GUIDELINES ON NATURE INTERPRETATION
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Edited by Oleg Rubel, Anastasiya Snigirova

Authors:
Natalia Fedoronchuk, Vladimir Poltorak, Galina Bevushko, Oleh Derkach, Tatyana Balatskaya, Mykola Rozhenko, Julia Nazarchuk

This book has been prepared in the frame of the Project “Interpretative Trails on the Ground: Support to the Management of Natural Protected Areas in the Black Sea Region” (InterTrails) funded by European Union. The authors have developed methodological and methodical basis of interpretation of nature protected areas. The structure and detailed description of four ecological trails located in protected areas of the Black Sea coast: Karadag Natural Reserve of NAS of Ukraine, Danube Biosphere Reserve of NAS of Ukraine, Lower Dniester National Nature Park, Regional Landscape Park "Kinburn Sand-spit". The book is designed for tour guides, travel managers and campaigns, staff of protected area, researchers, students and wide range of readers.

Reviewers:
Alexander Voloshkevich, PhD, director of Danube Biosphere Reserve of National Academy of Science of Ukraine
Natalia Gorip, director of touristic company "Salix"
Michael Zhmud, Ph.D., director of the touristic company "Pelican-Vilkovo-Tour"
Ivan Rusev, Ph.D., Ukrainian Anti-Plague Research Institute named after I. I. Mechnikov
Vasiliy Fedorenko, PhD, deputy director of the Danube Biosphere Reserve of National Academy of Science of Ukraine
Tetyana Chorna, head of the Regional Centre of dissemination of environmental knowledge, Odessa State Environmental University

Design: Tatyana Ostrogorskaya, Taras Narbut

Translated from Ukrainian by Tamara Tarasenko.

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Frantsuzskyi boulv., 29
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Nature of the Black Sea is unique possession of the countries and peoples of the Black Sea region, as well as of the entire mankind. Protection of the Black Sea and rational use of its resources is impossible without the development of sustainable eco-tourism. This idea became the impetus for the development of the project on ecological trails in 2008-2009, when it was discussed on the sidelines of the Conference of Ministers of Environment of the Black Sea countries.

The role of the initiator of the project was played by the Black Sea NGO Network (Varna, Bulgaria), together with partners from four countries of the Black Sea (Georgia, Moldova, Romania and Ukraine). Finally in 2011 a partnership consortium started implementing the project "Interpretation of ecological trails in order to facilitate the management of protected areas in the Black Sea region (InterTails)" funded by the European Union.

The project includes improvement of ecological trails in nature reserves, parks, sanctuaries and other valuable natural areas; description of biological, geological, cultural and historical sites along the trails; training and exchange of experience at national and international levels. In addition, the project provides educational activities and involvement of local authorities to address environmental problems. The project has a chance to become the cornerstone of the regional network of protected areas.

One of the results of this project is the following Guide to Guides, or, as Ukrainian counterparts call it "Guide on the interpretation of protected areas".

As you will see, the authors have gone far beyond a mere description of natural areas. Scientists and experts have created a unique world of "interpretation" of nature and historical attractions of the Black Sea coast. Thus, the authors of this book have made a considerable contribution to the defense of the Black Sea and the sustainable use of its natural resources; they have created scientific prerequisites of common information space.

We would like the readers to love the Black Sea, to keep its traditions, culture and nature, understand the sea, like the authors of this book do.

Sincerely,
Emma Gileva,
Black Sea NGO network
authorized representative
Bulgaria
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12 STEPS TO INTERPRETATION
**Step 1. Define what interpretation means**

Interpretation means explanation of natural, cultural or historic values attached to certain places. Interpretation envisages “first-hand experience” rather than merely sets of information and facts.

It enables visitors to gain *insight* and understand reasons for protecting our heritage.

Interpretation helps people appreciate something that is unique and deserves to be treasured.

**Step 2. Remember 6 vectors of interpretation:**

- *to encourage* visitors of natural areas to think;
- *to make contact*, which involves communication with the audience, based on the best principles of communication;
- *to disclose* distinctive features of the protected object;
- *to target* - specify the length of the route by time, the distance, rules, safety measures;
- *to inform* - mere facts do not mean interpretation although can be of interest to part of your audience;
- *to entertain* - use interactive games, interesting findings.

**Step 3. Identify the object of interpretation**

Interpretation can relate to a place/object: rural areas, elements of the environment (rocks, plants or animals), aspects of traditional culture, historical event or period, economic activities, such as fishing, etc.

**Step 4. Identify theme and topic of interpretation**

People can easily forget facts and figures, but they will remember presentation elements according to topics. The theme is the main message of your story. Topics encourage visitors to think and wonder, and these are first steps to change their attitudes and behavior. The theme contains the message that you would like to bring to people’s mind, it runs like a red thread. The theme is usually expressed in a sentence and contains an element of action.
Step 5. Identify and locate accessible, important, useful, relevant information

**Information and interpretation**

Where information provides facts, interpretation provides a story. Interpretation includes information and is based on sound knowledge of factual information. Good interpretation puts facts into context, explains and expands their meaning, and weaves them into stories. For example:

**Information:**

Like many other toponyms, it is difficult to trace the origin of the name of the Black Sea. It was first mentioned in writing sources in the 13th century, but there are indications that the name may be much older. Strabo’s Geography reports that in antiquity the Black Sea was often called "the Sea" (Pontos). Graeco-Roman tradition refers to the Black Sea as the "Hospitable Sea", Pontos Euxeinos. This euphemism replaces the "Inhospitable sea," Pontos Axeinos, first used by Pindar (early fifth century B.C.). It is also possible that the name Axeinos is connected in popular etymology from the ancient Persian word axšaina - "dark", "black" referring to the colour of the cardinal points of the world.

**Interpretation:**

One of the little known facts about the Black Sea is how it became to be called ‘black’. The name, used nowadays by all nations living along its coasts, was first mentioned in a 13th century manuscript, but there are indications that it may be much older. Several centuries B.C. ancient Greeks called it Pontos Axeinos, "Inhospitable Sea", probably because of difficult navigation and hostile inhabitants on its shores. Later, with the progress of colonization and trade, the name was changed to Pontos Euxeinos, "Hospitable Sea". But it is also possible that the name Axeinos arose from the ancient Persian word axšaina meaning "dark" or "black". The cardinal points of the world in ancient times used to have colour symbols so black signified north. Therefore the name “the Black Sea” may date back to antiquity.

**Information:**

The Southern Alps have formed along a tectonic plate boundary and are eroded by weather. The erosion rate and the uplift rate are very similar.

**Interpretation:**
The Southern Alps were created by the plates struck on the earth’s surface. When two sheets of paper hit each other, they bend, fold and rise. The Earth experienced something like that. Just as when you push two pieces of paper together they buckle, fold and rise, so does the earth. Weather is working. Trying to slow down the rise of the mountains, the weather tears wind, rain and snow at them. As much as the Southern Alps rise every year, the weather lowers them back again, that is why their height is practically unchanged.

**Step 6. Define your target group**

They may be pupils, students, extreme tourists or birdwatchers.

*Know your audience*

Find out where the visitors come from; learn their names, if possible, their level of knowledge on your topic. If there is someone very knowledgeable, try to encourage them to share their knowledge with the group.

**Step 7. Develop a strategy for interpretation using techniques and equipment:**

*Entertainment*

To hold people’s attention any form of communication has to entertain. Some of the following approaches can help make your tour more enjoyable for visitors:

*Provide means of interaction*

Keep people actively involved in the tour to make it more fun for them and you. Engage as many of their senses as possible. Ask questions or organize group discussions to make people form their own opinions and share them. Demonstrations and activities also stimulate people to interact with the environment and each other.

*Vary your style*

Changing the tone and volume of your voice can dramatically increase the effect of your words on the listeners. Silence, used at the right moment, can be very powerful too. It may help you emphasize the importance of something you just stated or help build suspense.
Embrace the unexpected

If something unplanned occurs, like a sudden storm, make use of the opportunity it provides and talk about it. For example, how local people using traditional clothing dealt with such conditions. If a small lizard creeps along while you are talking about something different, don’t be afraid to change your focus to it. Try to catch the opportunities that nature provides sometimes.

Relevant

If visitors can relate to what they see this may help them establish a personal connection to the place. When visitors can establish a link between new information and something they already know or have experienced, then it is more easily understood and may leave a lasting impression.

Use comparisons

Comparisons can highlight differences and similarities. This allows people to form connections to new places, animals, plants, landforms and local traditions by seeing them in relation to what they know.

Know your audience

Find out where visitors come from, learn their names, if possible and find out their level of knowledge on your topic. If someone is already very well informed you can try to include them and encourage them to share their knowledge with the group.

Avoid technical terms

Scientific language and complex terms do not bring a clear message to an audience without previous knowledge on the topic. Use analogies and comparisons to explain things your audience is not familiar with.

Organization

Information has to be presented in a logical order to be understood easily.

Objectives

If you know what you are trying to achieve, then it is easier to reach the end. Think about why you are running this tour and what you would like your audience to learn and experience during the tour. This will help you formulate objectives and will provide the framework and themes to build your task or tours around.
Planning

Plan the structure of the tour. A helpful approach is to follow the structure of a story with a beginning, middle part and end. This can be put to a draft or outline of the main facts. Make sure you have researched your topic well and can include stories about places and people that give liveliness to the story without too many terms, dates and figures. Check that your ideas and topics form an interrupted storyline. Then they will make sense to the audience too.

Thematic

People may quickly forget facts and figures but they will remember elements of a presentation based on a theme. A theme is the main message of the story you are telling. Themes provoke visitors to think and wonder, and these are first steps to changes in attitudes and behaviour.

The theme contains the message you would like people to go away with and provides the thread for linking the presented information in a meaningful way. A theme is usually expressed in a sentence and has an element of action. To create themes for your topics, ask yourself, “So what?” about your topic.

Topic: Sea cliffs Theme: Sea cliffs can reveal past changes in sea level.
Topic: Old trees Theme: Old trees are home for many creatures and are vital for a stable forest ecosystem.

Learning styles

People process information and learn in different ways. Probably the most popular approach is to rely on visual information. This includes text, graphics, art, maps, sculpture or video. Another common way of acquiring knowledge is through sounds, speech, music and songs. Action, movement and touch enrich the senses and may leave a lasting impression on visitors. Finally, the establishment of emotional connections can change attitudes and enrich the experience of visiting a place.

Our own learning preferences influence the way we present information and interpret facts. We often communicate information the way we like to receive it. To reach a diverse audience use different interpretation approaches based on a variety of learning styles. Learning continues long after the visit. That’s why a story about the place should intensify a visitor’s experience and trigger reaction and participation.
**Personal interpretation**

- Techniques
- Delivery skills
- Distractions and emergencies – dealing with them
- Props / Materials
- Drama
- Associates and partners

**Step 8: Personal interpretation techniques**

*Meet and greet*

Make a brief introduction then allow visitors to make their own way through a site. This is an effective way to make contact with a large group for a short time.

*Guided tours by foot or vehicle*

Guiding provides an opportunity to visit remote or less accessible places, see wildlife, or view landscapes in a different light. Tours can be easily tailored to different audiences with general or special interests.

*Talks or presentations*

They can be delivered at a scheduled time and place or can take place informally, such as a talk at an entry point to a site or at remarkable points of interest.

*Open days and events*

This can be a cost-effective way to reach bigger audiences. Good planning and promotion is essential to attract people.

*Volunteer programmes*

Mix active conservation work with interpretation to provide a deeper more meaningful experience. Include time on volunteer programmes for interpretative talks.

*Seasonal programmes*

On many sites summer programmes can be specially tailored for different audiences. Interpretation can be provided on short guided walks, river trips or special tours. The activities can be effective and memorable for those involved when you take into account their interests, background and way of learning. A few tourism operators are interpretation focused, for instance on culture trips, some include interpretation as an item in their programme, while others focus just on an activity.
Step 9: Delivery skills

Body

First impressions are important. Wear clean and tidy clothes. Don’t forget a name badge and hat for the sun.

Smile to help everyone relax and feel welcome.

Think about your posture and body language. Stand solid and firm to show confidence and competence. Avoid playing with objects, such as pens and keys.

Use natural gestures and always face your group.

Voice

Speak with enthusiasm and passion

Vary tone and rhythm. Remember to pause for emphasis, to collect your thoughts, to let your story be absorbed or to indicate a change in topic.

Replace “um” and “ah” with a pause.

Language

Use simple language and speak clearly with short sentences.

Avoid scientific and technical jargon – it turns visitors off.

Create images in people’s minds

Use humour. If your audience is laughing then everyone is relaxed. Make jokes or stories relevant to your subject.

Use silence for impact and focus.

Analyze your performance – what worked best, what did visitors really like? Ask for feedback. To calm down your nerves and improve your public speaking practice, join a presentation skills course and keep practicing. Practice your presentation delivery on other colleagues and prepare variations for different audiences and group sizes.

Answering questions

Buy time to answer to audience questions or remarks:

- rephrase the question
- acknowledge the point
- ask for clarification
- ask for an example
- agree
Develop your own style

Enthusiasm is the most highly valued attribute interpreters can have. Credibility and professionalism are also appreciated. While a sense of humour always helps relate to a visitor, don’t force humour if it doesn’t come naturally.

Managing large groups

Determine a maximum size to suit the talk and site; eight to twelve is often optimum but this would be determined by the number of interpreters involved – 30 people is a good maximum for 4 interpreters.

Stay at the front and appoint someone to bring up the rear.

Allow time to deal with obstacles.

Talk to your group once everyone has arrived.

Be visible and audible at all times, stand above your group if necessary, and project your voice to the person at the back

Provide children with tasks or games along the route and periodically count your group – safety first!

Talks

If your talk is longer than 30 minutes (the average adult attention span) take a break.

Have good images. Few talks are effective without visual aids.

Use sound to maintain interest and attention.

Present in a pleasant setting free of other distractions.

Distraction and emergencies

Distractions can come in many forms: a crying baby, a loud talker in the back of the group or an overly energetic child. Sometimes you can anticipate a problem and prevent it before it comes disruptive. Ask the hyperactive child to assist in a task, such as counting the number of people in the group or lead a song during a walk between two points. Invite the loud visitors to come closer, so they can “see well”. Deal with distractions in a professional manner; don’t let them ruin the experience for the majority of the visitors.

Accidents and emergencies do happen and they will test your efficiency. Preparation and contingency planning is the best approach to dealing with such situations. If someone becomes ill or injured during a visit you have to major responsibilities: assist the injured and direct the rest of the group.
**Step 10: Props**

Every visitor’s centre, museum or a protected area office is full of potential props. Props explain things, gain attention and engage a group.

People respond to familiar objects used in innovative ways.

Involve different senses with props – smell, noise and touch.

Pass around a sample of a smelly leaf or twig, feel the touch of a local bird feather. Use a whistle to imitate an animal’s call.

Try using historic artefacts as they were originally. Lifting or using a tool for a minute can give an insight into people’s life in times past.

Props can also be distracting and you can lose visitors’ attention when it is their turn to have a go. When passing a prop around, stay on the topic until visitors have finished with it then put it away.

Possible props:

- skins
- skeletons
- pressed plants
- rocks
- artefacts
- tools
- replicas
- costumes
- equipment
- traps
- laminated photos and sketches
- models and replicas
- books
- music
- instruments

**Step 11: Drama**

Dramatization of a history related to an event or period is a popular technique which takes visitors to another time. Theatrical skills are required to make this interpretation work well – interpreters need to stay in role at all times and be historically accurate.

Costumed guides who do not play a part are not limited to staying in character. The costume is part of the story and provides context. Tours of buildings and historic sites benefit from personalised stories or a political context to bring the architectural forms and features to life.
Re-enactment of real events provides the opportunity to immerse the audience mentally and emotionally. The resources, planning and the skills required of participants will depend on the scale and nature of the re-enactment, and can provide good opportunities for volunteer involvement.

Demonstrations of cultural practices involve visitors and provide a relaxed environment to talk about the activity and other cultural information.

Performing arts – music and theatre events often take place in outdoor sites and sometimes draw on the site for the story line.

*Non-costumed guides*

Costumes and characterization are not essential to create great interpretation. Once the theme has been established, the story can become more specific as points of interest are reached. A historic house can offer lots of engaging stories (mysterious deaths, ghosts, character people, and odd things) and plenty of opportunities to ‘do things’ with well placed props. Grab visitor attention.

**Step 12: Associates and partners**

*Tour operators, volunteers, museums, community groups, schools and others*

Partners from the tourism sector and associates such as museums, community groups, schools and others, play a significant role in delivering interpretation to visitors and providing satisfying recreation experiences. The responsibility for visitors becoming informed is shared by the interpreters, tour operators, other partners and associates in delivery, and by all people who choose to visit protected areas.

*Volunteers, communities and schools*

The work of volunteers and schools education is integral to achieving long term conservation and social benefits. The volunteer, community and schools education programmes provide information about opportunities for involvement and a public events calendar. They also incorporate policies, standards and procedures to direct, guide and support interpretation.
KARADAG NATURE RESERVE OF NATIONAL ACADEMY OF SCIENCE OF UKRAINE

INTERPRETATIVE TRAIL “GREAT KARADAG”

Biodiversity– Galina Bezvushko

Geological diversity – Ph.D. Natalia Fedoronchuk

Historical and cultural heritage – Ph.D. Volodymyr Poltorak
Karadag Nature Reserve of National Academy of Science is situated on the territory of Feodosia district of the Autonomous Republic of Crimea.

Coordinates: northern boundary - 44°57'46" N, 35°12'45" E; southern boundary - 44°54'40" N, 35°12'09" E; eastern boundary - 44°56'16" N, 35°15'15" E; western boundary - 44°55'45" N, 35°10'35" E.

Area: 2874.2 hectares, 809 hectares of which is coastal water area.

Subordination: National Academy of Sciences of Ukraine.

Karadag Nature Reserve of the National Academy of Sciences of Ukraine is a distinctive nature center with a unique combination of geological, archaeological sites, colorful biological and landscape diversity and phenomenal coastal aquatic complex in the south-east of the Crimean peninsula.

The reserve was created on August 9, 1979 in accordance with the decree of Council of Ministers of the USSR on the basis of one of the oldest on the Black Sea coast academic institutions – Karadag Biological Research Station, which was established in 1914 by assistant professor of Moscow Imperial University T. Vyazemskiy with financial support and in close collaboration with Professor L. Morohovets and Academician Pavlov. Today the reserve is subordinated to NAS of Ukraine. The Institute of Biology of the Southern Seas NAS of Ukraine is its scientific curator.

According to the physical and geographical territory, the national reserve belongs to the Crimean mountainous and forested Crimean mountain region. Its vegetation, according to geobotany zoning, belongs to Mountainous Crimean County of Crimean-Novorossiysk province of Mountainous Crimean province of Mediterranean forest area.

Trail "Great Karadag"

The length of the route: 7 km (mountainous) and 8 km (marine)

Average length of visit: 5 hours

Means of transportation: walking and on boats

Term of Visit: May to October

Visiting: only with a guide

Address: Nauki str., 24, Kurortnoe, Feodosia, Crimea 98188, Ukraine
Tel: +38 06562 26290, +38 06562 26512.

For visitors: tel. +38 06562 26287
E-mail: karadag@ukrpost.ua
1. BIOSTATION
2. “KING PLATEAU”
3. PISTACHIO FOREST
4. MONOMAKH’S CAP HILL
5. GLADE AT THE FOOT OF KARAGACH RIDGE
6. SOUTH SLOPE OF KARAGACH RIDGE
7. BAY: PUTSOLANOVA AND ROBBER BAYS
8. TUFF RIDGE
9. PLATFORM ABOVE BOUNDARY BAY
10. REMNANTS OF WEATHERING
11. WESTERN SLOPES OF HOBA-TEPE RIDGE
12. SOUTH PASS
13. SPHINX
14. MAGNETIC RIDGE
14a. STATION OF BACKGROUND ECOLOGICAL MONITORING
14b. SETTLEMENT TEPSEN
15. Koktebel Bay – Cape Malchin
16. Livadia Bay
17. CORNELIAN BAY
18. ROARING GROTTO
19. ROOTS OF HOBA-TEPE VOLCANO
20. GOLDEN GATE ROCK
21. BOUNDARY BAY
22. IVAN ROBBER ROCK
23. LEVINSON-LESSING ROCK
24. KUZMICH STONES
Karadag is a unique natural mineralogical object of world importance. Diversity and uniqueness of its nature led to the creation of this reserve.

In 1901 Moscow physician Terenty Vyazemskiy started looking for a place to engage in research far from the bustling city. He acquired an abandoned cottage on the Black Sea shore in Karadag Valley. With the support of another Muscovite - physiology professor Leo Morohovets - he began construction of resort, and also a research station. The works lasted for more than a decade and was mostly completed in March, 1914. Then it was given to the Society of promoting experimental science (at Moscow University and Moscow Higher Technical School) and systematic studies of the area began.

After the death of Terentiy Vyazemskiy (September, 23, 1914), the station was named after its founder. At that time geological and paleo-volcanic research on Karadag attracted academician Alexei Pavlov and his student Alexander Sludsky.

It was A. Sludsky who headed the station after the death of T. Vyazemskiy and made an invaluable contribution to the development of the scientific station. He also advanced ideas on the formation of Karadag. It was a new way of understanding the geological nature of the volcanic massif. In a number of his works he illuminated new data on paleontology, history of formation and complex geological structure of Karadag massif.

In course of his deep and comprehensive study, he determined the early-Callovian age of Karadag volcanic activity (164 million years), nature of its volcanic activity, sedimentary character of tuff - the product of volcanic activity, discovered the character of formation and bedding of Karadag igneous rocks, revealed the presence of dikes of lava flowsand covers, laccoliths.

Thanks to research of the first director of the station A. Sludsky, with the participation and under the influence of A. Pavlov, as early as in 1920 "Karadag National Park" concept was born, and the reserve was established in August 9, 1979. It received the status of "biological" in 1928, and in 1937 became subordinate to Ukrainian Academy of Sciences. During World War II the station was under occupation. In 1963 the station became part of the Institute of Biology of the Southern Seas named after O. Kovalevsky – first as a department, later as a branch. A unique library houses within the walls of the scientific station. It was created by T. Vyazemskiy who collected scientific publications of British, French, Russian academies (beginning with XVII-XVIII centuries), complete collection of works of eminent scientists Buffon, Linnaeus, Haeckel, Pasteur, Darwin, Sechenov, Pavlov and many others. Some of the library books are unique in Eastern Europe.

Modern Karadag Nature Reserve covers an area of about 29 km², 8 km² of which is the area of the Black Sea. Flora and fauna of the reserve has been declared national property of Ukraine and its rocky-aquatic complex has a conservation status of international importance and is included in the Ramsar Convention.
2. “KING PLATEAU”


Karadag with its coastal cliffs is unique, as, due to the weathering process, the volcanic formations (power of 400 m) are disclosed for 5 km. Here you can even see volcano roots – frozen magma chambers from which lava struggled through the vents.

Karadag massif consists of three parallel ranges that stretch, like all Crimean mountains, from southwest to northeast – Beregovoii Ridge, ridges Suru-Kaya and Balaly-Kaya. Beregovoii Ridge is composed of numerous lava flows and volcanic – sedimentary and igneous rocks which, after the formation, were intensely crumpled by internal forces of the Earth and split into separate blocks. The coastal part of the ridge was dumped into the sea by tectonic movements. Titanic force in the earth’s depths has created severe accumulation of blocks.

