Final Evaluation Report

Your Details	
Full Name	Bharat Suresh Ahuja
Project Title	Swimming with the Fishes: an integrated approach to assess the impacts of targeted fisheries on reef fish populations and behaviour in the Andaman Islands
Application ID	40104-1
Date of this Report	28-03-2025

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Developing a reef fish monitoring protocol that integrates assessment of populations and behaviour of reef fish				Our team standardized a 3-diver protocol which allows for the monitoring of pelagic, bentho-pelagic and benthic species of reef fish using underwater visual censuses by SCUBA diving. We

assemblages				were also able to monitor available resources and behaviour of herbivorous, invertivorous and detrivorous reef fish assemblages. All our dives were timed to allow for 60 minutes of data collection. Transcribing of the videos from BRUVs was also done for 60 minutes to ensure equal sampling effort across our methods. Sites were visited twice every field season. Each visit included one dive for the underwater visual census, one dive for reef fish behaviour monitoring and 2 BRUVs deployments. Information on our sampling methodologies and diver roles can be found in the reef fish monitoring protocol we developed for this project that is attached.
Monitoring of apex and meso predators using low cost, non-invasive sampling methods to assess impacts of targeted fishing on predator assemblages in reef environments across a fishing gradient				We used Baited Remote Underwater Video Stations (BRUVS) to assess the composition and relative abundances of predators at 16 sites within and outside Marine Protected Areas (MPAs). While we applied to sample across 20 locations (10 within and 10 outside MPAs), our permits restricted access to 2 of our proposed sites within protected areas. We thus omitted 2 sites outside MPAs to ensure equal sampling effort within and outside MPAs. In addition, COVID-related restrictions and time taken to receive permits reduced the amount of time that was available to sample.

				Since marine protected areas in the ANI serve as no take reserves, we found significantly higher densities of predators within MPAs. Predatory fish assemblages were found to attain greater sizes and have higher relative abundances within MPAs when compared to outside protected areas. This was especially true for the following guilds: large piscivorous ambush predators (represented by square tailed groupers, peacock groupers, coral hinds among other Serranids) and large active piscivorous predators (represented by giant trevallies, blue spotted trevallies and barracuda species). We were unable to collect samples of biological or geological origin as a part of this study owing to the nature of the permits issued to us by the Andaman & Nicobar Forest Department (Wildlife Division)
Capacity building and establishing long-term monitoring protocols for predator assemblages at select sites				We trained and continue to collaborate with 8 members of the Marine Dive & Patrolling Team (Andaman & Nicobar Forest Dept). This training covered safe deployment and retrieval of BRUVS to ensure long term monitoring of apex and mesopredators on a data sharing basis. 2 workshops were conducted for officials and staff of the Forest Department. These

				were held at the Marine Interpretation Centre in MGMNP, Wandoor. In one workshop (attended by 18 members), we collected feedback on the logistical issues faced in enforcing patrolling and monitoring in MPAs. We then conducted a second workshop which was attended by 8 members of the Marine Dive & Patrolling Team, ANI Forest department where we shared the results of our monitoring protocols through simple presentations.
Outreach and disseminating results to various stakeholders in the Andaman Islands				Our team designed and produced outreach material aimed towards educating students, eco-tourists and SCUBA operators in South Andaman & Ritchie's Archipelago. Dissemination of results in the form of peer-reviewed articles, popular articles and translating outreach material to regional languages are all in progress. At present, we have distributed our outreach material to 4 dive schools across 3 islands. As stated in our report, we faced difficulties organizing outreach sessions in schools owing to COVID related restrictions. We are currently in the process of translating our material to local languages before distributing them to school children across South Andaman Island later this year. Ongoing work at ANET/Dakshin Foundation engages with fishing

				communities both to gather ecological knowledge about fisheries as well as to initiate community monitoring programmes towards sustainable fishing. Since in-water studies are needed to study association patterns in MSGs, the engagement with fishers mostly reveals information about species composition and threats.

