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SUMMARY

This paper describes the process of colonization of a small island (Furugelm Island) in Peter the Great Bay (Russian side of the Sea of Japan) by a gull species from the *Larus argentatus* superspecies complex, starting from a single nesting pair in 2004 to a stable population of 72 pairs in 2012. The taxonomic status of the colonist species remains debatable and is not the purpose of this paper. Rather, this is an analysis of the dynamics of regional colonization, characteristics of seasonal migration, and species biology that allow for the conclusion that these observations amount to a sequential colonization by *Larus (smithsonianus) mongolicus* of the eastern periphery of the Asian continent. The settlers colonized two habitat types from Lake Khanka to the lower reaches of the Amur River: large, freshwater lakes, and coastal islands. The birds that settled on Furugelm Island started as a group of seven differently-aged birds: two mature birds (that bred) and five younger birds of varying maturity. Successful colonization by this species was based on a series of factors, including the protected status of Furugelm Island where the birds fortuitously chose to nest, an abundance of available habitat and food resources, and a relatively low abundance of Slaty-backed gulls, which occupy the same niche.

The referred figures and tables are in the original article in Russian, at pages 3—19

This manuscript was prompted by the discovery of a new nesting species in the Peter the Great Bay (in extreme southwestern Primorskii Krai, Russia); a gull from the *Larus argentatus* superspecies complex. Following a review of the literature it became clear that this was a species colonizing a vast region - the eastern periphery of the Asian continent. The purpose of this text, which documents the genesis of a new breeding group of this gull (apparently the first in the Sea of Japan), is to discuss the timing, means, and consequences of the new breeding population on Furugelm Island in the Far Eastern State Marine Biosphere Reserve.

MATERIALS AND METHODS

Field observations were carried out in southwestern Primorskii Krai from 2004-2012. Data were collected primarily at colonial waterbird nesting

sites on Furugelm Island in the Far Eastern State Marine Biosphere Reserve and also in spring and autumn 2009 during a series of surveys (to search for other concentrations of these gulls) along the entire coastline of Peter the Great Bay.

Observations at breeding colonies to detect breeding birds were conducted from 19 June-25 August in 2004, and from 14 May-24 June and 07 August-18 September in 2005. In all subsequent years, annual monitoring was conducted at the colony, including a census of all gulls nesting there.

The adjacent Tumen wetland—a complex of land, sea, and shallow bays—was a potential location for feeding habitat suitable for the colonist. In the pre-breeding period in 2005 (from 16 March-19 April), I conducted a series of surveys there, in which all “large, White-headed gulls” of the *L. argentatus* complex were recorded. Nearly all locations suitable for resting or feeding use by gulls were examined. The length of a single route was ~ 130 km. Other surveys were conducted 24 July-05 August in 2005, and 09 April-10 May and 28 August- 21 September in 2009. Some islands in Peter the Great Bay were surveyed from 06-16 June, 2012.

*E-mail: <birds@ibss.dvo.ru>

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RESULTS AND DISCUSSION

Historical Analysis

Starting in the second half of the 20th Century and into the 21st, scattered reports of a previously-unrecorded gull species from the *L. argentatus* superspecies complex appeared across the vast, temperate region of extreme eastern Asia. Different authorities have referred to this species by different names, but it is likely that all describe the same species. What follows is a brief summary of each regional report (and see Fig. 1).

Lake Khanka. The first “herring gulls” recorded nesting on the lake were in the 1970s (Glushchenko et al., 2011). From then, the breeding population grew from a few dozen pairs to 1,873 pairs in the present day (Fig. 2; Glushchenko et al., 2011). These Khanka gulls have been called different names, including *L. argentatus mongolicus* (Yudin and Firsova, 1988); *L. (cachinnans) mongolicus* (Yudin and Firsova, 2002); *L. cachinnans* (Glushchenko et al., 2011), and *L. vega mongolicus* (Firsova, 2013).

Lake Udyl, Lower Amur River basin. The first nesting *L. (cachinnans) mongolicus* were recorded on Lake Udyl in June 2003, when 16 adult breeding birds were seen there. The birds were identified following taxonomy in Olsen and Larsson (2004). This species was subsequently confirmed as a nesting species in 2010, when 20 young birds were observed, and again in 2011, when four nests were found (Pronkevich and Oleinikov, 2010; Pronkevich et al., 2011). Presumably, the species began nesting at Lake Udyl around the year 2000.

