



## MONITORING OF THE LEOPARD SEAL POPULATION (*HYDRURGA LEPTONYX*) IN WATERS OF THE ARGENTINE ISLANDS (ANTARCTICA)

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### Key words

*Hydrurga leptonyx*, *Pygoscelis papua*, *Lobodon carcinophagus*, Antarctica, population size, population structure, animal feeding

### doi

<http://doi.org/10.15407/TU1916>

### Article info

submitted 24.12.2019  
revised 06.04.2020  
accepted 11.05.2020

### Language

English, Ukrainian summary

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### Abstract

The state of the leopard seal population (*Hydrurga leptonyx* Blainville, 1828) in waters of the Argentine Islands was studied during the periods April 2015 — March 2016 and April 2018 — March 2019 according to the objectives of the State Target Scientific and Technical Research Programme of Ukraine in Antarctica for the period 2011–2020. During the study period, 14 males and 16 females were recorded within the archipelago (1M : 1.1F ratio). About 7 % of the seals were young individuals and more than 90% were adults. Leopard seals were recorded during all periods of the year. In the summer-autumn period, within the archipelago, there were 2 to 4 individuals simultaneously. The maximum period of stay of the predators in waters of the archipelago was about two weeks. Two individuals for at least two weeks were recorded twice in waters of the archipelago. The maximum period of absence of the seals in waters of the archipelago was 118 days. It was found that the occurrence of leopard seals and hence the traces of their life activities in various years were of different nature. In the autumn (April–May) of 2015, they were seen less frequently, on average every  $6.3 \pm 2.5$  days, and in the autumn of 2018, on the contrary, more frequently, on average every  $2.5 \pm 0.5$  days. The activity of the leopard seal in the winter (June, August) of 2015 decreased by half. It was recorded that the animals appeared in waters of the archipelago on average every  $12.7 \pm 5.5$  days, and in the winter of 2018 —  $5.5 \pm 1.9$  days. In the autumn of 2018, the predators and traces of their vital activities were seen less often — every  $6.6 \pm 1.6$  days. During the study period, out of 78 recorded cases of the leopard seal's occurrence, about 56 % of cases were recorded when they were on ice floes, in other cases (44 %) — when they were in water. In addition, several crabeater seals were recorded three times on an ice floe at an insignificant distance from a leopard seal. One of the main prey items for leopard seals within the archipelago are birds, in particular the gentoo penguin (*Pygoscelis papua*), as well as crabeater seals (*Lobodon carcinophagus*). The presence of two penguin colonies on Galindez Island attracts leopard seals to the archipelago. During the study period, successful leopard seal predation on penguins was recorded more than 20 times. Penguins were the most frequent prey of leopard seals in spring and summer, while crabeater seals in winter.

### Cite as

Khoyetskyy, P. B. 2020. Monitoring of the leopard seal population (*Hydrurga leptonyx*) in waters of the Argentine Islands (Antarctica). *Theriologia Ukrainica*, **19**: 138–147. [In English, with Ukrainian summary]

## MONITORING OF THE LEOPARD SEAL POPULATION (*HYDRURGA LEPTONYX*) IN WATERS OF THE ARGENTINE ISLANDS (ANTARCTICA)

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**Monitoring of the leopard seal population (*Hydrurga leptonyx*) in waters of the Argentine Islands (Antarctica).** — P. B. Khojetskyy. — The state of the leopard seal population (*Hydrurga leptonyx* Blainville, 1828) in waters of the Argentine Islands was studied during the periods April 2015 — March 2016 and April 2018 — March 2019 according to the objectives of the State Target Scientific and Technical Research Programme of Ukraine in Antarctica for the period 2011–2020. During the study period, 14 males and 16 females were recorded within the archipelago (1M : 1.1F ratio). About 7 % of the seals were young individuals and more than 90% were adults. Leopard seals were recorded during all periods of the year. In the summer-autumn period, within the archipelago, there were 2 to 4 individuals simultaneously. The maximum period of stay of the predators in waters of the archipelago was about two weeks. Two individuals for at least two weeks were recorded twice in waters of the archipelago. The maximum period of absence of the seals in waters of the archipelago was 118 days. It was found that the occurrence of leopard seals and hence the traces of their life activities in various years were of different nature. In the autumn (April–May) of 2015, they were seen less frequently, on average every  $6.3 \pm 2.5$  days, and in the autumn of 2018, on the contrary, more frequently, on average every  $2.5 \pm 0.5$  days. The activity of the leopard seal in the winter (June, August) of 2015 decreased by half. It was recorded that the animals appeared in waters of the archipelago on average every  $12.7 \pm 5.5$  days, and in the winter of 2018 —  $5.5 \pm 1.9$  days. In the autumn of 2018, the predators and traces of their vital activities were seen less often — every  $6.6 \pm 1.6$  days. During the study period, out of 78 recorded cases of the leopard seal's occurrence, about 56 % of cases were recorded when they were on ice floes, in other cases (44 %) — when they were in water. In addition, several crabeater seals were recorded three times on an ice floe at an insignificant distance from a leopard seal. One of the main prey items for leopard seals within the archipelago are birds, in particular the gentoo penguin (*Pygoscelis papua*), as well as crabeater seals (*Lobodon carcinophagus*). The presence of two penguin colonies on Galindez Island attracts leopard seals to the archipelago. During the study period, successful leopard seal predation on penguins was recorded more than 20 times. Penguins were the most frequent prey of leopard seals in spring and summer, while crabeater seals in winter.

