



# CITIZEN SCIENCE TOURISM MODEL

Version n.2/EN



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## ***1. THE BLUE ECONOMY AND CITIZEN SCIENCE***

Today, nature-centred tourism is a tool for economic and employment development and, at the same time, also acts to improve the quality of life by making virtuous use of a territory natural heritage.

Blue economy derives from the green economy while the latter envisages a business model based on a lower environmental impact with a decisive reduction in CO<sub>2</sub> emissions, the blue economy aims at eliminating emissions altogether by producing zero hazardous waste and creating greater profits with less capital investment.

The blue economy encompasses all economic activities that have a connection with the sea, the coast and the seabed and proposes new solutions for ocean-related activities: fishing, aquaculture, the food processing industry, shipbuilding and services related to yachting, coastal tourism and mining.

As a result of this particular focus on nature-centred tourism, Citizen Science or rather 'participatory science' developed since the mid-1990s which sees the involvement and active participation of citizens - students and enthusiasts alike - in scientific research, with the aim at making the concepts of environmental protection and respect for biodiversity understood and taken on board. Another aspect not to be underestimated in the development of Citizen Science is represented by a new evolution in the field of tourism, as the concept of mass tourism is being abandoned to leave more and more room for experiential tourism, where what counts is not the destination but the experience.

An increasingly important role within this type of tourism is played by the increased interest in whale and dolphin watching activities, thanks to which it is possible to observe the behaviour of cetaceans in their natural environment.

It is precisely in this type of tourism that the activities of Jonian Dolphin Conservation fall.

Creating a link between tourism, culture and the environment has been successful for more than 10 years of activity by achieving an exponential growth in the number of tourists on board the association boats.

## ***2. JONIAN DOLPHIN CONSERVATION***

JONIAN DOLPHIN CONSERVATION (JDC) is a scientific association specialised in marine project management with a focus on the Northern Ionian dolphins, whales and the study of environmental impact.

It designs and conducts visual and acoustic Marine Mammals Surveys with specialised equipment and personnel; it carries out Dolphin watching activities, involving tourists on board of catamarans; it conducts sighting and scientific research on cetaceans; it carries out professionalisation courses as Marine Mammals Observers and Whale Watching operators; carries out research activities at sea, in cooperation with other bodies/institutes, using nautical vessels equipped with echosounders, multi-parametric probes, hd video-photographic filming systems and hydrophones for bioacoustic studies; produces documentaries and sets up exhibition spaces for shows and events on marine environment protection issues.

Jonian Dolphin Conservation has been running the Citizen Science project since 2011, cutting important milestones in these more than 13 years of activity. The successes of the JDC team cut across different aspects of the lives of the individuals involved in this "community project", ranging from the world of scientific research, thanks to the important studies conducted on cetaceans with over 50 scientific publications produced, to the social implications through collaborations for public utility work (LPU) and the creation of new jobs. The educational function played by Jonian Dolphin Conservation over the last decade is extremely important, thanks to the involvement of more than 40,000 young people under 15 in environmental awareness and education courses.

A seed planted in the last decade and beginning to bear fruit through young people who are much more aware of the importance of the concept of environmental sustainability.

### **2.1 RESEARCH ACTIVITIES**

#### **2.1.1 The Gulf of Taranto**

JDC study area is the Gulf of Taranto, which is an ideal habitat for several cetacean species, a key hotspot for marine mammal conservation. Striped dolphins, bottlenose dolphins, grampuses, common dolphins, sperm whales, Cuvier's beaked whales and fin whales are the species encountered in the research area throughout the year in a variety of behaviours, from resting to hunting to socialising.

