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## Current status of *Belgica antarctica* Jacobs, 1900 (Diptera: Chironomidae) distribution by the data of Ukrainian Antarctic Expeditions

**Abstract.** Given the recent climate changes and their impact on the Antarctic Peninsula ecosystems, the emergence of invasive species, and increased tourism activity in this region, monitoring changes in the habitats of species native to the Antarctic Peninsula region is necessary. One such species is the Antarctic midge *Belgica antarctica* (Chironomidae). This insect is endemic to the Antarctic Peninsula and adjacent islands. Thorough studies of changes in the range of this species have not been performed in recent decades. In this study, we present the area of *Belgica antarctica* according to the collections of biological samples during 2007–2021 (XII, XIV, XVI, XXIV, and XXV Ukrainian Antarctic Expeditions). This Antarctic midge was recorded at 26 localities on the Antarctic Peninsula and 212 localities on 55 surrounding islands between 66°08'38.4" S, 65°43'37.1" W (Cape Even- sen, Stresher Peninsula, opposite the Marie Island, west coast of Graham Land) and 62°11'44.7" S, 58°57'40.6" W (King George Island, South Shetland Islands) from south-west to north-east.

**Keywords:** Antarctic midge, Antarctic Peninsula, chironomids, endemic species, polar insect

### 1 Introduction

*Belgica antarctica* Jacobs, 1900 (Diptera: Chironomidae) is chironomid midge, an endemic to the maritime Antarctic (Janetschek, 1970; Sugg et al., 1983; Richard et al., 1994; Convey & Block, 1996; Allegrucci

et al., 2012; Chown & Convey, 2016; Kozeretska et al., 2021), one of two native species of insects to this region — the other one is *Parochlus steinenii* Gercke, 1889 (Diptera: Chironomidae), which also occurs in southern South America and sub-Antarctic South Georgia (Convey & Block, 1996; Allegrucci et al., 2006; Chown

& Convey, 2016; Contador et al., 2020; Gañan et al., 2021; Kozeretska et al., 2021).

*Belgica antarctica* is well-known for its physiological, biochemical, genomic, and life-history features, which help this species to survive in extreme environments (Kozeretska et al., 2021). Traits of the life cycle of this midge are also interesting: unlike most other Chironomidae, it lasts two years (Sugg et al., 1983; Usher & Edwards, 1984; Convey & Block, 1996; Rinehart et al., 2006; Kozeretska et al., 2021). The lengthening of the life cycle is a peculiarity of polar invertebrates compared to phylogenetically related species from temperate, tropical, and subtropical regions (Convey, 1996; Søvik, 2002; 2003; Rinehart et al., 2006).

The distribution of *B. antarctica* has been described in few works (Gressitt, 1967; Wirth & Gressitt, 1967; Peckham, 1971; Convey & Block, 1996; Allegrucci et al., 2006; Harada et al., 2014). According to the literature, the southernmost confirmed record of this species is Refuge Islands (68°21' S, 67°08' W; Marguerite Bay) and the northernmost – Elephant Island (61°10' S, 55°14' W) (Usher & Edwards, 1984). The first published record of *B. antarctica* in the vicinity of Ukrainian Antarctic Akademik Vernadsky station, former British Faraday Station, is dated 1904. The samples were collected from several sites on Booth Island (65°4'48" S, 64°0'0" W) and Hovgaard Island (65°05' S, 64°05' W) (Roubar, 1906). It should be noted that the first record of this species on Galindez Island (Argentine Islands, Wilhelm Archipelago, where the Akademik Vernadsky station is located) is dated January 1963 (Wirth & Gressitt, 1967).

Considering that the ability of a species to adapt to environmental changes is reflected in the area of its distribution (Nunney, 2015), it is possible to expect changes in the distribution of *B. antarctica*. Climate changes have manifested in Antarctic ecosystems (Fowbert & Smith, 1994; Frenot et al., 2005; Convey & Smith, 2006; Parnikoza et al., 2009; Turner et al., 2014; Loisel et al., 2017; Sancho et al., 2017; Convey & Peck, 2019; Bargagli, 2020; Savenets et al., 2020; Bokhorst et al., 2021). Moreover, Kozeretska et al. (2021) proposed to consider *B. antarctica* as a model organism for studying adaptive mechanisms of survival under climate changes.

The information about the distribution of *B. antarctica* is obsolete, incomplete, and fragmentary, lacking coordinates of most sampling points. Therefore, it is necessary to study the current range of *B. antarctica* to initiate monitoring its changes. Our study is a part of this research.

## 2 Materials and methods

All data represented in this study are based on 323 invertebrate samples made in 2007–2010, 2012, and 2019–2021 (XII, XIV, XVI, XXIV, and XXV Ukrainian Antarctic Expeditions).

Samples were collected by the authors of this paper mostly from locations in the Wilhelm Archipelago and Kyiv Peninsula regions. But some of the materials were collected on several sites in the Palmer Archipelago, South Shetland Islands, Pefaur Peninsula, Arctowski Peninsula, and Graham Land.

Both the eclector (Golub et al., 1980; Protsenko, 2012) and individual catching were used for collecting samples. After it, the samples were preserved in 96% or 70% ethanol or 3 : 1 ethanol-acetic acid or ethanol-glycerin fixatives, deep-frozen (–20 °C), and then transported to Ukraine for analysis.

