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Sightings of Antarctic minke whales, *Balaenoptera bonaerensis*, near the Kiev Peninsula (West Antarctica) during the summer period of 2019

Abstract. Antarctic Peninsula region is experiencing one of the fastest rates of climate change on Earth. Its waters are known as important feeding grounds for the Antarctic minke whales (*Balaenoptera bonaerensis*). The purpose of the present study was to reveal the summer and early autumn presence of the Antarctic minke whales in the area adjacent to the Kiev Peninsula of West Antarctica and to estimate the encounter rates of the species in the area. The boat-based photo-identification cetacean studies were initiated as part of the long-term monitoring program based at the Akademik Vernadsky station near the Kiev Peninsula of West Antarctica. From 22 January to 7 April 2019, 35 boat and yacht cruises of the 821 nautical miles of total length were conducted. There were encountered 13 Antarctic minke whales in 7 sightings. The encounter rate was 0.015 whales per nautical mile. Minke whales were encountered only in 5% of the total sightings. Three more whales were opportunistically seen from the top of Galindez Island. There were single whales sighted and small groups of up to 3 specimens (Med = 2). At least 2 individuals were identified as juveniles. Primary behavior for whales in 7 sightings was foraging, and 2 groups were observed while travelling. A total 9 individuals of the Antarctic minke whales were photo-identified during the survey, and no matches were found between the different encounters. Our pilot study indicates summer and early autumn presence of the Antarctic minke whales in the area adjacent to the Kiev Peninsula. But encounter rates seem to be low in comparison with results of some previous surveys. Our results show the possibility to monitor minke whales in the area, and further long-term complex monitoring is essential for understanding the ecology and population dynamics of the Antarctic minke whales in rapidly changing marine environment of the Antarctic Peninsula.

Keywords: Antarctic Peninsula, Balaenopteridae, cetaceans, distribution patterns, photo-identification

1 Introduction

Waters of the West Antarctica are known to have high krill abundance and serve as important feeding grounds for several cetacean species including the Antarctic minke whale (*Balaenoptera bonaerensis* Burmeister, 1867 (Balaenopteridae, Cetacea)) that specialize on krill (*Euphausia superba* Dana, 1850 (Euphausiidae)). The Antarctic Peninsula is experiencing one of the fastest

rates of regional climate change on Earth: surface waters have warmed by more than 1 °C, winter sea ice duration and extent have decreased by nearly 80 days, and winter air temperatures have increased by 5 °C over the past 50 years (Vaughan et al., 2003; Clarke et al., 2007; Stammerjohn et al., 2012). These rapid changes are causing a transformation in marine ecosystem structure and function, affecting the Southern Ocean food web (Rogers et al., 2020). As top preda-

tors in this system, baleen whales are therefore important to study to better understand how these changes may manifest throughout the food web.

Antarctic minke whales have a circumpolar distribution in the Southern Ocean, they are abundant in the waters surrounding Antarctica during summer and some portion of the population migrates to breeding grounds at middle/low latitudes, while some individuals overwinter in the Antarctic (Thiele et al., 2004; Lee et al., 2017; Perrin et al., 2018). Antarctic minke whales feed predominantly on krill, and in the austral summer are abundant in both waters adjacent to and inside the sea ice edge (Friedlaender et al., 2006; Williams et al., 2014). They feed mostly under the sea ice, taking the advantage of their small size skimming below the ice cover while rapidly catching krill swarms (Friedlaender et al., 2014). Minke whale is the most abundant baleen whale in the Southern Ocean because of the amount of suitable ice habitat around the Antarctic continent but likely also because they were not subjected to widespread commercial harvesting like the other great whales. Along with humpback whales (*Megaptera novaeangliae* (Borowski, 1781), *Balaenopteridae*) that have made a rapid recovery from exploitation because of food and habitat availability, minke whales are the most common whales found in the nearshore waters around the Antarctic Peninsula. In the presence of humpback whales, minke whales tend to forage at depth (Friedlaender et al., 2009), which seems an energetically unfavorable condition for a much smaller species of baleen whale, so further growth of humpback whale populations may affect minke whale habitat or food availability (Ainley et al., 2012). The energy storage parameters of the Antarctic minke whale, blubber thickness, girth and fat weight, have been decreasing for the 18 years of whaling in frames of the Japanese Whale Research Program from 1987/1988 to 2004/2005 (Konishi et al., 2008), and weight of stomach contents decreased by 31% over the 20 years of catches since 1990/1991 (Konishi et al., 2014). The significant challenges such as population decline, recent commercial whaling, global climate change, increasing number of large whales recovering after whaling, and various anthropogenic impacts might severely

impact populations of the species which is already classified as Near Threatened under the International Union for Conservation of Nature's Red List and under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Cooke et al., 2018).