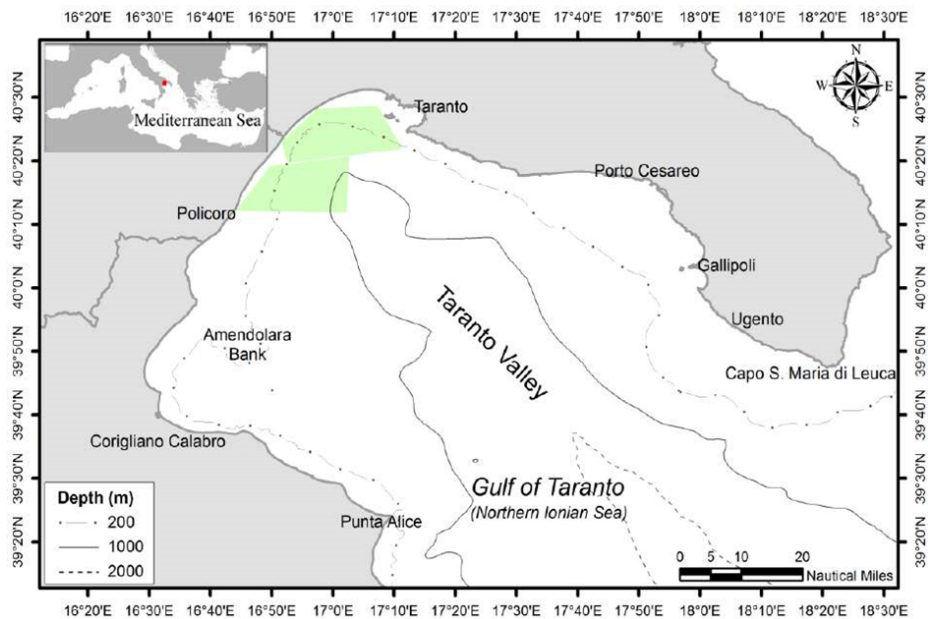
The Gulf of Taranto was defined as a 'Baia Storica' by Presidential Decree No. 816 of 26 April 1977, so it is an inland sea forming part of the territorial waters under the

complete jurisdiction of the Italian Government; it embraces not only the Apulian coast but also the Lucanian and Calabrian coasts: in fact, it lies between Punta Meliso (Santa Maria di Leuca, Lecce) and Punta Alice (Cirò Marina, Crotone).



The vast biodiversity of this area is due to the complex and articulated morphology of the seabed which, although it appears to be uniform, conceals important differences in its conformation.

A link between different geological formations in the Gulf of Taranto which presents a rather articulated morphology that makes it unique in the panorama of Italian seas. Specifically, the central part of the Gulf of Taranto presents a depression called the Taranto Valley that forms a veritable submarine canyon, which runs NW-SE along the Gulf of Taranto and reaches depths of over 2,200 metres. Following the fracture lines of the seabed, the Taranto Valley reaches as far as the Gulf of Corinth in Greece. This large canyon divides the western sector, which includes the Calabrian Lucanian coast, from the eastern sector of the Gulf, which includes the Apulian coast. The latter looks like a stepped platform on which Salento rests and is characterised by a continental escarpment furrowed by numerous other canyons of 1000-1500 metres depth. The Lucanian coast, on the other hand, is characterised by deposits of alluvial sediments contained in the depression of the Fossa Bradanica and a number of canyons that connect the centre of the Gulf with the Taranto Valley. Finally, the coast of Calabria, overlooked by the Apennine mountains, is jagged with ridges, underwater heights and canyons that also join the Taranto Valley.



The Taranto Valley ensures the recirculation of nutrients and oxygen throughout the water column, effectively enriching both the deeper and the more superficial layers. This occurs through the formation of upwelling and downwelling currents, called upwelling and downwelling respectively; these currents are triggered by differences in temperature and salinity along the water column. These conditions create a trophic network with cetaceans as top predators.

### 2.1.2 Photo-identification

Among the most widely used techniques for the recognition of an individual animal, useful for the study of ecology and species conservation, is photo-identification (photo-ID). This method consists of photographing markers, natural and characteristic signs, present on the dorsal or caudal fin of individual animals.

This has resulted in the identification to date of 160 Risso's dolphins, 160 bottlenose dolphins, 25 sperm whales and 10 common dolphins.

