provide a platform to everyone in the system to exhibit their talent. This will also provide authentic news an information about activities of Departments and communicate decisions, actions, plans and dissemination of other information from time to time.

Department of Environment & Climate Change – Govt. of Goa



Department of Environment & Climate Change – Is a department of Government of Goa having organogram as shown above, with six agencies for managing specific areas to ensure overall facilitation, coordination, management, monitoring, mentoring, supporting and overseeing all the six bodies and dealing with the matters pertaining with Environment and Climate Change.



Goa State Biodiversity Board

Goa State Biodiversity Board (GSBB), is an Autonomous Statutory Board, of Govt. of Goa. Constituted under Section 22 (1) of Biological diversity Act 2002 mandated with Biological Diversity Rules 2004 and Goa Biological Diversity Rules 2017. Biodiversity Management Committees (BMCs) are constituted in Gram Sabhas at local body level and making of Peoples Biodiversity Registers (PBRs) is a continuous process done by BMCs across the State.

The BMC are involved in documentation of biodiversity and associated traditional knowledge thereby generating comprehensive information in the form of register know as **Peoples Biodiversity Register (PBR)**. The prioritized list of focus areas for conservation, flagship and unique species of ecosystems in the area, sustainable utilization practices, strengthening of traditional livelihood linkages of biodiversity are being derived from PBR which will eventually lead to successful area specific conservation programmes. BMCs also maintain information and data about local Vagdali's (i.e. vaidyas or local medicinal practitioners) and traditional healers / practitioners / knowledge holders using biological resources. Based on PBR of Surla BMC, Goa State Biodiversity Board has identified and notified Surla – “Purvatali Rai” Sacred Grove as Biodiversity Heritage Site (BHS) after validation of Surla PBR.

GSBB is appointed as Key State Technical Institution under Scheme for Formalization of Micro-Food Processing Enterprises (FME) Scheme in the State of Goa. This is mainly due to the extensive documentation of bio-resources carried out by GSBB. GSBB intends to strengthen and utilize the network and platform of BMCs for convergence of various schemes of State and Central Govt. connected with biodiversity and its conservation.

Unique Initiatives by Goa State Biodiversity Board by involving the network of Biodiversity Management Committees (BMCs) constituted at ground level in every local body

Goa State Biodiversity Board has always strived to ensure maximum participatory approach at grassroots level and so far awareness programs on need for biodiversity conservation and mainstreaming biodiversity” have been conducted at all levels throughout the State of Goa.

Highlights of important initiatives of GSBB

- Roadside selling farmers were provided platform to sell their produce in air-conditioned mall to as part of celebration of International Day for Biodiversity in 2019 with theme “Our Biodiversity, Our Food, Our Health”. Surprisingly they earned over ₹ 60,000/- within half day and over Rs. 1.5 lac worth recurring orders for further period due to contacts developed.
- Special project is taken in the State on Conservation of biodiversity through livelihood interventions wherein local farmers, horticultural and minor forest produce will be subjected to value addition at clusters of villages, collection of minor forest produce through BMCs and handholding agency is also started in two BMCs. Market linkages will be provided to increase earning of Bioresources owners - locals. This will encourage them to conserve and multiply plantations of various landraces of plants, fisheries and also other shellfish ultimately leading to ecosystem conservation through beneficial mechanism. There is plan to promote GoVan brand wherein locals will be empowered through network of GoVan (also means go back to forests and nature).
- People's Biodiversity Registers are prepared with participation of villages especially elders, youngsters and traditional knowledge holders wherein not only biodiversity is documented but validation is participatory at three levels BMC level, Gramsabha level and State level. Hence village gets honored when they get opportunity to present their village biodiversity registers to

eminent intellects at State level. They even become emotional when they themselves present their PBRs at State level and learn about their village awhile documenting the vast Bioresources and associated knowledge which was so far confined to certain families or never given importance. Outcome of PBR is used for deriving conservation focus and prioritization of issues at village level. This has created micro level green revolution in villages. Certain examples are – revival of famous and unique watermelon variety of Parra Village. This variety was almost extinct and only two women in village had preserved handful of seeds (this emphasizes role and contribution of women in biodiversity conservation). GSBB took initiatives and revived this variety by multiplying seeds. In another initiative archiving of **Medicinal plants document/ Book in Urdu** from Curti Khandepar BMC area was possible due to PBR exercise.

- Uniqueness of our PBR process is that technical support groups are not only eminent institutions or ecologically expert companies but also local farmers self-help groups with necessary qualification and expertise have been empaneled with GSBB as technical support groups who guide villages in preparation of PBRs.
- Our next initiative is devising mechanism to impart **green skilling** through its conservation and restoration cell wherein employment opportunities will be created for aspiring youth in practicing traditional occupations such as – taking up ecosystem restoration works (eg. Efforts in Cavelossim with local BMC for restoration of sand dune areas), revival of traditional Knowledge based techniques, systems and practices such as **Bundhs and Sluice gates**. Making of watershed structures and walls with use of naturally occurring material including reinforcement by mangrove wood or bamboos.
- State level Biodiversity Awards are conferred upon the individuals as well as BMC level to encourage the conservation efforts in biodiversity.
- While signing **Access Benefit Sharing (ABS)** Agreements, first time agreement is signed with M/S Tanshikar Spice Plantations without cash

but in-kind type wherein signatory will conduct awareness and capacity building amongst villagers rather than paying to GSBB.

- **Television series** of 20 parts on biodiversity of Goa 'Bhowandi Jaivik Fudarachi' on Goa Doordarshan Channel featuring unique biodiversity of Goa
- Periodic public lecture series by eminent personalities in the fields related to biodiversity.
- Collaborative programs for Youth - Youth Festival – Yuva Jagruti and TEDx event wherein over 600 students participate in various competitions at State level.
- GSBB has documented and published the book '**Tradable Bio-resources of Goa**' comprehensive compilation of bio-resources already traded and with potential from various ecosystems.
- GSBB has published book on the prominent **Sacred Groves of Goa** authored by Shri. Rajendra Kerkar.
- Goa State Biodiversity Board has notified the Goa State's **first Biodiversity Heritage Site – 'Purvatali Rai' of Surla Village, Bicholim Goa**. The location has multiple flora species and diverse biodiversity located besides agricultural ecosystem.
- As part of six thematic committees of GSBB, Legal Advisory Group headed by Retd. Justice, involving legal aid cells of law college students for hand holding BMCs.
- Suomoto cognizance of Biodiversity related issues in many matters such as conservation of habitats of rare varieties of the windowpane oysters and other unique local varieties. In this case guidelines are being developed by special committee of experts constituted in this regard.
- The Curtorim Biodiversity Management Committee (BMC) & Farmers of Curtorim have launched a 100% locally grown rice under the name "CUDDTARI" - an initiative supported by GSBB.

Many other initiatives like plantation scheme, Community and Central State Seed Bank for the State of Goa is planned to be established, First in India Sand dune Park will be created through "ICZMP – World Bank", Sand mining impact and river Biodiversity Index study ongoing through Department of Environment, State Action Plan on Climate Change is approved by the cabinet.



Matti - *Terminalia Elliptica*

Careful Conservation of Biodiversity
Bright Future for Prosperity!

॥जीववैविध्यरक्षा स्यात् जनानां भाविभूतये॥

जतनायेन सांबाल जैव-विविधतायेचो
परजळीत फुडार फुडले पिलगेचो

ध्यान से संवर्धन जैव-विविधता का।
उज्वल भवितव्य होगा अगली पीढी का।

काळजीपूर्वक जतन जैव-विविधतेचं
उज्वल भवितव्य पुढच्या पिढीचं



Capparis moonii

Pic Credit: Raman Kulkarni



Grassy Dendrobium (*Dendrobium herbaceum*)

Pic Credit: Raman Kulkarni



Saraca asoca

Pic Credit: Raman Kulkarni



Goa State Wetland Authority

Wetlands of Goa : Identification, Notification for its conservation and management.

Area in which the soil is covered by water or is present either at or near the surface of the soil throughout the year for varying periods of time, indicates a Wetland. Water saturation of such areas determines how the soil develops and thereby determines the types of flora and fauna of the area. The Wetland (Conservation and Management) Rules 2017 defines wetlands as “an area of marsh, fen, peatland or water; whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters, but does not include river channels, paddy fields, human-made water bodies/tanks specifically constructed for drinking

water purposes and structures specifically constructed for aquaculture, salt production, recreation and irrigation purposes”.

Goa State Wetland Authority (GSWA) is a body of Government of Goa constituted as per Wetland (Conservation and Management) Rules 2017 and as per the provision made in Part II – Sec. 3 (i) Rule 5 (1) of “The Gazette of India : Extraordinary”. The State Government of Goa constituted the Goa State Wetland Authority in the year 2016, (Corrigendum No. GSWA/2017-18/WC/013/026/836 in Official Gazette of Government of Goa. Dated: 09th February 2018).

Ecosystem services of Wetlands are given in the table 1 below:

Wetland Services	Benefits to human well-being
1.Provisioning	
Food	Production of fish, wild game, fruits and grains
Fresh water	Storage and retention of water for domestic, industrial and agricultural use
Fiber and Fuel	Production of logs, fuelwood, peat, fodder
Biochemical	Extraction of medicines and other materials from biota
Genetic material	Genes for resistance to plant pathogens; ornamental species, etc.
2.Regulating	
Climate regulation	Source of and sink for greenhouse gases; influence local and regional temperature, precipitation, and other climatic processes
Water regulation (Hydrological flows)	Groundwater recharge/discharge
Water purification and waste treatment	Retention, recovery, and removal of excess nutrients and other pollutants
Erosion regulation	Retention of soils and sediments

Natural hazard regulation	Flood control, storm protection
Pollination	Habitat for pollinators
3.Cultural	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religious values to aspects of wetland ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspects of wetland ecosystems
Educational	Opportunities for formal and informal education and training
4.Supporting	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Storage, recycling, processing, and acquisition of nutrients

Source: Millennium Ecosystem Assessment, 2005. Ecosystems and Human-Well-being: Wetlands and Water Synthesis. World Resources Institute, Washington, DC.

Wetlands in Goa and their Status

Wetlands in Goa are unique ecosystems. These wetlands during earlier times have been embanked using sluice gates to increase the carrying capacity of the wetlands. Most of these were predominantly used to irrigate Paddy fields, Kulaghars and other traditional activities.

These Rules inherently protect these pre-existing rights of the local community which sustainably use the wetland resources for their livelihood. Most of the pre-existing traditional activities such as fishing,

paddy cultivation, irrigation of *Kulaghars* harvesting of water lilies etc. are allowed.

35 waterbodies had been primarily identified as potential wetlands in the State as shown in the table 2. Eleven (11) of these waterbodies have been Draft Notified as Wetlands under Wetland Conservation and Management Rules 2017. Furthermore Fourteen (14) more have been identified as Wetlands by the Technical Committee of GSWA and will be place for Draft Notification.

Always committed towards conservation of wetlands

परिक्षणे आर्द्रभूमे. सदा कार्यरता वयम्।

तेरे संवर्धन में सजग सदा... हे आर्द्रभूमि

संवर्धनार्थ तुझ्या कटिबद्ध आम्ही... हे आर्द्रभूमी

जतनायके तुज सदांच सज्ज... हे आर्द्रभुये



Photos of some of the Wetlands of Goa.



Batim Lake



Pilerne Lake



Orlim Lake



Tarvalle Lake



Toyaar lake

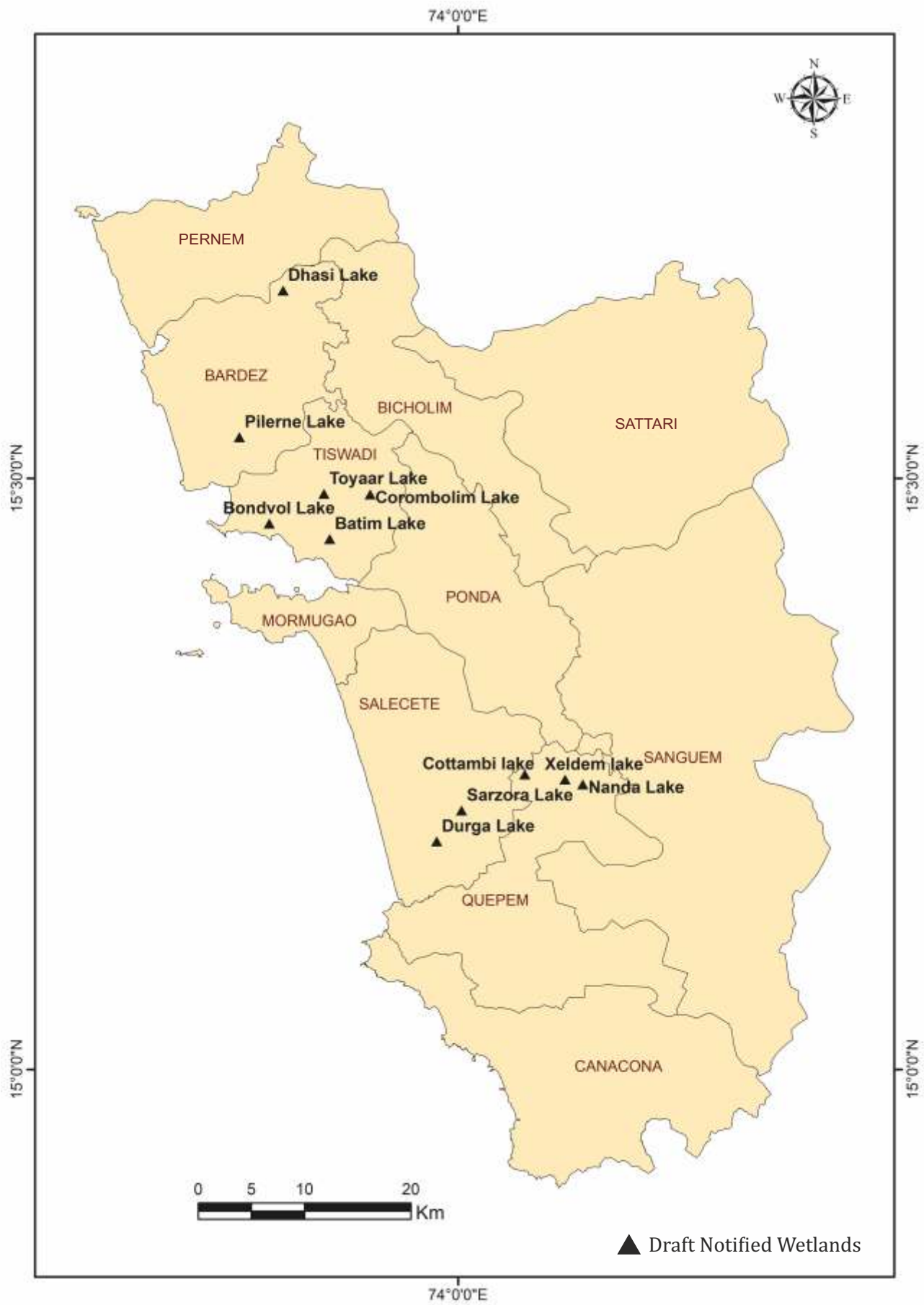


Nanda Lake

Table 2: List and details of water bodies identified on priority as potential Wetlands in the State of Goa