**Key words:** *Hydrurga leptonyx*, *Pygoscelis papua*, *Lobodon carcinophagus*, Antarctica, population size, population structure, animal feeding.

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Submitted: 24.12.2019. Revised: 06.04.2020. Accepted: 11.05.2020.

### Introduction

The leopard seal (*Hydrurga leptonyx* Blainville, 1828) is a circumpolar species distributed from the coast of Antarctica to the subantarctic islands and it is found off the coast of Africa, Australia, New Zealand, and South America. Some individuals were recorded at a considerable distance from Antarctica: Pitcairn Island (25°04'S, 130°06'W), Cook Island (21° 25'S, 159°8'W), Coast of South Africa (34°45'S, 19°42'E.), and South America (21°40'S) (Rodriguez *et al.* 2003; Vinding *et al.* 2013; Stewart & Grove 2014). Usually, the migrants were juvenile individuals that were found on the coast of Tasmania during July–November; in September–October, the maximum number of young individuals was recorded on Kerguelen Island (Borsa 1990; Rounsevell & Pemberton 1994). At Macquarie Island, seasonal occurrence of the seals was observed from late June to early December, with a maximum abundance in early August. Here, as at other subantarctic islands, young, 1-3 year old, immature animals were found (Rounsevell & Eberhard 1980). At South Georgia Islands, leopard seals occurred during April–October, of which less than 5 % were 1-year-old seals, and more than 70% were young immature individuals (Walker *et al.* 1998). In the years of low

ocean water temperature and widespread pack ice, leopard seals appeared earlier, a larger number of animals and a longer period of their stay at the islands being recorded (Jessopp *et al.* 2004). According to the data of Polish scientists, at King George Island, leopard seals rarely appear in January and February, they are absent from mid-March to mid-July, and their maximum number was observed in October (Myrcha & Teliga 1980). However, the studies conducted in East Antarctica indicate that adult leopard seals do not migrate northward in winter. The seals recorded off the coast of East Antarctica were residing within a radius of 50 km from the place of registration for more than three months (Rogers *et al.* 2005).

Since the beginning of the 21st century, Ukrainian biologists have been studying pinnipeds in coastal waters of Graham Land at the west coast of the Antarctic Peninsula, in particular species composition, population size, population structure, morphological features, aspects of seal feeding, etc. (Dykyy 2008; Dykyy 2009). The publications mainly focused on the Weddell seal (*Leptonychotes weddellii*) and less so on other species (Dykyy & Salhanskiy 2014; Drongovska & Dykyy 2016). The diurnal and seasonal migrations of Weddell seals at the Argentinean Islands, their topical conservatism, the characteristics of breeding and growth of seal pups are analysed in such works (Dykyy & Salhanskiy 2013; Dykyy & Drongovska 2015; Khoyetskyy 2018; Smagol & Dzhulai 2018). The scientists noted that the leopard seal within the archipelago is a non-abundant species (Dykyy 2008; Dykyy & Peklo 2012). Therefore, the aim of this paper is to study the population abundance and features of the leopard seal's occurrence in waters of the Argentine Islands.

## Material and Methods

The status of the leopard seal population of the Argentine Islands was investigated during April 2015 to March 2016 and April 2018–March 2019 (XX and XXIII Ukrainian Antarctic Expedition) according to the objectives of the State Target Scientific and Technical Programme of Ukraine's research in Antarctica for 2011–2020. The field material was collected within the archipelago located between 65°13'–65°16'S and 64°10'–64°20'W in the Pacific Antarctic.