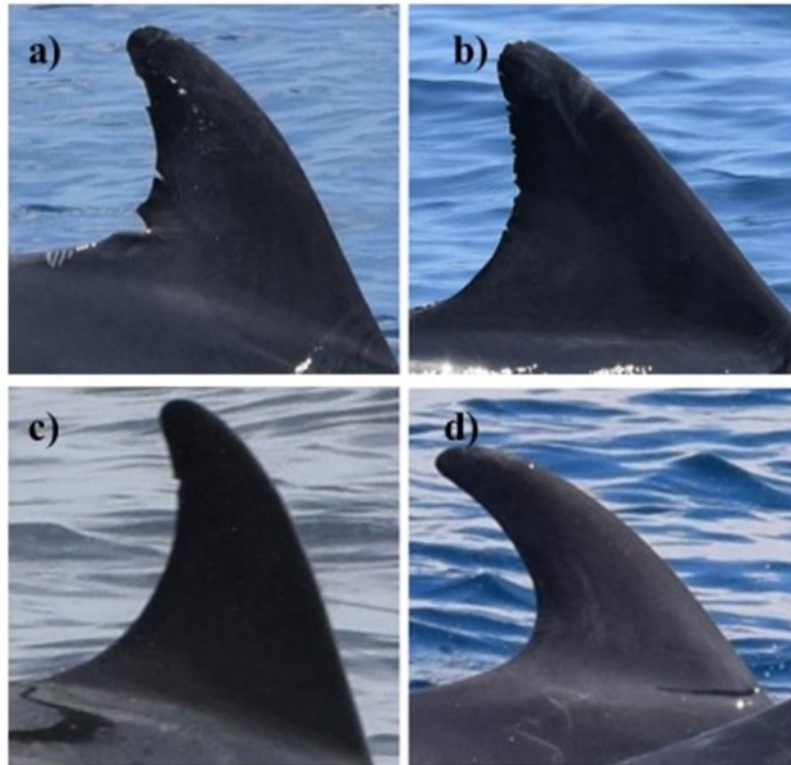
We apply two methods to identify the striped dolphin: the first based on distinctive markings on the dorsal fin, the second based on the pigmentation of the body.

In bottlenose dolphins, it is the dorsal fin that is suitable for recognition as it has differences in shape, size and margins, as well as different notches and scars; peculiar pigmentation may also prove to be a useful means of recognition.

Risso's dolphins, in particular, are covered with scars caused by interaction with other specimens or other species that accumulate on the body, turning the dorsal fins into unique and unmistakable fingerprints.



On sperm whales, we observe the caudal fins or fluke, which usually emerge moments before a long, deep hunting dive. Flukes are characterised by unique markings that allow to identify each individual sperm whale encountered.



### 2.1.3 Bio-acoustics

Studying the vocalisations of cetaceans can reveal a lot about their ethology (the study of behaviour), their health, and the ecological dynamics of communities. To this end, we have been running a marine bio-acoustic research programme for over 10 years to study and census cetaceans living or passing through the Gulf of Taranto.

Data collection involves the use of a hydrophone capable of recording the sounds and vocalisations of the dolphins without impacting on the species and its environment, a necessary condition in order not to change the behaviour of the animals and thus invalidate the information collected.

From the analysis of emission spectra it is possible to determine the frequency composition of the signals as a function of time, to describe the structure of the spectrum itself, to study emission frequencies and their duration, the presence of signature whistles and the number of vocalisations emitted; subsequently the emission spectra can be correlated to the species in general, to individuals in particular, to the behaviour and situations observed. The spectrographic analysis also makes it possible

to census the recorded specimens, estimate their size and determine, in broad terms, the breeding periods and areas.

It is therefore possible not only to create an acoustic catalogue of the different species that are present in the Gulf of Taranto, but also to census the acoustic spectrum of individual animals, thus making it possible to recognise them even at great distances or in the absence of direct observation.

Furthermore, the identification of any changes in acoustic and behavioural patterns acts as an indicator of a possible change in the balance of the marine environment, whether due to natural or anthropogenic causes, and leads to the adoption of mitigation and conservation measures that are in tune with the ecological characteristics of the environment and the species present.