Yellow Sea. There are multiple reports of a large, white-headed gull nesting on a number of islands off the western coast of the Korean Peninsula, both in North and South Korea. Initially, these birds were identified as Herring gulls *L. argentatus*, then later as “Mongolian gulls” *L. mongolicus* (Chong et al., 1996; Moores, 2003, 2008; Chan et al., 2010; Moores, 2012). According to Moores (2012), the “Mongolian gull” is a common breeding species on some islands in the Yellow Sea. A colony of ~100 Herring gulls were observed on Dokdo Island (North Korea) in the breeding season in 1995 (Chong et al., 1996), and Moores (2012), in interpreting information from Austin (1948), even suggested that “Mongolian gulls” were a broadly-distributed summer visitor to the

Yellow Sea in 1910 or even earlier.

Furugelm Island, Peter the Great Bay. Over the past few decades, only two gull species have been recorded breeding in this area: Black-tailed gull *L. crassirostris* and Slaty-backed gull *L. schistisagus*. Nesting by a third species was first recorded in summer 2004, on Furugelm Island. There was a single nesting pair that year, and by 2012 this number had risen to ~130 breeding adults (Figs. 3, 4).

After analyzing the literature, I believe that, more likely than not, all of these previously-published records refer to the same species: *L. mongolicus*. However, it was not my goal to identify the taxonomic status of this colonizing species, and in this manuscript I defer to the classification proposed in the latest (fourth) edition of The Howard and Moore Complete Checklist of the Birds of the World (Dickinson and Remsen, 2013), where the Asian form is regarded as a subspecies of the American herring gull: *L. (smithsonianus) mongolicus*. Hereafter, I use the conditional name «Mongolian gull» to refer to this bird.

The Likely Source of Colonization

Although this has not been specifically emphasized or discussed, most (if not all) authors of previous publications concerning this species note that this gull is distributed inland. The Mongolian gull’s primary breeding range is in fact continental (Fig. 1), so observations in eastern Russia represent an expansion towards the eastern periphery of the Asian continent. What follows are some facts and considerations to support this statement.

1. At the start of the 20th Century, the Herring gull *L. a. mongolicus* was a very rare bird in the Altai-Sayanskii ecoregion (Baranov and Melnik, 2009). These authors report that there was an increase in the number of these birds over the past 50 years, and that their colonization of the central Siberian section of the Altai-Sayanskii ecoregion during that time was “particularly intensive.” Numerous nesting colonies settlements have appeared in the Tuvinskaya and Minusinskaya Hollows, and it has become an abundant nesting species on water bodies of western Mongolia (Baranov and Melnik, 2009). This species clearly had means and opportunity for expansion.

2. The increase in numbers of *L. a. mongolicus* in its

primary breeding range largely coincides with the first breeding records of the "Herring gull" at Lake Khanka (Glushchenko et al., 2011). It seems that these birds began expanding their range into the eastern sections of the Asian continent sometime in the second half of the 20th Century. That is, the process of expansion continued past that documented in #1 above.

3. The breeding areas newly-established by these gulls are approximately the same latitude as the primary range of the mongolicus form. It is likely easier for birds colonizing from the west to acclimate to the seasonal rhythms of an area than if they were to come from the north.

4. The fact that a portion of the inland population winters in the Yellow and East China Seas is relevant (Brazil, 2009) Interestingly, some gulls from the primary breeding area move east during autumn migration, to the periphery of the continent (van Dijk et al., 2011). This means that at least some Mongolian gulls have had the opportunity to "scout out" the region now colonized.

5. Colonization by similar-looking but northern gull species Heuglin's gull *L. heuglini taimyrensis* or Vega gull *L. vegae* seems less likely than Mongolian gull. These species are exclusively detected in the eastern Asian continent outside the breeding season (Carey et al., 2001; Olsen and Larsson, 2004; van Dijk et al., 2011). Further, Moores (2012) believes that any mid-summer records of Herring gull in South Korea are far more likely to be a Mongolian gull than a Vega gull.

