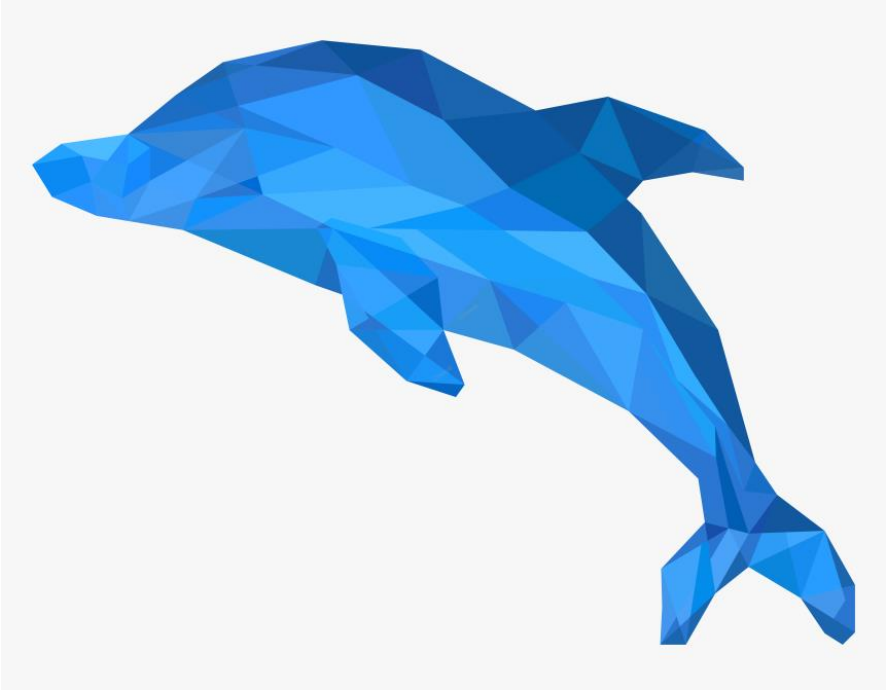
STUDY ON THE SUSTAINABLE TOURISM DEVELOPMENT AND CHALLENGES IN THE FIELD OF SCIENCE TOURISM – DOLPHIN OBSERVATION AND PROTECTION EXAMPLE IN MONTENEGRO



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INTRODUCTION

Tourism suffered the greatest crisis on record in 2020. According to UNWTO international arrivals plunged by 73% as the COVID-19 pandemic prompted nearly all governments around the world to introduce a range of measures to restrict travel, including border closures to tourists. One billion fewer international tourist arrivals for the year translates into an estimated loss of nearly $1.1 trillion in worldwide exports and over $2 trillion in direct tourism gross domestic product (GDP), more than 2% of the world's GDP. The pandemic has also put more than 100 million direct tourism jobs at risk, with women, youth, and micro, small, and medium-sized enterprises being the most vulnerable. At the same time, the pandemic allows a rethink of the structure of the tourism sector to increase its alignment with environmental and other public policy requirements. As tourism destinations gradually reopen and policies aim to spur a sustainable recovery.[1]

The principles of sustainability relate to the natural, economic and socio-cultural aspects of tourism development, and the appropriate balance must be established between these three dimensions in order to guarantee its long-term sustainability.

UNWTO foresees growth of the tourism industry and its associated tendency to overcrowd a destination progresses in tandem with strong environmental sentiments from consumers who increasingly demand cleaner, more sustainable and more environmentally friendly tourism destinations. Development of the biodiversity-based tourism products should aim at long-term sustainable development, promote social integration and increase the income of the tourism sector and that of the local community.

Since oceans cover more than 70% of the Earth's surface and are home to 94% of all life it's evident how vital marine environments are to the planet. Man has explored less than 5% of the Earth's oceans. As researchers strive to discover more, we're continually getting to know our oceans better. According to the World Register of Marine Species, there are now 240,470 accepted species, but this is believed to be just a small proportion of the species that exist, with new marine life being discovered every day.

The Adriatic Sea is one of the major global tourist destinations with rich but threatened biodiversity. Within the Adriatic Sea, there is The Boka Kotorska Bay, protected by UNESCO from 1979 as a cultural and natural heritage, with a coastline of about 100km, looking like a fjord and representing habitat for bottlenose dolphins.

This study is developed within BioTours (Biodiversity and Tourism Strategy to protect cetaceans) project with the aim to present the possibilities of developing sustainable tourism in the field of dolphin observation and conservation in Montenegro. The study refers to science tourism development based on dolphin observation, including good practice examples in dolphin conservation and sustainability.

The conducted research includes data on sustainable tourism, biodiversity, dolphin conservation methodologies, challenges and recommendation for the future.

[1] Big Data For Better Tourism Policy, Management, And Sustainable Recovery From Covid-19, Asian Development Bank (ADB) and World Tourism Organization (UNWTO),December 2021.

1. SUSTAINABLE TOURISM – A REQUIREMENT FOR SURVIVAL

As a result of intense and chaotic development, many tourist destinations face a growing pressure on their natural, cultural and socio-economic environment. It is now acknowledged that uncontrolled growth of tourism, which aim is short-term economic benefit, results in many negative impacts, disturbance of the environment and culture of local communities, destroying the foundations on which its development is based.

The contribution of tourism to overall sustainable development is enormous and requires a special treatment of this activity. On the one hand, this is due to the volume and dynamics of growth and economic effects that affect the economies of many countries and the living standard of the population. On the other hand, the character of tourism involves multiple and specific links between visitors, the environment, service providers and the local community, the integration of various economic and non-commercial activities, public institutions and social organizations. In this context, three important aspects of these relationships should be considered: interaction, awareness and dependence, as the premise of sustainable development. Therefore, tourism is also necessary for sustainable development.

The principles of sustainability relate to the natural, economic and socio-cultural aspects of tourism development, and the appropriate balance must be established between these three dimensions in order to guarantee its long-term sustainability. Therefore, sustainable tourism should:

- Make optimal use of natural resources which are the key element of tourism development, maintaining important ecological processes and preserving natural heritage and biodiversity;
- Respect the socio-cultural authenticity of the local community, protect their built and modern cultural heritage and traditional values and contributes to understanding and tolerance between cultures;
- Provide sustainable long-term business, generating socio-economic benefits that are fairly distributed to all stakeholders, including stable employment, income-generating opportunities and social care for local communities, as well as contributing to poverty reduction.

Tourism represents a major source of export revenues for many countries, and an important part of their GDP. The sector supports millions of direct and indirect jobs all over the world, particularly for women and young people. According to the UNWTO (United Nations World Tourism Organization) contribution of tourism to the world economy amounted to USD 3.5 trillion in 2019, or 4% of world GDP, measured in tourism direct gross domestic product (TDGDP).

In 2020-21, the COVID-19 pandemic caused an unprecedented disruption to tourism, resulting in a massive drop in international travel following a global lockdown and plunge in demand amid widespread travel restrictions put in place to contain the spread of the coronavirus. Tourism was the most affected sector by the COVID-19 pandemic, with businesses, employment and livelihoods around the world severely impacted by the crisis. The UNWTO's Economic contribution of tourism and the impact of Covid-19 report shows that tourism was the most affected sector by the COVID-19 pandemic, with businesses, employment and livelihoods around the world severely impacted by the crisis. The UNWTO key findings:

- The COVID-19 pandemic cut tourism direct GDP by more than half in 2020, reducing it by USD 2.0 trillion, to 1.8% of world GDP;

- International tourist arrivals dropped by 73% in 2020;

- TDGDP is expected to edge up to 2% of world GDP in 2021, following a rebound in domestic tourism and higher spending on both domestic and international travel.

Strategic framework for development of sustainable tourism in Montenegro

The new **Tourism Development Strategy of Montenegro 2021-2025**. with the Action Plan is drafted within the Working group at Ministry of economic development (since the previous one has expired in 2020). The new strategy will be an umbrella strategic document, which will define the vision of further development of tourism, considering the principles of sustainability, development needs and potentials of tourism in Montenegro. Tourism Development Strategy of Montenegro for the period 2021-2025. should provide an answer to the question of what kind of tourism Montenegro wants and should develop, and what key activities of tourism policy should be aimed for improving the competitiveness of Montenegrin tourism while respecting the principles of sustainable development.

The National Strategy for Sustainable Development until 2030 is the umbrella, horizontal, and long-term development strategy of Montenegro, which refers not only to the environment and economy, but also to human resources and social capital that should enable prosperous development of Montenegro. Project activities in the tourism sector are based primarily on respect for the principles of sustainability defined by the National Strategy for Sustainable Development of Montenegro until 2030.

As one of the priorities in the overall development of the Montenegrin economy, tourism is recognized in the development documents of the Government of Montenegro, in the following documents:

Development directions of Montenegro 2018-2021. – tourism is one of four priority sectors of development

Economic Reform Program for Montenegro 2020-2022. is the most important document of Montenegro in the economic dialogue with the European Union and a key strategic document of the country for medium-term macroeconomic and fiscal programming. Tourism is recognized as a priority reform measure 5: Diversification of the tourist product (measure "Sustainable tourism in the new reality")

Smart specialization strategy 2019-2024. Based on the strategic vision of the development of Montenegro, applying the s3 methodology and implementing the process of entrepreneurial discovery, five priority economic areas have been defined, namely: renewable energy sources and energy efficiency, sustainable agriculture and food value chain, new materials and sustainable technologies, sustainable and health tourism and ICT.

1.1 SUSTAINABLE TOURISM AND BIODIVERSITY CONSERVATION

Biodiversity means the diversity of living organisms that inhabit land and water, as well as diversity within different species, between species and ecosystems. Biodiversity is not only the overall diversity of forms and phenomena of flora and fauna, but also diversity of functions of living organisms. For the survival of our planet and the harmonious coexistence of human and nature, the world should focus on two main goals: conservation and sustainable use of biodiversity.

Biodiversity conservation is the conservation and restoration of damaged ecosystems and natural habitats, as and the conservation and recovery of plant and animal species. Sustainable use is the use of components biodiversity that does not cause disruption of biodiversity, but represents rational use of natural resources and maintaining the level of biodiversity potential that meets the needs and aspirations of present and future generations. Biodiversity conservation implies strategies at the local, national level and globally, based on environmental, social and ethical foundations. For that reason, it is necessary to:

- raise the level of research (inventory, identification, etc.);
- conduct regular monitoring of the state of biodiversity;
- rational use of biological resources;
- preserve and restore damaged ecosystems and habitats;
- have sustainable management of protected areas;
- establish red lists of rare and endangered species;
- implement international agreements and legal provisions regulating issues of biodiversity conservation and protection;
- educate and raise awareness of the population. [2]

As UNWTO foresees continued growth of the tourism industry and its associated tendency to overcrowd a destination progresses in tandem with strong environmental sentiments from consumers who increasingly demand cleaner, more sustainable and more environmentally friendly tourism destinations. These qualitative and quantitative trends necessitate the development and management of sustainable and biodiversity-based tourism products, linking tourism with the sustainable use of natural resources and conservation management.

The development of biodiversity-based tourism products should aim at long-term sustainable development, promote social integration and increase the income of the tourism sector and that of the local community. It should be based on a comprehensive action plan that focuses on product diversification, competitiveness and community-based development that emphasizes biodiversity protection and management, culture, heritage and sustainable tourism. [3]

According to the UNWTO and the Convention on Biological Diversity (CBD), sustainable tourism should contribute to the conservation of biodiversity and culture; to the well-being of the local communities and indigenous people; involve responsible action on the part of the tourist and tourism industry; be appropriate in scale; require the lowest possible consumption of non-renewable resources; respect physical and social carrying capacities; involve minimal repatriation of earned revenue; be locally owned and operate through local participation, ownership and business opportunities.

[2] Nature protection in Montenegro, 2019., Ministry of public administration, Greenhome p.7.

[3] Practical Guide for the Development of Biodiversity-based Tourism Products, 2010 World Tourism Organization – ISBN 978-92-844-1340-9, p.1.

1.2 EU COASTAL AND MARINE POLICY

Since the early 1970s, Europe has been firmly committed to environment protection. Air and water quality, conservation of resources, biodiversity protection, waste management and control of activities with adverse environmental impact are just some of the areas in which the EU is active, at both Member State level and the union level. European environment policy, based on Article 174 of the Treaty establishing the European Community, seeks to ensure the sustainable development of the European model of society. Here below are some EU directives regarding environment and marine issues.

- **The Habitats Directive** on the conservation of natural habitats and of wild fauna and flora. The habitats directive is basis for the development of the Natura 2000 network throughout the member states and accession countries.
- **Environmental Impact Assessment Directive** on the assessment of the effects of certain public and private projects on the environment.
- **Water Framework Directive** establishing a framework for Community action in the field of water policy and integrated river basin management for Europe.
- **Strategic Environmental Assessment Directive** on the assessment of the effects of certain plans and programmes on the environment.
- **Environmental Liability Directive** on environmental liability with regard to the prevention and remedying of environmental damage.
- **Maritime Spatial Planning Framework Directive**
- **Marine Strategy Framework Directive** on establishing a framework for community action in the field of marine environmental policy which will be presented briefly in the following text.

European Union's Marine Strategy Framework Directive aim is to protect more effectively the marine environment across Europe. The Marine Strategy Framework Directive was adopted on 17 June 2008. The Commission also produced a set of detailed criteria and methodological standards to help Member States implement the Marine Strategy Framework Directive. These were revised in 2017 leading to the new Commission Decision on Good Environmental Status. Annex III of the Directive was also amended in 2017 to better link ecosystem components, anthropogenic pressures and impacts on the marine environment with the MSFD's 11 descriptors and with the new Decision on Good Environmental Status.[4]

The Commission adopted a report on the first implementation cycle of the Marine Strategy Framework Directive in June 2020 (Figure 1). This report, required by Article 20 of the Directive shows that while the EU's framework for marine environmental protection is one of the most comprehensive and ambitious worldwide, it needs to be beefed up to be able to tackle predominant pressures such as overfishing and unsustainable fishing practices, plastic litter, excess nutrients, underwater noise and others types of pollution. [5]

[4] https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

[5] Also 3

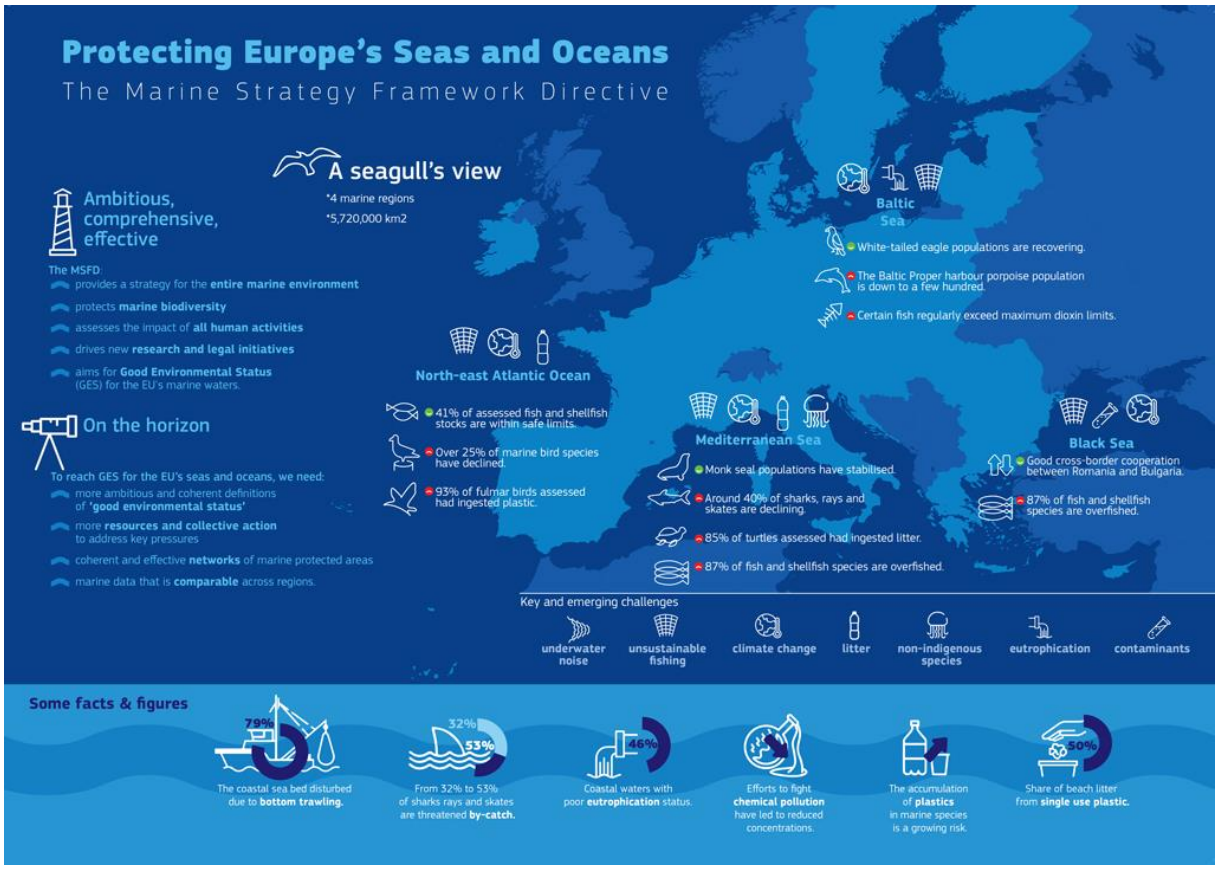

Figure 1. *Illustration of the Marine Strategy Framework Directive*

Source:https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

Even though The Directive has provided better understanding of the pressures and impacts of human activities on the sea, and their implications for marine biodiversity, their habitats, and the ecosystems they sustain, there is still room for improvement. The knowledge gained from implementing this Directive was for example a driving force leading to the adoption of the Single use Plastics Directive. It has led to increased cooperation among littoral Member States of the four European sea regions, as well as across marine regions. As a result, non-EU Member States also aim to achieve good environmental status or its equivalent. Still, EU Member States could further improve their coordination, namely in determining the coordinated objectives and targets and having effective measures tackling the right pressures. [6]

1.3 DOLPHIN CONSERVATION – EXAMPLE OF GOOD PRACTICE

As a good example on dolphin conservation connecting science and tourism on EU territory we chose The Blue World Institute in Croatia. The Blue World Institute of Marine Research and Conservation was founded in 1999 by a group of 10 members, all previously involved in the Adriatic Dolphin Project. This independent non-profit organisation was set up with the intention to carry out scientific research and conservation of the marine environment as well as educational activities, with an emphasis on the Adriatic Sea and the wider Mediterranean basin. Their three main programmes – research, education

[6] Adapted according to https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

and conservation – provide a framework for executing multiple projects aimed at furthering the understanding of the marine environment, its flagships species, and public participation in their protection. With partner organizations in Montenegro, Italy and Albania, The Institute conducted several survey programs, aerial surveys in the whole Adriatic Sea in 2010 and 2013 and the results of these surveys present the first ever data on distribution and abundance of cetaceans, sea turtles and giant devil rays in the Adriatic and are setting the reference point for a regular monitoring programme.[7]

Besides research, The Blue World Institute has also an educational programme for delivering accurate and evidence-based knowledge on the state and status of the marine environment, endangered species and assisting conservation efforts. Educational programme includes programme for kindergartens and schools, marine education centre and marine science museum to be opened in the future. The scope of work in conservation is widen through partnership with many organizations, projects and educational activities.