The structure of the Beregovoii Ridge is divided into four successive ridges: Karagach, Hoba-Tepe, Magnetic and Kok-Kaya. Western part of Beregovoii Ridge – Karagach Ridge – is overlooking from our observation point. Karagach is 333 meters high above the sea level. Weathering of the upper layers of the earth created fanciful forms of relief, which do not cease to surprise people. In the nearest cliffs you can see the so-called "King's group": "the King" with the crown, "the Queen" with a small cap and their "retinue", bowing towards the royals in the highest point (333 m). At the foot of Karagach one can see Karadag Bay and its beach, composed of volcanic rock pebbles.

Archaeological research.

From ancient times the territory of Karadag Nature Reserve has attracted the man not only by scenic landscapes but also by the opportunity to live and farm here. Written sources about the local population descend from ancient times. But archaeological research in this area takes place less than a hundred years.

Savannoids. Bright green capers.

Steppe covers the flat as a pancake terrace of the Karadag ravine, here and there ephemeral grasses dominate. Along the trail in the herbage one can see silvery Crimean wormwood (Artemisia taurica) and grayish hairy Crinitariai (Crinitaria villosa). Bright green capers (Capparis herbacea) stand out on yellow background of summer steppe.
3. PISTACHIO FOREST

Pistachio is a relict species listed in the Red Data Book of Ukraine.

At the foot of the Lobovoi Ridge Pistachio forest stretches away. *Pistacia mutica* is a relict species recorded in the Red Data Book of Ukraine. Pistachio trees with spreading crowns on powerful trunks up to 9 meters high are a real ornamentation of the landscape. Pistachio fruit bunches resemble bunches of grapes, while ripening they gradually change their color from pink to blue and purple. Equally beautiful are its leaves in autumn, thanks to a variety of colors, from pink to bright orange and burgundy. Pistachio seeds are edible, like those of real pistachios, but smaller and with a very hard shell, so only birds with strong beaks, such as barley bird, and wild boars and deer eat them.

Karadag Mountain massif as part of the chain of the Crimean Mountains. Orography and toponymy of the area. Mountains are formed by volcanic and sedimentary rocks.

The Crimean Mountains are part of the common Carpathian-Crimean-Caucasian orogen. This young rock system was formed as a result of Alpine orogeny – the youngest stage of active tectonic movements in the Earth’s history. The Crimean mountains are formed by crumpled into folds, sometimes posed vertically, sedimentary rocks formed at the bottom of the ancient Tethys Ocean – limestone, sandstones, clays of Triassic and Jurassic age. They began to rise from the ocean floor in the Jurassic period (160-180 million years ago). The processes of orogeny were accompanied by volcanism. Perhaps the chain of Crimean Mountains began to form from Karadag volcanic islands.

From the observation point one can see Karagach Ridge, the highest mountain of Karadag – m. Holy (577 m), rock-dike Kush-Kaya, Small Karadag Mountain (451 m), Northern Pass (287 m) and the ridge Syuryu-Kai (507 m).

Karagach Ridge, and the whole Beregovoy Ridge, as well as m. Holy and rock-dike Kush-Kaya are of volcanic and magmatic origin.

Syuryu-Kaya Ridge, located on the other side of Northern Pass, is not volcanic. It is composed of sedimentary rocks formed at the bottom of the ancient sea. The ranges located to the north of the trail are composed of the same rocks.

Population of Karadag in the antiquity and Middle Ages, legendary and real settlements of the Great Migration period.

Right in front of us we can see the highest peak of the reserve – m. Holy. On its slopes lived one of the first known from written sources people of Crimea – the Tavry. One of the names of the peninsula – Tavrida – comes from this Greek name. Material for making hand millstones, which were exported beyond Karadag, was mined here. In addition, the Tavry and their steppe neighbors Cimmerians left behind pottery fragments, specific grave stone boxes, settlements, sentry points, etc. Ancient geographers, describing ancient
Tavrida on the western borders of Bosphorus kingdom, recalled the Istrian river, in place of modern Kurortnoye and Koktebel, "an abandoned port of the Tavry – Scythians Afineon" and Hermiziy city, in place of Karadag – m. Holy with the sanctuary of Asclepius.

Fresh water has always been the greatest treasure in Crimea. Ravines and wooded slopes allow at least 12 water springs carry valuable water to people in Karadag and the surrounding area. The remains of ancient settlements, temples, sheep folds are close to the water sources. The microclimate of Karadag and Otuz valleys is favorable. The valleys are on the left when we look at the panorama of Karadag ravine. Grapes ripe faster here than in neighboring Koktebel and Feodosia, and this is where since ancient times wine making has given high income to the residents.

4. MONOMAKH’S CAP HILL

Pillow lava.

Monomakh’s Cap Hill is created with volcanic-sedimentary rocks, covered by lava flows. Pillow lava, created during earlier underwater eruptions, lie in the mountain base.

The origin of the name Monomakh’s Cap and Tumanova ravine.

The mountain in front of us was given its name Monomakh’s Cap in early 20th century by the scientists who were researching Karadag. It really resembles the regalia of Moscow Tsars.

Artificial planting on artificial terraces. The biggest mammal of the reserve – wild boar.

Here you can see tree species, planted by man in 1940-60s, when the terracing of slopes took place on Karadag, at the territory which is now protected. As a result, natural vegetation was disturbed. Uncharacteristic for the territory species were planted on artificial terraces, first of all Pallasovu or the Crimean pine (Pinus pallasiana) and Pitsunda or Stankevich pine (P. brutia var. Stankeviczii). Both species of pine are Crimean, but they grow to the west from Karadag. The Tatarian Maple (Acer tataricum), widespread in the south of Europe, in Turkey and in the Caucasus, was introduced into Karadag flora.

They occupied about 19% of the protected area before the reserve was announced, but now they are turning into more natural for Karadag plant communities.

The Crimean Pine (traces of wild boar). Further along the trail along deep Tumanova ravine, near one of the artificially planted pines, one can see traces of the largest mammal of the reserve – wild boar (Sus scrofa). In some places the soil is completely dug up, the turf is ripped off, some big stones are turned over – the wild boar did it all. Boars dig up large areas deep enough in search of food. The lower part of the pine trunk for them is something to rub against trying to get rid of the itching after the bites of bloodsucking flies.
Geographical position of Karadag at the edge of forests and steppes has defined its climate as transitional from Mediterranean to temperate continental, with up to 2565 hours of sunshine per year. Winter on Karadag is relatively mild; summer is hot, with a deficit of atmospheric moisture (388 mm).

The ground cover on Karadag is mosaic. There are different types of soils – brown forest soils and turfs, but they are not productive, their humus content is low. Under the meadow-steppe vegetation chernozem is formed.

At a relatively small area of the reserve one can meet all types of groups of vegetation, prevalent on the Crimean peninsula. Nearly half of its territory is covered with forest communities.

Shady rock oak forests cover less than 7% of the reserve and grow in the northern, north-western slopes and on top of m. Holy, between m. Lehener and Suru Kaya Ridge above 400 m asl, forming vegetation of the upper zone.

At an altitude of 450 m asl the mossy oak grows (Quercus pubescens) – drought-resistant photophilous species. The mossy oak is the main forest forming species, together with field maple (Acer campestre), ash (Fraxinus ohusarpa) and pistachio trees.

Oak, pistachio, juniper sparse woodlands are side by side to shrub groupings characterized by exceptional adaptability to various conditions, especially to long summer drought. They were formed in even more arid conditions, on the southern and south-eastern slopes of ridges and hills below 360 m asl, where summer moisture deficit is felt particularly acutely. They consist of thickets of the wild rose, hawthorn and juniper. Especially interesting is Mediterranean shrub-tree Paliurus (Paliurus spina-christi) (or "Christ's thorns"). Its branches are covered with many spikes, aimed in different directions. So, it is impossible to pass the thicket of Paliurus, it will "hold" you tight.

Characteristic species for light forests and woodlands are hawthorns (their Latin name "crataegus" means strong, solid). 15 species of hawthorn grow in the reserve, 2 of which are recorded in the Red Data Book of Ukraine. Poyarkova Hawthorn (Crataegus pojarkovae) is Karadag endemic, pride and attraction of the reserve flora, the largest hawthorn in Europe.

Under the forest canopy exceptionally beautiful large flowers Paeonia daurica bloom in May. In late May – early June a dangerous plant blooms on the forest fringes – Dictamnus gymnostylis, popularly known as "burning bush." Its large inflorescences of pink-purple flowers and leaves on hot days produce essential oils. The plant shouldn’t be touched, because it causes burns that do not heal for a long time.

108 species of Karadag flora have different conservation statuses. 22 species are recorded in the IUCN Red List of plants and animals, 21 – in the list of the Convention on International Trade in Endangered Species of Wild Flora, 9 – in the list of the Convention
on the Conservation of European Wildlife and Natural Habitats (The Bern Convention), 86 – in the Red Data Book of Ukraine.

In the spring and early summer on this section of the route you can hear birds singing – the finch (*Fringilla coelebs*), great tit (*Parus major*), woodpecker (*Dendrocopos major*), or see brightly colored jay (*Garrulus glandarius*). The principal soloist with modest coloration – southern nightingale (*Luscinia megarhynchos*) – hides in the bushes.

Wild goats (*Capreolus capreolus*) often come to the trail. Males have short horns with three spikes. They graze on the slopes alone or in small groups. About a hundred of these animals live in the reserve.

### 6. SOUTH SLOPE OF KARAGACH RIDGE


Karagach ridge, like the whole Beregovoi Ridge, is composed of igneous rocks and volcanic tuffs. Uneven weathering of tuff has created interesting landforms Example of such structures is rock Kozak, with a viewing platform near it. The rock is hardened by mineral veins that make the rock more resistant to weathering.

The observation point offers a magnificent panorama of ridges: Echki-Dag with three peaks to the northwest, Sandik-Kaya, an ancient coral reef formed at the bottom of the warm Tethys Ocean, further to the east. The sea has carried volcanic debris of Karadag massif to shallow waters by the reef and out of the fragments the waves formed pebbles, found nowadays in the limestone of Sandik-Kaya.

Besh-Tash ridge is located to the east, then - Balaly-Kaya (with two peaks). In Balaly-Kaya we can see telescope masts, used to control the Lunokhod. The remains of ancient corals were found in Galaly-Kaya rocks.

One of the largest and cleanest Karadag water springs *Gaur-Cheshme* ("Spring of the infidels") is on western slope of m. Holy. On the whole, Karadag is poor in water resources, but the water in the existing ones is very clear. *Gaur-Cheshme’s* water is carbonate-free; it purifies itself while passing through zeolite rocks of m. Holy.

**Plants on dry and rocky slopes of the Karagach Ridge. The European hare. The typical Crimean mountain steppe.**

On the way to the panoramic platform you can see the plants on dry and rocky slopes forming shrub communities. Next to the trail beautiful junipers (*Juniperus excelsa*) grow. These plants are not pretentious; they can grow in arid conditions, among rocks, in rock cracks. *Juniperus excelsa* is a relict species recorded in the Red Data Book of Ukraine.

On the steppe slopes with bushes and in the woodlands, even in rocky crevices overhanging the sea, the European hare (*Lepus europaeus*) lives. This animal, common throughout Crimea, is quite rare in Karadag reserve. The population of foxes (*Vulpes vulpes*) in the strictly protected area is the likely reason.

In the reserve there are all kinds of steppe vegetation typical of Crimea:
meadow, authentic and rocky steppes, semi-desert steppes and savannah groups. There are no clear boundaries between different types of steppe communities. The typical Crimean mountain steppe can be seen on the crest of the Karagach Ridge.

7. BAY: PUTSOLANOVA AND ROBBER BAYS

View of the Meganom peninsula from Karadag ridge. Karadag bays.

The crest of the ridge overlooks the Meganom Peninsula, one of the most arid territories in Crimea and in Eastern Europe. Rocky shores and slopes are almost devoid of vegetation and therefore are being actively weathered. The highest point is Mount Meganom, 358 m high above sea level. The area of the rocky peninsula is about 20 km², the coastline is about 16 km long.

Karadag rocks are steep, and there are small bays, where the waves have turned fragments of stones into pebbles. The bays are separated by headlands that are composed of very strong magmatic rocks. There are 15 large and small bays along the coast of Karadag.

Ivan Robber rock, which we see far below, separates two bays - Robber Bay (in the west) and Putsolanova (in the east). Their names have a long history.


Look down at a tall rock resembling a man in a high hat with a sack on his back. It’s hard to believe that it is 81 meters high (as high as a 30-storey building)! It covers the east entrance to the small bay called Robber bay (Hartsyz-Liman in Turkish). Ethnographers believe that it was there that Cossacks waited for Turkish ships and prepared to attack the neighboring Cafu-Feodosia (which they repeatedly stormed and captured).

History of putsolana search. In 1905, Professor Karl Ivanovich Bogdanovich suggested using Karadag tuffs as additives to hydraulic cement. In the same year, engineers Lyamin and Krusser found the rocks on m. Holy, which in their mind were similar to Neapolitan pozzolan (from Pozzuoli near Naples, Italy). In 1910, a joint-stock company “Russian Putsolana” was founded for research and production of that mineral. Search near m. Holy failed. To the left of the Ivan Robber rock you can see Putsolanova Bay. Engineer Nicholay Kozlovsky studied the slopes and pointed out the feasibility of mining tuff there. The properties of the local mineral did not correspond to the Italian one. However, the name has stuck. Industrial tuff mining on Karadag began in 1927 on the slopes of m. Holy.
8. TUFF RIDGE

Hoba-Tepe ridge - the largest volcanic center of Karadag.

Karadag volcanism did not have central point of eruptions. It intermittently lasted for tens of millions years, and lava erupted through numerous vents. The largest volcanic center in Karadag is Hoba-Tepe Ridge, which opens from the point of observation. The highest point of the ridge is Lodge rock (440 m above sea level). Rock Mayak, the most protruding into the sea, is a magmatic dike.

"The Dead City".

Translated from the Tatar language, namely the southern coast dialect, Hoba-Tepe means "a peak with caves". Indeed, here travelers can find several hollows that give a rare opportunity to escape from rain or bad weather. On top of Hoba-Tepe, the remnants of the so-called "Dead city" are visible.

Birds of prey on Karadag. Bats – the inhabitants of caves and grottoes.

4 species of birds of prey nest in rocky cliffs. Ubiquitous is the Kestrel (*Falco tinnunculus*), a representative of small falcons; its main prey are rodents and lizards. Its larger relatives, such as the peregrine falcon (*Falco peregrines*), balaban (*Falco cherrug*), steppe buzzard (*Buteo buteo*) are recorded in the Red Data Book of Ukraine.

In the rocks on the coast and in the karst caves of Suru-Kaya Ridge the cheiroptera (16 species) find shelter.

9. PLATFORM ABOVE BOUNDARY BAY

Features of the Black Sea relief and hydrology.

The Black Sea is one of the most peculiar marine basins of the planet. The Black Sea waters wash the coast of Ukraine, Russia, Georgia, Turkey, Bulgaria and Romania. Its area is 423,000 square km. The coastline is 4,725 km long, 1,629 km, or 34% of which is Ukrainian. On the one hand, it is an inland water body, removed from the ocean, directly connected with the Mediterranean Sea by shallow narrow Bosporus Strait. At the same time, the central basin of the Black Sea is very deep – up to 2245 meters. Geological history of the Black Sea is complex and interesting. 50-60 million years ago it was a part of the large salty Tethys Ocean. Later the movement of lithospheric plates changed the location of oceans and continents, and instead
of an ancient ocean mountain ranges of the Alps, the Carpathians, the Crimea, the Caucasus and the Himalayas appeared, and a number of continental basins, including the Black Sea.

The distinctive and unique feature of the Black Sea is hydrogen sulfide zone at a depth of 150-250 m, accounting for 87% of the sea, where only a limited number of organisms can exist (e.g. sulfur bacteria). In this area of deep stagnation, where no convection processes take place due to the great depth, hydrogen sulfide remains in the dissolved state.

Water salinity off the coast of Crimea is 18 ‰ (ppm), which determines characteristic flora and fauna, as ocean salinity is almost two times higher (35 ‰).

The origin of the Golden Gate rock name. Alexander Pushkin and Shaitan-kapu.

You can see a beautiful rock with an arch in the middle. This is Golden Gate. It received this name only a century ago. The gate had a Turkish name Shaitan-Kapu ("gate of Shaitan-Satan") before. Young Alexander Pushkin visited this natural wonder in 1820, and it has not changed since then. The poet depicted the unforgettable image in his poem "Eugene Onegin".

The Gate was called "Golden" because at sunset the cliff shines like gold.

How was Golden Gate rock formed? Sea abrasion, dikes.

How was Golden Gate rock formed and what is it in the geological sense? This rock is igneous, but not formed by volcano.

Among igneous rocks there are intrusive and effusive rocks, fundamentally different as to their formation. Effusive igneous rocks are lava, which reached the surface after volcanic eruptions. But part of the magma froze in the earth’s depths before reaching the surface. Magma filled cracks and voids in the earth’s crust. Gradually cooling down, the molten magma crystallized, forming very strong dense igneous rocks. That is how the intrusive igneous rocks formed. The forms of cracks stipulated the future shape of intrusions: if the crack was narrow and long, narrow intrusive bodies were formed – dikes while irregular fissures gave rise to the formation of intrusive bodies of fanciful shapes. Later the rocks, which concealed intrusive bodies, destroyed under the influence of weathering and marine erosion, and dense intrusions in the form of steep cliffs appeared on the surface. Selective destruction of rocks by the sea led to rapid destruction of the less strong host rocks, and intrusive bodies remained in the form of rocks.

That is how Golden Gate of Karadag was formed. Generally, there are many intrusions in Karadag and their thickness ranges from a few to tens of meters. They are up to hundreds of meters high. They occur in the m. Holy and Small Karadag area, penetrate Beregovoi Ridge, form Karadag’s largest capes. The Golden Gate is the most famous.
10. REMNANTS OF WEATHERING

Rock weathering and its consequences. Remnants of weathering?
"Gingerbread horse", "Pyramid", "Falcon".
Devil's Fireplace Rock - andesitic intrusions.

After crossing the Devil's Valley, which is the boundary between Karagach and Hoba-Tepe Ridges, you can see remnants of weathering of interesting shapes “Gingerbread horse”, "Pyramid", "Falcon". They were formed from hydrothermal tuff. Here is “the Devil's Fireplace” Rock – the most significant andesitic intrusion, more than 25 m high. Its transverse dimensions are 20x35 meters; it was formed by cooling and crystallization of magma in the isolated chamber in the depths of the earth. Hollows, into which magma came, were located a few tens of meters from the surface, magma cooled quickly there and cracked, due to which characteristic radial fissure of rocks occurred. Fracture lines coming from the center make this rock look like a fireplace.

There are no venomous snakes on Karadag!

Crimean reptiles inhabit Beregovoi Ridge. During the journey you can see brisk brownish-green Crimean lizards (Podarcis tauricus) in the grass throughout the reserve. Crimean lizards lead terrestrial life; they climb rocks and tree trunks only occasionally. Typical mountain lizards Lindholma (Darevskia lindholmi), deftly moving up vertical cliffs, are rare.

One of the most interesting Karadag reptiles is Mediterranean, or Crimean, gecko (Mediodactylus kotschyi). This small (up to 8 cm) nocturnal lizard is widespread in the Eastern Mediterranean. In Ukraine, it inhabits the southern coast of Crimea and lives in rock and cliff cracks and in holes under the bark of old trees. Only two populations have been found on Karadag so far. Geckos are able to change the color of the body. Gecko is the only reptile in the fauna of Ukraine that has a real voice, of sonorous, metallic tone.

Red and yellow, or Caspian, snake (Dolichophis caspius), the largest snake in European fauna, up to 2 meters long, can be met at this part of the reserve. The rarest, because of its most secretive nocturnal life, and the most graceful of snakes on Karadag is the leopard snake. This small (up to 1 meter long) snake got its name due to the characteristic pattern of brick red and ocher spots.

There are no venomous snakes on Karadag! The well-known grass snake (Natrix natrix) is associated with ephemeral streams of the reserve. This snake is easily recognized by two yellow or orange spots on the nape in the form of a crescent. Another one – the water snake (Natrix tessellata) – gets to the southeastern coast of the Crimea from Kerch peninsula, where its population is extremely high. On Karadag this interesting semi-water snake inhabits only on the sea coast. All fears of the locals are vain; water snakes are not relatives of poisonous sea serpents, which are anyway absent in the Atlantic. The grass snake is certainly not venomous.
11. WESTERN SLOPES OF HOBA-TEPE RIDGE

Plants on western slope of Hoba-Tepe Ridge. M. Holy - the highest point of Karadag mountain range.

The trail runs along the steep slope of Hoba-Tepe Ridge. Attention is drawn by low-growing succulent plants of the Crassulaceae family – pink fleshy leaves and white and pink flowers of Spanish stonecrop (Sedum hispanicum) and bright green and golden flowers of sedum (Sedum acre).

Behind a small forest there is a rocky ledge with panoramic view of the south-western part of the reserve and of m. Holy.

Trass, scenic jasper and other interesting minerals of Karadag.

M. Holy is the highest point of the Karadag mountain massif (576 m above sea level). At first the mountain was called Karadag, later – the whole mountain group, including non-volcanic limestone ridges adjacent to it, got that name.

M. Holy with the neighboring Small Karadag Mountain is the youngest volcanic massif of Karadag. Acidic volcanism is inherent to dry land. Northern and north-eastern slopes of m. Holy are composed of original Karadag trass – different kinds of tuff.

In some places of Beregovoi Ridge picturesque jasper (spotted, striped and picture) was formed as a result of hydrothermal rock processing.

In addition to jasper, interesting minerals can be found on Karadag: agate, chalcedony, carnelian, calcite veins, different kinds of quartz – rhinestone, amethyst, prase, heliotrope.

Besides, Karadag is unique in its zeolites – about a 100 mineral species have been found on Karadag.

12. SOUTH PASS


South Pass, 360 meters above sea level high, is overlooking mountain Sphinx, or Devil Finger. Magnetic Ridge starts from this mountain. Gorge Gaur-Bach separates Ridges Hoba-Tepe and Magnetic. Magnetic Ridge is composed of volcanic tuffs and lava. There are fewer vents here than in the western part of the Beregovoi Ridge.

Magnetic ridge is named so because magnetic field anomalies have been fixed here. They are caused by ferriferous mineral magnetite, which enriched igneous rocks in the depths of the ridge. Compasses in such anomalies do not work because the arrow does not point north, it points magnetized rocks.
Gorge Gaur-Bach is developed by tectonic fracture. A stream flows along the ravine, breaks down from the cliff and falls by a small waterfall to the beach of Cornelian Bay.

Places of worship in the reserve.

To the left m. Holy rises. In ancient times it was called Karadag (or Biuk Karadag – Big Black Mountain). Near its summit was the tomb of a Muslim saint – Aziz Kemal Baba. Some historians believe that in this place the ancient Tavry built an altar. Sanctuary of ancient god – Doctor Asclepius – existed there as well. On the western slope of the mountain the most famous spring of Karadag – Gaur-Cheshme lies (“The Spring of the infidels”, i.e. of Christians). In the Ottoman Empire, the population was divided into two parts – the Muslims and gaurs (the Christians and other believers). The gaurs paid special taxes, but were not persecuted. About 400 meters from the spring there are ruins of the St. Peter’s monastery of the XIVth century, from which a water pipe to the spring led.

