Foundation for Ecological Research, Advocacy and Learning

Annual Report   2022 - 2023

Foundation for Ecological Research, Advocacy and Learning (FERAL)

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Mandate

FERAL is a public charitable trust founded in 1997 with a mandate to develop sustainable and community centred solutions to address the pressing challenges that affect our natural ecosystems and the services they provide. We rely on interdisciplinary and quantitative methods to understand these systems and provide practical, participatory and gender responsive strategies toward their restoration and management. Our programmes invest in rigorous field studies to track and measure ecological processes over sustained periods. We adopt an evidence-based approach to identify problems, provide frameworks for their resolution and monitor the effectiveness of our interventions. We develop scientific and educational material, technical know–how, provide training, employment and skilling of stakeholders. We believe that addressing the seemingly intractable challenges we face in finding solutions to ecological and environmental problems today is only possible through meaningful collaborations with multiple stakeholders.

The Year That Was

The year marked the completion of 25 years since FERAL was founded and without fanfare our teams continued with their data-driven research and conservation projects through collaborative, and innovative approaches.

This year, we continued our effort in our four core programmes, with three new projects and continuation of older ones. Encouraged by our initial success in establishing community managed fish conservation zones in the north east India, our researchers from the wildlife biology and conservation program identified other communities and rivers stretches which could potentially be declared as fish conservation zones. Further, a new project to restore the catchment of the Tuivang river in Manipur was initiated. In this year, although our field presence in the Western Ghats was minimal, our researchers have been engaging with the forest departments, grass root organisations and other stakeholders to advise and steer conservation initiatives that are being proposed.

The frontier elephant programme saw the start of a project in the Brahmagiri-Nilgiris-Eastern Ghats landscape. This project seeks to create the first perspective plan for human-elephant conflict mitigation, especially in the agrarian context, utilizing the Capability Approach proposed by Amartya Sen.

Furthering our efforts towards better management of our natural resources, a study to understand the changes in downstream estuarine productivity due to hydropower operations was initiated in the Sharavathi River in the Western Ghats. This project will also document how communities dependent on the estuary adapt their livelihoods to ecological changes.

The marine sciences programme continued its efforts in the realm of sustainable fishing, focussing on sharks and rays. The team focused on taking their learnings to a larger audience and in expanding their efforts to the West Coast of India. A new project to understand the impacts of fisheries on guitarfish populations, a critically endangered species, was started in the state of Goa. This project aims to develop locally appropriate solutions, which can support the on ground implementation of India's Wildlfie Protection Act to conserve this endangered species.

Wildlife Biology and Conservation

The focus of the Wildlife Biology and Conservation Programme at FERAL is on scientific research on wildlife and their habitats and on using the outputs of such research to steer conservation interventions. This year saw us continuing our efforts in the conservation of freshwater and terrestrial ecosystems and associated wildlife.

Specifically, a new project to restore the catchment of the Tuivang river in Manipur expanded our efforts towards community-based interventions for the conservation of freshwater ecosystems. Following up on our initial success of setting up Fish Conservation Zones in the North East India, this year we identified another potential river stretch along the Tuivang river in Manipur.

As part of our conservation outreach activities we hosted talks in schools and colleges in the Western Ghats, about local wildlife and the surrounding landscape. The goal of this activity was to sensitise local residents on various issues faced by wildlife and their habitats.

Furthermore, the collective data, knowledge and experience gathered by our researchers from earlier projects was put to good use to advise and support various Government conservation initiatives, especially in the Western Ghats.

Over the past two decades, FERAL has contributed substantially to the conservation of various biodiversity rich zones in the Western Ghats, which has geographically been one of our main focus areas. The field-oriented work in this region was put on a hiatus for strategic planning to meaningfully evolve our efforts for a bigger impact for wildlife and habitat conservation.

Shifting cultivation and mechanized clear-felling have resulted in denudation of natural areas.
Image credit: Rajat Ramakant Nayak

Forest inventory and establishing nurseries for community based restoration of a river catchment in North-East India

This project is implemented along the Tuivang River and its catchment in the state of Manipur. Tuivang River is part of the Chindwin River Basin and this is one of the few free-flowing rivers remaining in the country and is important for maintaining aquatic biodiversity and providing various ecosystem services. However, this riverine ecosystem is facing threats in the form of habitat modifications due to logging.

Historically, the Tuivang River and its catchment has been actively managed and used by local communities, with shifting cultivation and selective logging being common practices. However, over the years, the number of shifting farmers has drastically decreased, and selective logging has been replaced by mechanized clear-felling of large tracts of forests. Anecdotal evidence suggests that this clear-felling on steep slopes has resulted in increased soil erosion and sediment loads in rivers. Local people have also reported increased flood events along the Tuivang River in recent years, which could be related to logging as degraded forests reduce rain-water infiltration and increase runoff, as suggested by findings of earlier research in the Western Ghats by others.

Our project aims to document the floristic diversity in the remnant forest patches and improve the health of forests and facilitate the community-initiated restoration activity along the Tuivang River in Manipur.

Project Objectives

1. Increase awareness among local communities on the importance of forests in retaining rainfall and reducing landslides and flood risks in the area

2. Identify potential sites for restoration

3. Documenting floral species richness and diversity in the area

4. Establishing village nurseries to aid restoration efforts

Setting up a plant nursery to aid our restoration effort in the Tuivang river catchment.

Questionnaire surveys helped in lunderstanding changes in flora and the landscape over the years.

5. Grow Rare, Endangered and Threatened (RET) plant species in nurseries at the participating villages, which could be later planted in the restoration sites

6. Restoration of denuded sites that will help in rejuvenating streams and the river and thus will benefit conservation and sustainable use of water resources in the long run

Status

Using Landsat and Sentinel 2 time-series images, different stages of vegetation degradation in the catchment of the Tuivang River were identified. The resulting map will help us in selecting the sites for restoration and in our awareness programmes with the local communities.

We also mapped the distribution of forest fragments within the catchment area using these images. So far, we have identified 66 different forest fragments which are being surveyed to document the remanent tree species found in this landscape. The information from these surveys will also help in collecting saplings to be raised in the nursery.

Our researchers interviewed 30 people, familiar with the local forests, belonging to nine villages in the catchment area. The purpose of this activity was to document traditional knowledge of tree species and identify plants for restoration. The survey provided valuable information on the species that have become rare in the area. The local community suggested 13 different species that they preferred in restoration sites. This included species like *Dipterocarpus tuberculatus, Dipterocarpus turbinatus, Michelia champaca*, and *Gmelina arborea*.

