



EUROPEAN UNION OF AQUARIUM CURATORS

REPORTING FORM

FOR CONSERVATION PROJECTS FUNDED IN 2023

1 TITLE OF PROJECT

Underwater exploration of Sulawesi lakes using drone

**2 NAME OF APPLICANT
INSTITUTION
ADDRESS**

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DATE OF REPORT: 27 December 2024

PLEASE SEND YOUR REPORT TO ISABEL KOCH, SECRETARY-GENERAL OF EUAC
(ISABEL.KOCH@WILHELMA.DE)

AND COPY TO

Lauren Florisson (lauren.florisson@eaza.net); Brian Zimmerman: bzimmerman@bzsociety.org.uk

3 LOCATION OF PROJECT (REGION & COUNTRY)

Sulawesi, Indonesia

4 PROJECT START AND END DATES:

10/2023 – 09/2024

5 PROJECT CO-ORDINATOR, ADDRESS AND INSTITUTIONAL AFFILIATION

(IF DIFFERENT FROM APPLICANT)

Markéta Rejlková

6 PROJECT TYPE

(TICK ANY COMPONENTS THAT APPLY)

- | | |
|--|---|
| <input checked="" type="checkbox"/> BIOLOGICAL/ECOLOGICAL RESEARCH | <input checked="" type="checkbox"/> EDUCATION/PUBLIC AWARENESS |
| <input type="checkbox"/> VETERINARY/CONSERVATION MEDICINE | <input checked="" type="checkbox"/> TRAINING/WORKSHOPS |
| <input type="checkbox"/> ANIMAL WELFARE | <input checked="" type="checkbox"/> COMMUNITY-BASED/SOCIAL POLICY |
| <input type="checkbox"/> CAPTIVE BREEDING | <input type="checkbox"/> ECOTOURISM/SUSTAINABLE DEVELOPMENT |
| <input type="checkbox"/> RE-INTRODUCTION/RE-STOCKING/TRANSLOCATION | <input type="checkbox"/> SUSTAINABLE USE |
| <input type="checkbox"/> HUMAN-WILDLIFE CONFLICT | <input type="checkbox"/> WARDENING/LAW ENFORCEMENT |
| | <input type="checkbox"/> PROTECTED AREAS MANAGEMENT |
| | <input type="checkbox"/> EX SITU PROJECT ONLY |
| | <input type="checkbox"/> OTHER: _____ |
-

7 FOCAL SPECIES (COMMON AND SCIENTIFIC NAME)

Flowerhorn ('Cichlasoma' sp., an invasive fish) will be in the focus, as it is the major and immediate threat to the lake ecosystem and endemic species. *Melanochromis auratus*, another invasive fish, is less important. The following species are affected and will be in the focus, too:

Fish: *Adrianichthys kruyti*, *A. roseni*, *Glossogobius flavipinnis*, *G. mahalonensis*, *Mugilogobius adeia*, *M. amadi*, *M. latifrons*, *M. sarasinorum*, *Nomorhamphus celebensis*, *N. towoetii*, *Telmatherina wahjui*, *Xenopoecilus poptae*

Snails: *Miratesta celebensis*, *Tylomelania abendanoni*, *T. amphiderita*, *T. bakara*, *T. baskasti*, *T. confusa*, *T. gemmifera*, *T. hannelorae*, *T. inconspicua*, *T. insulaesacrae*, *T. kristinae*, *T. kruimeli*, *T. lalemae*, *T. mahalonensis*, *T. marwotoae*, *T. masapensis*, *T. matannensis*, *T. molesta*, *T. palicularum*, *T. patriarchalis*, *T. sarasinorum*, *T. sinabartfeldi*, *T. tominangensis*, *T. towutensis*, *T. towutica*, *T. turriiformis*, *T. wesseli*, *T. zeamais*, *T. wolterecki* + about 30 species of *Sulawesidrobia*

Shrimps: *Caridina caerulea*, *C. dennerli*, *C. ensifera*, *C. fusca*, *C. glaubrechtii*, *C. holthuisi*, *C. lanceolata*, *C. liliana*, *C. lingkonae*, *C. loehae*, *C. longidigita*, *C. marlenae*, *C. masapi*, *C. mayamareenae*, *C. parvula*, *C. poso*, *C. profundicola*, *C. sarasinorum*, *C. spinata*, *C. spongicola*, *C. striata*, *C. tenuirostris*, *C. woltereckae*