Sr. No.	Name of the water body	Village/Tehsil	Taluka	District	Status as per NGT order
1.	Bondvol Lake	Satnta Cruz	Tiswadi	North Goa	Draft
2.	Sulabhat Lake	Agassaim	Tiswadi	North Goa	Identified as Wetland
3.	Curca Lake	Curca	Tiswadi	North Goa	Preparation of Brief Document
4.	Canturlim	Curca	Tiswadi	North Goa	Preparation of Brief Document

5.	Malebhat	Curca	Tiswadi	North Goa	Preparation of Brief Document
6.	Gawali-Moula	Curca	Tiswadi	North Goa	Preparation of Brief Document
7.	Toyaar Lake	Chimbel	Tiswadi	North Goa	Draft Notified
8.	Carambolim Lake	Carambolim	Tiswadi	North Goa	Draft Notified
9.	Batim Lake	Batim	Tiswadi	North Goa	Draft Notified
10.	Talaulim Lake	Talaulim	Ponda	South Goa	Identified as Wetland
11.	Banstarim Wetland	Bhoma-Alconda	Ponda	South Goa	Preparation of Brief Document
12.	Tarvalem Lake (Pagar Tale)	Shiroda	Ponda	South Goa	Identified as Wetland
13.	Tolle (Udden) lake	Shiroda	Ponda	South Goa	Identified as Wetland
14.	Parra Lake	Parra	Bardez	North Goa	Preparation of Brief Document
15.	Dhasi Lake	Revora	Bardez	North Goa	Draft Notified
16.	Pilerne Lake	Pilerne	Bardez	North Goa	Draft Notified
17.	Mayem Lake	Maem	Bicholim	North Goa	Identified as Wetland
18.	Curtorim lake	Curtorim	Salcete	South Goa	Identified as Wetland
19.	Sonbem lake	Maina	Salcete	South Goa	Identified as Wetland
20.	Macazana lake	Macazana	Salcete	South Goa	Identified as Wetland
21.	Comunidade lake	Guirdolim	Salcete	South Goa	Identified as Wetland
22.	Ambulor Lake	Verna	Salcete	South Goa	Identified as Wetland
23.	Sarzora lake	Sarzora	Salcete	South Goa	Draft Notified
24.	Durga lake	Cinchinim	Salcete	South Goa	Draft Notified
25.	Benaulim Lake (Vodle Tollem)	Benaulim	Salcete	South Goa	Preparation of Brief Document
26.	Benaulim Lake (Dhakte Tollem)	Benaulim	Salcete	South Goa	Preparation of Brief Document
27.	Kamla Tollem	Benaulim	Salcete	South Goa	Identified as Wetland
28.	Orlim Tollem	Orlim	Salcete	South Goa	Identified as Wetland
29.	Sapu Tollem	Velim	Salcete	South Goa	Preparation of Brief Document
30.	Maimollem Lake	Maimollem	Mormugao	South Goa	Preparation of Brief Document
31.	Sancoale Lake	Sancoale	Mormugao	South Goa	Identified as Wetland
32.	Cottambi Lake	Curcholem	Quepem	South Goa	Draft Notified
33.	Nanda Lake	Curcholem	Quepem	South Goa	Draft Notified
34.	Xeldem Lake	Quepem	Quepem	South Goa	Draft Notified
35.	Pali Lake	Quepem	Quepem	South Goa	Identified as Wetland





Goa State Pollution Control Board

The Goa State Pollution Control Board (GSPCB) is an autonomous statutory organization constituted on 1st July, 1988 under the Water (*Prevention & Control of Pollution*) Act, 1974. Prior to that, when Goa formed part of the erstwhile Union Territory of Goa, Daman and Diu, the Central Board for the Prevention and Control of Water Pollution was performing the functions of the State Board in Goa.

The Board aims to promote clean and green Environment to the people of Goa along with quality of good Air and Water. The Board also aims to promote cleanliness of wells, streams; rivers in different areas of the State, to have better quality of water by prevention & control. Board also wishes to make Goa plastic free in the near future. This can be achieved by bringing and arranging awareness programmes through school, social forums etc.

During the year under report the Board laboratory collected 1766 water samples from various sources such as ETP, STP, mine discharge (settling pond, mining pit, etc.), river water, well water, canal water, etc. and analyzed the same for various parameters i.e pH, Turbidity, Dissolved Solids, Conductivity, Dissolved Oxygen, Nitrate Nitrogen as NO₃-N, Nitrite Nitrogen as NO₂-N, Nitrate as NO₃, Nitrite as NO₂, Chloride as Cl, Sulphate as SO₄²⁻, Hardness as CaCO₃, Calcium as Ca, Magnesium as Mg, Suspended Solids, Oil & Grease, Chemical Oxygen Demand, Biochemical Oxygen Demand, Phosphate, Ammonical nitrogen, Acidity, Alkalinity, Fluoride, Boron (B), Chromium (Cr) Hexavalent, Potassium (K), Sodium (Na), Total Organic Carbon (TOC), Phenolphthalein Alkalinity, Total Fixed Solids, Cadmium as Cd, Copper as Cu, Nickel as Ni, Chromium as Cr, Zinc as Zn, Cobalt as Co, Lead as Pb, Iron as Fe, Manganese as Mn, Arsenic as As, Total Coliform, Fecal Coliform, E. Coli, Total plate count, Organo Chlorine Pesticides (OCPS) (Aldrin, Dieldrin, Heptachlor, Hexachlorobenzene, Methoxychlor, o,p' DDT, p,p' DDT, p,p'-DDE, α -BHC, β -

BHC, γ -BHC), Organo Phosphorous Pesticides (OPPs) (Chlorpyrifos, Profenophos, Malathion, Parathion-methyl). Also, a number of AAQM has been conducted to address complaints regarding dust pollution. A number of Stack emission Monitoring have also been conducted during the year.

Hon. National Green Tribunal, Principal Bench, New Delhi in (O.A no. 95/2018/M.A no. 1029/2018) Order dated 11/01/2019 had directed Central Pollution Control Board to conduct Performance Audit of all the SPCBs and Pollution Control Committees within six months by constituting expert inspection teams and furnish a report to the Tribunal. The Expert team audited the Goa State Pollution Control Board on 22/05/2019 and 23/05/2019. As per the assessment carried out, Goa State Pollution Control Board has been ranked 6th position at the National Level in respect of Performance Audit and 1st rank in the Environmental Quality Monitoring.

Study of GSPCB at Dudhsagar: Ambient Air Quality Monitoring (AAQM) and Noise Monitoring

Ambient Air Quality Monitoring at Dudhsagar collem has been conducted from 6/5/2019 to 08/05/2019 in order to check the dust pollution on the Dudhasagar waterfall due to transportation of tourist by Private passenger bolero vehicle which run on diesel fuel on katcha roads towards dudhsagar waterfall. The AAQM was conducted for Particulate (PM₁₀ & PM_{2.5}), SO₂ and NO₂ at two locations. Also Noise monitoring at Vehicle parking area at Dudhasagar Waterfall was conducted. The tables below show the details of the reports

Table 1: Compiled Data of AAQM station.

MAY-2019		Location: Near Dudhsagar entry Gate, Collem-Goa					
		Pollutants concentration in $\mu\text{g}/\text{m}^3$				AIR QLTY	
Sr. No.	Parameters	PM10	PM2.5	SO2	NO2	AQI	
Date		24-hr avg					
1	06-05-2019	132	9	2	14	121	M
2	08-05-2019	109	28	2	12	106	M
MAY-2018		Location: Near Dudhsagar temple, Collem-Goa					
1	06-05-2019	127	69	2	6	130	M
2	08-05-2019	48	41	2	11	68	S

Table 2: Compiled data of Noise Monitoring

Sr.No.	Date of Monitoring	Noise Monitoring Locations	Results in dB(A) Leq	Limits in dB (A)
1	24/04/2019	Dudhsagar Pond	43.2	50 dB(A)
2	24/04/2019	Dudhsagar Near Vehicle Parking	32.8	50 dB(A)
3	30/04/2019	Dudhsagar Near Ticket Gate	36.0	50 dB(A)
4	30/04/2019	Dudhsagar Near Temple	32.9	50 dB(A)
5	30/04/2019	Dudhsagar Near Vehicle Parking	32.8	50 dB(A)

Observation and Conclusions:

It was observed that there was re-suspension of dust due to movements of vehicles which leads to dust pollution. In order to control the dust re- suspension the dept. of Forest should pave the route with natural aesthetic to support free movements of fauna. The Noise monitoring reports suggest that at all the five locations along the vehicle transportation routes the noise measured are within the stipulated standard.

The Ambient Air Quality Monitoring reports indicates that PM10 parameter is exceeded on both the day of monitoring Near Dudhsagar Entry Gate, Collem ie on 06/5/2019 and 08/5/2019 and also one day near Near Dudhsagar Temple, Collem- ie on 06/5/2019. All other parameters are within the limits, however the AQI at both locations are indicating moderately polluted.

SLSC for NAFCC - GCZMA - GCEMS - GSEIAA - GSEAC - GSEPC

State Level Steering Committee (SLSC) for National Adaptation Fund for Climate Change (NAFCC)

The Ministry of Environment, Forests and Climate Change, Government of India has established the National Adaptation Fund for Climate Change (NAFCC) for scaling-up Climate Change adaptation interventions in accordance with National Action Plans for Climate Change (NAPCC) and State Action Plans for Climate Change (SAPCC). In accordance with the NAFCC guidelines para 7.2 (iv) of the implementation guidelines issued by the Ministry of Environment, Forests and Climate Change (MoEF&CC), a State Level Steering Committee (SLSC) is to be constituted under the Chairmanship of the Chief Secretary and representatives of the relevant Stakeholder /Departments and NABARD to co-ordinate the preparation and submission of the projects in the State. 2. Accordingly, the Government of Goa, hereby constitute the State Level Steering Committee (SLSC) for National Adaptation Fund for Climate Change (NAFCC).

The terms of reference of the SLSC are as under : To scrutinize and recommend the relevant Climate Change (adaptation / mitigation) projects to National Implementing Entity (NIE) i.e. National Bank for Agriculture and Rural Development NABARD and inward submission to the MoEF&CC for consideration of the proposals.

Goa Coastal Zone Management Authority (GCZMA)

In exercise of the powers conferred by sub-sections (1) and (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) (hereinafter referred to as the said Act), the Central Government hereby constitutes the Goa Coastal Zone Management Authority (hereinafter referred to as the Authority) for a period of three years.

The Authority shall, for the purposes of protecting and improving the quality of the costal environment and preventing, abating and controlling environmental pollution in the Coastal Regulation Zone areas in the State of Goa, take the following measures, namely : —

(i) the Authority shall, after receiving the application for approval of project proposal, examine the same if it is in accordance with the approved Coastal Zone Management Plan and within the requirements of the Coastal Regulation Zone notification issued by the Government of India in the erstwhile Ministry of Environment and Forests and published vide number S.O.19(E), dated the 6th January, 2011 (hereinafter referred to as the said notification), and make recommendations for approval of such project to the concerned authority, as specified in the said notification, within a period of sixty days from the date of receipt of such application;

(ii) the Authority shall regulate all developmental activities in the Coastal Regulation Zone areas as specified in the said notification;

(iii) the Authority shall be responsible for enforcing and monitoring the provisions of the said notification;

(iv) the Authority shall examine the proposals received from the State Government for changes or modifications in the classification of Coastal Regulation Zone areas and in the Coastal Zone Management Plan and make specific recommendations thereon, to the National Coastal Zone Management Authority;

(v) the Authority shall inquire into cases of alleged violation of the provisions of the said Act or the rules made thereunder; and review the cases involving violations or contraventions of the provisions of the said Act and the rules made thereunder;

(vi) the Authority shall inquire or review cases of violations or contraventions of the said notification

suo- moto, or on the basis of a complaint made by any individual or body or organisation;

(vii) the Authority is authorised to file complaints under section 19 of the said Act;

(viii) the Authority shall take such action as may be required under section 10 of the said Act, to verify the facts of the cases before it.

The Authority shall, for the purpose of maintaining transparency in its functioning, create a dedicated website and post the information relating to its functions, including the agenda in its meetings, minutes of the meetings, decisions taken in each meeting, recommendations for matters on violations and contravention of the said notification and actions taken on such violations and contraventions, court matters including the orders of the courts and the approved Coastal Zone Management Plan of the State Government.

The Authority shall furnish reports of its activities at least once in six months to the National Coastal Zone Management Authority.

“Goa Coastal and Environment Management Society (GCEMS)”

To implement the Integrated Coastal Zone Management Project for improving environmental status of the Coastal stretches of the State with the financial assistance from World Bank through Ministry of Environment & Forest and any other project of similar nature entrusted by the State or Central Government.