Three awareness programs were conducted at L. Bongjoi and Khengjang villages to raise awareness on the importance of forests in catchment areas and the need to protect these forests, nearly 40 people attended these sessions.

A nursery to house sapling collected from the near by forest patches has been established and raising saplings in the nursery beds will begin this monsoon.

Frontier Elephant Programme

The Frontier Elephant Programme (FEP) is a multi-institutional collaborative effort spearheaded by researchers at FERAL in association with scientists from the National Institute of Advanced Studies (NIAS), Asian Nature Conservation Foundation (ANCF) and the Indian Institute of Science (IISc). The aim of the programme is to conserve individuals and populations of wild Asian elephants that persist in human-dominated landscapes through long-term monitoring and citizen-science initiatives.

The goal of the programme is to harness the behavioural adaptability of elephants to help local communities adopt lifestyles that facilitate their coexistence with elephants while ensuring food security and safety in the region. Along with the long-term monitoring of individual elephants, we strive to conserve these individuals in the wild through projects that minimize human and elephant conflicts.

FEP has thus far conducted seven projects that has helped generate baseline data on elephants in the human dominated landscape of the Eastern Ghats and aided in the conservation of these wild elephants through community participation and reduction in human and elephant conflicts. At present, FEP is involved in understanding human and elephant relationships at the scale of an elephant landscape. Using the capabilities approach we are unraveling the complex interconnections between humans, elephants and the landscape that may help in selection of human and elephant conflict mitigation measures that are most appropriate for the local human and elephant populations given a changing landscape.

In the year gone by, many interns have been part of the FEP team. They are currently involved in assessing coarse and fine-scale parameters that determine decision-making in elephants and people given the environmental conditions. We are also in the process of building new partnerships with ATRIA University, Bengaluru, Quicksand Studio, Bengaluru and the Katie Adamson Foundation, Denver Colorado, USA.

FERAL researchers inspecting a banana plantation and talking to the farmer during the field survey.

Capable and Functional Elephants: A Capabilities Approach for Mitigating Human and Elephant Conflict in the Brahmagiri-Nilgiri-Eastern Ghats Landscape of Southern India

Project Period: September 2022 to March 2025
Budget: INR.1,50,38,228
Supporting agency: US Fish and Wildlife Service, USA
Principal investigator: Nishant Srinivasaiah
Co-Principal Investigators: Anamika Ajay and Srinivas Vaidyanathan
Collaborators: National Institute for Advanced Studies, India; Asian Nature Conservation Foundation, India; Indian Institute of Science, India

The endangered Asian elephant in India ranges beyond Protected Areas, necessitating a landscape-level approach for the management of wild elephants. The Brahmagiri-Nilgiri-Eastern Ghats Landscape (BNEGL) hosts a significant population of the Asian elephants, vital for conservation. Hosting a rich biodiversity, BNEGL spans the states of Karnataka, Tamil Nadu, and Kerala, and includes two Elephant Reserves. Human – elephant conflicts arise due to habitat loss, human population growth, poaching, and infrastructure development. Lack of available data, predictive models, and perspectives hinder efficient conservation. Currently, the proposed measures include legal protection for corridors, community involvement, and data-driven management. This project seeks to create the first perspective plan for human-elephant conflict mitigation in the BNEGL, utilizing the Capability Approach (CA) proposed by Amartya Sen. Capability Approach assesses well-being based on capabilities and functionings, emphasizing freedoms of choice. Implementing CA could enhance human-elephant relationships, thus addressing conflict more holistically, paralleling its use in agrarian crisis contexts.

Project Objectives

1. Mapping the current set of basic capabilities and functioning of agriculturists and elephants

2. Modeling future sets of basic capabilities and functioning of agriculturists and elephants

3. Identifying sets of unrealized functioning of agriculturists and elephants due to human and elephant conflict, both present and future

Data collection involved talking to farmers at various sites in the study area.

Researchers discussing the functions and capabilities of elephants and people, during a project planning meeting.

4. Identifying appropriate human and elephant conflict mitigation measures that minimize unrealized functioning of agriculturists and elephants

5. Capacity building and information dissemination

Status

The assessment of farmers' status in the BNEG elephant landscape involves both coarse and fine-scale analyses. At the district level, coarse-scale analysis considers 19 administrative units that comprise 1781 local bodies, including villages and towns. Various data sources like Village Census Directory, Census Abstract, National Sample Survey Data, and civil society information has been collected for the period 1991–2021. Census data for 19 districts has been analyzed, generating district profiles. For fine-scale analysis, a three-stage mixed-methods field research has been planned and the data collection to understand farmer-elephant interactions and capabilities across the landscape is in progress.

Elephant densities in the BNEG landscape were assessed across 41 forest divisions. Camera trap data on elephants was compiled across the three agro-climatic zones in the landscape to assess group dynamics, age, sex, and body condition. The data for one agro-climatic zone was analyzed to understand factors influencing male elephants' habitat preferences, considering biological (maturity, musth) and environmental variables (forest type, land use, human activity). This analysis differentiated forested and human-dominated regions, providing insights into elephant decision-making.

The spatial arrangement of natural and human-made elements impact elephant movement and conflict. The initial phase of the project involved cleaning and reclassifying Land Use Land Cover data from the National Remote Sensing Agency and infrastructure layers encompassing roads, railways, canals, mines, and reservoirs were integrated. Spatial pattern analysis of the Land Use Land Cover map was carried out to derive maps required to model elephant movement and decision-making considering the habitat heterogeneity in the landscape.

A computationally intensive agent based model was developed to simulate elephant decision-making and movement. High and very high movement areas were observed in 68.7% and 16.5% of human-inhabited villages, respectively, indicating a high probability of human-elephant interaction. Further refinement and additional variables are planned to analyze capabilities and overlaps comprehensively across the entire landscape.

Foraging elephants in the Cauvery Wildlife Sanctuary.