Remains of 12 Christian churches have been found on Karadag: the above-mentioned St. Peter’s Monastery under m. Holy, St. Geoge’s Monastery in Monastyrchick, the unknown XIII-XIV century monastery the near the Bugaz spring, St. Stephen’s Monastery in the Golden ravine (XIV-XVI century, the Armenian monastery (its dilapidated church apse existed in 1860), the church in Injir-Agach (near the Kilise-Chokrak spring). There were also remains of a temple in the vicinity of Kurortnoe village (on the beach by Mount Kordon-Oba, in the centre of the castle, which ruins were visible in XIX century). But most places of worship were found in Tepsen (VIII-X century settlement). St. Dmitry’s and St. George’s temples are mentioned in the written sources, and archaeologists unearthed the remains of 6 churches. Among them – a grand basilica 31 m long and more than 24 m wide. In Karadag the remains of 12 churches and monasteries have been found. At least one thing is for certain – Crimean Holy Mountain is unrivaled on the peninsula!

The most numerous representatives of the reserve’s wildlife – insects.

Insects are the most numerous representatives of the reserve wildlife (more than 8-9 thousand species); they meet travelers in the woods and in open spaces from May to October.

13. SPHINX

The origin of Sphinx rock.

As for the origin of mountain Sphinx, scientists have different opinions. Some believe it to be an ancient volcano, others – outlier of weathered tuff. The study of the mountain massif and surrounding structures suggests that it is a volcanic center with small intrusions concentrated around it. The head of the Sphinx (rock Devil Finger) is a deep core vent, on its surface
remained incompletely destroyed tuffs, through which lava had erupted. Rock Devil Finger is 32 m high.

**Origin of names on Karadag is connected with different peoples – Turbic, Slavic, Iranian, etc.**

One of the most famous natural objects of Karadag – Devil Finger – is in front of us (Shaitan-parmak from Turkic so the translation Devil Finger is not very precise). Another, a more modern name, of the rock is Sphinx.

The family of Turkic languages included the ancient Bulgars, Khazars, Pechenegs, Anatolian Turks, Nogai, Tatars, Krymchaks and Karaites. The differences between these languages can be very significant. Therefore, it is difficult to unambiguously interpret the names of Turkic origin. The Turks on Karadag were engaged in cattle breeding, horticulture, viticulture, and they found Christian population – Greeks, Italians, Armenians there. So the names "Garden of the infidels" (Gaur - Bach), "Source of the infidels" (Gaur-Cheshme), "Church spring" (Kilse-Chokrak) and many others appeared. The name Karadag (Black Mountain) is Turkic, too.

In the XIX<sup>th</sup> century Bulgarian names added to the Turkish and Tatar ones, when Balkan Slavic settlers moved to Koktebel from the Balkan village Hramatykovo – Golden Mount, Izsypana crana, etc. Then as belonging to different owners ravines were called, for example, Tumanov Ravine.

### 14. MAGNETIC RIDGE

**Panorama of Feodosia low hills.**

The panorama platform of the eastern slope of the Magnetic ridge overlooks Feodosia low hills. Koktebel Bay is by the eastern foot of Karadag. Next is peninsula Kiik-Atlama separating Koktebel Bay from Dvohyakorna bay. Bink-Yanyshar and Kucuk-Yanyshar low ridges are near Koktebel from the Kiik-Atlama side. To the east of Koktebel Cape Chameleon or Toprah-Kai (Clay Hill) can be seen.

To the north of Koktebel in the vicinity of Karadag, Tatar-Haburh ridge is located. Further to the north-east, there is a plateau-like ridge Tepe-Oba with Cape Ilya protruding into the sea. Behind the cape there is the city of Feodosia.

**Cimmeria in the works of poets and artists.**

Thanks to Homer’s "Iliad" and Hovard’s "Conan the Barbarian" the name Cimmeria is known worldwide. In antiquity, the Black Sea steppes – the northern region of the known world – was called so. This land, according to the Greeks, is "always covered with fog and clouds: neither rays or light of the bright sun ever shines there". Known from ancient archaeological and written sources, the legendary warlike nomadic Cimmerians lived in the Crimea three thousand years ago. Russian artists, poets and writers of the Silver Age
(early twentieth century) called by this name the legendary past of Eastern Crimea. One of the "discoverers" of Cimmeria, Maximilian Voloshin, wrote that he called so "eastern Crimea from old Sudak to the Kerch Strait, in contrast to Tavrida – the western part of the peninsula". It was mostly poetic image; its suppositional origin was recognized by those who called themselves the twentieth century Cimmerians.

At the end of the nineteenth century the school of painting (mostly landscape) appeared, called the Cimmerian. Depicting Karadag for the first time, the most famous artist of the school and its founder Ivan Aivazovsky (Armenian descent) paints the mountains at the background of marine element. His successor, Adolf Fessler, painted ranges of paleovolcano as theatrical scenery. Maximilian Voloshin in watercolors gave "soul of Gothic Ruins" of Karadag.

Maximilian Voloshin (friends called him Max) actually discovered Karadag and introduced it to Russian artists. On his father's side he was descended from the family of Cossacks (voloshin in the old Ukrainian language means a man from Wallachia - modern Romania, once the ancestor of Maximilian joined the Cossacks there). His mother – German – until her death in 1923 was engaged in building suburban home in Koktebel where her son moved in 1907. Now you can see this two-storey building on the embankment. A tower is attached to it, and the workshop of the owner is on the upper floor. During Max's life the house turned into Poet's home, which was visited by all the artists of the Silver Age of Russian literature. Among Voloshin's friends and visitors, inspired by Karadag and Koktebel beach, Osip Mandelshtam, Maxim Gorky, Alexei Tolstoy, Mikhail Bulgakov, Alexander Green, Marina Tsvetaeva, Nikolai Gumilev, Michael Zoshchenko, Korney Chukovsky were.

Voloshin permanently settled in his beloved Koktebel.

Further you can see the cape and hill – it is mountain Kucuk-Yanyshar. According to his will, Voloshin was buried there in 1932.

Schrenk tulip – the flower of May.

Massive red Schrenk tulip bloom (Tulipa schrenkii) takes place in late April – early May on the Magnetic Ridge. Graceful and elegant, with red, purple, sometimes yellow flowers, plant is listed in the Red Data Book of Ukraine. Its population is sometimes damaged by wild boars that dig large areas and eat away the bulbs. In the XVI century the Turks exported the tulip from the vicinity of Feodosia (Kaffa), later it was cultivated in Europe and began to travel around the world.

14a. STATION OF BACKGROUND ECOLOGICAL MONITORING

“Upper terraces” – the remnants of Karadag trass excavation complex.

A well-known Soviet journalist and writer Konstantin Paustovsky had a holiday on Karadag in 1940 and lived in the house to the left on our way. Now there is environmental monitoring station, and the place is called "upper terraces". Note the ruins around – they are remains of lower set of Karadag trass extraction, which we discussed earlier. In the 1920-1930s in the slopes
of m. Holy they mined this material with dynamite, and then transported down by a specially constructed cableway and drove to Novorossiysk water resistant cement plant. Karadag inspired Konstantine Paustovsky to the chapter in his novel "The Black Sea". In it he tells fascinating stories about local stones and the bays, to which he and his friends went by boat.

**14b . SETTLEMENT TEPSEN**

*Medieval city Tepsen was part of Great Bulgaria, Khazar Khanate and the Byzantine Empire. Mysterious Fully and Possidima.*

The Tatars called the plateau above us to the left Tepsen, i.e. "dish or saucer". The upland area covers 20 hectares. Since 1929, archaeologists have been unearthing the remains of a medieval town. It is still debatable whether this settlement can be identified with the city of Fully known from Byzantine sources – the center of the Christian diocese in the VIII-X centuries.

**15. KOKTEBEL BAY – CAPE MALCHIN**

*Environmental problems of the water area of the Karadag reserve.*

If you depart from Koktebel pier, you can view a wide Koktebel Bay, which to the west is closed by Cape Malchyn – the extreme eastern point of Karadag. Cape Malchyn closes Koktebel Bay in the west. It is the eastern most point of Karadag. In fact, from this cape begins the highest south ridge of the Crimean Mountains.

*Cape Malchin – the eastern boundary point of Karadag*

The name Malchyn comes from the Turkic word “mal” – cattle. The suffix “chy” means a trade – i.e. shepherd. A small sheepfold, or the place where shepherds drove their cattle from the Karadag slopes for the night, was located there. Archaeologists have found the remains of a VIII-X century fishing village – a satellite of the medieval town on the Tepsen hill. The remains of the pier were found on the seashore, and traces of shipwreck a little farther from the shore.
16. LIVADIA BAY

Livadia comes from a Greek word meaning “meadow”.
Snake Gorge – a rift between Kok-Kaya and Magnetic Ridges.

The name of the bay comes from the Greek word “meadow” (as there is a spring on a small platform above the sea).

By tectonic motions the Karadag massif is divided into separate ranges and units, unevenly raising one above another. These shifts occur along tectonic rifts, where streams and rivers flow, gorges and valleys form, as in rift zones cracked rocks break down faster.

Snake Gorge separates Kok-Kaya and Magnetic Ridges. By the tectonic rift the Kok-Kaya Ridge (right) dominates Magnetic Ridge (left).

Under volcanic rocks of Kok-Kaya older rock formations than of Magnetic Ridge, can be seen. Older dark gray, almost black, dense clays are found here.

Along Snake Gorge small streams run, flowing down the cliff on the pebble beach by small waterfalls. The bay where the gorge descends is Livadia Bay.

17. CORNELIAN BAY

Plochatyi Cape. Wall-like intrusions.

At the foot of the western part of Magnetic Ridge there is one of the largest Karadag bays – Cornelian Bay. Capes Tupyi and Plochatyi divide it into three bays – North, Central and South Carnelian. The name comes from the mineral carnelian that several decades ago was often found in beach pebbles. Carnelian is a red variety of chalcedony which is ordinary quartz by composition, but its thin fibers give the stone magical iridescent look. Carnelian stone is called the stone of romantics; it’s been used for decorations since Paleolithic times.

Plochatyi Cape separates South and Central Carnelian Bay. The Cape is formed by the so-called plochatyi lava that is crushed into tiny folds. These are traces of viscous paste-like solidified lava that rose from the volcanic center.

The natural end of the Khoba-Tepe Ridge in the east is Lagorio wall. It stands out against the rest of the mountains. This dyke is named after one of the first researchers of Karadag Alexander Lagorio. He was the first to describe the chemistry of the Karadag massif and perform their first microscopic study. He made the first geological map of Karadag and published the first guide to Karadag. This 20 m wide wall rises from the sea bay to a height of 405 meters. By its origin it is a dike – a crack in the rocks filled with magma. In course of millions years host rocks ruined, and stronger igneous rocks stayed in the form of a steep wall. These prepared dikes (wall-like intrusions) are common in coastal Karadag cliffs, and they often form capes.
Deep in the seawater the very important for sea life inhabitants called "plankton" (from the Greek word πλαγκτός (plaktos), meaning wandering) live. Phytoplankton is the plant part of plankton. The bulk of these microscopic plants, freely swimming in the sea water, constitute single-celled algae that exist singly or in colonies. Currently, there are more than 1,000 species and varieties of algae in the Black Sea phytoplankton. In spring, summer or autumn some species reach mass development, causing algal bloom, painting the water yellowish-brown, green or pinkish-red. Diatom algae are the most numerous in the Black Sea. Diatoms are called sea pasture and can be compared with grasses of the ground surface.

Along with phytoplankton there is zooplankton in the water. They are small organisms of animal origin. Zooplankton is the primary food for many fish, especially for the juveniles.

Some representatives of zoo- and phytoplankton in polluted and relatively clean water are different, so they can be bio-indicators of sanitary and environmental conditions of marine areas.

Jellyfish belong to major representatives of zooplankton. The body of jellyfish has a dome and tentacles. The most common are the aurelia (Aurelia aurita), shaped like a saucer with four tentacles arranged crosswise, and root-mouthed jellyfish (Rhizostoma pulmo), with long tentacles dangling from the center of the dome. All Black Sea jellyfish are safe for man.

18. ROARING GROTTO

Stories and myths.

At the bottom of the bay pinched with stone slabs you can see black hole of Roaring Grotto, which seems to open entrance to the dark underworld. Maximilian Voloshin in the early twentieth century gave another name to the Grotto – Entrance into the kingdom of Hades. Here for one of many walks he took with him a young and at that time little – known poetess Marina Tsvetaeva, who left vivid memories. "And this is, Marina, the entrance to Hades, where Orpheus went for Eurydice", - said Maximilian and sailed into the depths of the Grotto.
The origin of the Roaring Grotto.
How does the stone heart of Karadag beat?

Sea waves eventually destroy even the strongest rocks.

In Karadag there are several dozens of large and small grottoes. The most famous one is Roaring Grotto formed along the tectonic fault in the rocks. It goes deep into the rock for 71 m, the height of surface and underwater part at the entrance is 18 m. The first 20 meters of the Grotto is the overwater part, the rest is underwater. In calm weather you can enter there by boat and listen to the "stone heart of Karadag beating". The waves in the Grotto create airbag, which with deep rumble comes out of the grotto at certain intervals (usually 16-18 seconds). It’s like a slow heartbeat of a stone giant, which is heard from crevice. To the west of Karadag there are other large grottoes, namely Shaitan’s Grotto, Dove crack, Mouse crack, inhabited by bats.

The Black Sea fish.

There are about 200 species of fish in the Black Sea (most of them are by the Black Sea coast of Crimea). Recently the Black Sea with the Sea of Azov has been the most fish productive in the Mediterranean basin. However, a high level of human impact in the last quarter of the twentieth century led to a significant reduction in the number of fish. The main industrial fish species in the Black Sea during the last decades have been the Black Sea sprat (Sprattus phalericus) and anchovy (Engraulis encrasicolus). 98 % of total catch of fish in Ukraine is the contribution of these species. There are 114 fish species in the area of Karadag Reserve, 31 species are listed in the Red Data Book of Ukraine (2009), 30 species in the Red Data Book of the Black Sea.

Ancient cartilaginous fish, which have no skeleton, are bright representatives of large fish. Their skeleton is consisted of cartilages (except teeth and spines).

Prickly shark katran (Squalus acanthias), stingrays and sturgeon fishes belong to them.

Among bony fishes the biggest is Black sea Kalkan flatfish. Black Sea Kalkan (Psetta maetica) – is a typical groundling fish with dark painted upper body and white "blind" side. Mullet fishes do not differ in their appearance: they are torpedo-like silvery color fish. There are five species of mullet fishes in the Black sea. Among the most common is Loban (Mugil cephalus) and golden mullet (Liza aurata). A well known haarder (Liza haematocheilus) is a Far Eastern mullet, domesticated in the Black Sea in the 1970s. Black Sea horse mackerel (Trachurus ponticus) used to be one of the massive fish of the Black Sea. This is the fastest Black Sea fish, which pursuits anchovy at high speed or "runs away" from the dolphins. It used to be industrially very important in the recent past.
19. ROOTS OF HOBA-TEPE VOLCANO

**Birds of the Coast – the crested cormorant and martin.**

Exclusively on coastal cliffs and rocky islets crested cormorant (*Phalacrocorax aristotelis*) nests – a slender sea bird with shiny black feathers and a distinctive cowlick on his head, which it wears from December to April. This species is listed in the Red Data Book of Ukraine, in Ukraine it inhabits Crimea, and a nesting group of 200 pairs (the second largest one) exists on Karadag. On the rocks, next to Cormorant, Martins often settle (*Larus cachinnans* - the largest Martin on the southern coast of Crimea). Representatives of ornithofauna inhabit seashores (except for the rocky ones). Common here are Wheatear (*Oenanthe pleschanka*) – a black and white bird the size of a sparrow – and the white wagtail (*Motacilla alba*). These birds hide their nests in clay cliffs in voids and cracks between the stones. Sometimes among the bushes on the coastal slopes mallard (*Anas platyrhynchos*) nests.

The non-freezing coastal area, where about 40 species live in winter, is an important habitat for waterfowl.

**The main vent of paleovolcano Hoba-Tepe. Dyke-rock Mayak – the main cape of Beregovoi Ridge.**

An ancient igneous center – roots of paleovolcano Hoba-Tepe can be seen on the coastal cliffs on the seaward side. There were many vents on Karadag during eruptions, but in the earth’s interiors they were joined by one magma chamber. Not only vents, but also intrusion – igneous bodies that froze in the cracks – came from it. The largest centre of igneous rocks among lava and tuffs on Karadag is in Hoba-Tepe, so geologists suggest that there was the main vent of paleovolcano. Now we have the opportunity to see it in section.

Mayak Rock rises from the sea. It is clearly visible, standing out by the sea. By origin it is a dike, like Lagorio wall, consisting of igneous rocks that did not pour out to the Earth’s surface as lava, but froze in depth of tuffs. Like a real beacon, it can be well seen from the distance. This stony giant has long been a landmark for navigators.
20. GOLDEN GATE ROCK

Glorious Golden Gate Rock, a visiting card of Karadag, formed as a result of selective destruction of rocks by the sea. It is an intrusive formation – the result of magma filling the voids in the earth’s crust. Subsequently, the sea ruined the rocks that hid this intrusion. Under the rock the sea is up to 14 meters deep.

To the right from the Golden Gate the Lion Rock is located. The same process lies at the base of its formation. Lion and Golden Gate Rocks are combined under the water; they are a united intrusive body, the lower part of which is flooded by the sea.

21. BOUNDARY BAY

The Karadag Reserve area is inhabited by all Black Sea cetaceans: the short-beaked common dolphin (*Delphinus delphis*), the harbour porpoise (*Phocoena phocoena relict*a), and the bottlenose dolphin (*Tursiops truncates*). The first two species come into coastal waters during seasonal migrations, while the bottlenose dolphin lives here permanently. A pod of dolphins, consisting of a dozen of bottlenose dolphins, plies mainly between capes Megan and Kiyik-Atlama.

Opposite the Golden Gate you can see Boundary Bay, which was considered to be the border of spreading of specific rocks (spilits) that form the lower part of the Karagach Ridge. But later those rocks were found further on – in the Lion’s Bay. However, the name was not changed, as well as the name of the neighboring Putsolanova Bay. In addition, Boundary Bay is situated on the border of two Ridges – Khoba-Tepe and Karagach.

Tens of millions years ago, when Karadag erupted, it was about 3 km high and 12 km wide. It is impossible to judge, because most of the volcanic structure was destroyed by erosion.

In the last phase of volcanic activity, Karadag lava became very viscous and the nature of volcanism became explosive. Plugs were formed in the crater, which at explosion the volcano could throw at a distance of several kilometers. Volcanic bombs found themselves among the strata of tuff and formed separate cobs in the course of volcanic erosion. Such a volcanic bomb can now be seen on the beach to the west of the Golden Gate. The size of this round block is more than ten meters.
22. IVAN ROBBER ROCK

The history of Ivan Robber rock formation.

Ivan Robber Rock is a complex multiphase subvolcanic formation. It is composed of a 120-meter (in diameter) lava pedestal and an obelisk of the rock, 81 m high, which is a dike. It means that during the formation of this structure initially the lava of pedestal formed, later it was covered with dozens, or maybe hundreds, of meters of rock. Millions of years later the crack in the overlapping rocks filled with magma, which froze and became strong intrusive rock. Less stable rock collapsed because of weathering, and the strong dike remained in the form of a rock.

Marine Terrace is an indicator of sea level fluctuations.

At the height of 3 m above sea level, you can see a small niche. It is an ancient marine terrace. The sea level changes due to non-uniformity of tectonic raisings and lowerings of different blocks of crust, and also due to the effect of climate change on Earth. The current level of the Black Sea established approximately 10-11 thousand years ago, before that the Black Sea level was 40-50 m lower. In the course of time there occurred level fluctuations by several meters. Marine terrace formed several thousand years ago, when the sea level was 3 m above the present level.

23. LEVINSON-LESSING ROCK

Distinguishing features of the rock and the origin of its name.

Among the cliffs of Karagach Ridge the Levinson-Lessing rock is clearly visible. It is named after the famous scientist and geologist Franz Levinson-Lessing who was the first to discover multiphase of the volcanic complex, to make maps and charts of the coastal and interior Karadag Ridges, to measure sea depths along the coast. The rock is composed of tuffs - cemented sediments of volcanic ash and small fragments of minerals ejected by the volcano. It is an almost vertical wall 20 meters wide. Not far from the cliff, in the tuffs, geologists found deposits of mud flow, which accompanied one of the Karadag eruptions. Such flows occur due to earthquakes accompanying volcanic eruptions, they carry sparse clay and stones, flow down the slopes and fill the lower reaches.

At the bottom of the Levinson-Lessing rock at the level of the beach is a freshwater spring, also named after Franz Yul’evich. The spring can be seen in a small dark pothole in the rock where a stone pyramid has been made.
Animal and plant life on the seabed of the reserve is quite diverse. Rocks, stones, sand, silt under water are inhabited by various living creatures.

Most of the sea floor is covered by the carpet of colorful algae – macrophytes (from Greek: makros means “big”, phyton – “plant”) (325 species), and sea grasses (higher aquatic plants) (7 species) growing on rocks, boulders, stones, shells of shellfish. In the process of photosynthesis algae create organic matter, form organic substances and at the same time saturate water with oxygen. Algae thickets are both home and food for hundreds of species of fish and invertebrates.

Water’s edge on sandy beaches where the waves just occasionally wash ashore, inhabit numerous small crustaceans – amphipods, which are called fleas due to their jumping. Feeding on decomposing algae, these crustaceans clean the coastal part from excessive contamination. The same functions are performed by other crustaceans – crabs and shrimp. On Karadag there are 28 out of 38 species of crustaceans found in the Black Sea.

Mussels (Mytilus galloprovincialis) were until recently the brightest and most widespread animals. Mussel is the most powerful living filter of the Black Sea. Settlements of mussels are disappearing, and rapana (Rapana venosa) is one of the reasons. It is gastropod, which is spreading and feeding on mussels; was first discovered in the Black Sea in the 1950s. Rapana is a valuable commercial species, and divers catch them around the coast of Crimea.

Rock destruction occurs in different ways. Sea waves gradually erode cliffs at the level of swash; eventually the hanging stones cannot withstand their own weight and crumble to the shore and into the water. At this moment deafening noise is heard, as if Karadag itself is angry. Landslips are rare here, they can be caused by small earthquakes or occur without earthquakes because of accumulation of critical mass. Kuzmich Stones are the result of landslip. They are located on the edge of Karagach Ridge near Karadag Bay and got their name after an ordinary carpenter who used to fish there.

Great million-year history of Karadag will be imprinted on your soul. Karadag appears in different ways before the eyes of its visitors. It can be calm or angry, gentle or severe, but always powerful and majestic. It won’t leave you indifferent – you will want to come back here again and again.
DANUBE BIOSPHERE RESERVE OF NATIONAL ACADEMY OF SCIENCE OF UKRAINE

INTERPRETATIVE TRAIL “ZERO KM”

Biodiversity – Tatyana Balatskaya

Geological diversity – Ph.D. Natalia Fedoronchuk

Historical and cultural heritage – Ph.D. Volodymyr Poltorak
The Danube Biosphere Reserve of NAS of Ukraine (DBR) is located in the Kiliya and Tatarbunary district of Odessa region.