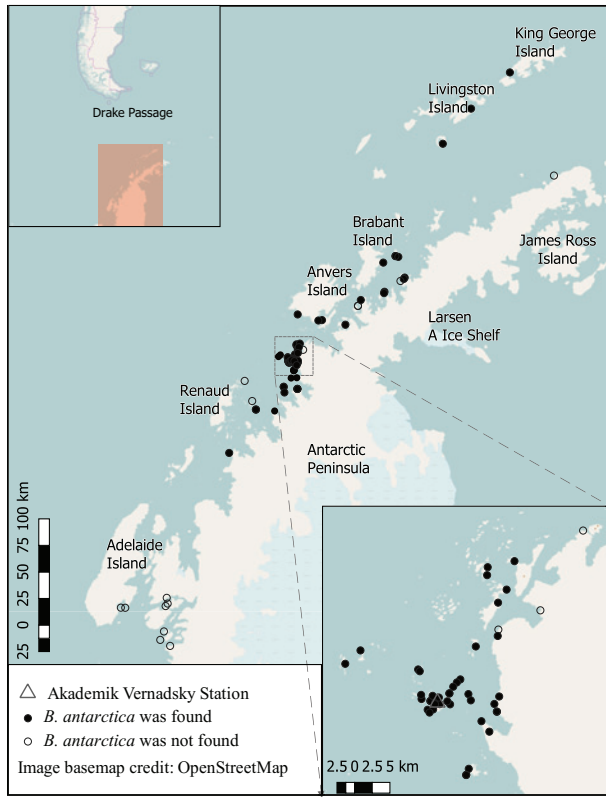
The species was identified according to Wirth & Gressitt (1967) and Usher & Edwards (1984), using stereoscopic microscopes: Bresser Advance ICD 10x-160x (Germany) and Olympus SZX12 (China).

A distribution map of *B. antarctica* was created using QIGS 3.10.10 (<https://www.qgis.org/en/site/forusers/download.html>).

The collected material was also used to perform genetic and cytogenetic (Kovalenko et al., 2021; Michailova et al., 2021a), morphological (Michailova et al., 2021b), biotic and cenotic studies (Polishuk et al., 2009; Dykyy et al., 2012; Caruso et al., 2013; Trokhymets et al., 2014).

## 3 Results

*B. antarctica* was found in Bryophyte carpet and mat subformation on *Sanionia* sp. Loeske, 1907 (Amblystegiaceae), *Warnstorfia fontinaliopsis* (Müll.Hal.) Ochyra, 2001 (Amblystegiaceae), and other short cushion



**Figure.** The distribution of *Belgica antarctica* in line with the data of Ukrainian Antarctic Expeditions

mosses (in some cases, with add of flowering plants: *Deschampsia antarctica* È. Desv. 1854 (Poaceae)); alga subformations (*Prasiola crispata* (Lightfoot) Kützing 1843, (Prasiolaceae); tall moss turf subformations (*Polytrichum strictum* Menzies ex Brid., 1801 (Polytrichaceae)); short moss turf and cushion subformations (undetermined Bryophytes); nesting and feeding areas of birds: kelp gulls (*Larus dominicanus* Lichtenstein, 1823 (Lariidae)) and cormorants (*Phalacrocorax atriceps* King, 1828 (Phalacrocoracidae)) (Appendix).

It should be noted that at all sites with *B. antarctica* there were found larvae (mostly — fourth-instar), nevertheless at some sites pupae and adults were also collected.

Based on the results of five Ukrainian Antarctic Expeditions, *B. antarctica* was found in 238 samples from 212 localities on 55 islands and 26 localities on the Antarctic Peninsula (Figure, Appendix). During these

expeditions, approximately 5 000 individuals of *B. antarctica* were collected.

According to these data, this midge was recorded between 66°08'38.4" S, 65°43'37.1" W (Cape Evensen, Stresher Peninsula, opposite the Marie Island, west coast of Graham Land) and 62°11'44.7" S, 58°57'40.6" W (King George Island, South Shetland Islands) from south-west to north-east.

#### 4 Discussion

Many previous works, which included the collections of *B. antarctica*, were indicated large islands without a list of accurate coordinates of the samples collections or archipelagos only, instead of individual islands. That is why it is difficult to say about possible changes in the range of this species. The discrepancies of our data with previous works can be caused by the limitations of our materials, the inability to get the names of all islands from these works, and by lack of precise coordinates in the body of literature. It should be noted that on all islands, individuals of *B. antarctica* were collected where this species had been previously registered. However, we have noted 42 mostly small islands (Wilhelm Archipelago, Palmer Archipelago, South Shetland Islands, and other islands of West coast of Graham Land) where there is no literature data about the presence of *B. antarctica* in their area (see Appendix).

According to the results of the five expeditions, there were no significant changes in the distribution of *B. antarctica* in the more detailed regularly studied regions (Wilhelm Archipelago and Kyiv Peninsula) over the past 14 years. This may be because these studies' main purpose was registering *B. antarctica* in the studied areas rather than monitoring its spread. In recent years there have been changes in the distribution of at least one species-consort of *B. antarctica* — *D. antarctica* (Fowbert & Smith, 1994; Parnikoza et al., 2011; Torres-Mellado et al., 2011; Vera et al., 2013). We can assume that they will be reflected in the distribution of this midge.