The year-round operating Ukrainian Antarctic Akademik Vernadsky station is located on Galindez Island of Argentine Islands near the Kiev Peninsula of the West Antarctica (Antarctic Peninsula), directly in the region that is most affected by climate change. During the summer period of 2019, the long-term research program on cetaceans based at the Akademik Vernadsky station was initiated for the first time, with the main focus on photo-identification and population demography studies.

The purpose of the present study was to reveal the summer and early autumn presence of the Antarctic minke whales in the area adjacent to the Kiev Peninsula of West Antarctica and to estimate the encounter rate of the species in the area.

2 Materials and methods

2.1 Visual observations

From 22 January to 7 April 2019 we conducted 35 cruises using boats (zodiacs; 31), and sailing yachts (4). The total length of the cruises was 821 nautical miles (680 by zodiacs). The most intense efforts were in February — 359 nautical miles and in March — 331. The length of the trips ranged from 1 to 59 nautical miles (average — 23). Penola Strait and the French Passage were the main research locations (Fig. 1). Visual observations were conducted under good or moderate weather conditions (Beaufort Sea state ≤ 2). Cetaceans were detected with the naked eye, and 10× binoculars were also used for observations. The following data were collected: GPS tracks and observational effort, weather conditions, group size, composition, and behavior.

2.2 Photo-identification

To confirm species identification and for the purpose of photo-identification, 298 photographic images of the Antarctic minke whales were taken using professional digital single-lens reflex cameras with telephoto zoom lenses: Canon EOS 70D and Canon EOS 7D

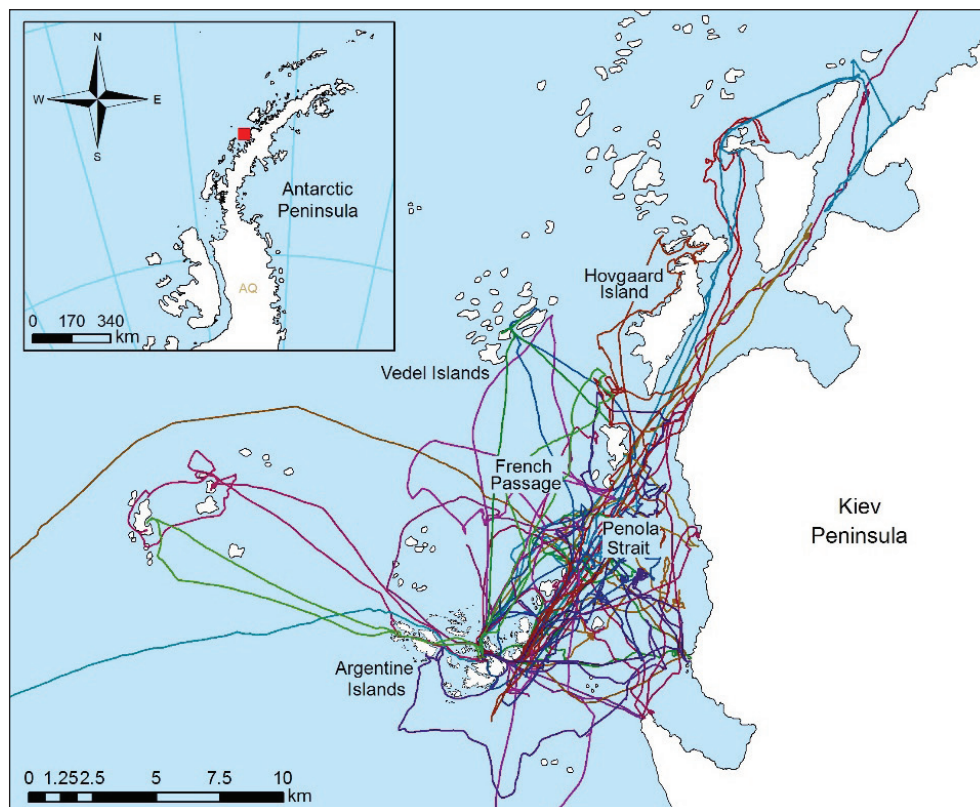


Figure 1. Study area and research effort: main GPS tracks of zodiacs and sailing boats

digital cameras with Canon EF 100–300mm f/4.5–5.6 USM and Canon EF 100–400mm f/4.5–5.6L IS II USM lenses. Photo-identification has been used to recognize and re-sight individual Antarctic minke whales. High-quality images of dorsal fin profiles, body scars and pigmentation patterns have been used for the identification of common minke whales (*Balaenoptera acutorostrata* Lacépède, 1804) since the late 1970s (Dorsey, 1983). The same patterns were used to identify individual whales in our study of Antarctic minke whales. The best photographs of the identified whales were added to the initiated photo-identification catalogue of the species.