**Total area:** 50,252.9 hectares, together with channels and inland waters and two-kilometer strip of the Black Sea, within the Kiliya area, the apex of the lake Sasyk and part of Dzhantsheysky liman within Tatarbunary district of Odessa region.

**Subordination:** National Academy of Sciences of Ukraine.

**Geographical coordinates:** 45 ° 13 'N - 45 ° 34 'N and 29 ° 23 ' E - 29 ° 46 ' E.

The Danube Biosphere Reserve was founded by the Decree of the President of Ukraine "On Establishment of the Danube Delta Biosphere Reserve "№ 861 of 10.08.1998 on the basis of the Nature Reserve "The Danube floodplains" (Resolution of the Council of Ministers of the USSR " on the organization of the State Reserve "Danube floodplains ”№ 203 of 04.23.1981).

Decision of UNESCO of 02.02.1999 included the DBR in the World Network of Biosphere Reserves as part of bilateral Romanian - Ukrainian Biosphere Reserve "The Danube Delta".

The territory of the Danube Biosphere Reserve belongs to geosystem of primary and secondary Danube Delta and is located in the northeastern part of the Danube Delta in Ukraine to the east of Kiliya and south of Lake Sasyk. In the East the Reserve borders the Black Sea, in the south – Romania. Secondary Kiliya delta, Zhebryyansky natural complex, Stensovsky-Zhebryyanivski floodplains and island Ermak are the parts of the reserve.

Around the perimeter of the main delta area of the Danube Biosphere Reserve villages Primorske, Desantne, Mirne, Shevchenkove, Lisky are situates; Tatarbunary town, villages Borysivka, Trapivka, Liman. The largest settlements in the area of the reserve are cities Kiliya, Tatarbunary and Vilkove.

**Interpretative trail "Zero Km"**

**Status of the route:** functioning

**The length of the route:** 36 km

**Means of transportation:** on water part of the trail – by boat

on the eco trail "0 km" (300 m) – by foot

**Route form:** ring

**Duration:** 1.5 to 4 hours (depending on the type of water transport)

**Term of Visit:** all year round

**The order of visit:** with guide.

**Official address:** str. Tatarbunary rebellion, 132 A, Vilkove, 68355.
tel.: + 38 (04843) 4-46-19, 3-11-95;
e-mail: reserve@it.odessa.ua; website: www.dbr.org.ua.
### Trail "Zero Kilometer"

Danube Biosphere Reserve of National Academy of Sciences of Ukraine

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**Point of the trail**

- **Green**: biology and ecology
- **Yellow**: geology and geography
- **Red**: history and culture

Map: Roman Sizo  Bing Maps Aerial © Harris Corp, Earthstar Geographics LLC © 2012 Microsoft Corp.
1. ST. NIKOLAY SQUARE (VILKOVO)
2. THREE CHURCHES
3. POSEIDON TRIDENT
4. MIRACULOUS ICONS
5. GREEN STOP “REED TALE”
6. FARM-MUZEUM “QUAKENBURG” (“CROAKENBURG”) 
7. GREEN STOP “MONASTERY YARD”
8. GREEN STOP “SALIX”
9. SAINTS PETER AND PAUL MONASTERY
10. BOUNDARY OF THE PRESERVED ZONE
11. FISHING CAMP
12. CORDON OF THE RESERVE
13. DELUKOV BAY
14. 0 KM
15. PROTECTED SEASIDE
16. ORNITHOLOGICAL TOWER
17. POLUDENNEN MOUTH
18. OCHAKIVSKE MOUTH
19. ECO-TOURISM COMPLEX “PELIKAN”
20. BILGORODSKE MOUTH
The founders and creators of Vilkove are the Lipovans – old-believers who fled from the Russian Empire to Turkish (Ottoman) Empire. First Old Believers fled here, most likely in the XVII century, immediately after the split of the Russian Orthodox Church. In 1709, after the defeat of Bulavinsky uprising, nekrasovtsi (cossacks – old-believers who rebelled under the leadership of Ignat Nekrasov) joined the Lipovans.

According to the legend, back in 1746 a group of refugees from the Russian Empire decided to camp at the site of today’s St. Nicholas square. In 1775 the Cossacks of the defeated Sich who did not want to live “under Russia” came to the delta. Zaporozhian Cossacks were skilled seafarers and fishermen. The delta increased, and a fork of multiple tributaries formed – that is how the name Vilkove appeared (“fork” in Russian is “vilka”). The main occupation of the pioneers was fishing – no wonder that two of three churches in the city are in honor of the patron saint of sailors and fishermen St. Nicholas. The main square bears the name of Nicholas, too (with the monument to a lypovvan in the center).

A large European river Danube originates in the German mountains Schwarzwald at an altitude of 678 m at the confluence of two streams – the Breguet and Brig. It has over 300 tributaries; the main ones are the Inn, Drava, Tisza, Sava, and Prut. The Danube River is the second in Europe after the Volga – its length is 2,783 km.

Meltwater of the Carpathians and Alps’s glaciers, underground springs and atmospheric condensation feed the Danube; its water area is 817 thousand km². The Danube runs through 10 countries: Germany, Austria, Slovakia, Hungary, Croatia, Serbia, Bulgaria, Romania, Moldova and Ukraine. European capitals Vienna (Austria), Bratislava (Slovakia), Budapest (Hungary), Belgrade (Serbia) are situated on its banks.

The Danube is a navigable river of trans-European importance, with 2414 km of the waterway. There are 19 locks from 5 to 34 m on the Danube. Sulina mouth (Romania) and Bystre mouth (Ukraine) ensure marine shipping.

The Danube meets the Black Sea, forming an extensive delta, located on the territory of Romania and Ukraine. The delta begins at Ismail Cape Chatal, where the Danube is divided into two mouths - Kiliya and Tulchynske; the latter forks on Georgievsk and Sulinske. In modern conditions the Danube annually brings on the average 208 km³ of water to the mouth, which is almost half the total river flow into the Black Sea.

Delta of Kiliya estuary, located below Vilkove, is the youngest part of the vast Danube delta and the new natural land in Europe. The Danube biosphere reserve is part of the Kiliya Delta.
2. THREE CHURCHES


This is the closest point to the European Union border. It’s interesting that from ancient times the Danube froze in cold winters (which is becoming less frequent now), and animals travelled on ice from one bank to the other.

Look at the panoramic view of Vilkove. On the western edge there are building of the Soviet era. This area has been inhabited by the Ukrainians (up 25 % of the population). 70 % of the population lives in the central, lipovan, part. The eastern outskirts of the city called Kilimbeyska, is insular. In total, there are dozens of islands in the city.

Only from here you can see all three churches of the city at the same time. The inhabitants of Vilkove have such a fishing tradition: when they go to the delta and sail from Vilkove, here they drink a glass of wine.

The earliest churches in Vilkove appeared in 1818 (Zaporizhzhya Orthodox Church made of reed and wattle, daubed with clay) and 1827 (lypovan chapel of wicker willow, daubed with mud). Both were consecrated in honor of the Holy Virgin - the patroness of the Cossacks.

Central lypovan church consecrated in honor of the Nativity of the Blessed Virgin Mary (celebration on September, 21) is the oldest in Vilkove. It was built after the Crimean War and opened in 1857. In Soviet times, it was used as a storehouse of fish products, children's club; in 1980 it caught fire. In 1993 the church was rebuilt by local Lipovans and opened for worship. The bell tower was built in 1873 when Vilkove was part of the Romanian kingdom. Now the church is a real gem of downtown Vilkove.

The second oldest is St. Nicholas Orthodox Church (Ukrainian Orthodox Church of Moscow Patriarchate; celebration on May, 22), in which mostly local Ukrainians attend services. It can be seen to the left of the Nativity of the Virgin church. Consecration took place on October, 14, 1902. The iconostasis was made by St. Petersburg workshop of Faberge.

The third church is St. Nicholas old believer's Church. It was consecrated on May, 22, 1913 and is called Kilimbeysky, as it is located on the island of the same name. The history of the name goes back to Ottoman rule when Belgorod channel was the border between Turkey and the Moldavian principality. The island was part of the possessions of the Kiliya governor (“Kilim-Bey” in Turkish).

3. THE POSEIDON TRIDENT

What is the "the Danube fork" and the trident of Poseidon?

Poseidon is a Greek god of the Ocean, lord of sea depths. He is always depicted with the symbol of his power - magical trident. Three large mouths of the Danube, which we can see from here, remind the trident. Branching of the Danube mouths was called "the
Danube fork”, and probably it gave the same name to the town Vilkove.

Here the Danube Kiliya mouth branches off. The Lipovans named three major mouths according to their direction – the left one led to Belgorod, the middle one – to Ochakov, the right one – to Tsarehrad (Istanbul). A little further from the Ochakov mouth the Ankudinov mouth branches off; it was called after the owner of local fishing industries.

What states have had their possessions in the Danube Delta?
How one can travel back in time, going down the mouths of this European river.

A journey through time... Since a long time ago the Danube has not only been a transport artery, but also the boundary between different peoples and nations. Here, on the "fork", 200 years ago were the boundaries of the Ottoman and Russian empires were defined.

Wars broke out, borders changed. And it all began in prehistoric times, when the river was an obstacle to resettlement of nomadic tribes from the steppes of the Balkan Peninsula. Over five hundred years in a row it was the frontier of the Roman Empire, and later of Byzantine. Since 2007, it has been the border of the European Union.

To the left of the Ankudinov mouth we face Ochakovsky Island, which before the flood of 1969 was part of Vilkovo. It was inhabited, the school worked there (its building can be seen on the shore).

Traveling along the river, we can imagine traveling through time. Here, in downtown Vilkove, there was sea shore in 1746, when the territory belonged to Ottoman Turks. A few hundred meters to Ankudinov we can see the banks born after 1812, the time of Napoleonic Wars, when these lands became part of the Russian Empire. Further away are the lands born in the era of the industrial revolution. Technological progress has not touched the Danube Delta – almost nothing has changed over hundreds and thousands years...

The Danube Delta. Formation of the delta.
Kiliya Delta – the youngest territory of Ukraine.
Formation and development. Mouths.

The Danube Delta is the ecological heart of Europe. It is one of the largest wetlands of the continent. The delta presents itself as reed marshes covered with a set of straits, channels, numerous lakes, areas of floodplain forests, meadows, marshes, sand, remnants of steppe. In accordance with the Ramsar Convention, it is listed in the wetlands of international importance. The Danube Delta was included by WWF in the list of 200 most valuable eco-regions of the world (WWF Global- 200).

The Danube Delta began to form 5-5.5 thousand years ago, when the modern Black Sea coast was forming. In those days, in place of the current delta there was marine shallow water, with coastal spits gradually growing along. Over a long period of time these shallow waters filled with solid deposits of the Danube, the riverbed branched off and the delta was formed.

Nowadays the Danube delta is a large marshy plain, cut by a dense set of tributaries and lakes. Its area is 4180 km2, 82% of which is located in Romania and 18% - in Ukraine. The Delta begins at Ismail Cape Chatal and stretches to the sea. The length of the sea edge of the delta is about 180 km. A large part of it is occupied by wetlands; it is the second largest area of wetlands in Europe (after the Volga Delta). What
is interesting is that 20% of the delta is below sea level.

The youngest natural dry lands in Europe and the youngest part of the Danube Delta is the Kiliya mouth. It is about 300 years old, and its marine part is being formed now. Terrestrial land steadily advances towards the sea within the Danube Kiliya Delta. The length of the Kiliya mouth is 116 km, its depth is 39 m. The main mouths are Ochakovskoe and Starostambulskoe. 70% of river flow of the Danube used to go through Kiliya Mouth in the recent past, about 50% nowadays.

Kiliya Delta appeared after the severe flood, when waters of the Kiliya tributary broke through the sand spit (grinda) Letya, which at that time was situated on the sea shallows. The Danube deposits began to accumulate on the outer side of the broken spit – on the underwater slope of the mouth. With its growth the surface part of the delta began to increase, too.

In the early stages of development (before 1800) the Kiliya Delta had one tributary, within the next 50 years the estuary was divided into 20 branches. The most active growth of the Kiliya Delta was observed in 1871-1922; its area increased by 163 km² (on average by 3.1 km² per year). The number of branches reached 60 at that time. Then the growth of the delta area slowed, in 1941-1980 amounted to 1.1 km² per year. At the end of the twentieth century the number of branches decreased, two main and about a dozen minor tributaries remained.

Vilkove town was founded in the middle of the XVIII century as a city on the sea coast; due to the growth of the delta, now it is situated 18 km off the sea. The town of Kiliya, which is 40 km from the sea today, was a coastal city back in XIII- XIV centuries.

4. MIRACULOUS ICONS

Tributaries of the Kiliya Delta.

On the XVIIIth km of Kiliya tributary, within the town of Vilkove, Belgorod tributary runs. The Kiliya tributary itself is divided into Ochakovskoe and Starostambulskoe, the latter one being the main, according to its hydrological and morphological characteristics. These tributaries are divided into some less important tributaries – the Prorva, Poludenne, Gneushev, Ankudynove, Serednie, Pischane, Bystre, Vostochnie and others. Some of them do not have direct access to the sea (the Shabosh, Serednie, Pischane), and the Belgorod and Gneushev are withering away.

Peter and Paul icon and Dormition of the Mother of God icon are at the beginning of Ochakov island.

In 1930s, when Vilkove was part of Romania, the land around the city was attacked by locusts. One cannot imagine the damage which the insects can cause. In the past locusts meant that the weakest and poorest would die in winter because locusts ate everything on their way. Smart Arabs used to joke about locust, “You ate our crops - and we will eat you”, but conservative Lipovans could not do it. They turned with prayers to the Apostles Peter and
Paul and Mary (to the icon of the Dormition of the Mother of God). And the locusts went away, leaving the harvest untouched! Since then, there are two icons on Ochakovskiy Island. Now local Christians consider it a sacred place.

5. GREEN STOP “REED TALE”

Guest house "Reed Tale". Economic activities on the Danube. "Lungs of the Danube". Reed harvesting.

Guest house "Reed Tale" is located on the right bank of the Ankudynove mouth at the beginning of Ankudynov Island. It is a typical house built of reeds and mud and covered with a thatched roof. Round windows overlook a small canal – yerik - that runs around the island. The Danube can be viewed from two balconies. If you wish, you can stay in a guest house for a few days. There is a bath at the green stop, several small pavilions under the reed roof, where it is nice to relax; a patio under a canopy which can accommodate up to 50 people. Guests can have a rest on the benches in the shade of the trees near the water, go fishing, taste delicious dishes and fragrant Vilkove wine "Novak ".

On the territory of the Danube Delta Biosphere Reserve (DBR) the main economic activities are commercial fishing, reed harvesting, horticulture and viticulture, livestock grazing and tourism.

The reed is widely used on the Danube. The common reed (Phragmites australis) is a giant among our grasses; it can be up to 5 meters high. The reed belongs to the family of grasses, the same family, to which wheat and oats belong. On the Danube, due to a large quantity of mineral nutrients and a warm climate, the reed is the most productive in Ukraine – an average of 5 kg of green mass per square meter, or 50 tons per hectare. Its rhizome is long and creeping, so the plant quickly conquers new spaces and creates large arrays. Its roots accumulate up to 50 % of starch, so they are nutritious and livestock can feed on them. Young shoots of the plant contain 25-30 % sugar, so swans, geese, wild boars and other animals willingly eat them. In some countries, people eat them as a vegetable. The reed is widely used as a building material (for fences, roofs) and for braiding. No wonder that its scientific name is derived from the Greek word phragma, which means fence.

In Western Europe the reed is a valuable building material, and there is great demand for it. Thanks to reed harvesting thousands of people around Vilkove and nearby villages have job. High quality reed is exported to Germany and Holland, where beautiful, fashionable roofs are made from this environmentally friendly building material, which is considered an indicator of a high standard of living. The volume of reed harvesting in recent years has reached 1 million sheaves. Not many people build reed roofs in Ukraine, as this luxury will cost thousands of dollars.
6. FARM-MUSEUM “CROAKENBURG”

A picturesque tourist spot, a stylized traditional lypovan yard.

Lypovan insular farm – museum "Croakenburg" is one of the main tourist spots organized by tour operator "Vilkove-Pelican Tour" – the founder of nature tourism in the Danube Delta. It traces its history from 1990, from a tourist complex "Vilkove".

The name "Croakenburg" can be easily understood. The area of 1.2 hectares in an old garden has everything you need for organized recreation.

The tourist spot has been created on the basis of the old insular homestead of the lypovan fisherman. In the renovated apartment building the décor of the main room is preserved as it was.

Four picnic pavilions for 20 to 100 seats, comfortable arbors will satisfy the requirements of the most demanding guests. Traditional fish cuisine with authentic lypovan soup and good local wine "Novak", local honey and herbal tea from a wood-burning brass samovar will make the picnic exceptional.

The exhibits of the Museum of traditional nature, unfolded in the open air in an old garden, and convenient information and educational materials allow to understand and see how in the Danube wetlands local people farmed and kept house. They have ever been living in harmony with nature. Fishing tools, use of reed, wine making and building of local boats are the main thematic exhibitions. The stands about nature and biodiversity of the Danube delta are interesting. And across the channel one can see a real garden and vegetable garden of the neighbors. The tour of the homestead is circular, with comfortable picturesque bridges over canals.

7. GREEN STOP “MONASTERY YARD”

Saints Peter and Paul chapel was built here in honor of the old believers monastery, closed in 1946.

This tourist spot has recently appeared. Once there was an old-believers monastery nearby, consecrated in honor of Saints Peter and Paul. A wooden chapel covered with reeds has been built; as the ancient strait to the site of the former monastery has silted up and it is difficult to get there.

There are "monastic" buildings in the yard-kitchen, refectory. While visiting stylized monastery stop, one can hear stories about traditions of old believers and taste monastic fish soup or wine.

8. GREEN STOP “SALIX”

In the Danube Delta the locals created a large number of artificial islands - gardens. Green stop of "Salix" company. The white willow.

The islands in the delta are consisted of some dry land surrounded by water. They look like a saucer: the banks are high, and the middle of the island is
almost always moist – it is impossible to walk there, even when the Danube water level is the lowest.

Riverine ridge is narrow – there is no territory for vegetable gardens; so the locals "built" them. They dug canals – yeriks – and used the soil for the garden. Every year the Danube brought new silt, which, when the water level fell, was taken out of yeriks to make the island higher.

The size of handmade vegetable gardens in the delta depends on the physical strength of their owners; its width is about 6-10 meters. These long rectangular gardens, perpendicular to the mouth, surrounded by water on all sides, are islands on the island.

The company "Salix" has its territory just on such a garden. It consists of an "old" and "new" garden. The old one, which is about 100 years old, is 6 small man-made islands built on riverine shaft. The new one was made about 20 years ago with the help of modern technology in the depths of the island.

The soil here happens to be different - not river silt, but silt and sand mixture. Perhaps, once there was a sandy spit – like the one on which the mark "0 km" was put.

The name "Salix" comes from the Latin name of the white willow (Salix alba), which is very common in the Danube delta. The willow is a cult tree, symbolizing vulnerability, sensitivity, melancholy; it is a symbol of the arrival of Spring. In folk culture it symbolizes fast growth, health, fertility, extraordinary vitality, as it grows without special conditions.

People find a place to dig a well with the help of a willow tree branch.

9. PETER AND PAUL MONASTERY

A hundred years ago in the depths of the Delta there was a monastery, surrounded by a beautiful garden.

To the right of the route we can see Strait Kazekin groove, through which you can get to the place where a monastery on the island Pischany used to be.

In 1857-1860 with the support of Governor of Tulchin Mehmet Sadik-Pasha (Ukrainian Pole from Volyn - Michael Czajkowski), when Lower Danube was part of the Ottoman Empire, a monastery was founded on the island.

For 86 years (1860 - 1946), it existed as old believers Peter and Paul monastery. 12 hectares were in its possessions – they were gardens and floodplains. 120 monks (at the time of its greatest prosperity) were engaged in horticulture, gardening, fishing and other crafts.

Witnesses of that time tell about an amazing monastery garden with apple and quince trees, artfully planted on silt shafts. Tree roots went down to yeriks and always had access to water, but the trunks were unreachable for destructive Danube flood. So, the trees did not suffer during the flood, did not dry when the water level in the Danube fell. They did not need to be watered even when there was no rain for a long time.

After the Second World War, in 1946, when Bessarabia became Soviet, the monastery was closed, the monks evicted, the church blown up.

In Soviet times, cows were kept in the monastery. Where the church was, a fence for cattle was made, because this place was the highest.

20 years ago one could get there along the furrow, but now it is almost impossible.
Variability of the delta. Withering away tributaries. The formation of new channels. Dredging works.

The Danube Delta is unique due to the fact that we can observe modern geodynamic processes – the process of delta creation: the banks are constantly changing, new islands, spits, bays appearing, old channels dying and new ones opening.

"Living" channels and lakes of the delta are being silted up and overgrown with reeds; main streams are branching out and forming new channels. A good example of the process is the silting of the Sredny channel, which led to Peter and Paul monastery.

To maintain the life of small channels, they should be constantly cleaned and deepened. In Vilkove dredging of yeriks is carried out.

The growth rate of the delta depends on the amount of solid flow of the Danube, which in turn is associated with rainfall throughout the Danube area.

At times of water abundance, active erosion of the adjacent land takes place. In addition, the intensity of the delta formation depends on tectonic movements, sea level and commercial activity.

The highest intensity of siltation is observed in the Ochakovsky delta area. Now all old navigable tributaries – the Polunochnyy, Belgorod, Sabbat, Prorva – have almost withered away, and the water area of the port of Ust-Dunaisk has been silted at a rate of up to 2.5 million m³ per year. Today, the Bystre mouth remains navigable within Ukraine, but it also requires significant dredging works.

10. BOUNDARY OF THE PRESERVED ZONE

The Danube Biosphere Reserve of NAS of Ukraine. A brief history.

Practically the entire territory of the Danube Kiliya Mouth is located within the Danube Delta Biosphere Reserve (DBR) of National Academy of Sciences of Ukraine.

DBR is an independent environmental and research institution located in the extreme south-west of Ukraine, in Kiliya and Tatarbunary district of Odessa region. DBR administration is in Vilkove. Scientific and research department of integrated monitoring of ecosystems, state protection service, auxiliary and other units operate in the reserve.

DBR is the habitat of a large number of rare species of plants and animals that are listed in the Red Data Book of Ukraine and international red data lists. Only in the Ukrainian Danube Delta one can see hundred-hectare thickets of white lilies and watch Pink and Dalmatian pelicans feeding. The total area of the DBR is 50 252.9 hectares. Due to the natural processes of continuous delta forming, all new islands, spits, etc. are automatically included into the territory of the DBR, taking into account a two-kilometer protected strip of the Black Sea.
**A brief history of the DBR.** On July 24, 1967 the decree of the Council of Ministers of the USSR № 490 announced a conservation area in the Danube Delta with the status of a natural monument of national importance. It included a 1 km-wide strip of floodplains along the coastal Black Sea wetlands, deepening into the mainland (an area of 3 hectares) and a 1 km-wide marine water zone. In 1973 the Council of Ministers of USSR № 84 of February, 20 established the Danube branch of the Black Sea State Reserve of the Academy of Sciences of Ukraine on the area of 7758 ha. In 1981, the branch was reorganized into Natural Reserve "The Danube Floodplains”.