Hypothetical Route of Colonization

The colonization of the region almost certainly took hold during a spring migration. The majority of the main breeding population returns north from the wintering grounds inland, likely via the Yellow Sea. However, some individuals, drifting with other migrants, might fly to the northeast. Perhaps these were birds that moved past this way in the autumn migration, and some of them stopped along the way, settling appropriate habitat (Fig. 1). Lake Khanka, as the largest body of inland water in the region, was likely the primary attraction for these spring migrants. It is possible that the newly-established colonies at Lake Udyal and Furugelm Island were sources from birds originating from the Khanka population. If true, this is

an advanced stage of colonization.

The proposed expansion from Lake Khanka might be the result of a deficit of nesting territories there. The appearance of nesting Mongolian gulls at Lake Udyal (in 2003 or a little earlier) and on Furugelm Island (2004) generally coincide with two potentially-related events at Lake Khanka:

1. Overpopulation. There was high nesting density and limited availability of flat, sandy islands. By 2003, there were already ~1,500 breeding pairs there (Glushchenko et al. 2011).

2. Deteriorating conditions for nesting. With the continuing rise of the water level in the lake, the islands where the birds nest are slowly becoming submerged. An indirect sign of a reduction in suitable nesting habitat at Lake Khanke in these years was the presence of 700-900 unpaired individuals near the nesting colony (Glushchenko et al. 2011). These could be birds that are not breeding due to insufficient space for them to do so; a situation that might prompt them to seek alternate suitable nesting sites.

One might suppose that the colonization of the Russian Far East by Mongolian gulls will continue. This is partly confirmed by the discovery of two new nesting sites on the Verkhovskii Islands in Peter the Great Bay in 2012, located at a distance of 85 km from the main settlement on Furugelm Island. This species definitely did not nest here in the past. It is possible that some other, new nesting sites have not been yet discovered.

The Establishment of a Local Population in Peter the Great Bay

Elements of luck

1. Due to long-term colonial waterbird monitoring on Furugelm Island, I was unexpectedly able to record the first year these birds nested on the island. Such opportunities are very rare. This gave me the opportunity to track the process of colonization.

2. These gulls fortuitously nested on the territory of a strictly-protected nature reserve, which significantly increased the chances of successful colonization in the region.

The situation in the colony

The first nest on Furugelm Island was discovered on 19 June, 2004, the day I arrived there for

monitoring. Only one pair nested that year (the remainder of this small island was carefully surveyed). This sole nest was successful. The nesting pair had adult plumage. In addition to this pair, there were also 5 immature, non-breeding Mongolian gulls: two second- or third-year birds and three fourth-year birds.

There were 11-12 nesting pairs the following year. Of these, two or three could conceivably be from the 2004 group of 'colonists,' but the rest were obviously new settlers. Breeding pairs were unevenly distributed across multiple colonies of Black-tailed gull *L. crassirostris*.

At least three factors likely contributed to formed pairs, ready to breed, being attracted to a new island:

1. The most important was the presence of birds with previous breeding experience there;

2. The presence of a reserve population, that is, a certain number of mature birds, ready for whatever reason to switch their nesting location. This seems to be confirmed by a noticeable number of «doubles» (i.e., paired birds) among those counted during migration (36% of all encounters were of birds flying in twos).

3. The adjacent Tumen wetland, which is an attractive location for many species of aquatic birds. This is a place where they can rest and feed. Any «newcomers» first arriving in the region would quickly be able to deduce the merits of Tumen as an important component of successful reproduction.

The population dynamics in this settlement was positive in all subsequent years (Figure 4), and by 2012 the number of gulls rose to 72 breeding pairs.

The situation on the adjacent mainland

Data from our mainland surveys demonstrated the distribution of gulls from 25 March (the first record) to 16 April (Fig. 5). The total number of detected birds was small (n=87). A detection event was an encounter with one, two, or a group of adult birds in a specific place on a specific day. Clearly, some individuals were likely recorded more than once. Young birds were only detected twice; the first time

on 16 March (2 subadults) and again on 18 March (2 second-year birds). Gulls of the *L. argentatus* complex, while occasionally sighted alone, tended to be found along with other gull species (e.g., Black-headed gull *L. ridibundus*, Black-tailed gull *L. crassirostris*, Slaty-backed gull *L. schistisagus*, and glaucous gull *L. hyperboreus*). Most birds were stationary when observed; a few made local movements. None appeared to be in the process of long-distance movements.

