

Injuries of Webs on the Feet of South Polar Skuas *Catharacta Maccormicki*: Results of Studying Active Obligated Aggregations

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Abstract: South polar skuas (*Catharacta maccormicki*) (further SPS) gravitate toward human activities in the Antarctic. They form active obligated aggregations (further AOA) in places of utilization of kitchen waste and enter into numerous aggressive interactions among themselves. Objective: to establish the possible role of the AOA obtaining leg injuries by SPS and the influence of human activity in this process. The investigations were carried out at the Russian Antarctic station Mirny (66°33'11" S, 93°00'35" E, Haswell archipelago, Davis Sea, East Antarctica). 13.01-30.03.2015-26.10.2015-11.01.2016 the feeding behavior of skuas was recorded in the video mode on camera Sony Cyber-shot DSC-WX220 Black. The total length of the analyzed video is 2308 minutes 40 seconds. Out of the 97 SPS captured and examined, 33 individuals (34%) had 54 cases of web injuries — 35 (64.81%) cuts and 19 (35.19%) punctures. Among 1374 aggressive contacts between skuas, evidence of damage to the webs on their feet in the analyzed sample was not registered and the probability of damage to the membranes was less than 0.2% at CI = 95%, that is, it was close to "0". This number was not extrapolated to the whole life cycle of the SPS. The difficulty of extrapolation lies in the absence of the quantitative data on the total number of aggressive interactions of SPS in its annual cycle and the changes to this number in the course of the whole life cycle of an individual. There is also no opportunity obtain the data on the aggressive behavior of the skua around the natural food sources to compare with that around the anthropogenic food sources. The aforementioned factors were conducive only to partial goal achievement.

Keywords: South Polar Skua, Injuries, Aggressive Interactions, Human Activity

1. Introduction

Wildlife living in proximity to stations may become disturbed by interactions with humans while others have developed some habituation [1]. South polar skuas (*Catharacta maccormicki*) (hereinafter SPS) well-adapted to the extreme Antarctic environment and breed around Antarctica [2, 3]. They are one of the few marine species of birds that tend to human activity in the region, and their total number in places of contact with humans can reach several hundred individuals [4-13].

These opportunistic generalist predators use scavenging, predation, and kleptoparasitism as their main strategies to procure food [14-17], rarely cannibalism [18]. The exact composition of the diet and feeding strategies are highly variable among different locations [for example, 19-22].

SPS is a convenient model for the study of various aspects of

aggressive behavior of the genus *Catharacta*. Throughout their life history, they enter into numerous antagonistic interactions with conspecific individuals or individuals of other species of seabirds. Conflicts between competitors, and possibly interactions with elements of the environment (the surface of rocks and ice) can result in injuries of varying severity. Visible damage to the webbed feet of skuas are common minor injuries and are easy to diagnose in field and laboratory conditions. It was these injuries that became the object of this study. SPS is a long-living species of Antarctic seabirds, performing long-term and long-distance trans-equatorial migrations with wintering in the Northern hemisphere [23, 24], and light injuries to the legs apparently do not have a significant negative impact on the future life history of a particular individual. Moreover, the relatively low or low success rate of breeding in its different breeding areas [25] is offset by the high survival rate of the

skuas with breeding experience, as well as the oldest birds, and is one of the highest among other bird species [26, 27].

It is well known that only about 0.34% of the Antarctic continental area is ice free, and it is here that most research stations are built [28]. There are currently approximately 100 active research facilities in the Antarctic Treaty area [1]. The growth of human activity in Antarctica in recent decades has increased significantly, and the number of interactions between SPS and humans has increased, so the optimization of such relationships is becoming increasingly important. Because SPS exhibit trophic plasticity that allows them to change feeding habits from one resource to another depending on their availability [29], one of the most important factors that attracts skuas to human activities in Antarctica becomes the available food waste upon disposal of which they form feeding aggregations. Acute competition for a limited food resource generates numerous aggressive interactions between individuals, composing it, and increases the risk of injury of competing individuals.