It is also important to note the appearance of alien species in the Antarctic Peninsula and adjacent islands (Frenot et al., 2005; Hughes et al., 2020; Bokhorst et

al., 2021); in addition, a surge in tourism activity has been observed in this region in the XXI century (Chwedorzewska et al., 2020; Yevchun et al., 2021). That can affect both ecosystems and separate species' ranges (Chwedorzewska et al., 2020). Due to these facts, it is necessary to keep monitoring the Antarctic biota to identify changes and make forecasts.

**Data availability.** All data can be found within the article and Appendix.

**Author contributions.** PK, VG — conceptualization; VT, IP, OS, AD, ID, MN — collecting samples; PK, VT — identification of samples; YuP — map preparation; PK, IP — Appendix preparation; PK, VG — writing the first draft of the manuscript, IK — project administration. Each author contributed to the analysis and discussion of the manuscript.

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**Conflict of Interest.** The authors vouch that they have no conflict of interest.

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### Сучасне поширення *Belgica antarctica* Jacobs, 1900 (Diptera: Chironomidae) за даними Українських антарктичних експедицій

**Реферат.** Враховуючи останні зміни клімату та їхній вплив на екосистеми Антарктичного півострова, а також появу інвазивних видів та посилення туристичної активності у цьому регіоні, необхідно відслідковувати зміни у місцях проживання аборигенних для регіону Антарктичного півострова видів. Одним із таких видів є *Belgica antarctica* з родини дзвінцевих комарів (Chironomidae). Ця комаха є ендеміком Антарктичного півострова та прилеглих островів. Грунтовні дослідження щодо змін поширення зазначеного виду протягом останніх десятиліть не здійснювалися. У цьому дослідженні ми представляємо ареал *Belgica antarctica* згідно зі зборами біологічних зразків протягом 2007–2021 років (XII, XIV, XVI, XXIV та XXV Українські антарктичні експедиції). Цей антарктичний комар-дзвінець був зафіксований у 26 точках на Антарктичному півострові та у 212 точках на 55 навколишніх островах від 66°08'38,4" пд.ш., 65°43'37,1" зх.д. (мис Евенсен, півострів Стрешер, навпроти острова Марі, західне узбережжя Землі Греяма) до 62°11'44,7" пд.ш., 58°57'40,6" зх.д. (острів Кінг-Джордж, Південні Шетландські острови) з південного заходу на північний схід.

**Ключові слова:** антарктичний комар-дзвінець, Антарктичний півострів, полярна комаха, ендемічний вид, хірономіди

## APPENDIX

**Table 1.** Information about sites for which *Belgica antarctica* was recorded during XII (2007–2008), XIV (2009–2010), XVI (2011–2012), XXIV (2019–2020), and XXV (2020–2021) Ukrainian Antarctic Expeditions. The names of islands on which *B. antarctica* was recorded for the first time (based on the analysis of literature data) by samples collections during the Ukrainian Antarctic Expeditions, highlighted in **bold**

Site	Year	Latitude	Longitude	Biotope
Galindez Island	2007	–65.247726	–64.240164	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.246200	–64.249050	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.245650	–64.252250	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.251133	–64.242617	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Galindez Island	2007	–65.246633	–64.248833	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> , <i>Sanionia</i> sp.) with add of <i>Polytrichum strictum</i>
Galindez Island	2007	–65.245067	–64.254717	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with add of <i>Polytrichastrum alpinum</i> and filamentous algae
Galindez Island	2008	–65.245017	–64.255500	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> , <i>Sanionia</i> sp.) with add of <i>Polytrichum strictum</i>
Petermann Island	2007	–65.172333	–64.137833	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.173983	–64.136367	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.173733	–64.134900	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.173800	–64.134667	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.173150	–64.132350	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.172567	–64.134700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.172250	–64.134900	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.172200	–64.138633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.177017	–64.138033	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.176017	–64.140000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.175733	–64.140750	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.178217	–64.144117	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.178200	–64.143483	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.177167	–64.145183	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.177100	–64.143633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.174850	–64.141250	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2008	–65.165767	–64.152033	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2008	–65.172533	–64.139050	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2007	–65.247483	–64.084683	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Fanfare Island</b>	2007	–65.216500	–64.188267	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Fanfare Island</b>	2007	–65.215967	–64.189567	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)