To interact with the Central and State Government Department/s and participating agencies ,funding agencies , Consultants and the Experts for the implementation of the projects in the state

To prepare all financial proposals and submit to the Ministry of Environment & Forest or any other funding agency through the State Government and obtain funds distribution to State implementing departments /organizations.

To render periodical progress reports expenditure statements etc to Ministry of environment and Forests or World Bank or any other funding agency with the Knowledge of the State Government.

To regularly monitor and evaluate all activities components of the projects ,suggest action plan for improving the output.

To organize periodical review including meetings of Executive Council or the Governing Body of the Society and take follow up action on the recommendations made by the Bodies.

To organize camps ,exposure visits ,training etc for capacity building and orientation of implementing departments /agencies ,Coastal Community ,Community based organizations and Non-Government Organizations.

To compile and analyze relevant data, prepare documents and give due publicity to projects activities and create adequate awareness among public on positive impact of the project.

To organize scientific studies for other stretches of the state requiring management in future.

To prepare interim and completion report of all components of the projects.

To acquire and hold property, provided that prior approval of the State Government is obtained for the acquisition of immovable property.

To deal with or dispose off or write off any property or loss there in belonging to or vested in the society in such manner as the society may deem fit for advancing its objects, subject to the provision that in case of transfer and disposal of any immovable property, the prior approval of the State Government shall be obtained.

Goa State Level Environment Impact Assessment Authority (GSEIAA) /Goa State Expert Appraisal Committee (GSEAC)

In exercise of the powers conferred by sub-section (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) and in pursuance of the notification of the Government of India in the erstwhile Ministry of Environment and Forests, number S.O. 1533(E), dated the 14th September, 2006 (hereinafter referred to as the said Notification), the Central Government hereby constitutes the State Level Environment Impact Assessment Authority, Goa. The Chairman and Members of the Authority, Goa shall hold office for a term of three years.

Goa State Expert Appraisal Committee (GSEAC)

To assist the Authority, Goa, the Central Government in consultation with the State Government of Goa, hereby constitutes the State Expert Appraisal Committee (SEAC). The Chairman and Members of SEAC, Goa shall hold office for a term of three years. The SEAC, Goa shall exercise such powers and follow such procedures as enumerated in the said notification dated 14th September, 2006. The SEAC, Goa shall function on the principle of collective responsibility and the Chairman shall endeavor to reach a consensus in each case, and if consensus cannot be reached, the view of the majority shall prevail. The Government of Goa shall notify an agency to act as Secretariat for the Authority, Goa and SEAC, Goa and the said Secretariat shall provide all financial

and logistic support including accommodation, transportation and such other facilities in respect of all its statutory functions of the Authority and SEAC.

Goa State Environment Protection Council. (GSEPC)

The Council shall:
Review the work relating to Environmental undertaken in the State by ,Government and non-government Organizations, ii) Advise the State Government on environmental issues of the stale, and iii) Identify areas requiring investigations research and restoration in the field of environment. The Council will meet twice a year or more frequently, as may be decided by the Chairman, to discuss the items suggested by the Members. Decisions will be arrived at by consensus and would be advisory in nature.



Pic Credit : Raman Kulkarni

Blue-headed Rock-thrush
Monticola cinclorhynchus



Pic Credit : Raman Kulkarni

White-rumped Shama
Copsychus malabaricus



Pic Credit : Raman Kulkarni

Asian Paradise Flycatcher
Terpsiphone paradise

Sustainable Use of Goa's Microbial Diversity for Economic Prosperity and Employment Generation

Dr. Nandkumar M. Kamat



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It's the unique geology of Western Dharwar Craton (WDC) and diverse landscape ecology, rich mineral and soil diversity which makes Goa a tropical paradise for a diversity of ecologically and economically useful microorganisms. The whole landmass is sitting on three geological folds crisscrossed by six tectonic faults, six major rock formations and the number of local ores and minerals would exceed hundred. A piece of laterite is a chemical factory teeming with more than 50 elements and number of microorganisms involved in ancient tropical microbiological weathering of basement rocks. The full Mesoarchean, Precambrian 'Banded Iron Formation' yielding exportable banded hematite quartzite (BHQ) and banded magnetite quartzite (BMQ) itself is magical creation of ancient microbial activity with huge role played by cyanoobacteria to precipitate the bands of Iron ore. Our studies found plenty of microbial fossils and chemofossils in these ores. Everywhere we sampled in the state the biological creativity of nature was evident.

This brief article is based on my research work since 1985-86 on several aspects of biodiversity of Goa and specifically the microbial diversity and in the limited space given for this special issue, I would try to offer a personal view of the importance, significance and potential of what we know. I had initiated the process of scientific documentation of microbial diversity of Goa long ago with focus on Viruses, Archea, Eubacteria, eumycota (fungi) and protozoa. My rough estimate as the year ends is we have more than 3000 known species and several thousand more to be

surveyed, isolated and identified. We are interested in viruses only to understand their threats to humans, animals and plants. Our interest is more in microbial diversity from ecological and economic angles because it is valuable biological wealth. The most important word related to 'microbial diversity' is 'bioprospecting. In other words not only we must know the microbial species by their names but we need to know their chemical constituents and bioprocesses and bioproducts which they yield so that we can create a new sustainable bioeconomy by utilizing industrially important biomolecules or bioprocesses.

Now where to begin and end the story of the stupendous microbial diversity of Goa?. Perhaps we could begin from the seashore and travel to some of the most ancient rocks on Earth- the exposed rocks in the intertidal zone of Palolem, Canacona beach known as Trondhjeimitic gneiss- dated to almost the beginning of life on Earth-that is 3400 million years. These wind and wave eroded rocks contain unique shallow pools teeming with salt loving microorganisms. Palolem rocks offer us insights into the first forms of microbial life as we can recover what are known as cyanobacteria and extremophilic halophiles from these unique rock pools. Very scanty attention has been paid in Goa towards biotechno-logically useful chemolithotrophs or 'rock eating bacteria' specially species of hyperacidophilic Acidithiobacillus, Leptospirillum and Sulphur oxidizing and reducing bacteria.

After years of work on using Winogradsky columns we found exciting succession of microorganisms- the Iron and Sulphur bacteria. A full new circular economy can be supported by building a state level culture collection of local strains of Iron and Manganese oxidizing bacteria and Sulphur bacteria. Our lab scale experiments showed their capacity for bioleaching of Iron and Manganese from ores- so for green economy and sustainable employment generation the industrially useful, carefully selected strains could be used and lot of value can be added to local metalliferous ores in biomining operations. We found excellent concentration of Lithium in local laterite and prepared a process to leach it out using chemolithotrophic bacteria. So for sustainable wealth generation we have a full roadmap ready to build novel enterprises based on mineral biotechnology. We were successful in isolating microorganisms from even millions of years old plant megafossils recovered from Sattari and Siddanath hillock Borim. What it means is that

1. We have bygone biospheres going down upto 120 metres from surface which can yield valuable chemolithotrophic bacteria
2. We have rocks, ores, minerals which can be tapped for biotechnologically useful strains
3. We have plant megafossils and marine fossil beds like one found from Bambolim to Chikhalim which could yield novel and useful microorganisms.
4. We have 25 soil types covering Goa and each of this sample on specific media can yield tremendous soil microbial diversity.

We developed special baiting techniques to study soil microbial diversity. Our results showed us the rich potential of the state to run an extensive novel antibiotic screening programme. We found rare Actinobacteria in soils of Canacona which could yield antibiotic like Streptolydigin which was more effective against pathogenic Staphylococci than the commercial antibiotics. This means when we destroy or lose the soils formed over millions of years we also lose useful, precious microbial diversity. So for sustainable wealth and employment generation the state needs to prepare a full atlas of soil microbial diversity followed by in and ex situ conservation measures. We found very useful nitrogen fixing cultures of Rhizobium. If we attempt to screen all the local leguminous plants and nodules then perhaps Goa could produce world's largest collection of industrially useful nitrogen fixing bacteria.

Several researchers at NIO and Goa University have worked for decades in marine and freshwater microbiology. We are astounded by the diversity of

marine bacteria, yeasts and fungi and the tremendous scope which exists to tap the industrially useful aquatic fungi. Our conservative estimate is that only the extremophilic archaea, eubacteria and fungi would exceed more than 200 species. Each of these strains is a chemical factory. We worked on different types of yeasts and found a prodigious diversity of tropical yeasts in almost every sample that we tested. Yeasts are very important in bioindustries based on fermentation technology. Our knowledge of tropical yeasts now covers yeasts from rivers, streams, waterfalls, springs, fountains, lakes and ponds, yeasts from floral nectar, ovaries, fruits, plant storage organs like tubers and bulbils and even from intestines of beetles. We have shown the excellent scope of local fruit yeast diversity which we have tapped successfully in laboratory to produce different types of fruit wines. So a state level useful fermenting yeast collection create new knowledge, business opportunities, wealth and employment as we seen production of fruit wines at cottage level employing thousands of people in rural areas. With the help of Western Ghats Kokum Foundation we produced 50 litres of high quality Kokum wine. Wines are now recognised as health drinks so Goa being a tourist state can look positively to the future based on a prosperous non grape tropical fruit wine industry.

Another huge and untapped area which has so far remained confined to only academic sector is microbial biofertilizers. Goa has tremendous diversity of cyanobacteria and algae. Our research had focussed on a living fossil a nitrogen and Carbon dioxide fixing cyanobacteria called *Nostoc pruniforme* which is found during monsoon on all the lateritic plateaus- it has been there for at least three billion years and except our work nobody has paid any attention to this highly efficient cyanobacteria which forms unique biological crusts teeming with prodigious microbial diversity. We successfully multiplied this species in rainwater in direct sunlight showing that it can be artificially multiplied, harvested, powdered and used as a nitrogenous biofertilizer.

The local *Spirulina*, *Azolla* and *Azotobacter* diversity is also neglected. There is tremendous scope for production of valuable seaweeds. More than 60 species have been catalogued and species like *Ulva* and *Porphyra* are in high demand as edible seaweeds. Full South Goa coast is covered after monsoon by velvety green alga *Enteromorpha* which has huge economic potential. There is tremendous scope for tapping the local algal and seaweed diversity and build an economy based on their artificial cultivation and processing. We have knowledge of diverse

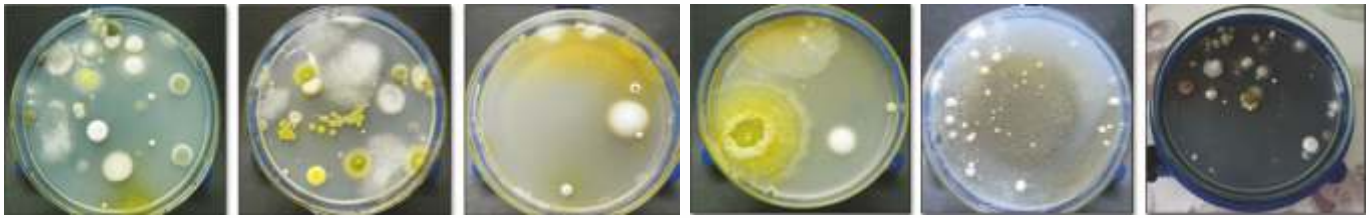
mycorrhizal species found in various habitats thus showing the prospects for building an unique state level mycorrhizal culture collection and creating facilities for mass production of phosphate solubilizing mycorrhizal bioinoculum. I have worked on yeasts and fungi for more than 30 years and this article would not be sufficient to cover the importance and significance of our work. As previously mentioned, if we only focus on yeasts then thousands of jobs could be created. Goa can even produce its own baking yeast, wine making yeasts. We have developed simple techniques to use yeast to remove turbidity from polluted water in mining areas. After scaling up we would be able to provide a simple solution in mining areas for bioclarification of turbid water and make it fit for domestic use. We found biotechnologically useful microfungi too numerous to list here which produce useful organic acids, natural colourants and enzymes besides showing antibacterial and anti fungal activities. Unfortunately research has not progressed beyond taxonomic descriptions, classifications and primary chemical screening. But if the leads obtained in primary screening of fungi are used then we can see their application in bioindustries. Again these leads are too exhaustive to be described and discussed here.

During 1989 we had successfully isolated wild, natural *Saccharomyces* and *Schizosaccharomyces* from a sealed bottle of fruit juice which had produced a cylindrical solid mass inside. It was an unique discovery which showed us the promise and potential of wild yeast cultures in understanding the genesis of solid tumours in humans. Freshwater streams yielded mind boggling diversity of beautiful aquatic hyphomycetes- with many species unique to Goa. The big question is what next because we know these species can produce so many things. We have also pioneered the technique to produce these freshwater fungi artificially in laboratory round the year and ready to transfer the same to any industry looking to utilise the local freshwater fungi by following the rules. The bioactivity of several micro and macrofungi of Goa would need a separate review article but we can mention that more than 1000 species are waiting to be put to industrial utilization. These include organic acid, pigment and enzyme and antibiotic and lectins producers. Even if a pharma company focusses on vast range of sugar binding lectins from local fungal resources then its hands would be full for years. Coming to the most important area of biodiversity research which I explored for 30 years- the mushrooms of Goa- only the sky is the limit to utilize these valuable resources without destroying their

natural habitats. We found at least 100 edible species from which it is possible to domesticate at least 20-30 for mass production. Then there are at least 50 medicinal mushrooms which could support a pharma industry. Then there are ill explored bioluminescent mushrooms which can yield fungal luciferase a highly sought enzyme in biotechnology. There are ectomycorrhizal mushroom species which could be propagated in mango, cashew and jackfruit orchards to increase their yields. Hundreds of wood decomposer mushrooms which we screened showed powerful enzyme activity useful in industries to degrade pollutants, bleach paper and pulp and in food processing. Several of these species can help in two step process of production of bioethanol from cellulosic feedstocks or even wooden chips.

