Final Evaluation Report

Your Details	
Full Name	Andrej A. Gajić
Project Title	Sharks, skates and rays of Albania: the final step towards the regional conservation, governance and management
Application ID	35037-D
Date of this Report	25th of March 2022

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
Deliver new knowledge on threatened and rare elasmobranchs in Albania			■	A total of 24 elasmobranch species were registered during the project (six orders and nine families). Further, six papers are published delivering new data on the presence and nursery areas of critically endangered (i.e., *Squatina* and *Oxyonuts centrina*), and other species.
Conduct extensive field expeditions and map important habitats and nursery areas in Albania			■	Despite originally planned for 30 days, we managed to conduct the extensive field research of both continental shelves and upper slopes for 7 months - which yielded far better results than expected. Several breeding areas are mapped, and we are currently preparing the related papers/maps!
Understand the effects of pollution on disease development in sharks, skates and rays			■	During the project, we have studied the presence of pathological lesions in 21 species, including the presence of micro- and nano plastics in seven species (funded by EC Discovery Channel and Federal ministry of Science and Education). Two papers and master's thesis are published!
Capacity building, encouraging citizen science and stakeholder engagement			■	I have conducted dozens of interactive workshops for students. Early-careers and both university/high school teachers in Albania. Through my support, additional project is already secured for the local communities. Further, we managed to develop close ties with stakeholders.
Detailed fish market surveys across the southern Adriatic and northern Ionian Sea of Albania			■	Detailed fish market survey evaluated several critically endangered and endangered species, of which bull ray (*Aetomylaeus bovinus*) is being regularly sold for 3 USD/kg. Most species were falsely identified as *Myliobatis aquila, Mustelus* spp. or *Raja* spp. Further education is necessary!

Develop and propose the amendments to the Albanian Red list of Wild Fauna				Based on the 7 months of the original systematic field research and stakeholder engagement, we managed to develop amendments to the Albanian Red List. Such measures were already discussed at the EU Strategy for Adriatic-Ionian Region (EUSAIR) forum and TSG3 meetings.

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

a). The project has delivered the new knowledge on the highly threatened and very rare elasmobranch from the southern Adriatic and northern Ionian Sea

A total of 24 species of sharks, skates and rays were reported during the project, of which six critically endangered (*Squatina*, *Oxynotus centrina*, *Isurus oxyrinchus*, *Odontaspis ferox*, *Leucoraja circularis*, *Aetomylaeus bovinus*) and two endangered (*Carcharhinus plumbeus*, *Raja radula*). Through past 12 months, we have published six papers in international peer-reviewed journals, while two more are currently in review. Featured paper:

Gajić, A., Lelo, S., Joksimović, A., Pešić, A., Tomanić, J., Beširović, H., & Dragičević, B. (2022). Contemporary records of the rare and critically endangered rough shark (Oxynotus centrina) from the eastern Adriatic Sea. Journal of Fish Biology, 100(1): 329-334. (IF 2.05, Read it here)

b). Plausible nursery and breeding areas of highly threatened elasmobranchs in Albania and the rest of the eastern Adriatic Sea are mapped

Seven months of the extensive field research including ROV habitat monitoring, sonar surveys, fishery analysis and research diving we have mapped potential nursery/breeding areas of highly threatened species. Currently we are still conducting detailed research on neonatal *Aetomylaeus bovinus* and *Isurus oxyrinchus* (Albania) and *Squatina squatina* (Croatia). Featured paper:

Gajić, A. (2022). New hope for critically endangered angel shark, Squatina squatina, in the eastern Adriatic Sea. Croatian Journal of Fisheries, 80(1): 1-8. (IF 0.80, Read it here)

c). Amendments to the Albanian Red list of wild flora and fauna are developed along with the species-specific measures for long-term conservation in-situ

Obtained scientific results and wider stakeholder engagement resulted in the development of amendments to the national red list and further measures for long-term conservation in-situ, which present the final step towards the unique regional protection of elasmobranchs in the eastern Adriatic Sea. Developed measures were discussed within the framework of the EU Strategy for Adriatic-Ionian Region - which fully met the ultimate project goal.