Site	Year	Latitude	Longitude	Biotope
<b>Irizar Island</b>	2007	-65.220467	-64.196633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Irizar Island</b>	2007	-65.220383	-64.196783	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Irizar Island</b>	2007	-65.220317	-64.198833	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Uruguay Island</b>	2007	-65.247967	-64.219450	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Berthelot Island	2007	-65.329217	-64.162767	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Black Island</b>	2007	-65.257867	-64.283583	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Black Island</b>	2007	-65.257683	-64.278683	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Leopard Island	2007	-65.254783	-64.287783	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Leopard Island	2007	-65.254867	-64.287000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Booth Island	2007	-65.063700	-64.043050	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Booth Island	2007	-65.064233	-64.040033	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Skua Island</b>	2007	-65.254383	-64.271033	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Skua Island</b>	2007	-65.252333	-64.254250	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2007	-65.235250	-64.158383	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2007	-65.234533	-64.163300	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2007	-65.235033	-64.163733	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2007	-65.233700	-64.161967	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2007	-65.234850	-64.157833	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2007	-65.269250	-64.124050	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Pléneau Island	2007	-65.099833	-64.053767	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Darboux Island	2008	-65.410700	-64.234217	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Darboux Island	2008	-65.410567	-64.234983	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Perez	2008	-65.404133	-64.099867	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island of the Lippmann Islands</b>	2008	-65.498033	-64.413117	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
cape close to Mount Waugh, Graham Land	2008	-65.518833	-64.082033	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (1)* of The Barchans</b>	2008	-65.241217	-64.306433	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (2) of The Barchans</b>	2008	-65.236083	-64.307700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island, Cruls Islands</b>	2008	-65.196750	-64.538667	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island, Cruls Islands</b>	2008	-65.190317	-64.537333	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island, Roca Islands</b>	2008	-65.178983	-64.492017	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.247603	-64.243728	Alga subformation ( <i>Prasiola crispa</i> )
Petermann Island	2020	-65.176912	-64.138783	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with green macroalgae ( <i>Prasiola crispa</i> ) and penguin feathers



Site	Year	Latitude	Longitude	Biotope
Petermann Island	2020	-65.178403	-64.145205	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with green macroalgae ( <i>Prasiola crispa</i> ) and penguin feathers
Petermann Island	2020	-65.177362	-64.144209	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and penguin feathers
Petermann Island	2020	-65.173955	-64.138582	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with green macroalgae ( <i>Prasiola crispa</i> ) and penguin feathers
Petermann Island	2020	-65.172415	-64.137016	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (1) of The Barchans</b>	2020	-65.241830	-64.300590	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae ( <i>Prasiola crispa</i> )
<b>un-named island (1) of The Barchans</b>	2020	-65.241830	-64.300590	Tall moss turf subformation ( <i>Polytrichum strictum</i> )
<b>Central of the Three Little Pigs Islands</b>	2020	-65.242510	-64.273960	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and limpet shells
<b>Central of the Three Little Pigs Islands</b>	2020	-65.242160	-64.274410	Nesting area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp. and other short cushion moss, limpet shells
<b>Eastern of the Three Little Pigs Islands</b>	2020	-65.242420	-64.271920	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> ) and limpet shells
<b>Western of the Three Little Pigs Islands</b>	2020	-65.243763	-64.279475	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae ( <i>Prasiola crispa</i> )
<b>Skua Island</b>	2020	-65.255110	-64.274800	Nesting or feeding area of <i>Larus dominicanus</i> : food remnants of <i>L. dominicanus</i>
<b>un-named island close to Winter Island</b>	2020	-65.254420	-64.274930	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Deschampsia antarctica</i> )
<b>un-named island close to Winter Island</b>	2020	-65.254420	-64.274930	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Winter Island</b>	2020	-65.249490	-64.272590	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Warnstorfia fontinaliopsis</i> and limpet shells
<b>Winter Island</b>	2020	-65.248667	-64.270233	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Indicator Island</b>	2020	-65.246020	-64.264860	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named biggest southernmost island of Forge Islands</b>	2020	-65.236860	-64.277180	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (2), Forge Islands</b>	2020	-65.237240	-64.272730	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island, Roca Islands</b>	2020	-65.178850	-64.491890	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island, Roca Islands</b>	2020	-65.178850	-64.491890	Alga subformation ( <i>Prasiola crispa</i> )
<b>un-named island, Roca Islands</b>	2020	-65.179830	-64.492310	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> ) and green macroalgae ( <i>Prasiola crispa</i> )
Galindez Island	2020	-65.244850	-64.255610	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae ( <i>Prasiola crispa</i> )

Continuation of Table 1

Site	Year	Latitude	Longitude	Biotope
Galindez Island	2020	-65.244850	-64.255610	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.244850	-64.255610	Alga subformation ( <i>Prasiola crispera</i> ) and penguin feathers
Galindez Island	2020	-65.244850	-64.255610	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Deschampsia antarctica</i> )
Galindez Island	2020	-65.245060	-64.252640	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., other short cushion moss and limpet shells
Galindez Island	2020	-65.245060	-64.252640	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Deschampsia antarctica</i>
Galindez Island	2020	-65.245060	-64.252640	Nesting or feeding area of <i>Larus dominicanus</i> : bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.), and limpet shells
Galindez Island	2020	-65.245500	-64.249520	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.247480	-64.252800	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with add of <i>Polytrichum strictum</i>
Galindez Island	2020	-65.247480	-64.252800	Nesting area of <i>Larus dominicanus</i> : <i>Warnstorfia fontinaliopsis</i> , <i>Polytrichum strictum</i> , and limpet shells
Galindez Island	2020	-65.247480	-64.252800	Bryophyte carpet and mat subformation ( <i>Deschampsia antarctica</i> and <i>Sanionia</i> sp.)
Galindez Island	2020	-65.248380	-64.245840	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Galindez Island	2020	-65.248380	-64.245840	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Deschampsia antarctica</i> and <i>Sanionia</i> sp.
<b>Irizar Island</b>	2020	-65.219390	-64.199790	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Irizar Island</b>	2020	-65.219390	-64.199790	Nest of <i>Larus dominicanus</i> : <i>Sanionia</i> sp.
<b>un-named island of the Argentine Islands</b>	2020	-65.225710	-64.209980	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Uruguay Island</b>	2020	-65.231770	-64.223380	Nest area of <i>Phalacrocorax atriceps</i> : <i>Sanionia</i> sp. and other short cushion moss
<b>Uruguay Island</b>	2020	-65.231740	-64.223530	Nest of <i>Phalacrocorax atriceps</i> : <i>Warnstorfia fontinaliopsis</i> , seaweed, and cormorant feathers
<b>Uruguay Island</b>	2020	-65.232810	-64.222490	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Lamy Island (Dannebrog Islands)</b>	2020	-65.084430	-64.106710	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Lamy Island (Dannebrog Islands)</b>	2020	-65.084260	-64.113300	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., other short cushion moss, and limpet shells
<b>Lamy Island (Dannebrog Islands)</b>	2020	-65.084150	-64.113210	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> ) and penguin feathers
<b>Elisabethinsel (Dannebrog Islands)</b>	2020	-65.075640	-64.099350	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., limpet shells and fur of seals
<b>Elisabethinsel (Dannebrog Islands)</b>	2020	-65.074360	-64.104940	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Booth Island	2020	-65.066680	-64.034180	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and penguin feathers
Booth Island	2020	-65.065970	-64.034360	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and other short cushion moss)

