УКРАЇНСЬКИЙ АНТАРКТИЧНИЙ ЖУРНАЛ
УАЖ, №15, 106—113 (2016)

UDK 598.2(292.3)

THE TOPICAL SEGREGATION OF PENGUINS OF GENUS *PYGOSCELIS* AND ANTARCTIC SHAGS (*PHALAROCORAX BRANSFIELDENSIS*)

V. Smagol[1], S. Molchanoff[2]

[1] I. I. Schmalhausen Institute of Zoology National Academy of Sciences of Ukraine. 15 B. Khmelnitskogo str. Kyiv, Ukraine, v.smagol@gmail.com
[2] The Department of Geology, Carraway building 909 Antarctic Way Florida State University Tallahassee, FL 32306 USA, smolchanoff@yahoo.com

1. Introduction

There are ecological groups of avifauna existed on the western part of Graham Land that could be differentiated according to the life mode as for the trophic and nest behavior (Пекло, 2007). The most specialized group is the group of so-called "divers" which occupied the water volume in order to get the food (krill and fish). Besides penguins of genus Pygoscelis, Antarctic shags are also taken into consideration. It has a social mechanism of behavior both for hunting and for colony nesting (Попов, 1979).

The trophic relations are the basis for multispecies interactions. The animals of the single trophic level are associated with mutual food objects (Шилов, 1998). In case of the studied ecological group, the krill (Euphausia superba) being the main trophic component makes the highest biomass with a significant productivity which can give a supply for all existing species in this environmental conditions. Thus, the trophic competition has formal features and there are not any real antagonistic relations there. In spite of all and looking at identical biotopes and a high density of settlements, spatial distribution of birds it is a reflection of a topical bird contest. Among mixed settlements, some species can use the features of micro relief, which decreases contest interactions to some extent, and of course, it does not erase it totally.

2. Materials and Study

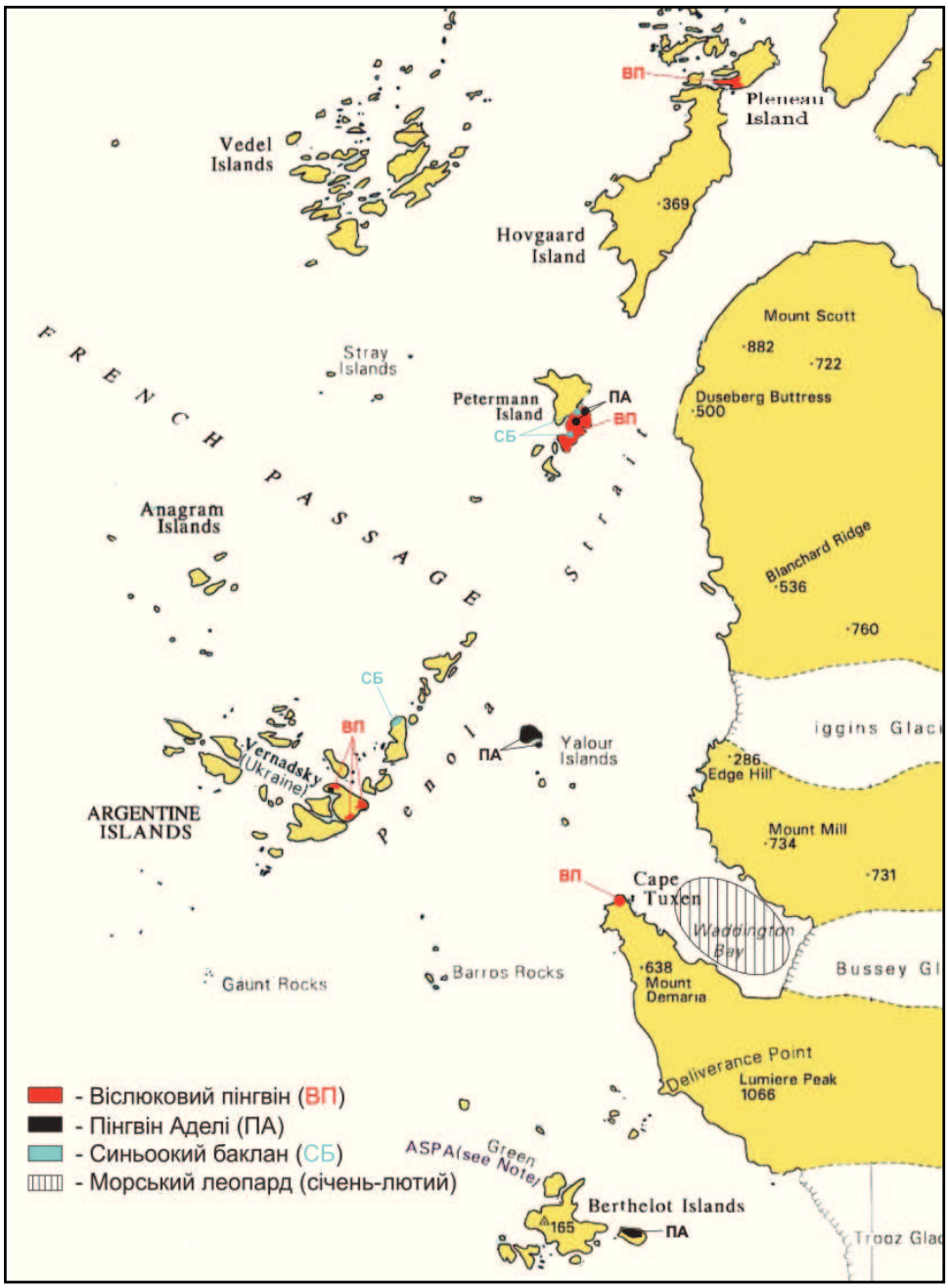
In 2013 the study took into consideration the location of Ukrainian Antarctic Station "Academician Vernadsky" (the former British Antarctic Station "Faradey) besides Argentine's islands Yalour and Pitermann which are located on the western shelf of Antarctic peninsula (Gozhyk et all 2002) to west from Graham Land (from 2 to 12 km). Coordinates for archipelago Argentine's islands are 65º 13′ – 65º16′ S, 64º12′– 64º21′ W. Yalour Island – 65º10′ S, 64º08′ W. Pitermann Island – 65º11′ S, 64º10′ W.