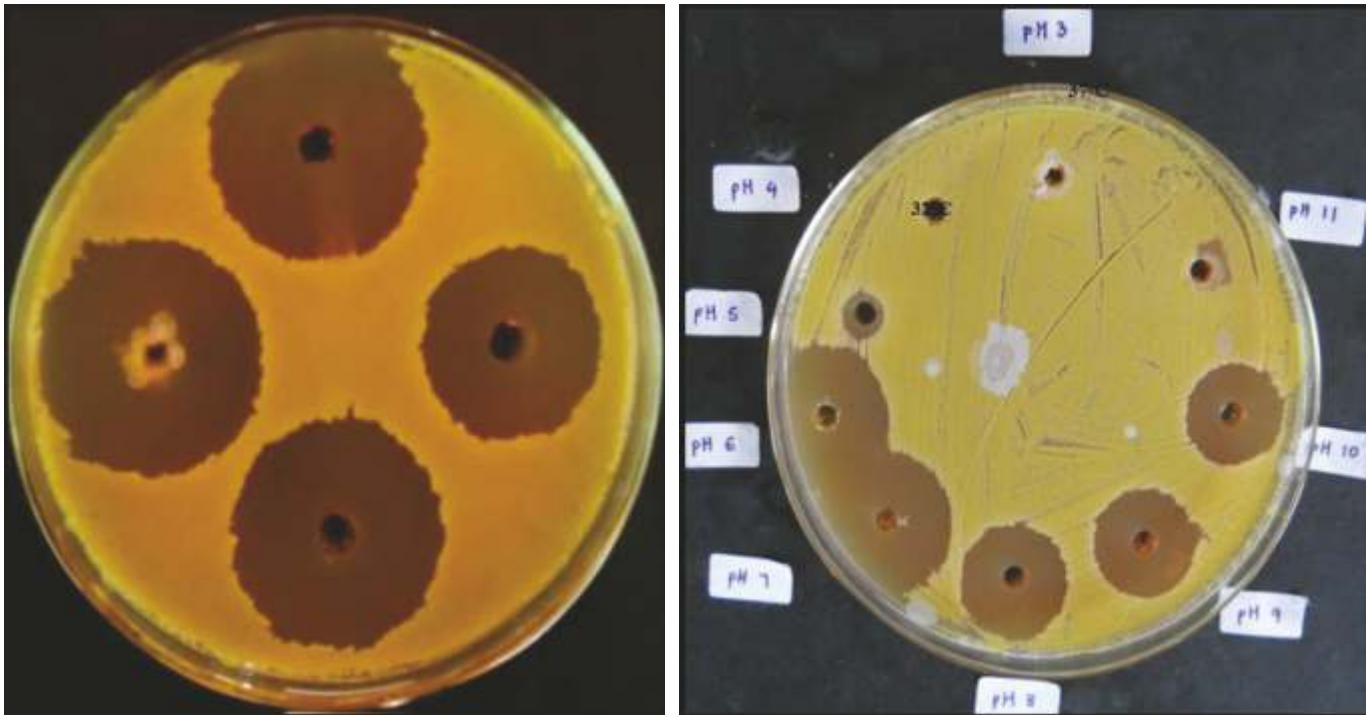
The medicinal mushrooms of Goa can support a whole new industry to exploit the bioactive molecules and nutraceuticals. The local strains of *Ganoderma lucidum* are excellent for artificial cultivation. Such eco-friendly industries based on production of drugs from cultivation of medicinal mushrooms can provide new and intellectually satisfying jobs to hundreds of unemployed educated youth. Even if we think of repackaging the locally produced salt then the availability of natural beneficial halophilic microorganisms could help to add value as probiotics. By establishing strong links of microbial biodiversity to systematic ex situ conservation, screening and industrial utilization efforts it is possible for Goa to emerge as a state capable of sustainable use of its microbiological biowealth. Roughly 5000 microorganisms are known. At least 25000 are yet to be discovered. These remain hidden in under and unexplored habitats. But even a tenth of what is known of microbial diversity is exploited then from simple domestic vinegar, wine, cashew and palm feni and fermented food production, modest scale biofertilizers and seaweed cultivation to bigger enterprises like drugs, pharmaceuticals, industrial enzymes, biocolourants and food grade pigments, antibiotics and by establishing eco friendly biomining operations utilizing beneficial microorganisms Goa can take a giant leap in this century for sustainable wealth and employment generation. We are working on the details of such a roadmap with help of researchers and industrial stakeholders. This roadmap would benefit the efforts of Goa State Biodiversity Board and the State and Central Government to indigenize production and produce novel avenues of employment using creative and beneficial microorganisms.

Microbial diversity from low grade Iron ore reject samples from Bicholim useful in biomining



Naik, S and Kamat, N (2013)

A local strain of Actinobacteria, isolated from soil from Canacona produced high antibiotic activity thus showing huge potential of Actinobacterial diversity of Goa useful in antibiotics research and soils of Goa can yield large number of new cultures producing new and powerful antibiotics Velho-Pereira S and Kamat N, 2013



First report in the world of Endophytic yeasts found in local edible fern- Ankur *Acrostichum aureum* (Dias V and Kamat, N, 2015)



AAY1

AAY2

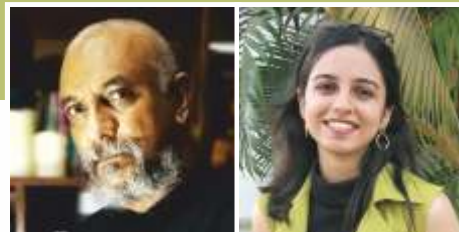
AAY3

AAY4

AAY5

Chicalim Bay: A Window to sustainable livelihoods

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Conflict between ethos and aspirations

Livelihood is prerequisite to a healthy dignified existence of individuals and communities, the means and their ability to procure these basic necessities for a fulfilled life. Further, the ability to maintain a steady procurement of these necessities without overexploiting the source or disturbing the renewal dynamics imparts a sustainable character to that livelihood option. Sustainability is the key to ensuring resource adequacy to future generations through judicious use in our life time. Sustainability is indeed an attribute of altruistic human behavior.

Nature based livelihood options and in particular bio-enterprises continue to support ethnic and marginalized communities across the world. Generally lacking in formal education, technological skills and paraphernalia; these communities however have a deep understanding and practical knowledge of resource renewal dynamics and ensure lowering of their exploitative pressures to avoid disturbances in recruitment of stock. Their Traditional Ecological Knowledge Systems and 'Bare Feet Technology' are commensurate with principles of sustainable livelihood, equitable access and benefit sharing mechanisms.

However, with alienation of such eco-friendly communities by capital intensive enterprise and ecologically damaging development, the depletion and erosion of natural resource stocks is imminent. Greed of monetary compensation, aggressive market forces of liberalized global economy and aspirations of instant material progress at the least of efforts evident

in the neo-literate generation catalyses faster annihilation of conservation ethos and fosters a culture of compromise for short term gains.; an absolute antithesis to sustainable progress.

Our marine bio-resources

Goa is a former Portuguese colony, and a maritime Indian State. Known for its sun, sand and sea; its colonial connect is evident in the architecture and culture. Goan coastline extends to about 105 km and the Arabian Sea ingresses into the mainland at various points. Though India's smallest State, Goa's sea is home to a vast diversity of aquatic species like the Indo-Pacific Humpback Dolphin, Finless Porpoises, Olive Ridley Turtles, Mugger Crocodile, and Corals; all of which promote eco-tourism in the State.

The two important estuaries of Goa are Mandovi and Zuari, with the Cumbarjua canal in between. The banks of the Zuari estuary have luxurious mangrove vegetation that traps detritus brought in by tides, making it highly productive feeding grounds of economically important species. ICAR-Central Coastal Agricultural Research Institute Goa has listed a rich diversity of fin-fishes and shell-fishes here. Situated on the banks of the Zuari estuary is Chicalim, an agrarian village with its rice-fields and clam-beds. Our inland waterscape replete with nature's bounty, and the onus lies on the citizens to use these resources without greed and ensure its replenishment by adhering to principles of sustainability.

Regrets and resilience of the Chicalim Bay

This treatise examines the biodiversity endowments

of Chicalim Bay of the Zuari estuary in the maritime State of Goa with special reference to the tradable Ichthyofauna (Fin Fish Resources) and Malacofauna (Molluscan Resources), anthropogenic wastes assaulting the bay waters and the pro-conservation community ethos that negates the exploitative pressures. Of particular interest here is the presence of a rare and scheduled species of Window Pane Oyster, *Placuna placenta* (Linnaeus, 1758), that serves as a single unified fulcrum of protection for the entire bay against unsustainable developmental proposals including Marinas and Shipyards. It is noteworthy that this species globally restricted distribution, breeds here. Of course the bay waters have stocks of fin fish including the Grey Mullet (*Mugil cephalus*) and the sediments also hold rich clam beds *Paphia malabarica* (Dillwyn, 1817). The intertidal is rocky and offers settlement to the edible Oyster *Crassostrea gryphoides* (Schlotheim, 1813). (See Fig.1)

The Chicalim bay is strategically positioned in the proximity of Mormugao harbour which is a major docking facility for maritime trade and passenger marine vessels, besides landing centre for inland trade consignments. Consequently the bay is always a hot bed of proposed infrastructure development including Marina and Shipyards. These proposals have been resisted and litigated by the local community over the last couple of decades, arguing that any such aggressive development will alter the hydrodynamics and geomorphology of the bay. That such changes shall prove detrimental to the long term sustenance of the bay dependent community is a view that has been upheld by several studies commissioned by the state as well as by the statutory bodies. However, the most convincing argument in favour of leaving the bay inviolate stems from the presence here of the Window pane Oyster! In 2010, the Chicalim Bay was notified as 'Ecologically Fragile Marine site' due to incessant efforts of the Chicalim Village Action Committee (CVAC) and the scientific dossier and deposition by the first author in several techno-legal forums. Currently the efforts are on to get this bay declared as a 'Biodiversity Heritage Site'. under Biodiversity Act, 2002 and Biological Diversity Rules, 2004.

Role of the State actors and community in sustainable utilization and conservation

Sustained efforts at sensitizing the stakeholders of this bay and its endowments have yielded results; in that the presence in the bay of the scheduled

Windowpane Oyster is now a much publicized fact. The project proponents and potential investors too are wary of the repercussions of the presence of the brood stock of this shell in the bay on their proposed enterprise and have shelved their entrepreneurial aspirations. The adjacent Nauxi bay at St Lawrence that has a small population of the Windowpane Oyster has also benefitted from this conservation campaign. The Goa based CSIR - National Institute of Oceanography has played a key role in researching this precious species for its population and renewal dynamics, and currently the Wildlife Trust of India funded research conducted by BITS Goa on ranching and restocking of the Windowpane Oyster has made some progress and raised hopes of restoring the overexploited stocks of this shell species.

But in the meantime the locals have been eager to harvest the clams from the adjacent St Jacinto island and Chicalim Bay too. The Covid pandemic and the enforced social distancing had disallowed them from collecting clams and this has resulted in resentment and anti conservation sentiment. The Chicalim BMC has been proactively trying to balance the harvest of the bay resources with the protection of its flagship species namely the Windowpane Oyster. The villagers are conscious of the exclusivity granted to their village by the presence and brood stock of the Windowpane Oyster, and have been consistent in their support to the conservation cause of this bivalve raising it to a status of a 'Flagship species'!

The GSBB with its Expert committee on Marine and Wetland Biodiversity (of which the first author is a member) is currently in the process of preparing guidelines for controlled harvesting and conservation of edible clams, critical bio-resources. The local clergy has also used its religious authority to safeguard the bioresources of this bay by appealing to the faithful to desist from unscrupulous harvest for commercial gains.

The way forward

The Chicalim Bay has a brood stock of Clams and diverse marine species of commercial value, including the Flagship species of Windowpane Oyster. However, it must be emphasized that the bay has been sustainably utilized by several generations of local community from Chicalim and Dabolim even before the word 'Biodiversity' was coined! When the regulatory policies and legislations were yet to be formulated and promulgated, the traditional

ecological knowledge systems were prevalent and practiced by the locals ensuring sustainable management and smooth resource renewal dynamics in the bay.

Suggestion of a blanket ban on harvesting of marine Clam resources from the Chicalim bay in the garb of conserving the Windowpane Oyster is somewhat radical and may actually be counterproductive and dilute the commitment of the community to protect the bay. Voluntary moratorium based on population assessment is a viable intervention to allow resource recuperation. Conservation Scientists across the globe also admit that regimented harvesting of natural resources is not contrary to its preservation mandate. Overexploitation can be effectively controlled through regulation. Sustainable use is an attribute of the user and not the resource. Thus, if the user is disciplined the resource can renew without any impediments.

The Chicalim Bay has been in focus since last several decades and multiple commissioned studies worth costing crores of rupees have been carried out by several agencies of national repute, yet no definite solutions towards conservation and sustainable utilization of its resources are coming forth. Ironically though every time the issue of balancing harvest with conservation crops up, yet another study is sought! In our considered opinion, research and academic pursuits can go on at its pace but livelihood cannot wait as many families in the villages depend solely on these resources, without alternatives of income.

Before the resurgence of the Window Pane Oysters in the bay and scientific evidences of viable recruitment by the brood stock, it may not be feasible to allow its collection and sale for trade purpose. But for the Clam stocks, staggered harvesting may be allowed until the end of the pandemic as declared by the health authorities. Clam collectors may be allowed restricted access in batches of maximum 10 individuals/500 m² of the Bay bed within collection zone. Traditional hand collection should be allowed, with a strict ban on mechanical appliances to avoid overexploitation. For every collector a fixed quota should be allowed per person/family. For Subsistence and sale, separate quotas can be fixed in consultation with Biodiversity Management Committee of Chicalim. Log book entries of harvest visits, quantity collected, average size of the collected clams should be maintained at the entry point. There is a contentious demand to restrict the bay access for clam harvest only to the residents of

Chicalim village, but this may trigger inter-village rivalry and social tensions. However, the locals must be identified and given prioritized opportunities based on their ancestry and/or domicile and issued identity cards with permissible quota mentioned on the card. Clam collectors from the jurisdiction of the Chicalim and Dabolim villages may be prioritized. Disallowing access to others will have to be assessed for its tenability in Law.