2. Describe the three most important outcomes of your project.

a) Fisheries in the Andaman Islands have been targeted towards species occupying higher trophic levels (apex and meso predators). By sampling in sites within and outside MPAs, we were able to find significant differences in size, richness, biomass and abundance of predators within MPAs.

b) Reef fish that are predominantly herbivorous and invertivorous modulate their behaviour by forming mixed-species groups. By participating in such groups, individuals can optimize foraging while minimizing predation risk. Large mixed groups of herbivorous reef fish contribute to accelerated algal removal at reefs, altering reef trophodynamics and local biodiversity.

c) We established long-term monitoring protocols by collaborating with local stakeholders in both government and private sectors. To the best of our knowledge, there has been no long-term monitoring within MPAs since the establishment of their boundaries in the 1980s. Periodic surveys have been conducted by other researchers in the 2010s that provided a rough baseline, but not consistent annual data. Thus, one goal of this study was to standardize a low cost, replicable protocol that can be implemented across these islands to generate reliable baseline data. Researchers affiliated with ANET have been monitoring select sites outside protected areas since 2016, and we made sure to include these sites in our study as well. We collaborated with the Marine Dive and Patrolling Team, ANI Forest Department from the Govt. sector. In the private sector, we collaborated with 3 dive schools (Dive India, Ocean Tribe and Laccadives) who have aided the forest department with capacity building in the past.

We believe that the results of these collaborations will allow us to make more informed decisions with respect to conservation and sustainable management of marine resources in the ANI. Baseline data is of utmost importance if we are to build robust models towards greater sustainability. As mentioned earlier, the ANI are data deficient

when it comes to research on the trophodynamics of reef systems. By collaborating with relevant local authorities, we can collect data far more frequently and at a far greater spatial scale than in individual projects. Also, when government agencies are involved in generating and making inferences from data, this is more likely to lead to policies that are tailor made to suit local needs.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

We encountered difficulties organizing outreach activities in schools across the Andaman Islands. This was due to the fact that schools were re-starting classes in person post COVID in 2023, and authorities were unable to accommodate us owing to congested schedules. We intend on conducting outreach sessions in schools after we have translated our material into regional languages which will allow us to reach out to a wider audience.

4. Describe the involvement of local communities and how they have benefitted from the project.

In collaboration with the Andaman and Nicobar Environment Team (ANET), we have been conducting outreach sessions for school children on ocean literacy since 2023. ANET also works closely with fishing communities at multiple locations across the South Andaman Islands. Our findings on the effects of fishing and MPAs is being integrated into discussions about fisheries sustainability and management practices for the ANI.

5. Are there any plans to continue this work?

We surveyed 16 sites from 2023-2025 within and outside MPAs of South Andaman & Ritchie's Archipelago. The reef fish monitoring protocol developed and implemented during this study will be sustained to ensure periodic assessments of reef fish assemblages across trophic levels and their behaviours at select sites.

We recognize that long-term monitoring of predator populations is essential for evaluating the effectiveness of existing management practices and conservation strategies in the Andaman and Nicobar Islands (ANI). To support this effort, we have collaborated with the Marine Dive and Patrolling Team of the ANI Forest Department to continue monitoring the diversity and abundance of meso and apex predators within marine protected areas. This will be carried out using low-cost, non-invasive sampling methods, which we have incorporated into our capacity-building training for team personnel. By ensuring ongoing monitoring of reef-associated fauna, we aim to contribute to more informed conservation and management decisions that align with the ecological and socio-cultural sensitivities of these islands.

6. How do you plan to share the results of your work with others?

We plan to share our findings through various channels, including peer-reviewed publications, popular articles, reports, and workshops. This approach will ensure our research reaches a diverse audience, including researchers, policymakers, conservationists, and the general public. We are currently preparing manuscripts to communicate our results within the scientific community. Unfortunately, we were not left with enough funds in our outreach budget head to commission a video. We used the remaining funds to design a poster that depicts mixed species grouping behaviour in the context of common microhabitats found at reefs in the ANI (refer Annex below). However, as part of the Communications work at Dakshin/ANET, several short videos are being made about our work, and we will ensure that MSGs of reef fish are in included in them.