Dolphin conservation at Blue World Institute

It is emphasized that there is a fine line between enjoying dolphin watching, with minimal or no impact on their behaviour, and causing severe disturbance while chasing them around. It is all too easy to step over this line if you are not careful and observant. Like humans, dolphins exhibit various natural behaviours throughout the day. They all serve a particular purpose and contribute to the overall health and survival of individuals within a group. These include feeding, travelling, resting, maternal care, social interactions and others. Having this in mind, it is clear that by approaching dolphins in the wild, we are creating a disturbance in their routine. To a certain extent, we are forcing them to abandon their current activities to deal with our presence. Persistent disturbance may cause long-term negative impacts such as stress related health issues, reduced reproductive success or avoidance of previously very important areas. What we choose to do when we encounter dolphins is going to make a huge difference to their well-being.[8]

In order to avoid the negative impacts, there is a set of rules (Figure 2) that need to be followed when observing the dolphins.

[7] https://www.blue-world.org
[8] Also 6

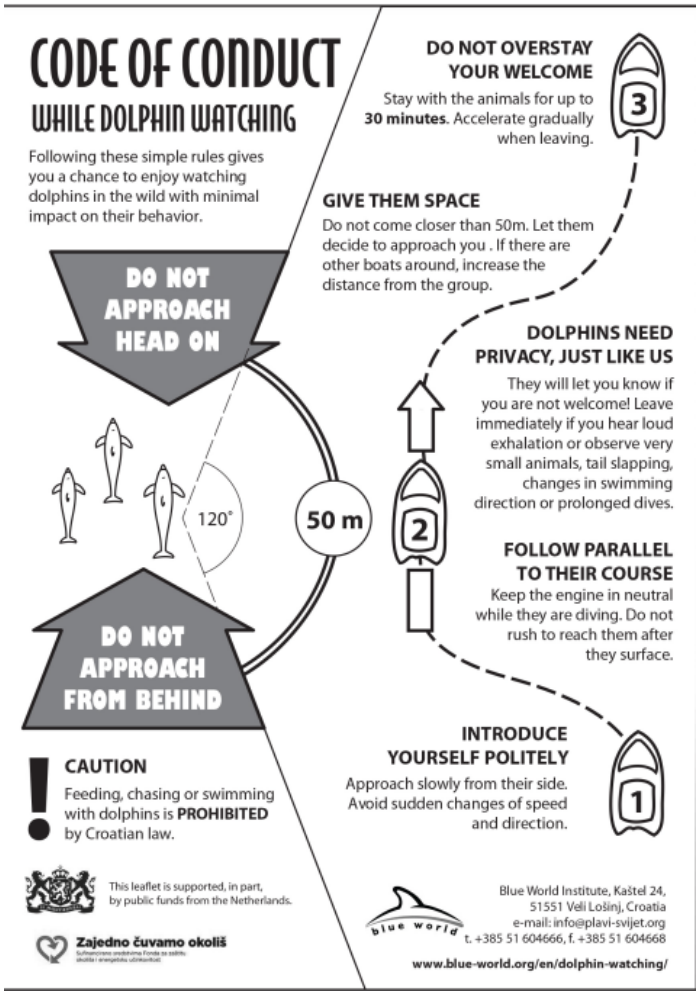

Figure 2. *Code of conduct while dolphin watching*
Source: Blue World Institute

Besides the code of conduct there are some important issues that should be taken into consideration very carefully when observing the dolphins according to The Blue World Institute:

- **Do not swim or dive with the dolphins.** There is a risk of harassing the animals while trying to position the boat in such a way that would enable a person to dive close to the group. Dolphins can move through water much faster than any swimmer so chasing them around is not going to give a chance for a closer look.

Situation is not safe for people or the dolphins. These are wild, untrained animals with unpredictable behaviour and should be treated with care and respect. People need medical attention due to bites and body strikes inflicted during such interactions.

While people in the water may become objects of interest for nearby dolphins, their curiosity should not be misinterpreted as friendly behaviour. By trying to seek out their attention, swimmer is disrupting their natural behaviour and forcing them to abandon their current activities such as resting, feeding and socialising.

The repeated presence of people in the water can also have the effect of decreasing fear of human interaction making them more vulnerable to boat strikes, entanglement in fishing gear or even intentional harassment.

Both humans and dolphins are mammals. Although sea water acts as an effective disinfectant, interaction with wild dolphins may result in disease transfer. These may present serious health threats to dolphins and humans alike.

Finally, swimming with dolphins represents harassment.

- **Do not feed the dolphins.** Many people lose track of the fact that dolphins rely on their hunting skills to survive as predators in the wild, and offer them food. Most believe they are helping "starving" dolphins by providing an easy meal. Some are trying to trick the dolphins into coming closer in hope of prolonging the encounter. While these are probably not the only reasons behind this kind of conduct, the results are always adverse. This is why:

- Dolphins can get accustomed to receiving food and become increasingly dependent on humans to provide the next meal.

- The adopted habit of looking for food near humans can prove to be fatal to offspring that may not learn essential hunting and foraging skills. These individuals become completely dependent on human intervention to survive.

- Animals used to receive food will often accept items they would normally refuse to eat. Ingestion of inappropriate food items such as candy bars, pretzels or even plastic objects that are sometimes offered by people who are unaware or unethical can lead to serious health problems.

- Even if people provide fish or other marine organisms such as squid, bear in mind the species in question may not be part of the natural diet of dolphins. These can be contaminated by bacteria and become a source of, potentially lethal, infection if improperly handled or stored.

- Dolphins accustomed to taking food from people lose their fear of humans and frequently approach boats. Being less cautious places them at greater risk of entanglement in fishing gear or ingestion of deployed equipment.

- Dolphins used to receive food from humans can become aggressive if you fail to produce the expected hand out or try to touch and tease them. These are wild animals with unpredictable behaviour.

- Feeding dolphins in the wild constitutes harming and harassment for reasons explained above.

The major scientific research interest of the Blue World Institute is the study of common bottlenose dolphins (Tursiops truncatus) in the Adriatic Sea, implemented through the Adriatic Dolphin Project (ADP) (Picture 1). Initiated in 1987, the ADP is now the longest ongoing study of a bottlenose dolphin population in the Mediterranean Sea and one of the longest in the world. It is recognised as an example for best practice, reflected in the international cooperation it has created. Over the years The Blue World Institute is using a wide spectrum of research methods to increase scientific knowledge on the ecology of the Adriatic marine environment, and on the anthropogenic impact on ocean health.

Picture 1*: Research Adriatic Dolphin Project*

Source: Blue World Institute

Some of the research methods used by The Blue World Institute in order to increase scientific knowledge on the ecology of the Adriatic marine environment, and on the anthropogenic impact on ocean health are listed below.

Aerial Survey - two aerial surveys carried out on the distribution and abundance of bottlenose dolphins (Tursiops truncatus) and other species of conservation interest in the entire Adriatic Sea. These surveys provided the first complete aerial survey data at the basin level on the distribution and abundance of these species.

Behaviour - understanding dolphins' behaviour is important in order to understand habitat use, population health and threats, etc. The goal is to understand the amount of time an individual spends doing one activity, creating a "behavioural budget" for an individual or group. Some activities aim at researching changes in the behaviour of individual dolphins in the vicinity of different vessels.

Bio Acoustics - research of the impact of underwater noise (sound pollution) on dolphins and their habitat through the application of passive bioacoustics. At great depths, where visibility is reduced, dolphins rely on their hearing to understand their environment. Over time, they have evolved a highly-sophisticated system of sound production and reception called echolocation, which is used for communication, prey detection, locating potential threats, orientation and navigation.

Diet - analysing the partially digested stomach contents of dead dolphins in order to identify their prey. Bottlenose dolphins are generally opportunistic feeders consuming fish and cephalopods (e.g., squid). The analysis detects the presence of the beaks of cephalopods and fish sagittal otolith (ear bones). Continuous monitoring of feeding habits is important because any shift in preference prey species could imply changes, not just in fish stocks, but also increasing competition with fishery in the area.

Genetics - understanding the genetic population structure in cetaceans provides insight into their biology and behaviour over both the long-term evolutionary and short-time scale. Such knowledge is important for conservation and management strategies because, while bottlenose dolphin enjoy a wide distribution at species level, there are survival challenges at population and group levels.

Picture 2. *Source: https://www.blue-world.org/*

Location-Tracking - supplements the photography and identification of the animals by recording the locations of sightings of groups and individual dolphins; it allows investigating the many different habitat uses.

Photo-identification - commonly used research tool used to identify individual dolphins and other animals. The camera "captures" an image of the animal whenever it is sighted, based on the amount of times it is "captured" a statistical method called "mark – recapture" is used to estimate the size of the population in a defined area.

During an encounter with dolphins, researchers photograph marks (such as cuts or scars) on the back of the animals.

Picture 3. *Source: https://www.blue-world.org/*

Picture 4. *Source: https://www.blue-world.org/*

The Blue World Institute has created several programmes and possibilities for interested citizens and tourist to get involved and participate in scientific activities to advance conservation. One of them is **Citizen science programme** which includes: [9]

Marine Partnership Application

Every time you are out at sea –diving, surfing, sailing, or even swimming – you might encounter a whale, a dolphin, a sea turtle or experience another event worthy of noting for conservation purposes. Report your sighting by filling in our form or report your sightings using our Marine Partnership mobile application for iOS and Android. The Blue World Institute has created a mobile device application with the purpose to expand the information available about marine species in the Adriatic by increasing public participation in science-based data collection (Figure 3).

Figure 3. *The Blue World Institute application*

Report a Sighting

Every time you are out at sea – diving, surfing, sailing, or even swimming – you might encounter a whale, a dolphin, a sea turtle or experience another event worthy of noting for conservation purposes. With help from members of the public and seafarers we can identify the spreading of alien species or quickly identify emerging environmental issues. It would help us a lot if you would share the information about these sightings with us. Please complete the form below and click send. You do not have to send all details but the fields marked with asterisk are necessary for a useable form. This information will be added to our growing database and will help us better conduct our marine protection work. Sometimes identification of species is tricky, especially when there are first-time reports. To confirm such reports we kindly ask you to add a photo or a short video, or add a link to allow us to download it. Contact info@blue-world.org if you have any questions or need assistance in completing the form.

[9] https://www.blue-world.org/

2. TOURISM AND BIODIVERSITY IN MONTENEGRO

Biodiversity is vital for tourism. Coasts, mountains, rivers and forests are major attractions for tourists around the world. Tourism in the Caribbean, Mediterranean and much of Southeast Asia depends strongly on the recreational opportunities provided by their coastal environments. Biodiversity plays different roles in different types of tourism. All tourism – even in city centres – relies on natural resources for supplies of food, clean water and other 'ecosystem services' that ultimately depend on biodiversity. For most other types of tourism, biodiversity contributes significantly to the attractiveness and quality of destinations, and therefore to their competitiveness: for example, coastal water quality and natural vegetation are both ecosystem services that contribute to destination attractiveness. And biodiversity is a direct attraction at the heart of nature-based tourism products – such as wildlife watching, scuba diving or tourism in protected areas. [10]

However, biodiversity is under pressure worldwide and has suffered severe losses as more land is converted for human use from a natural state, and as these human uses become more intensive. In 2005, the UN's Millennium Ecosystem Assessment concluded that human activities threatened the Earth's ability to sustain future generations. [11]

Tourism is the main economic activity in Montenegro and contributes almost 25% of the total GDP. Over 90% of total tourism turnover is recorded on the coastal part of Montenegro. Area of Montenegro is 13.812 km² with population of 625.000 inhabitants. The length of the coast is 293 km and beaches 72 km. The highest mountain peak is 2.525 m. Climate varies from Mediterranean to continental. Montenegro has very favourable weather conditions. Average air temperature in the summer is 27.4 ºC. Maximum sea temperature is 27.1 º C. Average number of sunny days during the year is 240. Swimming season lasts for 180 days. Montenegro has five national parks: Biogradska Gora, Durmitor, Lovcen, Skadar lake, Prokletije. Bay of Kotor, similar to a fjord, it is surrounded by mountains up to 1000m, which descend almost steeply into the sea.

In September 1991, Parliament of Montenegro declared Montenegro an ecological state, expressing a close connection between human and nature and calling for the protection of land and nature. The current Constitution reflects important elements of this Declaration and in this supreme legal act Montenegro was declared as an ecological state.

One of the main areas covered by the Acquis the communautaire of the European Union is the environment and use of natural resources. It is considered that one of the most important steps in the EU integration process is the adoption of appropriate regulations and standards in this area. European environment protection practice is an effective way for improvement and preservation in order to fulfil a basic human right, the right to healthy environment. European norms and standards need to be implemented not just because of the conditions of EU membership, but also because of the essential right to a quality environment.

Even if there is no formal ecosystem classification in Montenegro, broadly recognized classification, from the biodiversity conservation stand point in the National Strategy of Biodiversity with Action Plan are the following ecosystems: mountain, forest, grassy, freshwater, marine, coastal, karst, cave and canyon. Habitats are inhabited by crowd's species from almost all systematic categories. Within its coverage, 54% is covered by forests while natural forests cover 45% of the territory. Currently,

[10] Tourism and Biodiversity – Achieving Common Goals Towards Sustainability, 2010 World Tourism Organization – ISBN 978-92-844-1371-3, p.8.
[11] Also 2

protected areas cover 12% of the territories with a total of 73 protected areas of which the largest part (101,733 ha or 7.32%) are 5 national parks. The rest of protected areas refers to: nature parks (5), strict nature reserves (3), special nature reserve (1), nature monument (57), a region of outstanding features (2).

Since 1979 The Bay of Kotor and Risan (15,000 ha) is on the UNESCO World List heritage and it is subject of international protected area.

The coastal area of Montenegro is characterized by a series specific and diverse habitats and animal community. A review of available literature data can be concluded that the coastal area of Montenegro is inhabited by 1540 plant species, 113 lichens, 283 mosses, 232 fungi, 289 invertebrates, 29 representatives of ichthyofauna, 18 amphibians, 38 reptiles, 249 birds and 69 mammals. The Montenegrin sea zone covers area of 12 nautical miles (22,26 km) from the coast, covers 2.504,8 km2 and reaches a maximum depth of 1.233 meters. [12]

2.1 IMPACTS OF TOURISM ON BIODIVERSITY

Tourism has positive and negative impacts for biodiversity. It can be a way of protecting areas from other more detrimental forms of development and of providing an economic basis for investments in conservation and ecosystem restoration, and for generating local employment in areas where there are few other employment options: the value of national parks for tourism and the development of private game parks in South Africa are examples. Tourism also has serious negative effects on the environment arising from land conversion for tourism, inappropriate siting of tourism, pollution and wastes, overexploitation of natural resources, and disturbance of wildlife. It can also create negative social impacts linked to conflicts over resource use, clashes between tourists and local cultural norms and values, or associated with working conditions and opportunities for local people to work in tourism businesses. [13]

Tourism, produces an impact on the environment, even at low levels of intensity and despite the best management of protected areas. Such influences also occur at the level locations and in larger areas. Ecological risks from tourism are: construction of accommodation, visitor centres, infrastructure development, vegetation removal, habitat and species loss, impact on drainage, etc. Habitats can change significantly with the construction of roads, the establishment of hunting reserves, by establishing cultivation areas, removing trees and acting on erosion. Transportation may have direct negative effects on the environment (eg removal of vegetation, transfer of weeds, disturbance of animals).