In 1998 the Decree of the President of Ukraine established the Danube Biosphere Reserve, area of 46,402.9 ha, and in 2004 the reserve was expanded to 50,252.9 ha. The decision of the International Coordinating Committee of UNESCO “Man and Biosphere” on February 2, 1999 included the reserve in the World Network of Biosphere Reserves as part of bilateral Romanian-Ukrainian Biosphere Reserve "The Danube Delta" (area of 630,252.9 ha).

# 11. FISHING CAMP

**The variety of fish in the Danube delta.**

The Danube (Black Sea) herring – a visiting card of the delta.

The delta of the Danube Kiliya mouth, where the Danube Biosphere Reserve is situated, has not felt a significant anthropogenic influence and preserved almost in its natural state thanks to its protection status for more than 40 years. In addition, a large variety of water bodies in the reserve – from fresh to marine bodies of water – determines the richness and diversity of the species composition of the reserve fish fauna. 106 species are registered in the waters of the reserve (43% of the fish fauna of Ukraine), of which 7 species are recorded in the European Red Data List, and 24 species in the Red Data Book of Ukraine. They are: beluga (*Huso huso*), Atlantic sturgeon (*Acipenser sturio*), sturgeon (*Acipenser ruthenus*), Danube salmon (*Hucho hucho*), Black Sea salmon (*Salmo trutta labrax*), Umbra (*Umbra krameri*), striped ruff (*Gymnocephalus schraetcer*), and others.

The herring (*Alosa pontica*), also known as the Danube herring, is the most important from economical point of view, being the visiting card of Vilkove and all Danube Delta. Fishing is one of the most important sources of income for local residents. The most popular among the locals recipe of "dunayky" is boiled herring.

**Industrial fishing. Association of the Danube fishing farms.**

In the lower reaches of the Danube, including the waters of the DBR, commercial fishing is conducted in accordance with applicable regulations. It is the most important fishing area in the Ukrainian part of the river. About 80% of species of fish of the Danube is caught here, and the most valuable and large fish are in the delta. Now 10 private fishing companies go fishing in the delta; they are merged in the Danube association of fishing farms with more than 600 fishermen. Administration of the DBR enters into an appropriate agreement with every company, in which environmental and...
organizational conditions of fishing in the reserve are stipulated.

Fishing for herring runs from March, 1 to July, 15 (depending on the temperature characteristics of the year). Average annual catch reaches 400 tons.

There are five fishing camps in Kiliya Delta, 3 of which function in the conservation area in accordance with the "Regulations on the Danube Biosphere Reserve" (2008). One of them, a fishing village consisting of houses on stilts, we'll see along the trail. For fishermen who live in fishing camps, located in the conservation area, the reserve administration has introduced a special pass mode. The number of permits is strictly limited to 305.

12. CORDON OF THE RESERVE

State protection service of the DBR. Inspectors’ cordons.

One of the main objectives of the Danube Biosphere Reserve is the conservation and sustainable use of natural resources. In order to maintain natural integrity of the area, increase and enrich its resource potential, its multi-purpose use is envisaged with regard to increasing human impact. This approach promotes activity and employment of local people.

According to Cl. 9 of the Law of Ukraine "On Nature Reserve Fund of Ukraine" these territories are to be used for health, environmental, educational and recreational purposes.

Inspectors of State Protection Service guard the DBR territory and adjacent area. They are based on the four border inspections: “Polydenne”, “Bystre”, “Vostochne”, “Tsyganka”. Permanent presence of inspectors on borders enables them to guard the protected area round the clock. As the area of dry land in the protected area is penetrated by channels and washed by the sea, high-speed boats allow the inspectors to respond to trespassing of the protected territory and quickly appear in any place. Appropriate transport equipment, mobile communication, armed inspectors, constant patrolling play a significant role in the prevention of violation of environmental legislation and protected mode. Our trail passes near the cordon “Polydenne”.

The fifth cordon “Desantne” is situated in Stensovsko-Zhebryyaniv floodplains near the village of the same name. This area is patrolled both by boat and by car.

13. DELUKOV BAY

Delyukov sand spit. The origin of the name.

Delukov bay is a bay and the Danube meander before Delukov spit, on which the symbolic mark "0 km" is set. The name "Delukov" possibly comes from the Turkish delik meaning "hole". In Slavic language environment a typical Russian suffix was attached to the word. The name Delukov, and nicknames associated with it, is known in Vilkove today.
The mark “0 km”. Diversity of landscapes. Formation of terrestrial ecosystems.

The most famous tourist symbol of the Ukrainian Danube – sign “0 km”, which is located at the confluence of the protected Danube and the Black Sea. The point “0 km” is a great opportunity to see the place where the mighty Danube, which unites ten states, finishes its journey. The Danube is the only river in Europe whose length is measured from the confluence with the sea to its source.

A symbolic mark which was set here attracts thousands of tourists every year. For over fifteen years, the ritual of passing through "0 km" has been performed. Several times this metal construction has been taken closer to the sea. Thanks to the friendly cooperation between the sea and river waves that lay silt and sand, the youngest dry land in Europe is being formed.

The landscapes of the Danube Biosphere Reserve are very diverse, but most of them have typical characteristics of wetland landscape. Here tourists can see the endless plains, usually treeless herbaceous expanses of open water mirrors. Most of the wetlands are occupied by dense thickets of reeds and herbaceous associations, interrupted by lakes, waterways and canals. DBR is also an extensive system of mouths, tributaries, channels and a large number of lakes, lagoons and bays, which for almost all year round can be used as a transport artery for tourist travel.

Picturesque views have been created not only thanks to variety of landscapes, but also to multi-colored palette of vegetation in different seasons. The main color of wetlands is green of different shades. Tourists throughout the summer can enjoy a relaxing green background and the colors of blooming grasses, mauve, pink, yellow and white blooming plants. Aesthetic and cultural value of natural landscapes of the Danube Delta is not only national but universal. One of the most important ecological and aesthetic features of the delta land is its naturalness, which is one of the highest in Europe. In addition, here the formation of terrestrial ecosystems takes place naturally, without human intervention.

Flora of the Danube delta Biosphere Reserve includes 1551 species of plants. The largest number – 958 species – constitutes higher vascular plants (flowering plants). Among them, 26 species are listed in the Red Data Book of Ukraine, 10 – in the European Red Data List. From a height of several hundred meters the Danube Kiliya Delta looks as vast expanses of the common reed (Phragmites australis), with darker spots of the ash willow (Salix cinerea). Along major waterways (the strips 50-200 m wide) there are trees and shrubs of different species of willows and poplars (Salix alba, S. fragilis, Populus nigra, P. deltoides). Long and narrow, 10-30 m wide, strips of thick bushes of the common sea buckthorn (Hippophae rhamnoides), Russian olive and silver berry (Elaeagnus angustifolia and E. argentea), saltcedar (Tamarix ramosissima) grow on coastal spits in
several rows along the beach. Inland waters are mostly covered with groups of the water caltrop (Trapa natans), white water lily (Nymphaea alba), yellow water lily (Nuphar lutea) and water fringe (Nymphoides peltata). Along the edge of the shore one can see streaks of conventional air and water vegetation, consisting of the common reed, white and narrow-leaf cattail (Typha angustifolia and T. latifolia), branched bur-reed (Sparganium erectum), etc.


The solid flow of the Danube. The waters of the Danube are the muddiest in Europe. Before the reservoir by the Iron Gates was built, the Danube volume of flow was about 60 million tons per year, presently – about 30 million tons, thanks to which the delta is being formed.

The Danube deposits are characterized by their own set of heavy minerals – the mica, chlorite, garnet, epidote, amphiboles and plagioclase.

The mica is a typical mineral of the Danube deposits. It differs from other river deposits of the northwestern Black Sea shelf. Mica appears in solid flow of the Danube due to erosion of ancient metamorphosed rocks of the Carpathians and the Alps. Due to its shape, mica is carried by river flow for great distances from indigenous sources, and in the sea part it spreads for tens of kilometers from the coast and reaches Zmiinyi Island. Fragments of mica (up to 1 mm) are washed by the waves in the mouth. Their clusters can be seen with the naked eye in the splash zone (when the wave retraces) in the form of shiny dark stripes.

Debris of heavy minerals concentrates in the surf zone due to the difference in energy of the coming and retracing waves. That is how mineral deposits form on the coast.

15. PROTECTED SEASIDE


Marine edge of the delta. With the development of the delta not only its appearance changes, but also the position and shape of the coast. Protrusion of riverbeds to the sea occurs together with the delta growth. The youngest part of the Danube Delta – Kiliya Delta – grows the fastest. Here, on the Black Sea coast of Ukraine, within the Danube Biosphere Reserve due to deposits, which the Danube supplies from Europe, the youngest areas of the continent appear. The growth rate of Kiliya Delta nowadays is about 2 km² per year, and the rate of protrusion into the sea – from 0.3 to 34.0 m per year.

At the confluence of the Danube and the sea, the speed of the Danube water decreases. Marine deposits flow, which brings sand from the east here, also slows down. This causes sedimentation of a huge amount of solids, so sand spits, shallows, submerged banks and islands, which will later become part of the delta, are constantly forming in the sea. Spits can even clog up the mouth from the sea side. The sea bays on the coast turn into part of the delta.

In terms of reduction in the Danube Delta water, only large tributaries remain alive in the Kiliya Delta; small channels are being gradually silted and
disappear. Tectonic processes contribute to it: crustal blocks in northern and southern parts of the Kiliya Delta are rising slightly at present, albeit with low speed (1-2 mm per year). Central area of the Kiliya Delta is tectonically stable. Marine coastal part of the delta grows unevenly, in some areas even coastal erosion takes place. It is associated with the decrease in flow of the Danube through Kiliya Mouth and with general rise of the Black Sea level.

16. ORNITHOLOGICAL TOWER

350 bird species. Several million individuals.

Ornithological tower provides panoramic bird watching for visitors of the “0 km” route.

A variety of biotopes with sufficient food base and excellent location for nesting, relatively warm climate, and the most important thing – low anthropogenic pressure, has resulted in great species diversity and high numbers of birds in the Danube Delta. According to these indicators it is one of the richest places in Europe. Almost 350 species of birds can be found in the Ukrainian delta, with the total number of birds at certain time of the year up to several million individuals.

The importance of the delta for avifauna of Ukraine has determined the character of the natural reserve "Danube floodplains" as mainly ornithological. 276 species of birds (about 66% of the avifauna Ukraine) can be found in the Danube Biosphere Reserve. 61 species are included into the Red Data Book of Ukraine: Pygmy Cormorant (Phalacrocorax pygmaeus), White-tailed Eagle (Haliaeetus albicilla), Common Spoonbill (Platææa leucorodia), White Pelican (Pelecanus onocrotalus), Glossy Ibis (Plegadis falcinellus), Pied Stilt (Himantopus himantopus), etc.

As wetlands dominate in the region, the original visiting card of local avifauna is common spoonbill, whose colonies were the largest in Ukraine. It is easily recognizable by its long black flattened beak with extended yellow tip. The bird is snow – white, with an ocher stain below the neck and pale yellow hair on the forelock. Its legs are long, black. In search of food it moves its beak in the water in different directions. These movements are similar to the movements of mowers, which explains Ukrainian name of the bird. It feeds on invertebrates, amphibians, and small fish. Being a migratory bird, it appears on the Danube in late March – early April. They organize colonies from a few to 200-300 pairs, keeping to fresh and brackish waters.

The nests – big piles of reeds and branches (diameter about 1 m, height 5-80 cm) – are in trees and reed. There are 2-5 white eggs with brownish spots in the nest, incubated by both parents. In general, in this area there is a large number of members of the series, closely associated with water – pelicans, storks, geese, plovers. The Mallard (Anas platyrhynchos), Mute Swan (Cygnus olor) and Graylag Goose (Anser anser) are numerous among Anseriformes. The most diverse in species composition are Passeridae.

The life of pelicans and cormorants are entirely associated with the aquatic environment. These birds are typical fish-eaters. They have specific adaptations to this way of life: their legs of special structure resemble paddles. Dalmatian Pelican (Pelecanus crispus) is under special protection. It is a large bird; its body weight reaches 9-13 kg and wingspan – over 2 m. Its plumage is white, the tips of the wings are dark, the legs are gray. On the back of the head and neck there are elongated
curly feathers that form a forelock and mane. Young birds are gray; they get adult coloration only in their third year of life. Pelicans have a very interesting formation, which is used for fishing and feeding the chicks. In ancient times people believed that adult birds sacrifice their lives, tearing chest and giving their blood to their nestlings. In fact, the red-orange bag located under the beak is a real fishing net. It is big enough for up to 1.5-2.0 kg of fish. Pelicans often fish in groups. They beat their wings on the water and drive the fish to shallow water, where it is caught.

These birds nest in the wetlands in small colonies. The male and female birds build a large nest (60 cm tall, 50 cm in diameter), mainly of cane, and lay grass or moss over it. There are 2 to 6 large white eggs weighing up to 230 g in the nest. Both parents incubate the eggs, but most frequently – females. After 33-40 days they hatch. In the Ukrainian part of the Danube Delta this bird appears during migration. Both the Dalmatian Pelican and pink pelican breed in the Romanian part of the Danube Delta.

The floodplains of the reserve are of exceptional importance for breeding of species such as the Common Spoonbill, Glossy Ibis and Pygmy Cormorant. Their colonies in the reserve are believed to be the largest in Ukraine. Ukrainian delta lands are important for the egretta and little egret, gray, purple and squacco herons, night heron. The number of birds in the reserve reaches tens and hundreds of pairs.

The Danube Delta is one of the most important bird migration routes in Western Palearctic. In addition to spring and autumn migration, many birds use the area for the wintering grounds and summer migrations.

17. POLUDENNE MOUTH

The names of the islands and the mouths of the Danube delta appeared in the XVIII century.

When Ochakovske mouth branched off, it gave birth to Poludenne and Polunochne mouth (in old Russian and Ukrainian languages the names mean South and North), and the islands and inland waters were named Ankudynov, Gneushiv, Potapovskyy, Big and Small Lazarkiny, Anankin, Delyukiv, Taranov. Only in the area riverine or coastal water tracts are called “kuts”, which were given the names of the local fishermen with fishing permit.

It is interesting that the names of the Black Sea rivers – the Danube, Dniester, Dnieper, Don – have a root from Indo-European “dana” – river, water. The name is of Scythian-Sarmatian time that is approximately two thousand years.

18. OCHAKIVSKE MOUTH


To your right you can see metal structure (leading beacon) of the sea port Ust-Dunaisky, which practically never work today.
The Danube River is a navigable artery of Central Europe. Historically, the mouth of the Danube has always been an important transit point. After the XIII century towns on the Danube became important transshipment bases in trade between China, the Middle East and Europe. For some time Kiliya was one of the largest ports in the Black Sea. Grand fortifications were erected in Kiliya in the XVth century; in 1484 Ottoman Sultan Bayezid called it one of the keys "from Poland, Russia and Muscovy".

During Russo-Turkish wars profits of the Danube merchants significantly fell. However, in the XIX century the trade gradually resumed. It started needed new technical conditions – well-equipped port facilities, extensive fairways, pilot service and system of notifications. Paris Convention in 1857 defined the conditions of navigation on the Lower Danube; works on deepening and straightening of the Sulina mouth started at that time. Competition between the various waterways of the Danube Delta increased in the twentieth century. Now there are three navigable channels – two Romanian and one Ukrainian.

In 1978, at the confluence of Ochakiv mouth and Zhebriyanska Gulf port Ust-Dunaisky was built. After the collapse of the Soviet Union and the economic crisis of the 1990s the activities of the port stopped.

19. GREEN TOURISM COMPLEX "PELICAN"

Danube Delta and Vilkove have always attracted tourists. However, the lack of tourist infrastructure on the Danube coast for a long time limited the trip to one day only, with 6-8 hours journey from Odessa to Vilkove and back.

8 years ago an ecotourism complex "Pelican", of the area of about 1.5 ha, appeared on the outskirts of Vilkove, directly on the Danube. This is the main tourist base of "Vilkove - Pelican Tour". In its structure there are: a detached cottage "Pelican City" with 12 comfortable double and family rooms, and a budget class guest house with 8 rooms. As “Pelican” can be reached from both water and land, and it provides parking lots, including a bus parking spot, there are no difficulties in organization of travel.

There is a large promenade, internal lake with fish, backwaters, comfortable berths for boats; variety of pavilions and gazebos (which can seat from 6 to 60 people); convenient information stands on biodiversity and history of the Danube Delta. There is the world's only monument to Danube herring.

There are 15 different speed and slow motorboats, passenger capacity from 2 to 60 people, for the tourists.

The whole area is a well maintained natural lawn with flower beds, shrubs and trees. There are garden benches, beach loungers everywhere, so you can rest comfortably.

At customer's service is local fish and traditional cuisine, with superb lypovan soup and dozens of local and traditional dishes. The largest in Vilkovo range of travel and related services is provided.
20. THE BELGOROD MOUTH


The Belgorod mouth (also called Gusev). This is the left branch of the Danube Kiliya Mouth. In the XVIII century the mouth appeared on charts under the name of Akkerman. Its flow from Vylkove to Belgorod defined its name.

The name of mouth is very old, formed from the ancient Slavic name of the city Belgorod-Dniesterovskyi. It was on the XIX century charts. In the era of Turkish rule, the city was called Ackerman.

This is a narrow and shallow old arm, which divided the town Vylkove into mainland and the island parts. The latter, as already mentioned, is called Kilimbeyka. Belgorod mouth through Zhebrianivska Bay and Polunochny Kut is united with the sea.

In the town the Belgorod channel is the main water street, with a lot of channels and “yeriks” branch off. The houses overlooking running yeriks are very nice. Local residents built dam “high berizhok” (a water barrier) between water and the house. In spring, at low tide, taking out the fertile silt from the yerik, they strengthen the dam. One of the techniques is: they put willow pegs on the bottom of the water body. Later, as in biblical times, the willows sprout and amaze you with young crown without a top. Along the canals wooden bridges – sidewalks are laid. At the intersection of two or more channels, humpback bridges have been built.

A lot of boats have found their place within the town along the banks of the Belgorod channel. With or without motors, with skippers – men, women, teens, early in the morning they run along the river and streams, and return to their Belgorod homes in the evening.
LOWER DNIESTER
NATIONAL NATURE PARK

INTERPRETATIVE TRAIL “LOWER DNIESTER PEARL”

Biological diversity – PhD Mykola Rozhenko, PhD Yuliya Nazarchuk

Geological diversity – PhD Natalia Fedoronchuk

Historical and cultural heritage – PhD Volodymyr Poltorak
Lower Dniester National Nature Park (LDNNP) is located in three districts of Odessa region – Bilgorod-Dnistrovskyi, Bilyaivka and Ovidiopol’skyi.

**Area:** 21,311.1 hectares, including 3700 hectares of land provided for permanent use, and 17,611.1 hectares where traditional economic activity is engaged in compliance with general requirements to environmental protection.

**Subordination:** Ministry of Ecology and Natural Resources of Ukraine.

Recreational appeal, favorable climatic conditions of the Dniester lower reaches, unique natural landscapes and biodiversity were the basis for the creation of the National Park.

Lower Dniester National Nature Park, located within the wetlands of international importance "Northern part of the Dniester Liman” and "The Dniester and Turunchuk interfluve", plays an important role in biodiversity conservation and restoration of natural resources.

Lower Dniester National Nature Park was established according to the Decree of President of Ukraine of 13.11.2008 № 1033 "On creation of Lower Dniester national nature park" with the aim of conservation, restoration and sustainable use of typical and unique natural complexes of the lower reaches of the Dniester River.

Protected area of the Dniester floodplains of 7620 ha, established in accordance with the decision of the Odessa Regional Council on October 1, 1993, is the core of the national park.

Official address: 65009, Odessa, Frantsuzskyi boulev., 89

Tel./Fax: (048) 746-53-07.

**Eco trail "Lower Dniester Pearl"**

**Status:** offered for approval

**The length of the route:** 50 km

**Average duration of visit:** 6-7 hours

**Means of transportation:** on boats

**Term of Visit:** May-October

**Visited:** with guide or with permission of LDNP administration

**Contacts for those wishing to visit the trail:** Lower Dniester national nature park, office № 2, Odessa region, Bilyaivka district, Mayaky, 58 Soviet Army st,
tel./Fax: (048)523-31-23,
E-mail: dniestarpark@gmail.com; website : www.dniesterpark.com
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3. FLOODPLAIN FOREST
4. WHITE LAKE
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16. MOUTH OF DEEP TURUNCHUK
17. WHITE CASTLE
18. KARAGOL BAY
19. DNIESTER MOUTH
20. DNIESTER BED
1. GOLOVKIVKA

**Foundation of Bilyaivka (Golovkivka) by Ukrainian Cossacks. Political fate of this land in the nineteenth and twentieth centuries.**

Golovkivka has been a Cossack town since time immemorial. It is hard to believe, but two hundred and thirty years ago there was no river in this area. In the XVIII\(^{th}\) century on this spot the Turunchuk met the large White lake, then flowed out of it and met the Dniester. But in 1783 the flood destroyed the bank of the Dniester River and created a new tributary – the Turunchuk. It silted the lake, which in two centuries has decreased by 3 times.

The village Golovkivka was named after the Black Sea Cossack Ataman Anton Golovaty. But in 1792 he moved to the Kuban, and the place gradually regained its first name "Bilyaivka", which originates from White Lake.

Another local legend associates the name of the town with another Black Sea Cossack ataman Sidor Bilyi (i.e. White), who died in 1788 in the Dnieper Liman and was buried on the Kinburn Spit. One thing is certain, that the Black Sea Cossacks founded the town, so in 2008 a monument was unveiled in the center of Bilyaivka to its founders.

In 1791 the left, and in 1812 – the right bank of the Dniester became part of the Russian Empire. The state allowed the Germans, Bulgarians, Swiss organize their colonies, but the Ukrainians continued to dominate in number.

In 1918 the region was divided between Romania and Ukrainian People's Republic, later the Ukrainian Soviet Socialist Republic, the border passed through the Dniester. The battles of World War II took place on the Dniester River in 1940, 1941 and 1944, and as a result, bridges and other buildings were destroyed, many local residents killed. The bulk of the region's infrastructure was built after the war, in 1950-1960's.

2. WIDE CHANNEL


The Dniester River is a large Eastern European river. It runs from northwest to southeast in Ukraine, Moldova and Transnistria. The length of the river is 1352 km, basin area – about 72 000 km\(^2\). The Dniester brings 10 billion m\(^3\) of water to the Black Sea annually. The Dniester is a part of the border between Ukraine and Moldova, and also 398 km of the border between Moldova and Transnistria.

The Dniester starts in the Carpathians from the forest spring, near the city of Turka at an altitude of 900 m. The Dniester there is a small stream that meanders down the forest.

In the upper reaches the Dniester is a mountain stream that flows in a deep narrow valley along limestone, sandstone, marl. A large number of tributaries which originate in the slopes of the Carpathians meet the Dniester there. They are small but abundant rivers – the Svicha, the Lomnica, the Bistrica and others. The largest of the tributaries of the upper section is the Stry River, a tributary that meets the Dniester 1190 km from the mouth.
Before the Stry flows, the Dniester is 60-65 meters wide, after that the Dniester significantly increases in size (width up to 100 m, depth - 3 m).