Argentine's islands and Yalour Island are not high; the highest point (65m) is located on Uruguay Island. The highest point for Pitermann Island is 127m. Inner, narrow water streams among islands make the storm influences smoother therefore the places for nesting are quite good for the majority of bird species. The land area for our study was Galindes Island (pic. 1) where the mono settlement of Gentoo penguins (*Pygoscelis papua*) is located and Uruguay Island with a small colony of Antarctic shags (*Phalacrocorax bransfieldensis*) there and Yalour Island where during the long period of time the colony of

Adelie Penguins (*Pygoscelis adeliae*) exists. The Pitermann Island where the multispecies associations formed and it includes the whole representatives of the above-mentioned species.

Comparing it all, it was also paid an attention to the environmental conditions for Gentoo Penguins on Pleneau Island and Tuxen Cape, as for Adelie Penguins – Barthelot Island.

3. Analysis of Study



Pic. 1. Location of nest colonies of penguins and Antarctic shags

Orographic peculiarities for Yalour Island reflect the specific nest station for Adelie Penguins. Stone rocks with a flat surface (pic. 2) present them.

Pic. 2. Nest station of Adelie Penguines

In its turn, the rocky missives of Galindez Island (the station of Gentoo Penguins) have a crossed relief with sharp edges of Rocks (pic. 3).

Pic. 3. Nest station of Gentoo Penguins

Besides, for Gentoo Penguins the priority is given to rocks located near the water. Adelie Penguins do not occupy stone slops near the sea but they try to get to the rocks that located in the central part of the island.

Nest stations of Antarctic shags on Uruguay Island locate on rocky slopes (up to 30 m above sea level) and it makes these rocky slopes uninhabited for any other species of penguins (pic. 4).

