Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area, concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente, conclu sous l'égide de la Convention sur la Conservation des Espèces Migratrices appartenant à la Faune Sauvage (CMS)

Seventh Meeting of the Parties to ACCOBAMS

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IDENTIFICATION AND INITIAL ASSESSMENT OF CETACEAN GROUPINGS IN COASTAL WATERS OF THE NORTH-WESTERN BLACK SEA, UKRAINIAN SECTOR

Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente

ACCOBAMS

Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area

Project

Identification and initial assessment of cetacean groupings in coastal waters of the north-western Black Sea, Ukrainian sector

Final report

Implementing organization:
Scientific Research Organization "Ukrainian Scientific Centre of Ecology of the Sea"
Coordinator: Dr. Pavel Gol'din

November 2017

Identification and initial assessment of cetacean groupings in coastal waters of the north-western Black Sea, Ukrainian sector (final report)

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CONTENTS

1. INTRODUCTION

The project is conducted in the Black Sea (Fig. 1). It contributes to the ACCOBAMS Resolution 3.11 and the ACCOBAMS Conservation Plan for Black Sea cetaceans (Actions 13–15), in particular Actions 13c, 14c, 15a, 15d:

(13c) Developing long-term monitoring scheme(s) based on periodic surveying throughout the entire range of Black Sea cetaceans in the Black Sea, Azov Sea and Turkish Straits System. Standard methods should be used so that results could be compared over time (different years and seasons) and from one area to another.

(14c) The photo-identification constituent should be incorporated in subsequent monitoring schemes covering the entire range of Black Sea cetaceans. The access to Black Sea photo-identification datasets and catalogues of identified individuals can be secured by means of periodical publishing of relevant data on CD-ROM as well as online on a specially dedicated web site.

(15a) Developing the existing national CSNs and their functional fusion into the basin-wide network. A standardised methodology of data collecting and sampling should be set up supported by training of CSN members and providing them with appropriate literature. The regional CSN should operate permanently providing reliable information on dynamics of strandings recorded for each Black Sea cetacean species. Besides, in order to determine causes of death, the investigation of stranded animals should be carried out along with morphometric study of cetacean carcasses and samples collecting for further multidisciplinary laboratory analyses.

(15d) The data and samples collected by the regional CSN should be used to gain new knowledge on cetaceans mortality, population structure and genetics, life history, ecology, pathology, parasitology, ecotoxicology (persistent organic pollutants and trace elements), etc. These studies will contribute to monitoring schemes and periodical assessment of the status of Black Sea cetacean populations.

In addition, the project is compliant with the Resolution 1.12 (Conservation of the Black Sea *Tursiops truncatus* : bottlenose dolphin), 2.28 (On the promotion of photo-identification activities), 4.11 (Population structure studies) and 5.9 (ACCOBAMS Survey Initiative).

2. DESCRIPTION OF THE PROJECT

The project is conducted by the Ukrainian Scientific Center of Ecology of the Sea (UkrSCES) in Odessa, Ukraine, with the expert support of Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine. The UkrSCES is the main institution of the Ministry of Ecology and Natural Resources of Ukraine in the field of marine ecological research. The project is

aimed to increase knowledge about population structure and local distribution of the Black Sea cetaceans, among which there are endangered Black Sea bottlenose dolphins and harbour porpoises and vulnerable common dolphins.

This study is focused on two coastal areas where the highest densities of cetaceans were detected by previous studies (Salnikov, 1967; Mikhalev, 2005; Birkun et al., 2014) (Fig. 1):

(a) waters near the Dzharylgach (or Jarilgac in another transcription) Island, and particularly in the Dzharylgach Bay (Area 1), and

(b) waters near the Danube delta (Area 2).

In addition, the third area potentially important for cetaceans is covered by the study, the Hrigoryevsky Bay (Area 3), where a summer resident local group of common dolphins was recently discovered.

All three areas are extremely shallow (0–20 m near the Dzharylgach, 5–20 m in the Hrigoryevsky Bay and 5–50 m near the Danube delta), and some of them are semi-enclosed gulfs. Parts of the Dzharylgach and Danube areas are included into existing nature reserves, and Danube and Hrigoryevsky areas are actively used by man.

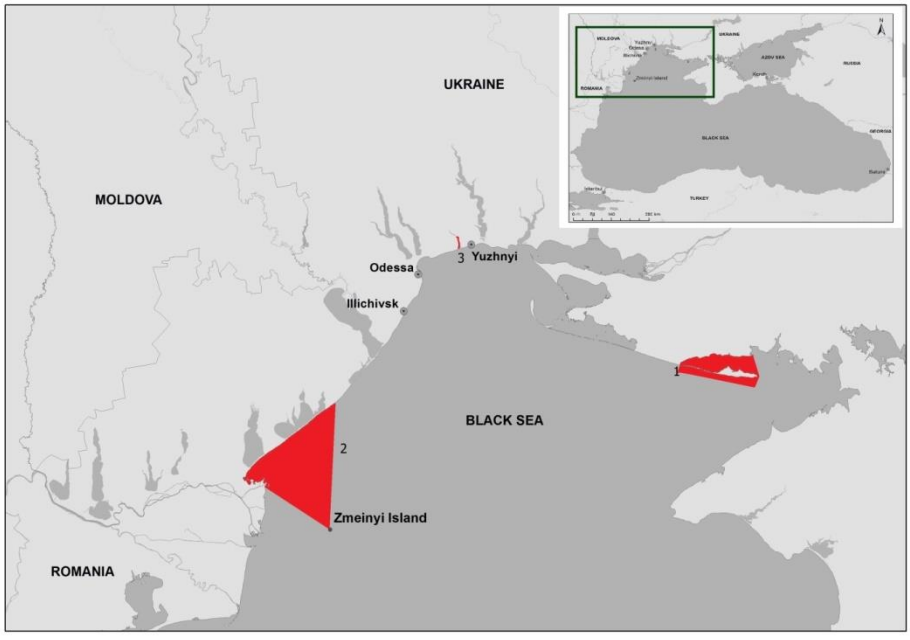


Fig. 1. Areas of study: 1, Dzharylgach, 2, waters near the Danube delta, 3, Hrigoryevsky Bay.

3. ACTIVITIES

The project field activities lasted from June 23 to September 20 in 2016 and from March 9 to August 10. Project field activities included photo identification boat cruises, a cetacean density survey, observations at sea from the platforms of opportunity, observations and photo identification efforts from coastal platforms and coastal surveys for monitoring of strandings. Also, the project included analytical activities: analysis of photographs and data of surveys, abundance estimates and initial assessment of local populations, creating an updating the databases.

Photography was conducted, using the Canon EOS 70D cameras specially purchased as a part of project with the lenses Canon EF 100-400 mm f/4.5-5.6 IS II USM and Canon EF 100-300 mm f/4.5-5.6 IS USM, and a private camera Canon EOS 7D.

In addition to the authors of the report, Bogdan Gulak, Anna Kryukova, Julia Ivanchikova and Tatyana Derkacheva took part in various activities. Ukrainian Scientific Centre of Ecology of the Sea (in the person of Viktor Komorin, the director) provided facility and utilities for the project. Dzharylagtsky National Nature Park (in the person of Svetlana Shulga, then the director of the Park, and Vitaly Kovalenko, the acting director) provided help in field work, and Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine (in the person of Igor Dzeverin, head of the department) provided expert support.

3.1. Population studies in the Dzharylgach area (Area 1)

3.1.1. Photo-identification study.

Photo-identification boat cruises initially targeting bottlenose and common dolphins were conducted in the Dzharylgach Bay, at depths between 5 and 9 m, and the sea area of the Karkinit Bay near the Dzharylgach Island, at depths between 3 and 12 m (Fig. 2, 3). Later, during the analysis, photo identifiable harbour porpoises were also revealed on the photographs.

Fig. 2. A boat and a yacht used for operations in the Dzharylgach area, summer 2017.

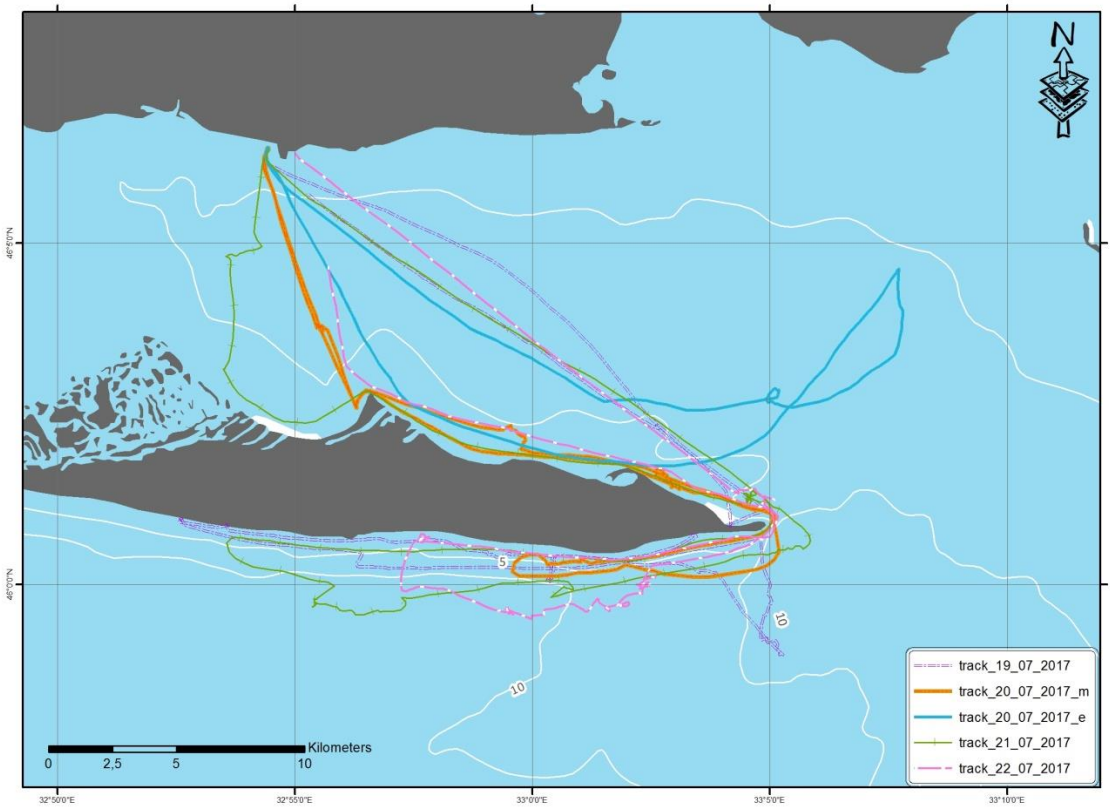


Fig. 3. Summary of tracks for four photo identification surveys in the Dzharylgach area, July 19-22, 2017.

In total, photo-identification boat cruises were conducted during 18 field days, between June 23 and September 3, 2016, and June 23 and August 9, 2017. The total effort was about 1900 km.

Cruises were based on a boat VMC470, other motor boats and a motor yacht.

Most of surveys, 13 of 18 field days, were recorded, using a protocol of effort (Annex 1) which included coordinates (every 15 minutes), route and navigation details, presence of other vessels, weather and other environmental conditions and references to cetacean sightings (Fig. 4).

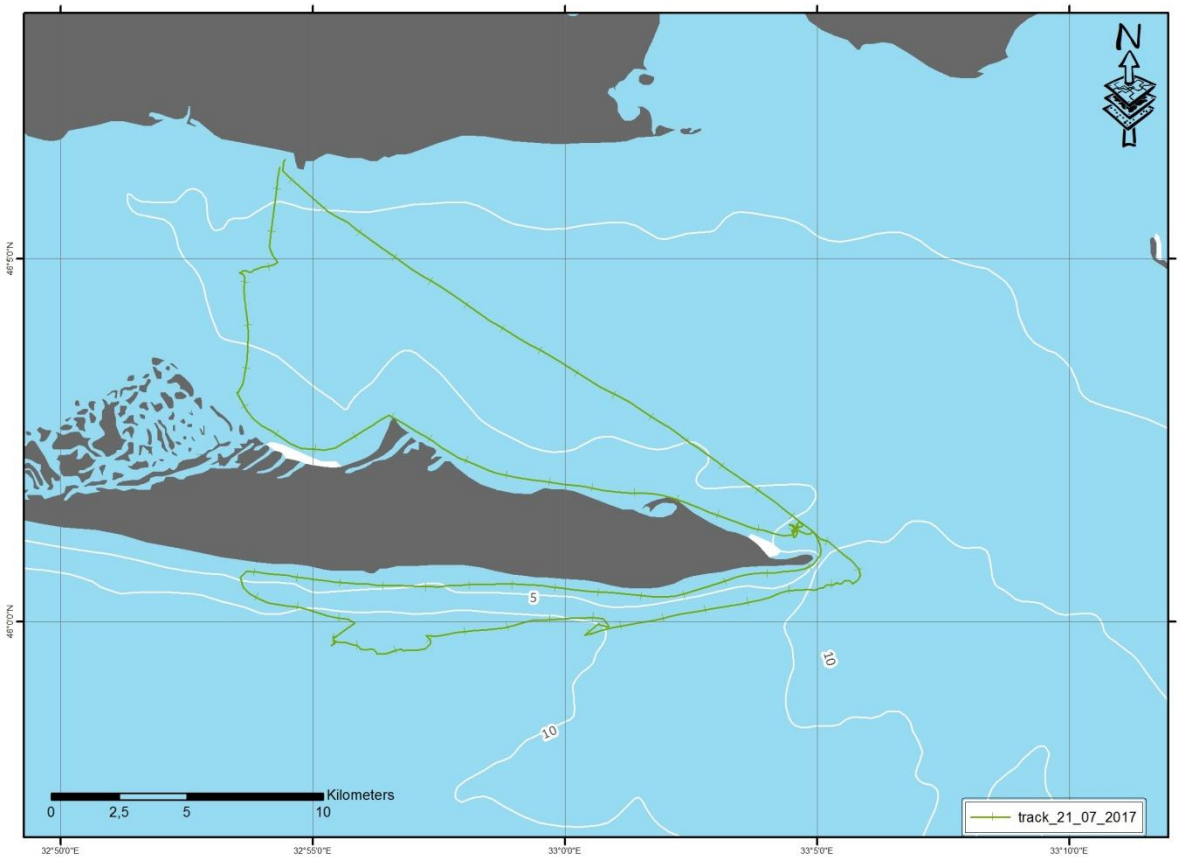


Fig. 4. An example of a daily survey track in the Dzharylgach area, with the marks of effort record.