Crabs: *Migmatelphusa olivacea*, *Nautilothelphusa zimmeri*, *Parathelphusa ferruginea*, *P. pantherina*, *P. possoensis*, *P. sarasinorum*, *P. tenuipes*, *Sundathelphusa molluscivora*, *Syntripsa flavichela*, *S. matannensis*

8 IUCN RED LIST STATUS (OR OTHER THREAT LISTING) OF FOCAL SPECIES

26 species of snails, 14 species of shrimps and 3 species of fish are **Critically Endangered**, with 6 of them evaluated now as **Critically Endangered (Possibly Extinct)**. Large part of remaining snails, fish and almost all crabs are **Endangered**. Other species listed above are evaluated as **Vulnerable**.

There are many other species affected by the current situation (i.e. mainly threatened by the Flowerhorn) that we have reason to believe will soon also be listed as threatened.

CITES NO

APPENDIX -

9 PROJECT BACKGROUND

The lakes of Sulawesi, an Indonesian island, are known for their diversity of shrimp, snails, crabs and fish – there are dozens of endemic species, often confined to a single lake. Most of the diversity is concentrated in Lake Poso and the Malili lakes (Matano, Mahalona and Towuti). However, these unique habitats are threatened by exotic species, particularly Flowerhorn cichlids. Flowerhorns cause shrimp and snail populations to decline, with the smallest species of snails disappearing entirely, as well as juveniles of larger species. This effect is easy to observe and dramatic. Flowerhorns have largely destroyed Lake Matano and are now migrating through connecting waterways to other lakes in the Malili system. It is impossible to catch them, although an effort was made (solitary project in 2020-2021). Lake Matano is 590 m deep. Markéta Rejlková is not only the aquarium curator at the Ostrava Zoo, but also a volunteer who devotes all her efforts to saving the Sulawesi lakes and their unique fauna. She works both underwater and at the desk. In 2021, she founded Sulawesi Keepers, an international NGO with the aim of connecting various institutions and individuals working to protect Sulawesi freshwater endemic species *in situ* and *ex situ*.

10 WAS THE OVERALL PROJECT PURPOSE FULFILLED?

Yes. Using an underwater drone has allowed us to begin exploring the deeper layers of the lakes and collect the first data on the vertical distribution of species. We collected lot of data in a very safe manner. We have also attracted many more young people to our work and to the study and conservation of the lakes than ever before. The images we have received from the drone have also caused many "wows" among teachers from local schools, which is a key step in expanding the curriculum by including the topic of local unique biodiversity. If one of our goals was to show that studying and protecting the environment and species can be "cool", we have succeeded.

11 WHAT OBJECTIVES WERE MET?

- **This project will examine, document and publish the possibilities of using underwater drone technology in the conditions of the Sulawesi lakes.** → Partially met (ongoing). We have examined and documented the use of the method. We are still working on a publication.
- **This project will enable the mapping of the occurrence of species (both endemic and introduced) and other aspects of the environment at depths below 5 m in the scope of at least 40 hours of video footage.** → Fully met. During the duration of the project alone (10/2023 - 09/2024), we collected more than 43 hours of video footage (159 recordings) and approximately 250 photographs from lakes Poso, Matano and Towuti. Another 10+ hours of footage was captured with a GoPro auxiliary camera, giving us a different perspective. We recorded a large number of species and also different types of environments; we also performed a night dive.
- **This project will lead to an increase in the awareness of residents around the lakes, as well as the wider public, about how unique the biota of these lakes is and at the same time how threatened it is. We will reach more than 300 people in person, and more than 1500 people online.** → Fully met. During the project, four seminars and workshops (1/2 day to 3 days) were organized for teachers and students from several local schools on the biodiversity of Lake Poso, where we used the underwater footage among other tools. We worked intensively with 35 people (students, teachers, local NGO volunteers) for several days, including directly on Lake Poso. We worked intensively with 10 people (fishermen, local NGO volunteers) at Lake Matano and Towuti. The total number of people personally approached (counted only if the interaction lasted more than an hour) was 318.
The website sulawesikeepers.org received 4,215 unique visitors during the project, 669 of whom were from Indonesia. The YouTube videos received 3,135 views (the video on the use of the underwater drone alone received more than 700 views). A video about invasive fish threatening endemic species in Lake Matano, also produced as part of the project using footage from an underwater drone, received 8.7 thousand views on FB and was shared and passionately discussed in Indonesian groups.
- **This project will give a tool to the local people to collect the litter under the water while documenting and publishing it.** → Partially met. We used the drone to collect litter, but it is very difficult to control in these conditions (strong waves complicate fine control). It turned out to be too complicated for children. However, we used the recorded video with the amount of trash in the lake and its difficult collection for seminars and will continue to include it in educational materials and our future activities involving local people.
- **Together with local collaborators, we will set priorities for the subsequent use of the drone (there are many areas where the drone could bring essential information that can be used for both *in situ* and *ex situ* protection). We consider this project a pilot.** → Fully met. In the weeks following the completion of (this phase of) the project, our local partners have already used the underwater drone to obtain additional video footage from Lake Poso and, for the first time, from Lake Lontoa and the surrounding rivers. Due to the presence of crocodiles, this is a safe way to look underwater. Two drones have remained in Sulawesi (one at Lake Poso, one in Makassar) and are available to local partner organizations and others interested in studying and documenting the unique underwater environment. We will continue to collect and process the recorded materials. Next season, we want to continue exploring, especially at greater depths, and recording interspecific and intraspecific interactions.