Through the BioTours project JDC was able to acquire a state of the art hydrophone knows as PAM (passive acoustics monitoring) system, consisting of a streamer (polyurethane tube) equipped with:

- \* 2 high-frequency hydrophones to detect odontocetes sounds
- \* 2 low-frequency hydrophones to detect whale sounds)
- \* depth sensor



### **2.1.4 DNA analysis**

DNA is the true wealth of information that characterises the individual and his or her species: gender, age, current population status, identity card of the animal studied (recognising it thanks to its characteristic genetic imprint, discovering parental links, observing its origin and migrations).



DNA samples are collected using non-invasive methods: simply swab the dead skin (dolphins change their skin every two hours). Thanks to new technologies, it really only takes small amounts of skin to discover everything that is invisible to our eyes.



These studies on striped dolphins and bottlenose dolphins have confirmed that these marine mammals are sedentary; there are, in fact, haplotypes characteristic of the population: it is as if the word Taranto were always in the phrases written in the DNA, which is obviously not found in dolphins from other areas. Due to a lack of interaction and exchange of genetic heritage with other individuals of the same species present in the Mediterranean, a process of speciation is probably underway.

All the data that is collected through DNA study also leads to understanding a lot of useful information about the animals in our area and this will allow us to develop further protection and conservation plans.

### **2.1.5 Phoebe - Ionian Sea Heritage**

In December 2019, the 'Phoebe - Ionian Sea Heritage' project was born on the island of San Pietro (Cheradi Islands, Taranto), following the beaching of a zephyr (*Zhiphius Cavirostris*).

Phoebe was an adult female zyphian. At 5 metres long, Phoebe today has become a heritage, a legacy for all who visit the KETOS - Euro-Mediterranean Sea and Cetacean Centre.



A team of engineers from the Physics Department of Bari University has reconstructed the most probable path that Phoebe's carcass may have taken from the day of her death to the day she was found: given the body's state of decomposition and the currents and winds of those days, the most reliable model places Phoebe in the southernmost portion of the Gulf of Taranto in front of Santa Maria di Leuca.

Phoebe died from heart problems and not from human causes: her aorta was severely compromised and she was also suffering from a Morbillivirus infection.

After the necropsy, Phoebe's body was immersed in the waters on the island of SÆo Paulo for two months, the time needed for partial natural decomposition. The cleaning of the bones then began: boiling, hydrogen peroxide and finally sodium hypochlorite turned Phoebe's bones very white. Phoebe's skeleton was first mounted on the floor and then displayed in the centre of the main hall of Ketos.





## 2.2 JDC PAST

Jonian Dolphin Conservation represents the concrete realisation of a dream and of the man who has really worked hard, creating a close-knit group of professionals who always work with passion and enthusiasm: the founder is Carmelo Fanizza, a great lover of the marine world who obtained his degree in Taranto, his hometown.

The first step taken in 2009 by the future members of the JDC was to deploy an inflatable boat and start collecting the first data on cetaceans, inviting some guests to share these new field research activities.

The association is becoming more and more structured, creating a team of professional researchers supported by academics.

This brings us to 2013, the year in which Taras, a 40 FT long research catamaran, was launched, built to a specific design by the Jonian Dolphin Conservation and representing the main observation platform. From this moment on, a whole series of activities are structured to involve citizens in the search for free cetaceans.

The boat trips are a great success and bookings are increasing to the point that in 2016 the decision was made to purchase the second research catamaran, Extraordinaria, Taras' twin. As a result, the research area is increased, more and more data is acquired on a daily basis and a large number of visitors are attracted each year.

In 2018, the number of boats became three, with the acquisition of Il Porto di Taranto, a vessel with different characteristics to the catamarans and much more suitable for winter activities.

Since September 2020, Jonian Dolphin Conservation has been involved in an important Interreg-IPACBC Italy - Albania - Montenegro, co-financed by the European Union



and managed by the Apulia Region with the participation of Italy, Albania and Montenegro: the BioTourS project.