Towards mitigation of human and elephant conflict through fence line expansion – Expansion of community fencing

Project Period: May 2022 to June 2023
Budget: INR 3,87,400
Supporting agency: Denver Zoo, USA
Principal investigators: Nishant Srinivasaiah
Co-Principal investigator: Srinivas Vaidyanathan
Collaborators: National Institute of Advanced Studies, India; Indian Institute of Science, India

In the context of a rapidly urbanizing landscape transitioning from traditional forest and agrarian settings to peri-urban environments, the primary objective of this project is to enhance the capacities of local stakeholders in monitoring elephant populations and effectively mitigating human-elephant conflicts within and around high human-use areas. The Ramanagara-Bannerghatta-Cauvery Landscape has undergone significant land-use changes driven by economic growth and development, leading to a human dominated landscape. Against this backdrop, the project aims to implement proactive measures to address the escalating issue of human-elephant conflict. By focusing on improved farm-based practices, the project seeks to mitigate the vulnerabilities of crops at various stages of cultivation to elephant incursions. An exemplary strategy involves the installation of cost-effective solar-powered 'hanging-wire' electric fences. Designed to be farmer-friendly and elephant-resistant, these fences act as a barrier, reducing the likelihood of elephant intrusion and crop damage. Through these interventions, the project endeavors to foster coexistence between elephants and local communities while contributing to sustainable agricultural practices and conservation efforts.

Project Objectives

1. Build capacities of local stakeholders in monitoring elephants and mitigating human-elephant conflict in and around high human-use areas by establishing solar-powered 'hanging-wire' electric fences that are affordable to the farmers and are designed in a way that elephants find it difficult to overcome the same

2. Carry out night observations of elephants to understand their behviour

Status

In pursuit of harmonious coexistence with elephants, ensuring the safety of human lives and the protection of their crops stands as the foremost imperative. A viable mitigation approach necessitates affordability, easy maintenance, construction, and mobility. The 'hanging-wire' fence design meticulously accommodates elephant

Observing an elephant near a crop field during night.

Low cost hanging wire fence installed before the cropping season.

behavior, rendering it a formidable challenge for elephants to breach. With no accessible fixed parts, the wires suspend from 15-foot poles, ingeniously accounting for the elephant's inability to dismantle the structure. Electric wires are powered by pulsating current regulated by a solar-powered battery-operated energizer. The material costs for a 1 km fence amount to approximately 1.5 lakhs Rupees, encompassing the battery, energizer, and solar panel. Notably, this cost estimate excludes ancillary expenses like labor, transportation, accommodation, and sustenance.

Remarkably swift, the installation of a 1 km fence takes 4 to 5 days by a group of farmers, offering an unparalleled advantage. Its affordability is further underscored by its comparative cost-effectiveness—roughly 2 to 3 times lower than existing solar fences deployed against wild animal intrusions in crop fields. Demonstrating exceptional efficacy, this fence has proven unparalleled in deterring elephants from crop fields. The collaboration with the Ramanagara Forest Division marked a pivotal phase, initiating the testing of three such fences to ascertain their effectiveness in crop protection. Encouraged by their success, several local farmers took the initiative to install these fences around their own lands. While some farmers could independently afford the measure, others received support from the project and the forest department. Collaborative efforts facilitated the provisioning of solar kits, covering nearly half the fence cost. Each solar kit included a battery, energizer, solar panel, and requisite wiring.

The project's scope expanded to encompass nighttime observation and behavioral documentation of elephants. This entailed procuring specialized equipment to facilitate nocturnal monitoring. With this integrated approach, the project successfully addressed both immediate protection needs and long-term ecological insights, enhancing the prospects of peaceful coexistence between humans and elephants.

Natural Resource Management

The primary goal of this programme is to study, restore and manage landscapes that sustain communities and provide essential products and services. Understanding the impacts of climate change on these services and consequently on the vulnerabilities of communities is a crucial component of this work. To this end, we collaborate with other research institutions working in the Western Ghats and along the south-eastern coast of India. We undertake action research and leverage mobile information and communication technologies coupled with low-cost environmental sensors for environmental monitoring.

Programme objectives

1. To unravel and quantify ecological processes that deliver ecosystem goods and services using participatory and multidisciplinary approaches.

2. To demonstrate and develop research tools for decision support in the management of natural systems with a specific focus on scenario building for impacts of climate change and trade-offs between interventions.

3. To use this research to identify strategies and inform and influence policy which will reduce the vulnerabilities of stakeholders and the ecosystems to natural disasters and climate change, and help restore and sustainably manage ecosystem services through community action in habitat restoration, protection and management.

This year, we continued our long-term monitoring of rainfall and collected stream data in the Nilgiris. We initiated a new project in Karnataka that aims to understand the effect of hydropower dams on the salinity regimes, flooding, and suspended sediment dynamics of the estuaries, and the influence of these changes on livelihood of communities dependent on estuaries.

The ongoing projects are conceptualised in line with the programme objectives and the outcomes from these projects contribute to improving our knowledge about ecosystems, their processes and services and in undertaking action research to restore ecosystems.

Bivalve collectors sell their catch in local markets. In shallow parts of the estuary, during low tides, women collect bivalves by wading.

Assessing the effects of hydropower operation on flow and sediment dynamics, and river-dependent livelihoods, in the tropical estuaries of Karnataka, India

Tropical estuaries are transition zones between freshwater and marine environments; their ecosystem functioning depends critically on the timing, quality, and quantity of upstream inputs such as freshwater and sediments carried by the river. In tropical developing countries, hydropower dams are promoted as "clean" and "renewable" sources of energy even though they drastically alter downstream flow and sediment regimes. Therefore, there is a need to understand flow and sediment alteration effects on estuarine salinity and suspended sediment concentration – two key physical parameters that influence estuarine ecosystem functioning. Additionally, in tropical estuaries, millions of people generate their livelihoods through reliance on artisanal fisheries and bivalve collection. However, hydropower dams–despite benefiting people in distant urban and industrial areas– are known to disproportionately affect local, downstream fisheries-based livelihoods. This project aims to understand how natural resource-dependent communities living downstream of hydropower dams adapt their livelihoods to ecological changes.

Project Objectives
The Objectives of this project are to understand

1) how freshwater and sediment inputs to the estuary are modified by hydropower dams.

2) how fisherfolk and bivalve collectors adapt to hydropower dam-induced changes to the estuary.

Status
To understand flow and sediment alteration and its effects on the estuary, four rivers and their estuaries have been instrumented. Out of these, two rivers have major hydropower dams. At the head of the estuary, in the freshwater region, water level recorders which measure the height of the water column have been installed. In the dammed rivers, recorders have been installed immediately

Sharavathi -- dammed river.