Site	Year	Latitude	Longitude	Biotope
Booth Island	2020	-65.065970	-64.034360	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and other short cushion moss)
Booth Island	2020	-65.066660	-64.023450	Nest of <i>Phalacrocorax atriceps</i> : limpet shells and penguin feathers
Nob Island	2020	-65.203920	-64.316790	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island close to Nob Island</b>	2020	-65.206160	-64.311780	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.247990	-64.242520	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp., <i>Warnstorfia fontinaliopsis</i> , and other short cushion moss) and limpet shells
Galindez Island	2020	-65.247500	-64.241250	Bryophyte carpet and mat subformation ( <i>Deschampsia antarctica</i> and <i>Sanionia</i> sp.)
Hovgaard Island	2020	-65.119340	-64.073410	Nest of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., <i>Warnstorfia fontinaliopsis</i> , <i>Polytrichum strictum</i> , <i>Usnea antarctica</i> , and feather
Hovgaard Island	2020	-65.119340	-64.073410	Short moss turf and cushion (undetermined Bryophytes)
Hovgaard Island	2020	-65.119430	-64.072650	Tall moss turf subformation ( <i>Polytrichum strictum</i> )
Hovgaard Island	2020	-65.119430	-64.072650	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
Hovgaard Island	2020	-65.120210	-64.069930	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Hovgaard Island	2020	-65.119960	-64.069160	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Hovgaard Island	2020	-65.120250	-64.066670	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2020	-65.131290	-64.124110	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae <i>Prasiola crispa</i>
Hovgaard Island	2020	-65.131320	-64.121450	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2020	-65.165860	-64.143990	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2020	-65.165860	-64.143990	Tall moss turf subformation ( <i>Polytrichum strictum</i> and other short cushion moss)
Petermann Island	2020	-65.165860	-64.143990	Bryophyte carpet and mat subformation ( <i>Deschampsia antarctica</i> and <i>Sanionia</i> sp.)
Petermann Island	2020	-65.165410	-64.148170	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae ( <i>Prasiola crispa</i> )
<b>Lahille Island</b>	2020	-65.533430	-64.328680	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Mount Waugh, Graham Land	2020	-65.518140	-64.083470	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> ) and other short cushion moss
Mount Waugh, Graham Land	2020	-65.519090	-64.082280	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp., <i>Warnstorfia fontinaliopsis</i> ) with add of <i>Polytrichum strictum</i>
Cape Perez	2020	-65.404130	-64.100000	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )

Continuation of Table 1

Site	Year	Latitude	Longitude	Biotope
Darboux Island	2020	-65.395267	-64.215683	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp., <i>Warnstorfia fontinaliopsis</i> ) and other short cushion moss, and limpet shells
Cape Perez	2020	-65.407730	-64.097250	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp.
Leopard Island	2020	-65.254860	-64.286860	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Leopard Island	2020	-65.255060	-64.286140	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and other short cushion moss, limpet shells, and fish remains
<b>Black Island</b>	2020	-65.258450	-64.278180	Nesting or feeding area of <i>Larus dominicanus</i> : penguin feathers, limpet shells, <i>Prasiola crispa</i> , <i>Warnstorfia fontinaliopsis</i> , and fur of seals
<b>Black Island</b>	2020	-65.257680	-64.283500	Nesting or feeding area of <i>Larus dominicanus</i> : penguin feathers, limpet shells, <i>Prasiola crispa</i> , <i>Warnstorfia fontinaliopsis</i> , and fur of seals
<b>Black Island</b>	2020	-65.258340	-64.282120	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Black Island</b>	2020	-65.257890	-64.284620	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (3) of The Barchans</b>	2020	-65.237010	-64.311910	Short moss turf and cushion (undetermined Bryophytes), limpet shells, and wool of fur seals
Galindez Island	2020	-65.247650	-64.250740	Tall moss turf subformation ( <i>Polytrichum strictum</i> and other short cushion moss)
Torgersen Island	2020	-64.771820	-64.074450	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Torgersen Island	2020	-64.771720	-64.075670	Alga subformation ( <i>Prasiola crispa</i> )
Torgersen Island	2020	-64.771760	-64.075530	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2020	-65.267660	-64.115930	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2020	-65.267660	-64.115930	Tall moss turf subformation ( <i>Polytrichum strictum</i> ) with add of <i>Sanionia</i> sp.
Cape Tuxen	2020	-65.267040	-64.115960	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Rasmussen Island</b>	2020	-65.257190	-64.077070	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Warnstorfia fontinaliopsis</i> , <i>Sanionia</i> sp., <i>Deschampsia antarctica</i> , limpet shells, fragment of fish, feathers
<b>Rasmussen Island</b>	2020	-65.256990	-64.078890	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Pléneau Island	2020	-65.102800	-64.047417	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> ) with green macroalgae ( <i>Prasiola crispa</i> )
Pléneau Island	2020	-65.102800	-64.047417	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Pléneau Island	2020	-65.102800	-64.047417	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island close to Berthelot Island</b>	2020	-65.336960	-64.170440	Alga subformation ( <i>Prasiola crispa</i> )
<b>un-named island close to Berthelot Island</b>	2020	-65.336960	-64.170440	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island close to Berthelot Island</b>	2020	-65.336740	-64.173870	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Grotto Island</b>	2020	-65.239370	-64.253620	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., other short cushion moss, green algae ( <i>Prasiola crispa</i> ), and limpet shells