The villagers could also be trained in handicrafts using the empty shells; providing them with lateral linkages for trade opportunities facilitated through 'Aparant', the handicraft emporium of the state government. Capacity building of local youth for ecotourism activity in and around the bay will surely lift the pressure off the clam beds.

For visitors there could be a Nature Interpretation Centre at entry points; with specimen and pertinent information displayed and films screened. The need of the hour is to map the bay for its molluscan resources and define the spatial coordinates unambiguously. Zonation of the bay into 'Harvest Zone', 'Closed Zone' for renewal and the 'Brood-Stock Zone' will help regulate the harvest pressure and allow normal renewal dynamics. It needs to be emphasized that this zonation is very dynamic and should be revisited periodically with changing exploitative pressures and natural events in the bay. There are a few ongoing live research projects pertaining to Recovery of Windowpane Oysters in the bay, lateral linkages with these projects should be strengthened in the interest of local economy.

The afore mentioned suggestions have been based on our understanding, personal observations and residence in the village of Chicalim for 14 years and interacting over the years with cross section of stakeholders. We are convinced that people best know how to protect their resources, and further that incentivisation strengthens conservation efforts.



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Fig.1 : Bio-resources of the Chicalim Bay (Clockwise from top left) : A local holding *Mendi* (Windowpane Oyster), children collecting *Tisreo* (Clams), *Kalvam* (Oysters), Chandelier of Oyster shells, Window Panes made with Windowpane Oyster Shell, a woman selling portions of clams and Windowpane Oysters in the village market.

GREEN HERITAGE & KNOWLEDGE V/S LIFESTYLE ADDICTION

Kamalakar D. Sadhale



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The Vedic Rishis meditating on the secrets of the world, sitting in solitude in the deep forest unearthed treasure of knowledge, how the world was formed and hoard of issues connected with life. Rishis of Rigveda say that prior to this world there was nothing: no light, no sound, and no space even. Only eternal Brahman was there. That unexpressed power decided to express itself and the universe was created with violent speed. (The modern science conceives this phenomena as Big Bang theory) Then the whole thing emerged including life through the wish of superpower as spelt out by the Rishis. The Upanishads of Vedic literature extensively discuss the physical world formed of five basic elements. 'Panchamahabhutas': the earth, the air, the water, the energy and the space. The earth constitutes all the solid things for our habitat and resources. The air is for our breath which is called 'prana'. Till it circulated in our body we are alive. The moment it stops, the life is ended. Water is called Jeevan. The seers say that all our bodies of living beings are made of water without which they cannot survive. 'Amrutam apaha' 'Amrut' is non-dying. Water may dry but not die. It comes back from the sky in the form of rain, fog or snow. The Vedic literature extensively discusses at the spiritual level the play of these five elements in this dynamic world. Vedic gods are not imaginary gods as of to-days religion. They are the real gods of nature who sustain us and with whom we can directly interact, the earth, the sun, the rain symbolized as Indra, water-bodies as Varuna, fire and Pashupati.

The Life, the living phenomena has been discussed at spiritual level. What is the purpose of life is discussed in Taittiriya Upanishad as an intellectual dialogue

between Rishi Bhruhu and Varuni. It concludes- 'Not the material, not the mind, not the intellect but ANANDA, the pure joy, an unconditional delight is the purpose of life'. Ananda smiles in the blooming flowers, it dances with rolling sea waves, it shines in the seven colors of rainbow in the thin layer of morning mist or light showers of rain. It cannot be captured, stored, sold or purchased, simply to be experienced. The Vedic literature discusses the journey to ANAND through the concept of five 'Panchakosha's.

As the universe is formed, the earth develops with living and non-living elements. The living beings are further categorized as moving-'Chara' and non-moving 'Achara'. All of them started functioning in rhythmic pattern.

When the man comes on the scene, what is his role and how he should act is the issue to be meditated upon for the Vedic seers. The very first verse of the first Upanishad, the 'Ishopanishad' sets the theme.

'The entire world is occupied by the supreme, from the smallest living beings to all are the part of him. You enjoy the world after leaving the resources designated for them Do not encroach upon theirs'.

This is an apt mantra for man to follow even to-day for Not only for bio-diversity conservation but as a social doctrine too. It is 'Srushtidharma' for sustenance of nature along with sustenance of mankind. 'Dharma' means that which holds, sustains. Further it is said 'those who protect Dharma, the Dharma will protect them.'

After the Vedic gods came the Puranic Gods. The green traditions seeped in to the new rituals also. Number of saints produced by the medieval period also preached the green culture. But in the modern world all these rituals got polluted by the easily available aggressive market elements. The crackers, thermocol, Plaster of Paris idols, loud speakers etc. the contentment of 'small is beautiful and containment of the celebrations within the non-disruptive use of local natural resources was replaced by explosive unethical material culture. This was the reflection of the commercial lifestyle that invaded the traditional societies. Scientists and thinkers of the modern world were pondering over how this world functions with billions of living beings each carrying on smoothly variety of multifarious activities for millions of years. Then they understood that the intricately and intelligently laid down eco-system manages it. It is the order of nature's functioning which maintains the discipline. Bio-diversity carries on a very important function of food-supply chain. The system maintains the population balance of each species through prey-and-predator relationship. Recycling of waste into resource is another system by which the excreta and dead body of one organism is converted into food for the others.

Thereafter it also came to light that there is a well-built silent communication system in the nature. When the grazing animal eats the grass the affected plant sends danger signal to the adjoining grass plants and they send temporarily bitter chemical in their leaves and the animal has to shift. It cannot go on eating the grass continuously. This is a mechanism due to which herbivorous animal cannot clear out entire grass stretch. This saves the grass as well as conserves the food of the herbivorous animal.

There is also inter-species communication and nature-to-creature communication. Man drifted from nature has forgotten the nature's language. One of the most primitive human tribe in the world lives in the Andaman- Nicobar islands. They were at the most vulnerable point of India where the deadly Tsunami waves attacked first. But they could read the advance danger signals of nature and all could quickly move to safe place. Free moving animal all over South India could rescue themselves. But the modern man equipped with all the technological devices could not read the signal and got attacked unaware.

A set of riddles come before the inquisitive human mind.

- 1) The solar radiation is becoming weaker and weaker in course of millenniums of years. (A rise

of just 20⁰c has been creating havoc now) How the same average temperature is maintained for thousands of the centuries?

- 2) A very precise 21% level of oxygen in the earth's atmosphere has been constantly maintained. How? Similarly the nitrogen level.
- 3) Level of salts in the sea has a delicate level mark for marine life to survive. But in spite of hundreds of million tons of salts from the land entering into the sea every year how the same level is maintained?

'Gaia' theory of James Lovelock says that the entire earth along with the living beings and few of the non-living elements like sea and rocks, atmospheres and stratosphere manages the proper environmental standards meticulously. The entire biosphere acts as a single mega creature. Here the prime role is played by the bacteria. Just like cybernetics in the human body, it manages the balance. The nature has got its own inbuilt system of repairing the incidental damages and maintaining proper environment. But beyond certain mark it cannot cope up with them especially in case of changes introduced by man.

If we look into the history of evolution of present man, the Homo-Sapiens from the apes we find that the nature has been very generous to award large number of rich attributes to human race to construct this super species within very short period. This looks to be rather a revolution and not evolution. But human attitude in the recent centuries towards nature has been ungrateful, rather arrogant. With the small success in technology he boasts of conquering and enslaving the nature. He is blind to the fact that nature is so great and strong. What he is carrying on is a misadventure and eventually will destroy him.

Man has been mesmerized by the technological miracles and pleasures sold by the commercial world. He has been addicted to comfort and ease. Domestic time saving equipment's flooded in the market have practically shown to be reverse working. In whichever community these gadgets have become profuse, the system that has entered has made the life more hectic. Whatever free time was available earlier has also been vanished. This technological advancement could not reduce the pollution in air and water, on the contrary escalated it. Last three centuries claiming tall achievements of man through industrial revolution by means of technological advancement has proved to be the black period in the ecological history of the earth. The nature's system of biosphere which had been advancing with more and more progressive life species more than three billions of years has come into

danger within these three centuries of industrial revolution. Many life species have gone into extinction and many are on the danger line. Pollution of air has damaged the atmosphere. Entire eco-system has been disturbed. Market system promoted by industrial revolution has transformed the human lifestyle by which human body capacities and skills have been degraded significantly. Body senses like smell and hearing have been degraded. Lifestyle diseases, psychological and environmental ailments have become profuse. Creativity of mind skills of hands has gone down. Man has become slave of the system. Basic natural necessities of man and other living beings like air, water, food and habitat have been seriously degraded.

In fact the section of the human community carrying out this maleficent activity is well educated class in terms of environmental awareness. But addiction to the market promoted callous lifestyle does not allow him to take a right step. His action does not go beyond lip sympathy to environmental issues and paper actions.

The same attitude for one or more reasons has been transcended to the nations of the world. Since half a century back Stockholm Conference more than half a dozen of international conferences on climate change have been held in the different parts of the world with heavy participation of more than 100 nations each time. Furious discussions are held powerful statements are issued elaborate programs are chalked out. But nothing has been happened on the ground showing the result of reduction of pollution and global warming gases at the world level. These nations are divided into groups each group demanding that the other group should act.

Just when the climate change disaster is crawling in, a new chapter of nature's anguish has opened. A microscopic size virus of Covid-19 has proved that gigantic political and money power equipped with monstrous technological built-up like Europe and America cannot ensure security to man. Technologically invented fast communication system of air travel has proved to be assisting the global hazard. Big urban communities have become more vulnerable and de-centralized villages safer. Self-sufficiency of a community can keep away the contamination for long time whereas market dependency for day to-day needs finds it highly difficult to avoid contamination. One year has passed crores have been affected and lakhs died. With hectic technological research, effective medicine is not yet available. In the last half a

century which can be labeled as highest polluted and nature disturbed period in the human history, more than half a dozen of new epidemics have rushed into the fragile modern world. During Covid-19 period it has been proved that prevention is more reliable than curative measures. Building up immunity with stronger physic and healthier environment is more dependable. Medicine will be acting for one specific disease. Immunity is for all.

To-days centralized system dominated by commercial and political forces has failed. The system of gigantic dams, lakhs of kilometers of canals and immeasurable jumble of pipelines has proved to be incapable of coping up with the water needs. Now we have to turn to system of augmenting water resources through 'catch to water it falls' programs including roof-top water harvesting system. After centralized hydro-electric power, thermal power, fossil fuel and atomic power being found insufficient and problem prone, we have to go to local generation through solar, bio-methanation etc. Modern system of chemical farming and GM seeds for bumper crop after poisoning the soil, water bodies, aquifers, atmosphere and bodies of the entire fauna including human beings have witnessed decreased soil fertility and increasing pests. Now we have to form new programs of organic farming with local seeds.

Centralized system of administration and financial order also has been finding instability and inefficiency throughout the world. Therefore new world order needs to be evolved. The present greedy, ever hungry system targeting maximization of physical necessities needs to be replaced by minimization, with maximization of ANANDA and contentment. Self-sufficiency of smaller communities harnessing local resources in a sustainable manner is the way out

There is a long history of Gramraj wherein India saw golden age of a thousand years. To-day also we have various successful models including of gramraj like Anna Hazare's. Ralegan Siddhi. It is an experiment of dry degraded, alcoholic and poverty struck village transformed into healthy alcohol-tobacco free wealthy village with water plenty only through intelligent use of local resources by local people only. **There is a way, will is needed.**

(The matter in this article has been elaborately discussed in the author's Marathi book 'Srushtidharma' which is under publication.)

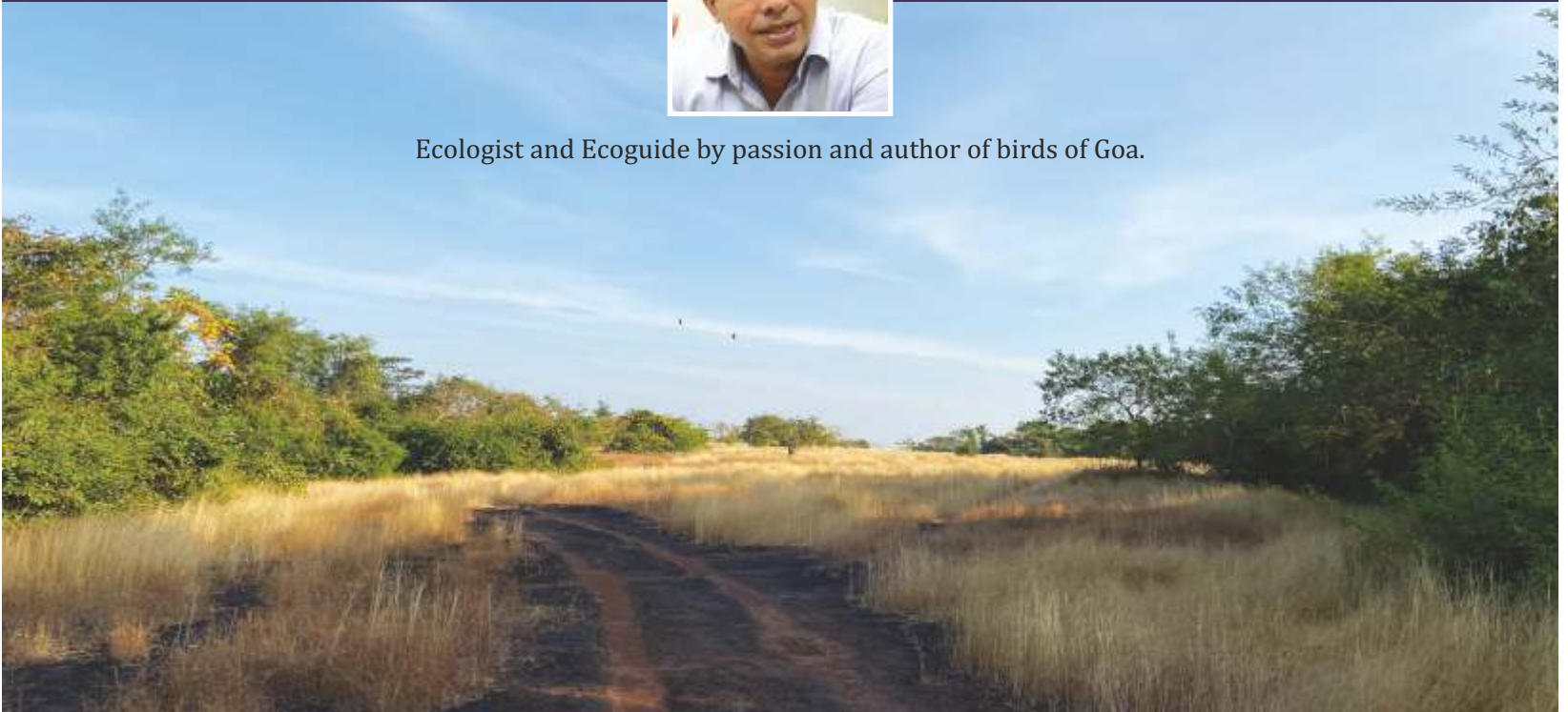
Socorro Plateau

– Pristine plateau of Bardez

Savio Fonseca



Ecologist and Ecoguide by passion and author of birds of Goa.