Observations of the predators were recorded using the survey route method (Fig. 1). The routes are laid to cover the largest possible area of the archipelago, which is more than 20 km<sup>2</sup> (Dykyy & Peklo 2012). On the routes that were laid to the islands of Uruguay, Black, Forge, Barchans and others, we examined the supposed locations of leopard seals. In order to survey the waters of the archipelago and to identify the animals with the help of optical instruments, we climbed to the highest points of the island (Galindez, Skua, and Uruguay).

The visual observations were carried out daily except for days with significant amounts of precipitation and winds with a speed of more than 20 m/s. Depending on the season and weather conditions, moving to the islands of the archipelago was carried out on sea ice (in winter), using a boat in the absence of ice cover (in summer), and, on the islands, using skis or snowshoes in the presence of significant snow cover.

The method of identification of the Weddell seal by features of the pattern on the ventral side of the body can be also applied to the leopard seal (Dykyy & Drongovska 2015). They also have a characteristic pattern of the underside, which makes up their distinctive feature (Fig. 2).

In all recorded seals, their belly, chest, and head were photographed. These photographs allowed to identify individuals by natural markers (patterns of the ventral side, head), as well as to track their migration.

## Results and Discussion

During April–May 2015, leopard seals were recorded five times in waters of the Argentine Islands (Fig. 3). The predators were observed resting on ice floes, growlers or when moving in the water. Thus, on 13 April 2015, in the afternoon, an adult female was recorded on a growler in the Stella Strait, and on the morning of 17 April, a leopard seal was observed from the pier of the research station. In the morning on 9 May, the predator was observed on an ice floe in the Meek Strait.

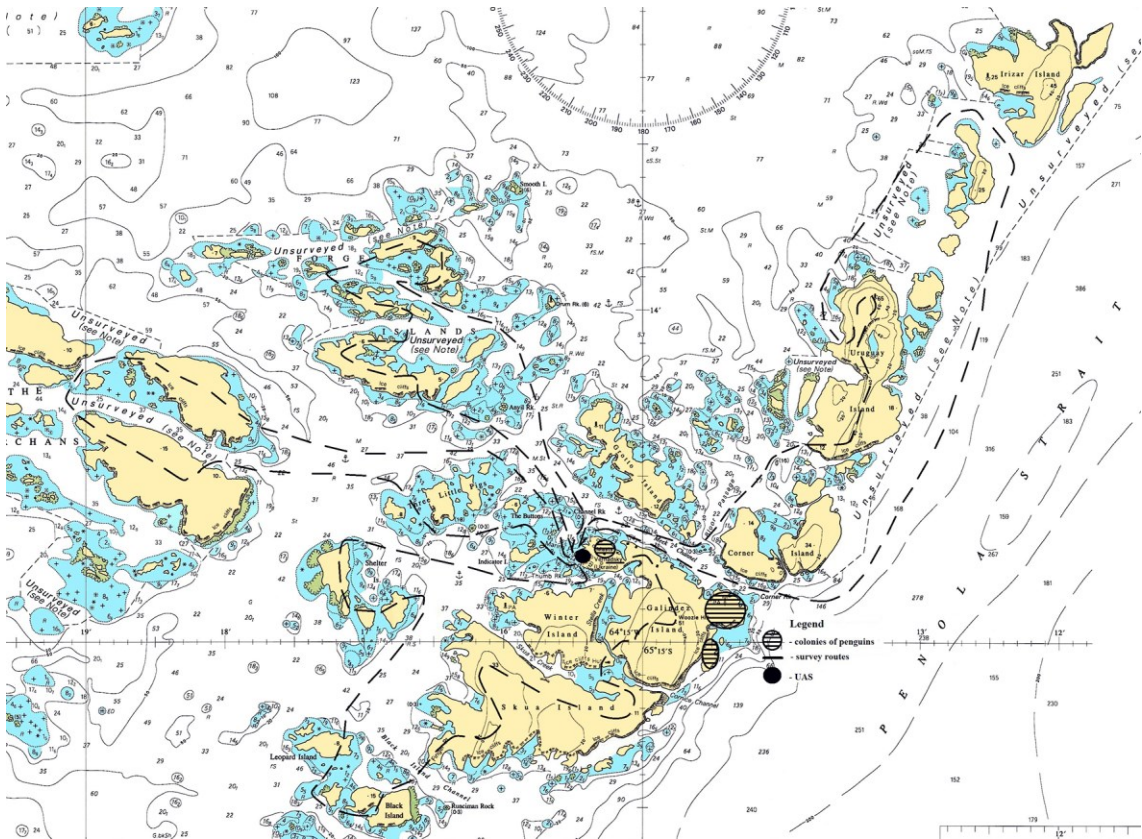
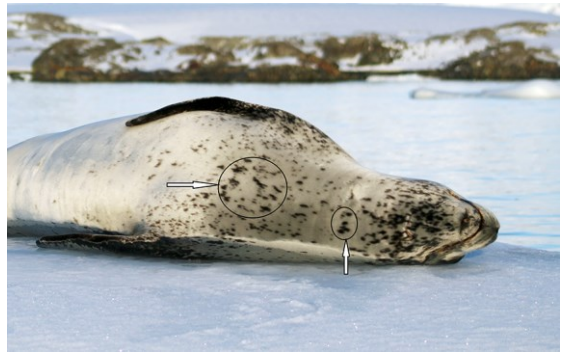