Tourism in protected areas creates space for neglecting those protected areas that have important conservation values but limited attraction for tourists. Ecotourism / sustainable tourism strategies should be based on strengthening the positive benefits and reducing the negative impact on environment before they occur. This is best achieved through well-designed planning strategies. Each protected area should have a plan that envisages how the tourism and development of that area will be managed. The plan should describe in detail the specific goals and objectives defined by the regulations in the field of nature protection.

[12] Nature protection in Montenegro, 2019.,Ministray of public administration, Greenhome p.18.
[13] Tourism and Biodiversity – Achieving Common Goals Towards Sustainability, 2010 World Tourism Organization – ISBN 978-92-844-1371-3, p.18.

Measures for biodiversity protection in the field of tourism:

- increasing the share of tourism revenues that will be used for environmental protection and biodiversity measures;
- improving water saving measures in the coastal area in order to reduce the need to obtain water from the lake;
- improving the implementation and enforcement of measures to mitigate the negative impacts of tourism on biodiversity in the sea.[14]

2.2 PROTECTION OF COASTAL AND MARINE AREA IN MONTENEGRO

The Montenegrin coast includes two significantly different areas by geographical and hydrographic-oceanographic characteristics: Bay of Kotor and open sea in front of the coastline. The total area of the sea is 6.347 km2 and the territorial sea about 2.100 km2 (of which 89 km2 in the Bay of Kotor). The coastal area in whole, and especially the narrower coastal area, with its natural, cultural and landscape values, is a key development resource of Montenegro. At the same time, the pressure of urbanization, especially real estate construction and hospitality facilities, result in numerous examples of endangering environment, as well as natural, landscape and cultural resources, which represents the most significant threat to the sustainable development of the coastal area. Except the anthropogenic impact, additional pressure on the resources of the land and sea makes the climate change. The marine ecosystem is exposed to numerous and diverse pressures which, above all, include the effects of pollution from untreated utility wastewater, solid waste, shipbuilding / ship repair, from port and marina. [15]

Vulnerability analysis (results from the Monitoring Program of the coastal sea area ecosystem of Montenegro, conducted in the period from 2008 to 2011) showed a very high vulnerability of the sea in the Bay of Kotor (Figure 4).

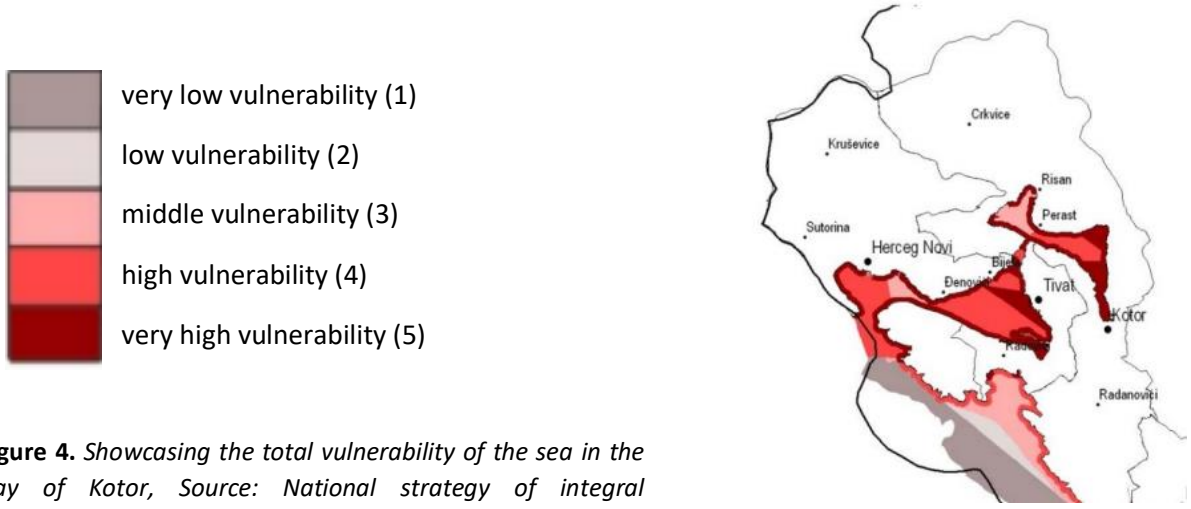

Figure 4. *Showcasing the total vulnerability of the sea in the Bay of Kotor, Source: National strategy of integral management of the coastal area in Montenegro, p.36*

[14] Nature protection in Montenegro, 2019., Ministray of public administration, Greenhome p.31.
[15] Petović, S. (2018): Protection of coastal and marine areas of Montengro. Kotor: University of Montenegro, Institute of marine biology, p. 1.

The following areas are recognized as extremely vulnerable: the most indented part of the Bay of Kotor, the part in between Shipbuilding in Bijela and the port of Porto Montenegro, the area around the island of Sveti Marko in the Bay of Tivat, part of the Herceg Novi Bay from Igalo to Mamula (Figure 5).

Generally, at the narrow coastal area of the open sea and the Bay of Kotor are very vulnerable to pollution from eventual accidents at the sea.

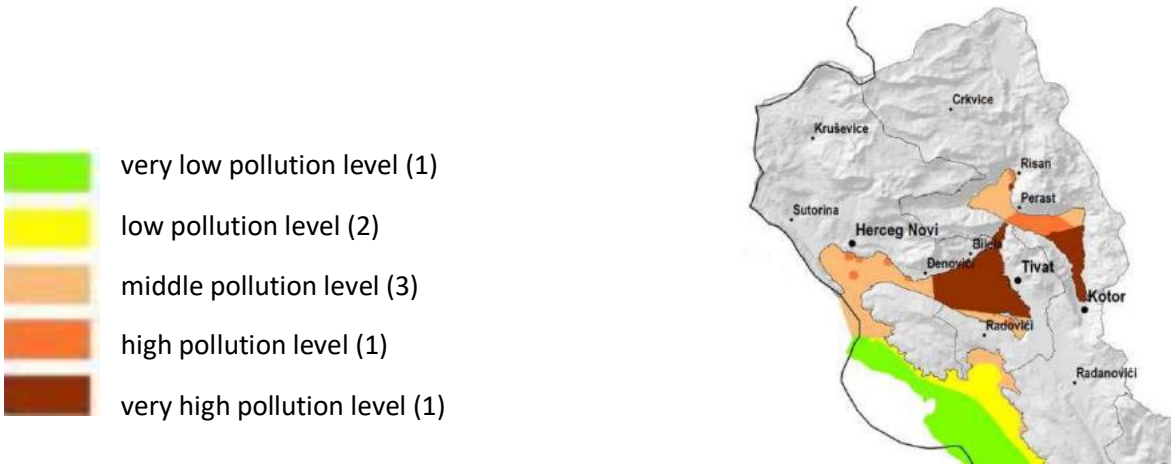

Figure 5. *Total pollution / endangerment of the sea in the Bay of Kotor (maximum value). Source: National strategy of integral management of the coastal area in Montenegro, p. 37*

Water and sediment pollution are especially present in the immediate vicinity of Shipbuilding in Bijela and the narrow coverage of the location of the former Overhaul Institute "Arsenal" in Tivat where high concentrations of heavy metals and organic metals have been recorded as pollutants. The level of pollution in the open sea is lower due to the relatively large depth and good mixing of the waters. Communal wastewater is a major source of marine pollution throughout the coastal area.

3. LEGAL FRAMEWORK REGARDING BIODIVERSITY AND MARINE AREA IN MONTENEGRO

There is a set of laws and other legal instruments governing biodiversity protection and use of coastal area. We point out some of the most important and relevant as follows:

1. Law on Environment ("Official Gazette of Montenegro", no. 52/16), which regulates the principles of environment protection and sustainable development, instruments and environmental protection measures as well as other issues of importance for the environment;

2. Law on Nature Protection ("Official Gazette of Montenegro", no. 54/16) regulates the conditions and modes of protection and nature conservation and is the primary regulation in this sub-area. Transposes habitat directives and wild birds and the CITES Regulation;

3. Law on National Parks ("Official Gazette of Montenegro", no. 28/14, 39/16) which defines protection, promotion and development of national parks;

4.Law on Animal Welfare protection ("Official Gazette of Montenegro", no. 14/08, 40/11, 47/15) which regulates obligations and responsibilities of legal and personal entities for the protection of the

welfare of animals they are holding for production, keeping them away from unnecessary pain, suffering or injury, protection in killing, slaughter and transportation, when performing procedures on animals and conducting experiments, as well as other questions from importance for animal welfare;

5. Law on the protection of the marine environment ("Official Gazette of Montenegro", no. 073/19) refers to protection, conservation, sanation and valorization of marine ecosystem i biodiversity protection and other important issues regarding protection of marine enivronment.

Besides the above mentioned, there are several laws that regulate the issues of proclamation and management of protected areas such as: Law on Spatial Planning, the Law on Forests, the Law on Environmental impact assessment, Law on Strategic impact assessment of environment, Law on Responsibility for Environmental Damage, Law on the Sea, Law on Maritime Property, Law on Marine Fisheries and Mariculture, Law on Marine Protection from pollution from vessels, etc.

The organization of the institutional system in Montenegro indicates that special importance is given to the coastal area. The area of marine property, as the most important part of the coastal area, since 1992. managed by the Public Enterprise for the management of marine assets. A large number of departments, state administration bodies, institutions and bodies of local authorities have competencies for improvement of coastal zone management of Montenegro.

Many documents define and treat the coastal area from the aspect of its protection and use. One of the crucial ones is the Special Purpose Spatial Plan for Coastal Area of Montenegro. The SPSP for the Coastal Area of Montenegro defines the mode of organizations and regimes of use of the coastal region. The plan provides rational use of space and drives significant economic development. Coordinated activities from the local level to the state, which is a prerequisite for achieving strategic development priorities of Montenegro. Special attention in the Plan is given to the narrower coastal area which is protected in accordance with the Protocol of the Barcelona Convention. The purpose is to connect the narrower coastal areas with natural hinterland. The Plan identifies the area marked as a maritime asset and its integral part, among other things, the sea (territorial and internal sea waters - except Skadar Lake), limited to the mainland from the coastline to the line where the highest waves are reaching during the strongest weather (SPSP for the Coastal Area of Montenegro, 2018).

4. BOKA KOTORSKA BAY - DOLPHIN HABITAT

Through many research works, Boka Kotorska Bay has been recognized as a natural habitat for marine mammals, including dolphins. Research works and field research on this topic have gained momentum only relatively recently. The first workshops were part of international projects dealing with environmental protection.

The first such project, which was conducted from October 2012 to September 2015 - **NETCET project**, "Natural and cultural resources and risk prevention". The aim of this cross-border cooperation program was to strengthen the capacity of the Adriatic region for sustainable development through a joint strategy of action among partners from specific areas.
The most important goal of the NETCET project was to develop a joint strategy for the protection of marine mammals and sea turtles in the Adriatic through regional cooperation (Adriatic cooperation). Marine mammals and sea turtles are common, endangered natural legacy that cannot be managed by

a single state. Due to the migratory nature of these species and shared responsibilities between Adriatic states, cooperation was needed in planning an effective long-term protection strategy.
The problem of protection of marine biodiversity, especially the protection of marine mammals and sea turtles is a common goal for all countries in the Adriatic, but practical experience in this field in the region varies from area to area. It is therefore recognized as important to bring together best practices and experiences in order to define a common protection framework, tools and measures for the protection of endangered marine species.

NETCET project, coordinated by the city of Venice, was managed by thirteen partners from several Adriatic countries: Montenegro, Italy, Croatia, Albania and Slovenia.

From theory to practice, in June 2013, monitoring of marine mammals by ships within territorial waters of the Republic of Montenegro, started with members of Blue World Institute from Croatia, in close cooperation with the Institute of Marine Biology in Kotor. This research provided the first data on the presence of marine mammals in this region.

A three-member team from The Institute of Marine Biology from Kotor has been trained by experts from the Croatian Blue World Institute about basic photography techniques and how to identificate a particular species of dolphins, according to special markings (notches, scars, natural coloring, etc.) on their fins and bodies.

From 26 done field trips, 15 resulted by finding and observing dolphins. The majority of dolphins were found in the open waters of the Adriatic within Montenegrin territorial waters and two partially regular groups appeared frequently, one in front of the famous tourist place Petrovac (near the town of Budva), and another inside Boka Kotorska Bay. This knowledge was used to implement a detailed conservation plan for cetaceans and enforce their protection. A total of 8 individual bottlenose dolphins were identified through photo-ID during the research effort in Boka Kotorska Bay. However, later the same study reported 72 catalogued individuals in the Montenegrin waters.

An article published in 2016, confirmed the presence of bottlenose, striped dolphins and other cetaceans such as the Cuvier's beaked whale and the Risso's dolphin and occasional sightings of fin whales in the Boka Kotorska Bay. However, only bottlenose dolphins were pinpointed as regular visitors of Montenegro.[16]

The Montenegro Dolphin Project ran the first dedicated annual survey effort within the coastal and offshore waters of Montenegro between 2016 and 2017, with plans to keep the survey effort going until 2020. The results presented contribute to fill the gaps in knowledge and provide baseline information on the cetaceans of Montenegro.

During the study, regular sightings of bottlenose dolphins and striped dolphins were recorded throughout the year. The encounter rate of bottlenose dolphins was estimated at 4 groups (9 individuals) per 100 km_2 for the entire country. Additionally, photo identification study of bottlenose dolphins revealed multi-year sightings of individuals with varying degrees of residency patterns, ranging from transient to regular individuals. Several individuals were noted to travel from the southern to the northern edge of Montenegro, and vice versa, with a maximum re-sighting distance of 80 km.

This project builds on integrating scientific research with community engagement for sustainable and effective conservation strategies on marine environment in the South Adriatic Sea. The focus is on

[16] Bottlenose dolphins and Striped dolphins: Species distribution, behavioural patterns, encounter rates, residency patterns and hotspots in Montenegro, South Adriatic, 2016 - 2017

cetaceans, because of their vital role on the balance of the marine ecosystem, as top predators. All of the cetacean species found in Montenegro are either classified as “Threatened” or “Data Deficient”, therefore conservation and management measures are of enormous importance not only on these species but also on the ecosystem that they support. Up until this project there have been no systematic annual scientific surveys carried out in Montenegrin waters, despite the consistent and expanding human threats. Montenegro is already a partner country of ACCOBAMS (The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area), and thus it holds the goal of healthy marine ecosystems through cetacean conservation. The lack of knowledge on cetacean populations here is, indeed, one of the strongest barriers against effective marine conservation effort in Montenegro.

For this purpose, the project was designed to carry out standardised annual surveys. Surveys were conducted both from the land and by boat, covering the entire coastline of Montenegro. These surveys provide regional level data about distribution, population statuses, abundance, residency patterns and human impacts, specifically touching on the effect of marine traffic. Besides the scientific scope of the project, another objective is to engage and inform stakeholders, from fishermen to students, and encourage them to carry out citizen science activities by organising community activities. This particular report aims to delineate the outcomes of our annual survey effort to initiate the first steps towards efficient conservation measurements and to raise awareness in the community about the cetacean species inhabiting the coast of Montenegro.[17]

The entire coastline of Montenegro, between Ada Bojana and Herceg Novi has been surveyed using a combination of fixed land stations and boat based surveys. Survey area covered the coastline and territorial waters in Montenegro (Figure 6).

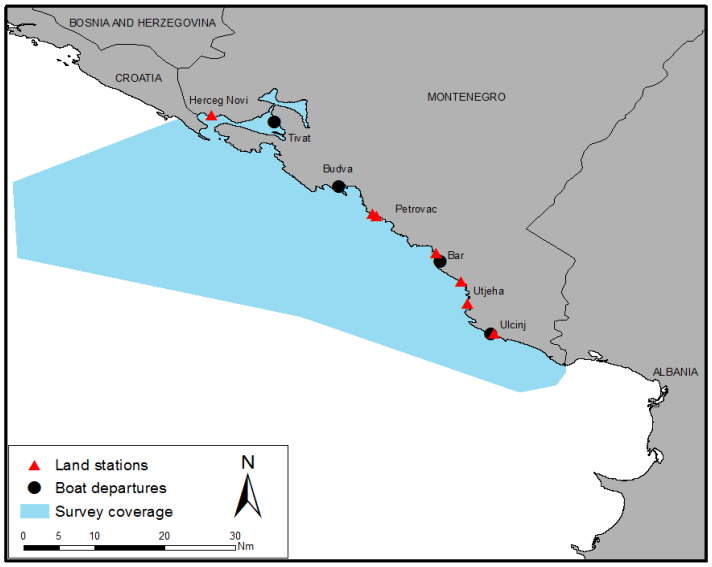

Figure 6. *The map of survey area (showed in light blue polygon). The polygon has been created according to our line and boat surveys to represent the true coverage*

[17] Bottlenose dolphins and Striped dolphins: Species distribution, behavioural patterns, encounter rates, residency patterns and hotspots in Montenegro, South Adriatic, 2016 - 2017

5 survey stations were selected to represent the Southern Adriatic Sea along the Montenegrin coastline (Table 1). Each survey station was selected with an optimal vantage point to study the animals as good as possible. Land based observations enable researchers to observe the natural behaviour of the focal group, without the possible impact of research vessels nearby. Two sets of land surveys were conducted; morning surveys (beginning with sunrise) and afternoon surveys (ending with sunset). Each survey occupied a minimum duration of three hours.

