

## Study of Ganges River Dolphins and Gharials Using Drones



*Team members carrying out drone flight & boat survey in tandem in the field.*



*Team members interacting with participants from the Bihar Forest Department during the training workshop for monitoring threats to riverine wildlife in the Gandak river.*

OVERVIEW	
<b>Flying Labs</b>	India Flying Labs
<b>Geographic area</b>	River banks of Gandak in Bihar, India
<b>Date range</b>	20th February - 23rd February, 2023
<b>Sector program</b>	<a href="#">EcoRobotics</a>
<b>Main SDGs</b>	<a href="#">GOAL 14: Life Below Water</a> <a href="#">GOAL 15: Life on Land</a>

SCOPE	
<b>Project stakeholders</b>	<ul style="list-style-type: none"> <li>● Technology for Wildlife (Co-lead of India Flying Labs)</li> <li>● Wildlife Conservation Trust (WCT)</li> </ul>
<b>People impacted</b>	Bihar Forest Department
<b>Number of people impacted</b>	16
<b>Problem</b>	<p>The Gandak River hosts the second largest population of the critically endangered gharial (<i>Gavialis gangeticus</i>) and is a significant habitat for the endangered Gangetic river dolphin (<i>Platanista gangetica</i>) which is also India's National Aquatic Animal.</p> <p>The riverine habitats of both species are threatened by water flow regulation by dams and barrages in this region. Reduced water flow leads to a reduction in foraging grounds, and affects connectivity within the river for seasonal movement.</p> <p>While we know this as a general principle, finer scale studies of habitat use by the species are required for more targeted conservation action. Current survey techniques involve boat- or land-based surveys for both species. While effective, these surveys are time and labour intensive.</p>
<b>Project objectives</b>	<ol style="list-style-type: none"> <li>1. To determine the most effective ways to use drones for the study and conservation of Gangetic river dolphins and gharials.</li> <li>2. To communicate our learnings in an effective manner for future conservation interventions in the region.</li> </ol>
<b>Scope</b>	<ol style="list-style-type: none"> <li>1. Assessing the feasibility of using drones for population abundance for gharials and Gangetic river dolphins</li> <li>2. Assessing the feasibility of using drones for behavioural studies for the species.</li> <li>3. Documenting habitat for Gangetic river dolphins and gharials using drones.</li> <li>4. Communicating recommendations for the appropriate use of drones for surveys of these, and related species, based on our field experience.</li> <li>5. Generating compelling visuals that can be used to raise awareness about the species and their conservation needs.</li> </ol>
<b>Outcome</b>	<ol style="list-style-type: none"> <li>1. We found that quadcopter drones are an effective way to assess gharial distribution for a population assessment.</li> </ol>

	<p>They provide a viable means to address some of the present challenges faced by land and boat surveys.</p> <ol style="list-style-type: none"> <li>2. We confirmed that it is possible to use drones to estimate the size of gharials. This information could be used to create age-profiles for the population.</li> <li>3. From our experience quadcopter drones do not seem to be the most effective means to assess population densities of the Gangetic river dolphins.</li> <li>4. We found quadcopter drones are effective in studying the social behaviour and habitat use of the Gangetic river dolphin in areas where there is high density of individuals.</li> </ol>
<p><b>Impact</b></p>	<ol style="list-style-type: none"> <li>1. Expand our knowledge of these endangered species and their habitat through the use of drones on their own and in tandem to other technologies and methods.</li> <li>2. Identify if and how UAVs may be helpful in studying and conserving these species, i.e. identification of types of uses.</li> <li>3. To determine the technical details of flying appropriately to study these species without disturbing them.</li> <li>4. Communication of our efforts to build public awareness on the species.</li> <li>5. Communication of our efforts (successes and challenges) within the scientific community so that our study can be built on and duplication of efforts avoided.</li> </ol>
<p><b>Challenges</b></p>	<p>Logistically, we faced challenges in obtaining timely permits for field operations.</p> <p>Technically, the project required learning and adaptation from our end. Gangetic river dolphins surface very briefly; there were trade offs to be made between using the image resolution required to capture a dolphin, with drone battery life and the speed and height at which we should be operating.</p> <p>Designing the survey methods hence required collaboration and iterations with species experts and also trials based on field conditions.</p> <p>Initially, we believed that we would be establishing flight paths that would be used for repeated surveys in subsequent years for the provision of long-term repeated scientific data for the area. However, we found that the flow and path of the river changes so</p>

	<p>drastically over the course of a single year that flying along predetermined paths from previous seasons is not productive. While this was an unanticipated challenge, we hope to communicate this to avoid duplication of efforts.</p>
<b>Next steps</b>	<p>While drones significantly reduce the time taken in the field to collect data, the processing and analysing of this data is time consuming and intensive. However, there is scope for automating this and hence significantly improving both the efficiency and accuracy of analysing this data. To this end, we are currently collaborating with researchers to use our data to train computer vision models to identify the species from our footage.</p> <p>We will also be communicating our field experiences on various platforms to allow for other conservation practitioners to use this information for their own purposes.</p>

### COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT

<b>Consent for data acquisition</b>	Consent was obtained from the Bihar Forest Department.
<b>Community engagement activities</b>	The project studied endangered species and did not collect any data on people in the region. We did not have any pre-planned engagement activities. However, we spoke openly with any member that was near our launch site to explain what we were doing to be able to dissipate any anxiety and also to build a sense of curiosity around the technology as well as the endangered species.
<b>Community groups engaged with</b>	Riparian communities
<b>Community attendance</b>	NA
<b>Community feedback</b>	Most people, especially children, were curious about drones. Elder members shared knowledge of the whereabouts of the species being studied.
<b>Stakeholder support</b>	Permissions to conduct the study were obtained from the Bihar Forest Department. We also engaged with the department with a workshop on identifying freshwater species as well as their threats and free and open-source tools they could use to assist them in their monitoring.

DATA ACQUISITION	
<b>Size of area</b>	~500 ha or 5 km <sup>2</sup>
<b>Drone</b>	DJI Mini 2, DJI Air 2S
<b>Sensor(s)</b>	1/2.3" CMOS sensor (DJI Mini 2), 1-inch CMOS sensor (DJI Air 2S)
<b>Flight plan software</b>	Litchi (Android App)
<b>Flight height</b>	40 - 100 metres above seal level
<b>GSD (Accuracy)</b>	2 cm/px
<b>Number of images acquired</b>	281 (for ortho-mosaicing)
<b>Number of flights</b>	15
<b>Time invested in data acquisition</b>	03:08:02 hrs
<b>Georeferencing</b>	Yes, with on-board GPS.

DATA PROCESSING & ANALYSIS	
<b>Processing software</b>	WebODM, DaVinci Resolve, and Dashware.
<b>Processing time</b>	Not applicable; multiple products processed on different devices.
<b>Data products</b>	Aerial video-transects of areas inhabited by gharial and Ganges river dolphin, orthomosaic map of sandbars and river banks.
<b>Analysis tools</b>	ArcGIS Pro, ArcMap, QGIS, and PyTorch.
<b>Analysis outputs</b>	Computer-vision based gharial identification and counts.
<b>Final outputs shared with stakeholders</b>	Drone footage of aerial transects for gharials and Ganges river-dolphin, observational footage of Ganges river-dolphin, orthomosaic map of sandbars and river banks.
<b>Data sharing</b>	YouTube and Google Drive.