Several photos from the laboratory examinations during the project are given below:

A. Gajić examining the gross pathology Carcharhinus plumbes (up, left), E. Karalić sampling blood from Isurux oxyrinchus (up, right), E. Karalić measuring deep-sea Dipturus oxyrinchus (bottom, left), and A. Gajić conducting autopsy of adult female deep-sea Hexanchus griseus (bottom, right) photos © Sharklab ADRIA.

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

The project was my biggest challenge, and I have enjoyed every single day of work. Considering the very successful field cycle of field research (August 2021), I have decided to leave my hometown and in support of Green Vision to move to Vlorë, to make a far better contribution to the conservation of species and habitats. Unlike the previous hard year, there were no unforeseen difficulties during the project.

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

Just like all previous projects, I have the encouraged engagement of various stakeholders from local communities – primarily fisherman (both commercial and small-scale), biologist, local NGOs, and decision-makers. For the very first time, I have included some of the most marginalised groups in Albania (i.e., fisherman) in the decision-making process. Through my interactive workshops I have helped several local organisations to obtain funds for field research on other taxa. Further, I have taught fisherman when/how to recognise a gravid female and that live specimens are not killed, but safely returned back to the sea. In such a way, they will already start to implement certain measures prior their legal adoption. I have conduct capacity building among locals and encouraged citizen science.

5. Are there any plans to continue this work?

Rufford has been with me since the beginning. For the past 5 years and four projects we have researched from the northernmost Adriatic in Slovenia to southernmost Albania. During projects, we have delivered new knowledge on more than 25 elasmobranch species, discovered breeding areas of the species that were at the brink of the extinction and conducted extensive capacity building on regional scales. Furthermore, we have developed measurement for unique regional long-term in-situ conservation of sharks, skates and rays.

Last year in Albania brought us extremely surprising results. We managed to discover neonates and juveniles of several critically endangered species that are extremely rare in the rest of the Adriatic Sea. This area certainly requires serious additional research and wider educations. As we had encountered more than 75 live elasmobranch embryos during the 7 months of trawl surveys and noted six stranded turtles just in Vlore – our team is planning to develop the very first centre for marine fauna rescue and research. Thus, we are about to apply for the fifth and final Completion Grant for 2022-2023 for initial funding and to give us the time to focus and obtain larger-scale funding through the European Union and some private donors.

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

Sharing the results from my work is among the most important outcomes. It is intended to directly help other researchers, support policymaking and educate. Furthermore, being a National Geographic explorer and Discovery Channel expedition awardee, and with all that to work with sharks, my research attracts significant media attention. Changing human behaviour in relations to sharks is already identified as key for overall conservation success (Simpfendorfer et al., 2021; Niella et al., 2021). Thus, through the media I tried to educate wider public about the diversity, importance and urgency for conservation of sharks, skates and rays.

Published and accepted papers 2021- 2022:

Contemporary records of the rare and critically endangered angular rough shark, *Oxynotus centrina* (Linnaeus, 1758), from the eastern Adriatic Sea

Andrej A. Gajić, Suvad Lelo, Aleksandar Joksimović, Ana Pešić, Jovana Tomanić, Hajrudin Beširović, & Branko Dragičevi

The angular rough shark, *Oxynotus centrina* (Linnaeus, 1758), is a poorly known and rare bathydemersal shark inhabiting continental shelves and upper slopes with a significant lack of data and rarely published records in the Adriatic Sea in this century. In this paper, we present 20 new occurrences recorded from May 2015 to September 2021, of which 19 are in Croatian and one in Montenegrin territorial waters. Records of juveniles, subadults and adults are reported. Higher number of records off the Kornati archipelago in the central Adriatic Sea suggest that this area is of particular importance for this species. Habitats in the Southern Adriatic might have lower density. Due to the nonsystematic research and nonprobabilistic data collection, it is difficult to establish whether the greater number of records in the continental shelf is just an ostensible phenomenon.