Aghanashini -- free flowing

Frequent fresh water release from the hydro-power dam affects barnacle deposition.

downstream of the dam. In each estuary, loggers which measure salinity have also been installed. The data from water level recorders and conductivity loggers showed very clearly that the undammed rivers have a natural flow regime and the estuarine salinity was influenced by tidal patterns. However, in the dammed rivers, the estuarine salinity is a function of intermittent freshwater releases from the hydropower dam. Notably, the results show that during peak summer, estuarine salinity in the dammed river frequently drops to 0 (freshwater) from 35 (sea water salinity). Such drastic variation in salinity is bound to have severe ecological and social-ecological consequences on estuarine biodiversity which has specific salinity tolerance levels.

Water samples are also being collected weekly from the rivers for measuring surface suspended sediment concentration (SSSC). The time at which these samples are collected coincides with the time when Landsat-8 and 9 imagery is captured. The field measured SSSC will be calibrated against the reflectance of the water as measured by Landsat imagery. The analysis on Google Earth Engine for processing cloud free imagery and extracting the reflectance values from Landsat from 1986 to the present has been completed. Lab work for testing water samples for SSSC will commence in September 2023.

To understand how fisherfolk and bivalve collectors adapt to hydropower dam-induced ecological changes, interviews will be conducted, for which, the study design is being finalized. A base map for the participatory GIS exercise is currently being developed. Informal interviews with fisherfolk and bivalve collectors has helped develop the semi-structured interview format.

Fishermen/boatmen (8-10 persons) help with installing and reading sampling devices and with the sample collection. Conversations with them has helped see rivers through their eyes, and their knowledge of biodiversity and seasonal changes in river has helped in understanding the study system.

In free-flowing Aghanashini, the tide-driven salinity can be experienced up to 30 km from the mouth of the estuary (where river joins the sea). Whereas in dammed Sharavathi, the tide-driven salinity is experienced only within a 10 km stretch from the mouth of the estuary.

Although not intended as a planned experiment, it was interesting to note that the PVC housing containing the salinity logger in free-flowing Aghanashini was covered in barnacles while the one in Sharavathi was relatively clean suggesting that freshwater releases might be affecting barnacle deposition as well.

Marine Science Programme

The programme focuses on protection and conservation of the marine and coastal ecosystems and the biodiversity found therein. Our approach to marine conservation starts from human interactions with the marine environment. We examine these interactions to identify key leverage points to initiate conservation action, either through collaboration with policy makers or in conjunction with communities. The goal of this programme is to provide evidence-based recommendations for marine conservation using participatory methodology, long-term monitoring and technology. We also aim to reach diverse audiences with our conservation message through unique and tailored outreach campaigns. This year, we continued our focus on sustainable fishing with emphasis on conservation of sharks, rays and skates.

A new project focusing on the guitar fish, a critically endangered species was initiated this year along the west coast. This project aims to understand the impacts of fisheries on guitarfish populations, and develop locally-appropriate solutions.

Two of the earlier projects along the east coast of India were continued this year, with outreach and dissemination of findings as the focus. A new tool for identification of species caught along the east coast for use by the general public was developed. The effort highlighted the need for more collaborative initiatives in the future.

The work at Pattinapakam and nearby fishing villages has shed light on emerging threats to elasmobranchs, such as an increasingly popular shore-based sport-fishery that regularly lands Critically Endangered Widenose Guitarfishes (Glaucostegus obtusus). Anecdotal research with beach shack owners at these locations also suggests an increasing demand for elasmobranch meat at these restaurants, after the pandemic.

To comprehensively understand elasmobranch fisheries across diverse contexts, exploratory visits to key shark and ray landing sites in Kakinada and Kanyakumari were undertaken to identify research and conservation requirements in these locations.

Bowmouth guitarfish caught in a trawl net.

Saving sharks with InSeason Fish

Project period: May 2019 - ongoing
Budget: INR 40,00,800
Supporting agency: Future for Nature, Netherlands
Principal investigator: Divya Karnad

Our perspective on marine sustainability is that it can be achieved only if all parts of the seafood supply chain align to support sustainable fishing. This project complements other ongoing work within the Marine Programme, by working to identify key gaps and interventions needed to ensure that fisheries can begin to reduce their impact on the marine environment. In the previous years, the project focused on the domestic supply chains with a specific focus on domestic seafood consumption and unsustainable fishing and on helping Indian seafood eaters diversify their seafood consumption and avoid eating threatened marine species.

Our earlier outreach efforts highlighted a critical need for a practical tool to aid the public in identifying the various species of fish caught in India's marine fisheries. Recognizing the potential of machine learning models in fulfilling this need, we have embarked on an ambitious endeavor this year to build this tool. Our extensive assessment of fish catches spanning multiple years serves as a rich source of data necessary for the development of such a tool. This application will be designed to facilitate near real-time fish species identification.

Given the enormity of data required for training machine learning models effectively, we acknowledge the limitations of a single research project. Therefore, we are envisioning a collaborative program in the future. Creating an application as a tool to bring together not only scientists, but also citizen scientists will enhances the volume and speed of data collection, as well as foster public engagement and awareness about the diverse marine species found in Indian waters.

Project Objectives

1) Assess fish catches for species diversity along the Coromandel Coast.

2) Document relative differences in species diversity and create a rubric to help consumers identify what they are eating

3) Create a technology-based tool to help seafood eaters choose diverse seafood and the most sustainable choices among the options available to them.

Small-scale fishers operate a shore-seine, which brings in several live rays, and sometimes guitarfishes.

The project team works with fishermen to identify fishing practices that produce varied levels of shark and ray catch.

Status

In our ongoing efforts to advance the understanding and conservation of elasmobranchs (sharks and rays) and teleost fish in marine ecosystems, our project embarked on an extensive data collection and categorization process. This undertaking aimed to compile a robust dataset for image-based identification and classification.

Our initial phase involved the collection and careful sorting of 901 images of sharks, 809 images of rays, 112 images of rhino rays, and 89 images of teleost fish. These images were meticulously sourced and categorized to ensure accuracy and relevance to our research objectives. To facilitate efficient image identification, we established 18 categories with the goal of classifying images down to the genus or species level. However, in response to challenges related to sample size and data availability, we made the pragmatic decision to condense these categories into three broader ones, focusing on family-level identification.

To effectively manage and organize this extensive image dataset, we leveraged the Computer Vision Annotation Tool (CVAT). Using this platform, each image was systematically labeled and tagged, allowing for precise identification and classification during subsequent stages of analysis.