Fig. 1. The waters of the Argentine Islands.

Рис. 1. Акваторія Аргентинських островів.



a



b

Fig. 2. Identification of *Hydrurga leptonyx* recorded in waters of the Argentine Islands: a) 16 April 2018; b) 23 April 2019 (arrows indicate spotted patterns by which seals were identified).

Рис. 2. Ідентифікація *Hydrurga leptonyx*, виявлених в акваторії Аргентинських островів: а) 16.04.2018; б) 23.04.2019 (стрілками показано рисунки плям, за якими проведено ідентифікацію тюленів).

The ice floe was drifting towards Indicator Island. The animal had been monitored until about 19:00, when the evening twilight prevented further observation. The significant amount of ice floes prevented the boat to approach the animal and identify its sex. Based on external visual characteristics, it was found that it was an adult. The next day, the predator was not found on the ice. A leopard seal was recorded on 24 May among the group of the Forge Islands. It was in the water, and then on the ice. According to the photo and video materials, it was identified as an adult male.

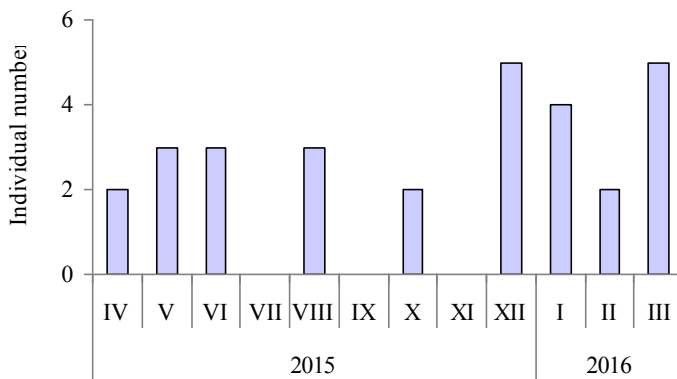


Fig. 3. Records of *Hydrurga leptonyx* in waters of the Argentine Islands (April 2015 to March 2016).

Рис. 3. Реєстрації *Hydrurga leptonyx* в акваторії Аргентинських островів (квітень 2015 — березень 2016).