Also, each survey was recorded, using a protocol of cetacean sightings (Annex 1) which included coordinates, time of each sighting, type of observations (visual *vs*. photo identification) and

biological information with all the necessary details, including group size, composition and behavioural details, individual variation if detected.

Whenever possible, each dolphin was photographed from the left and right sides, dorsal fin perpendicular to the camera lens, preferably with no backlight (Würsig & Jefferson, 1990).

Only photos scored as good to excellent quality were added to the catalogue and used for analysis; photos of moderate quality were used only for exceptionally distinctive individuals (for example, partially white specimens), whereas all photos of poor quality were discarded. Dorsal fin images were classified in relation to severity of scarring and individual distinctiveness (Würsig & Jefferson, 1990; Wilson et al., 1999; Urian et al., 2015): distinctive fins (with permanent fin features: notches, cuts, deep scars and depigmented areas) and subtly marked fins (with temporary markings: scars, scratches, but without any notches on the edge of the fin), the latter ones further classified on Left and Right sides.

Cetaceans were recorded both in the Dzharylgach Bay and in the sea area near the Dzharylgach Island (Fig. 4).

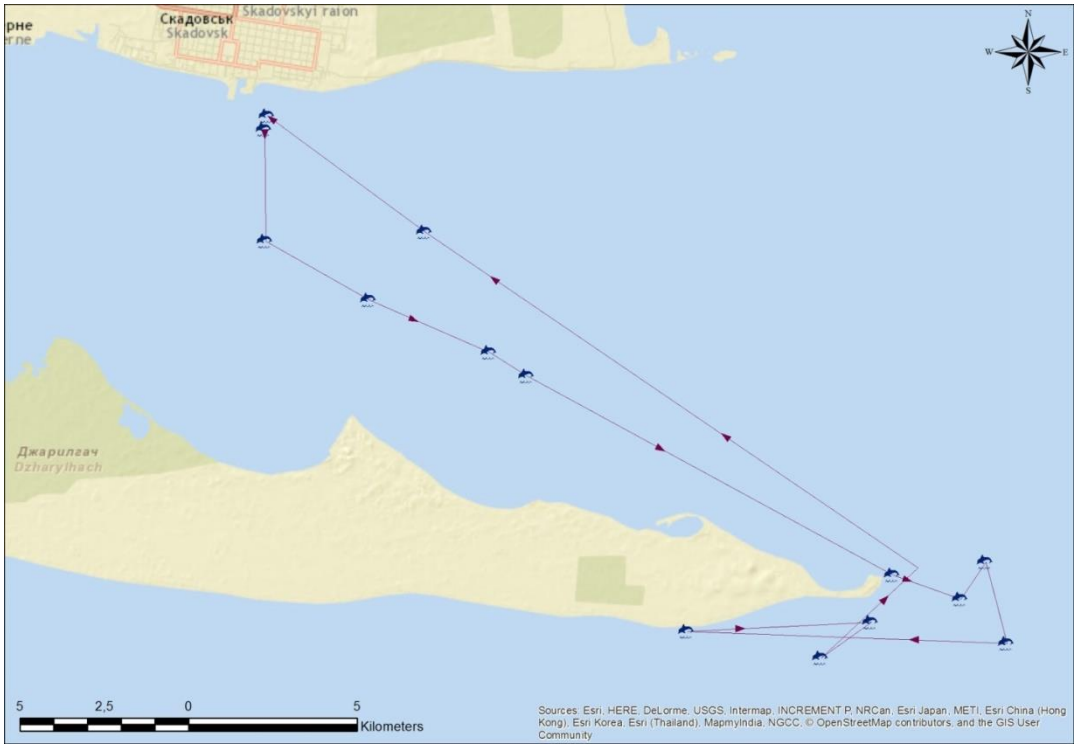


Fig. 5. Sightings during a photo-identification survey in the Dzharylgach Area on August 2, 2016.

More than 10 000 photographs were taken for photo-identification (fig. 6).

(a)

(b)

Fig. 6. Photographs of excellent and good quality usable for photo identification:

(a) a bottlenose dolphin, (b) a common dolphin.

Tentative estimate of abundance was calculated as a mark-recapture estimate, based on repetitive photo identifications, between two consecutive years of study. These conditions should be considered as preliminary assumptions, and thus the abundance estimates are only tentative. Only the category of photo-identified “marked fins” (distinctive individuals) was used in abundance calculations. The mark-recapture estimate ($\widehat{N}$) was calculated with the Chapman estimator (Chapman, 1951; Caughley, 1977; Wilson et al., 1999; Hammond, 2010):

$$\widehat{N} = \frac{(n_1+1)\cdot(n_2+1)}{m_2+1} - 1$$

where n_1 = number of marked individuals which were photo-identified during the first time interval; n_2 = number of marked individuals which were photo-identified during the second time interval; m_2 = number of “recaptured” marked individuals.
The variance was calculated as:

3.1.2. Stranding surveys.

Six surveys were conducted in summer 2016 and 2017 on the marine side of the Dzharylgach Island. On August 4, 2016, also the sandy bar to the west of it, between the island and Lazurne, was examined (Fig. 7). Additional surveys were taken on the northern coast of the Dzharylgach Island and the northern coast of the Dzharylgach Gulf, near Krasne. In addition, strandings on the coastline were checked during boat cruises. Also, inspectors from the Dzharylgatsky National Nature Park were interviewed for stranding cases in the area, with providing relevant photo documentation.

A workshop was held in Skadovsk on August 31, 2016 in which 12 persons participated, including staff of the Dzharylgatsky National Nature Park and student and NGO volunteers. The aim of the workshop was training in recognizing cetacean species in the wild and taking basic photo documentation of strandings allowing identification of species and bycatch signs.

Fig. 7. The Karkinit coast of the Dzharylgach Island, August 4, 2016.

3.1.3. Line transect surveys in the Dzharylgach area

The linear transect surveys (LTS) were designed according to standard principles of distance sampling (Buckland, 2004; Buckland et al., 2001). The surveys were conducted near the Dzharylgach Island in two water bodies, namely in the Dzharylgach Gulf and the northern portion of the Karkinit Gulf, i.e. to the north and to the south of the island, on September 2, 2016, and June 26-28, 2017 (Table 1; Fig. 8, 9). These areas, which were identified as two independently processed strata, substantially differ in physical and ecological characteristics: the Dzharylgach Gulf is an extremely shallow, less than 8 m deep, semi-enclosed, highly productive water area, whereas the Karkinit Gulf is a deeper, by 30 m in the middle part, open gulf of the Black Sea. The surveys were conducted in the areas 5-8 m deep in the Dzharylgach Gulf (the greatest survey area in 2017 was 116 km^2) and 5-14 m deep in the Karkinit Gulf (the greatest area of 143 km^2), and the results were separately calculated for each stratum.

The survey platform was the yacht 8.8 m long; two pairs of observers, equipped by binoculars (10x40 and 10x50), changed after 30 minutes, and a dedicated operator recorded the data. The survey was conducted under good weather conditions (sea state less than 2 points of the Beaufort scale, visibility more than 5 km, zero precipitation). Boat speed was on average 9.5 km/h, at maximum 11 km/h. The observer eye height was 2.5 m. Tracks and coordinates were recorded, using the GPS navigator Garmin eTrex 30. Protocols of effort and registrations were filled in during the surveys.

Table 1

General characteristics of linear transect surveys in the Dzharylgach area in 2016 and 2017

Year	Number of transect lines	Distance, km	Area, km^2	Locality
2016	5	21.0	71	Dzharylgach Gulf
2016	6	22.8	91	Karkinit Gulf
2017	7	49.4	143	Karkinit Gulf
2017	7	43.9	116	Dzharylgach Gulf

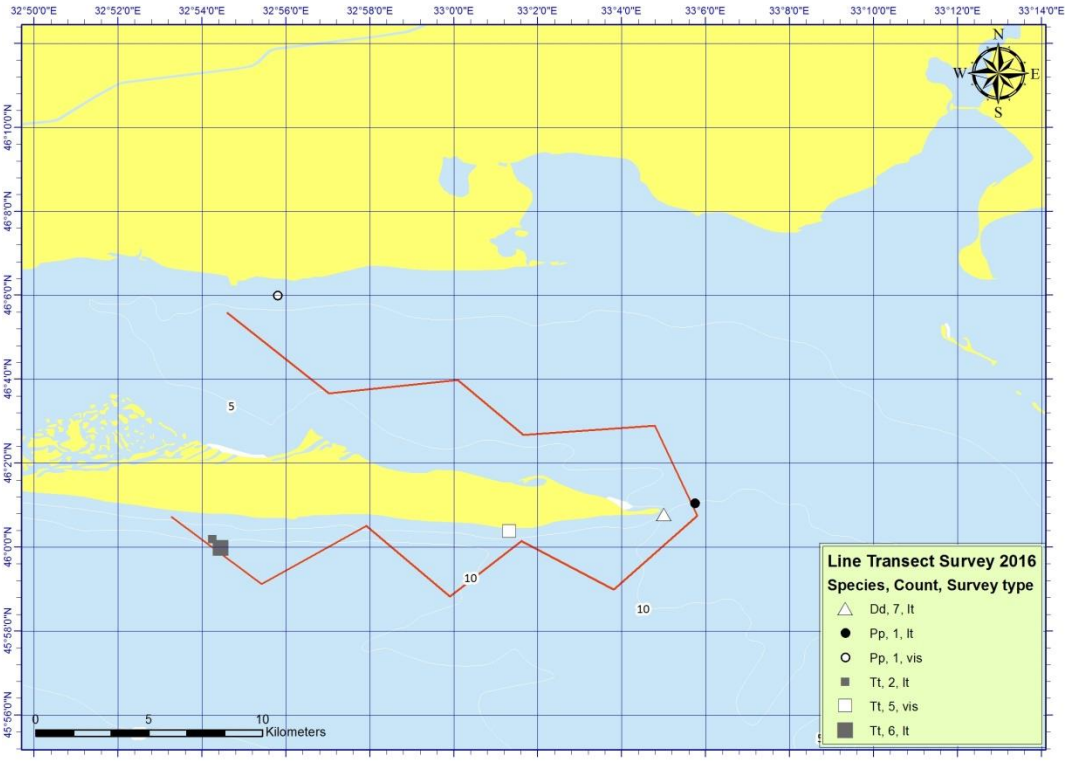


Fig. 8. Line transect survey in the Dzharylgach area, September 2, 2016.

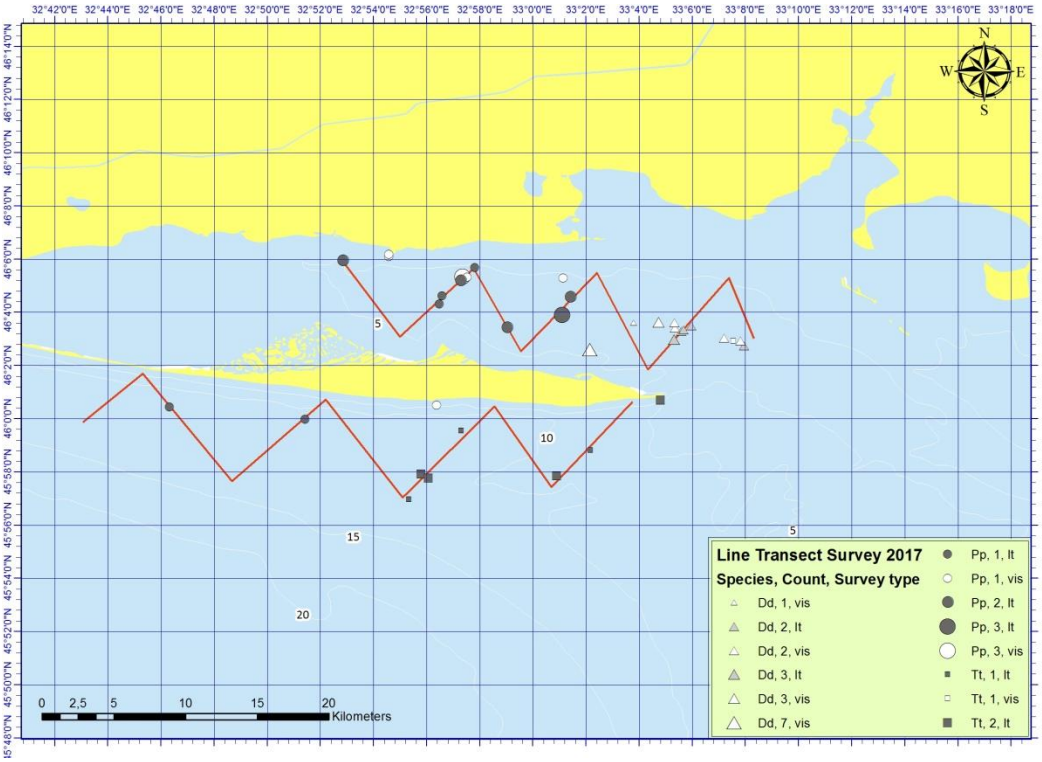


Fig. 9. Line transect survey in the Dzharylgach area, June 26-28, 2017.

Species, group size, distance and angle from the moving boat were recorded at each encounter. In addition, behaviour types were recorded: fast movement, normal movement, feeding, etc., as well as behaviour in relation to the boat: avoiding, attraction or neutral.

Density and abundance, cluster (group) density were estimated by analytical tools based on detection probability functions for distance sampling (Buckland et al., 2001), using Distance 7.0 software (Thomas et al., 2010). Encounter rate was defined as a number of group observations per km. Population density was estimated as a number of individuals per square kilometer. Type of spatial distribution (random, uniform or patchy) was estimated from the coefficient of variation for group density (Caughley, 1977). Only encounters on transect lines were used for density and abundance estimations: all the other records on the way to transect lines were only used as referring to cetacean presence in the area.

3.2. Population studies in the Danube area (Area 2)

3.2.1. Photo-identification study

Photo-identification boat cruises were conducted during eight field days, between July 17 and August 20, 2016, and April 25 and May 27, 2017 (Fig. 10). Cruises were based on boats *Lund*, *Amur* and *Krym* and covered the area between the Tuzly Lagoon and the Danube delta, including the Zhebriyanska Bay and the area east to the delta, to the waters as deep as 25 m, as well the delta portion adjoining the sea. Protocols of effort and sightings (Annexes 1, 2) were used, as well as in the Area 1. The total effort was about 900 km.