We believe the following journals would be a good fit for the dissemination of our results: Coral Reefs, Bulletin of Marine Science, Oryx.

For outreach, we have developed a handout and a poster illustrating the diversity of mixed-species groups (refer Annex Outreach Material I & II). This material has been distributed among dive schools in the region to promote continuous monitoring in areas where eco-tourism is prominent. Additionally, we plan to translate this handout into regional languages for wider dissemination among schoolchildren and local fishing communities in ANI.

Furthermore, we have shared our monitoring protocols and study findings with relevant members of the Forest Department through workshops using simple, accessible presentations.

7. Looking ahead, what do you feel are the important next steps?

Disseminating our findings to both scientific and local communities is essential for raising awareness among local stakeholders, policymakers, and relevant government authorities. Long-term monitoring of nearshore reefs within marine protected areas (MPAs) will be vital for developing recommendations that are tailored to the local context, considering the unique socio-ecological characteristics and challenges of these islands.

Additionally, integrating biodiversity monitoring of accessible wildlife along rocky and sandy coasts into school curricula, while encouraging eco-tourists to participate as citizen scientists, will help increase awareness of these often-overlooked nearshore habitats. This approach not only fosters community engagement but also promotes conservation through education and participatory monitoring.

We have also integrated mixed-species groups of reef fish into Reef Log, a citizen science initiative to monitor reef fish and their behaviour across the Indian coast and India's island territories.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The Rufford Foundation logo was featured in a poster presentation at the Third Joint Congress in Evolutionary Biology, held in Montreal, Canada, where aspects of our current work were presented to an international audience. Additionally, we included the logo in outreach materials distributed to dive shops and schools across South Andaman Island and Ritchie's Archipelago to enable long-term, continuous monitoring of key species and their behaviour. Furthermore, the Foundation received publicity through our outreach efforts and capacity-building workshops conducted during the course of the project.