Site	Year	Latitude	Longitude	Biotope
<b>Grotto Island</b>	2020	-65.238950	-64.256820	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
<b>Rasmussen Point</b>	2020	-65.247810	-64.084690	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with green macroalgae ( <i>Prasiola crispa</i> )
<b>Winter Island</b>	2020	-65.247500	-64.261950	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., limpet shells
<b>Winter Island</b>	2020	-65.248120	-64.264120	Alga subformation ( <i>Prasiola crispa</i> )
<b>Skua Island</b>	2020	-65.252210	-64.259860	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and green macroalgae ( <i>Prasiola crispa</i> )
un-named island (1) of the Yalour Islands	2020	-65.236610	-64.161740	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island (1) of the Yalour Islands	2020	-65.235320	-64.158760	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and penguin feathers
un-named island (1) of the Yalour Islands	2020	-65.233840	-64.161710	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island (1) of the Yalour Islands	2020	-65.235500	-64.155760	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Two Hummock Island</b>	2020	-64.171240	-61.718690	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
<b>Cobalescou Island</b>	2020	-64.179910	-61.649790	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Murray Island</b>	2020	-64.394356	-61.496695	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Lecointe Island</b>	2020	-64.23938	-62.01304	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
<b>Green Point</b>	2020	-64.40824	-61.51831	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
<b>un-named island near Enterprise Island</b>	2020	-64.540220	-61.983385	Nesting or feeding area of <i>Larus dominicanus</i> : undetermined Bryophytes
<b>Bryde Island</b>	2020	-64.87614	-62.92574	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Spigot Point	2020	-64.624631	-62.554717	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Jougla Point, Wiencke Island	2020	-64.829300	-63.495360	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Jougla Point, Wiencke Island	2020	-64.82907	-63.48868	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.), with <i>Polytrichum strictum</i> , <i>Prasiola crispa</i>
<b>Doumer Island</b>	2020	-64.833350	-63.577590	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Garcia	2020	-65.73547	-64.63110	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
<b>Lahille Island</b>	2020	-65.553605	-64.395064	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island close to Enterprise Island</b>	2020	-64.55345	-61.99451	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Duchaylard Island</b>	2020	-65.72158	-65.08225	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. dominates, <i>Warnstorfia fontinaliopsis</i> )
<b>Duchaylard Island</b>	2020	-65.72158	-65.08225	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., limpet shells

Site	Year	Latitude	Longitude	Biotope
Cape Evensen, Stresher Peninsula, opposite the Marie Island	2020	-66.143998	-65.726981	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and <i>Warnstorfia fontinaliopsis</i> )
Hovgaard Island	2021	-65.141150	-64.095030	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2021	-65.140720	-64.097980	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2021	-65.140220	-64.097180	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Hovgaard Island	2021	-65.141150	-64.095030	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.177167	-64.145183	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.172567	-64.134700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.177100	-64.143633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.178383	-64.144483	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.172333	-64.137833	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.177100	-64.143633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.172567	-64.134700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.172567	-64.134700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2021	-65.247889	-64.084056	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2021	-65.247917	-64.083611	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2021	-65.247778	-64.084556	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2021	-65.268139	-64.116083	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2021	-65.267667	-64.116583	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Skua Island</b>	2021	-65.250194	-64.273500	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Skua Island</b>	2021	-65.250194	-64.273500	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Skua Island</b>	2021	-65.250194	-64.273500	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.248194	-64.246139	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.248194	-64.246139	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.248194	-64.246139	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2021	-65.178383	-64.144483	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Winter Island</b>	2021	-65.247833	-64.267917	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Winter Island</b>	2021	-65.247472	-64.258722	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Winter Island</b>	2021	-65.247222	-64.255667	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Winter Island</b>	2021	-65.247806	-64.265361	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2021	-65.247917	-64.083611	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Grotto Island</b>	2021	-65.239389	-64.253750	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Corner Island</b>	2021	-65.245083	-64.232889	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Corner Island</b>	2021	-65.244167	-64.227917	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Uruguay Island</b>	2021	-65.234167	-64.221583	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Uruguay Island</b>	2021	-65.234167	-64.221583	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Pléneau Island	2021	-65.099722	-64.054000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Pléneau Island	2021	-65.099722	-64.054000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)