Table 1 *The coordinates and altitudes of land stations*

Station	Longitude	Latitude	Altitude (m)
Ulcinj	19˚12'37.8" E	41˚55'28.7" N	92
Utjeha	19˚08'45.8" E	41˚59'46.1" N	8
Bar	19˚04'18.7" E	42˚07'10.7" N	18
Petrovac	18˚55'17.4" E	42˚12'54.2" N	148
Herceg Novi	18˚32'24.8" E	42˚27'10.9" N	84

To determine geographic positions, a theodolite (SOKKIA DT5A) was operated and vertical and horizontal angles of target objects were recorded. To transfer the theodolite readings into geographic positions the tracking software Pythagoras (version 1.2) was used, based on the predetermined reference point and azimuth.

At least four researchers were present during the land surveys; one researcher was responsible for the theodolite operation, another one for entering the theodolite data in a computer in the Pythagoras software and at least two researchers were engaged with the scanning of the sea surface with binoculars. In case of a sighting, the behavioural data of the focal animals was determined ideally by the person using the theodolite. The other person with binoculars was responsible for entering the behavioural data on the data sheet. All members of the observation team rotated their responsibilities hourly.

Boat surveys have been carried out by following five different routes for the purpose of covering the entire Montenegrin coastline. 1. Bar to Utjeha, 2. Ulcinj to Utjeha, 3. Ulcinj to Ada Bojana, 4. Budva to Kotor and 5. Kotor Bay. Each route was tried to be followed at least once per month and data collection took place between sunrise and sunset (6:00 and 21:00), covering 3 to 7 hours per day, depending on the sea conditions. Surveys took place only in calm seas with Beaufort Sea State between 0-3 and good visibility (>1nmile). The speed of the boat was relatively constant with an average of 3 knots. Surveys have been carried either with 6-meter outboard engine fishing boats, 12-meter outboard speed boats or 17 m sailing boat under inboard engine.

Using a GPS (Global Positioning System), the geographic position of the observation boat was recorded every 3 seconds. In case of cetacean presence, the angle and the distance of the focal group from the boat was determined, to calculate the true coordinates of the cetacean group. The boat approached to the sighted cetacean group with an idle speed to get an accurate data and photographs on the focal cetacean group. As such, focal cetacean group was approached from the side or rear of with an idle speed whenever possible. The focal group was followed from a minimum distance of 50 m to a maximum of 400 m and if the dolphins approach closer, our vessel speed was reduced gradually. The research boat avoided showing sudden changes on its direction and speed. Any changes in the behaviour of the focal group due to the presence of the research boat were also recorded in order to measure our impact.

The survey team consisted of minimum 5 researchers; one researcher scan with the naked eye until 500 m distance from the boat, two researchers use binoculars scanning onward from 500 m, two photographers stationed on the bow-side of the boat. Researchers rotate hourly (starboard, centre,

port) to avoid fatigue. While starboard and port researchers were responsible from actual sightings, the researcher in the centre was only responsible from data recording. All sightings and effort data as well as environmental and survey conditions was recorded on the printed data sheets and entered into a database at the end of a survey day. Focal group datasheets contain information on cetacean species observed, observation time, observation number, the distance and angle of the species from the observation boat, species cluster size, their behaviour, their impacted behaviour. Environmental datasheets were composed of cloud cover, Beaufort scale or glare percentage on the sea surface. While focal group was recorded every 5 minutes after the initial sighting, environmental data collected in hourly bases.

Focal groups were defined as any aggregation of dolphins, observed in a clearly visible constellation (less than 100 meter apart from each other), with similar behavioural activities. The method of focal group scan sampling was chosen to collect behavioural data. With scan sampling the behaviour of all individuals in a focal group are recorded at a predetermined time interval of 5 minutes. Those behaviors can be regarded as states or events; behavioral states endure for an appreciable time, whereas behavioral events are instantaneous. Both, events and states were documented. Per each sampling unit (every 5 minutes), the present behavioral states and events and the number of individuals engaged with these behaviors were noted. In addition, the dominant behavioral state, with which the majority of individuals was engaged, was recorded as well. Behavioral states and events were explained in detail in Table 2 and Table 3.

Table 2. *Ethogram of all predetermined behavioral states and their abbreviations used in the study*

Behavioural States	Definition
Travel (TR)	Individuals move with a constant speed in a certain direction with diving interval between 3 and 5 seconds. They move at least 200 m in 1 minute.
Diving (DV)	Dive periods can range from 30 seconds to several minutes. Individuals show no obvious movement and resurface at almost the same location. They move less than 200 m in 1 minute.
Travel Diving (TR-DV)	Individuals move to a certain direction but dive for appreciable time (<1min) and reappear at a distance. They move at least 200 m in 1 minute.
Surface Feeding (SU-FE)	Individuals show active, rapid directional changes. The presence of birds and a lot of splashes is likely.
Socialising (SOC)	Individuals show various interactive behaviours and create body contact with each other. Events like synchronized full leaps or tail slaps are likely.
Resting (RE)	Individuals are drifting in a slow swimming speed near the water surface with steady and synchronous movements. Dive intervals are short. They move less than 100 m in 1 minute
Milling (MI)	The group shows a non-directional movement and varies in its bearing but stays constant in its cohesion.
Bow-Riding (BOW)	Individuals swim in front of a boat.
Interacting with boat (IN)	Individuals swim along the sides or behind a boat.

Table 3. *Ethogram of all predetermined behavioural states and their abbreviations used in the study*

Behavioural Events	Definition
Tail slap (TS)	Individual slaps its fluke on the water surface
Spy hoop (SH)	Individual raises its head shortly above the surface
Breaching (BR)	Individual leaps out of the water and lets its body slap the surface.
Belly up (BU)	Individual turns upside down with the belly up.
Full leap (FL)	Individual leaps its complete body above the water surface.
Fluke up (FU)	Individual protrudes its fluke above water surface.

Besides the behavioural states and events, their swim style and the group type was also recorded. The swim style of the focal group represented the spatial structure and formation of the group (Table 4). The group type described how the group is formatted based on the distance between the individuals in a group. Group type was categorized as either "alone" when there was one single individual, "tight" when the group was close together with a distance to each other below 5 m, "far" for a spread group with a distance to each other above 5m or "mixed" when some individuals were close to each other and others far apart.

Table 4. *Ethogram of all predetermined swim styles and their abbreviations used in the study*

Swim Style	Definition
Alone (AL)	One single individual is present.
Line (LI)	Individuals swim in a line head to tail. The line can be straight or offset.
Circular Dives (CD)	Individuals create a circular formation by appearing in turns at the surface after each other.
Clustered (CL)	Individuals are clustered with no directional movements.
Spread (SP)	The group is spread out, individuals do not swim close to each other.
Front (FR)	Individuals swim in a line side by side.
Team (TE)	The group split up in smaller independent groups ("teams").
Kettle (KE)	Often appears while group feeds at the surface. Many splashes can be seen, water seems boiling like a kettle.
Varied (VA)	The group shows a variation of different swim styles.

Moreover, for each sampling unit (every 5 minutes) the exact time, species, group number and group size were recorded, as well as the surrounding marine vessels and their estimated distance to the focal group. To distinguish between different focal groups during one survey, each group was numbered. When an observed group was out of sight for a timeframe of more than 20 minutes, the next sighting was considered as a new group. In case of a group splitting into to subgroups, the group number of the subgroups were documented as the previous group number added with "a" or "b".

Surveys were carried out over the course of 212 days (710 hours) between 15.09.2016 and 03.10.2017, of which 180 days (537 hours) were from land and 32 days (173 hours) from boat. The survey effort for each season was similarly distributed, whereas it was unequal between the sections of Montenegro, with the south section having the highest survey effort throughout the year (Table 5). Out of the three sections of coastline defined to survey the Montenegrin waters, 70% of surveys were carried out in the South, 19% in the centre and 11% in the North.
Overall, bottlenose dolphins were encountered on 74 days and striped dolphins were encountered on 12 days (Table 5). A focal group behavioural follow of bottlenose dolphins ranged from one sampling unit (5 minutes) to 29 sampling unit (145 min), while it was three (15 minutes) to 14 sampling units (70 minutes) for striped dolphins. The average group follow for both species was six units (30 minutes).

Group size of bottlenose dolphins varied from 1 to 12 individuals with a mean of 4 dolphins. The median group size was of 3 and half of the observation lied between 2 to 5 individuals per group. Whereas striped dolphins showed a variation ranging from 1 to 25 individuals with a mean of 8 and median of 5 individuals in a group and half of the observation lied between 3 to 13 individuals in a group.

Table 5. *Number of survey effort, sightings and groups for each species per season and section in Montenegro (TT=Bottlenose dolphins, SC=Striped dolphins; TR=Travelling, DV=Diving, SOC=Socialising, RE=Resting; NA=Not applicable)*

Season	Section	Survey effort in days (hours)	Number of sightings		Number of groups		Dominant Behaviour	
			TT	SC	TT	SC	TT	SC
Autumn	South	42 (115:31)	17	6	32	7	TR,DV	TR,DV
	Middle	10 (27:10)	1	0	3	0	DV,SOC,RE,TR	NA
	North	6 (34:31)	3	0	3	0	TR	NA
Winter	South	35 (99:49)	15	2	24	2	TR	TR
	Middle	7 (17:27)	2	0	7	0	TR,DV	NA
	North	2 (13:00)	1	0	1	0	TR	NA
Spring	South	33 (108:32)	9	1	10	1	TR	TR,DV
	Middle	10 (31:36)	3	0	8	0	TR	NA
	North	6 (38:35)	2	0	7	0	TR	NA
Summer	South	39 (107:56)	14	0	15	0	TR	NA
	Middle	12 (42:24)	4	0	5	0	TR,DV	NA
	North	10 (74:04)	3	3	5	6	TR	TR
Overall		212 (710:35)	74	12	85	16	TR	TR,DV

The probability of dolphins sightings were significantly affected by the survey type ($\chi 2 = 9.081$, df = 1, p = 0.003), whereas section and season were found to have no significance on dolphin sightings. Despite the much greater amount of land surveys, sighting probabilities were found to be greater from the boat, with dolphins seen about 67% of the time against only 34% for land based surveys. On average, 1.5 dolphin groups were sighted per boat survey against only 0.5 per land survey.

Despite the uneven spatial sampling pattern, no section (coastal region) revealed an increased sighting probability when compared to the others ($p>0.05$). Yet, the middle section holds the highest recording of sightings among the other sections by 1.4 groups per survey, even though the variation wasn't significant. Within boat-based observations, surveys covering the totality of the coastline instead of any specific subset were more likely to result in a sighting (sd=0.60, z=3.05, $p<0.01$).

No statistically significant effect of seasonality on sighting rates was found. Nevertheless, a clear trend towards increased sightings in winter and spring was observed, with an average sighting per survey of 1.2 groups. No effect of month on sighting probability was found. Lastly, when general environmental conditions were analysed Beaufort explained the variation in sighting probability best (AIC=266) (Figure 7). Sighting rate strongly decreased as Beaufort value increased (sd=0.14, z=-3.87, $p<0.001$).

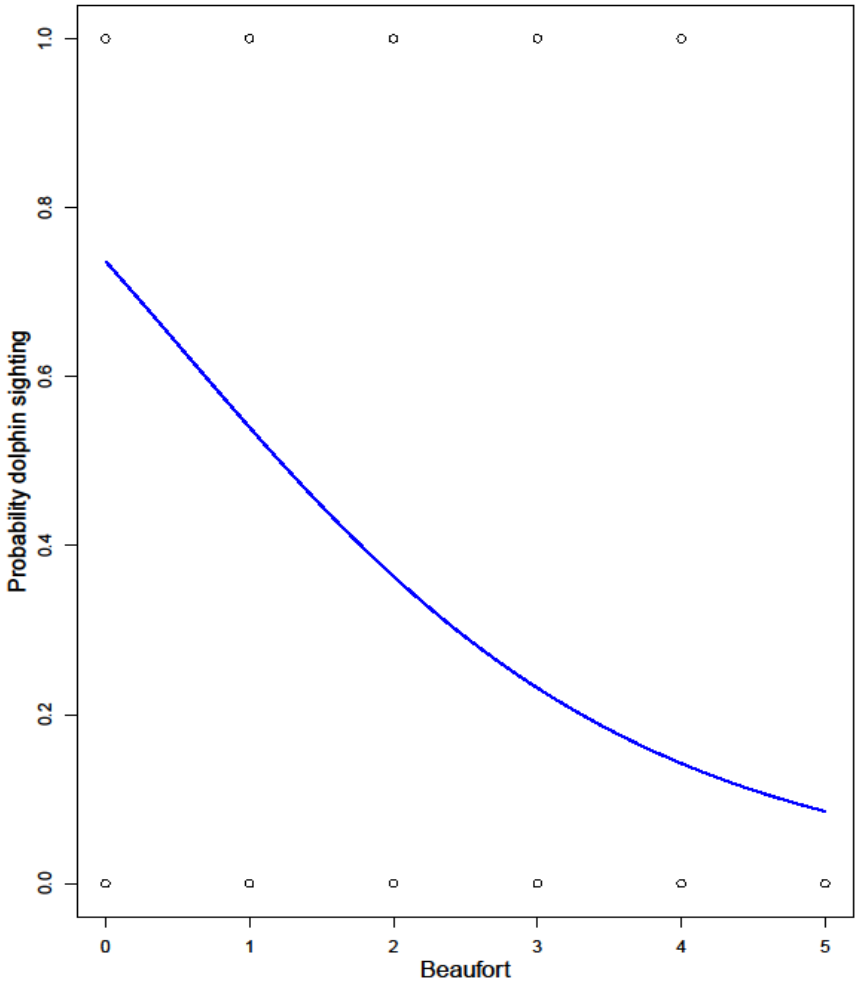

Figure 7. *The effect of Beaufort on the probability of dolphin sighting*

To analyse the encounter rate with a correction of the bias on the boat survey effort, 282 grid cells were created in the survey area and only 100 grid cells were used during the analysis. The overall encounter rate was estimated on average 3,5 groups and 9,2 individuals per 100km in Montenegro.

Variation in dolphin group size was best explained by a model taking season, time of the day, swim style and distance to the nearest marine vessel into account (AIC=2019). When the main effects were considered, season had a significant effect on group size with the lowest group size recorded in spring months with an average of 2 individuals in a group (sd=6.75e-2, z=-2.78, $p<0.01$), whereas, the highest group size on average was 3 in summer. Additionally, swim style was found to be highly correlated with group size (sd=1.26e-1, z=7.34, $p<0.001$), with an increase during kettle, team and varied styles (Figure 8). Distance to the nearest marine vessel alone had no significant effect on the variation in group size.

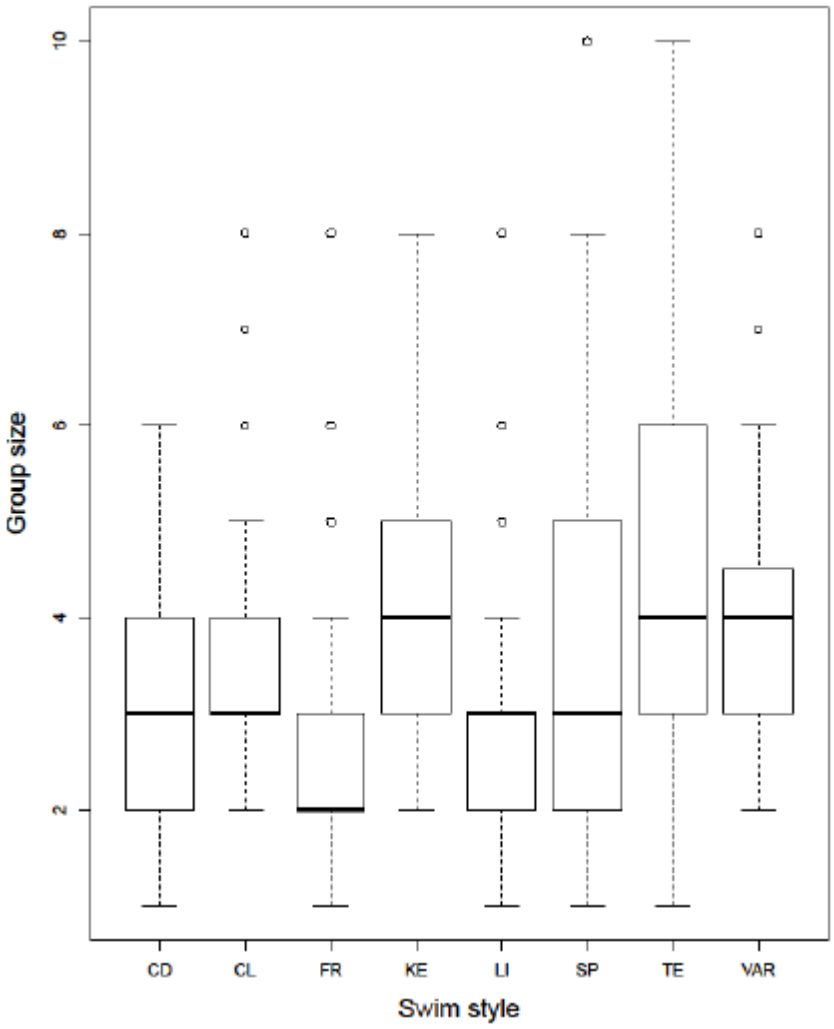

Figure 8. *The variation on group size under different swim styles (CD=Circular Dive, CL=Cluster, FR=Front, KE=Kettle, LI=Line, Sp=Spread, TE=Team, VAR=Varied)*

Overall, 50 individuals were catalogued in Montenegro, of which 15 individuals were re-sighted at least twice. The re-sighting of the individuals varied from 19 to 401 days. Regarding the re-sighting locations, seven and four individuals were re-sighted only on the south and north section respectively. Yet, four individuals were re-sighted in all sections from north to south, with a maximum re-sighting distance of approx. 80 km.