***Journal of Fish Biology* 100(1): 329-334.**

New hope for the critically endangered common angel shark (*Squatina squatina*) in the Adriatic Sea

Andrej A. Gajić

Historically, two angel shark species, common angel shark Squatina and smoothback angel shark Squatina oculata, were common in the upper continental shelf of the eastern Adriatic Sea. Although both species are considered critically endangered in the Adriatic and the rest of the world, there are almost no data on the current status of populations, threat assessment and species-specific in-situ conservation. Common angel shark is still present in highly fragmented areas of the eastern Adriatic with extremely rare but consistent records, while smoothback angel shark is mostly considered regionally extinct in the Adriatic due to overfishing and overuse of non-selective fishing gear. There have been only 3 published records of common angel shark this century, the last two of which were reported by fishermen. This paper presents data on 34 new finds, including neonates, juveniles, subadults and adults recorded between January 2020 and August 2021 in the Zadar-Šibenik archipelago (central Adriatic) and one in Premantura (northern Adriatic). Two are original findings during the field expedition, 9 were reported directly by local fishermen, while 23 were reported through a detailed questionnaire. Additionally, plausible breeding and/or nursery grounds between Zadar and Šibenik are discussed with their importance for revitalization and long-term conservation in situ.

***Croatian Journal of Fisheries* 80(1): 1-8.**

Histopathological alternations and individual immunological response to pollution observed in the sharks, skates and rays from the eastern Adriatic Sea

Andrej A. Gajić & Hajrudin Beširović

A total of 180 samples, within 21 different elasmobranch species, were examinted for the presence of lesions and individual immunological response to wider environmental pressures, across the eastern Adriatic Sea. Tissue samples were collected from the already dead by-catch and were routinely processed and stained with Hematoxylin-Eosin, Periodic Acid-Schiff, and Masson Trichrome for further microscopic examinations. The following changes were mostly observed: 1) multifocal inflammatory aggregations in liver parenchyma, comprising of macrophages and to a lesser-extent lymphocytes; 2) Degenerative changes in the renal tubules including karyolysis and pyknosis; 3) hyaline thrombosis in brain with extended Virchow-Robin space; 4) mild pancreatitis (only one case noted in gravid female). Plausible neoplasm of the gastric cardia and local cysts were noted in the critically endangered Bull ray and are currently being processed. Prenatal diagnostics was condcuted on 20 embryos and has revelated no lesions. Furthermore, our study pointed that disseminated encapsulated lymphoid aggregates in the brain and meninges may be a physiological phenomenon unrelated to pathological processes. By chaperoning the neurological disorders in sharks, we concluded that meningitis, encephalitis and meningoencephalitis might not be rare in these taxa and warrants further studies. All obtained results are addressing the effects of pollution, micro- and nanoplastics on disease development and aim to develop strategies for mitigation of pollution and species long-term conservation in situ.

AdriBioPro 2022, Institute for marine biology, University of Montenegro

Quantitative and macromolecular assessment of hepatic and splenic melanomacrophages and lipids in seven shark species from the Adriatic Sea

Andrej A. Gajić, Hajrudin Beširović , Federico Clementoni & Giorgia Gioacchini

Melanomacrophage centers (MMCs) are aggregates of highly pigmented phagocytes and are commonly used as biomarkers of pollution and wider environmental pressures. A total of seven shark species (*Prionace glauca, Isurux oxyrinchus, Squalus acanthias, Mustelus punctulatus, Mustelus mustelus, Galeus melastomus and Scyliorhinus canicula*) from the entire Adriatic Sea were studied for the quantitative macromolecular assessment of hepatic and splenic MMCs and lipids. Tissue samples were routinely processed, embedded in paraffin, sectioned at 5µm and stained with hematoxylin and eosin. A Bruker VERTEX 70 interferometer coupled with a Hyperion 3000 Vis-IR and Olympus BX41 microscope were used. The spectrometer was equipped with a liquid nitrogen