3.2.2. Stranding surveys north to the Danube area

In total, eight surveys were conducted along the Sasyk Lake bar on August 18, 2016, and between March 9 and August 2, 2017, and also on the Durnyi Kut peninsula on July 17, 2016 (Fig. 11). Five of them were conducted during the studies from the platforms of opportunities, with the help of coast guards, volunteers and local residents. The most remote unpopulated areas were chosen for the surveys. In addition, cumulative data from the Odessa region and other regions of Ukraine, including all the north-western Black Sea sector were accumulated from occasional coastal surveys, volunteer activities and responses from local residents during year 2017.

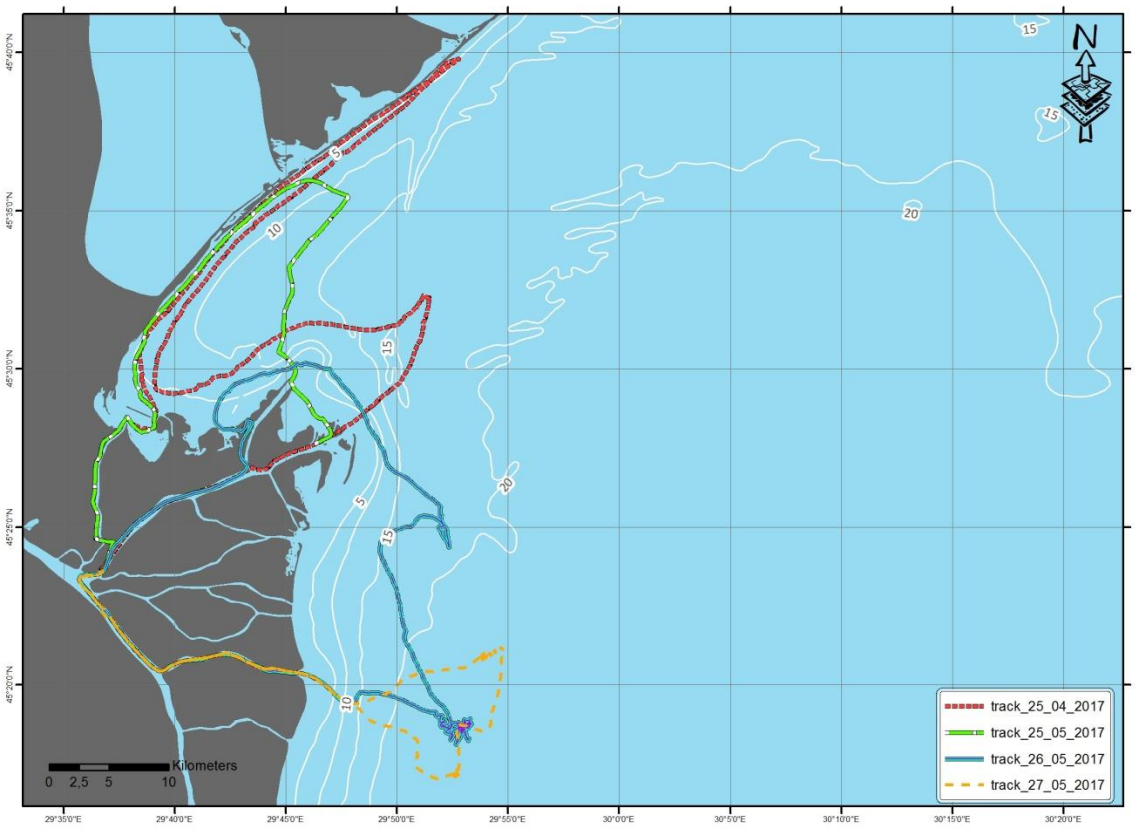


Fig. 10. Photo-identification boat cruises in the Danube Area, spring 2017.

Fig. 11. The Durnyi Kut peninsula, July 17, 2016.

3.3. Photo-identification study in the Hryhorivsky Bay (Area 3)

Sixty seven one-day sessions were conducted for a land-based photo-identification study in the Hryhorivsky Bay between July 9 and September 17, 2016, and between March 28 and July 27, 2017. Two observation points were located near Hrygorivka and Novi Bilyari, 0.1 and 5 km from the sea mouth (Fig. 12). In addition to photo identification effort, group size and composition, behavioural response was documented.

Fig. 12. The Hrihorivsky Bay, Port Yuzhny facilities.

3.4. Observations from the platforms of opportunity

Observations from a platform of opportunity, a ferry *Kosatka* cruising between Vylkove and the Zmiinij Island, were conducted on August 19-21, 2016 and August 5-7, 2017 (Fig. 13, 14).

In addition, coastal surveys with the records of strandings were conducted as the part of these activities between March 9 and August 2, 2017 (see above).

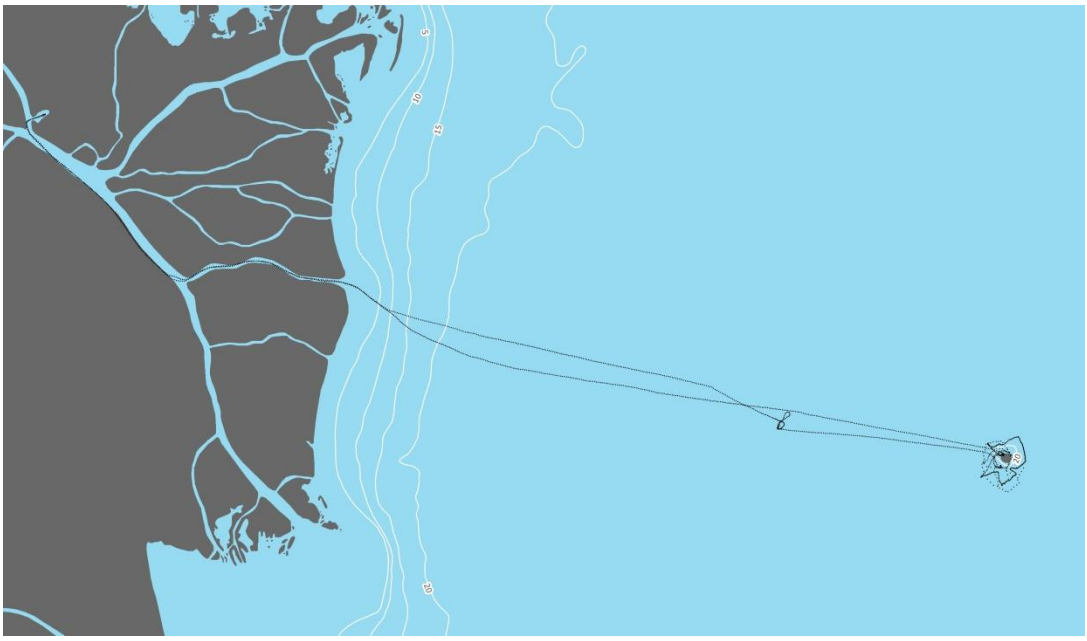


Fig. 13. Tracks of surveys between Vylkove and the Zmiinij Island, August 5-7, 2017.

Fig. 14. A ferry near the Zmiinij Island, August 6, 2017.

4. DIFFICULTIES ENCOUNTERED AND MEASURES TAKEN TO OVERCOME PROBLEMS

A platform of opportunity, the ship cruise between Odessa and Phyllophora Field, did not work. Also, another platform, a ferry between Vylkove and the Zmiinij Island, was used only twice, once per year. Therefore, the effort in 2017 was focused on the main activities, boat-based photo-identification and linear transect surveys.

A limited number of boats suitable for contracting were available in both areas, and their pricing for year 2017 was higher than in 2016. Therefore, the boat rent was partly covered from travel costs. The boat operated by the UkrSCES is under repair and thus could not be used for the project. Also, the car was ineffective in the field conditions. Therefore, only rented boats, a car and public transport were used during the project in 2016. Fuel was not purchased for the aims of the project, and the allocated amount was directed to purchase of equipment.

5. RESULTS

5.1. Population studies in the Dzharylgach area (Area 1)

5.1.1. Photo-identification study.

All three cetacean species of the Black Sea, the harbor porpoise (*Phocoena phocoena*), the common dolphin (*Delphinus delphis*) and the bottlenose dolphin (*Tursiops truncatus*) were recorded during the study (Fig. 15). Two former species, harbour porpoises and common dolphins, were recorded in the Dzharylgach Bay where their permanent summer presence was confirmed (see also: Birkun et al., 2014). Before 2013, only Tsemsh (1941) recorded common dolphins within the shallow Dzharylgach Bay (see also: Biodiversity…, 2000). More than 10 000 photographs were taken for photo identification of common and bottlenose dolphins. Of them, more than 5000 photos of excellent, good and moderate quality were selected for identification.

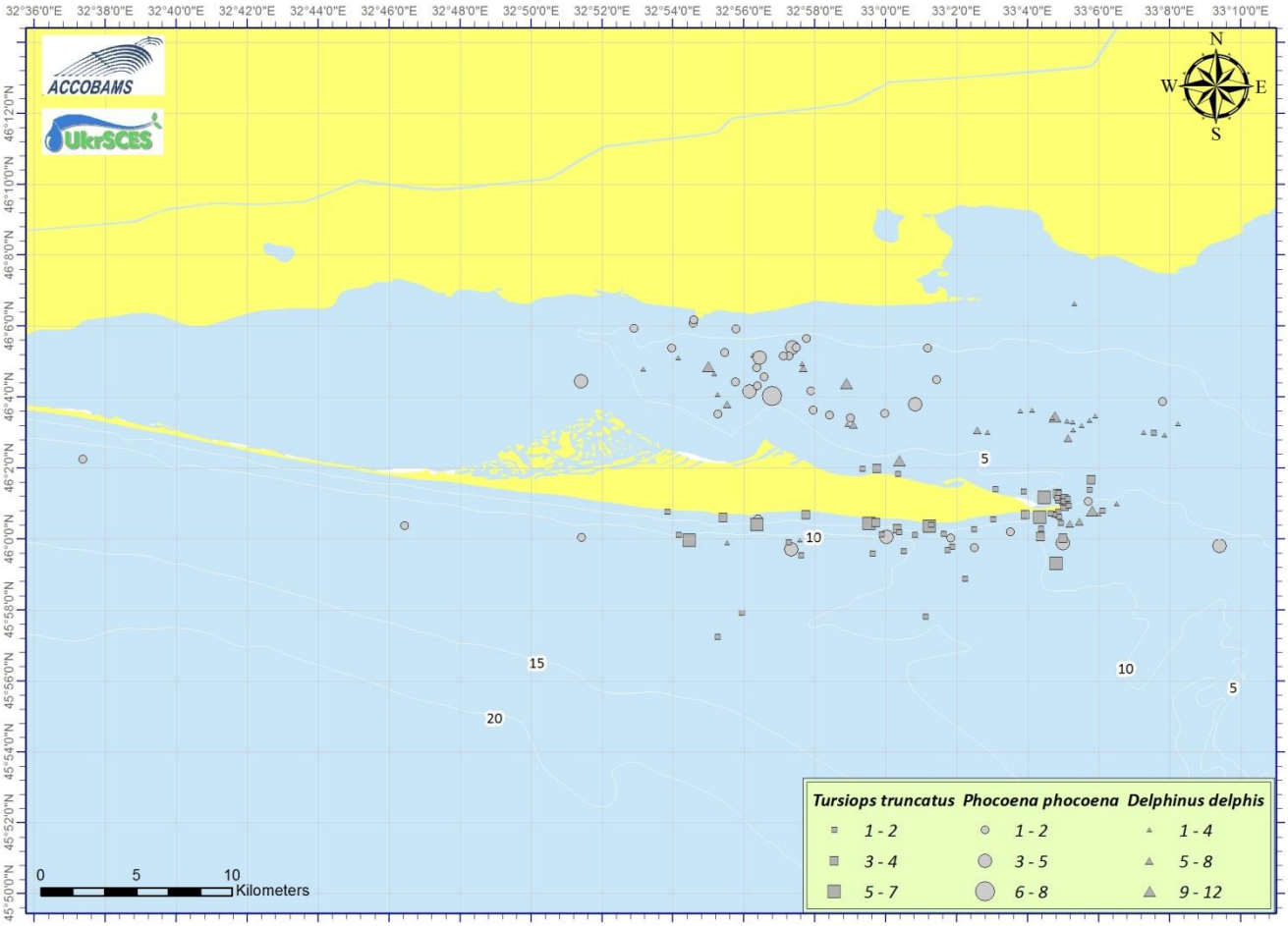
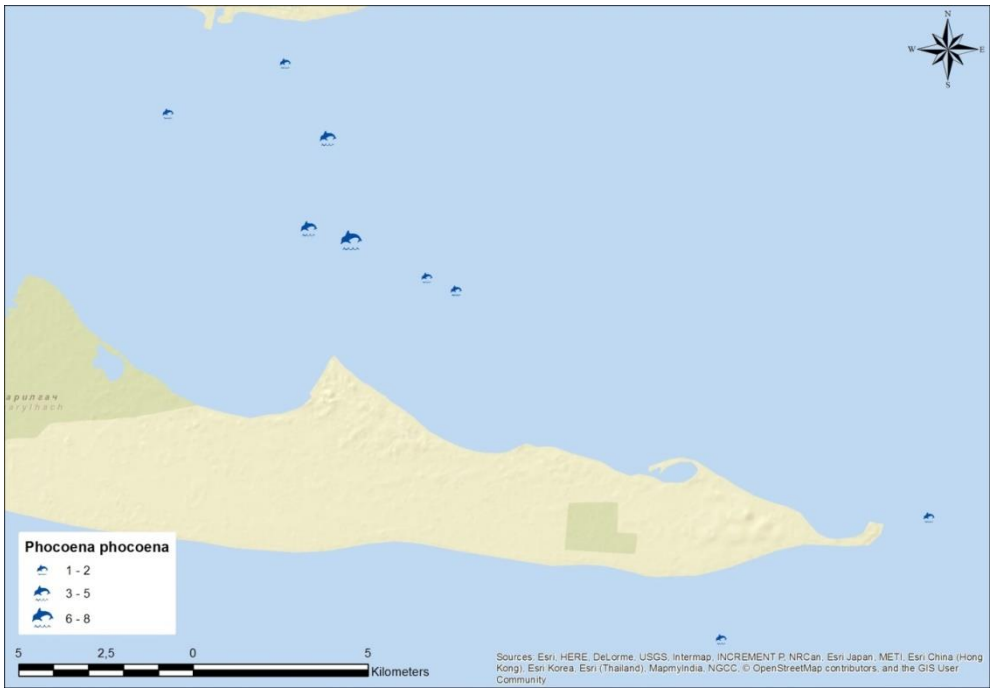


Fig. 15. Summary of cetacean sightings in the Dzharylgach Bay and near the Dzharylgach Island, June 23 – September 3, 2016, and June 23, 2017 – August 9, 2017: each symbol indicates a single or a group record.