The monthly residency ranged between 0.07 and 0.29 with a mean of 0.10±0.05. On the other hand, the seasonal residency of bottlenose dolphins ranged from 0.20 to 0.60 with a mean of 0.25±0.10. The site fidelity index ranged from 0 to 0.3, with a mean of 0.06±0.10. Considering all the above results, hierarchical cluster analysis suggests that three main group of residency patterns were present in Montenegro (Table 6). Group 1 was composed of 6 individuals and hold high residency indices but comparably low site fidelity, thus classified as regular. Group 2 had 35 individuals with the lowest residency rates and site fidelity indexes. Group 2 individuals were only sighted once or multiple times in the same day with no follow up sightings in following days or months, thus classified as transient individuals. Whereas, Group 3 holds 9 individuals with the highest site fidelity and considerably high seasonal residency thus they have classified as frequent visitors.

Table 6. *The mean seasonal and monthly residency indices and site fidelities of bottlenose dolphins according to the groupings of agglomerative hierarchical cluster analysis*

Group	Seasonal Residency	Monthly Residency	Site Fidelity
1	0.433	0.167	0.091
2	0.200	0.071	0.000
3	0.333	0.159	0.247

According to the photographed individuals of bottlenose dolphins, the individuals showed no obvious marks of starvation signs. However one individual recorded with an abnormal tissue development on the right side of its body (Picture 5). Regarding to the direct consequences of human interactions, one individual dolphin recorded with a plastic bag around its blowhole (Picture 6). Another individual, called Tangled, suffered from an entangled rope around its tail and fractured his tail either during or after the entanglement (Picture 7). Tangled were photographed in six different dates by our research team in Kotor Bay in summer 2017 and also its presence were reported by the locals. During each encounters, Tangled were spotted alone and close to the human settlements, ports and boats.

Picture 5. *Bottlenose dolphin with an abnormality*

Picture 6. *A dolphin entangled with a plastic bag*

Picture 7. *"Tangled" with an entangled rope on the fractioned tail*

Additionally, between 1999 and 2001, three dead dolphins were stranded in Kotor bay, Bigova and Herceg Novi, Montenegro. The post-mortem examination determined the cause of death was from firearms and dynamite fishing, respectively. In 2008, another dolphin washed ashore in the beach of Igalo. It was probably killed deliberately since the fins were cut off and assumingly kept as a trophy. Another dead dolphin, stranded in 2013 near Tivat, was thought to have drowned in fishing gear. Two more strandings were recorded in 2017, with one of them recorded as striped dolphin on the 10th of April in Budva. The cause of death was assumed to be related to dynamite fishing. Latter, a highly decomposed dolphin carcass found drifting in the sea on the 12th of October in Budva.

According to the results of the study, south section of Montenegro (Ulcinj and Utjeha) has the highest density recordings of bottlenose dolphins. Additionally, north section of Montenegro, specifically the entrance of Boka Kotorska Bay also holds important density of bottlenose dolphins in its waters (Figure 9). It is important to highlight that south section also holds the highest survey effort (Table 5), which is the likely reason of high sighting rate. Bottlenose dolphin presence is confirmed mainly to coastal areas, with a range of up to 80 m depth and their maximum distance to the nearest coast was recorded as 8 km. Regarding the striped dolphins, their highest density recorded 30 km of the coast (Figure 10). However, their high coastal presence was also recorded in the south and north section of Montenegro, mainly in the coastal waters of Herceg Novi and Ulcinj. Their depth preference ranged from 10 m depth waters up to 450 m depths. However, it is important to consider that the hotspots highlighted by this map are representative of our sampling locations and the nature of the surveys, with south section notably surveyed more than the rest of the sections.

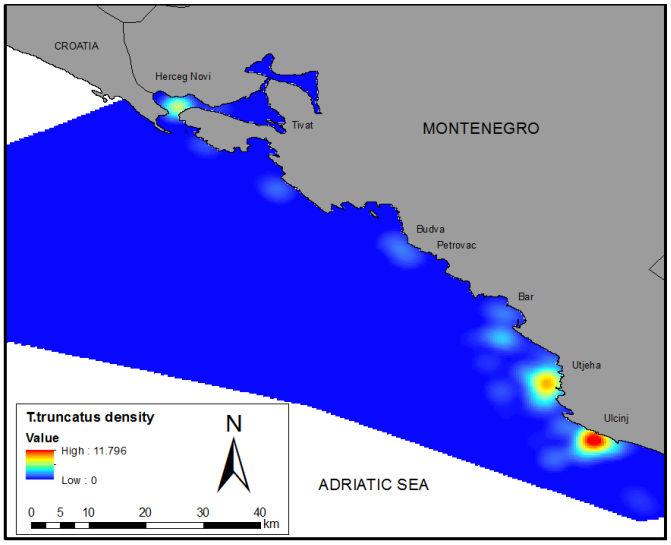

Figure 9. *Density distribution of bottlenose dolphins in the survey area*

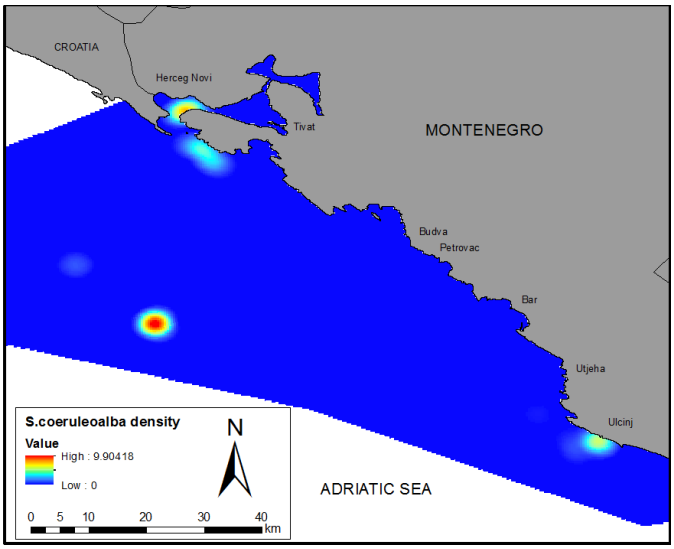

Figure 10. *Density distribution of striped dolphins in the survey area*

After the detailed results of the first study of marine mammals in Montenegro, the annual research was continued and great efforts and resources were invested in order to gather as much knowledge as possible about their life in the territorial waters of Montenegro. The 2021 annual report presents summary research results for all years.

Montenegro Dolphin Research Team has had an ongoing survey effort in Montenegro. The report approaches data that was collected between 2016 and 2020, with additional information from 2021 to investigate changes in dolphin sightings when human impact reduced even slightly during the COVID-19 pandemic.

The report firstly presents the variation in survey effort per year and its associated sighted species within Montenegrin waters. Later, the annual variation in sighting rates of bottlenose dolphins is described with an assessment of behavioral preferences and group cohesion for southern, central and northern Montenegrin waters.
Photo-identification results are also presented with their sighting history in Montenegro. Further, re-sighting maps have been produced to investigate the movement patterns of individual bottlenose dolphins.

Preliminary results on the vocalisation behaviour of bottlenose dolphins in the Boka Kotorska Bay also analysed by RavenPro software and summarised in this report.
Species distribution was mapped to visualise bottlenose dolphin range and habitat preferences. Bottlenose dolphin data points, collected from land and boat surveys, were clustered according to survey date and group number. Paths were then created to show dolphin movement along the Montenegrin coast and in Boka Kotorska Bay. Based on these paths, kernel density maps were produced. Finally, contour polygons were drawn to indicate bottlenose dolphin core zones (50% inclusion for seasonal and annual variation, 70% inclusion for general variation). Initially, seasonal variation was assessed. Core zones, depth and distance to shore of dolphin observations for each season were compared. Following their seasonal spatial distribution, core zones were calculated for each year to allow for a comparison between years. Then, general spatial distribution was mapped for the entire period between 2016 and 2021. Finally human pressure maps, including marine traffic and seismic operation were mapped to overlap the general core zones of bottlenose dolphins and human pressure in the area to assess the impact range. Marine traffic maps were created using boat data points from land surveys. Kernel density maps were then produced in the same way as for the bottlenose dolphins. Following the total spatial distribution, specific density maps were created according to the aforementioned boat types (and activities):

- Tourism: JS, MB (TO), LB, PED, SB
- Small fishing: MB (FI)
- Big fishing: FV
- Transport: FE, PB
- Large ships: CS, CR

The seismic operation map was produced using GPS coordinates from three ships performing seismic activities in 2019: the Sanco Sea, the Ramform Titan and the Thor Freyja. Kernel density maps were produced in the same way as for the other maps.
All spatial analyses were conducted in QGIS software, Version 3.14.[18]

The territorial waters of Montenegro were surveyed using a combination of fixed land stations and boat-based surveys since 2016 (Figure 11). The land survey coverage was calculated using wedges for each land station. The extent of a wedge was determined using the outermost data point collected on either side of a station. The radius of the wedge was determined using the furthest data point collected. The total land survey coverage was 509 km^2. The boat survey coverage was calculated by drawing an area around the boat survey track lines in Montenegrin waters. The total boat survey coverage was 5,069 km^2 with the furthest distance of 83.5 km from the nearest coast. The surveys were mainly conducted in shallow waters (<100m depth), the maximum depth that was surveyed reached to 1000 m depth.

[18] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

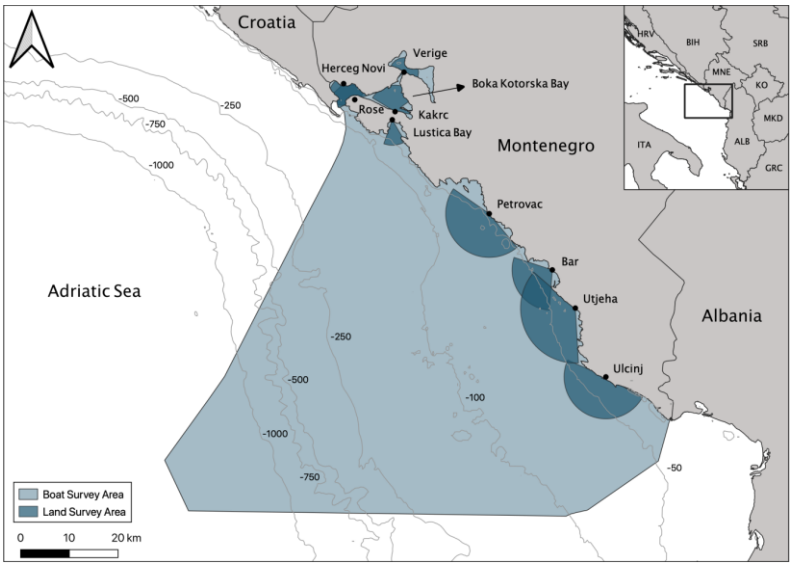

Figure 11. *Survey Area of Montenegro with land station and boat survey coverages*

To cover all of the coastal waters of Montenegro, the project has nine predetermined locations along the Montenegrin coastline and in the Boka Kotorska Bay (Picture 17; Table 1). Every land survey location was carefully selected at least 10 meters above sea level with no obstructions such as trees or buildings blocking the line of sight. This maximised the range of view and thus the likelihood of cetacean sightings. The observations were conducted during the morning (beginning with sunrise) and the afternoon (ending with sunset) for a minimum of 3 hours. By completing land-based surveys, researchers observe cetaceans in their natural behavioural state without being disturbed by the research vessel.

Table 7. *The coordinates and altitudes of land stations*

Station	Latitude	Longitude	Altitude (m)
Ulcinj	41°55'28.7"	19°12'37.8"	33
Utjeha	42°03'01"	19°07'52"	78
Bar	42°07'11"	19°04'19"	23
Petrovac	42°13'14.09"	18°54'42.77"	165
Verige	42°28'38.20"	18°41'25.19"	14
Lustica Bay	42°23'20.54"	18°39'51.012"	103.6
Kakrc	42°24'14.942"	18°40'14.37"	30.2
Rose	42°25'26.85"	18°34'9.25"	255
Herceg Novi	42°27'11"	18°32'25"	84

During all the land- and boat-based surveys the environmental conditions were recorded every 60 minutes or when the conditions changed as environmental conditions can influence the visibility of the cetaceans. The conditions that were recorded consist of the tide height, sea state, glare, cloud cover, sea surface temperature, swell, air temperature, wind speed and direction. The sea state was recorded using the 0-12 integers of the Beaufort scale. Glare and cloud cover were estimated as a percentage in steps of 10 (0, 10, 20, 30, 40 etc.). The tide, sea surface temperature, swell, weather temperature, wind speed and direction were ascertained from online sources before the survey started. Environmental conditions were noted on a datasheet as well as in the software Pythagoras.

When the team of at least 4 researchers arrived at the survey station, the team leader divided the tasks. One researcher was responsible for theodolite operation, one for entering the horizontal and vertical data from theodolite onto the laptop using the program Pythagoras. The other researchers

were constantly scanning the sea with binoculars. In case of a cetacean sighting, the researcher on the theodolite would give the behavioral information of the cetaceans. One of the researchers on the binoculars was responsible for writing down all the information on the datasheet. Tasks were rotated periodically to avoid observer fatigue.

An attempt was made to conduct boat surveys at least every 10 days, dependent on the weather conditions and logistics. Additional logistical issues were introduced due to restrictions resulting from the COVID-19 pandemic in 2020 and 2021. Boat surveys took place throughout the year in calm seas, where the visibility was more than 1 nautical mile and there was a Beaufort Sea State between 0-3. These surveys took place between sunrise and sunset times (06:00 and 21:00). Depending on the sea state, the surveys lasted between 3-7 hours. Surveys were generally conducted at a speed of 4 knots, and 3 different kinds of boats used:

1. Motorboat with an outboard engine, with a length of 6 metres
2. Rigid inflatable Boat with an inboard engine, with a length of 12 metres
3. Sailing boat with an inboard engine, with a length of 17 metres

To create the track line of the survey, the geographical coordinates of the boat were recorded every 1-2 minutes in the software Logger 2010 (Marine Conservation Research, 2019). For this, a GlobalSat G-Star IV (SIRF Star IV) GNSS (Global Navigation Satellite System) was used. The software Logger 2010 also recorded data on the date and time of the survey, the number of researchers and their responsibilities, behavioral data of cetaceans, marine traffic and environmental data which was collected as with land surveys. To calculate the true coordinates of the cetacean group, the distance and bearing of the focal group were recorded during the sighting.

In the case of a cetacean sighting, the research boat/vessel would approach and follow the focal group maintaining a low and consistent speed from the side or rear and in the case that the cetaceans approached the research boat/vessel, the speed was reduced gradually to idle. The distance between the cetacean and the boat ranged from a minimum of 50 metres to a maximum of 400 metres. Any sudden changes in the speed and direction were avoided and in order to measure the impact of the presence of the research vessel, any changes in the cetacean's behavior were recorded.

During both the land and boat-based surveys, researchers used a focal group scan sampling to collect time and date of the observation, species, group size, behavior, reaction to marine traffic, presence of juveniles and surrounding marine traffic. All data was collated to a database at the end of each week and photo-identification pictures and acoustic recordings were saved on a hard drive and regularly backed up.

In total, 699 surveys (2339:20 hours) were carried out between the 15th of September 2016 and 26th of April 2021 (Table 8). The majority of the survey effort consisted of land surveys which formed 84% of the total effort. While three years (2017, 2018, 2019) had full yearly survey effort, 2016 had only five months, covering autumn and winter, and 2020 and 2021 had eight and four months of survey effort, respectively, due to restrictions that took place during the COVID-19 pandemic. While the highest survey effort was in 2017 with 192 days spent in the field, the lowest efforts were in 2016 with 51 days and 2021 with 53 days of surveys. It is important to note, however, that the survey effort for 2016 and 2021 represents only five and four months of survey, respectively.

Table 8. *Number of survey days of each survey type. The number in brackets represents days where a dolphin sighting took place*[19]

Year	Boat Survey (Sighting)	Land Survey (Sighting)	Total
2016	8 (5)	43 (20)	51 (25)
2017	31 (20)	161 (51)	192 (71)
2018	36 (23)	118 (35)	154 (58)
2019	23 (11)	132 (26)	155 (37)
2020	18 (8)	76 (17)	94 (25)
2021	6 (3)	47 (22)	53 (25)
Total	122 (70)	577 (171)	699 (241)

Regarding variation in survey effort per season, each season was surveyed almost equally with a slightly higher survey effort in autumn with 200 days. The lowest survey effort was recorded in winter with 146 days of survey effort (Figure 12).