Model for studying aggressive interactions (behavior) and their consequences (injuries) have become groups of SPS emerging during their feeding on kitchen waste in Mirny. According to E. N. Panov [30], these groups of individuals are called active obligated aggregations (hereafter AOA) in places of local abundance of food. The term AOA is not familiar to most biologists and Panov's original description and definition of AOA in his book is hardly available and not understandable for non-Russian researchers. For an easier understanding of this phenomenon, I will give a brief quote from his work: "The most significant case is the accumulations of animals of one or several species in places of local abundance of food. A convenient model for studying a similar situation is the grouping of granivorous birds in artificial feeding points. In the house sparrow *Passer domesticus*, these "flocks" are completely variable in composition. Leaving the feeding area, the birds immediately disperse and subsequently keep alone or in small groups". The term feed aggregation may also be used. J. F. Spellerberg [14] such groupings of SPS termed communal feeding.

A characteristic feature of the AOA is the variability in the composition and number of SPS individuals that compose them, as well as the possibility of presence of breeding and non-breeding individuals of different age classes, with the exception of fledglings. In contrast, non-breeding individuals are found in clubs [31, 32], individuals which have lost eggs or chicks [33], and the composition and number of skuas in them is relatively constant. Both in the clubs and in the AOA during the breeding season the number of individuals varies, but in the AOA the limits of variation are significant - from several individuals to several dozen individuals. In the wild, inside an AOA simultaneously collected near food up to 30 SPS [34], and the size of the feeding flocks can exceed 75 individuals [35]. Another feature of skuas is the ability to form aggregation with a high numbers in a short period of time. For instance, publications describe a case where in a matter of 20 minutes about 60-70 of SPS gathered during separation of the flesh of the Leopard Seal (*Hydrurga leptonyx*) from the carcass of the

Weddell Seal (*Leptonychotes weddelli*) [36].

The duration of the existence of AOA ranges from a few minutes to several hours and depends on the abundance, availability and quality of the food resource. The location of the AOA is not fixed in space. On the contrary, clubs exist constantly during the breeding season and to a greater or lesser extent have a fixed location, sometimes slightly shifting in some years. The maximum number of non-breeding SPS in the clubs of 136 individuals was marked in the Southern Shetland Islands [37], and at the garbage dumps of the Antarctic stations – up to 115 individuals per Pointe Géologie [9]. On the Haswell archipelago the number of skuas in the club every year usually varies from 25 to 30 individuals, on a dump in Mirny station from 10 to 30 individuals.

Objective: to establish the possible role of AOA obtaining leg injuries by SPS and the influence of human activity in this process. The following tasks were set: to identify and describe the leg injuries, especially the webs on the feet of the skuas; to obtain a quantitative assessment of the injuries of the webs within the local breeding population of the SPS of the Haswell archipelago; to investigate the qualitative and the quantitative characteristics of aggressive contacts between the skuas during collective feeding in places of long and year-round human activity; to establish the functional role of the legs as one of the tools used in aggressive behavior (conflicts) of competing individuals; to assess the possibility of injuries of the webs of the SPS directly inside the AOA.