WHAT OBJECTIVES WERE NOT MET?

12 WHAT PROJECT ACTIVITIES WERE UNDERTAKEN?

- We trained drone operators to understand the goal and scope of our work, explained them the characteristics of the lakes and taught them to recognize our target species, local plants and categorize the environment.
- We recorded video footage for a usability pilot study at various depths and light modes, also using auxiliary camera.
- We collected data from various locations in lakes Poso, Matano, and Towuti, focusing on invasive and endemic species and their distribution and interactions.
- We produced and distributed several short documentaries from the obtained videos.
- We trained local people (teachers, students, volunteers) in recognizing the species of fish and invertebrates and in their occurrence and behaviour. This included in-person training as well as printed materials.
- We organized events for schools, during which we performed a practical demonstration of working with the drone and played the videos; we explained what made the lake so important and why we were involved in its protection.
- We recorded the litter scattered on the lake bottom and also our difficult attempts to collect it. This video was included in our school presentations.
- We discussed the experience together with all drone operators and our local partners. Drones remained available to them because they expressed interest in them (and are already actively using them even after the pilot project ended). We are working together to process a large amount of material and publish the results.

13 WHAT OUTCOMES WERE ACHIEVED DURING THE COURSE OF THE PROJECT? IF THIS WAS AN EX SITU PROJECT ONLY, WHAT WERE THE BENEFITS TO THE SPECIES EX SITU AND IN SITU?

- In total, more than 50 hours of video. These recordings contain important insights into the vertical distribution of species and their behaviors. They will be used to investigate and describe the findings, but we will also edit the videos themselves for educational and popularization purposes.
- Recordings of the beauty, but also the devastation, of the unique environment of the Sulawesi lakes. We captured the beautiful environment, fascinating rock formations, deep-water species. But also the garbage in the depressions on the bottom and the cyanobacterial growth spreading from them.
- We met new local volunteers and established further collaboration. We provided our partners with technical equipment and professional training about lakes and their biodiversity.
- We reached thousands of people online with information and visual evidence about the threat to Sulawesi lakes.
- We personally introduced over 300 people to the biodiversity of lakes, of whom we worked intensively with almost 50 for several days directly in the lakes. Teachers and students from schools are very interested in continuing the program and learning more.

ARE ANY ONGOING?

- Processing of materials and publishing results (scientific + for the general public).
- Collaboration with our partners on further use of technology and data collection.
- Continuation of activities with 5 schools that went through the intensive program + there are already other schools interested in a similar experience in 2025.

DID ANY EXPECTED OUTCOMES FAIL?

- Garbage collection by drone by the students themselves was not possible, as control is complex and requires long training.

14 DID LOCAL PEOPLE/COMMUNITIES PARTICIPATE IN THE PROJECT? IF SO, WHO WERE THEY, HOW MANY PARTICIPATED AND WILL CONTINUED CONTACT BE MADE?