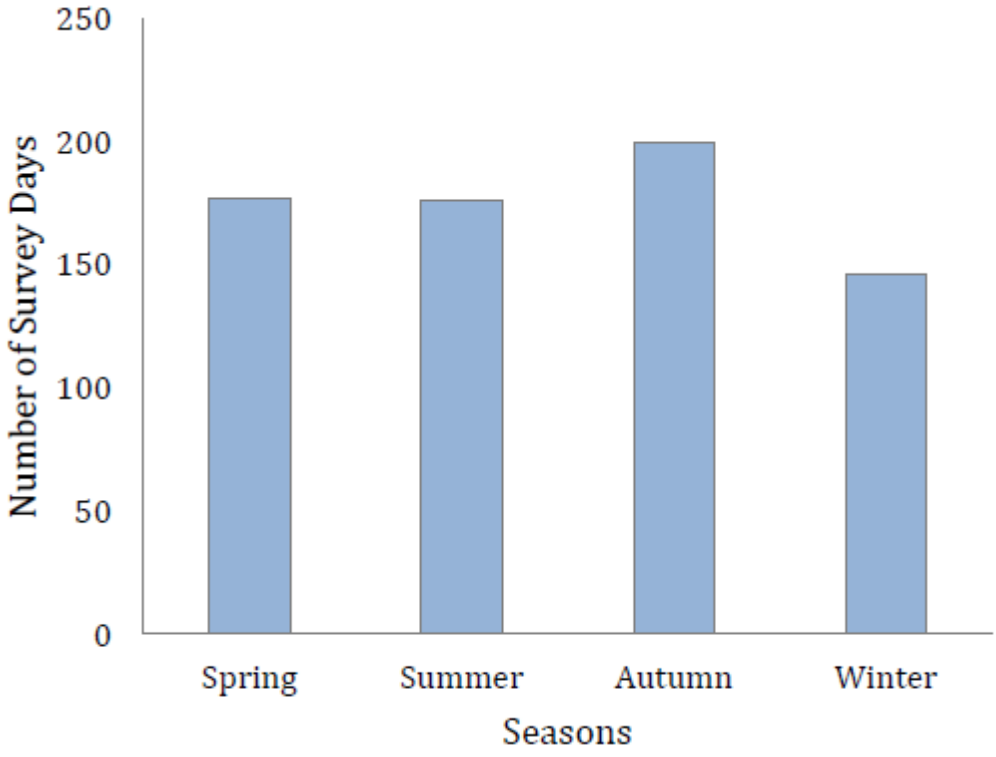

Figure 12. *Number of survey days per season*

Overall, 403 focal groups were encountered in 241 days of survey effort, during which two species were recorded; Bottlenose dolphins (*Tursiops truncatus*) and striped dolphins (*Stenella coeruleoalba*). While bottlenose dolphins formed the highest sighted species being responsible for 95% of the sightings, striped dolphins were only encountered on 20 occasions (Figure 13).

[19] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

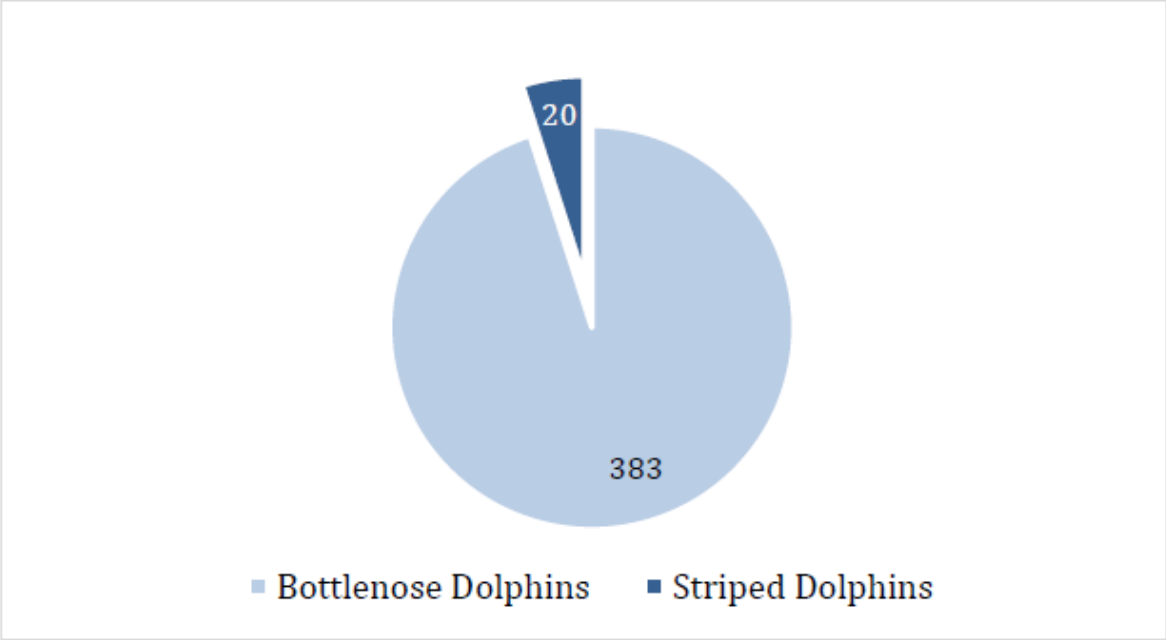

Figure 13. *Species sighting numbers during the surveys*[20]

When the encounters were assessed by season, even though bottlenose dolphins were slightly more regularly encountered in spring months with 29% of their entire sightings, their sighting rates were similar between seasons with a minimum rate recorded in summer of 22% (Figure 14). Therefore, bottlenose dolphins do not appear to use Montenegrin waters preferentially in a season, instead showing a similar abundance between seasons. On the other hand, striped dolphins were rarely sighted, with the highest encounters in the summer and autumn months with 8 encounters in each season, followed by three encounters in winter and only one in spring (Figure 14).

[20] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

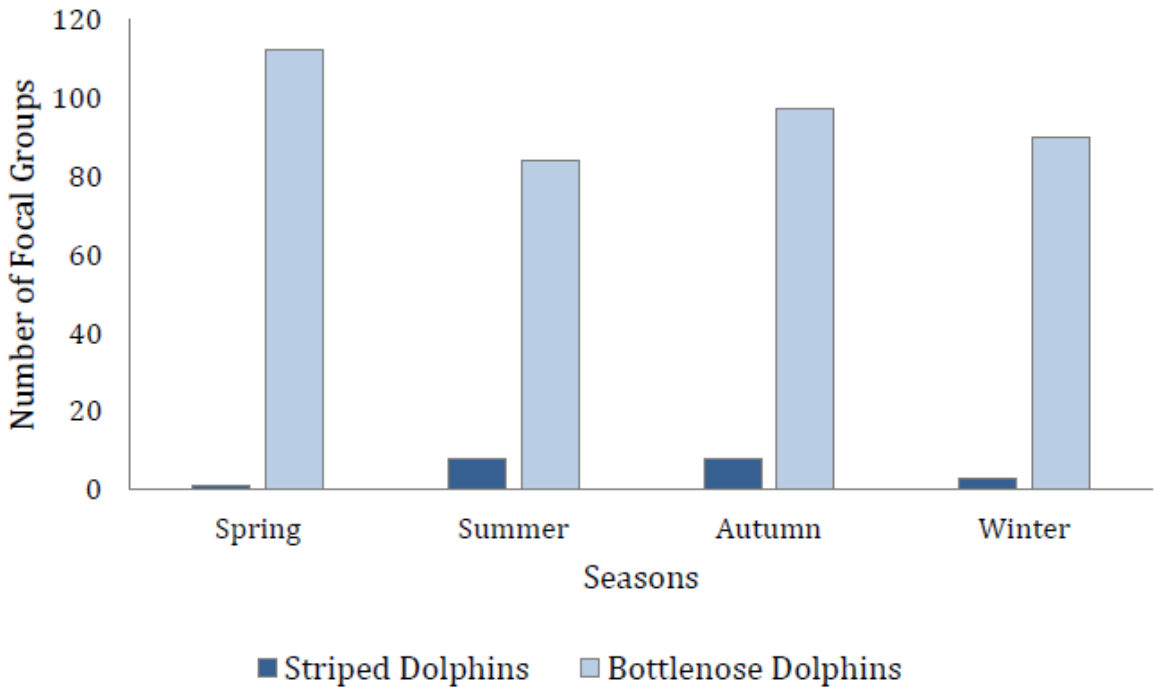

Figure 14. *Seasonal variation in the sightings of dolphins in Montenegro*[21]

When the yearly variation on the bottlenose dolphins' sighting rate was assessed, the species were sighted in 49% of surveys in 2016 with a steady decline in their sighting rate up until 2019, with 37%, 38% and later 24% in 2017, 2018 and 2019 respectively. Later in 2020, the sighting rate slightly increased to 27%. However, the sighting rate reached up to 47% in 2021 (Figure 15). The variation in the sighting rate of striped dolphins was not examined due to the small sample size.

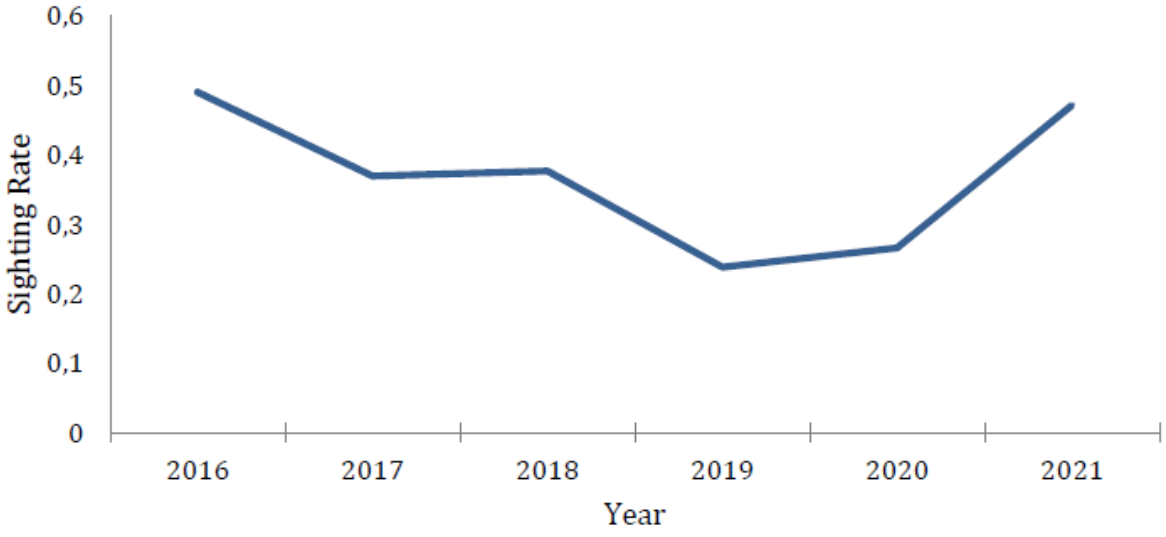

Figure 15. *The yearly variation in sighting rate of bottlenose dolphins in Montenegro*[22]

[21] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

[22] Also 21

Dolphins were followed for an overall of 181.6 hours of the 2339 hours of survey effort (7.8%), comprising 2179 behavioral sampling intervals. While group sizes of bottlenose dolphins ranged from 1 to 20 individuals with a mean of 3±2 individuals and mode of 2 individuals, it was between 1 and 30 individuals with a mean of 7±2 individuals for striped dolphins. Approximately 50% of the bottlenose dolphins' groups had at least one sub adult, yet sub adult groups were also recorded with a maximum group size of six. Striped dolphins were also recorded with sub adults in 20% of the recordings, with the number of sub adults ranging from 1 to 10 in a group.

Focal group scan sampling of bottlenose dolphins revealed that the dominant behavior recorded in Montenegro was diving, forming 35% of the total recordings, followed by travelling behavior, making up 26% of recordings. Bow-riding was the least reported behavior when combined with interaction with marine vessels formed 3% of the total recordings, which is equal to the reported resting behaviour (Figure 16).

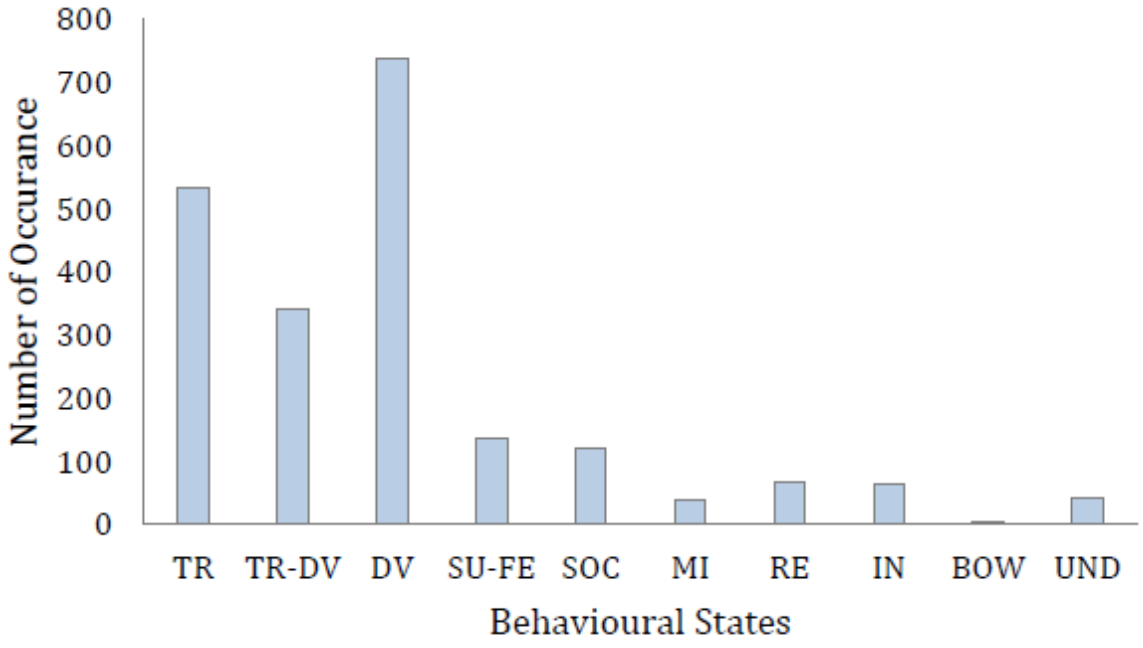

Figure 16. *The behavioural variation of bottlenose dolphins in Montenegro*[23]

Striped dolphins also showed similar behavioural patterns with diving forming 22% of the reported behaviours followed by traveling (19%), travel-diving (18%) and surface feeding (16%). Bow-riding was once again the least recorded behaviour (Figure 17).

[23] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

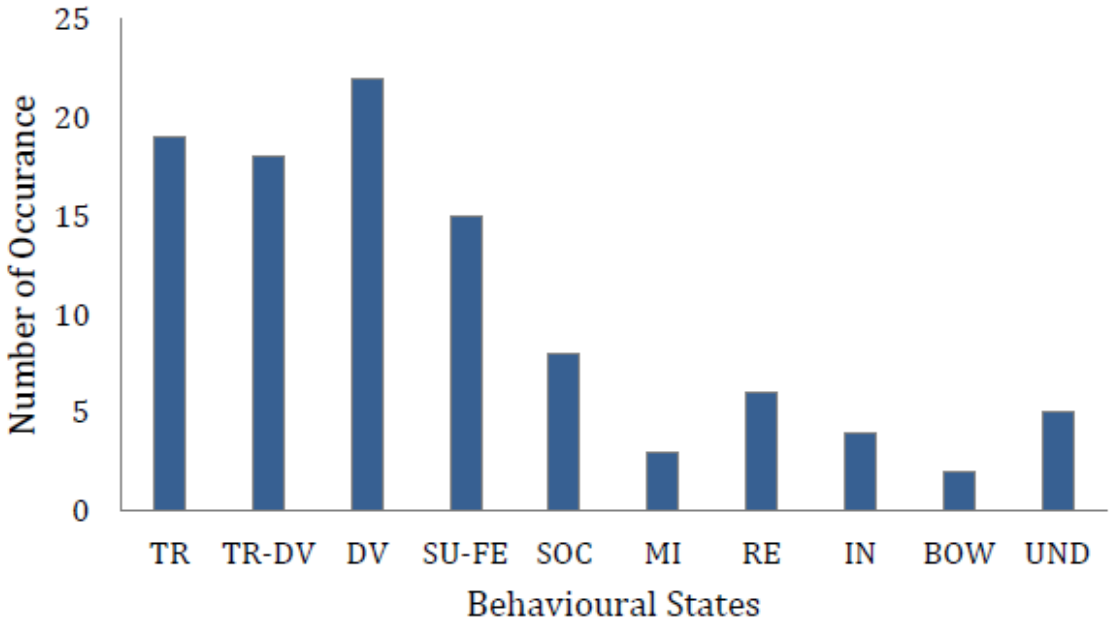

Figure 17. *The behavioural variation of striped dolphins in Montenegro*[24]

When the effect of year and season on behaviours was considered, bottlenose dolphins showed similar patterns between years. Each year, either diving or traveling was the most dominant behaviour. Similarly, either resting or milling was one of the least recorded behaviour, except in 2017 where dolphins engaged in relatively more resting. Further, interaction with boats was highest in 2018 (Table 9).

Table 9. *Behavioural variation of bottlenose dolphins per year in Montenegro*[25]

Years	Behavioural States									
	TR	TR-DV	DV	SU-FE	SOC	RE	MI	IN	BOW	UND
2016	42	23	51	23	18	4	5	0	0	0
2017	197	128	164	26	18	52	13	14	1	7
2018	130	57	228	34	28	8	4	50	2	10
2019	103	25	90	44	25	1	3	0	0	17
2020	32	35	102	6	29	1	3	0	0	6
2021	17	82	102	3	1	2	10	0	0	1
Total	521	350	737	136	119	68	38	64	3	41

Season also showed a similar pattern on behavioural variations in bottlenose dolphins in Montenegro, with diving and travelling being the most dominant behaviour recorded. However, travel-diving, diving and interaction with boats showed a considerable increase in Spring, whereas socialising behaviour was highest in autumn (Table 10).