2. Material and Method

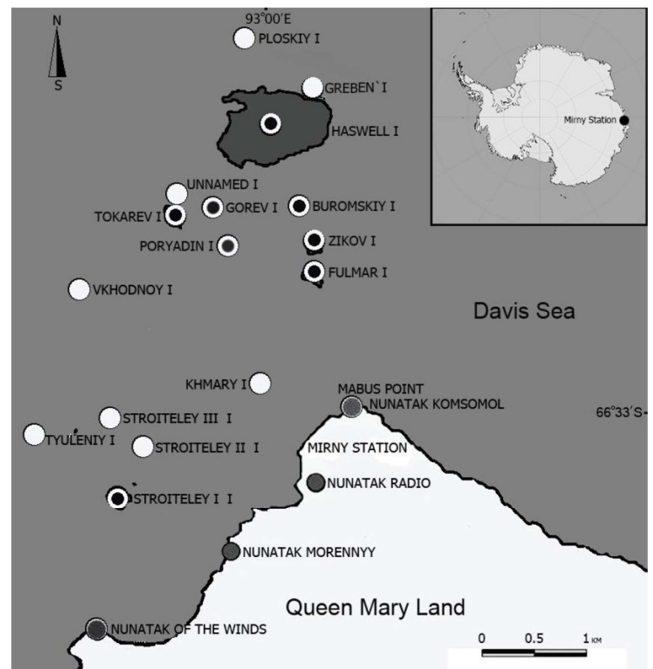


Figure 1. SPS breeding sites on the Islands of the Haswell archipelago. The inset shows the location of the Russian Antarctic station Mirny. The white circles are the main islands of the archipelago, the black and the white circles are the islands where skuas breed, gray circles are coastal nunataks of Antarctica. The largest island of the archipelago – Haswell marked in dark gray.

The study was conducted at the Russian Antarctic station Mirny (66°33'11" S, 93°00'35" E), based on the nunataks of the Davis Sea coast (East Antarctica) (Figure 1) mainly in 2015, with the involvement of materials collected by the author in 2012.

Near the station are the Islands and islets of the Haswell archipelago, where 9 species of birds breed: Emperor penguin (*Aptenodytes forsteri*), Adelie penguin (*Pygoscelis adeliae*), Antarctic petrel (*Talassoica antarctica*), Antarctic fulmar (*Fulmarus glacialisoides*), Cape petrel (*Daption capense*), Snow petrel (*Pagodroma nivea*), Wilson's storm petrel (*Oceanites oceanicus*), South polar skua (*Catharacta maccormicki*) and a subspecies of the Brown skua (*Catharacta antarctica lonnbergi*) (hereafter BS), among which the breeding population of Adelie penguins has the largest abundance. Haswell is the only island that has (the Emperor penguin) or on which all of the above-mentioned species of seabirds breed, and their total number is the highest in the archipelago.

The breeding population of SPS is based on the free from snow and ice territories of some islands with the largest colony being on Haswell Island. Total number of SPS during the season of 2009/2010 was not less than 170 individuals, from that number 62 couples bred [38]. In 2012 skuas were present at the archipelago 192 days, in 2015 – 170 days (registration of the last individuals 12.04.2012 and 03.04.2015, arrival of the first individuals - 02.10.2012 and 14.10.2015).

From 28.01.2015 to 23.03.2015 in the AOA in the Mirny on nunatak Radio (66°33'32" S, 92°59'56" E) (Figure 1) were caught 97 individuals SPS, of which 54 individuals were ringed and individually marked with the original set of colored plastic labels. The remaining ringed individuals were captured and tagged by the author in 2012 or in previous expeditions by other biologists. Thus, all skuas subjected to handling, were individually recognizable. During the inspection, injuries were recorded on the outer covers of each individual, special attention was directed to fixing and describing injuries on the webs between the toes of the skuas. The web was considered damaged if the length of the cut or puncture on it equaled or exceeded 1 mm. The maximum length of damage was recorded along the chord between the two most distant points. Measurements were carried out with callipers. The length of work with one individual was 10-15 minutes.

13.01-30.03.2015-26.10.2015-11.01.2016 the feeding behavior of skuas with elements of aggression in the AOA was recorded in video mode with a portable digital camera Sony Cyber-shot DSC-WX220 Black during daylight, although the SPS agonistic activity can be observed at all hours of the day [39]. The resulting video was sorted and analyzed in the laboratory, its total length was 2308 minutes 40 seconds. The observation site had a diameter of about 4 meters. The most aggressive interactions and the maximum frequency of conflicts occurred on a patch of about 1 meter in diameter with a food source in the center. Observation was conducted around the clefts at the edge of the Antarctic ice

sheet at points of food waste disposal. The skua had access only to the food waste lying on the surface of the continental ice. At more or less regular intervals the birds were checking the sites of food waste, more so in late spring and Australian summer. In this way the study of the skua behavior was predictable and had an artificial foundation. SPS started using the kitchen waste of the Mirny station in the second half of the 20th century [5].