cooled bidimensional Focal Plane Array (FPA) detector that allows to perform the imaging analysis of non-homogeneous biological samples. The highest number of melanomacrophage centers (MMCs), including the higher mean area, was noted in S. canicula. Besides, the same species had lower hepatic lipid content compared to the other studied species, suggesting that S. curricula might be subjected to more acute and chronic stress. Furthermore, a correlation between the sexes was observed wherein females had a significantly higher lipid content and a lower mean area of MMCs compared to males. Comparison between sexes and reproductive period for M. mustelus implied showed a significant decrease in the mean number of MMCs and hepatic lipid content in post-mating females compared to females in pre-mating period, supporting the hypothesis of maternal offloading of lipids and pollutants to the ova. However, further research is needed is needed to validate these results.

AdriBioPro 2022, Institute for marine biology, University of Montenegro

First record of the Pelagic stingray, *Pteroplatytrygon violacea* (Bonaparte, 1832), in Albanian seas

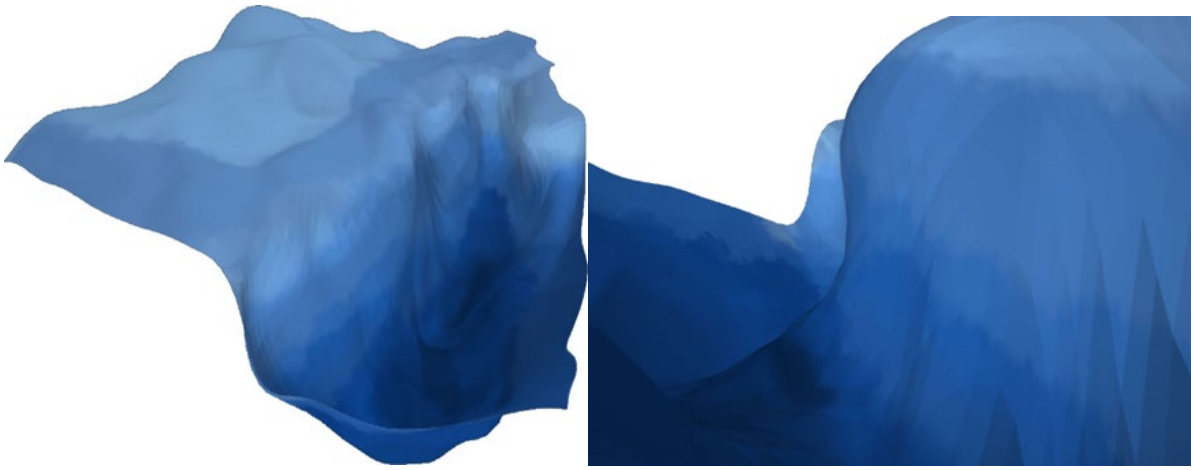
Andrej A. Gajić & Simo Ribaj

The very first finding of the Pelagic stingray, *Pteroplatytrygon violacea* (Bonaparte, 1832) (Elasmobranchii:
Myliobatiformes: Dasyatidae), in Albanian seas is reported in this paper. Female specimen was recorded in
August 2021 at Gjiri i Vlorës at the depth of 25 m and was collected for further examination. The specimen
measured 43.18 cm WD, and 101 cm in TL and weighted 2.730 g in total weight. There were 25 upper tooth rows and 23 lower tooth rows, which is less than previously described for this species. No gross pathological changes were observed, nor parasites. Although there were no previous reports in the territorial waters of Albanian territorial waters of the southern Adriatic and northern Ionian Seas, it can be attributed to the lack of studies and lack of proper monitoring in fisheries. Despite importance of the record on the state level, based on our regional research we believe that the Pelagic stingray is not rare species and could be encountered in waters not too far offshore across the entire Adriatic and Ionian Seas, including the Albanian territorial waters..