Yes – volunteers from three local NGOs and UNHAS university, local fishermen and boatmen – around 20 people who worked with us intensively during our three field trips. 29 teachers and students from 5 different schools spent with us 3 days and helped us explore the lakes and collect data and observations. We stay in touch with most of them. Based on our seminars for schools (almost 300 participants in total), several other people (individual students, teachers or school principals) approached us with a request for future cooperation.

IF THERE WAS COLLABORATION WITH ANOTHER EUAC MEMBER OR AQUARIUM PLEASE PROVIDE DETAILS ON THE COLLABORATION.

n/a

15 DID THE GOVERNMENT OF THE HOST COUNTRY RECEIVE INFORMATION ON THE PROJECT'S RESULTS?

This project was carried out in cooperation with Institut Pertanian Bogor (IPB University, Bogor, Java, Indonesia) and its newly established Center for Research on Bionvasions. Department of Biology of Hasanuddin University (Makassar, Sulawesi, Indonesia) also collaborated. Following bodies were also informed: National Research and Innovation Agency; Pemerintah Kabupaten Poso (Poso Regency Government).

16 HOW DID THE RELATIONSHIP WITH OTHER NGOS WORK? WERE THERE ANY ISSUES?

No issues at all. The main partner was **Sulawesi Keepers**, focusing on coordination, expert materials, public outreach and co-funding the project. The main local partner in the Lake Poso area was **Institut Mosintuwu**, providing communication with schools, organizing seminars, and logistics for trips to the lake with students. At Lake Matano, we have established a new collaboration with **Spearfishing Luwu Timur**, local environmental activists and endemic species protectors. During two trips in 2024, we also invited representatives of a new NGO, **Tarsius**, which was founded among students of UNHAS from Makassar, and we knew them from 2023. We wanted to involve them in our activities to help them develop their own conservation work. The underwater drones are now being held and used by Institut Mosintuwu and Tarsius, along with other equipment and accessories.

17 TOTAL PROJECT BUDGET AND EXPENDITURE (IN EUROS)

18 645,45 €

18 AMOUNT OF MATCHING FUNDS SPENT: 19 AMOUNT SPENT FROM EUAC FUNDS:

11 171,06 €

7 474,39 €

Ostrava Zoo 3 500 €

Sulawesi Keepers 7 671,06 €

20 EXPENDITURE BREAKDOWN (IN EUROS)

| | |
|--|------------|
| TRAVEL | 2 388,26 € |
| SALARIES | |
| ACCOMMODATION | 844,76 € |
| EQUIPMENT | 4 151,82 € |
| COMMUNICATION | |
| MISCELLANEOUS (PLEASE DETAIL) | 89,55 € |
| - Tools for field trips with schools: snorkeling gear sets; paper, printing and laminating; batteries and styrofoam box | |
| TOTAL | 7 474,39 € |

21 PUBLICATIONS PRODUCED AS A RESULT OF THE PROJECT

Due to the amount of material (recorded in 10/2023, 5/2024 and 8/2024) and the complexity of its processing, publications will follow in a longer time horizon.

Outputs published so far (only the essential ones) for the general public:

<https://sulawesikeepers.org/underwater-drone-project/>

<https://youtu.be/0Ewq-QyPnnc>

<https://youtu.be/NU4ak-y5HN4>

This project was also presented at the following national and international events:

- Annual meeting of the Czech Coalition for Biodiversity Conservation, 28.-29.10.2023, Ostrava, Czech Republic
- Biodiversity Goes to School, 29.11.2023, Tentena, Sulawesi Tengah, Indonesia
- Conservation Day, 28.1.2024, Lausanne, Switzerland
- Biodiversity Goes to School, 28.-29.5.2024, Tentena, Sulawesi Tengah, Indonesia
- EUAC, 17.-20.9.2024, Rotterdam, Netherlands
- Annual meeting of UCSZOO aquarists, 24.-25.9.2024, Chleby, Czech Republic
- Conference for environmental education teachers, 3.10.2024, Ostrava, Czech Republic
- Annual meeting of the Working Group on Invertebrates in Inland Waters, 26.10.2024, Leipzig, Germany
- International Aquarium Congress, 27.-31.10.2024, Guadalajara, Mexico