In the laboratory analysis of video materials in aggregations, only bodily contacts during aggressive interactions were put on record — hits by beak, hits by wings, hits by legs and chest, and bites by beaks that reached the goal (touched the opponent's body or caused him pain and discomfort) (Figure 2).

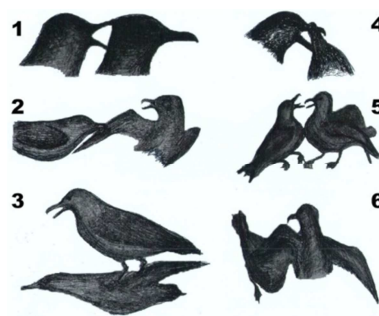


Figure 2. Visualization of some aggressive interactions SPS in AOA: 1) hit by beak; 2) bite by beak; 3) hits by legs; 4) coupling by beaks; 5) chest-to-chest collision; 6) hit by wing.

Attacking the enemy or defending themselves, the skuas struck their beaks with both closed and open jaws. Bites occurred with a slightly opened beak followed by pinching of the competitor's feathers or parts of its body. Coupling beaks occurred when one of the conflicting individuals grasped the opponent's upper or lower jaw and held it for a while. A chest-to-chest collision occurred between conflicting individuals, facing each other on the ground or in the air in a synchronized jump. Such clashes were often followed by blows to the head and / or neck area with a beak. The dominant received a breast stroke from a subordinate during an unsuccessful landing of the latter to the feeding site of the dominant individual and is not a characteristic behavioral element of SPS in a conflict situation. Hits by legs to the body of the competitor (head, chest and other parts of the body) were made on the ground during aggressive contacts between competitors or during landing of the intruder in the epicenter of the competition, where the dominant individual is the most aggressive to the intruder. Landing of the intruder with two legs on the back of the competitor dominant or subordinate took place with the aim of pressing it to the ground and subsequent expulsion from the feeding territory. Wing strikes between competitors occurred intentionally as well as indirectly in an attempt to avoid conflict by both individuals. High energy agonistic encounters (e.g. fights, chases) [40] were observed in the conflicts between the dominant and subdominants or between subdominants on the ground or on ice. The sex of the observed individuals was not determined.

The dense plumage of the body of the skua performs the function of an effective shock absorber, smoothing the force of the opponent's strike during attacks. However, in aggressive interactions, a competing individual receives many blows from an opponent and some of them transform into bruises, hematomas, abrasions or superficial wounds hiding under the skin or feather cover of the bird and are very difficult to diagnose. In skua conflicts, it is easier to establish losses of contour feathers, damage to primary, secondary and tail feathers. Scratches on the surface of the skua's beak, resulting from conflicts, foraging activity and comfortable behavior (cleaning the beak on the rough surface of rocks) are less accessible for diagnosis in the field. Injuries to the legs (damage to the membranes of the feet, toes, foot injuries, leading to abnormal movement coordination), on the contrary, are clearly visible and convenient for study.

Handling of the caught in Mirny SPS and directed observation of them inside the Haswell archipelago revealed the following types of injuries, which according to severity are classified as: light mechanical damage (webs and horny shields on the legs, scratches on the beak); moderate damage (absence of claws on toes, absence of toes, limping individuals); hard injuries (fractures of the wings). Extreme severe injuries incompatible with life, leading to death, were not recorded in the AOA.

Mathematical data processing was carried out with the help of "Excel" software.

3. Results

3.1. The Duration of the Period Demonstrating the Aggressive Behavior by SPS During the Year and the Bird Species Composition in Aggregations

In 2015 the skuas demonstrated aggressive behavior from early January to the first days of March and from the end of October to the end of December, that is, during the pre-breeding, breeding and post-breeding periods. The composition of the aggregations noted consisted either solely from SPS or of SPS together with single BS. Occasionally,

supposedly hybrid individuals between the SPS and the BS took part in the aggregations.

