

SHIV NADAR

INSTITUTION OF EMINENCE DEEMED TO BE

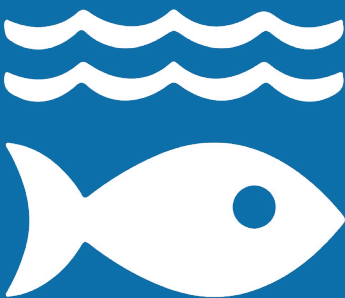
UNIVERSITY

DELHI NCR

**Report on**

# Sustainable Development

**GOAL 14**



## LIFE BELOW WATER

Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.



Horaglanis populi (Photo credit - CP Arjun)

With ten targets and ten indicators, **Sustainable Development Goal 14, Life Below Water**, aims to prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

At Shiv Nadar Institution of Eminence, we are contributing to SDG 14 by way of teaching and research on marine bodies, life below water, and aquatic ecosystems at large. At the same time through research partnerships, faculty and students are undertaking exciting projects.

## 1 Teaching and Learning

Every undergraduate student at Shiv Nadar must mandatorily take a core group of common subjects designated as Core Common Curriculum (CCC). The CCC has an Ecology and Environmental Sciences components which includes courses such as Global environmental issues (CCC 715) and Environmental studies (CCC 704).

The Department of Life Sciences offers a core course to undergraduate students on Ecology and Environmental Science (BIO 104). The course explores the importance

of biological conservation, current anthropogenic stressors that are affecting ecosystems, and how these problems can be mitigated using a multidisciplinary approach, including biotechnology.

### Student projects

1. Tarani Jindal, 4th year B.Sc. Biotechnology (Research) student, worked on **Molecular phylogenetic position of enigmatic subterranean blind catfish genus *Horaglanis***.

By understanding the molecular phylogenetic position and evolution of subterranean freshwater catfish *Horaglanis krishnai* endemic to lateritic aquifers of Kerala, the study established that the species is an evolutionarily distinct lineage sister taxa to two families, Clariidae and Heteropneustidae. It also established

that the species shared a common ancestor with its sister taxa 120 million years ago, suggesting that the lineage evolved when India was still a part of Gondwana.

### 2. Molecular evolutionary analysis of freshwater subterranean loach *Pangio bhujia* endemic to southern India.

The study provided the first molecular phylogeny for subterranean lineages of genus *Pangio* from the Western Ghats and its relationship with the South-East Asian lineage suggesting that they are not genetically related. The study showed that the species separated from its surface-dwelling lineage about 20 million years ago, which could be due to the Miocene drought in southern India.



MicroCT scan of Horaglanis populi (Photo credit - Ralf Britz)

Jindal, T., Raghavan, R. & Dahanukar, N. (2022) Molecular evolutionary analysis of subterranean loach *Pangio bhujia* endemic to southern India. Poster presented at the SMBE Everywhere Global Symposium (Genetics of Adaptation:GS6) organized by SMBE and NCBS Bangalore on November 22, 2022.

## 2 Research

Many exciting projects and research by Shiv Nadar researchers address Goal 14. This section highlights a selection of research projects.

The university faculty made an exciting discovery in the lake in 2018. They isolated the bacterial strains *Exiguobacterium sibiricum* strain DR11 and *Exiguobacterium undae* strain DR14 that can degrade plastic, especially polystyrene. These bacteria have great potential in Arsenic removal from wastewater and biodegradation of polystyrene from waste. All efforts are taken to preserve the lake and its natural ecosystem. During summers, the lake is supported by external water to preserve life underwater, and the water is conserved and rejuvenated through rainwater harvesting.

Full story: [bit.ly/3ZHyzhb](https://bit.ly/3ZHyzhb)

**1. Molecular Ecology and Evolution Laboratory in the Department of Life Sciences, the School of Natural Sciences.**



*Neolissochilus pnar* (Photo credit - Uros Aksamovic)

Research in the laboratory focuses on the following aspects of aquatic ecology - **Aquatic conservation; Molecular phylogeny, phylogeography and, evolution; Subterranean aquifer ecology; and Molecular systematics, molecular taxonomy and, diversity.**

At present, a student is working on a project on population genetics and phylogeography of catfishes of the family Bagridae from the Indian subcontinent. And four first-year students of B.Sc. Biotechnology (Research) are working on the molecular ecology and evolution of freshwater fish of Channoidea (snakehead fishes), Mastacembelidae (spiny eels), Sisoridae (torrent catfishes), and Danioninae (minnows).