A pivotal aspect of our project involved collaboration with Dr. Debayan, an expert in the field of automation and image recognition. Together, we developed a specialized program designed to automate the identification process. Once our images were categorized into the three family-level categories, we initiated testing to evaluate the program's efficacy.

Initial tests of the automation program served as a proof of concept, demonstrating its potential to streamline the image identification process. This marked a significant step forward in our project, as it hinted at the possibilities of accelerating species-level identification in the future.

Our current efforts are directed toward expanding our image database. We are actively sorting and loading additional images into CVAT, increasing the richness and diversity of our dataset, which is critical for enhancing the program's accuracy and reliability.

Furthermore, we are forging new collaborations with partners and organizations to bolster our image data resources to ensure that we have sufficient quantity and diversity of images required for rigorous testing and refinement of the automation program, ultimately aiming for species-level identification.

Mobula ray captured in a gill net.

Beyond fins: Monitoring elasmobranch landings and consumption

Project period: October 2021 - Ongoing
Budget: INR 21,70,934
Supporting agency: Stichting Burgers Zoo Conservation, Netherlands
Principal investigator: Divya Karnad

The project focuses on monitoring and studying elasmobranchs (sharks, rays, and skates) at two landing sites in Chennai, Tamil Nadu: Kasimedu and Patinapakkam. These two sites have distinct characteristics and practices when it comes to fishing and elasmobranch catches.

Kasimedu Harbour is a major fish landing harbour in Chennai with around 600 vessels, including 250 deep-sea vessels and others using bottom trawl gear. A large diversity of elasmobranch species (especially sharks and rays) are landed in significant numbers here. Elasmobranch products are exported internationally from this harbour, and some are transported to different states across India. These products are also consumed locally in residences, restaurants, and by retailers.

On the other hand, Patinapakam is a small-scale fishing village where fishermen predominantly use gill-nets and manual fishing gear. Catch diversity at this site is lower than that in Kasimedu, but catch frequency is higher. Fishermen go out on small boats early in the morning, catch their fish, and sell them locally. Unlike at Kasimedu, there is no export of elasmobranch products from Patinapakam. The catch is primarily sold within the local community.

Project Objectives
1) Monitoring incidental shark and ray catches from non-selective fishing gear at a major fishing harbour

2) Monitoring incidental shark and ray catches from more selective fishing gear at a small-scale fishing site

3) Assessing the impact of these fisheries, by comparing with targeted fisheries for sharks and rays

Status
The project currently focuses on data collection, analysis, and the initiation of outreach efforts, all of which contribute to a comprehensive understanding of elasmobranch ecosystems and their interplay with human activities.

Deep sea sharks are now being targeted as India's fisheries shift offshore. Here, sharks that were landed are being measured by the team.

Identifying shark traders, for future research and interventions.

Over the fishing season of 2022-2023, we successfully completed the task of data collection of elasmobranch landings at both the Kasimedu and Patinapakkam sites, which included documenting the species, quantities, and patterns of elasmobranch catches. The dataset from this project is invaluable for understanding the variations and trends in elasmobranch populations in the Chennai region. The project's analytical phase is now underway, with researchers analysing the collected data to unearth patterns, correlations, and critical information about elasmobranch fishing. This analysis promises to reveal valuable insights into the impact of market links, fishing technology, and ecological factors on elasmobranch populations. By delving into the intricate relationships between these variables, the project aims to provide informed recommendations for sustainable fisheries management and conservation strategies.

In a significant expansion of its scope, the project has extended its reach beyond Chennai. The project staff embarked on exploratory visits to key shark and ray landing sites in Kakinada and Kanyakumari. These visits marked the project's strategic expansion, setting the stage for future research endeavors in these locations. By broadening its geographical footprint, the project demonstrates its commitment to comprehensively understanding elasmobranch fisheries across diverse contexts.

Additionally, recognizing the importance of disseminating knowledge and raising awareness, the project team is designing outreach programs. The project has developed an illustrative poster that distils complex scientific information into an accessible format, making it a valuable tool for public events, workshops, and educational sessions. By utilizing such visual aids, the project ensures that its findings are communicated effectively to a diverse audience, ranging from local communities to policymakers and beyond.

Catch of an artisanal shore seine net. These nets will be surveyed for guitarfish catch over the project duration.

Strum with care: Understanding fisheries impacts on threatened guitarfish in India to inform their conservation

Giant guitarfishes (Glaucostegus sp.) are found in tropical nearshore waters where they are highly vulnerable to overexploitation by coastal fisheries. Our study species, the widenose guitarfish (Glaucostegus obtusus), is classified as Critically Endangered, protected under CITES (Schedule II) and has recently been listed under Schedule I of India's Wildlife Protection Act (WPA) - yet, this species is exceptionally understudied. In Goa, G. obtusus is found in shallow coastal waters, in spaces overlapping with fishing, tourism and other disturbances. Juveniles and pups are frequently caught as incidental catch in small-scale fisheries, suggesting the presence of nursery grounds on Goa's coast. Identifying these nursery grounds and other essential fish habitats, and understanding their seasonal use by different life history stages, is needed to protect the most vulnerable life-stages. Fine-scale data on guitarfish habitats can guide avoidance strategies by small-scale fisheries. Alongside area-based strategies, live release has been proposed as a bycatch mitigation measure for guitarfish, and has been successfully implemented in some regions. However, the survival rate of these individuals post-capture remains unknown; this needs to be assessed to investigate the effectiveness of live release in conserving guitarfish populations. The aim of this project is to understand the impacts of fisheries on guitarfish populations, and develop locally-appropriate solutions, such as area-based strategies and live-release measures, which can support the on-ground implementation of India's Wildlife Protection Act.

Project Objectives

The specific objectives of this project are to assess

1) Habitat use and overlap with small-scale fisheries.

2) Biological and population characteristics in nearshore habitats.

3) Post-capture stress and survival.

Adult widenose guitarfish (*Glaucostegus obtusus*) captured by a shore seine net at the study site.

Release of a widenose guitarfish into the sea to assess its post-capture survival.

4) Establish a baseline for guitarfish to develop monitoring and conservation measures.

Status

Preliminary work including purchasing of necessary equipment, hiring of a research assistant, obtaining project permits from the Goa Forest Department and setting up field logisitics has been initiated. In the initial months of the project we will be monitoring artisanal fisheries catch for the study species (guitarfish), and finalising methodologies for our ecological surveys. Development of a questionnaire for use in semi-structured survey of local stakeholders is underway. The objective of this survey is to map nearshore fishing and tourism activity, and identify guitarfish habitats for the ecological surveys. The coming months will focus on questionnaire surveys and other pilot surveys with the main fieldwork activity and data collection initiated by September 2023.