Starting from a dream to a nationally and internationally known organization, which formed partnerships with private entities, the Biology Department of the University of Bari and CNR - STIIMA department.

### **3 THE PRESENT AND PROJECT BIOTOURS**

#### **3.1 Researchers for a day**

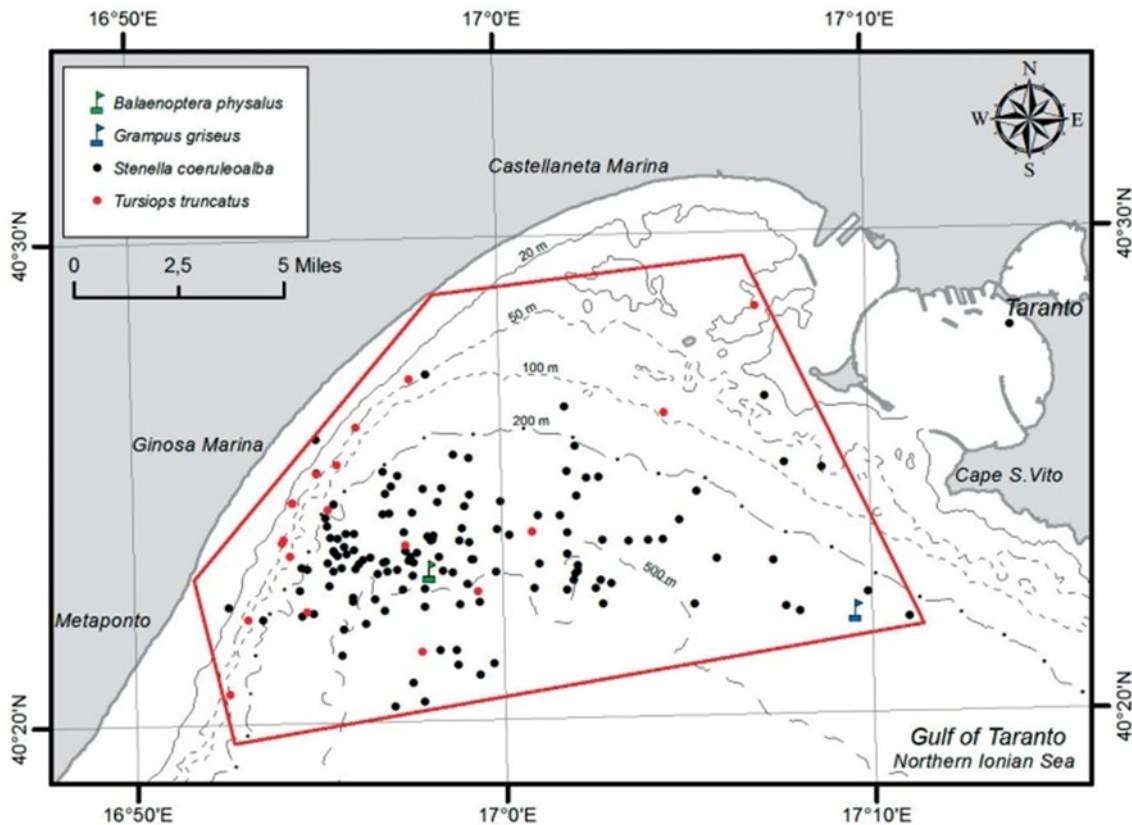
Through the "Researchers for a day" programme, Jonian Dolphin Conservation, with over 250 monitoring days each year, continues to involve tourists in research activities: guests, on board the two catamarans, are first informed with a briefing about what will happen during the navigation (data collection for scientific research on bioacoustics, behaviour, photo-identification), and then are directly involved in a real scientific monitoring campaign.

The search area is 960 km, within which navigation transects are carried out. Equipped with binoculars and a great deal of patience, our guests immediately begin the planned activities, collaborating with the staff on board.