3.2. Damage to the Webs (Cuts and Punctures), Claws and Toes of SPS

Out of the 97 SPS captured, 39 individuals (40.21%) had signs of damage to their feet; in particular 33 individuals had 54 cases of web damage (Figure 3), and 8 individuals showed 8 cases of toe damage.

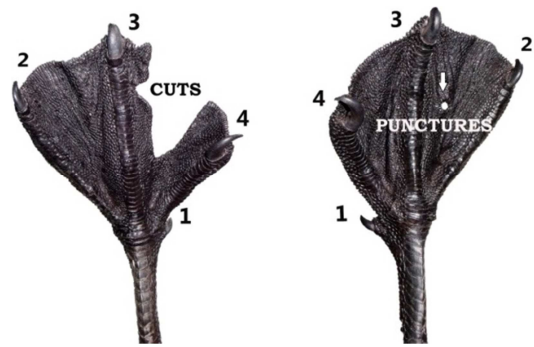


Figure 3. Damage to the webs of the legs SPS. Numbers denote finger numbering.

Two types of damage to the webs on the legs of skuas were recorded: cuts and punctures. The cuts often had a longitudinal direction along the phalanges of the toes. The degree of damage to the webs is different. The heavily damaged webs of some individuals looked like the legs of the grebes (order Podicipediformes) or coots (order Gruiformes) - in the phalanges of the toes they formed something like leathery edges (Figure 3). 21 individuals had single cases of damage, 5 individuals showed 2 cases of damage each, three - 5 individuals, four each - 2 individuals. The number of injuries to one web varied from 1 to 3. The record total number of injuries to webs on both legs of one individual is 4. The results of the distribution of damage to the webs on the legs of the SPS and their sizes are presented in Tables 1-4.

Table 1. Distribution of damage on the webs of the feet of SPS.

Damage to webs:	1	2	3	4	5	6	7	8
on the left leg between 2 and 3 toes;	14	14,43	10	10,31	5	5,15	2	2,06
on the left leg between 3 and 4 toes;	11	11,34	6	6,19	6	6,19	1	1,03
on the right leg between 2 and 3 toes;	14	14,43	11	11,34	3	3,09	0	0
on the right leg between 3 and 4 toes.	9	9,28	7	7,22	3	3,09	2	2,06

Designation: 1 – number of individuals with damage of webs; 2 - % of individuals with damage of webs from the total number of examined individuals; 3 – the number of individuals with cuts webs; 4 - % of individuals with ruptures of webs from the total number of examined individuals; 5 – number of individuals with through punctures at webs; 6 - % of individuals with through punctures at webs from their total number; 7 – number of individuals with more than one damage at the webs; 8- % of individuals with more than one damage on the webs of their total number.

Table 2. The size of damage to webbed feet of SPS.

Cuts to the webs:	Left leg					Right leg				
	min	max	medium	SD	n	min	max	medium	SD	n
between 2 and 3 fingers	1	14	4,5	4,4	11	3	34	17,8	13	11
between 3 and 4 fingers	2	20	8,5	7,9	6	2	26	12,2	11,6	7
Punctures to the webs:	Left leg					Right leg				
	min	max	medium	SD	n	min	max	medium	SD	n
between 2 and 3 fingers	3	6	4,4	1,1	5	3	18	8,3	8,4	3
between 3 and 4 fingers	2	6	4,1	1,3	7	2	8	5,5	2,5	4

Table 3. Distribution of cuts and punctures on the webs of the feet of SPS (n=54).

Damage type	Left leg (n=29)		Right leg (n=25)		Σ	Σ
	n	%	n	%	n	%
Cuts	17	58.62	18	72.0	35	64.81
Punctures	12	41.38	7	28.0	19	35.19

Table 4. Damage to the toes of the SPS (n=8).