**2. Exploring population genetics of freshwater fishes.**

The research explores the population genetics (which can provide

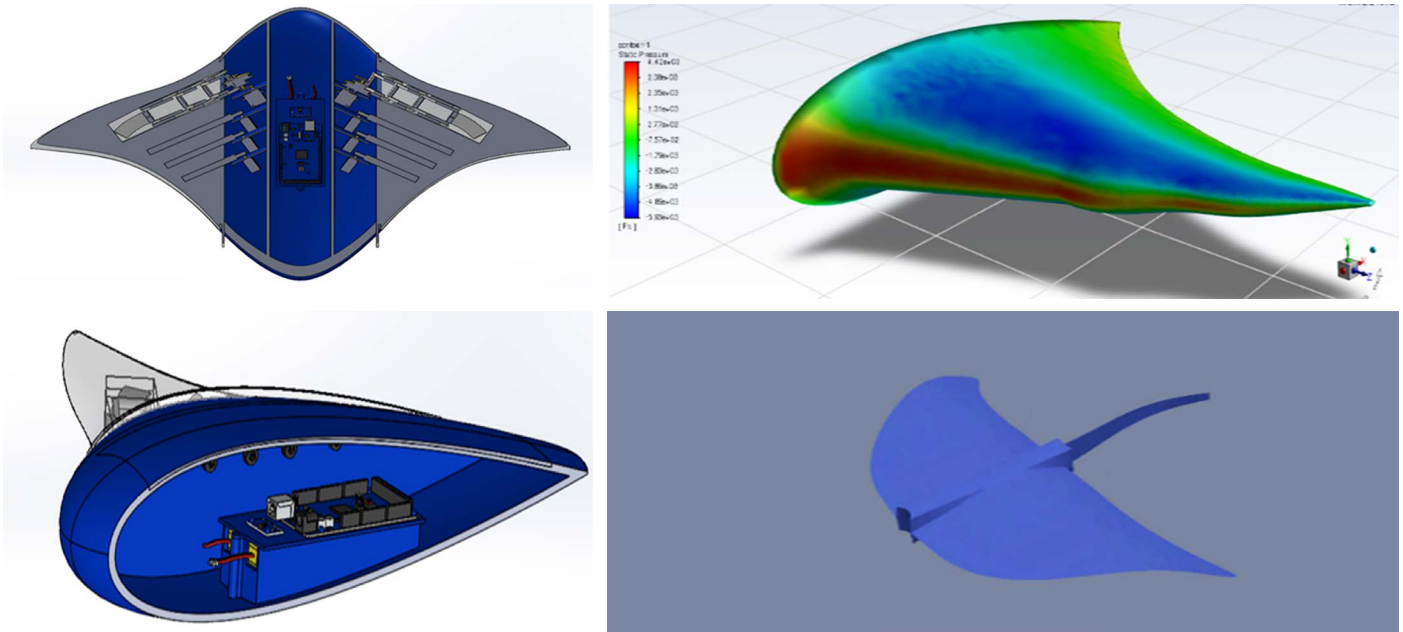
important insights into the ecology, population dynamics and migration of freshwater fishes in river systems) of two hillstream loaches to understand how the natural barriers such as waterfalls and artificial barriers such as dams can affect species migration patterns. The research establishes that while sturdy fish like *Bhavana australis* does not get affected by dams more sensitive fishes like *Travancoria elongata* can be affected, which might have led to their population decline in the recent past.

Sidharthan, A., Dahanukar, N., Sundar, R.L., Ranjeet, K. & Raghavan, R. (2022) [Beyond waterfalls and dams: Riverscape genetics of two endemic mountain loaches in the Western Ghats biodiversity hotspot.](#) *River Research and Applications* 38:152-159.

**3.** The research provides the first genetically confirmed report of *Contraecaecum* nematode parasites in freshwater fishes called hill-stream loaches of Western Ghats, India. It suggests that the parasite affects the muscle of the loaches and leads to oxidative stress in the fish. Since people from tribal areas consume loaches, there is a potential threat of human infection. Therefore, the study has implications for both fish conservation and human health.

Verma, C.R., Kumkar, P., Khare, T., Pise, M., Kalous, L. & Dahanukar, N. (2022) [Contraecaecum nematode parasites in hillstream loaches of](#)





CAD model and assembly of the proposed vehicle, snapshots of Manta Ray swimming (3D CFD study)

[Western Ghats, India. Journal of Fish Diseases](#) 45(12):1873–1882.

#### 4. Design and Development of Bio-inspired Unmanned Underwater Vehicles (UUV).

The Department of Mechanical Engineering has designed a bioinspired unmanned underwater vehicle. This is a physical intelligent system that looks like natural species, propels efficiently underwater, and achieves multiple tasks, including, underwater pollution monitoring, oil cleaning, migration of species, and underwater threat detection, to name a few.