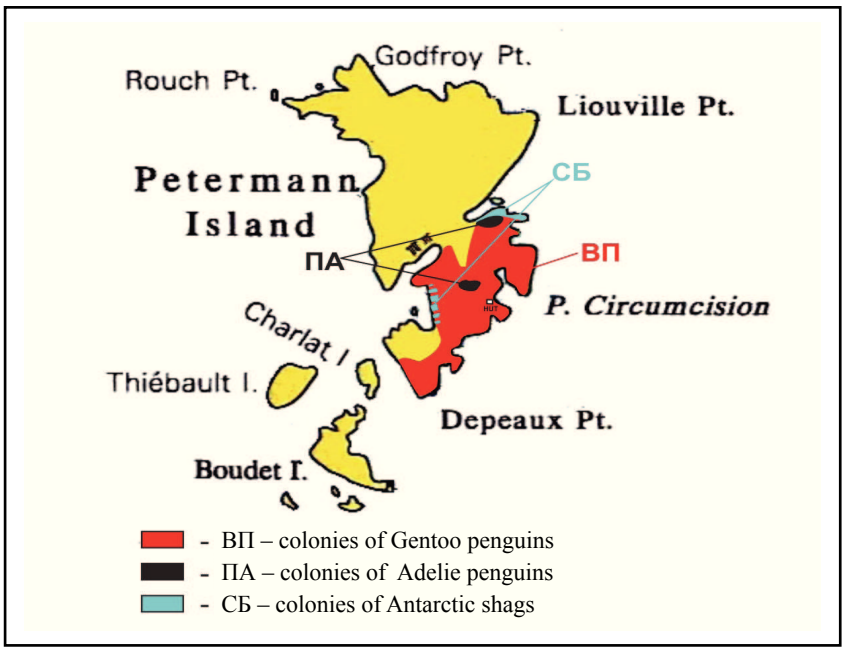
Pic. 4. Nest station of Antarctic shags

Taking into account that the peculiarities of nest stations on Pitermann Island there was a study on multispecies associations of birds. One need to say that their high density of the settlement on the island belongs to the area of off snow rocks in southern and east-southern parts (pic. 5).

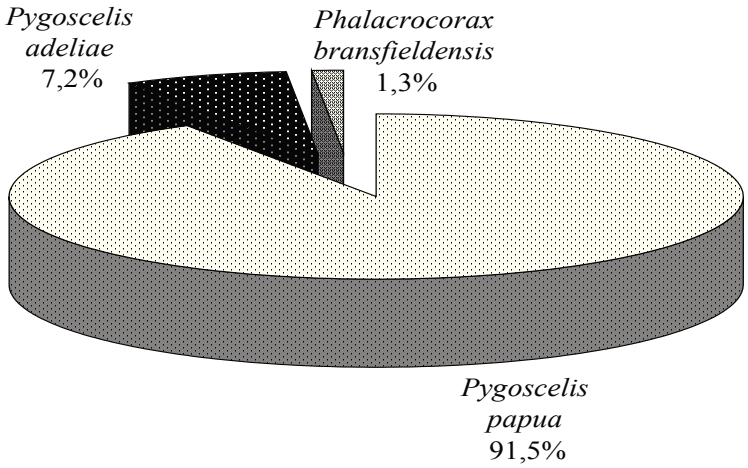
The ratio of species was divided in the following way Gentoo penguins – 3458 nest pairs, for Adelie penguins – 274 pairs, Antarctic shags – 48 pairs (pic. 6).

Thus, the dominant of multispecies association is Gentoo penguins. The nest cycle for this species is sprawling on Pitermann Island and the manner of nesting has a great peculiarity in the different parts of the island. In its lowest parts the babies of Gentoo penguins appeared in the beginning of the second decade of January. Also around seven per cent of pairs at this time they hatched eggs. In the upper part of the island (up to 30 m above the sea level) with a crossed relief, the size of babies indicates on their three-week age.

The birds with a higher social status occupy biotopes placed on higher locations firstly. In opposite on the lower parts (more flattened) birds occupy with the lower social status. According to the study and concerning Yalour Island, the lower and flat stations are mainly good for Adelie penguins, which in retrospective view were the basis for the bird population of Pitermann Island (Пекло, 2007; Oceanites: Counting Penguins, 2009).



Pic. 5. The Distribution of bird colonies on Pitermann Island



Pic. 6. The ratio of species for bird association on Pitermann Island

Birds of the above-mentioned species are now presented in small amount. Adelie penguins are presented by two colonies and in other cases; they make nests together with Gentoo penguins' nests (pic. 7). If several settlements are subdivided by the equal parts of birds of two species, so these aggregations of nests are placed according to the single species level. These nest spots take place on the proper settlement. If Adeli penguin's nests locate among Gentoo penguins' ones the first nests locate on the edge of the settlement. There is another structure in placing the nests for Gentoo penguins and Antarctic shags. The nests for these two species locate on the rocky slopes and with "diffusion" order. Generally, nests of Antarctic shags locate on the edge line but very often Gentoo penguins make nests there too. In this case, the location of nests are definitely distinguished in shape according to micro relief. Antarctic shags take place on a higher level, concerning penguins they take lower levels (pic. 8).