***New Biological Reports* 10(2): 103 – 106.**

The greatest milestone happened prior to the 2nd cycle of field studies when we decided to go for 6 months instead of only 2 weeks originally planned in the project. Such a decision arises from the results of the 1st expedition and the urgency in delivering new data on the abundance, frequency and key habitats of highly threatened species. In such a way, we had about 7 months of the extensive field work (instead of one) with about 130 days in the field, which was supported by our local partners SEEP & Green Vision that have recognized the importance of my work.

Instead of 13 capacity building events, we have conducted 35 in-person events which have significantly strengthened the local communities and environmental NGOs in the field of marine science and conservation. Furthermore, there were more than 50 meetings with the fisherman which significantly raised the awareness. Thus, together with my team I have conducted about 500% more activities than originally planned in the project proposal and recorded more than 450 sharks, skates and rays. Through 7 months of the extensive field studies across the Albanian territorial waters, we have conducted the very first bottom mapping using sonar and ROV. As we were too busy with ongoing research, papers and conservation actions, we haven't had a time to develop the 3D seabed view, as planned. Thus, we are hoping to have this interactive 3D map of species and important habitats by December 2023.



3D view of the seabed off the Karaburun peninsula designed upon the sonar data, actual depth might vary, copyright © Sharklab ADRIA.

Despite, at this point we are happy to share all the obtained data and imaging. Thus, anyone who will use it for conservational purposes across the region can contact us.

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

Albania has highly fascinated and deeply disappointed me at the same time. As I was extremely fascinated with the diversity of the species and habitats, I stayed deeply disappointed that many highly threatened taxes are being even targeted in fisheries and regularly sold in local fish markets. Here, I have recorded some species I have never hoped to see in the area, unfortunately all dead as by-catch on trawlers and longliners.

There is far more work in Albania to be done than I previously thought, and I am more than willing to seriously engage in the years to come. The importance of my work was already recognised among local communities through the first expedition, and they managed to invite two of us for an additional 6 months of field research, education and capacity building here in southern Albania. As soon as we arrived back, I realised it was the best possible decision and I focused all my efforts to deliver new knowledge and effective conservation actions - before it's too late.

It is necessary to continue the field research and extensive fishery surveys. Furthermore, due to a significant number of late-stage gravid females recorded at the field (214, of which 18 critically endangered) we are planning to create the very first regional centre for rescue and rehabilitation in Vlorë. Such centre will advance both regional and global conservation through rehabilitation and release of highly threatened elasmobranchs (and other marine animals) caught as by-catch (or stranded), cutting-edge scientific research, capacity building and education.

To complete my story at the eastern Adriatic Sea, and to make initial steps for the development of such a centre, I am planning to apply for the Completion Grant within The Rufford Foundation. Such funds will empower me to stay at least 12 more months in Albania and to develop the most basic conditions for research and rescue of the highly threatened taxa that we encounter here almost on daily basis. Another major goal for the next 12 months is to develop and apply large-scale cross-border project to EU for significant multi-year support and full affirmation of our work. Initial steps in such action are made during this project through the EUSAIR (European Union Strategy for Adriatic-Ionian Region). To strengthen my application for Completion Grant, Dr. sc. Senad Oprašić, one of the coordinators of the Environmental Qualiy pillar of the EUSAIR will be the reference and to confirm the initial steps we made and the importance of the project idea we have submitted and discussed with the EUSAIR.

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 has received significant publicity during entire project both through regional media campaigns and promo materials (i.e., posters, leaflets, presentations). Of course, the logo was used in all produced materials and t-shirts, same as in all previous projects. We were all were proud to highlight the logo of the Rufford Foundation, which is our first and perennial partner in conservation!