According to literature sources, one of the leopard seal's food items are birds. In the diet of the predator, birds and seals make up 35 %, about 15 % are fish and cephalopods, but the bulk of the diet is krill — 50 % (Bastida & Rodriguez 2009). Probably, in different parts of the distribution range, the composition of the leopard seal's diet varies depending on the availability of food, according to seasons, locations, etc. Thus, the bulk of the leopard seal's diet in the waters of the South Georgia Islands were fur seals (*Arctocephalus gazella*), gentoo penguins (*Pygoscelis papua*), and macaroni penguins (*Eudyptes chrysolophus*), while krill and fish were less frequent prey of the leopard seal (Edwards *et al.* 2010). Near the Danco coast of the Antarctic Peninsula, krill (*Euphausia superba*), as well as penguins and fish (*Gobionotothen gibberifrons*, *Gymnoscopelus nicholsi*) were the basis of the predator's diet (Casaux *et al.* 2009). In waters of the Argentine Islands, penguins were often the predator's prey. On the islands of the archipelago, remains of birds were revealed, usually of the gentoo penguin and, less often, of the Adélie penguin (*Pygoscelis adeliae*). During April–May and August, we recorded dead penguins (10 April, 14 May), injured penguins (4 May and 8 May), hunting seals (17 May, 3 August). In autumn, the number of gentoo penguins at Cape Pigeon and Penguin Point (Galindez Island) was about 2 000, which made the predation on them by the leopard seal more extensive. Therefore, one of the factors influencing the presence of the predator in waters of the archipelago is two gentoo penguin colonies at Cape Marina Point and Pigeon-Penguin Point of Galindez Island. Meanwhile, small colonies are less attractive to the predator. Much larger colonies are located near the Argentine Islands on Petermann Island and the Yalour Islands. On Petermann Island, a multi-species colony of gentoo penguins and Adélie penguins of more than 7 000 individuals is located 10 km off the archipelago; at a smaller distance are the Yalour Islands where there is a colony of more than 5 000 birds. The leopard seal's speed of movement is more than 10 km/h, and it covers a distance of 150 km during a day (Rogers *et al.* 2005). The close location of the colonies provides the predator with sufficient food.

In winter, leopard seals migrate northward. However, in waters of the Argentine Islands, they also occur in winter. In June, some leopard seals were seen twice. In particular, on 4 June, an adult male was recorded on the Forge Islands, and on 25 June, an adult female was observed in the Meek Strait, not far from Grotto Island. As of 25 June, the strait was covered with ice. The female seal climbed out of the ice-hole formed around a small remainder of a growler and moved to a distance of 10–15 m. Under the influence of currents and winds, the growler was in constant movement, which prevented the freezing of water around it. Such formations are convenient for leopard seals, Weddell seals, and crabeater seals to get out from water onto the ice.

In August, leopard seals were recorded three times. One seal was detected on 3 August in the Meek Strait. The observation of this predator, which was eating a bird, probably the blue-eyed cormorant (*Phalacrocorax bransfieldensis*), was carried out from the station slip. The next occurrence of a seal was four days later (7 August) in the eastern part of the Forge Islands. During the day, it was on the ice near an ice-hole. The third leopard seal was recorded in the morning on 10 August in the Meek Strait, similarly to the one that was seen on 3 August.



No leopard seals were found during September. On 6 October, the first penguins appeared in waters of the archipelago. Late in October, there were favourable living conditions for penguins: many ice-holes appeared, the size of the existing ones increased, and the area of ice cover decreased. An increase in the number of birds probably attracted the predator to the archipelago. In the last third of October, two cases of occurrence of leopard seals were recorded: on 24 October, one seal was found near Cape Pigeon Point (Galindez Island), on which there is also a penguin colony, and on 29 October, another leopard seal was seen near one of the Forge islands.

Leopard seals were most often seen (five cases) in December. For the first time, on 7 December, a 1-year-old female seal was recorded on an ice floe in the Meek Strait. Within the distribution area, seal pups are born in November–December among pack ice (Shirihai & Jarrett 2006). In waters of the archipelago, these predators do not breed. Probably, the seal pup came from other territories or the female gave birth near the archipelago. Leopard seal pups were recorded in previous years as well. In general, leopard seals inhabit the drift ice zone, and their abundance among pack ice is greater than of other seal species, except for crabeater seals and, in some places, the Ross seals (*Ommatophoca rossi*) (Bester *et al.* 2002).

Next registrations took place in the last third of December. In particular, on 22 December, an adult female seal was found on an ice floe in the Meek Strait, and in the evening on 23 December, again, one individual was resting on an ice floe in the strait between Galindez–Grotto–Corner islands. One more predator was recorded here on 31 December. According to the available photographs, it was found that in December there were three female seals in these waters: two adults and one young individual. A comparative analysis of the ventral side of the body of the females recorded in April, June, and December was carried out and it was found that their individual patterns are different. The female leopard seals turned out to be different individuals.