Site	Year	Latitude	Longitude	Biotope
Galindez Island	2021	-65.247389	-64.253361	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.247361	-64.250278	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.250833	-64.242083	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>un-named island (1) of The Barchans</b>	2021	-65.240556	-64.305222	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Edge Hill	2019	-65.238056	-64.070000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2019	-65.247819	-64.243342	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2019	-65.248333	-64.238889	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2020	-65.247222	-64.084722	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>Fanfare Island</b>	2020	-65.215556	-64.189167	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island (1) of the Yalour Islands	2020	-65.233611	-64.159722	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
<b>King George Island</b>	2020	-62.195750	-58.961267	Alga subformation ( <i>Prasiola crispa</i> )
<b>Half Moon Island</b>	2020	-62.595883	-59.897083	Alga subformation ( <i>Prasiola crispa</i> )
Deception Island	2020	-62.979117	-60.577450	Alga subformation ( <i>Prasiola crispa</i> )
Deception Island	2020	-62.979000	-60.555917	Alga subformation ( <i>Prasiola crispa</i> )
Lécuyer Point, Wiencke Island	2020	-64.829467	-63.489517	Alga subformation ( <i>Prasiola crispa</i> )
<b>un-named island (2) of the Yalour Islands</b>	2020	-65.242933	-64.156367	Alga subformation ( <i>Prasiola crispa</i> )
Galindez Island	2020	-65.246165	-64.248986	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.246369	-64.247143	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.248328	-64.246293	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2012	-65.282435	-64.100000	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Tuxen	2012	-65.16155	-64.07443	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)

\* Numbers in brackets near un-named islands mean that samples were collected on different un-named islands from one archipelago.

**Table 2.** Information about sites for which *Belgica antarctica* was not recorded during XII (2007–2008), XIV (2009–2010), XVI (2011–2012), XXIV (2019–2020), and XXV (2020–2021) Ukrainian Antarctic Expeditions

Site	Year	Latitude	Longitude	Biotope
Galindez Island	2007	–65.251000	–64.242633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.246367	–64.246667	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.248050	–64.241700	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2007	–65.247833	–64.252900	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.171217	–64.136500	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.174233	–64.140633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.178300	–64.140650	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.178383	–64.144483	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.178017	–64.146117	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.174350	–64.142267	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Petermann Island	2007	–65.177733	–64.146750	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Rasmussen Point	2007	–65.247750	–64.083600	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Uruguay Island	2007	–65.240133	–64.229950	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Berthelot Island	2007	–65.327583	–64.143667	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Berthelot Island	2007	–65.328900	–64.162633	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Booth Island	2007	–65.066850	–64.023800	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Skua Island	2007	–65.255150	–64.273117	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Skua Island	2007	–65.255150	–64.274783	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island of the Lippmann Islands	2008	–65.497967	–64.412600	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
King George Island	2020	–62.194954	–58.966338	Short moss turf and cushion (undetermined Bryophytes)
King George Island	2020	–62.195135	–58.966991	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with add of <i>Polytrichum strictum</i>
King George Island	2020	–62.193457	–58.971036	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) with add of undetermined Bryophytes
King George Island	2020	–62.189115	–58.968600	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cape Legoupil	2020	–63.322024	–57.899281	Alga subformation ( <i>Prasiola crispa</i> ) with fur of seals
Mount Scott, Kyiv Peninsula	2020	–65.153476	–64.072531	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Coast of Kyiv Peninsula near Girard Bay	2020	–65.129067	–63.944600	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island (1)* of The Barchans	2020	–65.241830	–64.300590	Fruticose lichen and moss cushion subformation ( <i>Usnea antarctica</i> )
Eastern of the Three Little Pigs Islands	2020	–65.243405	–64.270425	Short moss turf and cushion (undetermined Bryophytes), limpet shells
Western of the Three Little Pigs Islands	2020	–65.243770	–64.279290	Fruticose lichen and moss cushion subformation ( <i>Usnea antarctica</i> )
Skua Island	2020	–65.255180	–64.274500	Fragment of tall moss turf subformation ( <i>Polytrichum strictum</i> )
Skua Island	2020	–65.255180	–64.274500	Short moss turf and cushion (undetermined Bryophytes)
un-named island close to Winter Island	2020	–65.254420	–64.274930	Fruticose lichen and moss cushion subformation ( <i>Usnea antarctica</i> , <i>Xanthoria</i> sp., and other undetermined lichens)