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

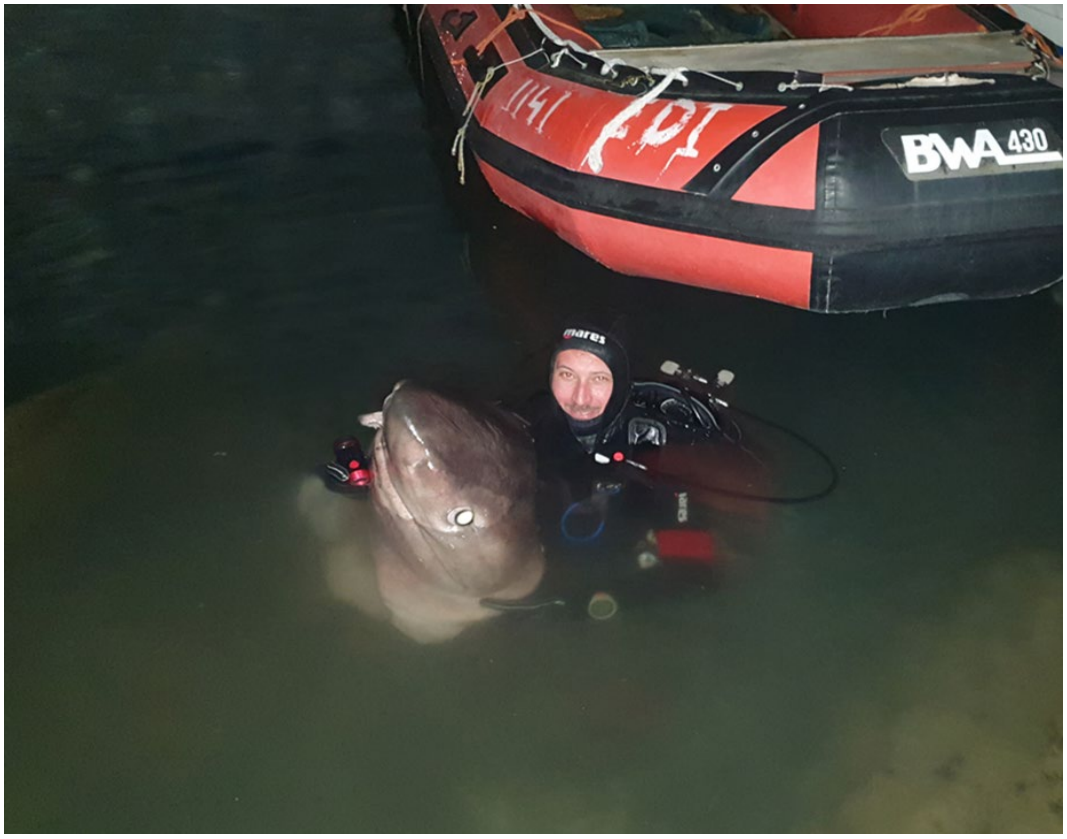
Full Name	Role in the project
Andrej A. GAJIĆ B. Eng, M.Sc. P.Biol.	Principal investigator responsible for project management and implementation, quality of the conducted research and further dissemination of the obtained results. Andrej wrote all published papers, Red list amendments and conservation actions.
Emina KARALIĆ, med. lab. tech.	Emina coordinated sampling of the biological material obtained from already dead by-catch and oversaw the laboratory studies in Albania and Bosnia. Further, she was engaged in the prenatal diagnostic.