The plumage of Mongolian gulls can be contrasted with that of the Slaty-backed gull, which also breeds on Furugelm Island. The slaty-backed has almost-monotonous dark upper parts with indistinct black wing tips. Conversely, this gull in the *L. argentatus* complex has lighter upper parts (with varying intensity), and distinctly-visible black wing tips. That is, the upperparts of these two species differ dramatically. I was able to examine about a third of the detected *L. argentatus* birds in more detail. There were two types of coloration observed: «pink-legged» and «yellow-legged» birds. The «pink-legged» individuals had a light gray mantle and a pale pink tibiotarsus and tarsometatarsus and pinkish-gray feet (n=26). There were only three «yellow-legged» birds observed; a pair with a darker mantle and a single individual with a bluish-gray mantle. The pair of «yellow-legged» *L. argentatus* looked very similar to *L. heuglini heuglini* and the solo bird could have been *L. heuglini taimirensis* (see Olsen and Larsson, 2004). I considered most of the birds designated as «pink-legged» to be locals—that is—Mongolian gulls. The most recorded in a single trip around Ekspeditsiya Bay was 11 individuals (04 April), followed by 7 individuals (06 April). These were mostly groups of two (n=5), and small groups of 3-5 birds (Fig. 6). These «doubles» are noteworthy as these were birds that had apparently already paired. From where these birds were located to Furugelm Island was a straight shot of about ~20 km.

In the late-nesting season, a repeat survey of the Tumen wetland was conducted from 24 July to 05 August, 2005 (Fig. 7). A number of encounters with Mongolian gulls were recorded (n=9). These were primarily solitary birds found on lakes and rarely in

1. The term «gull of *L. argentatus* image» is a working designation of adult large white-headed gulls, excluding Slaty-backed gull, which could not be accurately identified. The color intensity of the mantle varied, and the color of legs remained unrecognized.

shallow estuaries. Some birds were seen in flight, and some of these were moving toward Furugelm Island. It is likely that all observed birds had some connection to Furugelm.

These records are complemented by additional observations made along the coast of the Peter the Great Bay in the spring and autumn 2009 (Figs. 8, 9). The spring survey was conducted at the conclusion of the northern migration of large gulls and the initiation of gull nesting on Furugelm. There was a large, noteworthy spatial gap between the primary locations where large gulls were observed. Birds seen in the area of Poset Bay (16 April – 09 May) were clearly local and linked to Furugelm Island. Almost all of them were solitary adults and, apparently, were the partner of the breeding pairs not presently brooding. Gulls observed 02-04 May at another site to the northeast were still in the process of migration. Among them were birds with darker or lighter upperparts—this was clearly a mixture of different species. They were observed in mixed flocks with other gulls such as Black-tailed gull, Black-headed gull, Common gull *L. canus*, glaucous gull, and Slaty-backed gulls. They were most commonly seen with these first two species. The largest group of gulls from the *L. argentatus* complex (n=~200-300) was seen in a massive, multi-species cluster of ~4,500 individuals in Vostok Bay (02 May, 2009). The date and location of this observation suggests that these birds may have nested somewhere in the north. Other encounters in this area were recorded as small groups of several individuals.

A survey of the same area was conducted again in autumn, prior to the migration of large northern gulls, from 25 August-21 September, 2009, in which birds of the *L. argentatus* complex were encountered on 21 occasions. Some locations were visited several times. Almost all gulls were located on the extreme southwest of the region closest to Furugelm Island (Fig. 9). The maximum number of individuals (n=260-280) were recorded on 19 September, 2009. It is logical to think that most of them (possibly all) were local. Juvenile birds and families (where begging and feeding behaviors were observed) were recorded at the mouth of Golubini Bay and in the lower reaches of the Tumen River. Throughout the rest of the area surveyed along the coast (from 11-17

September, 2009) there were only three encounters with 5 individuals of this species (Fig. 9).