Over the years, the Citizen Science activities carried out by Jonian Dolphin Conservation have made it possible to collect a considerable amount of information on cetaceans in the waters of the Gulf of Taranto.

The starting date of the sightings is the year 2007, considering that previously there was no data on this subject other than reports of strandings and scarce observations at sea. However, the presence of cetaceans in the Gulf of Taranto has been expanded on the basis of data collected from 2009 to date. The estimated sighting rate for as many as 7 cetacean species (striped dolphins, bottlenose dolphins, Risso's dolphins, sperm whales, Cuvier's beaked whales and fin whales).



The sighting rate of the various species in our research area is

- 59% striped dolphins
- 25% bottlenose dolphins
- 10% Risso's dolphins
- 5% sperm whale
- 1% common dolphin
- Occasional sightings of Cuvier's beaked whale, fin whale and pilot whale have occurred over the years.

### 3.2 Taranto Cetaceans' Education Centre - Ketos - Centro Euromediterraneo del Mare e dei Cetacei

In 2019, JDC educational proposal doubles: dissemination, awareness-raising, research and training activities 'land' in the prestigious Palazzo Amati, located on the seafront of Taranto's old town. Scientific research and tourism activities, in fact, find their physical location at Ketos - Centro Euromediterraneo del Mare e dei Cetacei ([www.progettoketos.eu](http://www.progettoketos.eu)) a scientific centre/museum of Citizen Science, which represents a cultural container aimed at regenerating and fostering the development of knowledge and enhancement of the territory's resources as well as a reference point for the Blue Economy. The centre offers a constant presence through seminars, workshops



and cultural events, and opens its doors to students, with specific, engaging and original programmes aimed at learning about the sea and its many aspects. Approximately 600 metres are entirely dedicated to the sea and cetaceans, an ecology laboratory, a second laboratory with 8 virtual reality stations, allowing visitors to enjoy an exciting experience of immersive viewing of the seabed, and a teaching room (equipped with 4 touch screens).



The word 'centre' commonly refers to a place where people with the same interests come together for a well-defined reason. A centre is, therefore, a physical space that allows people to meet and benefit from each other. Those who have access to an educational path receive and assimilate knowledge, consequently acquiring cultural and behavioural awareness. It is correct, therefore, to say that an education centre is to all intents and purposes an educational institution.

Ketos is, therefore, a Cetaceans' Education Centre, which aims to intrigue and at the same time educate users and citizens about the presence of cetaceans in the sea off their

coasts, providing knowledge to develop greater awareness of the protection and conservation of these mammals.

### **3.3 BioTourS Project: BIODiversity and TOURism Strategy to protect cetaceanS**

The BioTourS project, modelled on the Jonian Dolphin Conservation, aims to introduce best practices in the field of sustainable tourism, addressing new challenges in the field of the environment, sea conservation and protection of the natural heritage of the Adriatic-Ionian area. The main objective of this project is to involve young people engaged in cross-border tourism activities aimed at raising awareness on cetacean conservation. Besides the 4 project partners, Jonian Dolphin Conservation (Italy), Agenzia Kombotare e Turizmit (Albania), Municipality of Termoli (Italy) and Inovaciono preduzetniški centar Tehnopolis (Montenegro), there are 2 other associated strategic partners, CBC Italy-Albania-Countries of Montenegro, the Cooperativa Dalla Luna Onlus and the Institute of Marine Biology of the University of Montenegro. Jonian Dolphin Conservation, in particular, carries out coordination and management activities to ensure the proper organisation and implementation of the project.