Harbour porpoises formed groups up to 8 animals, on average 2.4 (median = 1). They were randomly dispersed both within and outside of the Dzharylgach Gulf. The greatest groups were recorded in the centre of the bay, at depths near 5 m, and they tended to sea floor slopes, sometimes approaching the Skadovsk port area. In the Karkinit Gulf the greatest groups occurred south to the Dzharylgach Island and tended to the depth of about 10 m (Fig. 16). A partially white porpoise with unusually distinct patchy coloration was recorded within the Dzharylgach Bay (Fig. 17, Annex 4). This specific pattern makes the individual suitable for photo identification which is quite rare for harbour porpoises: even albino or pale specimens often have relatively uniform, less individually distinct coloration (Tonay et al., 2012).

a



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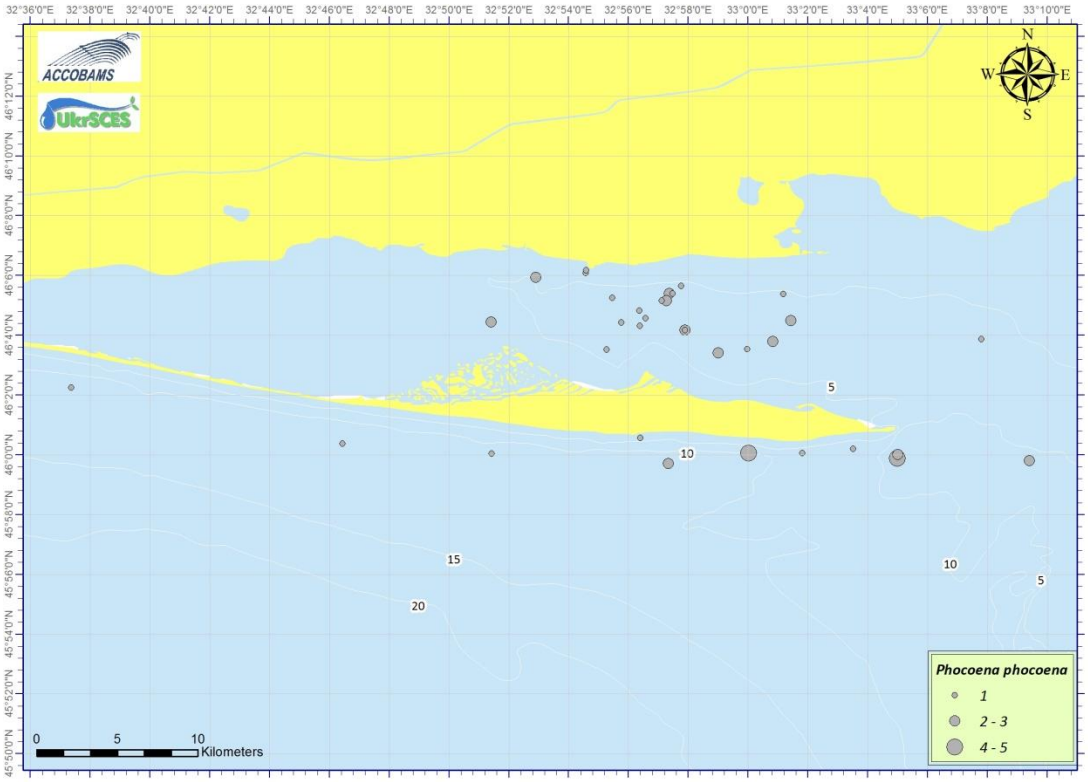
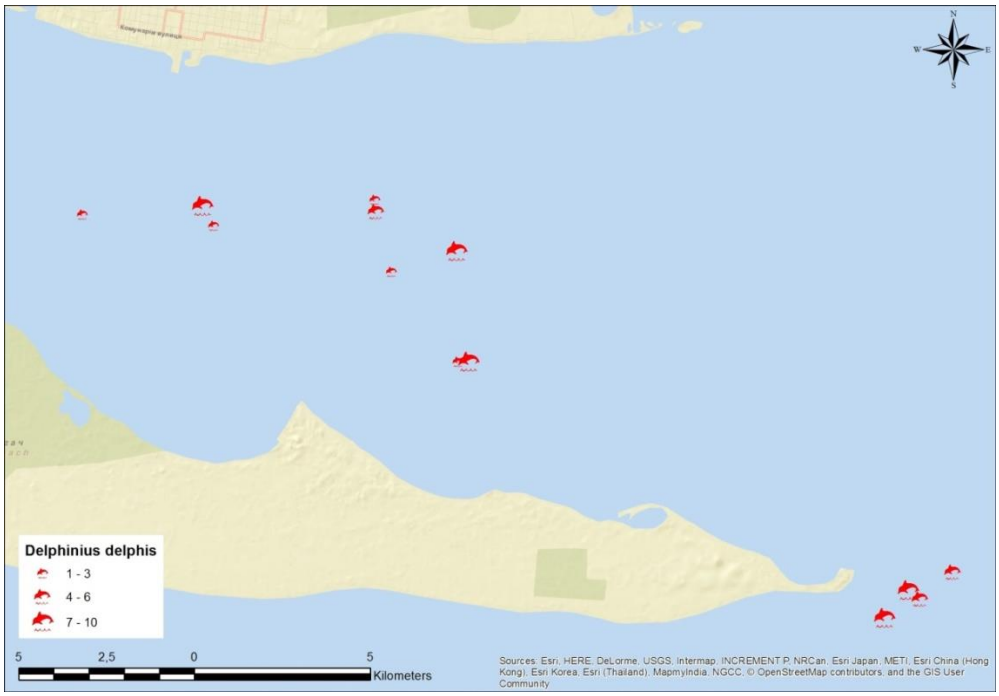


Fig. 16. Sightings of harbour porpoises in the Dzharylgach Bay and near the Dzharylgach Island; group sizes are indicated: a, 2016; b, 2017.

Fig. 17. A partially white harbor porpoise in the Dzharylgach Bay.

Common dolphins occurred in groups up to 12 individuals, 4.2 on average (median = 3). Group size in common dolphins was significantly higher ($p<0.05$) than in the other species. The common dolphins strongly tended to the Dzharylgach Gulf, and only few of them were observed in the Karkinit Gulf. The greatest groups were recorded both in the middle and in the easternmost part of the Dzharylgach Gulf, north to and near the tip of the island. There were juveniles and calves in 30% of groups. The dolphins were noticeable for their distinctively marked dorsal fins, some of them with severe scarring. There were 65 photo identified individuals, 29 first identified in 2016 and 36 in 2017, six of which were repeatedly recorded between the years 2016 and 2017, and three more repeatedly recorded within the same year; two dolphins (number 8 and 9) were recorded in 2016 and a few times in 2017 (Annex 3). Therefore, at least some of the dolphins were classified as summer residents. There were direct observations of dolphin feeding, and sand smelts (*Atherina* sp.), the horse mackerel (*Trachurus mediterraneus*) and the garfish (*Belone belone*) were directly identified as prey objects. On July 20, 2017, courtship behaviour was observed in the eastern part of the Dzharylgach Gulf. **The abundance of common dolphins was estimated with Chapman estimator for 2016/17 as 158 specimens (SD = 44; CV = 0.28).**

a



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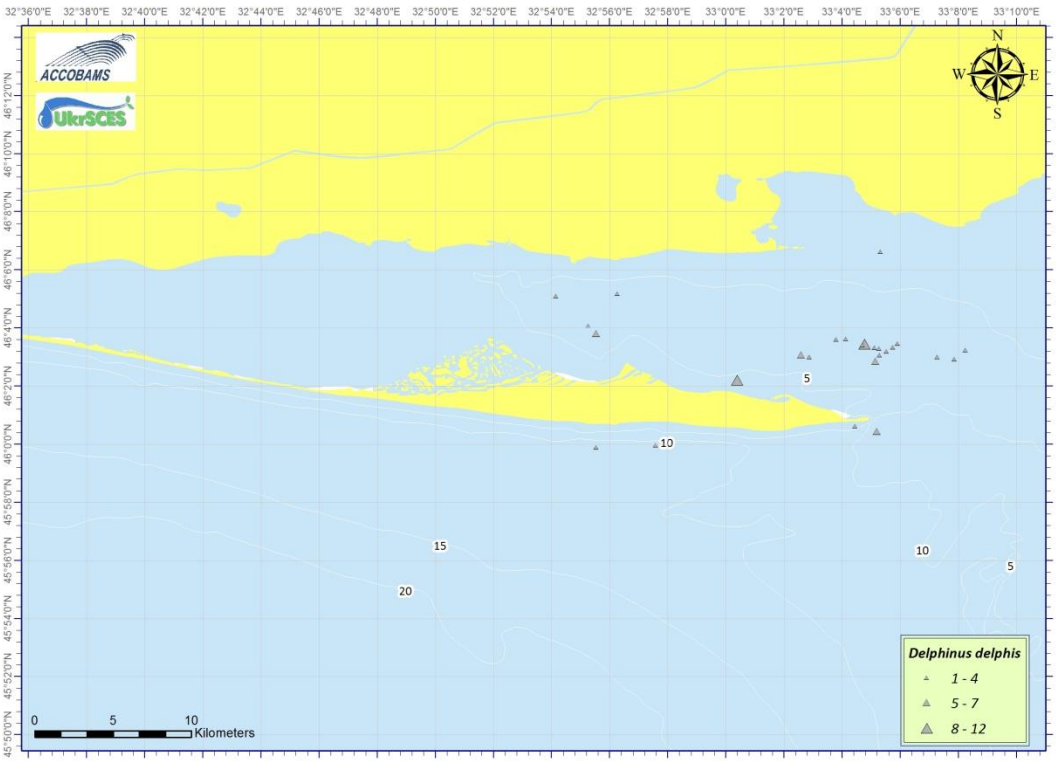


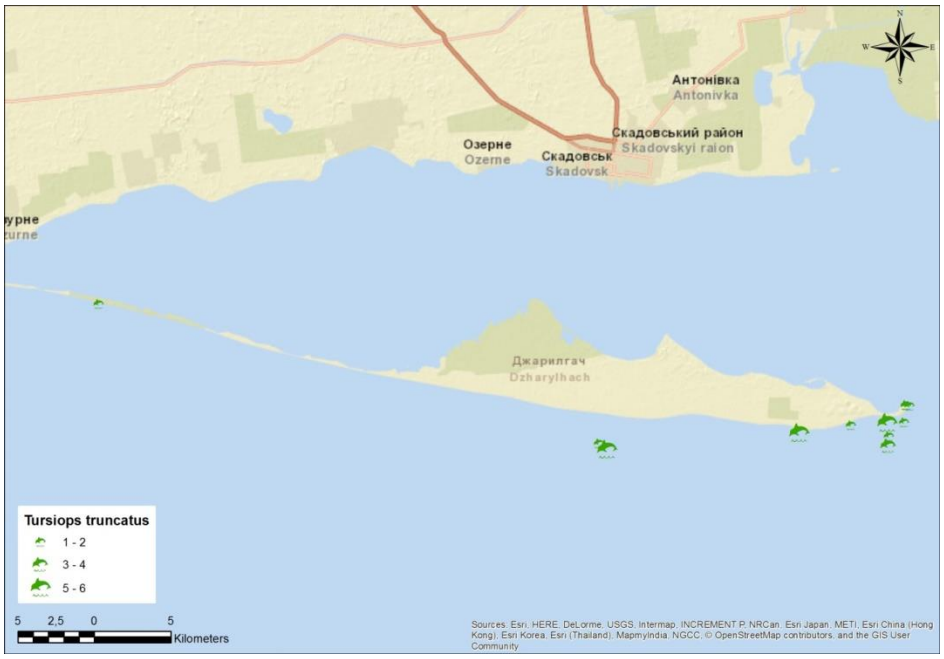
Fig. 18. Sightings of common dolphins in the Dzharylgach Bay and near the Dzharylgach Island; group sizes are indicated: a, 2016; b, 2017.

Fig. 19. Common dolphins in the Dzharylgach Bay.

Bottlenose dolphins were recorded in groups up to seven individuals, 2.3 on average (median = 2), and most of the sightings were pairs. There were juveniles in 27% of sightings: one of the groups of six dolphins contained three juveniles and, thus, was likely a mother-juvenile aggregation. All the sightings were on the open sea side or near the tip and the north side of the island rather than in the Dharylgach Gulf. Therefore, the bottlenose dolphin was the species with the clearest spatial preferences.