The Earth plays host to about 10500 bird species, and of these, about 462 have been observed in Goa.

The significance of the number of birds found in Goa increases in staggering proportions in terms of species density when compared to those reported by various nations.

If Goa (about 462 bird species observed and 3702 km² in area), was a country, it would have been ranked 78th (in terms of bird abundance) in the world, much ahead of

- *Mongolia (444 birds and 19th largest country - area 1.6 million km²)*
- *Saudi Arabia (441 birds and 13th largest country - area 2.14 million km²),*
- *Kazakhstan (422 birds and 9th largest country - area 2.7 million km²),*
- *Egypt (357 birds and 30th largest country - area*

1 million km²),

- *New Zealand (357 birds, 76th largest country - area 268 lakh km² and a bio diverse island country) and*
- *Madagascar (259 birds, 47th largest country - area 587 lakh km² bio diverse island country and tectonically once related to Goa)!*

The secret behind Goa's abundant bird density lies in the inherent geological structure of the State wherein multiple habitats exists in close proximity to each other, ranging from saline coastal wetlands to mixed riparian zones to freshwater ponds and mountain streams, primary forests to secondary dry forests ranging from dry, moist to wet, grasslands, cultivation zones, gardens & orchards and of course, our mangrove zones. Bird existence is a function of the land feature and as much as it is preserved.

Some of these habitats by themselves have recorded bird species that are more than some countries around the world. The leading bird habitats are ...

- Carambolim Lake Area – 283 species
- Bondla Wildlife Sanctuary – 256 species
- Bhagwan Mahaveer National Park and Wildlife Sanctuary – 234 species
- Socorro Plateau with 238 species.

The Socorro Plateau over the last few years has been unraveling its secrets and its attraction to birds in a slow and a mysterious way. It is one of the last remaining plateaus in Goa and stays as an island of calm in the bustle of Bardez. Its existence remains as a grazing ground, a snapshot of its illustrious past, reservoir of exotic and medicinal plants and a water catchment zone for around 10 villages around the periphery of its base and providing year-round water for potable, agricultural and fishing requirements of its people. Much of the ecosystem services related to fresh water supply & control, pollination and pest control sourced from Socorro Plateau directly impact agricultural activities in the cultivation expanses of Socorro, Guirim, Bastora, Punola- Ucassaim, Nachinola - Moira, Olaulim - Pomburpa, Salvador-do-Mundo, Penha-de-France and Chora Island.

Socorro Plateau has been able to stave off development multiple times in its long history and yet has been an important part of the anthropological history of North Goa with the bullock cart trails etched deep eons ago in perpetuity on its laterite surface across the plateau with trails then emerging out at the foot of the plateau in all directions towards the trading centers of Goa of yore.

An accepted scientific indicator of the health of its ecosystem is its bird density and more specifically, the incidence of rarely observed birds. Rare birds are sensitive to degraded ecosystems and would avoid the location at the slightest hint of a disturbance.

However, Socorro has been fortunate to be visited recently by the following rare birds – rare not only for Goa but for India!

- Eastern Imperial Eagle
- Long-billed Pipit
- Isabelline Shrike
- White-naped Woodpecker
- Shaheen Falcon
- Black Eagle
- Lesser Kestrel

- Eurasian Hobby
- Eastern Orphean Warbler
- Rufous-tailed Lark

Besides, the plateau plays host to the following long distance passage migrants during different times of the year, that make a pit stop for replenishing their protein needs:

- Amur Falcon – migrating from Far East Asia to Africa, stopping at Socorro Plateau before flying non stop over Indian Ocean for about 3500 kilometres and 8 days in November.
- European Roller – migrating from Central Asia to Africa, stopping at Socorro Plateau before flying non stop over the Indian Ocean in September.
- Common Cuckoo or Eurasian Cuckoo – migrating from China to Africa, stopping at Socorro Plateau before flying non-stop in October.
- Jacobin's Cuckoo – migrating from Africa to India on the pre monsoon winds, making landfall at Socorro before spreading out to various directions in India in May / June.

The other migrants making their home at Socorro especially during the winter months are:

- Indian Roller
- Pallid Harrier
- Montagu's Harrier
- Lesser Whitethroat
- Eurasian Wryneck
- Indian Thick-knee
- White-eyed Buzzard
- Eurasian Kestrel
- Common Hoopoe
- Rosy Starlings
- Yellow and White Wagtails
- Oriental Honey Buzzard
- Greater-spotted Eagle
- Yellow-crowned Woodpecker

Meanwhile, local resident shorebirds from the Mapusa and Mandovi River seek refuge at the plateau during monsoon months when the river levels are high due to heavy rainfall coupled with high tides. It is therefore not uncommon to spot waders including Common Snipes and Sandpipers at the plateau during the monsoons. The other year-round residents at the plateau are the Malabar Larks, Oriental Skylarks, Indian Peafowl, Red Spurfowl, the Red-whiskered and Red-vented bulbuls,

all sunbirds including the Crimson-backed Sunbird, the Oriental Magpie Robin and the Indian Robin.

The monsoons are also the breeding season for many of the aforementioned birds whose young feast on the rich diversity of insects that the plateau provides. Birds feed on a variety of options based on their profile. However nectarine, granivorous and frugivorous birds still need to feed proteins to their young. The abundance of insects around provides such proteins. Some of the notable breeding birds on the plateau are the Yellow-wattled Lapwings and the Red-wattled Lapwings that nest on scrapes of rocks on the plateau. These nests can be easily disturbed by human activity elsewhere but are relatively safe here on the plateau. Other rare nesting birds found on the plateau are the Nilgiri Wood Pigeon, Malabar Pied Hornbill, Indian Blackbird, Barred Buttonquail, Blythes Starlings etc. In all, about 50 bird species nest on the plateau and around at different times of the year.

In my fruitful time spent at Socorro over the last decade, I have understood that the core of Socorro's rich attraction remains the diverse abundance of - believe it or not - the insects on the plateau! Insects like grasshoppers, caterpillars etc. that thrive on the vast expanse of grasses and vegetation that sprout on the plateau during monsoons and grow chest-high by December. In fact, we have found that the plateau is also



a host to insectivorous plants - *Drocera indica* and *Utricularia graminifolia*. Insects are slowly being respected for their role in providing ecosystem services that largely benefit humans in all facets of life primarily in agriculture and other sectors of the economy.

The extent of bird density is not restricted to the plateau. The slopes encircling the plateau are covered with dense vegetation and mature trees ranging from teak, cashew, mango, fish-tail palms, bamboo, silk cotton, *Terminalia sps.* and many ficus species. These slopes are inhabited by many of the forest species that are common for the Eastern regions for Goa but extremely rare for Bardez and they are:

- Great Hornbill
- Malabar Pied Hornbill
- Oriental Dwarf Kingfisher
- Blue-eared Kingfisher
- Puff-throated babbler
- Racket-tailed Drongo
- Bronzed Drongo
- Indian Pitta
- Slaty-legged Crake
- Black-hooded Orioles
- Grey-headed Bulbuls
- White-browed Bulbuls
- Vernal Hanging Parrots
- Common Rosefinch
- Jerdon's and Gold-fronted Leafbirds
- Grey Junglefowl
- Crested Serpent Eagle
- All flowerpeckers

Beyond the seasons and the terrain at the plateau, the nightlife throws up an interesting parade that include mammals, reptiles besides birds:

- Indian Scops Owl
- Brown Fish Owl
- Barn Owl
- Spot-bellied Eagle Owl
- Savanna Nightjar
- Indian Nightjar
- Jerdon's Nightjar
- Common Leopard
- Indian Palm Civet
- Indian Civet Cat
- Indian Crested Porcupine
- Indian Boar
- Indian Gerbil
- Indian Terrapin
- Saw-scaled Viper, Spectacled Cobra, Russell's Viper, etc

The Plateau ranks among the top 10 birding habitats in Goa with Carambolim Lake and Bhagwan Mahaveer National Park & Wildlife Sanctuary, Bondla Wildlife Sanctuary being the other locations. But Carambolim Lake is severely degraded due to poor management and bird counts are steadily dropping over the years. Bhagwan Mahaveer and other sanctuaries have their counts stagnating and abundance figures are not expected to grow since habitats are essentially forests. However, Socorro seems ascending in its counts and appears to be a meeting zone for diverse bird species and throws up species in surprising ways due to its

location on a possible major migration flyway and diverse habitats offered in a compact location. I expect the Plateau to rank among the top 3 birding hotspots of Goa within the next 10 years with all parameters remaining constant. But, the plateau is in constant danger to its existence. However, it has been protected from misuse by its village and the comunidade on several occasions in the past. Its long-term survival as a biodiversity heritage site hinges on its secrets being unraveled and getting statutory protection as soon as possible. Perhaps this is the last pristine plateau of Bardez and maybe of Goa.

Here are photographs of various birds, all clicked at the Socorro Plateau location on various occasions



Amur Falcon
Falco amurensis



Shaheen Falcon
Peregrine falcon



Common Hawk-cuckoo
Hierococyx varius



Crested Serpent Eagle
Spilornis cheela



Thick-billed Flowerpecker
Pachyglossa (Dicaeum) agile



Nilgiri Flowerpecker
Dicaeum concolor



Purple Sunbird
Cinnyris asiaticus



Indian Black Robin
Saxicoloides fulicatus



Paddyfield Pipit
Anthus rufulus



Tree Pipit
Anthus trivialis



Barred Buttonquail
Turnix suscitator



Indian Roller
Coracias benghalensis



Pied Bushchat
Saxicola caprata



Common Hoopoe
Upupa epops



Vernal Hanging-parrot
Loriculus vernalis



Little Green Bee-eater
Merops orientalis



Indian Pitta
Pitta brachyura



Gold-fronted Leafbird (Chloropsis)
Chloropsis aurifrons



Jerdon's Nightjar
Caprimulgus atripennis



Savanna (Franklin's) Nightjar
Caprimulgus affinis



Jacobin (Pied Crested) Cuckoo
Clamator jacobinus



White-bellied Drongo
Edolius caerulescens



Yellow-wattled Lapwing
Vanellus malabaricus



Red-wattled Lapwing
Vanellus indicus



Eggs (Yellow-wattled Lapwing)



Eggs (Red-wattled Lapwing)



Chick (Red-wattled Lapwing)



Spotted Dove
Streptopelia chinensis



Indian Peafowl
Pavo cristatus

Sea Turtle Nesting and Habitat Management Guidelines

Nesting conservation practices

Mr. Sujeetkumar Dongre



Mr. Sujeetkumar Dongre is working as Scientist E at the Centre for Environment Education (CEE Goa State Office). Presently he is expert member GCZMA and has prepared the turtle management plan for GCZMA

The beach stretches of Morjim, Mandrem in the North and Agonda, Galgibaga in the South are designated sea turtle nesting sites under the Coastal Regulation Zone Notification (CRZ), 2011. The Goa Government, through the Department of Forest and the local community has made a concerted effort since 1996 to protect these nesting beaches.

1. Mandrem beach, North Goa: A 2.6 km stretch of beach has been known for sporadic nesting. The nesting has been monitored by the Goa Forest Department since 2000. The protection staff monitors the beach during the nesting season. Initially, the nests were protected in-situ. But, of late, the eggs are being relocated to the hatchery located in Morjim for better protection. Nests laid on the mouth of the creek (Ashvem) near the property of Mr. Denzil Sequeira are kept as it is since Mr. Sequeira monitors them and gives the required protection to these nests. The Goa Forest Department has maintained nesting records for the years 2011-2014 and 2017-2020.

Tourism has been a major revenue source for the villagers in Mandrem. The locals have been customarily putting up temporary seasonal shacks on this beach. The CRZ Notification, 2011 recognises this right and allows such structures on the beaches as a special consideration for the state of Goa. The Department of Tourism has allotted 10 such shacks on Mandrem beach stretch, with certain conditions stipulated by the Goa Forest Department.

2. Morjim beach, North Goa: The Goa Forest Department has demarcated a stretch of Morjim beach (approximately 660 meters length) at the Chapora river mouth as **NO-TAKE Zone** exclusively for the positioning of a turtle hatchery. The stretch extending towards the north has been earmarked as a Sustainable Livelihoods Zone where in certain tourism related activities such as erecting seasonal temporary shacks, allowing tourists to access beach and water for swimming etc with strict guidelines and conditions. This arrangement has so far worked in favour of sea turtle conservation. It is noteworthy, that the sea turtle conservation efforts were initiated on all four designated beaches by the local community. There is huge sense of pride of sea turtles among locals. The Goa Forest Department has maintained records of nesting since the year 1997.