9. Provide a full list of all the members of your team and their role in the project.

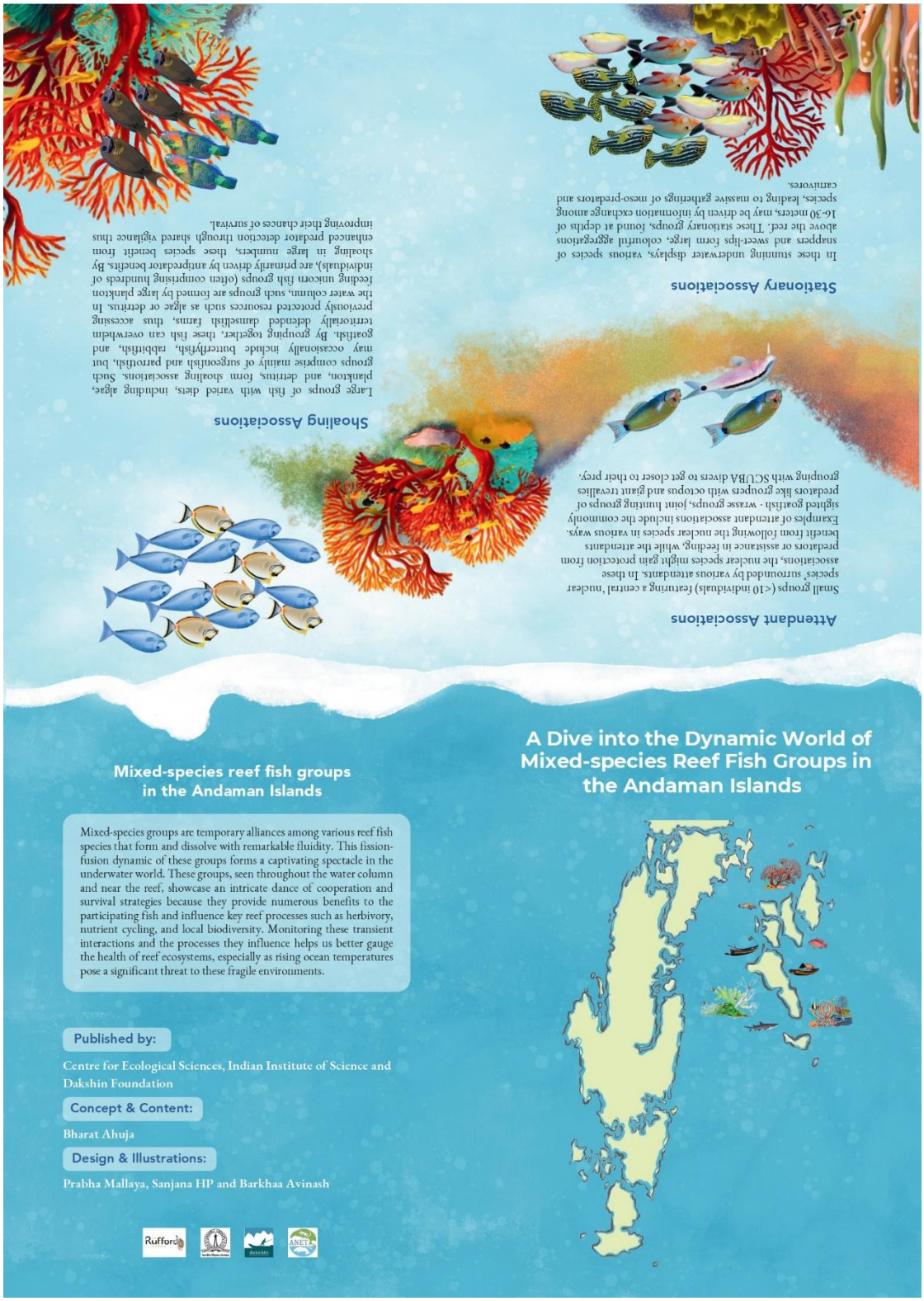
Sl No.	Name	Affiliation	Role in the project
1	Bharat S Ahuja	Centre for Ecological Sciences, Indian Institute of Science	Project leader and principal investigator
2	Titus Immanuel	Centre for Ecological Sciences, Indian Institute of Science	Study design, data collection, transcription
3	Shawn Dsouza	Centre for Ecological Sciences, Indian Institute of Science	Study design and data collection
4	Akshta Joshi	Centre for Ecological Sciences, Indian Institute of Science	Data collection and transcription
5	Samar Ahmad	Dakshin Foundation	Data collection and transcription
6	Babu Kutty	Andaman Nicobar Environment Team, Dakshin Foundation	Boat captain and field staff
7	Jeevan Horo	Andaman Nicobar Environment Team, Dakshin Foundation	Boat captain and field staff
8	Saw Thesorow	Andaman Nicobar Environment Team, Dakshin Foundation	Boat captain and field staff

10. Any other comments?

We sincerely acknowledge The Rufford Foundation for their financial support in executing this project. We would like to thank members of the Rufford Small Grants committee for granting us an extension which allowed us to conduct sampling for an