At least, 27 dolphins were photo identified; of them, there were 18 marked dolphins with distinct markings of dorsal fins and at least 9 more unmarked dolphins, including calves: nine of marked animals were first sighted in 2016 and nine in 2017 (Annex 2). Six of them were re-sighted between two years, 2016 and 2017. Five more animals were re-sighted within the same year. Most of them were re-sighted at least 4 times. Two of them (003-16S and 004-16S) were re-sighted during both summer periods (on 10 of 18 field days each) at the same locality, near the tip and southern side of the island. They showed distinct hunting and game behavior, with beaching and playing with jellyfish. Their prey objects are well seen on the photographs, and some of them can be identified as mullets (*Liza* sp.). On July 22, 2017, their courtship pre-copulatory behavior was recorded. Therefore, a significant portion of the bottlenose dolphins were classified as summer residents. **The abundance of marked bottlenose dolphins was estimated with Chapman estimator for 2016/17 as 22 specimens (SD = 3.3; CV = 0.15). Given the average percentage of marked specimens in a group (47.5%), the overall abundance was 46 specimens.**

a



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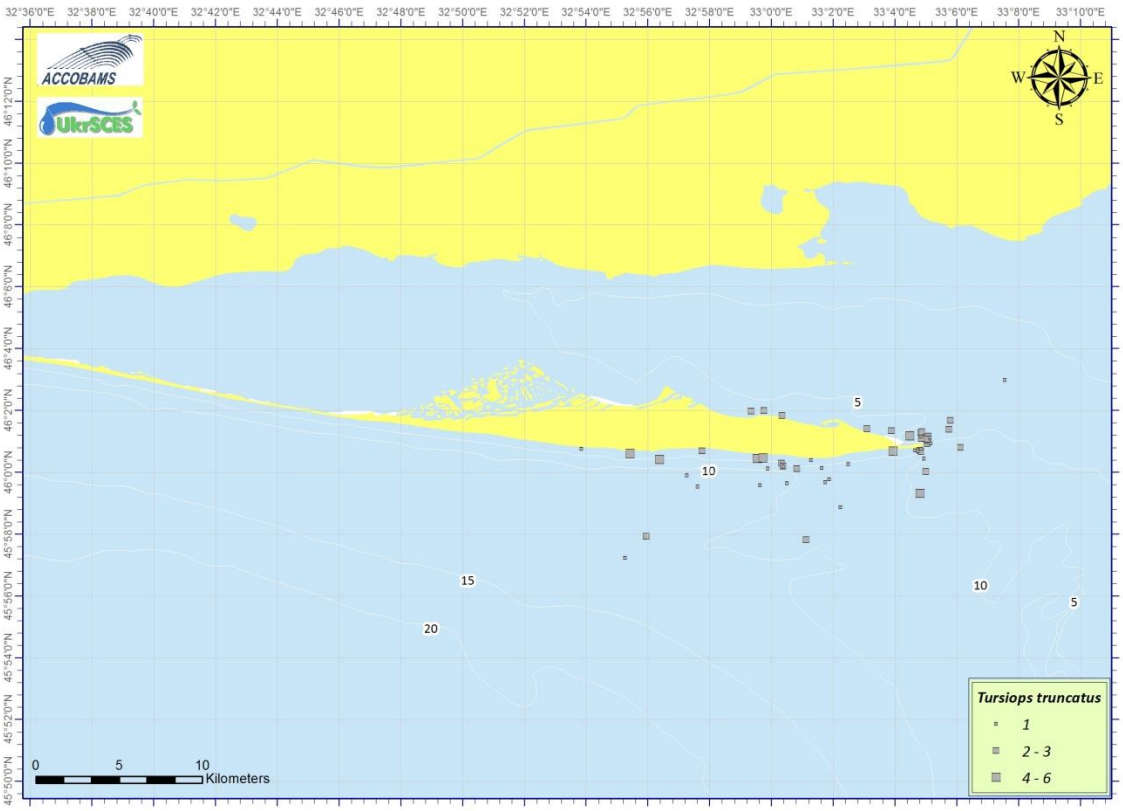


Fig. 20. Sightings of bottlenose dolphins in the Dzharylgach Bay and near the Dzharylgach Island; group sizes are indicated; a, 2016; b, 2017.

Fig. 21. A bottlenose dolphin near the Dzharylgach feeding on mullet.

Fig. 22. A bottlenose dolphin near the Dzharylgach playing with a jellyfish.

Fig. 23. Courtship behaviour of bottlenose dolphins near the Dzharylgach Island, July 22, 2017.

Thus, the sea area near the Dzharylgach Island, including the Dzharylgach Bay, was confirmed as an important summer habitat for all three species of cetaceans.

5.1.2. Stranding surveys

All the records of stranded cetaceans during the project were in 2017: eight cases (five harbor porpoises, two common dolphins and one bottlenose dolphin) were reported by the staff and visitors of the Dzharylgatsky National Nature Park, and three of them were examined by us. Five of eight cases occurred on the coast of the Dzharylgach Island (Fig. 24), whereas the rest occurred near the town of Skadovsk. Two live strandings occurred during the year: on April 14, 2017, a bottlenose dolphin stranded in Skadovsk and was successfully returned into the sea. On July 21, 2017, a just dead emaciated mature male of the harbour porpoise with the signs of pathology was found in Skadovsk (Fig. 25).

Fig. 24. A carcass of a common dolphin on the southern coast of the Dzharylgach Island. June 26, 2017.

Fig. 25. A harbour porpoise stranded in Skadovsk, July 21, 2017.

In addition, inspectors of the the Dzharylgatsky National Nature Park provided data and photographs for a stranding of a dead adult bottlenose dolphin on the tip of the island on June 23, 2016 (the carcass was buried). A live stranding of a pregnant female of a common dolphin occurred in May 2016 in the north-eastern part of the Dzharylgach Bay. Therefore, stranding rate is apparently low in the entire region.

Thus, stranding rate of cetaceans in the Dzharylgach area is low, and the recovered carcasses are often strongly decomposed which hinders their individual identification. The monitoring of strandings in the Dzharylgach area was shown to be inefficient for tracing life history or population dynamics. Meanwhile, it is crucial for identifying causes of death and threats for cetacean populations.

5.1.3. Line transect survey in the Dzharylgach area

All the three cetacean species inhabiting the Black Sea, the harbour porpoise *Phocoena phocoena,* the short-beaked common dolphin *Delphinus delphis* and the common bottlenose dolphin *Tursiops truncatus*, were recorded during the linear transect survey (Fig 1 and 2, Table 2). The most of encounters were recorded in areas 5 to 12 m deep. Spatial distribution of groups of all the species was random (CV = 45-85%). Although the survey in the Dzharylgach Gulf was conducted during two consecutive days, there were no repeated encounters of cetaceans between two days: the harbour porpoises were recorded only during Day 1, while the common dolphins were recorded only on Day 2 (Fig. 2).

Harbour porpoise. On September 2, 2016, a single animal was recorded north to the tip of the Dzharylgach Island. In 2017 porpoises were encountered both in the Karkinit (2 encounters by single animals) and in the Dzharylgach Gulf: 8 encounters of 14 specimens, single animals and groups of 2 or 3 animals, group size on average in the Dzharylgach Gulf 1.75 individuals, median value 2 individuals. Also, two groups were recorded on the way to the transect line (4 specimens) and a single animal was recorded after the survey, near the port of Skadovsk: therefore, all the records on the way were in the northern part of the Dzharylgach Gulf. Thus, the harbour porpoise, not only the most abundant but also the most widespread species in the area of study, was recorded throughout all the area; however, it mostly tended to the Dzharylgach Gulf. The encounter rate in the Dzharylgach Gulf in 2017 was 0.18 per km (CV = 49%) (Table 2).

Common dolphin. In 2016 a single group containing 7 individuals was encountered near the eastern tip of the Dzharylgach Island. In 2017 common dolphins were encountered near the eastern entrance to the Dzharylgach Gulf and in its eastern part, 5 encounters of 11 specimens, groups of 2 or 3 individuals, group size on average 2.2, median 2. Another group of 7 individuals was recorded in the Dzharylgach Gulf on the way to the LTS transect. After the survey 11

dolphins were recorded in groups by 2 or 3 in each and one more single dolphin. The encounter rate in the Dzharylgach Gulf in 2017 was 0.11 per km (CV = 67%) (Table 2).

Bottlenose dolphin. In 2016 there were 2 groups of 6 and 2 individuals encountered in the Karkinit Gulf near the southern coast of the Dzharylgach Island. In 2017 there were 7 encounters of 11 individuals, single and pair sightings, all in the Karkinit Gulf, 3-7 km south to the Dzharylgach Island. The average group size was 1.43, median 2. No bottlenose dolphins were recorded in the Dzharylgach Gulf during the LTS, and the only exception was a single dolphin recorded north to the tip of the island after the LTS on June 28, 2017. The encounter rate in the Karkinit Gulf was 0.09 per km (CV = 101%) in 2016 and 0.14 per km (CV= 64%) in 2017 (Table 2).

Density and abundance by species. Due to limited number of observations of each species all the estimates of density and abundance are of low precision, and they characterize only the order of values (Table 2). As for 2016, final abundance estimates were not presented here because of extremely high variance of estimates. Besides, all the estimates are uncorrected by detection probability $g(0)$, i.e. they do not involve differences in species detection rates: e.g., bottlenose dolphins are encountered during such a survey within an effective strip width at ideal weather conditions with the probability near 1; on the contrary, harbour porpoises spending much time underwater can be severely underestimated (Teilmann et al., 2013). However, it is clear that the harbour porpoise in the Dzharylgach Gulf is characterized by the highest density among all the encountered species in the area of study: its density is significantly higher than any one for the other species ($p < 0.05$). Based on these data, it is seen that the abundance of harbour porpoises in the Dzharylgach is at least of a few hundred animals, whereas the abundance of bottlenose and common dolphins is around some tens animals each. Interestingly, the estimate for bottlenose dolphins is close to the mark-recapture estimate (31 vs. 46 individuals); whereas the estimate for common dolphins is lower than in mark-recapture data (59 vs. 158 individuals), and the latter one is to be reassessed by future studies.

There were all the three species of the Black Sea cetaceans recorded during both surveys in 2016 and 2017 in the area of study which confirms their summer presence in the waters of the Dzharylgach.

The surveys in 2016 and 2017 showed great differences in occurrence and distribution between cetacean species in the Dzharylgach and Karkinit gulfs. Bottlenose dolphins were encountered exclusively in the Karkinit Gulf and near the tip of the Dzharylgach Island. Meanwhile, common dolphins were observed in the Dzharylgach Gulf and near the tip of the island, and harbour porpoises were encountered throughout the area but with strong prevalence to the Dzharylgach Gulf. Thus, each species has its specific habitat preferences within the local area. In this regard, notable is the presence of aggregations of common dolphins in the shallowest

Dzharylgach waters. Such a shallow inshore habitat is unusual for *Delphinus*, which prefer deeper waters worldwide, but this kind of behavior has been already recorded for common dolphins in the north-western Black Sea which come close to the shoreline and even enter some estuaries.

Table 2

Results of estimation of cetacean abundance in the waters of the Dzharylgach Island, linear transect surveys 2016-2017

(species (Sp.): Tt – bottlenose dolphins *Tursiops truncatus*, Dd – common dolphin *Delphinus delphis*, Pp – harbour porpoise *Phocoena phocoena*; n, number of detected groups; Est., estimate; CI, 95% confidence interval; CV, coefficient of variation, %; AIC, Akaike information criterion))

Sp.	Year	Region	n	Encounter rate (groups per km)		Mean group size		Effective strip width (m)		Density (specimens per km^2)		Abundance				Group density (groups per km^2)		AIC
				Est.	CV, %	Est.	CV, %	Est., m	CV, %	Est.	CV, %	Est.	CV, %	95% CI		Est.	CV, %	
Tt	2016	K	2	0.09	101	4.0	50	200	110	0.88	121	n/a				2.5	45	133.4
Tt	2017	K	7	0.14	64	1.4	14	470	37	0.22	75	31	75	7	137	0.15	74	88.93
Dd	2017	J	5	0.11	67	2.2	9	259	53	0.51	86	59	86	11	313	0.22	85	71.71
Pp	2017	J	8	0.18	49	1.7	14	107	29	1.51	59	175	59	53	583	0.86	57	76.63

Encounter rate for each species in the strata where it could be calculated was within 0.09-0.18 per km (Table 2). These values are lesser than those from the coastal waters of the south-eastern Crimea (Krivokhizhin et al., 2012; Gladilina and Gol'din, 2016) and somewhat less than average values for coastal Ukrainian waters as a whole, as well as Romanian and Bulgarian coastal waters (Birkun et al., 2014). However, as seen from this survey and previous locally based studies at coastal Black Sea sites (Zatevakhin, 1987; Birkun et al., 2006; Selyunina et al., 2006; Krivokhizhin et al., 2012; Gladilina and Gol'din, 2016), each species shows patterns or fluctuations of local density which can differ from overall region-wide trends. For example, the harbour porpoise is characterized by notably high density and encounter rate, nearly the greatest values across the Black Sea region which only can be compared to winter distribution in the waters of Georgia (Birkun et al., 2006, 2014) which are known for extremely large aggregations of porpoises. Possibly, the Dzharylgach Gulf is among the greatest summer hotspots for this species, although it is unclear how regular and stable is their summer

presence. Notably, only a single specimen was encountered in 2016, indicating that large porpoise aggregations stay in the gulf for a relatively short time period or even occasionally visit the area.

On the contrary, two dolphin species are characterized by modest densities which are in contrast with their high visibility near the coast (see, e.g., Selyunina et al., 2006). In 2017 the encounter rate for bottlenose dolphins was 0.14 per km, at the average group size of 1.4 and density of 0.22 per km^2. Meanwhile, in the area near Sudak in the north-eastern Black Sea the survey in 2012, which covered an area similar by size, showed similar average group size (1.64) almost twice higher encounter rate (0.26) and far greater density (4.3 per km^2) (Gladilina and Gol'din, 2016). In a result, the tentative abundance of Dzharylgach bottlenose dolphins of a few tens animals is lower in an order than that one near Sudak (n = 604) (Gladilina and Gol'din, 2016), at the same area size (respectively, 143 and 140 km^2), and significantly less than near Karadag in summer (n = 267) (Krivokhizhin et al., 2012). A higher concentration of bottlenose dolphins has also been noticed in the southern Karkinit Gulf, north to the coast of the Tarkhankut Peninsula. During a boat survey in September 2003 Birkun (2006) encountered 48 dolphins in 19 groups at 40 km (ER = 0.47), group size on average 2.5. Notably, bottlenose dolphins visit the northern Karkinit Gulf only during the warm season and are present there only from April to September (Selyunina, 1996; Selyunina, 2001; Selyunina et al. 2003; Tarina et al., 2003; Mikhalev, 2005; Birkun, 2006). Birkun (2006) suggested that bottlenose dolphins from the Tendra and Dzharylgach are locally wandering groups of a local population with the centre of distribution and density located at the south, near the Tarkhankut. However, local surveys near the Tarkhankut coast, although 30 years ago, showed density similar to that recorded in this study (0.13 per km^2 in May) (Zatevakhin, 1987), and maximum group size near the Tendra, up to 80 individuals in May (Selyunina et al, 2006), is at least the same as near the Tarkhankut (Zatevakhin, 1987; Mikhalev, 2005). Thus, contrary to the statement by Birkun (2006), bottlenose dolphins near the Tendra and Dzharylgach can equally represent a relatively separate, distinct summer grouping which is comparable in abundance and similar in density to the local stock near the Tarkhankut. This idea, as well as the tentative estimate of abundance presented here, is to be confirmed by photo-identification studies.

Relatively low density of coastal dolphin groupings in the north-western Black Sea, as seen from previous studies and this survey, is compliant with the hypothesis by Bushuyev (2000) who indicated that the modern cetacean abundance in the Black Sea and especially in its north-western part is generally limited by scarce, depleted prey fish resources. From this perspective, even expansion of cetacean ranges could be partly explained as dispersal driven by lack of prey pushing dolphins for search of new habitats.

5.2. Population studies in the Danube area (Area 2)

5.2.1. Photo-identification study

Harbour porpoises and bottlenose dolphins were observed east to the Danube delta during the photo identification cruises only on two field days in spring 2017 (Fig. 26). Both species tended to the relatively remote areas as deep as at least 15 m, although there have been reports from researchers operating in the area on approach of large aggregations of bottlenose dolphins (about 20 animals) to the coastline north to the delta.