To the east of Ivano-Frankivsk the Dniester leaves the Precarpathians. The foothills of the Dniester basin mainly refer to Podolsk Upland. The main tributaries of the Dniester River in the Podol'e are the Siret and Zbruch. The Dniester reservoir, 200 km long, is located in the Podolsk area.

In the upper and middle reaches due to constant tectonic uplifts, the valleys of the Dniester and its tributaries are deeply incised into limestone, sandstone and clay banks. The valleys have steep slopes and spectacular meanders; sometimes there are canyons, up to a 100 m high.

Downstream, the Dniester valley extends up to 120 m, maximum depth is 3.4 m. Lower Dniester Basin is located within the Black Sea lowlands. This crust lowers smoothly, which has contributed to the formation and accumulation of solid river deposits.

In the lower reaches of the Dniester the Reut, the Byk, the Botnia flow. The Reut, the largest among them, originates in the Codri and flows into the Dniester below the dam of the Dubossarsky reservoir in Moldova.

The reservoir extends for approximately 120 km from the village of Vyhtyntsi to the city of Tiraspol. It accumulates the bulk of solid flow of the Dniester – millions of substances transported by the Dniester waters from the Carpathians.

To the south of Tiraspol, the Dniester valley widens, up to 16 km in its lower reaches.

Near the Moldovan village Chobruchy (146 km from the mouth) near the border with Ukraine, the riverbed is divided into two tributaries. The right one retains the name Dniester. It runs along many well-developed meanders; the left one, a more direct and affluent, is called the Turunchuk. The most part of the interflue is wetland that belongs to Ukraine. Near Bilyaivka, 20 km from the mouth, the Dniester and the Turunchuk merge again near White Lake, and below Mayaky village the river again is divided into two tributaries: the Deep Turunchuk to the right, the navigable Dniester to the left. The Dniester and the Deep Turunchuk finally meet the Dniester Liman and form a small delta. The Lower Dniester region including mergers of the Dniester and Turunchuk, are included in the international list of the Ramsar Convention.

Mammals. European mink – a symbol of LDNNP. Carnivorous mammals.

The European mink is a unique and rare aboriginal species of the Lower Dniester. Interesting is the fact that the Dniester Delta today is the only area in Europe where the mentioned species does not compete with its close relative – the American mink, which on the reproductive level is blocking reproduction of the European mink. This species has become a symbol of the Lower Dniester National Nature Park.

Among the groups of mammals in the Lower Dniester an interesting zoological phenomenon can be observed: despite the reduction in the diversity of predator species in the south of Ukraine, an increase in the number of species takes place in the park. This is due to natural expansion of such species as the golden jackal, marten, badger. And this process continues within the Dniester Delta. Since 2010, the squirrel can be found in this area. There is no clear explanation of the phenomenon. But most scientists believe that this is due to changes in the environment – especially to global warming.
During the whole period of research in the Lower Dniester the appearance of a typical and relatively numerous in South Ukraine beast – the wolf – has not been recorded, which is probably connected with the biological characteristics of the animal.

In the 1950s such mammals as the muskrat and raccoon dog were successfully introduced to the territory.

### 3. FLOODPLAIN FOREST

**Floodplain landscape of the mouth of the Dniester River.**
**Favorable microclimatic conditions for many species of birds and animals.**

Sailing along the beautiful Broad Strait, visitors enter into the natural floodplain forest. It is located in riverine ridges and channels, and is also called "the gallery" forest. Floodplain forest in the national park does not occupy a large area, but is typical for the landscape of the Dniester. Floodplain forests grow under extreme environmental conditions: in spring the forest areas are flooded for a long time (from 3 to 5 weeks). Therefore, the species composition is limited: the main tree species are the white willow (*Salix alba*) and the white poplar (*Populus alba*). The gray willow (*Salix cinerea*), the brittle willow (*Salix fragilis*), the black poplar (*Populus nigra*), and the wych elm (*Ulmus glabra*) and the common ash (*Fraxinus excelsior*) can be also found. Tiered structure of floodplain forests creates favorable conditions for the existence of many birds and animals, and forms many cozy corners.

The white willow is a widespread tree of floodplains. It has soft wood, can be easily processed. In addition, the white willows is the earliest and the most valuable honey plant, but even more important is the branched root system of the willow, thanks to which it secures and strengthens the shores of rivers and canals.

In addition to trees, there are different types of shrubs in the lower tiers of the forest: the alder buckthorn (*Frangula alnus*) and the common buckthorn (*Rhamnus catharica*), the guilder rose (*Viburnum opulus*), and others. In floodplain forests one can meet a lot of mushrooms growing on wood – polypores. Some of them can be used in food when young, for example, sulphur polypore (*Laetiporus sulphureus*).

Herbaceous cover is not rich in wetland woods – the common nettle (*Urtica dioica*), the asparagus (*Asparagus officinalis*), various sedges (*Carex*) and others can be found. But of particular importance are lianas that climb and twine along the trees, creating impassable jungle. Often you can see the forest vine (*Vitis sylvestris*), the hops (*Humulus lupulus*) and the birthwort (*Aristolochia clematitis*).
4. WHITE LAKE

The unique habitat of plant species, protected at different environmental levels. White Lake. Endemic of the Lower Dniester – the umber.

Plants. White Lake is one of the largest lakes on the Dniester estuary after Lakes Tudorovo and Putryne. The number of white lilies on the lake is so great that its surface seems white. The lake is about 2 km long, 1.3 km wide. In some places it is up to 1.6 m deep. The lake is connected with the Dniester and Turunchuk by channels.

The total number of plant species is only about 25 species, but, nevertheless, it is a unique habitat of plant species, protected at different environmental levels. In the Red Data Book of Ukraine native plants are registered, such as the floating fern (*Salvinia natans*) and the water chestnut, or buffalo nut (*Trapa natans*); in the list of the protected plants of the Odessa area – the white water lily (*Nymphaea alba*) and the yellow water lily (*Nuphar lutea*).

*Salvinia* is an annual water fern, tertiary relict of flora of Ukraine. It is a plant that has survived since the preglacial period. Salvinia has no roots, their functions are performed by a modified leaf, and among these leaves a huge number of fish larvae are hiding.

Another preglacial relict that grows on the lake is the water chestnut, or floating buffalo nut. Its Latin name “trapa” means a weapon used against the Roman cavalry – calcitrapa, or “trap for heels”; they were scattered on crossings and fords. This weapon is a small iron ball with conical spines, no matter how the ball is lying – one of the spikes is always directed upwards. Similarity of the fruit of the plant to the weapon was so obvious that in the future the word "trapa" became the name of the plant. The seeds of this plant do not lose the ability to produce sprouts for over 40-50 years. The seeds are white and tasty, in the past the plant was widespread in the Russian Empire, its fruit was sold in the markets by carts and bags. In India and Africa today the locals make bread, cook soup from the seeds of this plant.

The main decoration of White Lake is the white water lily – a perennial plant with a powerful rhizome, which contains a lot of tannins, protecting it from rotting in the water. The flowers open at about 7 am and close at 6 pm, which allowed Carl Linnaeus to add lilies into his list of "Plants - Flower Clocks". A lot of legends are associated with the water lily, it has long been surrounded by an aura of mystery and mysticism. According to Greek mythology, the lily was once a white nymph who died from love to indifferent to her Hercules and turned into a beautiful flower. Scandinavian legends say that each flower lily has a friend – an elf who is born at the same time with the flower and dies with it. Ancient Slavs believed that the flowers dipped into the water at night and become beautiful mermaids, and when the sun rose, the mermaids became flowers again. Perhaps that is why botanists gave the water lily the name "Nymphea" (Nymph - Mermaid).

Fish. White Lake is a jewel in the natural necklace formed by a number of beautiful lakes in the Lower Dniester.

First, due to its geographical location, it gets the purest water after a powerful biological filter of wetlands.

On the other hand, it is the first large lake on the migration route of fish from the Dniester estuary to the spawning grounds. For example, the roach (*Rutilus rutilus*) and bream (*Abramis brama*) in huge flocks, during the spawning run, go from the river to
shallow lakes. Amateur fishermen in some years could catch up to 20kg of roach a day. In Soviet times large, 3 kg, bream was dried or smoked and, in great quantities, sent to Moscow; on this occasion the locals called it the "party" fish.

Since time immemorial White Lake was a place where amateur fishermen caught gluttonous pikes (Esox lucius), handsome perches (Perca) that permanently inhabit the lake. The bright and attractive common rudd (Scardinius erythrophthalmus), the tench (Tinca tinca), and in recent years – the lazy silver carp (Carassius gibelio) have always been nice prey.

Really handsome is the carp (Cyprinus carpio). Sometimes, with rise of the water level, giant catfish (Silurus) swim into the lake. They can eat almost anything, but crayfish is a real delicacy for them.

However, besides usual and well-known species, which have just been mentioned, there are fish that avoid meeting fishermen and will never be caught by non-professionals. First of all we are talking about in the loach (Misgurnus fossilis) – a fish with very interesting biology. Striking is its ability to inhabit shallow wetland lakes with very low levels of dissolved oxygen, especially during extreme heat in summer and cold in winter, when the lake is icebound.

Hidden from the human eye is another unique small fish (slightly larger than a match) – the Umbra (Umbra krameri), which is endemic to the Lower Dniester. It used to be mass in all wetland lakes, including Lake White, but now it is recorded in the Red Data Book of Ukraine. In 1980s the umber was popular among aquarists and spread across Europe. Now it is a common species even in Holland.

Colors of the Lower Dniester.

According to another version, calm waters of the lake have been a source of clean, "white" water. No wonder that there is another lake nearby- Black lake. Generally, the Dniester delta is very rich in toponymic names derived from flowers. We have already met the Turunchuk (Orange), will visit Karaholsky Bay (Black Bay in Turkic), will see right-side Red spit (from the Moldavian settlement of Guru Rushu-Red Mouth). And, of course, we’ll mention Bilyayivka, Belgorod and castle-phantom Chornohoro.

5. TRACT "DNIESTER FLOODPLAINS"

A wonderful place for bird-watching.

Birds. According to another legend, the name of the lake is connected with a great number of snow-white swans, which have allowed nature lovers and visitors of the Lower Dniester admire them.

Every visitor of these places will certainly notice white birds – different species of martins and terns. Some of them (e.g. marsh terns) form their settlements – colonies – directly on aquatic plants, on water lilies and yellow lilies.

Whirlwind of different species of birds is always before the eyes of birdwatchers. During the past 10 years the White
pelican (Pelicanus onocrotalus), listed in the Red Data Book of Ukraine, is usual here in the summer, and the pelicans make the landscape even more attractive. Today it is the largest bird in Europe, with a wingspan of over 2 meters.

With bated breath, the visitor can see a large flock of black birds of medium size rise over the lake with noise and fly to the horizon. The birds are Great Cormorants (Phalacrocorax carbo), coming to the lake to enjoy fish. Eurasian Coot (Fulica atra) is always busy – prowling by the water.

In a remote corner of the lake a bunch of birds is lurking, their appearance resembles domestic ducks. They are Mallards (Anas platyrhynchos) – the most common species in the floodplains of large rivers of Ukraine.

Little and large egrets (Egretta garzetta and E. alba), red and gray herons (Ardea cinerea and A. purpurea) guard the lake.

Raising your eyes, you can see amazing black birds with curved beaks and long legs flying over the lake. This is the Glossy Ibis (Plegadis falcinellus) – an indicator of ecological balance and well-being of the lower reaches of the Dniester. This bird is a close relative of the sacred ibis, whom the ancient Egyptians worshiped.

When approaching the lake, you will be accompanied by brightly colored birds with distinctive voice – the Common Kingfisher (Alcedo atthis). When it sees the fish, it is immediately ready to attack; it takes aim accurately and, flapping its wings vigorously, attacks the victim.

Raising your eyes up high, you will notice a huge bird soaring in the air, held by the lifting power of warm air – the White-tailed Eagle (Haliaeetus albicilla). After a long break it has nested again in our area, in the vicinity of White Lake.

More than 300 species of birds can be found here at the period of nesting, migration and in winter. It is interesting that because of regular flooding of nests in the spring, such ducks as mallard species has adapted to nesting in trees, in hollows, magpie’s nests, etc.

More than 40 species of the Dniester Delta birds are recorded in the Red Data Book of Ukraine, and the white-tailed eagle, the red-breasted goose, the Pelecanus crispus are listed in the Red Book of the International Union for the Protection of Birds (IUBP).

6. DNIESTER ARROW

Names of the Dniester River.
The spot where the Turunchuk meets the Dnieper – an arrow. Crossing. The Tiras. The Turla.

Origin of the name of the Dniester River. So finally we got to the Dniester itself. Our boat had sailed the Turunchuk and the Wide channel. The locals call the place where the Turunchuk meets the Dniester the arrow, as this place reminds a Tatar arrow directed towards the sea. Here begins the area which has long served as the place of crossing, because the high left bank approaches the joint in one riverbed Dniester water, and the way from the floodplains leads to the right side hill near Palanka.

It is appropriate to talk about the origin of the name of the ninth longest European river. The oldest name came to us from the historical and geographical works of antiquity – the Dniester was called Tiras at that time. Local residents of those times – the Scythians and Sarmatians – spoke languages that are related to modern Ossetian, Persian, Kurdish and Tajik
languages (the Iranian language family). “Tiras” means "fast"; indeed, the Dniester, flowing down the slopes of the Carpathians and Podolsk Upland, with its turbulence and velocity, is different from other steppe rivers. In Scythian the word "Danas" meant "river, water" – that’s the origin of the second part of the modern name of the river. "Danas Tiras" reduced to "Danastr", later – to "Dniester". Others have interpreted the name differently, e. g. the Turkic name “Turla” appeared – a modification of “Tiras”. But in the Turkic languages “turla” means “pasture”, hence the Tatars and Turks reinterpreted the ancient name, linking it with the word from their vocabulary. Now the Turla is often referred to the main riverbed of the Dniester in contrast to the Turunchuk, the young Dniester.

7. BILYAIVKA WATER INTAKE

Built in the late nineteenth century, the water supply station "Dniester" provides water to more than half the population of Odessa region.

On the left side you can see the channel that deepens in the lowlands of the bank. This is the element of a grand water supply system. Imagine, from this point the water flows to the homes of more than half a million people in urban Odessa, Yuzhny, Illichivsk, Ovidiopol, Bilaivka and Bilhorod-Dnistrovskyi. That’s more than half the population of Odessa region, the largest in Ukraine.

In the first decade of its existence (the last third of the nineteenth century) the water supply system from the Dniester to Odessa was the largest in the world.

It all started in March 1872 in London, where "Odessa Water Supply Company" was founded on the initiative of the Odessites. 18 months later the first jet of Dniester water was officially unveiled at the Cathedral Square in Odessa. The water filter system purified it at the first stage then it was pumped to the station in the city.

Eventually, the city bought the water supply system out, and it became communal property. Subsequently, seven more pipes were added to the first, 75-cm diameter pipe. The water supply network provides water to all the central part of Odessa region.

The history of water supply station "Dniester" (as it is officially called now) knows not only time of peaceful work, but also turbulent years of wars and revolutions, when the people of Odessa became hostages and were forced to restrict water use to a minimum. This happened in 1917-1920, and in 1941-1944.

During World War II it was a miracle that the station was not destroyed. Heroic were events of August 1941, when the station was at the rear of Romanian troops (allies of Nazi Germany). 18 employees of the station headed by Mykola Kovalchuk dared to run the pumps and supply Odessa with water for three days (the city was surrounded from all sides by the enemy). It was possible to accumulate necessary water supplies and significantly weaken in thirst in the city. The film dedicated to these events was named - "The thirst". In April, 1944 Anna Kostetska from Bilyaivka informed the Soviet army about the plans of the Germans to undermine the station.
8. FERRIAGE OF KING DARIUS

Famous kings and military commanders of the ancient world crossed the lower reaches of the Dniester.

Yes, you heard it right. These banks and the river saw Persian king Darius cross the Dniester. In his time the Persian empire reached its peak, but we know that Darius was not lucky. First he was defeated by the Black sea Scythians, later he lost the battle of Marathon (from which originated the length of marathon – 42 km).

Imagine the grand Persian army of one to five hundred thousand men! Not all returned back, but only a pitiful handful of fugitives led by the "King of Kings" fled from the Scythians. This is how a 17th century Turkish traveler describes the crossing of the Dniester near Mayaky, "O Allah! Several hundred of horses entered the Dniester, they filled it like the sea. And it seemed that the Dniester ceased to flow. Tatar light cavalry suddenly moved to the bank by shallow water, as even such a great river as the Dniester did not reach the horse’s belly ... Khan crossed the river by boat in a small tent. Then all Tatar army rushed into the waters of the Dniester ".

For several thousand years so many have crossed the Dniester here in any direction! Alexander Macedonian’s military commander Zopirion, Attila the Hun, Gothic chieftains and kings, Bulgarian khans Kubrat and Asparukh, Prince Daniel of Galicia, Mongol Batu Khan and many others. Among them there are literary characters by Ukrainian writers who escaped from slavery to the Dniester free right bank. Also in this place the final scene of the novel by Ilf and Petrov "Golden Calf" took place, when Ostap Bender, loaded with jewels, was stopped by Romanian border guards. And maybe somewhere there the treasure of the literary character is still hidden?

9. BLACK CASTLE

Bridge. Stone towers and real castles - Palanca (Moldova) and Mayaky (Ukraine). Black Castle. The origin of its name Mayaky – port-satellite of Odessa.

A beautiful reinforced concrete bridge, built just after the Second World War, is in front of us. Earlier the river crossing was organized by ferries – public and private. The way through the floodplains led to Palanka, sometimes it crossed the river channels. Temporary wooden causeways, and from 1950 – fixed bridges were built. In ancient times on both sides of the crossing stood stone towers and real castles – Palanca (Yanik Hissar) Mayaky (Miyake – Hechit).

Yanik means “blazing”, Hissar – “castle, fortification”. “Palanca” is also translated as a “small (usually wooden) fortress”. "Miyak" means oil or actually, lighthouse, on which the mentioned oil burns. "Hechit" means crossing. Somewhere here, on the left-hand bank of the Dniester another mysterious castle – Chornohorod (Black Castle) – was situated.

Black Castle was first mentioned in 1421, when the governor of Podolia Hedyhold by order of Grand Duke of
Lithuania and Russia Vytautas built a castle opposite Belgorod. 12,000 employees constructed the fortress, brought stone and wood on carts. It was destroyed in the XVth century, but was designated on the XVIth and even XVIIIth – century maps. Historians still argue where exactly the legendary Chornohorod was situated. Most think it was on site of the Tatar tract Miyake-Hechit. In the XVIIth century it was called Tatar-Hazan (“headquarter” of Tatar khan). On the ruins of Tatar-Hazan Ukrainian Cossacks and peasants and Russian Old Believers, founded modern Mayaky in the late XVIIIth century. Local Tatars told an old legend about the origin of the name of the settlement: once there lived on these lands an Islamic righteous man. Local residents asked him to show a miracle, but he refused. The residents were stubborn, so he asked Allah to make yellow butter flow along the river. It was done, and there was so much butter that it flew as far as Istanbul. The residents collected it in every possible container. But the saint died, exhausted by prayers. Since then "Miyako" was sent to Turkey, where its excellent quality was well known. Crimean khans built there “turbe” – a tomb in the form of a dome. It is called Miyak-Baba-Sultan-turbe. Other Islamic righteous men were buried next to it. In the XVIII century the ruins of their tombs, mosques and fortress walls were well visible at the site of modern cemetery of Mayaky. But today no trace has been left. As to other archaeological findings, more than 30 mounds have been found in the vicinity of Mayaky and nine small towns of ancient times excavated. They were part of the sphere of influence of Thira and Nikoniya - ancient Greek cities (we will speak about them a bit later).

The nineteenth century, when Mayaky became a river port-satellite of Odessa, was the time of heyday. It is from Mayaky dock the goods that arrived by the Dniester were delivered to Odessa. Almost all wood for building and for heating, grain and other agricultural products of Bessarabia, Podolia and Galicia were transited through Mayaky. In 1862 Mayaky received the city status. However, with the construction of the railway, which bypassed Mayaky and went to the Dniester wharfs near Tiraspol and Bendery, the city significance reduced. Now it is a large (about 4,000 inhabitants) village, but not a city.

10. GONTARENKO ISLAND

Scientific research on the Lower Dniester. Hydrometeorological stations and radio telescope "Uran-4" associated with the names of prominent scientists – Vadim Gontarenko and Vladimir Tsesevych.

Islands of the Dniester delta are mostly nameless. Straits, corners, spits have names, but not islands. Gontarenko Island is one of a few exceptions. It was named only about ten years ago after Vadim Gontarenko (1926-2000) who led the local meteorological station for 40 years (1960-2000). The station was founded in 1947 and since then has been a center of the Dniester delta research. Vadim Gontarenko is remembered as a real fan of the Dniester delta protection.

Mayaky in the second half of the twentieth century was the center of research work. A prominent astronomer, the Member of National Academy of Sciences of Ukraine, Vladimir Tsesevych (1907-1983), organized the construction of suburban observatory in 1956 in Mayaky (as polluted atmosphere of the big city did not allow watching celestial bodies). Later, in the 1960s, the local station built the radio telescope "Uran-4"- on the left side you can see a large field with mysterious metal constructions.
Activity of the observatory allowed creation of the third largest photo library of celestial bodies in the world.


Walking by the island, you can see the diversity of the Lower Dniester entomocomplex. Insects are representatives of animal world playing a key role in the natural trophic systems in general and of the Lower Dniester in particular. The most numerous group – more than 3000 species of insects inhabit the Dniester floodplains.

The most typical group is so-called “bloodsuckers”. They, on the one hand, exasperate a person during the summer vacation, on the other – provide nutrition for the Dniester Delta residents – from fish to carnivorous mammals, not to mention members of avifauna. At present, the most effective guard of the Dniester wetlands – mosquito – is the protector of the entire Dniester delta environment. But this protecting behavior was quite accidental, as only females drink the blood of all warm-blooded animals and only in order to ensure procreation.

We know that insects far exceed any class of animals by their total biomass. Some of them have very interesting biological features. For example, ephemera – lives as an adult insect one day only. It spends the rest of its life in the form of larvae in the water. The adephaga beetle is capable of moving in any environment and space – it can fly, swim under water, crawl on land. In periods of sharp reduction of fish stocks, the beetles are food for otters and minks.

Attractive and beautiful dragonflies whirl from morning till evening in the air above the floodplains. Dragonflies are sentinels of the Dniester sky. They clearly watch their prey in the air over the Dniester floodplains, significantly reducing the number of insects that bother people on holidays. They are predators and feed on smaller insects.

11. FLOODPLAIN MEADOWS

Floodplain meadows – the area where fish spawn, birds nest, insects and amphibians breed.

Floodplain meadows occupy a small area of the Lower Dniester national park. Meadows are characterized by the dominance of perennial herbaceous plants, primarily grasses and sedges, which can exist in moisture. Meadows are in the riverine valleys and in spring are flooded for up to 2 months. In the Dniester delta there are meadows flooded for a short period (up to 20 days) and for a long period (2 months).

Herbage of short flooded meadows consists of bluegrass (Poa pratensis), couch grass (Elytrigia repens), purple loosestrife (Lythrum salicaria). On lowered overwet areas, where meadows are flooded for a long time, sea clubrush (Bolboschoenus maritimus) and various sedges grow.

The significance of floodplain meadows for life of the Dniester delta is great: during floods fish spawn, birds nest, insects and amphibians breed there.