3 Results and discussion

3.1 Sightings of Antarctic minke whales

There were encountered 13 Antarctic minke whales in 7 sightings during 5 of 35 yacht and boat cruises (Fig. 2).

The encounter rate was low — only 0.015 whales per nautical mile. Which is significantly lower than in the ship-based studies conducted in the area of Antarctic Peninsula during the 1998–1999 summer season, when minke whales encounter rate was 0.14 (Secchi et al., 2001), and in 2016 — 0.12 (Öztürk et al., 2017).

Antarctic minke whales were encountered in 5% of the total sightings, while the humpback whales prevailed (94%), and killer whales (*Orcinus orca* Linnaeus, 1758) were the least numerous (1%). These rates for the minke whales are significantly lower than in other studies. During the ship-based surveys conducted in the waters of Western Antarctic Peninsula since the beginning of 2000s, minke whales made 20–40% of total encounters of both minke and humpback whales (Thiele et al., 2004; Friedlaender et al., 2006; Öztürk et al., 2017).

However, such a significant difference in encounter rates could be partially caused by the

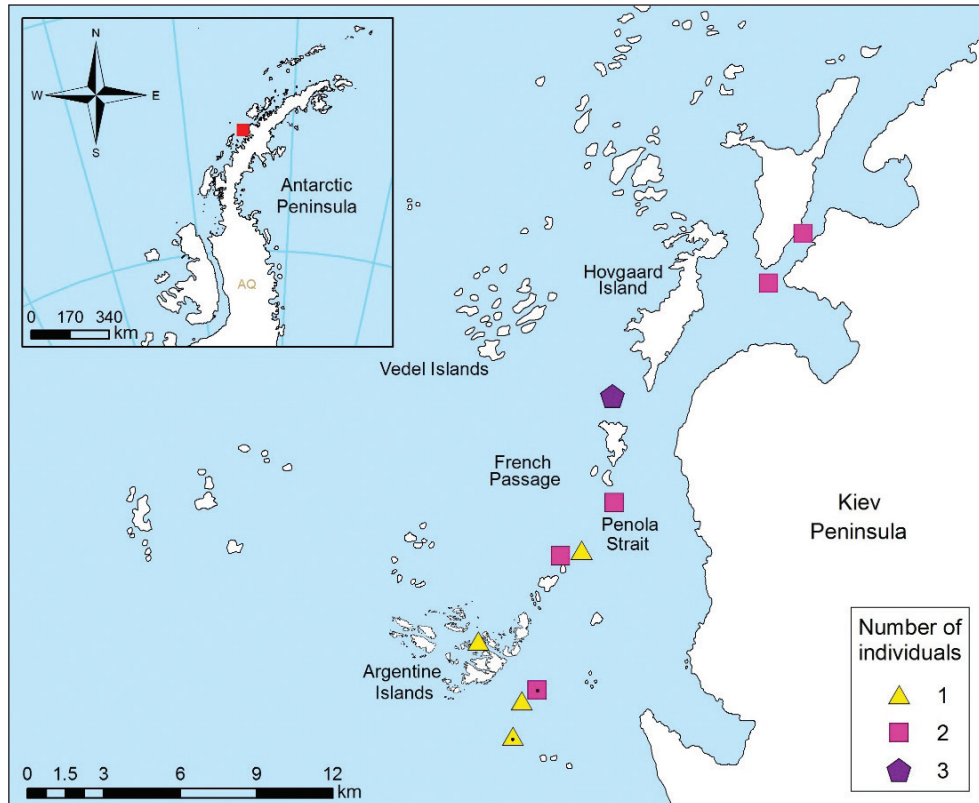


Figure 2. Distribution of the sighted Antarctic minke whales (symbols with dots inside indicate whales observed from the shore)

specifics of the survey methods: observations from the height of the bridge of a ship are supposed to be more accurate than from the lower height of a boat or yacht, in particular due to such limitations as small size of minke whales, their inconspicuous blows, ice-dependent and avoidant behavior.

Minke whales were encountered in different months: January 22 (2 sightings), February 19 (2), February 20 (2), March 1 (1), and March 30 (1).

Also, 3 more whales were opportunistically seen in Penola Strait from the top of Galindez Island: February 20 (1 sighting), and February 27 (1).

There were single whales encountered, and small groups of up to 3 specimens (Med = 2). In the previous study conducted in the same area in 2016, the group sizes of minke whales also ranged between 1 and 3 (Öztürk et al., 2017).