[24] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

[25] Also 16

Table 10. *Seasonal behavioural variation of bottlenose dolphins in Montenegro*[26]

Seasons	Behavioural States									
	TR	TR-DV	DV	SU-FE	SOC	RE	MI	IN	BOW	UND
AUTUMN	146	53	171	27	62	36	16	4	1	6
SPRING	130	168	274	43	8	6	14	30	0	12
SUMMER	148	64	162	20	32	23	4	16	1	17
WINTER	107	55	130	46	17	3	4	14	1	6
Total	531	340	737	136	119	68	38	64	3	41

Acoustic data on bottlenose dolphins were collected on 8 separate survey days between the 17th of August 2020 and the 9th of April 2021 in the Boka Kotorska Bay. A total of 7:12 hours of acoustic recordings were analysed, with an average of 56 minutes of recording in each acoustic survey. A total of 5:24 hours of dolphin vocalisations were recorded which resulted in the identification of 847 calls, of which 541 belonged to good quality recordings therefore further investigated. During the recordings, both echolocation clicks and tonal calls were recorded in similar proportions with echolocation clicks recorded slightly more, forming 55% of the entire recordings. Of the 467 echolocation clicks, 27% were formed from burst pulses, thus indicating possible foraging activities. Additionally, nine different whistle types were recorded, of which multiloop whistles were the most dominantly recorded whistles making up 39% of whistles, followed by type U which made up 29% of whistles. Less than 3% of the recordings involved flat, harmonic and a specific call we termed “grunt” (Figure 18).

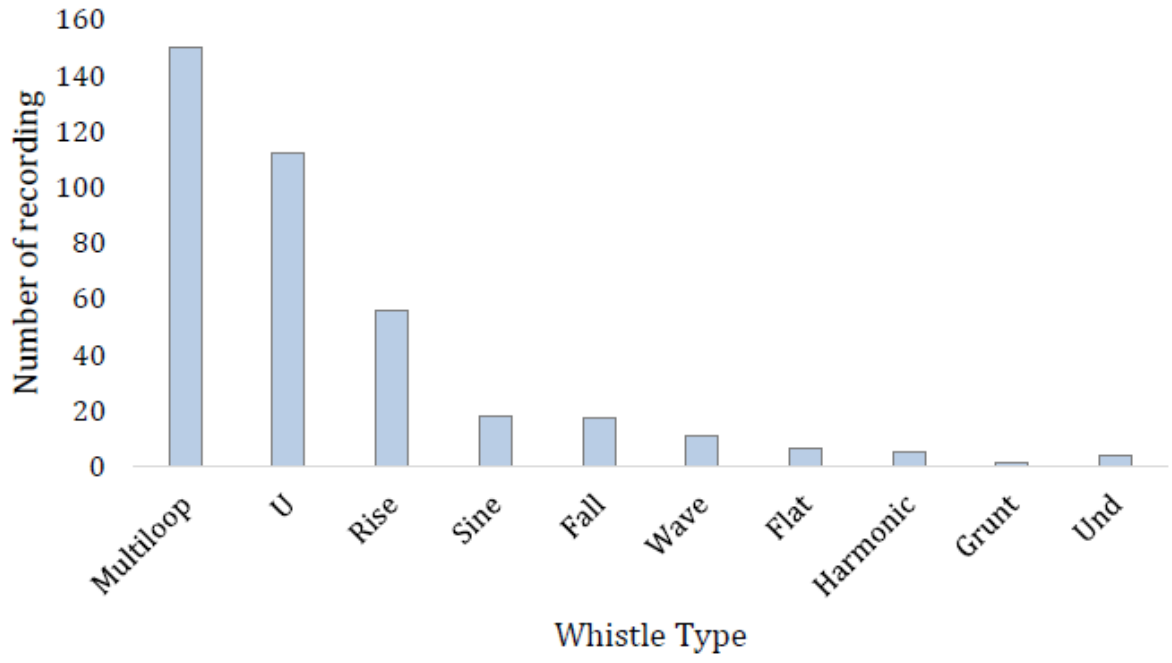

Figure 18. *Whistle type of bottlenose dolphins in the Boka Kotorska Bay*[27]

[26] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

[27] Also 18

There was no considerable variation in the depth and distance to shore preferences of bottlenose dolphins between seasons (Figure 19). The median depth range was between 36.5 meters in autumn and 40m meters in summer months, with spring and winter showing the same preference to a median of 39m depth. However, the maximum theodolite range covers waters of a maximum depth of 88m. Therefore, it is important to consider the highly concentrated survey effort in shallow waters and deeper water preference of dolphins might be unnoticed due to the survey methodology. A similar pattern was also recorded when the distance from the nearest coast was considered with the median distance from the nearest coast ranging between 899m (spring) and 1138m (winter).

The core zones of bottlenose dolphins were present within the Boka Kotorska Bay for each season, however the core zone in Petrovac was only present in winter months and they were present for spring and autumn for Bar. Utjeha had core zones only in colder months (autumn and winter) while Ulcinj had it for summer and autumn.

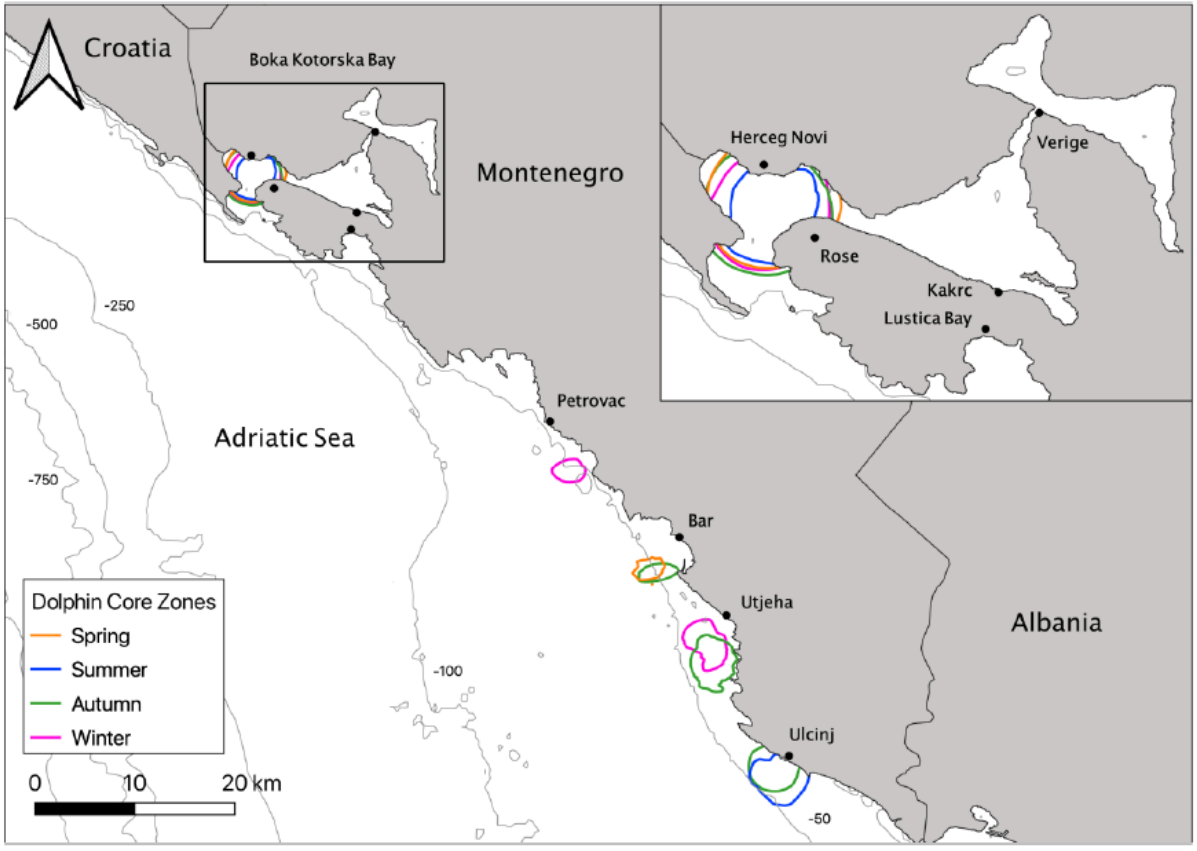

Figure 19. *Bottlenose dolphin core zones in Montenegrin waters per season*[28]

Next, variation between years was compared. The coastal waters of Bar, Utjeha and Ulcinj contained core zones in 2016, 2017, 2018 and 2020. The entrance of Boka Kotorska Bay contained core zones in 2018, 2019 and 2020. A single core zone was identified further into Boka Kotorska Bay in 2021 (Figure 20). In 2016 and 2017, survey efforts were skewed to the southern section of Montenegro (43 of the 51 surveys in 2016 and 123 of the 192 surveys in 2017), due to DMAD being based in Ulcinj and in Bar in 2016 and 2017 respectively. This explains the absence of core zones in the other sections of Montenegro. The presence of a single core zone in Boka Kotorska Bay in 2021 is directly related to the

[28] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

highly skewed survey effort to the northern section of Montenegro due to the travel restrictions during the COVID19 period (52 of the 53 surveys).

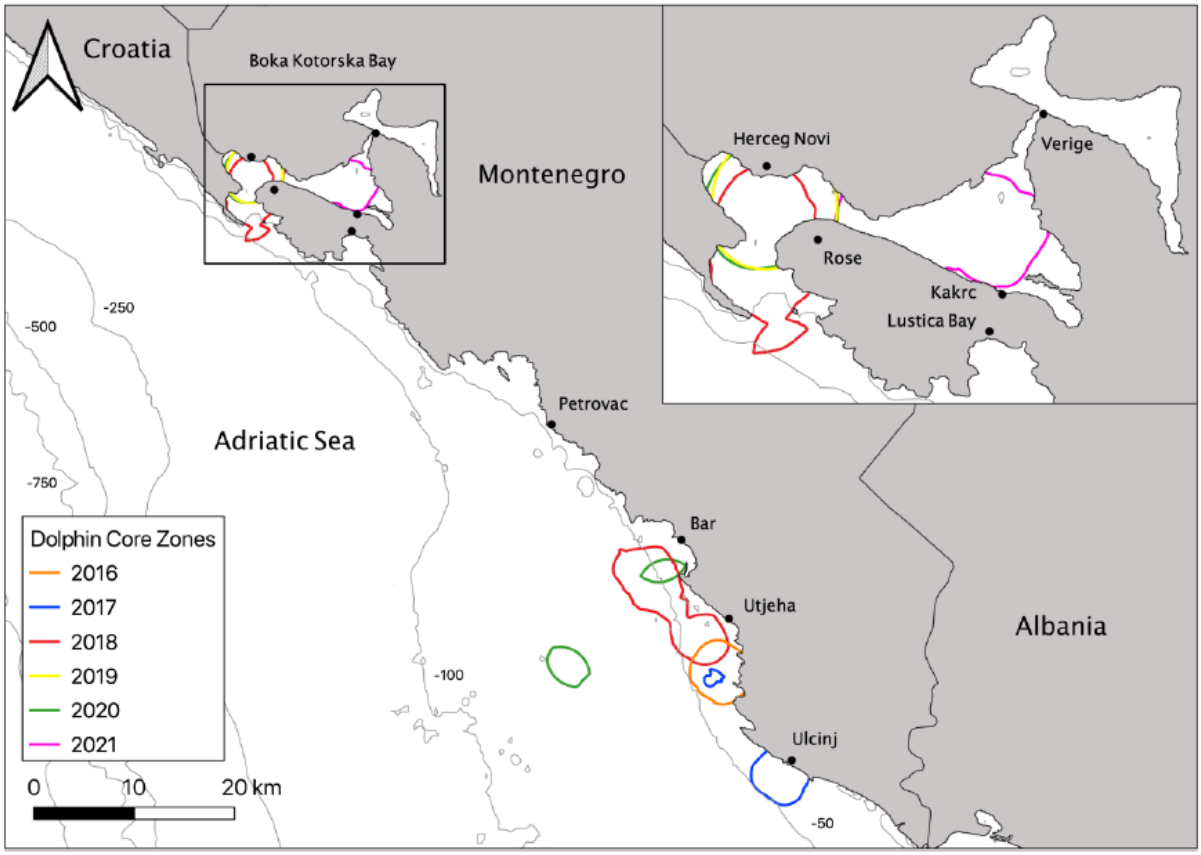

Figure 20. *Bottlenose dolphin core zones in Montenegrin waters per year*[29]

To visualize the impact of marine traffic on bottlenose dolphin distribution, maps were created showing the general dolphin core zones and the density of the different types of marine traffic (Figure 21). The total marine traffic showed the strongest overlap with the dolphin core zones in the coastal waters of Bar and in the entrance of Boka Kotorska Bay. The strongest overlap with the different types of marine traffic was then identified.

- Tourism: in the entrance of Boka Kotorska Bay and in the coastal waters of Bar
- Small fishing: in the coastal waters of Bar and Ulcinj and in the entrance of Boka Kotorska Bay
- Big fishing: in the coastal waters of Bar
- Transport: in the entrance of Boka Kotorska Bay
- Large ships: in the coastal waters of Bar

[29] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

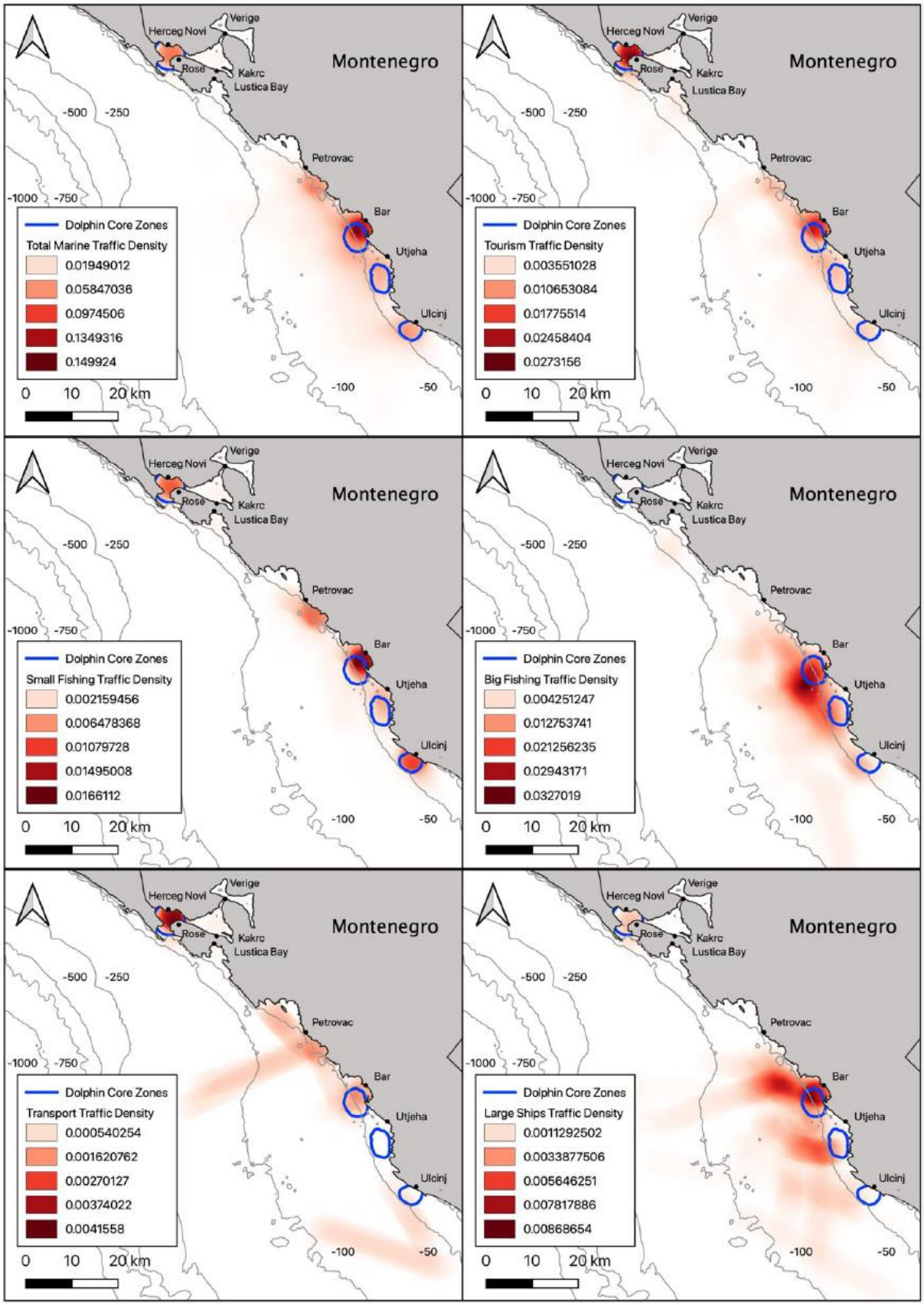

Figure21. *Overlap between general dolphin core zones and marine traffic density*[30]

When the spatial-temporal distribution of bottlenose dolphins was mapped, bottlenose dolphins revealed the presence of year-round core zones in Boka Kotorska Bay which highlights the importance

of this specific location for the bottlenose dolphin populations of Montenegro. It is also important to point out that the southern sections between Bar and Ulcinj showed autumn dominant core zones within their coastlines. Seasonal variations in area preference pose an importance consideration in the development of conservation strategies and increase its impact zone. Therefore, the results of this report have to be considered carefully and should be included in the development of future protection strategies.