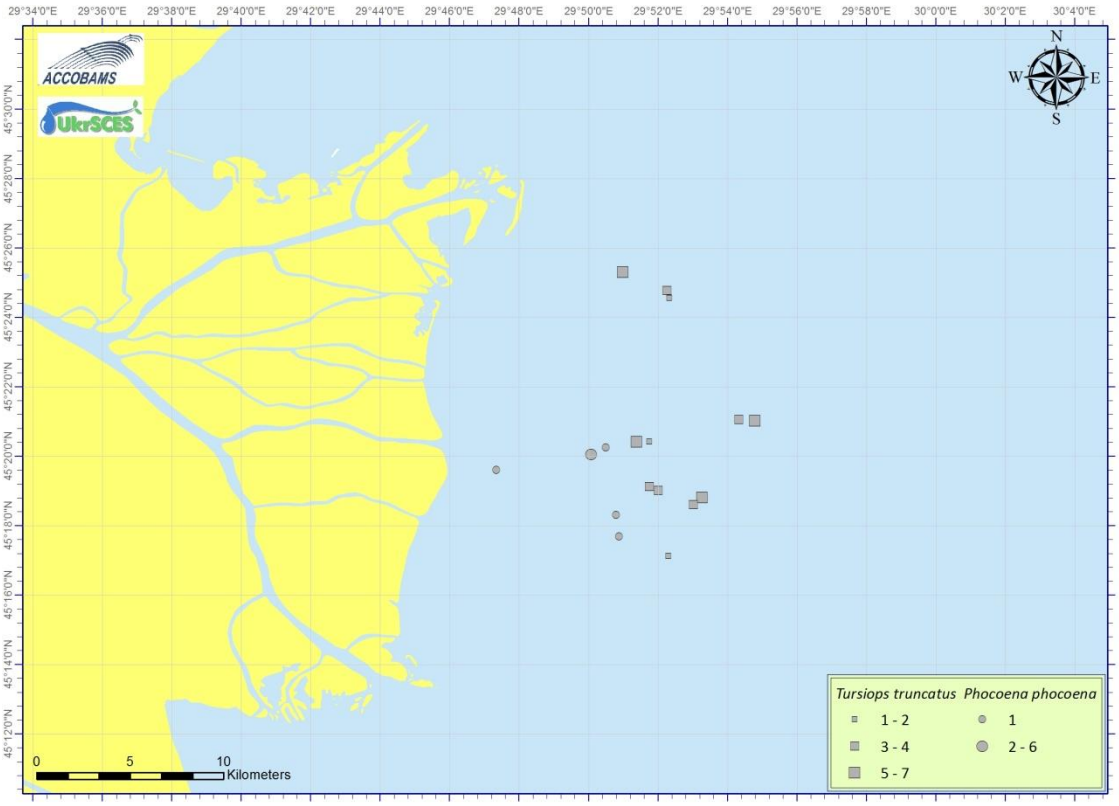


Fig. 26. Records of cetaceans east to the Danube delta in 2017.

Fig. 27. A mother-calf pair of bottlenose dolphins east to the Danube delta. May 27, 2017.

Harbour porpoises were mostly represented by solitary individuals (4 of 5 records). However, a group of 6 porpoises was also seen.

Bottlenose dolphins (12 records) formed groups up to 7 animals, median = 4 (mean group size 4.2), which is a remarkably large average group size in comparison with most of the north-western Black Sea inshore waters. Some of these small groups seemed to be parts of a larger aggregation, in total counting about 15 individuals, and each large group contained calves. At least, 18 animals have been photo-identified, of them 10 were well or slightly marked (Annex 5). Among the animals in this area, there was one partially white animal with a white patch on its tail.

5.2.2. Stranding surveys north to the Danube area

The only remnant of a cetacean found in the studied area in 2016 was an isolated lumbar vertebra of a harbor porpoise found at the Sasyk Lake bar on August 18. This is the stranger as our study was simultaneous to the greatest outbreak of strandings of harbor porpoises on the coasts of Bulgaria and Turkey.

On the contrary, the year 2017 was marked by an enormous outbreak of cetacean strandings on the Ukrainian coast. A particularly high number of cases were recorded in the region between Odessa and the Danube delta (Fig. 28).

Fig. 28. A carcass of a harbour porpoise in the Danube delta, May 25, 2017.

Fig. 29. A harbour porpoise stranded in Zatoka, Odessa region. Photo provided by a local resident.

In total, at least 144 cases were entered in the newly established Ukrainian nation-wide stranding database by August 1, 2017, based on dedicated stranding surveys in the frames of this project, other field studies and reports from volunteers and local residents; all the cases were validated by original photographs allowing to identify the species and relevant information on locality (Fig. 29). Of them, 54 cases were in the Odessa region, and 30 cases in Mykolaiv and Kherson Black Sea regions: thus, at least 84 cases were reported for the project area. Of the total number of strandings, 115 cases (80%) were represented by harbor porpoises, 20 (14%) by common dolphins and 9 (6%) by bottlenose dolphins. The first reports are from March 22, while most of cases were reported in May (48; 33%), June (40; 28%) and July (43; 30%). Among them, 16 cases (15 harbour porpoises and one common dolphin) were reported from the Sasyk and Tuzli sandy bars north to the Danube delta between May 25 and 29 which was among the greatest outbreaks. The number of reported cases (now being processed) significantly decreased since the early August. There were at least 9 cases of live strandings; all the three cetacean species were reported to strand in the north-western Black Sea, mostly in the Odessa region. Among them, three common dolphins were successfully rescued by Alena Syvak on July 18 in the Danube delta; however, three carcasses were reported from the area north to the delta on August 7.

There were a few causes of death identified or suspected. Some of the animals had bycatch signs; also, seven by-caught harbor porpoises were found by coast guards in the IUU (illegal) fishing net 2 km east to the Danube delta on June 22, 2017. However, some animals had signs of emaciation, disorientation (in cases of live strandings), and pathological signs. Harbour porpoises were recorded in unusual localities, including the rivers of Pivdennyi Buh and Dnieper, 70-80 km upstream from the mouth. Also, the monthly dynamics of strandings indicates an infection outbreak as a possible cause of deaths.

5.3. Photo-identification study in the Hryhorivsky Bay (Area 3)

The ***common dolphin*** was the predominating species (Fig. 30, 31) which occurred during 15 days of study, between July 11 and September 17, 2016, and May 3 and July 27, 2017, in groups up to 14 individuals, 6 on average (median = 5). Most groups contained calves and juveniles. Some specimens had distinctly marked dorsal fins, and they are suggested as potentially photo-identifiable and recognizable if recaptured. About 1 000 photographs were taken for photo identification; however, there were no photographs of suitable quality allowing to include the photo-identified specimens into a catalogue.

Harbour porpoises were recorded on 5 days, on August 23, 2016, and between March 28 and May 5, 2017, in groups up to 4 individuals. Therefore, based on this study and previous research (Savenko et al., 2016) it can be considered as an irregularly occurring species.

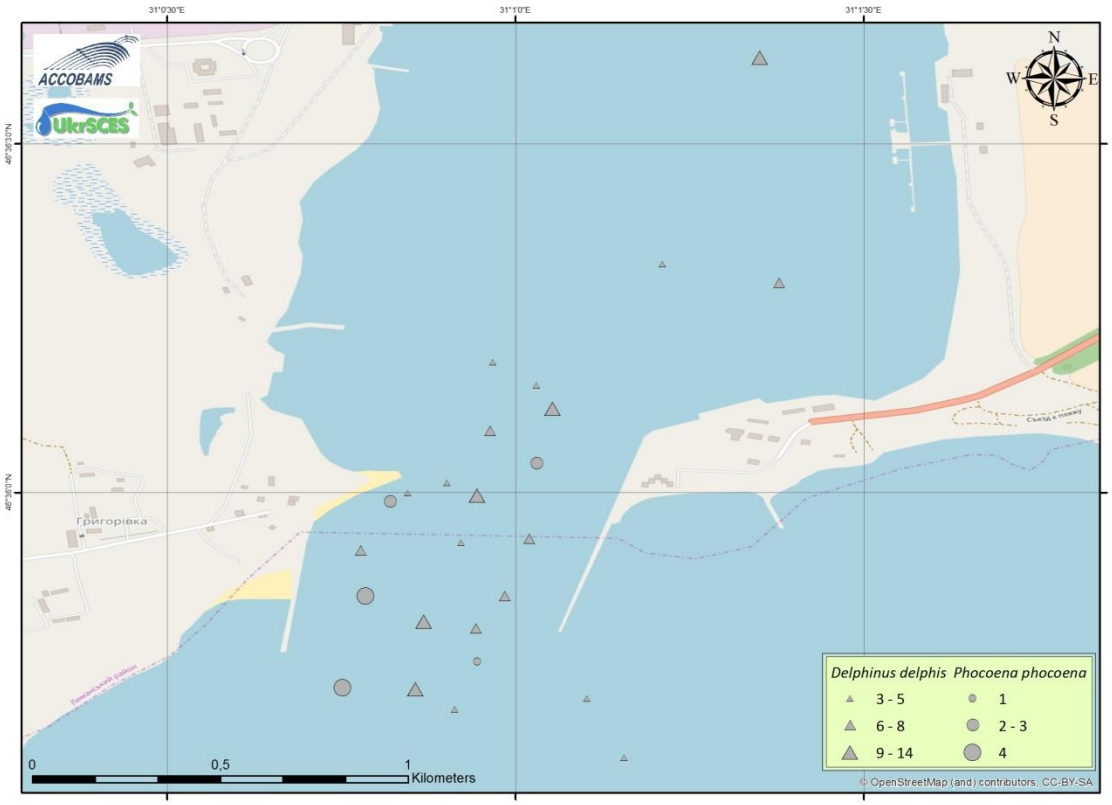


Fig. 30. Summary of cetacean sightings in the Hrygoryevsky Bay, July 11 – September 17, 2016, and March 28 – July 27, 2017.

Fig. 31. Common dolphins in the Hrygoryevsky Bay.

5.4. Observations from the platforms of opportunity

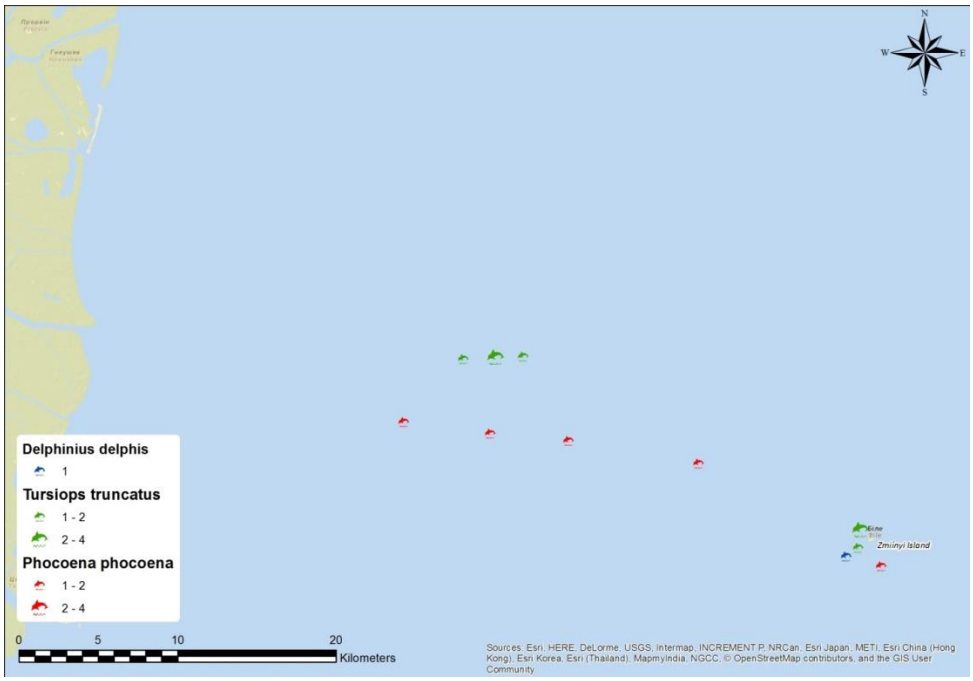
Observations from a platform of opportunity were conducted between Vylkove and the Zmiinij Island on August 19-21, 2016, and August 5-7, 2017. All three cetacean species were recorded near the Zmiinij Island and west to it, between the Danube delta and the island (Fig. 33).

Harbour porpoises were recorded in five sightings in 2016 and six sightings in 2017, only solitary individuals or pairs, mostly in open sea. A solitary ***common dolphin*** was recorded near the island in 2016, and two groups of 2 and 4 animals in the open sea in 2017. Bottlenose dolphins were recorded near the island and west to it, in 14 sightings of groups, mostly up to four individuals, 2.5 on average (median = 3) (Fig. 32). In addition, an extremely large aggregation of a few tens individuals was recorded east to the Danube delta on August 7, 2017.

Four bottlenose dolphins were photo-identified (Annex 6). Interestingly, there were no resightings of individuals from the waters east to the Danube delta (Annex 5) in this sample.

Fig. 32. A group of bottlenose dolphins west to the Zmiinij Island. August 2017.

a



b

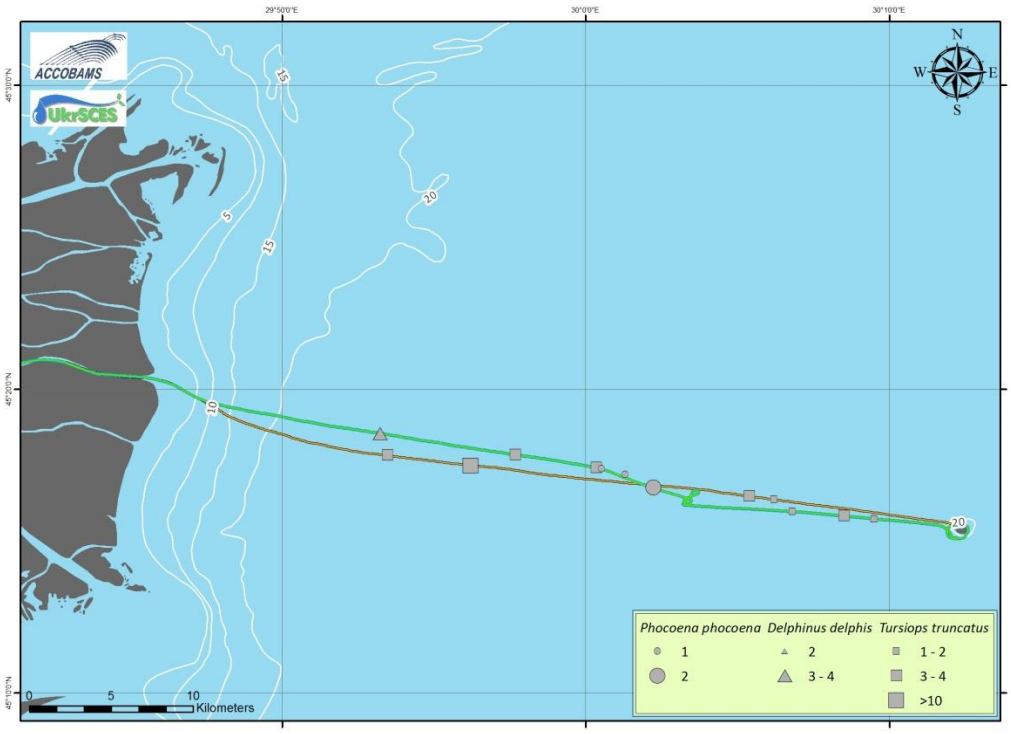


Fig. 33. Summary of cetacean sightings between the Danube delta and Zmiinij Island, August 2017.