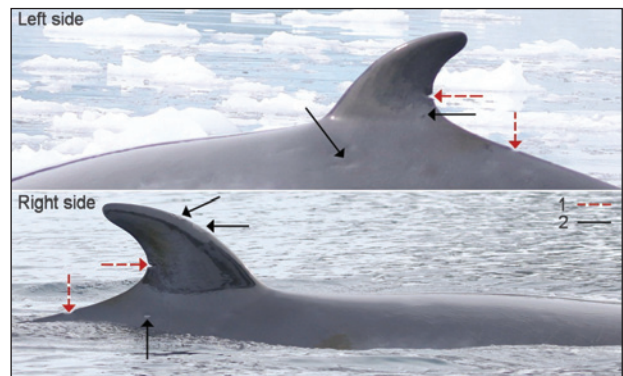


Figure 3. Catalogue-quality photo-identification images of an adult Antarctic minke whale specimen, containing the main (1) and some additional or temporal markings (2)

At least 2 individuals were identified as juveniles. Primary behavior for whales in 7 sightings was foraging, and 2 groups were observed travelling.

3.2 Photographic identification of specimens

A total 9 individuals of the Antarctic minke whales were photo-identified during the survey. Images of both sides were obtained for seven specimens (Fig. 3). Also, photos of only the right sides were taken for two whales, including a juvenile one with no significant markings. No matches were found between the different encounters of the Antarctic minke whales. Best high-quality photos were compiled into photo-identification catalogue.

4 Conclusions

Sightings of Antarctic minke whales occurred throughout the research period. Our pilot study indicates summer and early autumn presence of the Antarctic minke whales in the area adjacent to the Kiev Peninsula of the West Antarctica. But encounter rates seem to be low in comparison with results of some previous surveys.

Results of this initial effort of the cetacean studies in the framework of the Ukrainian Antarctic expeditions based at the Akademik Vernadsky station show our ability to monitor Antarctic minke whales through regular boat surveys, using methods of visual observations and photo-identification. As a part of long-term year-round cetacean research, regular visual coast-based monitoring and passive acoustic monitoring should be also performed to better understand seasonal distribution and density dynamics of minke whales in the area. The initiated photo-identification catalogue of the Antarctic minke whale will be complemented during the multi-year studies and used to investigate the movements, population structure and seasonal habitats of the whales utilizing the waters of Antarctic Peninsula. These tasks are listed as a priority for future research of minke whales' populations (Risch et al., 2019). Long-term monitoring is essential for understanding the ecology and population dynamics of the Antarctic minke whales in rapidly changing marine environment of the Antarctic Peninsula.

Conflict of Interest. The author declares that there is no conflict of interest.

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Виявлення смугачів антарктичних, *Balaenoptera bonaerensis*, поблизу півострова Київ (Західна Антарктида) під час літнього періоду 2019 року

Реферат. В районі Антарктичного півострова темпи зміни клімату є одними із найшвидших на Землі. Води Західної Антарктиди є важливим районом для живлення антарктичних смугачів (*Balaenoptera bonaerensis*). Метою дослідження було виявлення присутності антарктичних смугачів в літній період та в першій половині осені, в районі що прилягає до півострова Київ (Західна Антарктида), та оцінити зустрічальність виду в цьому районі. В рамках довгострокової програми моніторингу китоподібних на антарктичній станції «Академік Вернадський», поблизу півострова Київ було ініційовано фото-ідентифікаційні дослідження китоподібних з човнів. З 22 січня по 7 квітня 2019 року було здійснено 35 рейсів на моторних човнах та яхтах загальною довжиною 821 морську милю. Було виявлено 13 особин антарктич-

них смугачів в 7 спостереженнях. Частота зустрічей становила 0,015 китів на морську милю. Лише у 5% від загальної кількості спостережених китів було виявлено антарктичних смугачів. Ще 3 китів вдалося побачити з вершини острова Галіндез. Серед китів були як поодинокі особини, так і невеликі групи розміром до 3 звірів ($Med = 2$). Щонайменше 2 особини були ювенільними. Під час 7 спостережень кити живилися, а у 2 випадках подорожували. Було фотоідентифіковано 9 особин смугачів антарктичних, повторних зустрічей тих самих особин не виявлено. Найкращі фотографії було використано для створення ідентифікаційного каталогу виду. Проведене пілотне дослідження вказує на присутність смугачів антарктичних влітку та в першій половині осені в районі, прилеглому до півострова Київ. Але зустрічальність виявляється низькою у порівнянні з результатами деяких попередніх досліджень, що частково може бути пов'язано з методикою досліджень, бо в попередніх випадках спостереження здійснювали з великих суден, а при спостереженні з човнів ймовірність не побачити цього невеликого кита з невиразним фонтаном є вищою. Отримані результати підтверджують можливість досліджень китоподібних та зокрема антарктичних смугачів в акваторії, що прилягає до станції «Академік Вернадський»; подальший комплексний моніторинг важливий для розуміння екології та динаміки популяції цих китів в умовах Антарктичного півострова, що швидко змінюються.

Ключові слова: Антарктичний півострів, Balaenopteridae, китоподібні, розподіл, фотоідентифікація