Intertidal habitats in Goa where guitarfish are found. These sites will be surveyed for guitarfish presence and abundance.

Participants collecting data on vegetation and biodiversity as part of the GIS based conservation prioritisation exercise.

Instructors providing hand-on training to the participants.

Learning and Events

Our learning programme comprises of formal and informal courses which often overlap with other events. FERAL also conducts workshops in collaboration with other organisations.

Basics of GIS and Remote Sensing for Wildlife Monitoring and Conservation, Pondicherry 2022

Project Period: 6-8 July 2022
Budget: INR 2,94,598
**Supporting Agency: The Rufford Foundation, United Kingdom**
Principal Investigator: Rajat Ramakant Nayak

The Rufford Foundation has funded 1,186 projects in the Indian sub-continent and over 5,700 projects worldwide. Since 2012, the Rufford Foundation has been hosting conferences in collaboration with local organisations in various parts of the world to encourage communication and networking opportunities for grant recipients. FERAL has been organising Rufford conferences in India since 2013. This year, we conducted a workshop on the basics of GIS and Remote Sensing for wildlife monitoring and conservation, which was held at our campus in Pondicherry.

In recent times, the use of GIS and remote sensing have become essential tools for researchers working in the field of conservation and management of natural resources. However, the fundamental concepts of GIS are not available outside of a formal academic institution. Hence, the focus of this workshop was to fill this gap in available learning opportunities. The specific objectives of the workshop were

1. To familiarize the participants with basic concepts of GIS, type of data, and visualising and analysing the data that was collected in field.

2. To provide intensive and hands-on training in the use of QGIS for data visualisation, analysis and preparing publishable maps.

3. To provide a common platform for the Rufford grantees from different parts of India to meet at one place and share and learn from each others' experiences.

This workshop was attended by 22 researchers working in different parts of India. Out of this, 13 participants were Rufford grantees. All the participants were active researchers working in the field of wildlife and conservation, representing 19 different institutions across India.
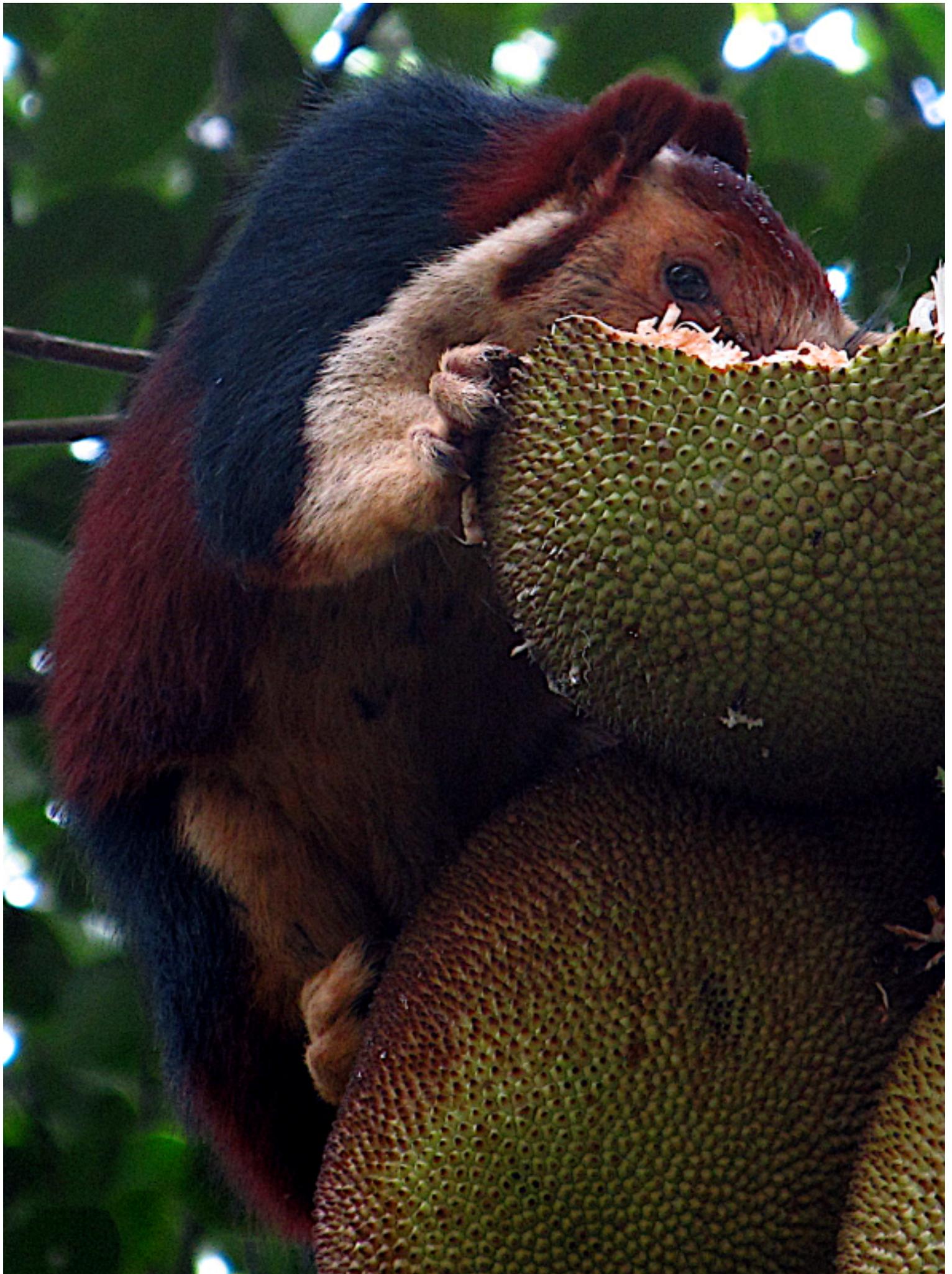
Publications

Below is a list of our publications including articles in scientific journals, books, book chapters and technical reports.

Journal articles

Gupta, T., Karnad, D., Kottillil, S., Kottillil, S., & Gulland, E. J. M. (2022). Shark and ray research in India has low relevance to their conservation. Ocean & Coastal Management, 217, 106004. https://doi.org/10.1016/j.ocecoaman.2021.106004.