The design and manufacturing of flexible propulsions are an essential part of batoid-inspired UUV. The current study focuses on Manta-Ray species that have a unique advantage over other underwater species and can carry a larger payload. Their efficient locomotion of the vehicle leads to higher speed and energy efficiency. The higher payloads facilitate various sensors, cameras, and other sophisticated components to make it intelligent and adopt strategic locomotion.

**The department, in collaboration with the Naval Research Board (NRB) of the Defence Research and Development Organization (DRDO),**

**is working on two projects with a funding of 35 lakhs.**

#### 5. Evolution in the dark: Unexpected genetic diversity and morphological stasis in the blind, aquifer-dwelling catfish.

The research provides the first molecular phylogeny of the enigmatic subterranean catfish genus *Horaglanis*, and discusses its population genetics, cryptic species diversity, and describes a new species *Horaglanis populi*. The species name *populi* (Latin for people), honours the invaluable contribution of citizen scientists from Kerala who helped in documenting the biodiversity of subterranean and groundwater ecosystems, which led to the discovery of new species.

Raghavan, R., Sundar, R.L., Arjun, C.P., Britz, R. & Dahanukar, N. (2023) [Evolution in the dark: Unexpected genetic diversity and morphological stasis in the blind, aquifer-dwelling catfish \*Horaglanis\*. \*Vertebrate Zoology\* 73: 57-74.](#)

**6. A project on population dynamics study based on the commercial exploitation of two eels *Anguilla bengalensis* and *A. bicolor* to understand whether the fisheries of these species are sustainable.**

The project showed that the exploitation is not sustainable and unless the fisheries are regulated, the population of both species might collapse. The study emphasizes on an integrative conservation approach, including raising awareness (to enhance voluntary restrictions), fishing closures in reservoirs, village-level quotas, and regular monitoring of population, to ensure a sustainable future for these freshwater eel species.

Shanmughan, A., Dahanukar, N., Harrison, A., Pinder, A.C., Ranjeet, K. & Raghavan, R. (2022) [Demographics and exploitation of two 'Near Threatened' freshwater eels, \*Anguilla bengalensis\* and \*A. bicolor\* in small-scale subsistence fisheries and implications for conservation. \*Aquatic Conservation: Marine and Freshwater Ecosystems\* 32:269–281.](#)

### 3 University Operations

#### The Campus Lake

The campus lake is part of the Dadri wetlands, also called the Bil Akbarpur wildlife habitat. The lake was almost dried up when the university was founded. Its immediate revival has allowed many fish and aquatic plants

to thrive, such as *Nitella*, *Chara*, and other phytoplanktons, which provide food for winged visitors. On the lakes' fringes, *Alternanthera philoxeroides* grows gregariously throughout the year, encroaching on the water body and offering a good insect population to feed the birds.

## 4 Partnerships

### Shiv Nadar IoE in collaboration with The Habitat Trust (THT)

The collaboration is to encourage inter-organizational partnerships to achieve synergistic gains by bringing together diverse areas of expertise and launching multidisciplinary conservation programs. One of the programs responding to Goal 14 is collaboration with the Department of Life Sciences Department for eDNA studies of elasmobranchs across India's coastline.

Elasmobranchs, including sharks, rays, and skates, are under enormous anthropogenic pressure all over the world, with many species classified as threatened with extinction. The sawfish, which are closely related to rays, is an intriguing and understudied group of elasmobranchs. The population of five known species of sawfish around the world has declined by more than 90% due to overfishing

(directed and bycatch) and habitat loss (IUCN). Three of the species are endangered while the other two are threatened. Understanding the distribution of these critically endangered elasmobranchs is critical because they live in coastal waters and estuaries that are subjected to intense anthropogenic pressure. These can serve as flagship species for habitat conservation, and using eDNA methodology allows for large-scale sampling, making it ideal for studying such elusive species while also paving the way to study organisms that are difficult to observe or are extremely rare (Beng and Corlett, 2020).

### Collaboration with the International Union for Conservation of Nature (IUCN)

Dr. Neelesh Dahanukar, Assistant Professor at the Department of Life Sciences, is working with IUCN for a long time to understand the conservation status of freshwater fishes of the Indian subcontinent. He has assessed [170 species of freshwater fishes](#) to understand their conservation status in the IUCN Red List of Threatened Species, which helps in understanding the likelihood of a species going extinct in the near future unless conservation actions are designed to protect them.

### Evolution in the dark: New Fish Species Discovered in India.

*The new catfish species discovered with the help of the local population*



Shiv Nadar Institution of Eminence is fully committed to the UN Sustainable Development Goals (SDGs). We have embraced a four-pronged strategy for SDGs through **teaching, research, our core institutional practices, and partnerships.**

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