Simo RIBAJ M.Sc., P. Biol.	Simo Ribaj, CEO of SEEP, was main Albanian partner and provided significant logistical support for all the field research and fishery surveys. Simo coordinated the team of volunteers that conducted fish market analysis and he boarded trawlers and longlines together with our team.
Adem HAMZIĆ, PhD, P.Biol.	As former FAO expert and Andrej's colleague from the University, Adem was advisor during the amendments to the Red list and development of the sustainable management goals.
Marija VUČIĆEVIĆ, M.Sc. **Belma NAHIĆ,** M.Sc.	Marija and Belma are in-house experts within the Sharklab ADRIA conducting IUCN assessments for elasmobranchs and other target taxa. Those actions were overseen by Andrej and used for the developing the Red list amendments to.
Martina PEŠA, D.V.M.	Martina, as our expert for clinical medicine, worked on the understanding the effects of pollution on disease development and detailed threat assessment. She assisted Andrej and the external expert associates (Prof. Dr. Hajrudin Beširović) in histopathology and immunological biomarkers.
Amina HRNČIĆ mr. ph.	Amina is our toxicologist working on threats assessment from both waste and industrial waters. Her engagement was very helpful during the threat analysis prior to the development and proposal of conservation actions (which are in progress now)
Dario ŠAKIĆ M.Sc.	Dario was with us from the very beginning as advisor in biogeography. Anyway, to develop the 3D saved views based on sonar surveys we were forced to engage third-party. This work is currently in progress and will last most likely until December 2023.

10. Any other comments?

The Rufford Foundation was there from the very beginning of my career. Together, we brought new knowledge and developed protection measures for elasmobranchs across the entire eastern Adriatic, from Slovenia down to Albania. This work was recognized by National Geographic, Discovery Channel and many others, including the Government of Bosnia and Herzegovina which awarded Andrej a Special Governmental Recognition for extraordinary scientific achievements and promotion of science across the Balkans. Thus, I am looking very forward to our further success, and I am more grateful to you than you'll ever know.

Please enjoy several most important moments during the course of the project and do not hesitate to contact me in case there is anything else you might need.



Andrej with adult female bluntnose six-gill shark (Hexanchus griseus) in Triport, Vlorë night diving in January 2022.

Andrej holding the critically endangered juvenile mako shark (Isurus oxyrinchus) caught by bottom longlines and discarded by local fisherman. The individual was used for detailed pathological and immunological examinations.

Emina with juvenile endangered sandbar shark (Carcharhinus plumbeus) caught by bottom trawler and used for detailed health examination in our laboratories. Taxidermy was prepared for further educational purposes.

Andrej Gajić and Simo Ribaj in the project crew t-shirts during the habitat mapping in the outer part of Karaburun peninsula. During this particular trip we have mapped (ROV and sonar) habitats up to 100 m deep.

For the extraordinary scientific results, conservation work and promotion of science and has received the very first Special Recognition awarded by the Government of Federation of Bosnia and Herzegovina by nomination from Ministry of Education and Science. Photo: Andrej Gajić and Prime minister Fadil Novlić, November 2021.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Andrej Gajić and Simo Ribaj during the fishery survey (August 2021) in Triport, Vlorë. Extensive fishery surveys were conducted for total seven months and have resulted in many records of both endangered and critically endangered species.

Educations were highly important part of the project. Photo taken during the capacity building interactive workshops in SEEP office, August 2021. SEEP biologists were trained to conduct gross pathological examinations and to sample the tissue fur further examinations in our labs. Further, they learned to identify the species and preserve the sample prior to analysis.

SPECIAL GOVERNMENTL RECOGNITION

At the initiative of the Ministry of Education and Science, for the outstanding scientific international contribution in the field of natural science, popularization of science and promotion of Bosnia and Herzegovina domestically and internationally – Andrej has received Special Recognition by the Government of Bosnia and Herzegovina, which is the very first of its kind in the history of the country. Just a year before, in 2020, Andrej has received prestigious Early Career Leadership award by National Geographic in Washington, D.C. For the media, Andrej stated "I'm eternally grateful, these awards are the proof we are on the right path, doing our very best to deliver effective conservation actions. They are also obligation to work even harder in the future, we are still on the beginning".

Representatives of the Federal Ministry of Education and Science together with the winners of federal awards and recognitions for science in Sarajevo, Bosnia and Herzegovina.

Below: Federal science awards ceremony in Sarajevo, Bosnia and Herzegovina (November 2021). Andrej and prime minister Mr. Fadin Novalić (left) and Andrej with Emina Karalić (right).