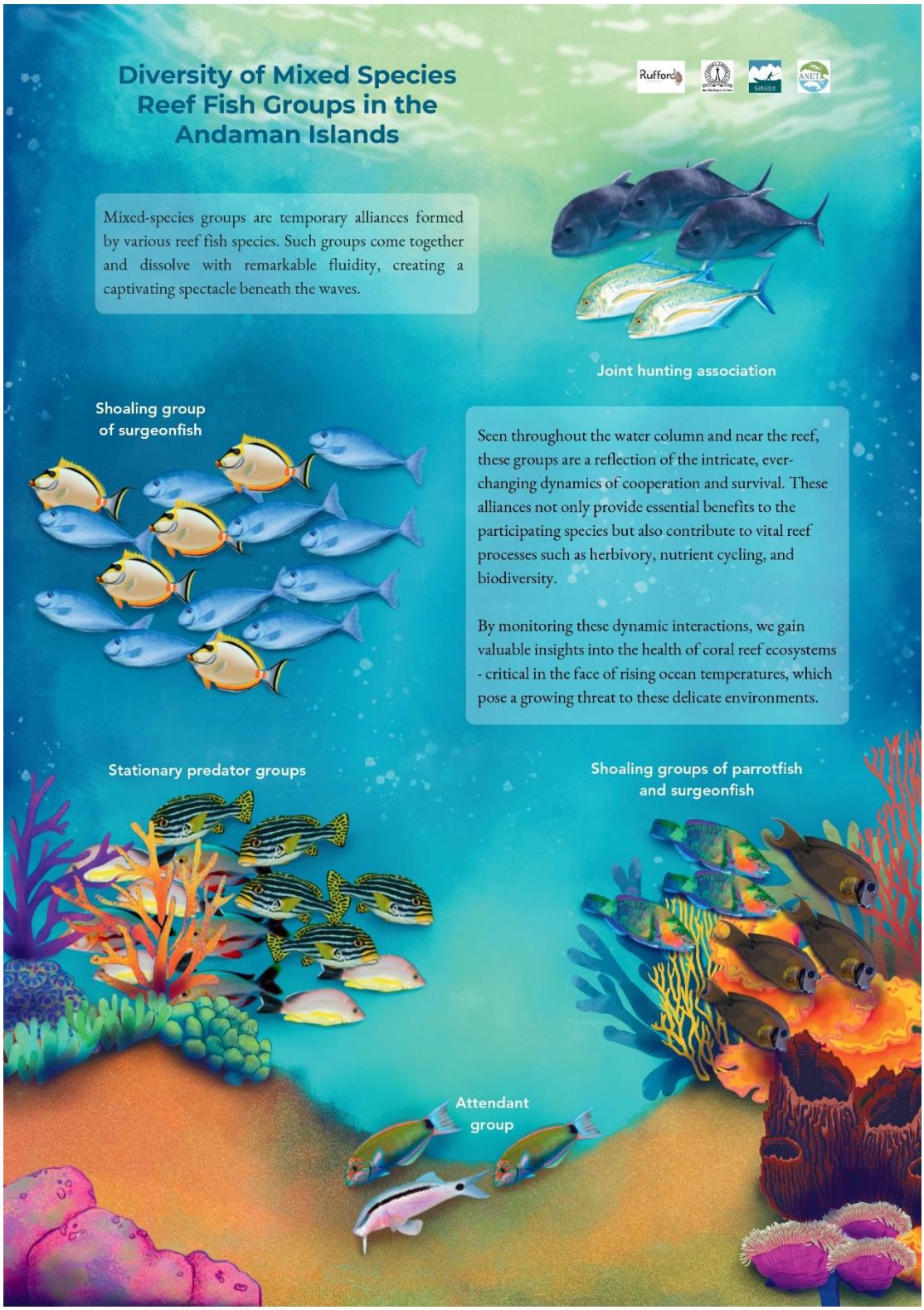
additional field season in early 2025. We extend our gratitude to our referees, Dr. Bryan Wilson and Dr. Naveen Namboothri, for their invaluable support. A special thanks to our supervisor, Prof. Kartik Shanker, for his insightful guidance in designing the study and his continuous support throughout the project. We also acknowledge the Department of Environment & Forests and the Department of Fisheries in the Andaman Islands for granting us permission to conduct surveys within MPAs. Lastly, we are deeply grateful to the field and support staff at ANET, our field station in the Andaman Islands, where much of this work was carried out.

ANNEX – Outreach Material I



A foldable pocket-handout depicting our study area with information about the diversity of mixed-species groups encountered in the Andaman Islands.

ANNEX – Outreach Material II



A poster designed to depict where SCUBA divers are most likely to spot different MSGs of reef fish in the water column along with information on their importance.