Tourism has been a major revenue source for the villagers in Morjim. The locals have been customarily putting up a temporary seasonal shack on this beach. The CRZ Notification, 2011 recognises this right and allows such structures on the beaches as a special consideration for the state of Goa. The Department of Tourism, has allotted 11 such shacks on a designated stretch of Morjim beach. These shacks have been provided with certain conditions stipulated by the Goa Forest Department.

Management approach recommended for Morjim and Mandrem nesting beaches

Zoning: Three management zones have been proposed



Mandrem beach



Morjim beach

Legends : ■ NO-TAKE Zone ■ Sustainable Tourism Zone ■ Fisheries Livelihoods Zone

NO-TAKE Zone

- a) This zone must be maintained as a sacrosanct space. While tourist will be permitted to enter this space, no extractive activities will be permitted over-here. No shacks will be permitted, riding of bikes, parties, bright lighting etc will be prohibited. The beach ecology including sand dunes will be maintained and enriched by the plantations of native beach vegetation species.
- b) Turtle nesting and hatching periods will be given special concern and strict guidelines issued by the Forest Department will have to be adhered by.
- c) The Goa Forest Department shall deploy adequate number of staff to monitor nesting and provide adequate protection through-out the nesting season (October to May)
- d) The Goa Forest Department shall set up a Marine Turtle interpretation centre at Morjim to facilitate education and awareness activities for tourists and general public.

Sustainable Tourism Zone

- a) This constitutes the areas where tourism is permitted. The allotted number of shacks will be permitted in this zone following strict guidelines. This including turning off lights and sounds particularly during the turtle nesting and hatching periods. The positioning of shacks will be based on the DSLR maps only by maintaining a mandatory distance of 20 meters between each shack (attached) and the shacks will be placed on stilts as per the guidelines attached. The seasonal shacks permitted by the Government on the beach, sea-facing shacks, bar and restaurant in private property shall close their operation no later than 8p.m. In other areas that do not encompass the above which include street lights, private huts, resorts other measures such as directional lighting will be imposed. Temporary beach activities permitted for shacks during the day time such as deck beds, beach umbrellas, tables, chairs etc should be removed and staked properly in respective establishments before sunset.
- b) All shacks and other establishments along the beach stretch shall promote marine conservation

outreach activities. Nesting any found in this stretch, the same should be informed to the Forest Guards deployed on the beach for safe relocation to the NO-Take Zone.

- c) Tourism enterprises following best practice should be incentivized and an award must be constituted by the Tourism Department.
- d) Capacity Development for various stakeholders especially the tourism establishments shall be undertaken by Government departments such as Goa Forest Department, GCZMA, Fisheries Department, Biodiversity Management Committees etc.
- e) Certain activities such as watersports, motorcycle activities shall be prohibited on all four nesting beaches.
- f) In Morjim, smaller shanties, road side stalls etc must be brought under common management and must be well regulated and promoted and brought under the purview of the village Biodiversity Management Committee.
- g) Waste and sewage generated by the tourist operations including shacks must be properly managed and safely discharged, which include the use of bio toilets. This can be done in close coordination of the Goa Waste Management Cooperation.
- h) The tourism department must ensure that all these conditions are adhered to. To facilitate this process a Task Force could be constituted to make sure the above guidelines are implemented. This task force may include independent scientists, forest department officials, members of the biodiversity management committee, GCZMA member, shack owners, police etc.

Fisheries Livelihoods Zone

- a) This zone has been envisioned keeping in mind the livelihoods needs of the small-scale and artisanal fishing communities including the ramponkars, the magkars etc. While these communities maybe allowed to continue with their way of life, no disturbing tourist activity will be permitted. The beaches in this zone maybe used to berth their boats, dry nets, fish etc.

3. Agonda beach, South Goa: The beach stretch of approximately 2.8 kms is preferred nesting site of Olive Ridley turtles. The Goa Forest Department has a record of nesting since the year 2000. The entire beach stretch has been designated as **NO-Take Zone**. No shacks on the beach is permitted. However, there are shacks/huts on private properties being put up in vicinity of the nesting area. The Government of Goa has taken a decision to not to allow beach shacks on the beach stretch.

The Goa Forest Department has deployed its protection staff to monitor the beach for nesting. There has been continuous reporting of nesting on this beach since the year 2000. As that of Morjim and Mandrem, locals from this village also initiated community led sea turtle conservation under the guidance of parish priest. Rev. Fr. Mariano of Galgibaga Church. The villagers are sensitive enough on the issues of sea turtle conservation. The Goa Forest Department periodically organizes education and awareness programs for locals and tourism stakeholders.

4. Galgibaga beach, South Goa

One of the most pristine beaches of Goa. The Galgibaga beach stretch (which includes Talpona beach) have been a regular nesting site for Olive Ridley's since the year 2000. Both beaches have now been acquired by the Goa Forest Department for protection. The Department has a plan to declare these beaches as Conservation Reserve under the Wildlife Protection Act, 1972. The Government has taken a decision of not allowing beach shacks on this beach too. There are no private shacks as the area is under the Goa Forest Department.

Since the Galgibaga beach stretch and the adjoining land are to be declared a Conservation Area under the Wildlife Protection Act 1972, the management shall follow the guidelines stipulated by the Act itself.

Temporary seasonal beach shack design guidelines

Structure –

The guidelines given herewith are for a temporary seasonal shacks structure to be erected in the CRZ zone. The definition of temporary seasonal shack being – a structure constructed with material, to last for a specific period and specific purpose, for a limited time after which the structure is to be dismantled.

Shacks on stilts with minimum clear height of 1 metre between underside of the floor and ground level to be permitted.

A mandatory distance of 20 meters must be maintained between each shacks in Morjim and 30 meters in Mandrem.

Conditions:

1. The columns/pillars extending into the ground shall be supported by a horizontal base plate or a precast base/shoe for the distribution of load.
2. No levelling of the ground/sand shall be done while positioning the stilted structure. The structure shall be raised sufficiently such that the ground/sand beneath remains in a relatively undisturbed state except for the pillars. (specific for turtle nesting areas)
3. The floor will either be the natural ground or a raised plinth comprising of floor beams and such support structure overlaid with fibre cement boards or equivalent material as a base for the flooring finish.
4. The main structure shall comprise of columns / pillars and horizontal beams at the eaves level as well as at the platform / plinth level. This

structure maybe of timber, bamboo or metal. It is important that the construction methodology followed should be such that the structure can be dismantled easily.

5. The roof structure maybe made of timber or bamboo. This structure would be covered with thatched roof or terracotta tiles (such as Mangalore tiles). An addition of cosmetic boards or waterproofing material maybe allowed under this roofing material. However externally only thatched roof or a terracotta tile roof appearance is desired in keeping with the local context.
6. The roof shall be a pitched roof with no portion as a flat terrace or flat roof with a minimum slope of 15 degrees.
7. The height of the structure shall be governed as per the existing CRZ regulations.
8. Wall panels shall be made of timber, thatch or any other alternative material such as WPC or fibre cement sheets.
9. Railings if any shall be made of timber or bamboo.
10. Overhead tanks shall be concealed under the sloping roof.
11. All electrical wiring must be in conduits and completely insulated from the structure.
12. A water supply and sewage system layout must be included as part of the design proposal to the CRZ authorities.
13. Fire fighting equipment such as fire extinguishers shall be suitably located and clearly marked.
14. No masonry shall be used in the construction of the plinth or any part of the sub and super structure.



Representative sketch of the Shack.

How climate change is affecting Goa?

Dr. Rajiv Kumar Chaturvedi



Assistant Professor, Department of Humanities and Social Sciences,
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Nestled between the pristine Western Ghats and the Arabian sea, Goa state is gifted with unparalleled natural beauty. No wonder Goa is a major tourist attraction in the World, where people from across the World come to enjoy and celebrate its climate, biodiversity, clean air, and its beautiful beaches. However, climate change, like rest of the World, has already started affecting Goa's pristine climate. In 2019 Goa witnessed floods and crops over 1300 ha were affected by these floods leading to estimated losses of about INR 10 Crore. Again this year (2020) Goa witnessed one of the record monsoon season rainfall.

Recently Goa State Biodiversity Board has put together the first ever State Action Plan on Climate Change, with the help of NABARD bank. I was requested by the NABARD bank to carry out the long term climate change analysis for the state. I was particularly asked to look in to how the temperature and rainfall profile in the state has changed in the last 118 years (over the period 1901-2018) and further how it is likely to change in future all the way to the year 2100 under different climate change scenarios (and assumptions).



Figure 1: Sunset on a beach in Goa (Photo Credit: Rajiv K Chaturvedi)

Goa has a pleasant climate at mean annual temperature of about 26.7°C. The state is blessed with plentiful of rain. Goa on an average witnesses an annual total rainfall of about 3000 mm, which is about three times higher than the national average. Much of the rainfall in the state takes place in the monsoon months from June to September. Winters are pleasant and rain-free and is the season when tourist footfall peaks in the state. However, our analysis of more than 100 years of climate data for the state suggests that the climate of Goa state has already changed in the last century under the influence of rising greenhouse gases in the atmosphere. The mean annual temperature in the state has increased by more than 1°C.

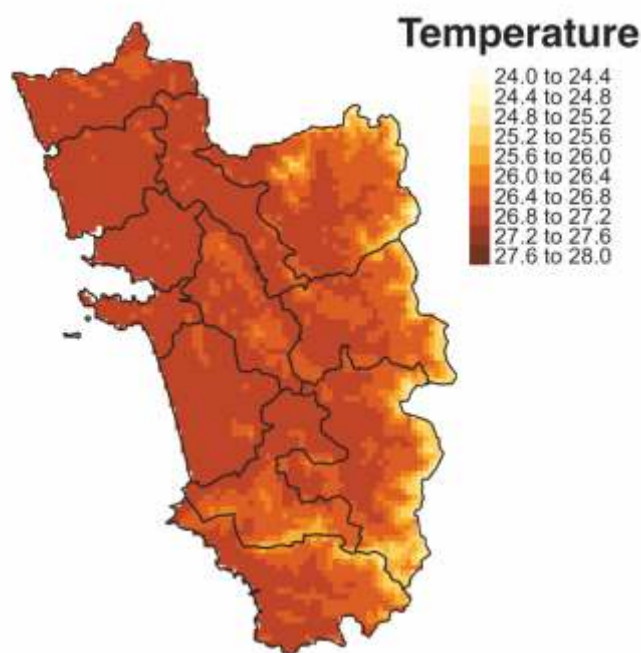


Figure 2: Geographical distribution of mean annual temperature (°C) in Goa

Our analysis further shows that the mean annual rainfall in the state has increased by about 68%. While, increasing temperatures have a negative impact on our state's famed climate by making it increasingly unpleasant and uncomfortable. However, increasing rainfall, on the face of it looks like a blessing for our biodiversity rich state. Our in-depth analysis of daily rainfall data for the last 118 years suggests that this increase in overall rainfall has not helped Goa, rather it has created problems for us. While mean annual rainfall in the state has increased, we find that moderate to light rainfall days in the state have

declined. Further, very heavy and exceptionally heavy rainfall events have increased by more than 100%. It is interesting to note that it is the moderate and light rainfall events that nourishes biodiversity, agriculture, various life-forms and ecosystems, whereas very heavy and exceptionally heavy rainfall events create devastation, floods and chaos to life-forms as well as to different natural and production systems. Unseasonal rainfall events have also increased in the state. Thus, our study concludes that increasing frequency of very heavy and exceptionally heavy rainfall events in Goa is one of the key impacts of climate change witnessed in the state. We should worry about how such events may evolve in future and may affect the climate, economy and biodiversity of our state.

Given this background, it is important to see how climate change affects Goa in future especially in the next 15 to 20 years, next 30-40 years and next 50-70 years. In order to project future changes in temperature and rainfall for Goa, we obtained temperature and rainfall projections for two future scenarios, one representing moderate emissions (RCP4.5) and another representing high emission scenarios in future (RCP8.5), from the Co-ordinated Regional Downscaling Experiment (CORDEX). We find that looking forward in future mean annual temperatures in Goa may increase by around 2°C in the decade of 2030s compared to the long term average of 1901 to 1950 period, and further to by around 4°C by in the decade of 2080s under high emission scenarios. Mean temperature rise does not fully convey risks associated with extreme temperature events such as heat waves. Today Goa is rather a pleasant place and so far we have not witnessed heat waves in the state (heat wave is defined by days when temperature is more than 40°C). Our future projections are alarming in this regard, as it suggests that Goa will start experiencing heat waves (>40°C) beyond the decade of 2040s. The daily maximum temperature that reaches 36°C today may reach 40°C and beyond during peak summer months in future under high emission scenarios. Minimum temperatures may rise even more if World fails to effectively control greenhouse gas emissions. This is particularly a concern for a coastal state like Goa, with high levels of humidity.

Looking forward to rainfall projections, it is important to understand that future rainfall projections are associated with much larger uncertainties. CORDEX

based models that we chose to apply for this study project slight decline in mean annual rainfall in the state under high emission scenarios. What further complicates the water security scenario for the state is the fact that very heavy rainfall events are projected to further increase in the state under climate change scenarios. Similarly, exceptionally (rare) very heavy extreme rainfall events which are rare and exceptional in today's climate are projected to become commonplace in future climate change scenarios for the state.

It is more than clear from our work (as part of Goa's State Action Plan on Climate Change) that climate change seriously matters for Goa. I am glad that Goa state has already meticulously prepared its SAPCC with wide ranging inputs from different stakeholders, it's time to implement this action plan on ground. This action plan provides a much needed window for our state to address this looming issue, I wish the best for its implementation.



Youth participation in celebration of International Day of Biodiversity organized by Goa State Biodiversity Board



Goa State Biodiversity Board



GOA STATE BIODIVERSITY CONSERVATION AWARD 2020



The Government of Goa's "Goa State Biodiversity Conservation Awards-2020" in appreciation of exemplary contribution in the field of conservation of biodiversity, ecology and environment were presented at an awards presentation ceremony held on 02nd October 2020 at Conference hall, Goa State Biodiversity Board (GSBB), Saligao, Goa. Due to Covid-19 Pandemic restrictions the function was held with restricted number of invitees.