Additionally, when the annual variation of the core zones was under the scope, Boka Kotorska Bay once again stands out with its importance not only within the year but also between the years. Yet, in 2016 and 2017 the entrance of Boka Kotorska Bay did not have a core zone due to the low number of survey efforts. Back then, DMAD was located in Ulcinj and Bar respectively and therefore fewer surveys were organised in Boka Kotorska Bay (1 of the 51 surveys in 2016 and 30 of the 192 surveys in 2017). Therefore, the absence of core zones in this specified location is only the result of biased survey effort to the southern waters, rather than reflecting the actual preferences of dolphins.

When the entire dataset between 2016 and 2021 was pooled, the total spatial distribution of the bottlenose dolphins in Montenegro revealed a high-density presence once again in the Boka Kotorska Bay, followed by the neighboring waters of Bar, Utjeha and Ulcinj.

Regarding the marine traffic density, Bar holds the highest density within its waters, followed by the Boka Kotorska Bay. However, the same locations are also identified as core habitats for bottlenose dolphins due to the high species sighting rates. In an additional pressure, seismic activities for oil and gas exploration take place in the waters immediately off Utjeha and Bar which again shows area overlap with the dolphin core habitats. The identification of these overlapping zones with human activities that are proven to have direct and indirect negative impacts on the threatened species, alters them as “critical habitats” for protection.

5. DEVELOPMENT OF TOURISM PRODUCT BASED ON DOLPHIN OBSERVATION AND PROTECTION IN BOKA KOTORSKA BAY

In recent years the requirements for sustainable tourism strategies have widened to include the search for tools that guarantee more benefits for local communities and indigenous peoples, particularly in rural areas. These areas are mostly characterized by rich biological diversity, the central asset for tourism. However, as yet there is insufficient local expertise to create tourism that is beneficial to the local community and maintains the local biodiversity, determining that the course of development is in a sustainable direction according to the UNWTO. In the international tourism market typical tour operators are searching for new products, integrating new countries into their portfolio in order to diversify their tourism packages.

UNWTO also highlights that tourism activities fundamentally involve the transportation and hosting of the tourism consumer in a local community, i.e., “tourism destination,” where the tourism product is consumed. A tourism product is therefore the heritage, wealth and expected legacy of the local

[30] Montenegro dolphin research, Annual report of 2021, Turning research into conservation outputs for ceteacen protection in Montenegro, Five years of dedicated research efforts for the creation of species conservation action plan, 2021

community that serves as the tourism destination. The core business activity of tourism is to promote, as a tourism package, the "saleable" or appealing aspects of the local community, e.g. the local culture and way of life, physical and natural attractions, as well as social knowledge. UNWTO also refers that the tourism package, which is the complete travel experience; a mosaic of a number of different commodities such as transportation, foods, accommodation, beverages, leisure and other attractions, provides tourists (consumers) with a complete set of services necessary for the tourism experience. The quality of a product, the attractiveness of individual packages and the distinctiveness of a destination can be regarded as the key elements of a successful tourism product. When both the package and the product quality are ensured during product development, tourists will be interested in consuming the offered attraction; they will not only recommend the attraction, but will most likely return to the destination. The number of tourists purchasing a tourism product and the number of tourists that either return to a destination or come as a result of a recommendation are important indicators on the quality of a tourism product. Therefore it is very important for destination managers and local entrepreneurs to maintain and periodically evaluate their existing tourism products and to understand that tourism products have life cycles. [31]

In order to develop high quality products that support biodiversity conservation, UNWTO Practical Guide for the Development of Biodiversity-based Tourism Products emphasizes that destination managers and local entrepreneurs should understand and pay attention to the characteristics of tourism development that support biodiversity conservation. Some essential characteristics include:

• the use of environmentally friendly and low impact techniques, i.e. controlling the number of visitors per site. This is aimed at reducing the level of intrusion to the environment and biodiversity, as well as keeping in line with the carrying capacity of the site;

• encouraging tourists and the local community to support conservation initiatives;

• recognizing that nature, culture and local knowledge are the prime elements for tourist experience;

• providing educational value for tourists and locals;

• supporting the local economy, e.g. through involvement of local community members as guides or hosts or by purchasing local products;

• using tour guides or interpreters who have in-depth knowledge about local nature and culture;

• ensuring that the (observed) animals are not disturbed (e.g. during wildlife watching);

• respecting local culture and tradition[32]

Involvement of the community is very important since the overall experience of the tourist at a destination is often affected by the attitudes of the local community towards tourism and tourists. The brief encounter between the visitors and the communities that host them can either make or break the product experience according to the UNWTO. Therefore it is necessary to develop appropriate and targeted strategies with timely impacts to increase the capacity of local communities and the possibilities for their involvement as statet in the UNWTO Guide.

[31] Practical Guide for the Development of Biodiversity-based Tourism Products, 2010 World Tourism Organization – ISBN 978-92-844-1340-9, p.5.
[32] Adapted from Practical Guide for the Development of Biodiversity-based Tourism Products, 2010 World Tourism Organization – ISBN 978-92-844-1340-9, p.7.

When developing sustainable tourism, ecotourism or community-based tourism, also science-based tourism based on dolphin observation and protection it is often initiated by environmental or conservation-based NGOs. They usually work together with local communities or local guides in developing new tourism products and packages. According to the UNWTO, apart from these destination-level stakeholders, national or international tour operators sometimes initiate tourism product development, in cooperation with local tour operators or local tour guides.

A person willing to initiate tourism product development based on science in dolphin observation and protection should have:

• the capability to analyse the existing potential to create the condition according to market preference;

• the capability to communicate with local communities involved in dolphin observation and protection;

• the capability to communicate with tourists interested in science-based tourism;

• awareness, concern and knowledge of community empowerment;

• awareness, concern and knowledge of dolphin conservation;

• awareness, concern and knowledge of cultural preservation;

• the expertise and capability to manage a tour based on dolphin observation and protection;

• knowledge on business development, economy and management.[33]

4.1 DESIGNING TOURISM PRODUCT BASED ON DOLPHIN OBSERVATION AND PROTECTION IN BOKA KOTORSKA BAY

Designing is one of the important steps because only a good tourism product will have a high selling value and constantly attract tourists according to the UNWTO. A good tourism product should:

• cater to the needs of the targeted market; for example, for the dolphin observation and protection-based tourism market, most of the duration of the tour should be spent at the sea locations where dolphins could be observed;

• contribute to dolphin conservation in the Boka Kotorska Bay;

• involve and distribute benefits to the local community;

• provide opportunities for tourists to get first-hand experience;

• provide educational value for tourists and the local community in the field of dolphin protection.

UNWTO defines some key steps that need to be taken when developing a good tourism product. It is important to:

[33] Also, p. 15.

• identify and select the targeted market - in the field of dolphin observation and protection targeted market would be young people and families interesting in connecting science regarding dolphin protection trough tourism experience;

• identify the needs and preferences of the targeted market;

• select the tour activities which will best meet the needs and preferences of the targeted market;

• make good use of the inventory database for this purpose;

• decide on who decides at the local level what products should be promoted;

• identify new products that are complementary to the existing ones so that a win-win situation can be created[34]

When developing a tour package based on dolphin observation and protection in Boka Kotorska Bay it is important to:

• link the component of activities from one attraction to the other carefully: a good combination of tourism products will create an appealing tour package. Combining cultural activities with science-based activities might give an added value to the tour on dolphin observation and protection in Boka Kotorska Bay since Kotor is a town of rich cultural and historical heritage. The duration of the tour can be adjusted to the average length of stay of tourists. In this step, a product developer should consider some additional criteria:

– travel time from one location to another or from one destination to another. Longer travel time will affect the condition of the tourists, thus might influence the evaluation of tourists to the overall implementation of the tour and the destination;

– type of transportation used from one location to another or from one destination to another;

– type of activities;

– time spent on an activity;

– difficulty and level of fatigue which will be experienced by the tourists;

– cost factors;

– avoiding any discrepancy between the description of the product and reality;

– avoiding overloading the tour and allowing for a period of flexible relaxation;

According to the Report on Cross-border Youth Camps consisted in marine research activities for cetacean conservation using thematic equipment on board of BioTours projects Lead Partner Jonian Dolphin Conservation (JDC) Research Vessel “Il Porto di Taranto”, tourist activities should be carried out in the form of one-day "mini-cruises", as the long bay is not navigable at high speed due to the speed limits imposed and for obvious safety reasons. This implies that from Kotor the time needed to reach the open sea is about 1 hour and a half. Three hours would be dedicated just to this journey. Therefore, carrying out longer activities, with a larger and slower boat, gives the opportunity to carry out these activities in the necessary time, monitoring both the interior of the bay and the outside,

[34] Adapted from Practical Guide for the Development of Biodiversity-based Tourism Products, 2010 World Tourism Organization – ISBN 978-92-844-1340-9, p.19.

allowing a pleasant navigation to the team and guests on board, thus creating a unique and high-quality experience. [35]

Next step in developing tourism product based on dolphin observation and protection in Boka Kotorska Bay is **timing** which is crucial for a product. If a product developer fails to select the best time for undertaking a tourism product it will be very difficult to sell it to tourists. Kotor is the city located at the end of an almost closed bay (Picture 8), which allows the navigation for calm conditions almost every day of the year.

Picture 8. *Kotor, Montenegro*

After time defining, the next step for tourism product development is the pricing. **The price** of the product has an influence on the consumer's perception of important elements of the bundle on offer such as nature, dolphin observation, service quality, etc. In calculating the price, providers should consider the distribution channels of tourism products.[36]

Marketing the tourism product is the next important phase in product development. A proactive marketing strategy is needed to entice potential travellers interested in dolphin observation and protection during the marketing phase. The marketing approach should be well-targeted with a well-balanced marketing mix. It is important to study the market before starting and during the finalization stages of the product; to understand and pre-determine which market groups will be attracted to the offers of science-based tourism. [37]

5.1 CHALLENGES

Development of a new tourism product such as dolphin conservation and protection based product could face many challenges on the way. We will start from the general challenges regarding biodiversity, institutional capacity, legal frame, pollution. We will also refer to an apparent decline in bottlenose dolphins in Montenegro.

[35] Report on Cross-border Youth Camps, BioTours project.
[36] Adapted from Practical Guide for the Development of Biodiversity-based Tourism Products, 2010 World Tourism Organization – ISBN 978-92-844-1340-9, p.22.
[37] Also, p. 26.

Factors that cause threat to biodiversity are different economic activities, as well as weaknesses in the environmental management system.

One of the main causes that makes direct **pressure on biodiversity** in Montenegro and one of the main reasons for insufficient progress in the implementation of protection measures, is a low awareness level regarding the importance and biodiversity values at all levels (from citizens up to decision makers), resulting that biodiversity issues have often low priority.

An adequate scientific background, monitoring and use of modern tools regarding nature protection management is mostly absent or the subject of external funded projects.

Administrative capacity at the national and local level in Montenegro are insufficient for complex treatment of environment protection. In order to ensure the implementation of protection measures and nature conservation, a strong inspection network is needed, improved management capacities of protected areas, marking of protected areas and integration of nature protection in sectoral strategies such as tourism, marine biodiversity etc.

There are many challenges regarding the current nature protected area system in Montenegro. Protected areas are divided as territories and they should have a better protection approach.

One of the challenges is **illegal hunt and fishery**. There is insufficient data on fish stock and its productivity in Montenegro

Also, **marine pollution** by marine litter has both environmental and economic impacts and presents risks to marine life, human health and safety.

Additionally, results of an International Investigation on **Bottlenose Dolphin** presence in Montenegro show an apparent **decline** in 2019 and 2020 comparing to 2017 (Figure 22). Research was conducted by a group of researchers from DMAD – Marine Mammals Research Association, Laura Rudd, Tim Awbery, Sian McGuinness, Selina Brouwer, Enorha Guimard, Liam van Walsum and Aylin Akkaya since September 2016 up to 2020.

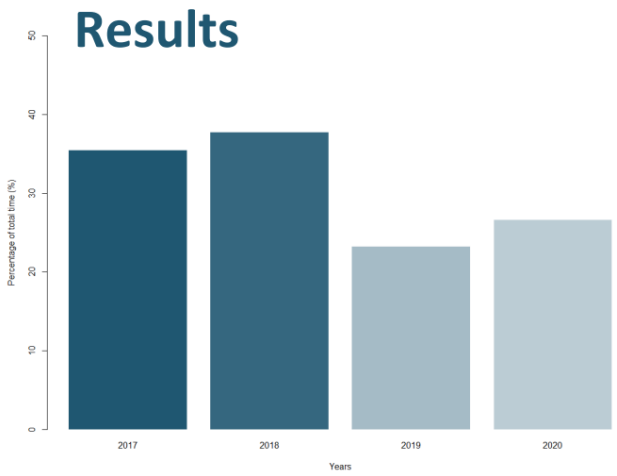

Figure 22. *Results International Investigation on Bottlenose Dolphin presence in Montenegro (2017-2020)*

During the Covid-19 travel ban, citizen science supplemented the data with key sightings (Figure 23).

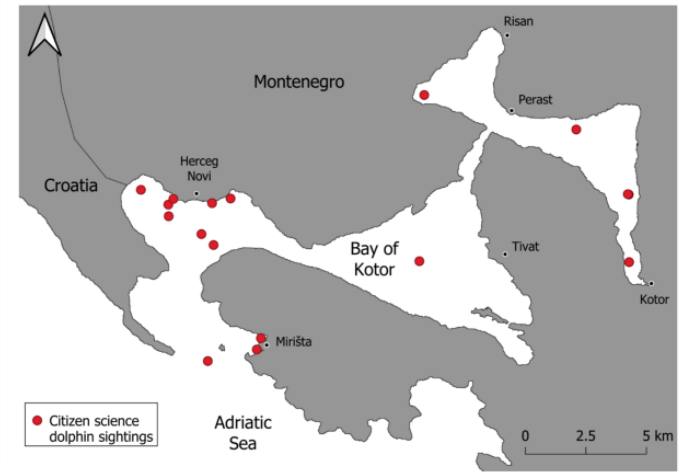

Figure 23. *Citizen science dolphin sightings in Boka Kotorska Bay*

6. CONCLUSION AND RECOMMENDATIONS

Protecting biodiversity is cruisal national and international importance. Many studies have shown the economic value of biodiversity and the ecosystem services it provides; and that this needs to be fully taken into account in planning and decision-making by all levels of government, the private sector and other stakeholders.

Research presented in this study shows the high value of biodiversity for tourism. Biodiversity is a vital component of the environmental quality and attraction of destinations for tourists, and needs to be protected for the long-term success of tourism.

All stakeholders should be involved in minimizing, and where possible avoiding, adverse impacts from tourism on biodiversity. With the international recognition of the need to halt and reverse biodiversity loss, the time is right for all those involved in tourism – governments, at national, local and destination levels, the private sector and other stakeholders – to implement and strengthen policies and actions to help achieve this goal recognized also by UNWTO.

Science-based tourism can support sustainable use, conservation and management of biodiversity through the following ways:

• promoting the economic value of biodiversity conservation;

• promoting conservation by raising awareness among the local community and visitors;

• generating additional funds for conservation from tourism.

Developing tourism products that support the protection and conservation of biodiversity in a destination requires joint actions with appropriate inputs from governments, site managers, indigenous people and local communities, and other stakeholders.

Data collected within this study contributes to a better understanding of the biology and ecology of the local bottlenose dolphin community, using marine area of Boka Kotorska, thereby contributing to

the proactive monitoring and assessing the status of the population in the future. In order to ensure the above mentioned, following measures should be implemented:

• continued monitoring and research activities within the area of Boka Kotorska Bay in order to determine trends in population abundance (rise, fall, stagnation) and to get a more complete dataset on the home range and changes in the distribution of individuals that can be the result of anthropogenic disturbance;

• collecting further data on the relevant habitat characteristics and the distribution of bottlenose dolphins in the research area to perform an analysis of habitat use and to identify critical habitats/areas;

• It is necessary to continue to collect detailed information about the types and extent of anthropogenic activities in the research area as well as its spatial distribution that will help identify and re-evaluate areas where the population is under the greatest real or potential pressure;

• It is necessary to monitor fishing stock and the impact of particular fishing tools on the availability of prey to bottlenose dolphins and in particular, determine the extent of use of fishing tools specifically interacting with bottlenose dolphins.

Regarding the development of tourism product based on dolphin observation and protection in Boka Kotorska bay, these issues should be taken into consideration:

- When creating environmental impact studies as part of planned economic activities, it is necessary to ensure an assessment is made with reference to impacts on the bottlenose dolphin community and other cetaceans;

- When planning eco-tourism based on bottlenose dolphin watching, it is necessary to determine the carrying capacity for the number of boats involved in such activities and to create a fixed set of rules of conduct that will lower any negative impacts of an increased number of vessels following dolphin groups;

- It is necessary to continue to disseminate information to the public about the biology and ecology of bottlenose dolphins that will ensure a positive outlook towards the conservation of the marine environment and the organisms inhabiting it.

Considering that there is evidence to suggest that the bottlenose dolphin population is declining in Montenegro and the cause of this is unclear, further research and the precautionary approach with the help of citizen science is needed and recommended.

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