There are several objectives of this project:

- achieve a common identity in Adriatic among the public, institutions, research institutes and tour operators
- sharing know-how and experience of the different PPs involved
- develop a tool to expand scientific knowledge on cetaceans, conservation and tourism management
- conduct onshore and offshore awareness sessions and science tourism activities
- conduct Youth Camps, consisting of marine research/scientific tourism activities for the protection of cetaceans through the use of equipment such as echosounders, HD photo-video recording systems and hydrophones for bioacoustic studies
- create 4 Cetacean Education Centres in partner territories, set up to raise awareness among the general public on biodiversity and cetacean conservation
- hold workshops and lectures for visitors on various topics and aimed at all age groups
- develop of the BioTourS web catalogue

### 3.4 Youth Camps

"Researchers for a Day" was exported as a model during the BioTourS project. For about a month, in fact, with the boat *Il Porto di Taranto*, Jonian Dolphin Conservation operated in the Adriatic Sea, demonstrating how scientific research can be developed to monitor and protect cetaceans in the study area. JDC has adopted the same Citizen Science programme it has been using in the Gulf of Taranto for more than 10 years to combine sustainable tourism and environmental protection of the ecosystem in which these splendid mammals live. In October 2022, 25 days of activities involving all project partners were carried out at sea in four coastal towns. In order of activity: Bari and Termoli in Italy, Kotor in Montenegro and Vlora in Albania.



In all host cities, round tables and discussions were also organised involving stakeholders, institutions, tour operators and academia representatives.





*Il Porto di Taranto* and its crew travelled a total of 950 nautical miles in the Adriatic Sea and of these about 150 miles were covered during the Youth Camps: over 260 people were involved on board, divided into 4 different target groups of young people, students, young researchers, people with disabilities, young tour operators. Youth Camps were organised in Italy, Montenegro and Albania:

➤ BARI

The camp took place from 7 to 9 October 2021. One of the most exciting moments was the participation in 'Researchers for a Day', again as part of the BioTourS - Youth Camps project, autistic people from the non-profit organisation 'Dalla Luna', an association based in Bari, and other third sector organisations. A second local stakeholder involved was the Plana Sailing school, which was given the Survey Data Sheet used by JDC to collect data in a scientific and standardised manner.

➤ TERMOLI

On 13 and 14 October 2021, JDC's experts and the external expert from the municipality of Termoli, Dr. Antonio Celona, carried out awareness-raising and training workshops to make young participants discover how Citizen Science projects for the protection of cetacean species work. On both days, the young participants were able to experience virtual reality, realised by the Lead Partner, giving them the opportunity to discover the world of the oceans thanks to the latest technological aids.

Children from the 'Il mondo a colori' and 'San Damiano' socio-educational centres, autistic children, children with disabilities and their support staff, as well as students from four Termoli schools participated in these days: Istituto Difesa Grande, Istituto

Comprensivo Schweitzer, Istituto Comprensivo M. Brigida and Istituto O. Bernacchia.

➤ KOTOR (Montenegro)

The camp took place from 18 to 20 October 2021. Major preliminary research activities were carried out in the Kotor Straits, spending several hours at sea, involving the young participants in every step of the monitoring process, using both binoculars and hydrophones. JDC experts also conducted a workshop ashore on the main cetacean research methodologies.

Important was the involvement of the Boka Aquarium, the only public aquarium in Montenegro, with the aim of building public knowledge and action to protect the species and habitats of the Adriatic Sea. By visiting the aquarium, participants were able to deepen their knowledge of the ecological systems of the Adriatic Sea and experience local best practices combining science and tourism.

➤ VALONA (Albania)

The camps took place from 26 October to 28 October 2021. The partners involved were the Albanian Tourist Agency, local stakeholders (municipality, public and private bodies) and Aleksander Moisiu University of Dures. On each day of activities, the JDC experts shared with the guests on board the principles of Interreg projects and gave the participants the opportunity to concretely take part in the research activities, using the scientific equipment on board.

Before the departure of the JDC research vessel from Vlora to Taranto, the young participants were able to experience virtual reality to find out more about marine biology.

On board *Il Porto di Taranto*, JDC biologists and volunteers then involved the participants in research and study activities, as well as sharing and learning about the various characteristics of the cetaceans living in the area. When weather conditions were adverse, the young people were involved in other activities on land: thanks to advanced IT support, including virtual reality visors, and 3D reproductions of underwater scenes, participants were able to explore marine ecosystems.