Damage type:	n	1	2
the absence of the first toe on the left leg;	1	2.56	1.03
the absence of claw on the first toe of the right leg;	5	12.82	5.15
the absence of claw on the first toe of the left leg;	1	2.56	1.03
the absence of claw on the second toe of the left leg.	1	2.56	1.03

Designations: n – number of individuals; 1 - % of total number of individuals with leg injuries; 2 - % of the total number of surveyed individuals.

3.3. Which Body Parts are Used and Targeted by Skuas When Attacking Each Other

Bites and blows with the beak, legs, wings and other parts of the body, inflicted by competing SPS individuals during aggressive interactions, for convenience, I have designated with the term aggressive contact. The total number of aggressive contacts recorded during the analysis of the video was 1374. Of these, a simultaneous bite by the beak to the web and the end of the toe of the competitor was observed only once. In conflicts on the surface of the ground or ice, skuas attacked their opponents with beak strikes (62.95% of the total number of contacts) with the active participation of the neck and head, to a much lesser extent by biting (14.99%), with wings strikes (9.24%) and with their feet (7.28%). The chest-to-chest collisions (4.0%) occurred almost three times more often than the beak clutches (1.38%), but were rare. The situation when one skua hit the other with its chest when landing was observed twice (0.15%).

Beak strikes were inflicted all over the body of the competitor, most often to the head (39.42% of the total number of blows with the beak), neck and chest (29.25%), less frequently to the wing (13.41%) and back (12.25%), very rarely the belly, body sides (4.51%) and tail (1.16%). Beak bites were mainly directed at the primary wing feathers of the wings (44.66% of the total number of bites), two times less at the neck, chest (20.87%) and head (19.42%). Legs in SPS conflicts were used in landing of one of the competitors on the back of the other, followed by pressing it to the ground (62% of the total number of hits by legs), with hits by legs to the chest and other parts of the body (33%) and very rarely with blows to the head (5%).

3.4. Direct Evidence of Light Injury Being Inflicted to the Feet of SPS and the Probability of Web Damage

Evidence of injury to SPS is classified as hard-to-document events. Only two facts were recorded when one of the skua grabbed the membrane on the opponent's leg with its beak. The first case recorded on 12.02.2015 - one of the skuas defended its temporary forage territory from the intruder, who was trying to settle on its back. In an attempt to expel it, the dominant grasped with a beak the webbing of the

foot of the soaring intruder and began to shake it, causing the opponent severe pain. In an aggressive battle, skuas struck each other with strong blows with their wings all over their bodies. The fight lasted about 30 seconds. The intruder broke free, and on the web between its fingers it had a gap of about 20 mm. This incident occurred outside the place of regular recording of the aggressive behavior of the skuas, and it was not included in the analyzed sample. 11.22.2015, a bite was recorded by the beak of one individual to the web and the end of the middle finger of the right foot of the other (bite duration 1 second), during which the membrane was not damaged (Figure 4).



Figure 4. SPS captured end of the third toe and the web of competitor by beak.

Among the 1374 aggressive contacts of SPS direct proof of damage to the webs on their feet was not noted. Thus, the probability of damage to the webs of SPS can be estimated as less than 0.2% (with CI 95%) that is close to “0”.

4. Discussion

Analysis of minor injuries of the feet of the skuas and observations of tagged individuals in and outside of aggregations did not reveal negative functional deviations in behavior and did not have a noticeable effect on the normal functioning of the birds in their future life cycle. Cases of loss of a claw on a toe, loss of a toe, and also cases of the limping individuals were rare. Skuas with missing claws and fingers led a full life. The fate of limping individuals is not entirely clear. For instance, one lame-marked SPS individual was repeatedly recorded in Mirny in 2012, and in 2015 it had no

deviations in motor skills. In 3 other cases, lame birds were observed on the islands of the Haswell archipelago in 2012, but were not observed in 2015. The number of very rare cases include severe mechanical injuries and collisions of skuas with machinery. Living or dead skuas with fractures of wings that reached or did not reach the flight stage were repeatedly discovered by different researchers [41, 42, author's data 2014]. J. F. Spellerberg [14] sometimes observed skuas with broken wings during aerial attacks while defending a territory. In some episodes of severe injuries and deaths, a man is guilty — one of the skuas broke a wing during its capture [26], another was killed by a truck [42]. Apparently, in Antarctic conditions, all survivors, skuas with broken wings, are doomed to death with the onset of the Antarctic winter or earlier.