In December, the penguins that were in waters of the archipelago showed significant activity. Penguins hatch chicks, which makes adult birds often go hunting to provide the offspring with food. In the colonies of the gentoo penguin on Galindez Island, there were more than 2 000 individuals. The station's biologists repeatedly observed how a leopard seal, grabbing a penguin, with jerky movements of its head from side to side, frees the penguin from its skin and eating only the meat. In the morning on 23 December, a predator was observed hunting, killing and feeding on a penguin near the Shelter islands, and on 9 January 2016, a wounded penguin was found near the station. Three times predators were recorded in the last third of January. Thus, on 23 January, a male seal was seen on an ice floe between the Shelter Islands and Leopard Island. Approaching humans worried the animal, but it remained on the ice. Another leopard seal was seen on 28 January on a small iceberg remnant north of Grotto Island. It was impossible to establish the animal's sex because, when being approached, it dived into the ocean. For the last time, a predator was recorded on 31 January in a small bay of Cape Penguin Point (Galindez Island) about 20 m off the coast. Under the influence of the north wind, many ice floes and growlers got concentrated in the bay. This adult male seal was resting on one of the ice floes, and nearby (5–8 m), on the same ice floe, there were also three crabeater seals.

Two days later (2 February), in waters of the archipelago, a leopard seal moving from Indicator Island towards the Shelter Islands was observed in the morning (ca 7:00), and at about 10:00, some male leopard seals were found on an iceberg remnant near the north-western part of Grotto Island. The growler, which stumbled upon hidden rocks, did not move, which allowed observing this animal until 16:00.

Leopard seals were repeatedly observed in March. All cases (five occurrences) were recorded during the first and the second thirds of March in the Meek and Penola Straits. On 4 March, a leopard seal was found in the Meek Strait near the station, 20 metres off the coast, where a penguin colony was located.

Feeding of leopard seals on prey penguins always attracted many birds. In particular, on 15 March, near a seal, there were about 20 south polar skuas (*Catharacta maccormicki*) and several kelp gulls (*Larus dominicanus*). The birds were trying to eat the remains of the victim.

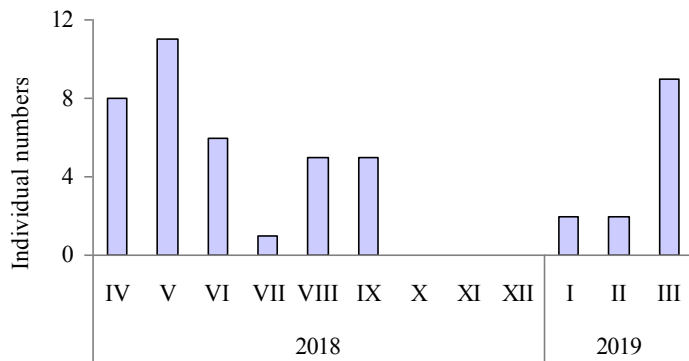


Fig. 4. Records of *Hydrurga leptonyx* in waters of the Argentine Islands (April 2018 to March 2019).

Рис. 4. Реєстрації *Hydrurga leptonyx* в акваторії Аргентинських островів (квітень 2018 — березень 2019).

Three days later (18 March), in the Meek Strait, hydrobiologists of the station (A. Utevsky and D. Shmyrev) recorded a predator killing and feeding on penguins. In general, in the second third of March, remains of birds killed by leopard seals were found on Cape Pigeon and Cape Penguin (Galindez Island): three penguins and one 1-year-old kelp gull. In March, the hydrobiologists found a young individual in the water at Cape Penguin Point. The last observation of a predator was recorded on 19 March in the Meek Strait near the station's variometric building, and at the end of the month, a wounded crabeater seal was recorded.

In the autumn of 2018, leopard seals were recorded in waters of the archipelago the most often (Fig. 4). From 12 April to 27 April, between the islands of Shelter–Winter–Three Little Pigs, in the Meek Strait, leopard seals were observed six times at Winter Island resting on ice floes. In five cases, the animals were female seals.

The seal recorded on 16 April was found for the second time on 23 April (at about 09:00) on an ice floe in the Meek Strait, and another one at about 11:00. This indicated the simultaneous presence of at least two leopard seals in waters of the archipelago and the fact that one of these individuals was within the archipelago for about a week.

In general, the animals were characterised by significant activity and they did not stay within the archipelago for a long time and left probably in 1–2 days. According to the studies conducted in different parts of the area, only some individuals remain for more than 100 days (Macquarie Island); in waters of the South Georgia Islands, eight seals stayed for more than 100 days, 130 days the longest (Rounsevell & Eberhard 1980; Walker *et al.* 1998).