Site	Year	Latitude	Longitude	Biotope
un-named island close to Winter Island	2020	-65.254420	-64.274930	Fruticose lichen and moss cushion subformation ( <i>Usnea antarctica</i> , <i>Xanthoria</i> sp., and other undetermined lichens)
un-named island close to Winter Island	2020	-65.254420	-64.274930	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
un-named island close to Winter Island	2020	-65.254420	-64.274930	Alga subformation ( <i>Prasiola crispa</i> )
Indicator Island	2020	-65.246020	-64.264860	Short moss turf and cushion (undetermined Bryophytes), limpet shells
un-named island (2), Forge Islands	2020	-65.237670	-64.273600	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., limpet shells, and penguin feathers
Green Island	2020	-65.322700	-64.150970	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Berthelot Island	2020	-65.336800	-64.174600	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Galindez Island	2020	-65.245500	-64.249520	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Sanionia</i> sp., limpet shells
Galindez Island	2020	-65.245500	-64.249520	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
Galindez Island	2020	-65.246160	-64.248270	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes)
Galindez Island	2020	-65.246160	-64.248270	Fragment of tall moss turf subformation ( <i>Polytrichum strictum</i> and undetermined Bryophytes)
Galindez Island	2020	-65.246160	-64.248270	Bryophyte carpet and mat subformation with <i>Sanionia</i> sp. and <i>Deschampsia antarctica</i>
Galindez Island	2020	-65.248380	-64.245840	Fragment of tall moss turf subformation ( <i>Polytrichum strictum</i> ) with add of <i>Sanionia</i> sp.
Nob Island	2020	-65.205150	-64.314320	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
un-named island close to Nob Island	2020	-65.205900	-64.311950	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.) and limpet shells
Galindez Island	2020	-65.248584	-64.238834	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Deschampsia antarctica</i> , undetermined Bryophytes, and limpet shells
Galindez Island	2020	-65.245720	-64.256820	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2020	-65.245720	-64.256820	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes)
Galindez Island	2020	-65.245720	-64.256820	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
Galindez Island	2020	-65.245720	-64.256820	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
Galindez Island	2020	-65.245930	-64.257560	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes)
Hovgaard Island	2020	-65.119340	-64.073410	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Hovgaard Island	2020	-65.119340	-64.073410	Fruticose lichen and moss cushion subformation ( <i>Usnea antarctica</i> and <i>Umbilicaria</i> sp.)
Petermann Island	2020	-65.165430	-64.142670	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes), limpet shells

Site	Year	Latitude	Longitude	Biotope
Torgersen Island	2020	-64.771580	-64.074220	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes) and green macroalgae ( <i>Prasiola crispa</i> )
Cape Tuxen	2020	-65.267660	-64.115930	Short moss turf and cushion (undetermined Bryophytes)
Rasmussen Island	2020	-65.257190	-64.077070	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes)
Rasmussen Point	2020	-65.247810	-64.084690	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> ), green macroalgae ( <i>Prasiola crispa</i> )
Winter Island	2020	-65.248320	-64.266020	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Deception Island	2020	-62.982130	-60.518980	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Two Hummock Island	2020	-64.171240	-61.718690	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> and <i>Sanionia</i> sp.) and <i>Usnea antarctica</i>
Eckener Point	2020	-64.429295	-61.599018	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Cuverville Island	2020	-64.684360	-62.622660	Fragment of tall moss turf subformation ( <i>Polytrichum strictum</i> )
Cuverville Island	2020	-64.68436	-62.62266	Bryophyte carpet and mat subformation ( <i>Warnstorfia fontinaliopsis</i> )
Wienckie Island	2020	-64.825460	-63.481160	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp. and undetermined Bryophytes), limpet shells
False Cape Renard	2020	-65.02776	-63.81460	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Lagoon Island	2020	-67.59465	-68.23127	Nesting or feeding area of <i>Larus dominicanus</i> : <i>Polytrichum strictum</i> , <i>Sanionia</i> sp., <i>Deschampsia antarctica</i> , limpet shells, and penguin feathers
Hook Island	2020	-65.638110	-65.172240	Fragment of tall moss turf subformation ( <i>Polytrichum strictum</i> and undetermined Bryophytes) with add of <i>Sanionia</i> sp.
un-named island, Pitt Islands	2020	-65.43937	-65.35348	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Lagotellerie Island	2020	-67.88486	-67.38765	Alga subformation ( <i>Prasiola crispa</i> ) with fur of seals
Camp Point on Fallières Coast	2020	-67.93874	-67.14997	Bryophyte carpet and mat subformation with <i>Deschampsia antarctica</i>
Horseshoe Island	2020	-67.80884	-67.29895	Short moss turf and cushion (undetermined Bryophytes)
Pourquoi Pas Island	2020	-67.57904	-67.25851	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Blaiklock Island	2020	-67.55621	-67.20963	Bryophyte carpet and mat subformation with <i>Sanionia</i> sp. and <i>Deschampsia antarctica</i>
Léonie Island	2020	-67.59375	-68.33702	Bryophyte carpet and mat subformation with <i>Sanionia</i> sp., <i>Warnstorfia fontinaliopsis</i> , <i>Deschampsia antarctica</i>
Arrowsmith Peninsula	2020	-67.504220	-67.231650	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Winter Island	2021	-65.250111	-64.256250	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Grotto Island	2021	-65.239389	-64.253750	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.247444	-64.241861	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Galindez Island	2021	-65.246139	-64.248917	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Central of the Three Little Pigs Islands	2021	-65.242083	-64.274917	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Eastern of the Three Little Pigs Islands	2021	-65.242139	-64.271194	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)
Indicator Island	2021	-65.245861	-64.265111	Bryophyte carpet and mat subformation ( <i>Sanionia</i> sp.)

\* Numbers in brackets near un-named islands mean that samples were collected on different un-named islands from one archipelago.