The camps focused on retrieving information (abundance, behaviour, group size, location of sightings) on cetaceans, using equipment such as echosounders, HD photo-video recording systems and hydrophones for bioacoustic studies. Information on anthropogenic impact data (tourism activities, fishing practices, habitat degradation, marine litter, marine traffic) was also collected.

During monitoring in the Adriatic Sea for the BioTourS project, six different sightings of three different dolphin species were made:

- \* Striped dolphin
- \* Tursiops
- \* Common dolphin

The significant number of sightings and the preliminary scientific data collected on the presence of cetaceans in the areas monitored thus demonstrate the concrete possibility of applying, also in this area of the Adriatic, best practices that combine the study and protection of cetaceans with innovative, sustainable and marine ecosystem-friendly forms of tourism. All the actions of the BioTourS project, therefore, have indicated the right path that the Adriatic realities can follow through the BioTours model.





### 3.5 Web Catalogue

As part of the BioTourS project, a web application was developed to support Jonian Dolphin Conservation in managing the data acquired during the Youth Camps.

The data collected during the monitoring were used to produce a catalogue, which shows the details of each sighting.

The system has a home page and an information section, explaining the purpose of the project and the platform.

The web application is also accessible from desktop and mobile.

Photo-identification data collected on bottlenose dolphins and common dolphins were analysed in collaboration with Dr. Rosalia Maglietta, an artificial intelligence expert at CNR-STIIMA, and led to the creation of a software program, the first automatic photo-identification algorithm: it involves comparing digital images of the dorsal fins of individuals whose identity is to be known, and a database of previously photo-identified individuals. The algorithm is capable of analysing huge amounts of images in a short time and without human intervention, which makes it suitable for use in large-scale studies. All the products of the study can be found in the innovative digital platform DolFin, which can be accessed online and will in the future allow in-depth studies of the spatial distribution of a cetacean species across the Mediterranean or on a global scale. Using DolFin, it will also be possible to understand whether the identified dolphin stays in one and the same stretch of sea or whether it makes movements, what its travelling companions are, and what motivates it to make these migrations.



### 3.6 Cetaceans' Education Centers

The creation of a Cetaceans' Education Centre, modelled on the Ketos centre, is an objective of the BioTourS project, at the headquarters of each partner involved. Each centre will be a cultural attractor for the new generations who, in this new perspective,

will be able to see an alternative employment outlet based on the blue economy, repeating the tried and tested JDC model. In each of the locations involved in the project, i.e. Taranto, Termoli, Montenegro and Albania, a structure has been identified with minimum characteristics and requirements common to the other locations, with access open to all and free of architectural barriers, and with the same (homogeneous) basic equipment. It will be a facility open to all those who want to get closer to the world of cetaceans and the sea in its entirety, and will be a valid attraction and educational centre, especially for students of all levels, thanks to the staff's ability to modulate information according to the age and knowledge of those present.

### CETACEANS' EDUCATION CENTER



As per the project, a didactic exhibition itinerary was created within each centre, which is easy to use, both individually or with a guide. On the walls are panels explaining the project, the different species of cetaceans, marine biology, seabed geology, threats, and finally a panel depicting the logbook of the Youth Camp activities carried out from 4 to 29 October 2021 with a description of the activities carried out during each stage. A touch screen monitor (preferably positioned vertically) will also be installed where videos and multimedia presentations can be viewed. Finally, a computer connected to a VR (augmented virtual reality) visor with 3D content will be positioned.

A number of exhibits from the JDC or related partners were placed in the room, or, in their absence, copies were made using a 3D printer. The room will be used for conferences, in-depth, popular meetings drawing attention to environmental issues and, in this case, mobile chairs will be placed in a number appropriate to the capacity. The layout has been enriched by placing photographic panels and installations hanging from the ceiling that reproduce marine elements so that a visit to the centre can arouse emotions that increase the experiential value of the project.

Through the BioTourS project, IEC Tehnopolis created the BioTourS Dolphin Centre, which houses an educational exhibition on cetaceans. The centre was created on the premises of the Natural History Museum of Montenegro. The opening ceremony was held on 26 December 2022.





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