On 24 April, from 09:00 to 18:00, some predators were recorded several times in the Meek Strait near the penguin colonies. Probably in April, the main prey item of leopard seals were birds. In particular, on 29 April, at Drum Rock, a predator was observed feeding on a penguin. Their prey items were recorded in different parts of the archipelago on the previous days. Thus, on 24 April, a wounded bird was found on Galindez Island, whereas remains of a penguin were discovered on 21 April on Big Forge Island. The analysis of scraps indicated that the bird was the prey of a leopard seal.

During May, leopard seals were repeatedly observed hunting and eating penguins. On 2 May, several giant petrels at Winter Island were seen eating remains of the leopard seal's prey. The next day (3 May) at about 11:00, a leopard seal was seen eating a penguin between Buttons Island and a small growler, and around 17:00 at Indicator Island and an iceberg remnant, a seal caught a penguin. The leopard seal uses icebergs and growlers for hiding, which helps to suddenly attack birds that swim nearby. The presence of ice floes in the water increases the likelihood of successful hunting. On 7 May, a leopard seal was observed actively moving and hunting penguins at Cape Penguin Point (Galindez Island). The second half of the day is the most favourable period for hunting penguins. In autumn, usually after 16:00, penguins that went out to the ocean for food in the morning return to the colonies. Studies have found that more than 50 % of the time the leopard seal spends hunting birds with a catching rate of 0.61 birds/h (Penny & Lowry 1967).

In May, there were at least two predators within the archipelago. An observation on 4 May revealed that one individual was on an ice floe in Yacht Bay of Galindez Island, and another one (female) was on an ice floe near Winter Island. The female was recorded for the second time two weeks later (16 May) in one of the bays of Skua Island. The number of the predators increased in early June to four individuals, the sex of three individuals was determined: two males and one female. In the period from April to early June, the frequency of the leopard seal's occurrence with traces of their vital activities was 2-3 days. However, from 20 June to 22 July no leopard seals were found within the archipelago. A predator was last recorded on 7 June, while on 11, 15, 19, and 20 June only traces of vital activities were revealed (skins and remains of penguin skeletons, wounded crabeater seals). The next recording of a predator took place on 27 July, although traces of the leopard seal's vital activities were recorded on previous days: 22 July (twice) and 23 July. On 22 and 23 July, giant petrels were seen eating the remains of a leopard seal's prey and on 31 July a crabeater seal was discovered with a wound on its side on an ice floe near Skua Island. Traces of vital activities of leopard seals were further detected in August (Table 1).

A decrease in the number of birds in the archipelago was recorded at the beginning of the winter period. As the data in Table 1 indicate, probably with the decrease in the number of penguins within the archipelago, the main prey of leopard seals were crabeater seals. According to the studies, of the four species of seals (Weddell seal, crabeater seal, Ross seal, and southern elephant seal), crabeater seals are the most frequent prey of leopard seals (Hall-Aspland & Rogers 2007). The fifth species, the fur seal, prevails in the predator's diet in winter in the sub-Antarctic islands of South Georgia and in the southern Shetland Islands in summer (Walker *et al.* 1998; Hiruki *et al.* 1999). Leopard seals predation on fur seals within the Argentine Islands has not been recorded.

In the spring of 2018, leopard seals were recorded in waters of the archipelago in the first half of September (on 1, 5, 10, and 15 September). They were last recorded on 28 September while moving in one of the ice-holes near the station. The next time a predator was recorded 118 days later — on 24 January 2019: it was a young female seal found on an ice floe near the Three Little Pigs islands.

Table 1. Records of predation of *Hydrurga leptonyx* in waters of the Argentine Islands in the summer of 2018

Таблиця 1. Випадки полювання *Hydrurga leptonyx* в акваторії Аргентинських островів влітку 2018 р.

Date	*Prey species	Location
11 June	<i>Lobodon carcinophagus</i>	Galindez Island
15 June	<i>Lobodon carcinophagus</i>	Galindez Island
19 June	<i>Lobodon carcinophagus</i>	Galindez Island, Yacht Bay
20 June	<i>Lobodon carcinophagus</i>	Winter Island
22 July	Unknown	Among the ice floes near Uruguay Island, seven <i>Macronectes giganteus</i> ate the remains of a prey
22 July	Unknown	Among the ice floes near the Three Little Pigs islands, five <i>Macronectes giganteus</i> ate the remains of a prey
23 July	Unknown	Among the ice floes of the Meek Strait five <i>Macronectes giganteus</i> ate the remains of a prey
28 July	<i>Lobodon carcinophagus</i>	Meek Strait
31 July	<i>Lobodon carcinophagus</i>	Stella Strait
7 August	<i>Lobodon carcinophagus</i>	Near the southeast coast of the Forge Islands
13 August	<i>Lobodon carcinophagus</i>	Near the southern coast of Skua Island.
16 August	<i>Lobodon carcinophagus</i>	In the Skua Strait near Winter Island
16 August	<i>Lobodon carcinophagus</i>	50 m off the northern coast of Grotto Island
19 August	Unknown	Among the ice floes near the Three Little Pigs islands, six <i>Macronectes giganteus</i> ate the remains of a prey
20 August	<i>Lobodon carcinophagus</i>	Near the northern coast of Winter Island