SPS leg injury sources can be their aggressive and non-aggressive behaviors in and outside the AOA. The non-aggressive behavior of SPS allows for the possibility of “passive” leg injuries (breaks and punctures of webs on the feet), for example, on sharp cutting surfaces of natural (ice or rock surfaces) and anthropogenic substrates. Injuries due to aggressive forms of behaviour of skuas are probable when competing for food or protecting the territory from the intruders during the breeding season.

As far as I know, for the first time, the problem of SPS web damage was noted by J. F. Spellerberg [14], who studied the SPS population on Cape Royds in Antarctica in the 1960s. He found that out of 285 individuals examined in one summer, 57 (20%) had some damage to webs [14]. Detection of damage to webs on the feet of skuas was not the main goal of this scientist therefore his article did not contain detailed data on the method of collecting the information, on the nature of the damage and the minimum size of damage that was included in the total number of individuals with damage to the webs on their legs. In Mirny, as mentioned above, out of 97 SPS examined, 33 individuals (34%) had web damage, which is 14% higher than Cape Royds. The differences in the values obtained at Cape Royds and in Mirny can be tentatively explained on the one hand by researchers using two different methodological approaches to the problem, on the other hand by the influence of as yet unidentified but significant environmental factors on these two remote SPS breeding populations in the Antarctic.

In Mirny among the 1374 aggressive contacts of SPS direct proof of damage to the webs on their feet was not noted. Thus the probability of damage to the webs of SPS can be estimated as less than 0.2% (with CI 95%) that is close to “0”. Aggressive interactions of SPS in OAO cannot be a significant source of light leg damage (damage to the webs on the feet) as such even in sites of human activity where the frequency of aggressive contacts is high.

The role of the legs in aggressive interactions. The fact that the legs were used by SPS during the fighting and had many tears, cuts and holes in the webs of adult individuals was previously known [14]. My observations of the aggressive behavior of skuas in the AOA on solid substrates (earth, ice) showed that the most important tool of the SPS attack during the attacks of rivals was blows with its beak -

63% of the total number of aggressive contacts. The share of hits by legs was only 7.3%, while they were not as effective as compared to beak hits. Nevertheless, 62% of the total number of beak hits were recorded when one of the skuas landed on the back of the other with it pressed to the ground. It was in this situation that I watched as one of the skuas was injured to the web (see the Results section). Thus, with aggressive interactions in the AOA, SPS legs do not play the role of an effective attack tool, but can be a risk factor for light mechanical damage. In contrast, during the protection of breeding territory when swooping from above, the SPS inflicts very strong blows on the intruder [41] with their feet, and in such situations they are used as the most important tool of aggression. E. C. Young [36] mentioned that when cutting a penguin chick's carcass, for example, the SPS did not use its legs to hold it or tear it — the beak served this function. According to my observations, the legs were used as a stop when rupturing the carcasses with the beaks by two skuas.

Age characteristics of individuals with damaged webs on their feet. Aggressiveness is manifests itself in the form of sibling aggression from the first days after hatching of the chick from the egg [14, 31, 34, 40, 43]. In the future, aggressive interactions will accompany the individual throughout its life history. During sibling aggression, SPS chicks received injuries in the form of cuts and abrasion on their beak and face [44]. In cases of injuries to chicks by adult skuas deep cuts were found on their heads and necks [45]. Two pairs of sibling chicks had their feathers plucked from their heads in their days before their deaths. One of these pairs was 4-6 weeks old, showed successively more severe wounds to the head, neck and back in the 2 weeks before they died [40]. The scientific literature describes cases in which adult SPS from border areas shortly after an oil spill could inflict wounds on the nestlings, as the parent individuals were forced to spend time cleaning their plumage, rather than protecting the brood. Oil spill caused a disruption in the normal parental behavior of SPS [46]. However, there was no indication of damage to the feet of the chicks.