Gupta, T., Milner Gulland, E., Dias, A., & Karnad, D. (2023). Drawing on local knowledge and attitudes for the conservation of critically endangered rhino rays in Goa, India. People and Nature, 5(2), 645–659.

Nayak, R. R., Krishnaswamy, J., Vaidyanathan, S., Chappell, N. A., & Bhalla, R. S. (2023). Invasion of natural grasslands by exotic trees increases flood risks in mountainous landscapes in South India. Journal of Hydrology, 617(A), 128944. https://doi.org/10.1016/j.jhydrol.2022.128944.

Rao, S., Krishnaswamy, J., & Bhalla, R. S. (2022). Linking flow alteration with fish assemblage structure in a river regulated by a small hydropower project in the Western Ghats of Karnataka, India. River Research and Applications, 38(1), 138–151.

Srivathsa, A., Vasudev, D., Nair, T., Chakrabarti, S., Chanchani, P., DeFries, R., Deomurari, A., Dutta, S., Ghose, D., Goswami, V. R., Nayak, R., Neelakantan, A., Thatte, P., Vaidyanathan, S., Verma, M., Krishnaswamy, J., Sankaran, M., & Ramakrishnan, U. (2023). Prioritizing India's landscapes for biodiversity, ecosystem services and human well-being. Nature Sustainability, 1–10. https://doi.org/10.1038/s41893-023-01063-2.

Conference Papers

Karnad, D. (2022). Rights Based Approaches to Marine Conservation in India. UN Oceans Conference Side Event: Rights Based Approaches to Marine Conservation, Shedding Light on Oceans Declaration and the Youth Call to Action for G7, Lisbon.

Karnad, D., & Kottillil, S. (2022). Using the local knowledge of fishers to reduce shark and ray bycatch in India. International Bycatch Meeting, IUCN, Spain.

Kottillil, S. (2023). Characteristics of elasmobranch fisheries of Chennai. Student Conference on Conservation Science, University of Cambridge, Cambridge, UK.

Administrative Information

FERAL is a non-profit trust founded under the Indian Trusts Act (1882), in July 1997. We are certified as a Scientific and Industrial Research Organisation (SIRO) by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, New Delhi. Donations made to FERAL attract deduction under section 80G of the Income Tax Act, 1961 and we are registered and authorised to receive foreign funds under the foreign contribution regulation act (FCRA) 2010.

We have a simple organisational structure which provides a supportive framework for our researchers while ensuring them functional autonomy. As per the DSIR and Trust Act rules, we are advised by an academic advisory board for all scientific matters and governed by a board of trustees for overall administration and organisational policy.
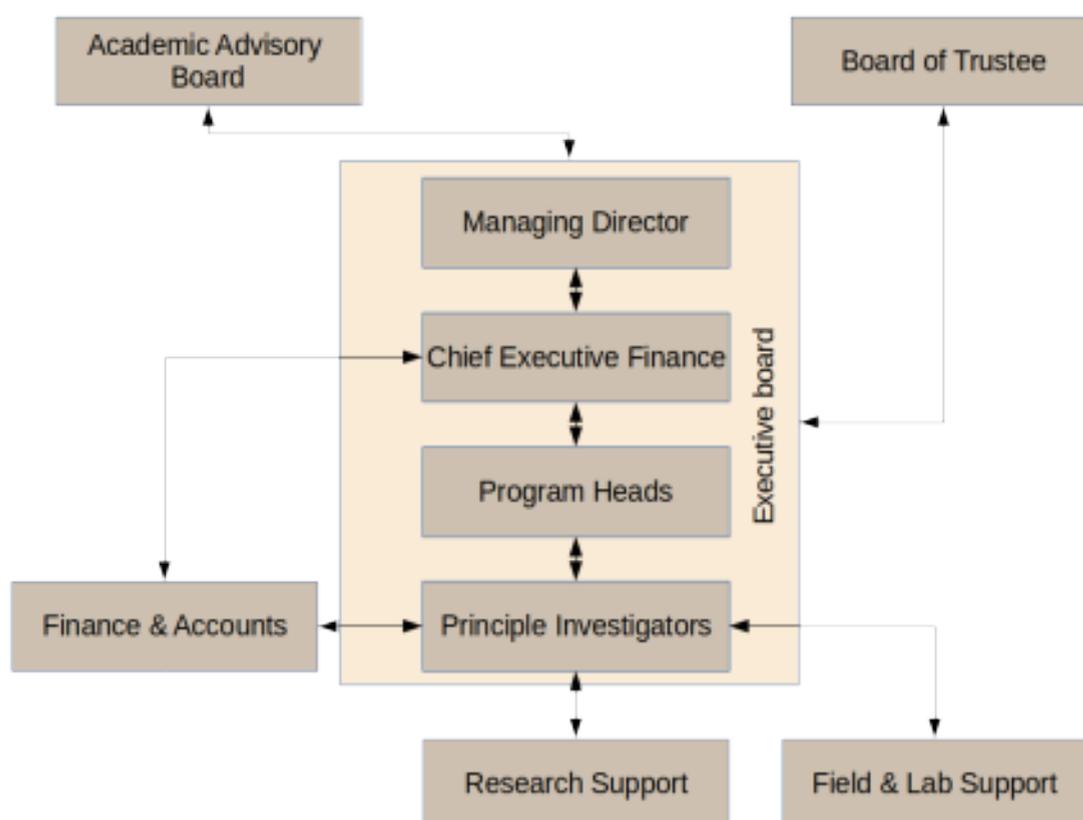
Balance Sheet

FOUNDATION FOR ECOLOGICAL RESEARCH ADVOCACY AND LEARNING
No .170/3, Morattandi Village, Auroville Post, Tamilnadu - 605101

Balance Sheet as at 31st March 2023

(Amount in Rs)

Particulars	Sch.Ref	As at 31.03.2023	As at 31.03.2022
SOURCES			
Corpus	1	12,30,928	12,51,670
Project Asset Reserve	2	2,01,015	2,01,015
Projects Account (Cr)	3	55,28,384	62,31,800
		69,60,327	76,84,485
APPLICATION			
Fixed Assets *(Less)* Depreciation	4	4,19,390	4,94,366
CURRENT ASSETS, LOANS AND ADVANCES			
Cash and bank balances	5	60,38,713	66,94,456
Loans and advances	6	51,626	33,149
Projects Account (Dr)	3	3,99,921	4,76,635
Interest accrued but not due	7	50,677	35,879
(i)		65,40,937	72,40,119
Less: Current liabilities	8	-	50,000
(ii)		-	50,000
Net Current Assets (i) - (ii)		65,40,937	71,90,119
		69,60,327	76,84,485
Notes on Accounts	13		

As per our report of even date attached
For ASA & Associates LLP
Chartered Accountants
Firm Reg No: 009571N/N500006

For Foundation for Ecological
Research Advocacy and Learning

G N Ramaswami
Partner
Membership No : 202363

Srinivas Vaidyanathan
Trustee

Place : Chennai
Date : 25/10/2023

The FERAL Team

Feral's team is a mix of researchers and professionals from various disciplines who are supported by a small but competent and highly trained team. Below is a short introduction to the people who make FERAL tic (arranged alphabetically).