The dignitaries present included the Chief Guest, Shri. Kunal, IAS, Secretary Environment, Government of Goa; Shri Subhash Chandra, IFS, Principal Chief Conservator of Forest (PCCF), Government of Goa, and Shri. Sanjith Rodrigues, Commissioner, Corporation of the City of Panaji and Dr. Pradip Sarmokadam, Member Secretary, Goa State Biodiversity Board.

The award ceremony commenced with the National Anthem, followed by the lightening of traditional lamp at the hands of the dignitaries.

Dr. Pradip Sarmokadam, Member Secretary, Goa State Biodiversity Board, in his welcome address introduced the award winners and briefly apprised about the Awards selection procedure followed by the Goa State Biodiversity Conservation Awards Selection Committee, which is headed by the Principal Chief Conservator of Forests. He explained different activities carried out by GSBB.

Function started with launch of Goa State Wetland

Authority (GSWA) Website.

The Awards were presented to the awardees at the hands of the Chief Guest, Shri. Kunal, IAS, Secretary Environment and Shri Subhash Chandra, IFS, PCCF.

GSBB felicitated Secretaries of selective Biodiversity Management Committees, who received appreciation certificate, Memento and a sum of Rupees Five thousand each.

List of Secretaries of BMCs:

- ✓ Shri. Sandeep Desai (Shrithal BMC)
- ✓ Shri. Vinod Shinde (Barcem Quedem BMC)
- ✓ Shri. Gokuldas Kudalkar
- ✓ Shri. Ravindra Wadikar (Xeldem BMC)
- ✓ Smt. Asha Mesta (Chicolna Bogmalo BMC)
- ✓ Shri. Alvito D' Silva (Pomburpa Olaulim BMC)
- ✓ Shri. Ganpat Sidhaye (PDF BMC)
- ✓ Shri. Sushant Naik (Tivrem Orgao BMC)
- ✓ Shri. Prajanan Naik (Surla BMC)
- ✓ Shri. Mukund Ukshekar (Warkhand Nagzar BMC)
- ✓ Shri. Sanjit Rodrigues (CCP BMC)
- ✓ Shri. Lancy Dias (Curca Bambolim)

Special Individual appreciation were awarded to Shri. Ankush Uttam Bagli and Shri. Agnel Fernandes (North Goa); Shri. Shirish Gopal Krishna Pai and Shri. Omkar Dharwadkar (South Goa) with appreciation certificate, Memento and a sum of Rupees Five

thousand each.

Goa State Biodiversity Conservation Awards - 2020 Individual Category:

In individual category, **Suryakant Shankar Gaonkar, from North Goa & Janu Ghurkho Gaonkar, from South Goa** were awarded the State Biodiversity Award for their contributions in the field of Biodiversity & Environment. Both the Awardees were felicitated at the hands of Chief Guest Shri. Kunal, IAS, Secretary Environment and Shri Subhash Chandra, IFS, PCCF, with Shawl and Shriphal, Memento, Citation and a sum of Rupees Twenty-Five thousand each.

Special recognition certificate were given Shri. Sadashiv Datta Narverker, Adv. Prakash Mahadev Govekar, Shri. Sahil Vijay Warang, Shri. Gowind Bhobe, Shri. Ashay (Ashu) Abhay Korde, Shri. Sandeep N.S. Parker, Shri. Damodar Vasant Chari, Fr. Bolmax, Shri. Sadhanand Gawde.

Special BMC appreciation were awarded to **Corporation of the City of Panaji (CCP) BMC, Anjuna Casiua BMC, Chodan Madel BMC** (North Goa) and **Curti-Khandepar BMC, Chicalim BMC** with appreciation certificate, Memento and a sum of Rupees ten thousand each.

Goa State Biodiversity Conservation Awards - 2020 BMC Category:

In the BMC category, **Shri. Shri. Sitaram P. Raut and Shri. Vinay Tubki**, the Chairpersons of **Agarwado Chopdem BMC from North Goa & Shristhal BMC from South Goa** respectively, accepted the Awards on behalf of their Biodiversity Management Committees. This award included Shawl and Shriphal, Citation,



Shri. Kunal, IAS, Secretary Environment lighting the traditional lamp during the award ceremony.

Memento and a sum of Rupees Fifty thousand each.

Shri. Subhash Chandra, IFS, Principal Chief Conservator of Forests, Goa Forest Department, addressed the gathering. In his address he congratulated all award winners and he said people should conserve nature for better future, he appreciated the efforts of GSBB & extended full support of Forest Department for the activities of GSBB, especially regarding afforestation and livelihood related activities in collaboration with BMCs.

Chief Guest **Shri. Kunal, IAS**, spoke about Goan Biodiversity and how rich it is, and also advice people to impart traditional knowledge to future generation.

Award function also includes appreciation of Chandrajitsing Rane, Arjun Govekar, Sidhant Haldankar, Ravikiran Gaonkar, Manjunath Wadyar, Rohit Apa Gaonkar students of Ramanata Crisna Pai Raikar School of Agriculture, Savoi Verem, Ponda Goa, for participating in plant distributing activity, with appreciation certificate. Also appreciated to all staff of GSBB for mentoring BMCs.

Shri. Niles Cabral, Hon'ble Minister Environment, Chairperson GSBB addressed the gathering via video message. In his message he congratulated all the winners and also declared two more award categories for upcoming years.

The vote of thanks was proposed by Ms. Joyce Rodrigues, Legal Assistant, GSWA. The entire program was compered by Shri. Subhash Jan.

The program was attended by 80 people.



Dr. Pradip Sarmokadam, Member Secretary, GSBB, addressing the gathering



Shri. Janu Ghurkho Gaonkar,
receiving Goa Biodiversity Awards -2020
(Individual Category) South Goa



Shri. Suryakant Shankar Gaonkar,
receiving Goa Biodiversity Awards -2020
(Individual Category) North Goa



Shri. Sitaram P. Raut, Chairperson Agarwado
Chopdem BMC and other members receiving Goa
Biodiversity Awards -2020 (BMC Category) North Goa,
on behalf of Agarwado Chopdem BMC.



Shri. Vinay Tubki, Chairperson Shristhal BMC
and other members receiving Goa Biodiversity
Awards -2020 (BMC Category) North Goa,
on behalf of Shristhal BMC.



Shri Subhash Chandra, IFS, PCCF, Government of Goa,
addressing the gathering during program



Chief Guest Shri. Kunal, IAS, Secretary environment,
Government of Goa, addressing the gathering
during program



Citation awarded to winners



Memento for winners

Green Initiative by Goa State Pollution Control Board

The Hon Minister for new and renewable energy formally inaugurated the 45 kw solar power plant installed by Goa Energy Development Agency on the roof of the Goa State Pollution Control Board



AS part of Green initiative Roof-top Solar plant has been connected to the Grid. Till date 45kW solar power plant at GSPCB has generated 33,350kWh. Expenditure incurred is Rs.23,23,620.00



Important communication to readers

Goa State Action Plan for Climate Change (GSACPC) - The GSAPCC is a comprehensive policy document planned for next decadal activities to adapt and mitigate climate change in Goa. It is prepared through maximum consultations and spread over a period of two years has rigorous analysis of weather, rainfall and other IMD data for climate parameters with future projections. Several layers of consultations included biodiversity management committees, institutions, scientists and the general public. Besides it was presented before the State Cabinet and also the final draft was kept open for public comments. Inclusive decision making based on stakeholders consultation is the unique system adopted by Goa State Biodiversity Board and Goa State Wetland Authority in the activities including process of identification and notification of wetlands. Another initiative is People's Biodiversity Registers being prepared by Biodiversity Management Committees constituted at local body level is a platform for participatory work of documentation of biodiversity and associated traditional knowledge based on consultations at grassroot level. This is based on scientific methods and assistance from technical support groups of GSBB and is validated at village and State level and could provide a basis for planning if incorporated at all levels.

Important media clips

Morjim, Mandrem, Agonda and Galjibag to be declared as Silent Zones

Team Herald

PANJIM: The Goa Coastal Zone Management Authority (GCZMA) has decided that the beaches of Morjim, Mandrem, Agonda and Galjibag- the turtle nesting zones- to be declared as "Silence Zone".

During the recent meeting, the Authority decided that the beaches of Morjim and Mandrem in Pernem Taluka in North and Agonda and Galjibag in Canacona Taluka, South be declared as 'Silence Zones', to ensure that there are no disturbance during turtle nesting process.

The Authority has also roped in Centre for Environment Education (CEE) to prepare Coastal Zone Man-

agement Plan (CZMP) to protect turtle-nesting grounds along these beaches.

SAVE TURTLE NESTING SITES

The High Court, in September, last year, directed GCZMA to prepare a management plan for protection of the turtle nesting sites within the next three months.

During its recent meeting, GZCMA deliberated and decided on the preparation of a management plan for the protection of turtle nesting sites. The members were of the opinion that there could not be a blanket ban on the entire beach stretches and that there

should be a proper management plan to strike a balance between environment and livelihood.

"Without human intervention there won't be proper protection and growth of the endangered species," the authority noted.

As per CRZ Notification 2011, Clause 8 (3) (vii) provides that the beaches of Mandrem, Morjim, Galgibag and Agonda have been designated as turtle nesting sites and protected under the Wildlife Protection Act 1972 and these areas shall be surveyed and management plan prepared for protection of these turtle nesting sites and that no development shall be permitted in the turtle nesting areas.

Govt invites public inputs on draft State Action Plan for Climate Change

Team Herald

PANJIM: The State government has invited public inputs on the draft State Action Plan for Climate Change (SAPCC), according to which nearly 15% of the land in Goa, much of it in the coastal zones, is vulnerable to flooding from extreme rainfall or sea-level rise.

The Goa State Biodiversity Board (GSBB), the nodal agency, has kept the draft plan open for public inputs and suggestions for a period of ten days till December 10. The draft was approved by the State Cabinet in October.

As per the report, the flood vulnerability analysis from the state reveals that 14.73% of the land is less than 15 metre elevation - much of which are in the coastal zones, and are se-

Goa will start experiencing heat waves (>40C) beyond the 2040s, as maximum temperature increases by about 5°C towards the century-end under high emission scenarios, it said. Similarly, the minimum temperatures are expected to rise even more by up to 8°C by the century-end

verely vulnerable to flooding both from extreme rainfall events and sea-level rise.

"In terms of vulnerability from floods and sea-level rise the talukas of Salcete, Tiswadi, and Bardez are most vulnerable," the report mentioned.

It added that Goa is exposed to several climate risks like loss of land due to erosion; loss of life; livelihood; the outbreak of disease; damage to buildings; drainage; and other infrastructure.

"It is also exposed to sea-level rise, storms, high-speed wind, altered runoff, changed wave pattern and sea temperature in addition to the other threats like rainfall and temperature profile changes," it added.

The study reveals that the mean annual temperatures (model ensemble) in Goa may increase by around 2°C in 2030s compared to the 1901-1950 period, and further to by around 4°C by 2080s under high emission scenarios.

Goa will start experiencing heat waves (>40C) beyond the 2040s, as maximum temperature increases by about 5°C towards the century-end under high emission scenarios, it said. Similarly, the minimum temperatures are expected to rise even more by up to 8°C by the century-end.

"The mean annual rainfall in Goa is projected to slightly decline under high emission scenarios, which under low emission scenarios is projected to slightly increase," the report said.

GSBB has added that the inputs and suggestions will be scrutinized and placed before the State Level Steering Committee for the National Adaptation Fund for Climate Change and then presented to the Union Ministry of Environment, Forest and Climate Change.

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THE TIMES OF INDIA

Sarzora, Saulem among 5 lakes to get wetland tag

TNN | Nov 23, 2020, 04:47 AM IST

Panaji: After Bondvoll lake, five more waterbodies have inched closer to being declared as wetlands in Goa, under the Union environment ministry's wetland rules. The Goa State Wetlands Authority, in a draft notification, has proposed to declare as wetland the Sarzora lake in Salcete, the Toyyar or Chimbel lake, the Dashi lake in Revora, the Saulem lake in Pilerne and the Xeldem lake in Quepem.

The authority has called for any objections or suggestions within a period of 60 days to the draft notification of these five waterbodies being declared wetlands.

After the five lakes are declared as wetlands, several activities will be prohibited in and around them as per the Wetlands (Conservation and Management) Rules, 2017 of the central government.

The five waterbodies are proposed to be declared wetlands as they are 'considered to be critically significant for its ecosystem services and biodiversity values for the local communities and society at large'.

Of the five, Sarzora lake includes the largest area of over 1.69 lakh sqm, followed by Saulem lake with an area of more than one lakh sqm.

While the Toyyar lake comprises of an area admeasuring 51,000 sqm, the Dashi lake includes an area of over 28,000 sqm. Similarly, the Xeldem lake is made up of 18,400 sqm of area.

The lakes as well as their areas of influence will be protected.

Once the areas are declared wetlands, the activities prohibited in the areas include its conversion for non-wetland, setting up of any industry and expansion of existing industries, disposal or handling of any construction waste, solid waste dumping, discharge of untreated wastes, among others.

Encroachment or any construction of a permanent nature except for boat jetties will also be disallowed from notified wetlands.

WHAT NEXT!!

The Environment And Development Dilemma

It was a pleasant Friday morning
The bright sun shining
Into the city I walked
Unaware of the killer that stalked
Axe after axe fell on the tree
Save me! Save me! Cried the tree
I was hurt, I was dumbstruck
Within no time the tree would bite the dust
And I stood there wondering what next!!

Appeared a wise man to speak for the tree
Doesn't it have the right to live free?
It provides you food, clothing and shelter
Without which you would run helter-skelter
Convinced appeared the woodcutter
But said I need to cut to survive
Today morning someone lost his father
If it is not this tree, it would some other
I still stood there as the woodcutter left
Wondering what next!!



Parag Rangnekar is an expert member on Goa State Biodiversity Board, He is an ecologist and works with Mineral Foundation of Goa.



Map Showing Bioresources in Goa
(Source TBR, GSBB - 2019)



Government of Goa

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