6. CONCLUSIONS

1. All the three cetacean species regularly occur near the Dzharylgach Island in summer. The harbour porpoise is fairly abundant, up to a few hundred individuals at certain moments, and its density in the Dzharylgach Gulf, even if being an occasional record, is among the highest in the whole Black Sea. The abundance estimate for bottlenose dolphins obtained in the linear transect survey is close to the mark-recapture estimate (31 vs. 46 individuals); whereas the estimate for common dolphins is lower than in mark-recapture data (59 vs. 158 individuals) which is to be reassessed by future studies.

2. Common and bottlenose dolphins show the clearest patterns of habitat preferences near the Dzharylgach Island restricting respectively to the Dzharylgach and the Karkinit Gulf. Notable is the presence of aggregations of common dolphins in extremely shallow coastal waters of the north-western Black Sea, both in the Dzharylgach Gulf and the Hrygoryevsky Bay which is unusual for this species. In Hrygoryevsky Bay the port area regularly visited by common dolphins.

3. Both bottlenose and common dolphins form summer resident groups in the waters near the Dzharylgach Island. In particular, bottlenose dolphins show site fidelity for waters near the tip and the southern side of the Dzharylgach Island in summer, and they are also distinct in specific forms of behavior.

4. Bottlenose dolphins near the Dzharylgach Island and east to the Danube delta represent local populations which are isolated from all the other identified local populations in the Black Sea.

5. The sea area around Dzharylgach Island, including the Dzharylgach Bay and waters south to the island, 0-10 m deep, is a particularly important cetacean summer habitat where cetaceans forage, reproduce and stay with neonates and calves. It can be a critical habitat for some populations (e.g., a local population of bottlenose dolphins) that require some special conservation activities.

6. All the three cetacean species were recorded in waters east to the Danube delta. Relatively large aggregations of bottlenose dolphins were observed in that area, and existence of a local population can be suggested for that area which deserves a special research.

7. Increase in stranding rate of cetaceans (primarily, harbor porpoises) in 2017 in comparison with 2016 indicates a possible outbreak of infection which can be a potential threat for cetacean populations. In addition, bycatch in IUU fishing gears is a disturbing factor and permanent threat for harbor porpoises.

7. RECOMMENDATIONS

1. The Dzharylgatsky National Nature Park should be expanded and include a sea area of the Karkinit Gulf where summer resident bottlenose dolphins are permanently present, forage, reproduce and stay with calves. At present, only some waters of the Dzharylgach Gulf north to the Dzharylgach Island are included into the protected area (Fig. 34), whereas the most of bottlenose dolphins were recorded east and south to the island (Fig. 35). Thus, it is recommended to include the waters as deep as 0-10 m (approximately 5 km area to the east of the island and 3 km area to the south of the island) into the Dzharylgatsky National Nature Park, with restriction of use the fishing nets between June 1 and September 15.

Fig. 34. The present-day protected area (a Ukrainian map provided by the Dzharylgatsky National Nature Park).

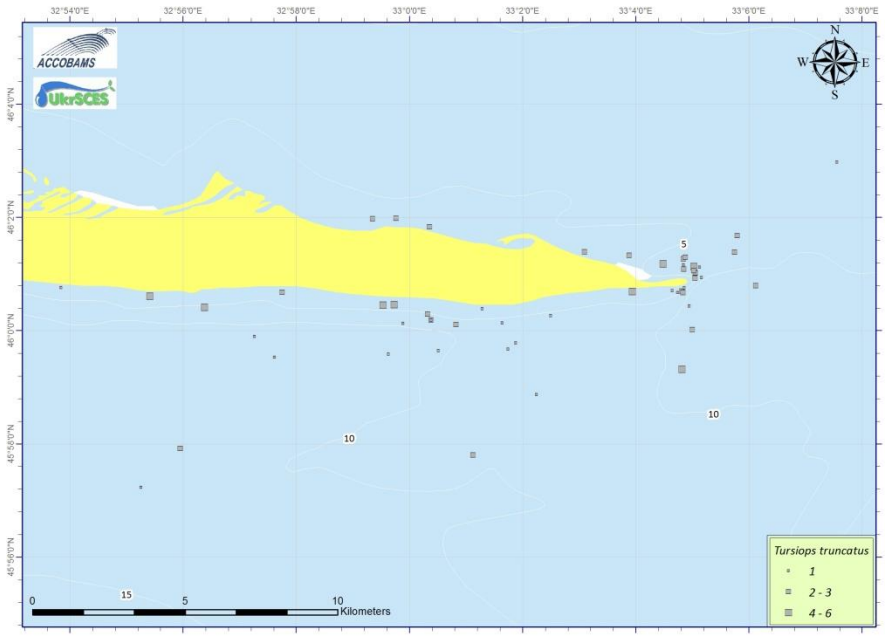


Fig. 35. Occurrence of summer resident bottlenose dolphins in coastal waters of the Dzharylgach Island.

2. Given the presence of summer resident groups of bottlenose and common dolphins in the shallowest coastal waters and small gulfs and bays of the north-western Black Sea, it recommended to estimate their abundance, using photo identification as the most precise and sustainable approach, added by passive acoustic monitoring and, when necessary, linear transect surveys.

3. It is recommended to continue the studies of cetacean abundance and population biology in the Dzharylgach area and the waters west to it, including the Karkinit, Yagorlyk and Dnipro gulfs, as well as the waters east to the Danube delta.

4. It is important to enhance recording and monitoring of strandings, stranding response, rescue operations in the wild, sampling and lab analysis.

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SUMMARY

The project "**Identification and initial assessment of cetacean groupings in coastal waters of the north-western Black Sea, Ukrainian sector**" was conducted by the Ukrainian Scientific Center of Ecology of the Sea (UkrSCES) in Odessa, Ukraine, with the expert support of Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine. The project aimed to increase knowledge about population structure and local distribution of the Black Sea cetaceans, among which there are endangered Black Sea bottlenose dolphins and harbour porpoises. This study was focused on two coastal areas: the shallowest waters near the Dzharylgach Island, and waters near the Danube delta. In addition, the third area important for cetaceans is covered by the study, the Hrigoryevsky Bay, where a major port of Ukraine is situated. Project activities included photo identification boat cruises, linear transect surveys, observations at sea from the platforms of opportunity, observations from coastal platforms and monitoring of strandings. Linear transect surveys of density and abundance were conducted in the Dzharylgach Gulf and the northern Karkinit Gulf, total area up to 259 km^2. All three cetacean species of the Black Sea, the harbor porpoise (*Phocoena phocoena*), the common dolphin (*Delphinus delphis*) and the bottlenose dolphin (*Tursiops truncatus*) were recorded near the Dzharylgach Island. The ***harbour porpoise*** was the most abundant species with the abundance estimated as 175 individuals in the Dzharylgach Gulf, the recorded density (1.5 specimens per km^2) among the highest in the whole Black Sea. Porpoises were observed both within and outside of the bay, and they tended to sea floor slopes at depths near 5 m. A partially white porpoise with unusually distinct patchy coloration was recorded within the Dzharylgach Gulf. ***Common dolphins*** with the estimated abundance between 59 (linear transect survey) and 158 (photo id effort) occurred in groups up to 12 individuals. There were juveniles and calves in 30% of groups, and courtship behavior was observed. The dolphins were noticeable for their distinctively marked dorsal fins, and 65 dolphins were photo identified, some of them with severe scarring. **Bottlenose dolphins** (estimated number between 31 and 44) were recorded in groups up to six individuals. There were juveniles in 27% of sightings, and there was a mother-juvenile aggregation among them. 25 dolphins were photo identified; a few of them were re-sighted during two summer seasons at the same locality, near the tip of the island. They showed distinct hunting and game behavior, with beaching and playing with jellyfish, and mating behavior. Therefore, at least some of the dolphins were summer residents. Common and bottlenose dolphins showed the clearest patterns of habitat preferences, being restricted respectively to the Dzharylgach and the northern Karkinit Gulf. The common dolphin was the predominating species also in Hrygorivsky Bay, with a few individually distinct animals and frequently occurring mother-calf pairs. Also, harbour porpoises were observed in this port area during the season of migrations. An unusual trait is the preference of the shallowest habitat by common dolphins in both localities. Also, all three cetacean species were recorded both around the Zmiinij Island and in the coastal mainland waters, and 18 bottlenose dolphins

were photo identified from the Danube delta region. All the identified bottlenose dolphins were recorded only in a single sea area, either Dzharylgach or Danube delta.

During 2017 the Ukrainian waters was affected with mass mortality of cetaceans, at least 86 cases reported from the north-western Black Sea coast by August, including live strandings. Increase in stranding rate of cetaceans (primarily, harbor porpoises) in 2017 in comparison with 2016 indicates a possible outbreak of infection which can be a potential threat for cetacean populations. In addition, bycatch in IUU fishing gears is a disturbing factor and permanent threat for harbor porpoises.

The sea area around Dzharylgach Island, including the Dzharylgach Bay and waters south to the island, 0-10 m deep, is a particularly important cetacean summer habitat where cetaceans forage, reproduce and stay with neonates and calves. It can be a critical habitat for some populations (e.g., a local population of bottlenose dolphins) that require some special conservation activities. It is recommended to include the waters as deep as 0-10 m (approximately 5 km area to the east of the island and 3 km area to the south of the island) into the Dzharylgatsky National Nature Park, with restriction of use the fishing nets between June 1 and September 15.

ANNEX 1. PROTOCOL FOR OBSERVATIONS *(translated)*

Vessel: ________________ Responsible observer: _____________ Observers: __________________________ Page __ of __

Date: _________________ Start time ________ End time ___________

Time hh:mm	Lat. (min.sec)	Long. (min.sec)	Vessel activity	Speed (km/h)/knots	Path °	Glare Deg.	Type of obs.	Precipitation				Visibility (km)	Waves		No. obs.	Wind	Clouds (%)	Comments
								Type		Intens			Pts	H				
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								
	N	E				0 1 2 3	Vis	-	R	S	L M H	<1 1-5 6-10 >10						
							ID	S		L								

Vessel activity NR=no vessels, YA=sail vessel, OB=oared boat, SB=speedboat, MB=motor boat, FB=fishery boat, BG=barge, FAR=>30м; **Glare** 0=no, 1=fair, 2=moderate, 3=strong; **Type of observations** Vis=visual, ID=photo ID; **Precipitation** -=no, R=rain, S=snow, S=short, L=long, L=light, M=medium, H=high; **Waves** Pts=points (9-point system), H=height (L=<1м, M=1-2м, H=≥2м).

Comments: Computer entry ______________ Checked ________________

RECORD FORM *(translated)*

Computer entry ______________ Checked ______________

Date: ____________________ Page ___ of ___

Rec. №	**Time** hh:mm	**Lat.** (min.sec)	**Long.** (min.sec)	**Type of obs.**	Loc. (°)	**Path** °	Dist (m)	Species		Min	Max	Opt	A	J	C	NB	Seen	Behav	Reaction		Who saw
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	
		N	E					Tt	Dd										A	T	
								Pp											U	N	

Type of observations Vis=visual, ID=photo identification; **Species** Tt=T truncatus, Dd=D delphis, Pp=P phocoena; **A**=adult, **J**=juvenile ⅔ adult body length, **C**=calves ½ adult body length, **NB**=newborns ⅓ adult body length; **Seen** HE=head, F=fin, L=leap, S=splush, B=breath, BI=birds, O=other, U=unknown; **Behaviour** SS=slow swimming, NS=normal

swimming, FS=fast swimming, SF=suspected feeding, FF=feeding (fish seen), L=leap, B=bow riding, R=rest, S=social, O=other, U=uknown, N=no data; **Reaction** A=avoiding, T=tending to a boat, U=unknown, N=neutral.

ANNEX 2

Photo-identification catalogue of bottlenose dolphins (*Tursiops truncatus*) for Ukrainian Black Sea waters near the Dzharylgach Island, 2016-2017.