Research team

Abhishek Gerald

Abhishek Gerald has an Integrated Masters degree in Marine Science from the Centre for Marine Science and Technology, M.S. University. He is interested in the conservation of marine mammals and large elasmobranchs on the East and West coasts of India.

Anamika Ajay

Anamika is a social scientist with a PhD in Development Studies. Her research interests lie at the intersection of political economy of livelihoods and local governance. She was awarded the Chief Minister's Nava Kerala Post Doctoral Fellowship for her research on the political economy of livelihoods in Kerala.

Chaitanya Krishna

Chaitanya holds a PhD in Wildlife Biology and Conservation. He currently works on a community-based natural resources management and marine programme. His work focuses on the anthropogenic impacts on wildlife, and he has consulted on environmental and social safeguards compliance for industry.

Divya Karnad

Divya works on a community based natural resources management and the marine programme. She holds a PhD in geography with a focus on marine fisheries management. She works on sustainable fisheries, sustainable seafood trade and the conservation of threatened marine species.

Kumaran K

Kumaran works as part of the field team in Pondicherry and in the Western Ghats. He has worked on land cover changes in the Nilgiris with a focus on invasive species in the shola grasslands. He is currently pursuing his PhD at Manonmaniam Sunderanar University.

Letkhosei Baite

Letkhosei has a Masters degree in Botany from Manipur University. He has worked as a biologist in the fish conservation zone established by FERAL in Manipur, since 2020. He is keen on conserving riparian forests and currently leading a catchment restoration project in Manipur.

Narayani

Narayani has completed her PhD in marine biology, specialising in fish and fisheries. Her areas of interests include fish biology, fish feeding ecology and ecomorphology. A nature writer, she has a lot of experience in conducting science programmes for school children.

Nishant Srinivasaiah

Nishant is instrumental in starting a multi-institution, multi-disciplinary collaboration to manage Asian elephants in India. Over the last decade he has been monitoring elephants, understanding their behaviour and interactions with humans to find solutions to conserve elephants.

Rajat Ramakant Nayak

Rajat has a Masters in Wildlife Biology and Conservation. He is interested in understanding the influence of anthropogenic activities and climate change on ecosystem processes and services. He currently works on forest fragmentation and its influence on wildlife movement and ecosystem services.

Shruthi Kottillil

Shruthi Kottillil has a Master's in Environmental Studies and Resource Management. She is interested in the conservation of sharks and rays and has been studying different aspects of elasmobranch conservation such as the post-capture survival and the catch composition in different fisheries and gears.

Srinivas Vaidyanathan

Srinivas is an ecologist with an interest in understanding changes in landscape-level processes and structure and how they affect large mammal populations. Srinivas uses spatial approaches for finding innovative and practical solutions to conservation problems.

Sudha Kottillil

Sudha Kottillil has a master's in Environmental Studies and Natural Resource Management. She has worked on the phylogeography and genetic diversity of sharks and rays along the Indian coast. She is interested in improving public engagement and support for shark and ray conservation in India.

Sunita Ram

Sunita has an MPhil in Biological Sciences. She has worked extensively on the ecology and distribution of primates in the southern Western Ghats. She is interested in finding long term conservation strategies in the Western Ghats.

Trisha Gupta

Trisha Gupta is a PhD student at the University of Oxford. Her research focuses on the fisheries and conservation of sharks and rays in India.

Venetia Sharanya

Venetia has completed her Masters in Environmental Studies and Resource Management. She is interested in animal behaviour, social structures and human-animal interactions. She currently works with the Frontier Elephant Programme towards creating shared spaces for elephants and humans.

Research support

Kamalraj S

Kamal started off at FERAL as a field assistant more than a decade ago. He is adept at handling a range of equipments and data loggers. He is a reliable driver in tough forest terrain and is good with managing field staff and taking over running of field stations at a pinch.

Ngamsei Philip

Philip is a farmer by profession, but he also works in Khengjang, Manipur, as a field assistant.

Saravanan S

Saravanan holds a masters in human resources development and is very experienced in undertaking social surveys and in coordinating field activities. He is also a resource person for GIS and GPS workshops conducted at FERAL.

Interns

Alissa Barnes

Alissa is a marine biologist specialising in shark and ray fisheries along the north-western coast of India. She is interested in understanding the perspectives of fishing communities towards sharks and rays.

Sandra Maria Augustian

Sandra has a Masters in applied economics from the Jawaharlal Nehru University. Her skills include literature reviews, designing questionnaires and data analysis. She has experience in undertaken field-level social surveys in urban and rural areas of Kerala.

Uthayaseelan, J. D.

Uthayaseelan has a Master's in Zoology from the Loyola College, Chennai. He has worked on the isolation and identification of heavy metals degrading bacteria from bivalves present in the industrial areas during his Master's.

Vinitha

Vinitha has completed her Masters in marine biology and oceanography and is passionate about coastal and marine conservation. She is a PADI certified diver.

Administrative support

Anupama Pai

Anupama has been associated with FERAL since inception and has wide interests ranging from gender and development, natural resource management and developing study abroad programs. She is the Chief Executive Finance and supports project management.

Shanthi R

Shanthi is our finance manager handling the day-to-day accounting responsibilities of the organisation. She has a postgraduate degree in commerce and is versatile in the use of a range of accounting softwares.

Sumathi

Sumathi manages the upkeep of the FERAL campus at Morattandi which includes handling the boarding and lodging arrangements during training programmes and events.

Foundation for Ecological Research, Advocacy and Learning (FERAL)

Web Page: https://www.feralindia.org

Email: feral@feralindia.org