\* *Lobodon carcinophagus* — animals with wounds.



There are differences in the frequency of occurrence of leopard seals and traces of their vital activities in different years. In the autumn (April–May) of 2015, they were recorded less frequently, on average every  $6.3 \pm 2.5$  days, and in the autumn of 2018, on the contrary, more frequently, on average every  $2.5 \pm 0.5$  days. The activity of leopard seals was halved in the winter (June, August) of 2015. The animals were observed in waters of the archipelago on average  $12.7 \pm 5.5$  days, and in the winter of 2018 —  $5.5 \pm 1.9$  days. In the autumn of 2018, the frequency of their occurrence and traces of their vital activities decreased to  $6.6 \pm 1.6$  days.

In the summer of 2019, leopard seals were recorded four times within the archipelago: twice in January and twice in February. On 26 February, two leopard seals were recorded on ice floes at Grotto Island. In one case, a male leopard seal was on an ice floe next to three crabeater seals, which were located 5 m far from the predator (Fig. 5).

In autumn, leopard seals were regular visitors of waters of the archipelago. In particular, on 7 March, the first leopard seal was observed at Galindez Island. The next day (8 March), an adult female was recorded on an ice floe near Skua Island. A successful predation on penguins was recorded on 10, 16, 27, and 31 March, and four cases of hunting on birds were recorded on 11 and 12 March.

On 11 March, three different individuals were recorded simultaneously within the archipelago:

- Around 16:00, a leopard seal was observed killing and feeding on a penguin for about 10–15 minutes near the station slip. The predator did not pay any attention to the people who were on the shore 5–10 m away;

- At the Three Little Pigs islands, an adult female seal was found on an ice floe;

- Near the Shelter Islands, an adult male leopard seal and five crabeater seals were found on the same ice floe at a distance of 3–5 m from each other.

In total, during the study period, out of 78 observations of leopard seals, in about 56 % of the cases, the animals were recorded while being on ice, in other cases (44 %) — when they were in water.



Fig. 5. *Hydrurga leptonyx* and *Lobodon carcinophagus* on the same ice floe in waters of the Argentine Islands (26 February 2019).

Рис. 5. *Hydrurga leptonyx* та *Lobodon carcinophagus* на одній крижині в акваторії Аргентинських островів (26.02. 2019).

## Conclusions

From April 2015 to March 2016, 29 occurrences of leopard seals were recorded in waters of the archipelago. The sex of 11 individuals was determined, including six males and five females, while the sex of 18 individuals could not be identified. From April 2018 to March 2019, 49 occurrences of leopard seals were recorded in waters of the archipelago. The sex of 19 individuals was identified: 8 males and 11 females. Thus, during the study period, 14 male leopard seals and 16 females were recorded within the archipelago (1M : 1.1F ratio). About 7 % of the individuals were juveniles, more than 90 % were adults.

The leopard seal was recorded throughout the year. The studies showed the simultaneous presence in waters of the archipelago: two times of two leopard seals, two times of three animals, and one time of four animals. The presence of two individuals in waters of the archipelago for at least two weeks was recorded twice. The maximum period of stay of leopard seals in waters of the archipelago was about two weeks, and the maximum period of absence of seals in waters of the archipelago was 118 days.

One of the main prey items of leopard seals within the archipelago are birds, in particular penguins, and crabeater seals. The presence of two penguin colonies on Galindez Island attracts the predator to the archipelago. During the study period, observations of successful predations of the leopard seal on penguins were recorded more than 20 times.

During the study period, the presence of a leopard seal and several crabeater seals on the same ice floe at an insignificant distance from each other was recorded three times.

## Acknowledgements

The author is grateful to the State Institution “National Antarctic Scientific Centre of Ukraine” for financial and logistic support of the research.

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