Marsh vegetation covers the bulk of the floodplains and consists mainly of groups of the reed (Phragmites australis). Thickets of reed in the floodplains perform many important functions. They purify the Dniester water from contamination, acting as a natural filter; create favorable
conditions for many species of birds and animals; assimilate huge amounts of carbon dioxide being the most powerful source of oxygen...

12. DEEP TURUNCHUK

In 1840, merchant Alexander Surovtsev financed the construction of the canal from the Dniester River to the Dniester Liman, which significantly shortened the river way.

In the XIX century it took a long time to go from Mayaky to the Dniester Liman and even longer to come back. The long riverbed wriggled along the delta making scheduled flights impossible, complicating navigation. Unloading barges and rafts in Mayaky was quite expensive because transportation to Odessa significantly increased the price of goods. In 1838 a Russian merchant Alexander Surovtsev appealed to the local government to dig a canal. He was ready to cover the costs, but asked for a 10 year monopoly on transportation of goods from Mayaky to Odessa. However, he spent all his fortune to create the canal called Surovtsev’s canal but received no guaranteed benefits, went bankrupt and died in poverty.

He created a surprisingly comfortable and effective canal. Now all the boats that follow from Mayaky and back choose it as the shortest and safest way.

Migration routes of fish.

The Deep Turunchuk is an important water area in terms of formation of ichthyological complex. The deepest place at the fork of the Dniester and the Turunchuk (about 20 m), the sea and the liman close by – it all creates favorable conditions for many fish species. Migratory fish species, i.e. those that live in the sea or liman and come into the river and floodplains to breed, can be found in the Deep Turunchuk. This defines the role of the Deep Turunchuk in fisheries of the region. The Black Sea herring, moving upward from the Dniester Liman to places of natural spawning, is a desirable catch for fishermen, who annually take from 1.3 to 62.0 tons of herring in the Dniester Delta and Liman. The sturgeon fish (beluga, sturgeon, sevruga) used to move by the same migratory route. Great industrial importance has the perch, roach and bream. Fish species diversity in the Turunchuk is richer than in the Dniester: the silver bream, bream, roach, pike, crucian carp, amur bittering, bleak, perch, goby.

13. KILIARIYSKY SHALLOW CHANNEL

Commercial and recreational fishing.

Commercial fishing in the Deep Turunchuk is significantly affected by Kilyariyskyy shallow channel, artificially created by local fishermen in the nineteenth century. Despite the depth of only about 2 m, and width of
3.4 m, it plays an important role in the migration of bream and herring.

Proximity to the Dniester Liman creates very favorable conditions for recreational fishing. The perch, carp, catfish, roach, bream, crucian carp, perch and pike - this is an incomplete list of the species that are usually caught.

14. "BUDZHAK BAY"

The purest Dniester delta area. Biological filtration. Submerged aquatic vegetation.

The northern part of the Dniester Liman is the cleanest area of the Dniester Delta, as the water passing through thickets of reed (Phragmites australis), filters and clears of silt, organic and certain toxic substances. In the area of Kilyariysky shallow channel the Water caltrop (Trapa natans), Water fringe (Nymphoides peltata), Floating fern (Salvinia natans) can be found, but the main role is played by submerged aquatic vegetation that is represented by hornwort, different types of pondweed. Among others there are Canadian waterweed (Elodea canadensis), Naiad (Najas maritima), Straight Vallisneria (Vallisneria spiralis), etc. The Nitellopsis, representative of charophyta algae, is found in the area, which indicates the purity of water: it quickly dies in muddy, polluted water and when algal "bloom" occurs. In communities of submerged aquatic plants the Canadian waterweed (Elodea canadensis), or water plague is found. It came from Canada's lakes to Scotland together with steamers and ships in 1842, from where it spread throughout Europe. It is called water plague as it multiplies rapidly, fills waterbodies, preventing navigation and fishing.

Budzhak: historical names of the right bank of the Dniester Liman.

The land between the Danube and the Dniester is a historical region Budzhak or Bessarabia. This region has had different names, belonged to different states, has been populated by different peoples, because it is located on the border of different cultural worlds and is the gateway between them. Historically the territory was colonized from four corners. The Celts and Slavs came from the north, the Greeks, Armenians, Turks – from the south, different nomadic tribes from the east, the Romans, Romanian and Moldovans – from the west. From whatever direction they came, it was the border of the world for them. Both the Turkic name Budzhak and Slavic Ohlos mean “corner, border”. For those who sailed by ship, this region was important for its seaside location – hence the Greek name Paratalasiya (translated as coastal land). Other people called the area by the names of major rivers – the Danube (Istria) and Dniester (Tiras), some by the name of the people who lived here – Minor Scythia, Lower Moesia, Tiro – Gothia, West Gothia. Some names are still ambiguous, including the popular name Bessarabia, which has been used since IV century.
15. DNIESTER LIMAN

Formation of the Dniester Liman.

The history of the formation of the Dniester Liman is similar to the formation of other Black Sea limans.

About 10 thousand years ago the sea level began rising, which led to the connection of the Black and the Mediterranean seas and formation of sea bays. They eventually separated from the sea by sand spits and turned into limans. This is known as the ancient Black Sea transgression.

8.5 thousand years ago the Dniester bay (future liman) almost reached Ovidiopol. Over the next six thousand years the Dniester Liman was completely filled with sea water and was deeper than today. Periodically, the sea level was even higher than the modern level, and the Dniester bay in the upper reaches went up to Tiraspol.

About 3 thousand years ago the sea began to recede. These events are called the Phanagorian regression. The sea maximally receded in Vth century BC, when the sea level was 2 m below the current level (in some places up to 8 m).

Geological data confirm that the central part of the liman was extremely shallow at that time, and the sandy bottom in the upper reaches probably was the land. According to historical information, there was an island in the liman at that time (which could be the bottom of the ancient bay).

After the Vth century BC the sea levels began to increase again, Nymphaion transgression started, and the Dniester bay filled with the sea waters again.

Gradually the bottom of the bay became more and more shallow, filled with deposits of the Dniester. Later the bay separated from the sea by sand spit and turned into a desalted water body – liman.

Nowadays the Liman is a shallow elongated water body, extending from the northwest to the southeast for 41.5 km. Its northern part is wide; the southern part is narrower. The maximum width of the liman is 12 km; its area is 400 km2. The depths of the liman is up to 3 m, average depth – 1.75 m

It is separated from the sea by a long (9 km) and narrow (500 m) Bugazkaya spit, famous for its sandy beaches. The liman is connected with the sea through Tsarehradsky Mouth. Till 1926 there was another mouth – Ochakovskaya – in the Bugazkaya spit through which the liman connected to the sea. But gradually the mouth was buried in sand.

In the sediments of the liman the geologists have found small grains of unique green diamond, which the Dniester brings, eroding diamondiferous rocks from the Carpathian Mountains and the Ukrainian crystalline shield.

Hydrobionts of the Dniester Liman.

The liman is characterized by a hydrobionts complex, in which fish occupy key positions. The reason is high biological productivity of the water body, which no deeper than 2 m, i.e. there is an abundance of nutrients,
leading to intense development of microscopic algae (phytoplankton).

Commercial fishing here is based on the already mentioned fish – the carp, crucian carp, bream, roach, perch. According to oral information from the fishermen, annual catch on the Dniester River and the Dniester Liman has decreased by 4-5 times over the past 25 years, to about 150 tons per year.

The Dniester Liman is a key fattening water body for anadromous fish, including the herring, which feed for some time in the Dniester Liman, before their powerful upstream "jump" to traditional spawning grounds.

In spring, it is still sometimes possible to meet rare giants – the belugas (Huso huso). Being over 500 kg of weight and 4 m long, they spectacularly appear in the shallow Liman. Other sturgeons-stellate sturgeon and Russian sturgeon- are also sometimes found in the Dniester Liman. All of them are listed in the Red Data Book of Ukraine (11 species) and the International Union for Conservation of Nature (IUCN) (8 species). 6 species of fish found in the lower reaches of the Dniester, belong to the European Red List, 6 – are protected by the Berne Convention.

Out of the species of interesting biology of the Dniester Liman, the European eel (Anguilla anguilla) should be noted, which is able to travel along upland areas for long distance, eventually reaching the Sargasso Sea – a single spawning ground of the eels in the world.

16. MOUTH OF THE DEEP TURUNCHUK


Some old Moldovan and Ukrainian villages can be seen on the horizon. One of them is Udobne, which until 1944 was called Han-Kishla. In the VI century it became the residence of the head of the great Tatar Budzhak Nogai Horde, which was subject to the Crimean Khanate and the Ottoman Empire. Often Udobne was marked on maps as Budzhak, because it was the capital of the entire Tatar land at that time.

In the XIX century the village to the west of the liman were inhabited by the Ukrainians and Moldovans. The villages became part of the lands of Novorossiyisk Cossack troops – descendants of Zaporozhsky Cossacks. They continued history of the Cossacks in the south of Ukraine. The army was disbanded during the military reforms in 1863, but the population still remembers their Cossack roots. Villages near Udobne are called Cossatske and Starokozache.

17. WHITE CASTLE

_Bilhorod-Dnistrovskyi, “White Castle”, fortress._

Now look to the right: over there on the horizon lies the ancient city of Bilhorod-Dnistrovskyi. It is more than 2500 years old. The legendary fortress is situated in the centre, on the Dniester Liman bank, its towers are visible with the naked eye.
18. KARAGOL BAY

Aquatic vegetation. Steppe Land – decoration of southern Ukraine. Xerophytic and early spring plants.

The largest in the Dniester Delta population of the Water Fringe (Nymphoides peltata) is in Karaholskiy Bay. This plant is listed in the Red Data Book of Ukraine. Its population is shrinking as a result of water pollution. It can grow in places where the water body is overgrown and marshy; its leaves resemble a shield.

Another widespread plant in Karaholskaya Bay is the Yellow Water-lily (Nuphar lutea). The plant is very demanding, so if wastewater enters the water body, it dies very quickly. Its Ukrainian name is translated as “yellow pitchers”, due to the fruit, which resemble pitchers.

In addition, Karahol Bay is the wintering grounds for the carp, common carp, crucian carp. That is why commercial fishing is traditionally prohibited in the area.

Karahol Bay overlooks the steep banks of the Dniester liman. In these circumstances typical steppe vegetation in the Lower Dniester National Park preserved.

Among the plants from the Red Data Book of Plants, feather grass should be noted. They are xerophytic plants, i.e. those that grow in arid areas. Leaves of the feather grass are often rolled into a tube and look like wire. Feather grasses are perfectly adapted to life in the steppes. They have the original means of spreading seeds: when caryopsis has ripened, it flies with the help of pubescent net and falls not far from the parent plant. With drops of dew caryopsis begins “to drop anchor” i.e. to screw into the ground like a corkscrew.

In addition to feather grass, there is a large number of early spring plants on the banks of the Dniester Liman. Some of them are also listed as protected plants of different categories: the iris (Iris pumila), the Hyacinthella (Hyacinthella leucophaea), the grape hyacinth (Muscari neglectum) and others.


The banks of the Liman are quite steep. East banks are mainly composed of loam, west banks – of Pontian limestone, with Meotic clay beneath.

Low banks of the Liman are formed by sand deposits of the Dniester River and its tributaries.

Loess-like loam soil of which eastern banks of the Dniester Liman are composed, were formed during the last 2.5 million years, when the ancient glacier retreated. The complex, the so-called stratotypic (etalon) section, includes 18 layers of loess (silty) sediments and fossil soils. Such a section was found near the village Roksolany. Scientists from all over the world come here to study this stratotype section.

West banks are formed by Sarmatian and Pontian limestone, similar to the limestone of the Odessa catacombs. The limestone was formed at the bottom of an ancient sea more than 7-10 million years ago. The limestone is a mineral and a building stone. Bilhorod-Dniestrovskyi fortress was built of it. Buildings of dry limestone are clean and durable. Crystallized variant of the limestone is the marble; its deposits are developed near Bilhorod-Dniestrovskyi.
Pontian limestone is supported by Meotic clay, the outputs of which can be seen in the south-western bank of the liman. These clays were formed in Neogene period 7-9.5 million years ago at the bottom of an old deep sea. This blue-gray clay, consisting mostly of montmorillonite, is an excellent sorbent. This Meotic clay is used in traditional medicine and cosmetology under the name of “the blue clay.”

19. THE DNIESTER MOUTH

At the mouth of the Dniester River in ancient times there was a lighthouse, named after the son of Achilles – Neoptolemos.

According to a prominent ancient geographer Strabo, ancient Greek settlers built a tower in the mouth of the Tiras (Dniester) and called it Neoptolemos, after the son of Achilles, the Trojan War hero. Neoptolemos never visited the place, but since his father was known as "Lord of the Sea" (Pontarh), the beacon tower and his name had to help mariners better locate the entrance to the river in the darkness. The search for traces of the tower led Odessa archaeologists to the conclusion that two and a half thousand years ago the Dniester Liman did not exist, and the Tiras met the Black Sea further south – in the Budaksky Liman. This is confirmed by ancient geographers, who wrote about a large island washed by two tributaries of the Tiras. On the right tributary stood Thira (Білохород-Дністрівський), on the left – Nikon (today the village of Roksolany).

20. THE DNIESTER BED

Shipping in the Lower Dniester. Dubăsari Dam.

Since time immemorial, the Dniester was used for export of goods produced in the Lower Dniester areas. The ancient Greeks traded with their northern neighbors. Later, in the XIII century, Genoese merchants used ships called galleys (in the form of a rectangular box), carrying capacity of 12 tons, to carry cargo down the Dniester.

In Ottoman times the importance of the Dniester in trade decreased, but in the XVIII century the transit of goods came to life again.

In 1843, Novorossiysk Governor General Mikhail Vorontsov bought a steamer in Great Britain. It was named the "Dniester". Trying to sail up to Tiraspol, the vessel ran aground. Subsequent attempts also failed: ship by ship headed for the Dniester, and stopped before reaching the Tiraspol. Then the main channel was deepened and navigable canals were dug.

In 1881, Russian Society of shipping and commerce did a research on possibilities of using the Dniester River for navigation. In 1884, they started to deepen the Dniester, and in 1893 the river was made available for tugboats and passenger ships. From 1918 to 1940 the Dniester was a border zone and was strictly guarded. During that period the navigation on the Dniester stopped, and resumed only in 1940.

Dubăsari hydro-electric dam. In 1954, a hydroelectric dam was built near Tiraspol and the Dubăsari reservoir
appeared. Therefore, regular shipping was only possible in two isolated areas: from the city of Soroky to Dubăsari hydro-electric dam and from the dam to the mouth. So, today mainly tourists sail along the Dniester.

Population. Over the past two hundred years the population of the surrounding villages has changed. First, the Nogai Tatars were evicted. They were replaced by Ukrainian and Moldovan farmers and German colonists. On the right you can see one of the former German settlements – Frantsfeld (now Nadlymanske). The Germans moved out in 1944, before the Red Army came.

**Legend of Cimmerian kings.**

However, change of the population is not unusual for this land. Herodotus wrote about the Cimmerians – nomadic people who lived on the banks of the Dniester three thousand years ago. When their enemies – Scythians – invaded the Black Sea steppes, the Cimmerians gathered on the border of their land, on the Tiras – Dniester. Most of them wanted to save themselves and to seek refuge abroad. Only a few hundred aristocrats refused – they were willing to die for their native land. They divided into two equal groups, and killed each other. Dozens of mounds appeared on their graves. True or not, but in the vicinity of Mayaky, Bilyaivka, Udobne archaeologists have found more than one hundred mounds of different ages. And now you can see them in local steppes.
REGIONAL LANDSCAPE PARK
«KINBURN SKAYA SAND- SPIT»

INTERPRETATIVE TRAIL “KINBURN”

Biological diversity – PhD Oleg Derkach

Geological diversity – PhD Natalya Fedoronchuk

Historical and cultural heritage – PhD Vladymyr Poltorak
Regional landscape park «Kinburnskaya sand-spit» is situated on the territory of the Pokrovka council of Ochakiv district in Mykolaiv Oblast and covers the western part of the Kinburn Peninsula (excluding the area of the Black Sea Biosphere Reserve "Volzhyn forest") and adjacent waters (1 km) of the Dnipro-Bug Liman, the Black Sea and the Yagorlyk Bay water area.

Approximate geographic coordinates: 46 ° 31' N - 46 ° 26' N and 31 ° 30' E - 31 ° 48' E.

Area: 17 890.2 ha.

Subordination: Main Department of Economics of Mykolaiv Regional State Administration.

The park was created by the decision of Mykolaiv Oblast Council from 15 October 1992 No 16, according to the Law of Ukraine "About the Nature Reserve Fund of Ukraine".

Official address: ul. Shkreptiyenka, 16, Ochakiv, 57555 Mykolaiv Oblast.

Tel. +38 (05154) 307-56; borisfenida@mail.ru; website: http://www.kinburn.org

National Nature Park "Biloberezhzhya Svyatoslava" is located in the Ochakiv and Berezanskyi districts of Mykolaiv Oblast.

Area: total area of the Park is 35.2 hectares, including 25 hectares of water area Dnipro-Bug estuary, Yagorlitsky Bay and adjacent waters of the Black Sea around Kinburn Peninsula.

The park was established according to the Decree of the President of Ukraine No 1056/2009 from 16.12.2009

Subordination: Ministry of Ecology and Natural Resources of Ukraine.

Official address: NNP "Biloberezhzhya Svyatoslava" 57008, Ochakiv, str. Lenina, 18, Mykolaiv Oblast.

Tel: +38 (05154) 3-00-26, 2-39-43, fax: +38(05154) 3-00-26

E-mail: npp_bilosvyat_ochakov@ukr.net; веб-сайт: http://nationalparkbilosvyat.org.ua

Kinburn Sand Spit is a natural territorial complex of ancient river sandy plains and coastal landscapes unique for Europe. It is a habitat of many species of plants, fungi, animals, including those that do not occur anywhere else in the world. Today Kinburn environmental conditions are favorable for resorts, mud cure, fishing, mushroom picking, as well as for scientific and sports tourism. Kinburn ecosystem is very vulnerable and, in view of anthropogenic pressure increase may become uninhabitable not only for wild flora and fauna, but also for the local population.

**Trail "Kinburn"

**The length of the route:** 20 km (land area).

**Average length of visit:** 2 days (for travel by foot).

**Means of transportation:** combined (water, hiking).

**Term Visit:** May-October.

**Visiting:** alone or with a guide.
1. OCHAKIV
2. DNIPRO-BUZKYI LIMAN
3. IS. PERVOMAISKYI
4. KINBURN ARROW
5. BIENKOVI FLOOD-PLAINS
6. SPAWNING LAKES
7. VOLYZHIN FOREST
8. SAND DUNES
9. WOLF DEN
10. ALDER FOREST
11. LOPUSNE LAKE
12. ORCHID FIELD
13. MULLET LAKES
14. MUD LAKE
15. YAHORLYK BAY
16. IS. KRUHLYI AND DOVHYI
17. OYSTER FARM
18. "OSETINSKOE" TRACT
19. COASTAL SANDS
20. WATER AREA OF THE BLACK SEA
1. OCHAKIV


On the right bank of the Liman Nicholas Orthodox Cathedral rises. This is the former Great Mosque of Ottoman fortress Ozi, which translated means "river" or "Dnieper". This is the only monument of the Ottoman era, which came to our time. According to official data Ochakiv was first mentioned in 1415 as Dashiv.

Together with the Turkic Ozi a new Slavic name Ochakiv is used. With this town one of the earliest reminiscences to sea voyages of Cossacks relates.

In 1526 Ozi went to the Ottoman Turks ownership, and later became the administrative center of a huge vilayet (region). Strong fortress walls were built and the city has grown considerably.

For the period of the next Russian-Turkish War (1768-1774) the Russian army did not dare to approach to the modernized castle. During a siege and storming of Ochakiv in 1788 tens of Russian generals, officers and ten hundred thousand soldiers perished. This glorious siege of Ochakiv by Russian army led by Prince Grigoryi Potemkin made Ochakiv the famous city throughout Russia and Europe. Several monuments were set for the memory of the battle, but the fortress was not retained.

Unfortunately, we won't visit Ochakiv peculiarly during our trip - but even from Kinburn Sand-Spit we can see the grand buildings, which is owned by the Ministry of Defense of Ukraine.

2. DNIPRO-BUZKYI LIMAN

The largest liman among all the Black Sea coastal estuaries. Benthic invertebrates of relict brakish fauna. High fish productivity.

It is the largest liman among all the Black Sea coastal estuaries. Numerous representatives of marine, brackish and freshwater flora and fauna live here, including relict and endemic species.

The lake maintains relatively high fish productivity. In the first half of the last century, it was one of the highest in the world (up to 80 kg/ha). Spacious shallow waters of the liman are the place of feeding of migratory (sturgeon, herring) and semi-anadromous species of fish – Common Roach (Rutilus rutilus), Common Bream (Abramis brama), Pikeperch (Lucioperca luctioperca), Common Carp (Cyprinus carpio), Zanthe (Vimba vimba). The coastal part of the reservoir is a spawning place of local fish fauna.

The water area of the west part of the Dnieper-Bug Liman and the Black Sea near the Island Berezan is rarely icebounded. Therefore, it is the main destination of many wintering waterfowls, including Common Goldeneye (Bucephala clangula), mergansers (Mergus albellus, M. serrator, M. menganser), Oldsquaw (Clangula hyemalis), Common Scoter (Melanitta nigra) and Velvet Scoter (M. fusca). Many species of birds use the area as wintering grounds (up to 10 thousand individuals).

<sup>1</sup> It is told on the pier in Ochakiv.
Dnipro-Buzkyi (Dnieper-Bug) Liman is located at the confluence of two big rivers – the Southern Bug and the Dnieper. It is mostly 5-6 m depth, but there are some deep (about 12 m) pits. The Liman is connected with the Black Sea by the Strait 3.6 km width. Kinburn Spit separates the Dnieper-Bug Liman from the sea. The spit is formed due to sand deposits from Dnieper and resedimentation of sea waves. The Kinburn’s age is about 1.5 thousand years, but its appearance changes over time. Traditionally Kinburn is called “Spit”, but nowadays it is quite large peninsula with two marine arrows – modern spits. The length of the Kinburn Spit coast is about 23 km, but marine arrows are growing and coastline length gradually increases.

**Fishery. Fishing gear.**

Since ancient times, the Dnieper-Bug Liman attracted fishermen. The most famous of them are the Cossacks, who brought the art of fishing to the highest professional level.

Since XVIII century on the Kinburn Sand Spit there has been known fish factories – small fishing cooperatives and artels of Cossacks. Typically, they were separate buildings in which lived two dozen fishermen headed by “koshovyi”. The boats were three sizes – big (for 12 people), medium and small (up to 2 people). Near the houses sheds and other farm buildings erected. Near the water the long nets were hung. Between the fishing they should not be neither too wet nor dry.

The most common method of fishing is by nets. The largest nets were up to 800 meters and called "Matuly" (the synonym of dragnet). There were zabrodchyky, sitochnyky and kruchnyky between fishermen, who strictly subordinated to their chief. Gardovyi method was very effective. The method consists in building the special barriers (gards) on the small channals and yeriks where the fish is coming for spawning in summer. Through such barriers the big examples of fish were unable to come and get into the sea. In such gards fresh fish could be preserved till winter frosts. This gave the opportunity to sale the fish during all autumn getting much higher returns.