In Mirny there were observed individuals both of those which reached reproduction age and those at the age of pre-breeding. Among skuas with leg injuries, there were no individuals whose age was less than one year according to the description of the dresses [25], and one-year-old specimens were also rarely present. Young individuals, under the age of one year, usually do not show aggression in the AOA, avoid conflict situations, compete poorly for food, and keep on the periphery of the local feeding territory. Injuries of membranes in skuas at this age were not recorded. Experienced but immature and more adult individuals that have settled in a particular area usually enter into competition for a limited food resource. Most likely, leg injuries skuas begin to get after the age of two years. Observations of individual skuas over 15 years of age showed that such individuals were able to compete for food, but they avoided aggressive interactions from time to time, did not show the maximum degree of aggression against competitors, rarely

became dominants in aggregations, and kept this status for a short time.

The risks and benefits of feeding of SPS. The kitchen waste of the station on the one hand can serve as an additional food resource supporting a significant number of skua for a long time, on the other hand serve as an additional source of injury to birds. In case of SPS feeding in the colonies of Adelie penguins, the increased risk of injuries to skuas is not excluded, but it is probably small. P. J. Pietz [40] has never observed feeding-related injuries. Lame individuals may be the result of injury when ringing. One pair of skuas left the eggs during incubation due to abscesses on the legs [45]. In contrast, pairs of SPS that have obvious feeding territories with food availability or food from station refuse in some cases produced more chicks that reached the flight stage [33]. Earlier breeding dates were established for SPS which received food at the station [47], cited from [40].

On migration sites and wintering grounds. SPS spend 65–95% of their time on the sea surface, and the overall level of activity of skuas in wintering grounds was low, indicating a strong energy restriction and high availability of food [24]. Taking into account the aforementioned, as well as the statements of E. C. Young [36] that SPS do not use legs for fishing in wintering places, it can be assumed that there is a low probability or lack of damage to the legs of the skuas.

I hope that the general direction and the methodological approaches used in this work will contribute to the progress in a more detailed study of the phenomenon of aggressive behavior of skua and their injuries in the future.

In general, the adaptive role of the AOA for SPS in the extreme conditions of the Antarctic is the possibility of using a limited food (energy) resource through aggressive interactions with other applicants of the genus *Catharacta*. In other words, in conditions of tough competition for food with no fixed leadership of dominants in aggregations, the most hungry individual, demonstrating the maximum degree of aggression and able to compete for a limited resource, gets access to food, but at a certain stage of satisfying its own hunger and fading aggression, it becomes a target for the aggression of another hungry individual.

5. Conclusion

In fact, the likelihood of injury to the webs on the legs of the SPS in the AOA at Mirny station turned out to be close to “0”. This data was obtained only from the analyzed sample, and it was not extrapolated to the whole life cycle of the skua. At the moment the difficulty of the extrapolation lies in the lack of the quantitative data on the total number of aggressive interactions of the skua in its annual cycle and the change to this number in the course of the whole life cycle of an individual. There is also no opportunity obtain the data on the aggressive behavior of the skuas around the natural food sources to compare with that around the anthropogenic food sources. The aforementioned factors were conducive only to partial goal achievement. At present the disposal of food waste occurs in such a way that the skua do not have access

to it. Thus, the paper presented will be of historic significance and may serve as a starting point for further study of aggressive behavior by the skua in AOA. The first step in that direction has already been done. Observations of individual marked skuas during 2012 and 2015, with damaged webs on their feets and participating in many aggressive interactions, did not reveal negative deviations in their behavior, since these individuals subsequently bred - successfully incubated the clutches and protected the breeding areas. Injuries to the webs of the legs of the SPS are not an obstacle in their future.

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