Pic. 7. General settlement of Gentoo and Adelie penguins

Pic. 8. General settlement of Gentoo penguins and Antarctic shags

There is a location where all three species were presented: 13 nests of Antarctic shags locate on the edge line, 47 nests of Adelie penguins locate on the flat territory and on a higher level, lower level, where the relief is presented as a broken shape there are 26 nests of Gentoo penguins there(pic. 9).

Pic. 9. The distribution of nests of penguins and Antarctic shags in a common colony

The level of development for babies in such locations is different. Adelie penguins' babies were more than one month of age. As for Antarctic shags' babies they were even older around 1.5 month of age. Concerning Gentoo penguins' babies in common settlements they were the youngest ones. This fact shows that Gentoo penguins come to settle to Adelie penguins and Gentoo penguins are of a lower rank and much younger. It means that "classic" adult bird species take places that are more prestigious.

The same one can say about Gentoo penguins in the lower part of the island where there are babies or eggs there. However, Adelie penguins are not met there at all though the relief is flat.

Thus, we can suppose that Gentoo penguins find the ways to make settlements in untypical areas (parts with a flat relief) with taking off the more specialized Adelie penguins, which show signs of stenobiont. The success of Gentoo penguins (in comparison with Adelie penguins) demonstrates their occupation of Pleno Island, which was populated earlier by Adelie penguins only, where the relief was flat. This island is a "classic" biotope for adelie species. Now in the colony of Gentoo penguins there was no one egg of Adelie penguins found there.

The indication of Gentoo penguins nest spreading area is located on Tuxon Cape in 2010. The highest levels were occupied by birds with the exposition of slopes (50m above sea level) it is more suitable for Antarctic shags nest station.

American scientists Ron Naveen and Melissa Rider discussed decreasing of Adelie penguins' area. They say it is connected with a global raise of temperature in the area of Antarctic Peninsula during the last one hundred years (Oceanites: Counting Penguins, 2009). Simultaneously Gentoo penguins are considered ecologically plastic species, which have success in adaptation during the climatic changes. In this case, Pitermann Island is an example of its unique ecosystem where two species of penguins live together in the marginal part of areas (Gentoo penguins – southern part, Adelie penguins – northern part). The distribution of the closest species on the boundaries of nest biotopes supposes a topic contest which can be observed as a monopolization of proper resources (in this case it is a station to live for them).

Interesting facts reflect penguin study generally in conditions of flattened relief Adelie penguins are quicker in motion than Gentoo penguins. In addition, they are very good in maneuvering. However, when the snow coverage occurs there appears some details in active motion of penguins. It has an evidence about the primary biotope species segregations. When moving on deep (non-pressed) snow penguins move often with using their bellies in order to make their support firm. Adelie penguins move very quickly using their front and back limbs. Gentoo penguins can also move on the bellies but they do it not so quickly, with signs of awkwardness using back limbs only. If there is a possibility to stand vertically, they do it immediately.

It is possible that this observation can serve as a proof for these species to be involved into evolution in different orographic levels. Quick motion of Adelie penguins on their bellies is because of flattened relief (there are no sharp stones there) where nearly there is no possibility for them to be wounded. In opposite a quick motion on the crossed (very often nearly vertical) relief is not safe for Gentoo penguins.

3. Conclusion

The penguin fauna succession is studied from the western part of Graham Land. Due to climatic changes (warming up) the distribution of Gentoo penguins is observed and decreasing of area for Adelie penguins is indicated too. Gentoo penguins began to make nests on the territory of Adelie penguins, which show signs of stenobiontness.

Literature

1. **Гожик П. Ф.,** Греку Р. Х, Усенко В. П., Вернигоров В. П., Греку Т. Р., Острецов Г. А., Гончар А. И., Клочан Ю. А., Моц В. Н. Карта рельефа дна мелководной зоны архипелага Аргентинских островов в районе Украинской антарктической станции «Академик Вернадский». – Геологический журнал. – 2002. – № 1. – С. 128−131.
2. **Пекло А. М.** Птицы Аргентинских островов и острова Питерман. – Кривой Рог : Минерал, 2007. – 264 с.
3. **Попов Л. А.** Год в Антарктике. – М. : Наука, 1978. – 92 с.
4. **Шилов И. А.** Экология. – М. : Высшая школа, 1998. – 512 с.
5. **Oceanites:** Counting Penguins / Antarctic Site Inventory / 2009@Lindblad Expeditions