They organized another traditional Zaporiz’kyi craft – getting of salt from the liman brine. The salt was used by the Cossacks for storing fishery products, including caviar. Besides, the salt went for export - to Podilla and the Upper Dnieper.
3. IS. PERVOMAISKYI


The manmade Pervomajskiy Island is located at the mouth of the Dnieper-Bug Liman between Ochakov Cape and Kinburn Spit (3 km to the south from Ochakov).

The defense of the Dnieper-Bug Liman mouth was an important task for early Ottoman Empire (that intended to close the entrance to the Black Sea for Ukrainian Cossacks). Later it was relevant for the Russian Empire and the Soviet Union who should not have to miss the landing or fleet of the enemy on their territory during the war. For this purpose the fortresses were erected on the banks.

The famous military engineer Eduard Totleben developed a plan of a new Ochakiv fortress. Between its fortifications there was a battery on the embankment island in the middle of the Liman. The building began in autumn 1874. The Island`s battery was called Mykolayevska.

Along the perimeter of the future island the three soil lines (3-4 lines each) of grooved and plain piles were constructed. Between the piles stone and clay were put. All space between the piles and traverses were covered with sand. As a result the foundation of the island was formed. Not to be destroyed by the storm waves a huge elongated ellipse of stone protecting dam (6 m width and more than 1400 m length) was built around the island.

Although the battery was not finished during the war of 1877-1878, its arming with 11-inch guns and a 9-inch mortars were sufficient to stop Turkish armored fleet. It didn`t dare to battle with coastal fortifications.

At the time of final completion of its construction in 1881, 12 long-range guns of the circular firing on moving platforms were established. They say that the material for the construction of the island was the remains of the destroyed Kinburn Fortress. If so, it is clear why on Kinburn Spit there are almost no traces of any fortifications.

In summer 1919 - winter 1920 Nikolaev battery joined the fighting during Civil War in Russia. On May 1, 1920 the Island was renamed as Pervomajskiy.

During the first year of Great Patriotic War the fort on the Pervomajskiy Island has resisted to German invaders in 15 days after the fall of Ochakov.

Since 1968, 17th separate brigade of the Main Intelligence Directorate of the Armed Forces of the USSR housed on the island. Since then, all that was done on the island was highly classified until in 2003 when the crew was relocated to Ochakov. In 2005 the Island was put up for sale and now belongs to a private person.

The artificial island created for coastal battery was a significant hydraulic structure of late nineteenth century, which had no analogues in the world.
4. KINBURN ARROW\(^2\)

Link of marine ecocorridors, rare species of birds. Mass growth of Iris.

Kinburn Arrow is situated in the western part of the Kinburn peninsula in front of Ochakov. At its narrowest point one foot can stay in the sea, and another in the liman. This is an important link in the marine coastal ecocorridor, the place of concentration of mass nesting of birds during seasonal migrations. The site supports the existence of many rare species that are under protection: Common Eider (*Somateria mollissima*), Eurasian Curlew (*Numenius arquata*) and Whimbrel (*N. phaeopus*), Eurasian Oystercatcher (*Haematopus ostralegus*) and others. The multispecies colony of seagulls is placed on the arrow. The total number of breeding complex is more than one thousand couples.

The Kinburn arrow is a place of mass growth of Iris (*Iris pumila*), which colorful spring blossoms are very picturesque in spring.

Creation of Kinburn Fortress. Russian and Turkish Wars. Armored battery

The name of the Kinburn Sand Spit comes from transformed Turkish expression "Kil-burun", which means "clay nose". Initially, this concerned only the name of the spit, but then was spread to the entire peninsula. In XVIII century the name “Kil-burun” transformed in Russian and German languages in Kinburn or Kinburg.

Kinburn Fortress. The first mention of the fortress on the spit belongs to the XV century. The quadrangular castle was built with four towers at the corners. According to Evliya Celebi its walls were up to 40 yards (28 meters). Of course, this is a significant exaggeration, but Ottoman fortifications were really inaccessible – there is no messages about the capture of the castle until 1736.

20 cannons that shoted through the fairway (from Dnieper-Bug Liman mouth to Ochakov) were located on the walls. Subsequently, the head of the Ottoman fleet Piyaile-Pasha built the second line of stone fortifications. 80 small houses for the garrison and other residents were erected. The suburbs were inhabited by Tatars who were involved in cattle breeding and forestry. Local vegetables were imported even to the Crimea.

On June 8, 1736 Russian general Leontiev forced the Turkish garrison of Kinburn to capitulate, and in 1739 according to the Peace agreement the fortress returned to the Ottoman Empire. In the next war, in 1771 Cossacks again took the Turkish fortress which from 1774 officially became a part of the Russian Empire. Fortifications were upgraded; new earthen fortifications were built around.

During the war in 1787 the Kinburn Fortress was the first one who took part in battle for exit to the Black Sea. The battle took place on the eve of the Holy Virgin day. After a long battle, in which the head of the Russian garrison Alexander Suvorov was badly wounded, Russian army managed to throw Turkish troops to the sea. As a result 5 thousand Turks died or were taken prisoner. The Russian army lost 435 soldiers and officers.

During the siege of Ochakov in 1788 Kinburn Fortress continued to block

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\(^2\) It is told during the travel along the Dnieper-Bug Liman
the Turkish fortress from sea side. To do that of two fortifications were built on a spit – the battery and block-fort. After the war Kinburn was renovated according to the plan of engineer Franz de Volan. After the destruction of Ochakov fortress it remained the only castle at the mouth of Liman.

During the Eastern (Crimean) War the thrust of Franco-British Union fleet was sent to Kinburn Fortress.

Almost all buildings of the fortress were destroyed. In terms of the Peace Agreement in Paris they were dismantled in 1857. Today, only small lakes and swamps on the place of ditches are the evident traces of a glorious fortress.

Archaeological expedition of the Institute of Archaeology of National Academy of Science of Ukraine, headed by Doctor of Historical Sciences Svetlana Bilyaeva during several seasons unearths the remains of the Ottoman castle-citadel. The foundations of once powerful citadel, fragments of dishes, shots and smoking pipes are facing the earth.

5. BIENKOVI FLOOD-PLAINS

Remains of an ancient river floodplain. Herbaceous marshes that provide high water purifying ability.

Bienkovi flood-plains are situated on the coast of the Dnieper-Bug Liman to the east from Pokrovskoe birth. It is the remains of ancient river floods with numerous water bodies and flooded parts with the area of 600 ha. The grassy marshes dominate in the western part of themassiv and are represented particularly pure and very thick tangles of reed (*Phragmites australis*). Miscellaneous herbs are met only on the margins of such associations and provide high purifying ability of the water body.

6. SPAWNING LAKES

Brackish lakes. Artificial canal. Assembledges of pink pelican. One of the biggest in southern Ukraine colonies of herons. The most productive spawning of carp.

Brakish lakes 0.5-1.0 m depth are situated in the eastern part of the Bienkovi flood-plains. The bottom is silty sandy, covered with thick overgrowth of submerged vegetation – sago pondweed (*Potamogeton pectinatus*), zannickelia (*Zannichellia pedunculata*) and widgeongrass (*Ruppia maritima*). These waterbodies are connected with Dnieper Liman with the artificial cannal that earlier provided appropriate water exchange between them. Now the cannal is silted and is needed tobe cleaned.

Local people name this lake system Rozlyvy. Recently it was the most productive nature spawning area of carp in Lower Dnieper. In some years several tons of carp entered the lakes.

The lakes play the main role in protection of waterfowls. The area supports the life and security of big accumulations of white pelican (500 - 2500 examples) and one of the most on the south of Ukraine multispecies colony of herons (about 600 pairs), who use this territory as feeding ground.

About 20 representatives of
ornytofauna are registered in the Red Data Book of Ukraine and European Red List and live here during movements.

**7. VOLYZHYN FOREST**

The remains of the famous Hylaeus. It is the most natural forest massive in the Lower richer of the Dnieper. The record quantity of species of amphibians and reptiles.

The small oak-birch, sedge and alder forests scattered throughout sandy spaces of the Peninsula are the peculiar feature of the natural environment of the Kinburn Sand-spit. It is the remains of the famous Hylaeus, the country of forests, according to ancient Greek historian Herodotus, which existed here during the V century BC. In the forests numerous purely hylads growth, which is an evident of relic and originality of Kinburn forests.

Volyzhyn forest is the largest natural forest in the Lower Dnieper. Together with the lake and virgin steppe plots its area reaches 203 hectares. This territory belongs to the Black Sea Biosphere Reserve. A giant oak, which miraculously survived on the liman coast is probably the oldest tree in Mykolayiv Oblast.

Unlike the artificial forest plantations, this natural massif has an exceptional importance for biodiversity conservation of the area. In particular, a record for the steppe zone of Ukraine the number of species of amphibians and reptiles dwell here.

The legends about wooded land Hileus – the sacred land of Scythians – are the peculiar character of the Lower Dnieper.

The description of ancient Hileus (i.e. Woodland) by Herodotus of Halicarnassus is based on his own experiences and interviews with local people. He described the area at the mouth of the Dnieper, as sacred to the Scythians. According to the legend, ancestor of all the Scythians, whose father was well known Hercules, was born in Hylaeus. Skiff’s Mother considered to be a forest half-snake goddess. Modern historians place Herodotus Hileus in different places – from the Dnieper mouth to the Hortytsa Island.

The life of one of the most famous Greeks – Achilles – is related to Hileus. The sand-spits (for example, Tendra) of the northern part of the Black Sea served as racetracks for Achilles. That is why they were called “Achillodroms” that means *Achilles run* from Greek. According to one version the hero run down the girl Iphigenia, on the other he held competitions among his soldiers.

**8. SAND DUNES**

Movement of sand. Retention of sand by vegetation.

Dunes are sandy hills blown by the wind. Huge amounts of sand have been being accumulated in the Dnieper mouth since last glaciation and continue to pile up now. Dunes can be drifted up to half meter high during a day. Sand is often carried at considerable distance from the marine...
coast. When the wind is strong the sand fills everything. The only thing that effectively withstands the sand is vegetation.

**Pioneers that grow on the sand. Black Sea sandy steppe. Endemics.**

The first plants among vascular that grow on sand there are *Agropyron dasyanthum*, *Chamaecytisus borysthenicus*, *Linaria dulcis*, *Jurinea laxa*. The strong rhizomes and long roots help them survive. The associations of these species are derived from floristic complex of the Black Sea sandy steppe, which dominates on the Kinburn Peninsula and have been formed for a long time isolated from the continental conditions.

That is why a large number of endemic, relict and rare species of plants that are under special protection can be found here. The mosses and lichens play the significant role in formation of the sand steppe cover.

Most animals completely depend on sand steppe that is replaced by artificial planting of pines (*Pinus pallasiana*, *Pinus sylvestris*). All these animals are listed in the Red Data Book of Ukraine.

9. WOLF DEN

**The place of wolf’s breeding. Wintering of White-tailed Eagle.**

Wolf’s den is a place of wolf’s breeding. Usually, it is situated in the same area among the cozy forest areas and near water bodies that are rarely visited by people. There should be enough food to feed mother of the brood.

On the Kinburn Spit the wolves appeared in the late 80s of past century. Today, a pack of these predators has about ten individuals. However, it is not always possible to detect their presence. The necessary knowledge and skills are needed. One can get valuable information from wolf paw tracks left in the sand.

The old forest is of great importance to maintaining populations of White-tailed Eagle (*Haliaeetus albicilla*). A few hundred of these birds flock here for the night in cold winter.

10. ALDER FOREST

**Assemblages of Black alder. The jungle in the desert. A place of concentration of birds and bats.**

Near the farm Kovalivka (north-western outskirts of the village Pokrovka) there is an alder forest. It is situated on the bottom of the hollow, which was formed on the site of the Dnieper oxbow lake, and covers an area of about 10 hectares.

The Alder forest represents a fairly flooded marsh where sedges dominate.
Tree layer is formed by thickets of black alder (*Alnus glutinosa*), which reaches 18 m in height and 50 cm in diameter.

Shrub layer is represented by grey willows (*Salix cinerea*) and almond willows (*Salix triandra*). The alder buckthorn (*Frangula alnus*), elder (*Sambucus nigra*), dewberry (*Rubus caesius*) and blackberry (*Rubus nessensis*) grow on "pedestals".

Herbaceous cover is also well-developed. About 50 species of marsh and meadow and forest plants grow here, including ferns and mosses. It reminds impassable jungle in the desert and attracts many visitors.

These island forests, unlike artificial ones, are of particular importance for biodiversity of conservation area. Kovalivka saga is a place of concentration of birds and bats during migrations.

### 11. LOPUSNE LAKE

*The largest nesting colony of the Kentish plover on Kinburn. Artificial island- platform.*

Lopushne Lake is located in the southern part of Kovalivka saga and, like alder forest, is situated on the bottom of the hollow, which was formed on the site of the Dnieper oxbow lake.

The lake is shallow and salty, it often dries up in summer. Being 700 m long and up to 350 m wide, the lake is an important place of breeding and concentration of birds during seasonal migrations. On the saltmarsh areas in the southern part of the lake is concentrated the largest nesting colony of the Kentish plover (*Charadrius alexandrinus*) (40-60 pairs) on Kinburn, listed in the Red Data Book of Ukraine (2009) and is protected by the Bonn and Berne Conventions, the agreement AEWA¹. Its population in Europe has been declining over the past two decades. In Ukraine, the number of species is about 2000 pairs.

To optimize the conditions for breeding of rare waterbirds in shallow lakes, in 1990s an artificial island platform of about 40 square meters was built.

Later, a similar island platforms were built on other lakes of Kinburn Spit, which allowed to compensate for the lack of natural nesting birds and increase the attractiveness of wetlands for the visitors, as possibility for birdwatching has significantly increased.

### 12. ORCHID FIELD

*One of the largest habitats of wild orchids in Europe; their development and symbiosis with fungi. Salep.*

Orchid field is located near the village of Pokrovka within coastal meadows between Chernin and Cherepashyne lakes. This is one of the largest and most popular habitats of wild orchids in Europe – (*Anacamptis picta*), (*Anacamptis morio*), (*Anacamptis coriophora*), (*Anacamptis fragrans*) and (*Anacamptis palustris*). The area of the orchid field is about 30 hectares, and
the density of plants in some places is over 100 individuals per 1m².
The Pokrovskoe orchid field is as unique as the Narcissus Valley in the Carpathians.
Not everyone knows that orchids are very sensitive to changing living conditions. Many of them die during wetland drainage and meadows development, poorly grow on trodden lawns. Orchids develop very slowly, first blooming in their 7 (to 10) year. Fine seed germinates and develops only when a particular group of fungi is present in the soil, with whose hyphas it forms symbiotic relationship. In summer the plant stays completely underground as tubers.
Many wild orchid tubers produce salep, which has tonic and anti-inflammatory properties. It is said that the Cossacks took tubers of orchids with them on campaigns in case of lack of food. It was believed that one tuber and one sip of water is enough to live at least a day.
All wild orchids are now listed in the Red Data Book of Ukraine and the list of CITES.

13. MULLET LAKES

Shallow brackish water bodies. Fattening and fishing of the mullet.

Mullet Lakes are located along the southern coast of Kinburn and are connected with Yahorlyk Bay of the Black Sea. They create a system of shallow brackish waterbodies.

Among the aquatic inhabitants predatory actinia, various amphipods, polychaetes and molluscs can be found here. Besides, it is a favorite place of fattening of valuable commercial species of fish – golden grey mullet (Liza aurata), leaping mullet (Liza saliens), flathead mullet (Mugil cephalus).

In spring, at time of north winds, through straits mullet whitebait enters the heated and rich in food lagoon. With southern winds the fish comes back into the sea. This continues until late autumn, until the water temperature drops to 6-8 degrees and the fish stops feeding.

In the past, local fishermen blocked the entrance to the lake by fishing dams and let the fish go one way only. The streams, periodically silted up, were maintained in good condition.

Fresh and salty lakes. Salty extraction.

The flat terrain of the Spit favors development of a large number of lakes, especially in the coastal part, both fresh and salt.

Freshwater lakes are formed where there is no connection to the sea. They feed mainly precipitation and are known as “sweet saga”.

Salt lakes prevail on the spit. They are easily identified by the presence of red plants on their banks – Salicornia. With winds from the sea the water level rises slightly, and straits between lakes form, through which sea water gets into the territory. Active evaporation and complicated water exchange leads to the salt concentration increase, sufficient for extraction of salt in the lake.
14. MUD LAKE

Sapropel deposits of lagoons. Formation and properties of muds. Hydrogen sulphide water.

The water in the lagoon is very well warmed up, that is why microorganisms rapidly develop, and when they wither away, they turn into different groups of organic compounds. So sapropel is formed – silt deposits rich in organic matter. It has high biological activity and can be used as medical mud.

15. YAHORLYK BAY

Highly productive shallow water. Thickets of sea grass. Wetlands of international importance. The Mute swan.

Yahorlyk Bay is located between Kinburn Spit and Peninsula Yahorlyk Kut. It is partially separated with Pokrovska Sand spit, Kruhlyi and Dovhyi Islands from the sea. Bay area is 1 to 4 m deep and freezes in cold winters only. At the bottom of the Bay sea grass (Zostera marina, Z. noltii) forms real underwater meadows. Many species of invertebrates and fish inhabit its thickets. Sturgeon whitebait often feeds near them, and mullet and dolphins next to it.

Productivity of such assemblages is several times higher than that in the northern seas.

In order to fulfill the commitments of Ukraine under the Ramsar Convention, Yahorlyk Bay has been included into the list of Wetlands of International Importance especially as Waterfowl Habitat. The waters of the Yahorlyk Bay with islands and numerous lakes completely became part of the Black Sea Biosphere Reserve and National Park “Biloberezhzhya Svyatoslava”.

Turkic name Yahorlyk

Turkic name Yahorlyk can be found in all the former Crimean Khanate from the Sea of Azov to the middle reaches of the Dniester. According to linguists, it comes from the word "crooked ", "uneven ".

It is known that the Cossacks in the XVI century often used this bay for inconspicuous access to the Black Sea or return to the Dnieper. The Ottoman Empire tried to block exits from the Dnieper- Bug estuary, and the system of small lakes and straits allowed Cossack boats, called seagulls, to avoid Turkish Ochakov and Kinburn.
The key nesting place for representative of Arctic fauna – the Common Eider. The zone of the Black Sea Biosphere Reserve.

These islands in the Yahorlyk Bay is a key nesting site of the Common Eider (*Somateria mollissima*) on the Black Sea. It is well known around the world for its extremely light and warm feathers, with which it lines the nest and protects themselves and offspring from the cold. Yet it remains unclear what made the representative of arctic fauna change the usual route and settle on territories adjacent to Kinburn Spit. Perhaps they were attracted by great number of mussels, on which they mainly feed. In some years the colony of the eider included more than 600 pairs, and the total number of birds reached seven thousand individuals. Today, it has somewhat decreased.

Modern processes of coastal growth of Kinburn Spit.

Kinburn Spit in the southeast is constantly building up, as powerful transit of marine sand sediments takes place here.

17. OYSTER FARM


Oyster farm is located on the Yahorlyk Bay shore at the extreme southern point of the route. It was built in the late 1970s. The possibility of keeping this delicacy (*Ostrea edulis*) is associated with its natural resources (oyster banks) in Yahorlyk, Tendrivska and Karkinitskaya Bays of the Black Sea.

However, within a short period their natural resources were virtually wiped out due to pollution and siltation of marine areas. Great loss to the colonies of oysters and mussels also caused predatory mollusk rapana (*Rapana thomasianna*), which accidentally got into the Black Sea from the coastal waters of Japan.
In 1960s-1980s there was one of the most productive fishing camps on Kinburn, which specialized in sturgeon and caviar. The basis of this industry accounted for such species as the Russian sturgeon (*Acipenser gueldenstaedtii*) and sevruga (*Acipenser stellatus*). Often the beluga (*Huso huso*) was caught in the seine – the biggest fish of the Black Sea (can weigh up to a ton).

Recently, instead of the fishing camp, one of the boundaries of the Regional Landscape Park "Kinburn Spit" was set. It is blocking access to a young area of sand and shelly sediments, which intensively built up the sea towards the island Dovgyi.

Coastal sands occupy a narrow strip of the south-western coast of Kinburn Sand Spit more than two dozen kilometers long. They are periodically filled with water, form a specific littoral ridge and are covered with original vegetation. These pioneer plants are well adapted to significant salinity, high summer temperatures and infertile soil. Only a small number of flora species are able to withstand these extreme conditions. The core of the complex is consisted of Black Sea and the Black and Azov Seas endemics, which have to be protected. Damage to natural flora along the coast leads to sand deflation, destruction of littoral bank and sea coming ashore.

The formation of alluvial Kinburn. Ancient sands development. *Yahorlyk Bay. The myth of the “golden fleece”*. Formations of Ukrainian Shield – the array of crystalline metamorphic rocks – is the main source of sand Dnieper deposits. Its age is more than 2 billion year old. These rocks contain large amounts of ore minerals. The Dnieper, washing these rocks, bring plenty of useful ore minerals together with quartz sand, the main ones are garnet, zircon and ilmenite.

Sediments of water edge are enriched with heavy minerals. As a result, in favorable areas of the coast, coastal deposits of heavy minerals form. In beach sand of Kinburn one can see a thin strip of dark minerals – these are areas enriched with ore minerals. In addition to garnet and titanium minerals, iron and zirconium, which is the most stable, and therefore concentrated in the sand, small grains of gold can sometimes be found (which can be seen under a microscope). The myth of the “Golden Fleece” is not groundless. In ancient days fine grains of gold from gold-bearing rivers were taken with the help of ram skin: the skin was spread out on the bottom of the river, and the gold detained in the wool. Then the skin was burned, and gold smelted. Perhaps the Argonauts, led by Jason, went to Colchis to find this fleece. The Dnieper is one of the most important agents of carrying out small-scale gold from Ukrainian shield that is why the Dnieper sands are potentially auriferous.
Surrounded by water, Kinburn Peninsula is a wonderful land – a mysterious adornment of the Black Sea. Shallow areas of the northwest sea shelf have always been quite productive. The sturgeon, scomber, bluefish, mackerel, phyllophora (*Phyllophora nervosa*) and mussels (*Mytilus galloprovincialis*) used to be actively caught. In recent decades, under the influence of human activities, their stocks have been undermined.

Today valuable for fishing are the sprat (*Sprattus phalericus*), anchovy (*Engraulis encrasicolus*), mullet (mainly golden grey and haarder), several types of gobies (*Neogobius melanostomus*, *Mesogobius batrachocephalus*), shrimp (*Palaemon adspersus*). Besides, off the coast of Kinburn one can find the crab (*Carcinus aestuarii*), stingray (*Dasyatis pastinaca*), pipefish (*Syngnathus tenuirostris*), Black-sea turbot (*Psetta maeotica*), small flocks of dolphins – harbor porpoise (*Phocoena phocoena*), bottlenose dolphins (*Tursiops truncatus*) and short-beaked dolphin (*Delphinus delphis*).

In the water the barrel jellyfish (*Rhizostoma pulmo*) occur, and on the sandy bottom – the soft-shell clams (*Mya arenaria*). They appeared here only in the 1960s. More than 3.5 thousand species of aquatic organisms inhabit the Black sea waters.

The crab, pipefish, beluga, Russian sturgeon, sevruga and all three species of dolphins are listed in the Red Data Book of Ukraine.
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