Compiled by Elena Gladilina

The cameras used for photo-ID sessions were :

- Canon EOS 7D with lens Canon EF70-300mm f/4-5.6 IS USM
- Canon EOS 70D with lens Canon EF100-400mm f/4.5-5.6L IS II USM
- Canon EOS 70D with lens Canon EF70-300mm f/4-5.6 IS USM

Following abbreviations are used in the catalogue :

Catalogue :

S – Slightly marked

W – Well marked

U – Unmarked

Side:

L – Left

R – Right

Date: YYMMDD

Encounter number: EEE

Region: Skadovsk

Authors:

Elena Gladilina	EGL
Karina Vishnyakova	KVI
Oksana Savenko	OSA

1. **001-16**

001-16W_L_160623_004_Skadovsk_EGL_001a

001-16W_L_160623_004_Skadovsk_EGL_010

2. **002-16W**

002-16W_L_160623_005_Skadovsk_EGL_022

3. 003-16S

003-16S_L_160802_020_Skadovsk_KVI_057

003-16S_R_160802_020_Skadovsk_OSA_064

4. 004-16S

004-16S_L_160804_025_Skadovsk_EGL_181

004-16_R_160802_020_Skadovsk_OSA_069

5. 005-16S

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005-16S_R_160804_025_Skadovsk_KVI_293

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006-16S_R_170722_109_Skadovsk_EGL_046

7. 007-16S

007-16S_L_160804_025_Skadovsk_KVI_249

007-16S_R_170722_109_Skadovsk_EGL_026

8. 008-16S

008-16S_R_160804_025_Skadovsk_EGL_062

9. 009-16W

009-16W_L_160902_029_Skadovsk_EGL_005b

009-16W_L_160902_029_Skadovsk_EGL_004

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010-17S_L_170626_010_SkadovskLTS_EGL_002

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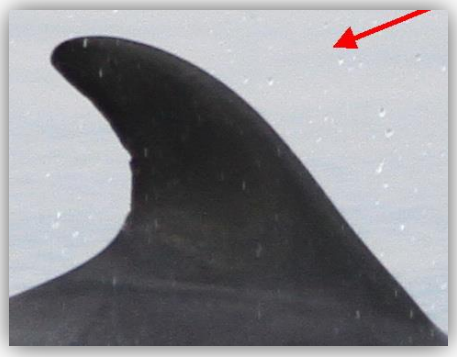

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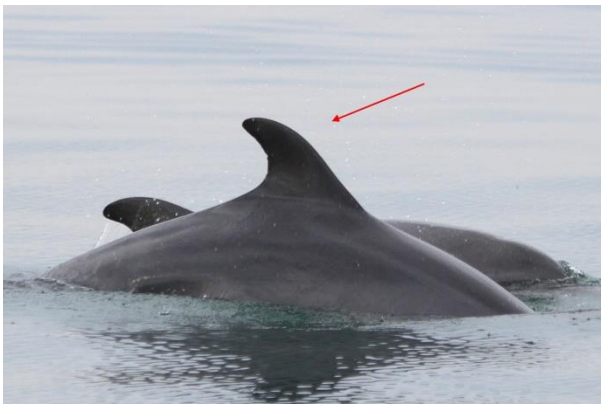

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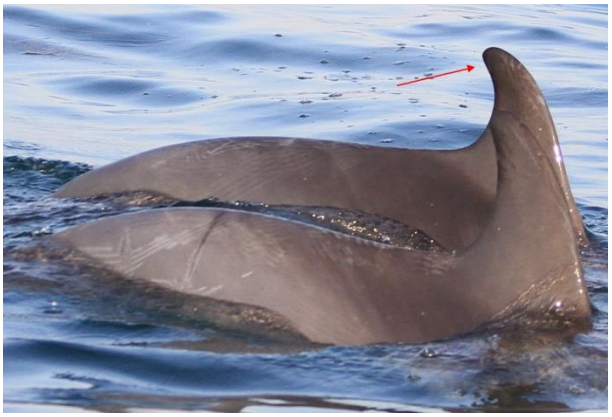

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014-17S_L_170719_073_Skadovsk_EGL_111

014-17S_R_170719_073_Skadovsk_EGL_039

15. 015-17S

015-17S_L_170720_076_Skadovsk_EGL_034

015-17S_R_170720_076_Skadovsk_EGL_007a

16. 016-17S

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18. 018-17S

018-17S_L_170627_040_Skadovsk_OSA_IMG_7456 018-17S_R_170627_040_Skadovsk_OSA_IMG_7440

19.

001-16U_R_170719_073_Skadovsk_EGL_043b

20.

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21.

003-17U_R_170719_073_Skadovsk_EGL_033

22.

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23.

005-17U(004-17Rc)_R_170719_073_Skadovsk_EGL_044

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25.

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26.

008-17_U_R_170722_101_Skadovsk_EGL_020

27.

004-16U(calf)_L_160804_025_Skadovsk_EGL_078

ANNEX 3

Photo-identification catalogue of common dolphins (*Delphinus delphis*) for Ukrainian Black Sea waters near the Dzharylgach Island, 2016.

Compiled by Oksana Savenko

The cameras used for photo-ID sessions were :

- Canon EOS 7D with lens Canon EF70-300mm f/4-5.6 IS USM
- Canon EOS 70D with lens Canon EF100-400mm f/4.5-5.6L IS II USM
- Canon EOS 70D with lens Canon EF70-300mm f/4-5.6 IS USM

Following abbreviations are used in the catalogue :

Dd – *D. delphis*

Side:

L – Left

R – Right

Date: DDMMYY

Authors:

Oksana Savenko	OVS
Karina Vishnyakova	KAV
Elena Gladilina	EVG

1.

Dd_1_R_020816_EVG_1178

2.

Dd_2_L_020816_OVS_4823

Dd_2_R_020816_OVS_4562

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Dd_3_L_020816_KAV_0607

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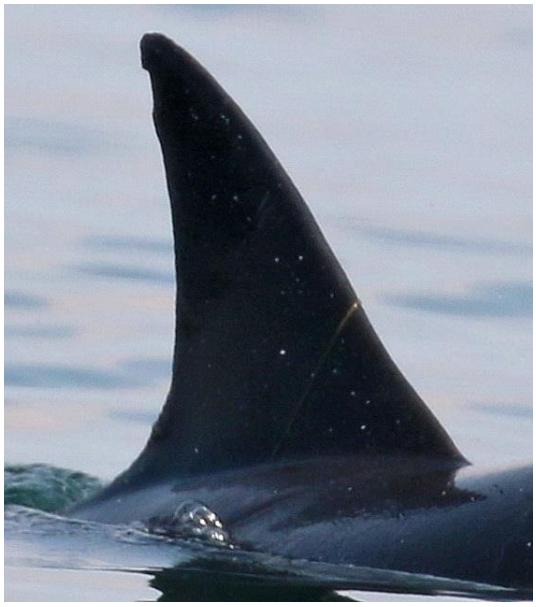

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7.

Dd_7_L_020816_KAV_0566 Dd_7_R_020816_KAV_0545

8. 

Dd_8_L_020816_OVS_4846 Dd_8_R_020816_KAV_0479

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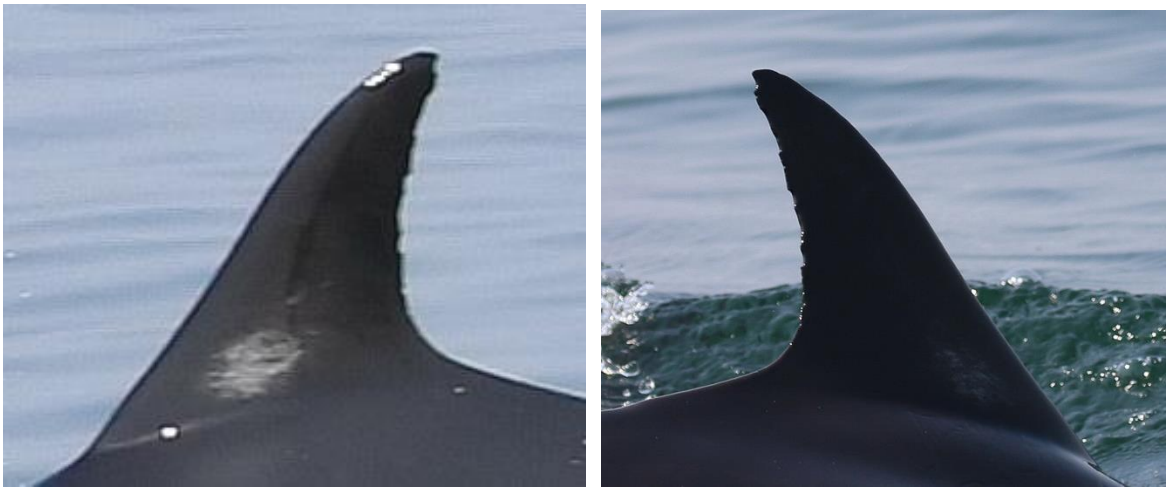
10. 

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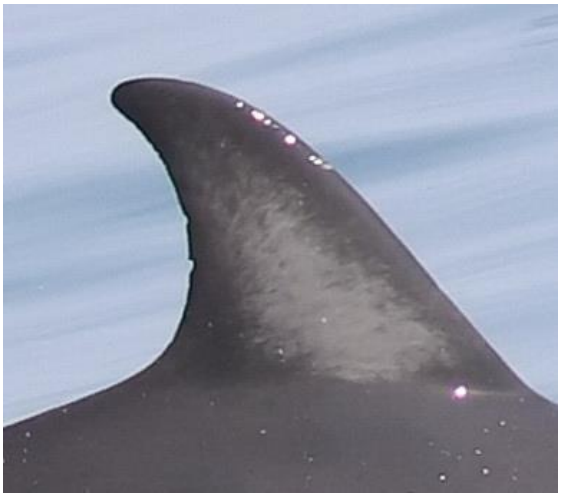

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Dd_31_R_260617_OVS_5556

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Dd_33_L_260617_OVS_5733 Dd_33_R_260617_OVS_5798

34.  

Dd_34_L_260617_OVS_6384 Dd_34_R_260617_OVS_6335

35.  

Dd_35_L_260617_OVS_6387 Dd_35_R_260617_OVS_6330

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Dd_36_L_260617_OVS_6463 Dd_36_R_260617_OVS

37. 

Dd_37_R_260617_OVS_6515

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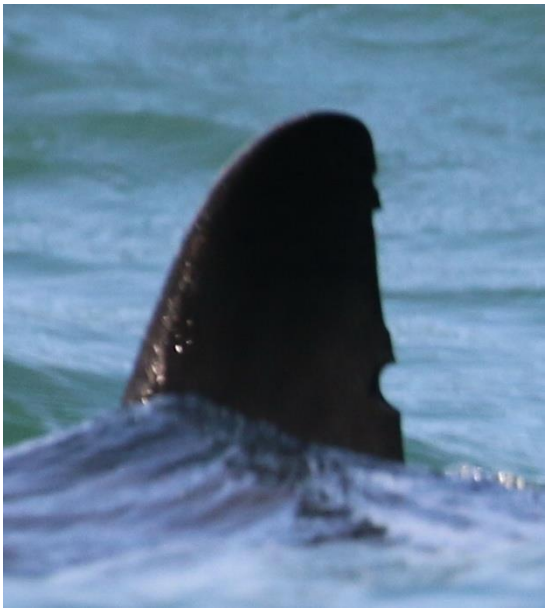
47. 

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Dd_62_R_21072017_EVG_8353

63. 

Dd_63_R_21072017_6882

64. 

Dd_64_L_22072017_EVG_8752

Dd_64_R_22072017_EVG_8733

65.  

Dd_65_L_22072017_EVG_8718 Dd_65_R_22072017_EVG_8740

ANNEX 4

Photo-identification images of partially white harbour porpoise (*Phocoena phocoena*) which was encountered in the waters of Dzharylgach Bay in August 2, 2016.

Authors:

Oksana Savenko OVS

Elena Gladilina EVG

1.

Pp_1_L_020816_OVS_4894

Pp_1_R_020816_EVG_1277

Pp_1_R_020816_EVG_1278

ANNEX 5

Photo-identification catalogue of bottlenose dolphins (*Tursiops truncatus*) for Ukrainian Black Sea waters near the Danube delta, 2017.

Compiled by Elena Gladilina

1. **001-17S**

001-17S_R_170526_002_Dunay_EGL_016

2. **002-17S**

002-17S_R_170526_002_Dunay_EGL_022b

3. 003-17S

003-17S_L_170526_002_Dunay_KVI_121

4. 004-17W

004-17W_L_170526_006_Dunay_EGL_007

5. 005-17S

005-17S_L_170526_006_Dunay_KVI_034

6. 006-17S

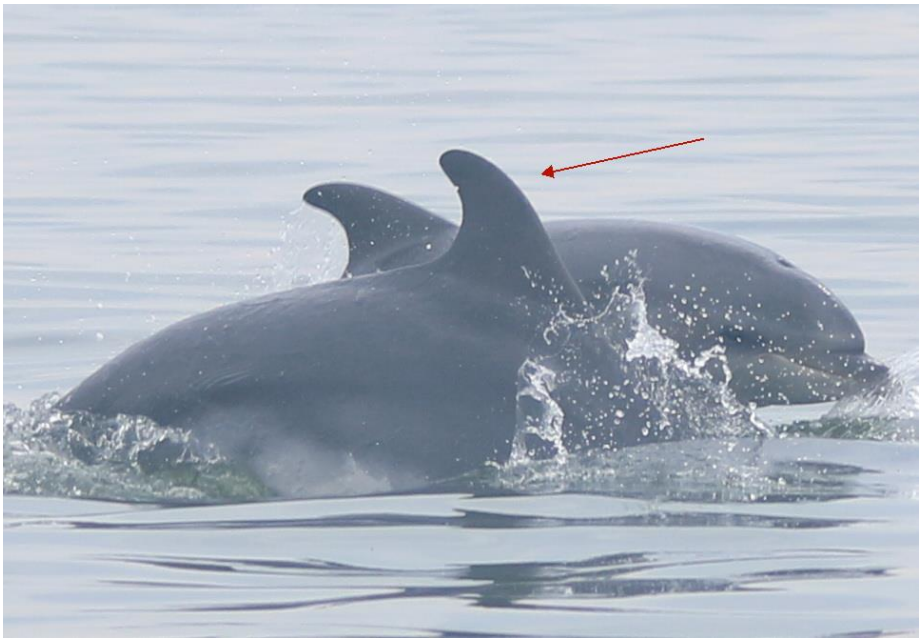
006-17S_L_170527_011_Dunay_EGL_008a

7. 007-17S

007-17S_L_170527_012_Dunay_EGL_087

007-17S_R_170527_012_Dunay_EGL_032

8. 008-17S



008-17S_R_170527_012_Dunay_KVI_187

9. 009-17W

009-17W_L_170527_012_Dunay_EGL_141

10. 010-17S

010-17S_L_170527_012_Dunay_EGL_080

010-17S_R_170527_012_Dunay_EGL_118b

11. 001-17U_R

001-17U_R_170526_002_Dunay_EGL_019a

12. **002-17U_R**

002-17U_R_170526_002_Dunay_EGL_062

002-17U_R_170526_002_Dunay_KVI_157a

13. **003-17U_R** 
003-17U_R_170526_002_Dunay_KVI_147a

14. **004-17U_R** 
004-17U_R_170526_002_Dunay_KVI_107b

15. **005-17U_R_**

005-17U_R_170526_006_Dunay_EGL 001a

16. **006-17U_R**

006-17U_R_170526_006_Dunay_EGL_001c

17. **007-17U_R**

007-17U_R_170527_012_Dunay_EGL_120

007-17U_R_170527_012_Dunay_EGL_121a

18. **008-17U_R**

008-17U_R_170527_012_Dunay_EGL_036

ANNEX 6

Photo-identification catalogue of bottlenose dolphins (*Tursiops truncatus*) for Ukrainian Black Sea waters near the Zmiinij Island, 2017.

Compiled by Oksana Savenko

1. Tt-Zm-01

2. Tt-Zm-02

3. Tt-Zm-03

4. Tt-Zm-04