In addition to ground surveys, I was also able to partially survey coastal waters from a ship. These routes went from Vladivostok to Furugelm Island and back (06-09 September, 2006); Furugelm Island to Vladivostok (10-11 September, 2007); Vladivostok to Slavyanka (17 September 2006); and Furugelm Island to Vladivostok (07 September, 2008) All routes were relatively linear; other than the 10-11 September, 2006 journey, which was along the coast, all routes were way from land. Despite active searching, the Mongolian gull was not once encountered. This result is consistent with data of other surveys, and is evidence of the extreme localization of species distribution at that time and (most likely) the absence of other colonies in the Peter the Great Gulf at that time.

The Region of Expansion

Not all surveys were conducted specifically with the goal of locating Mongolian gulls. Nevertheless, the information obtained allowed for a more accurate assessment of this species' expansion into Peter the Great Bay. The "region of expansion" is defined as those locations (both terrestrial and aquatic) where colonists of all ages were recorded. These include breeding sites as well as post-nesting feeding and nomadism (i.e., any space used by the birds from the time of arrival to departure for the winter).

In the first 2-3 years after this species began breeding in the area, it had assimilated southwestern Primorskii Krai and, apparently, neighboring portions of North Korea. The direct distance between the breeding colony on Furugelm Island and encounters with birds on the mainland ranged from 12-31 km; roughly an area the size of ~50 x 40 km. It seems that by 2009 the birds have not yet expanded beyond these limits, and Furugelm Island was the only place where they nested. During this time, population dynamics were positive (Fig. 4). There were other, suitable breeding locations for these gulls in Peter the Great Bay (although none likely as ideal as Furugelm Island). Unfortunately, it was not until 2012 that the opportunity to survey some of these other islands presented itself. In that year, two breeding pairs of Mongolia gulls were found on Verkhovskii Island.

Thus, the «region of expansion» continues to

expand, and it is difficult to say exactly how large it is. The new nesting site on Verkhovskii Island is ~ 80 km straight-line distance from Furugelm Island (Figs. 1, 9).

The Colonists

In the first year of breeding (2004), a single pair bred on Furugelm Island. This was confirmed by repeated and careful examination of the colony. In addition to the pair, I also recorded a few other, non-breeding birds, which I aged following markers described in Olsen and Larsson (2004). The breeding birds were adults. Three of the other birds appeared to be “fourth-summer” adults, and two others were subadults (a “second-summer” bird and a “third-summer” bird). All five non-breeding birds showed some evidence of juvenile plumage and age-appropriate behavior. Only one of the five (a female, “fourth-summer” bird), seemed to be physiologically mature.

Thus, the «colonial group» consisted of 7 birds of three age groups: two mature, breeding adults, and five «maturing» birds of varying development. The term «group» here is arbitrary and does not mean that the birds arrived as a single unit; they might not have met up until already at or near the breeding area.

The behavior displayed by the breeding pair (including during migration) could have been a sign and a stimulus for the corresponding behavior of the younger birds. There is constant movement of Black-tailed gulls flying to and from Furugelm Island from the mainland during the breeding season. It seems likely that this was the course that the colonists followed to reach the island. The pair that eventually bred likely arrived there early in the season, followed by the younger birds. This is how the breeding population may have been established.

In subsequent years, as the colony grew, the proportion of subadults fell markedly, with only four individuals seen in 2008 (although counts were perhaps incomplete). From time to time, some breeding birds, although generally in fully-mature adult plumage, exhibited some physical characteristics of third-year birds (black spots on tail feathers).

Demography and Expansion

The birds of different age classes differed in their attitude to this new area. The strongest connection to this new area, naturally, occurred with mature,

breeding pairs. This new place was most likely where their descendants would nest. A strong bond would also be made among maturing birds, which saw adults nesting there successfully. They would regularly visit the colony and nesting site for two months (the breeding season), observing. Most likely, their first breeding attempts would be the following season. The younger, juvenile gulls probably made the weakest connection with this new place.

This «colonist group» can be regarded as the «nucleus» of a new population, which could be generated if a series of events transpired successfully. And in this case, they did.

Behavior of Birds that do not Participate in Reproduction

Birds of unknown age (some looked like adults) were seen outside the Black-tailed gull colony at the end of June, 2004. On 02 July, while circling the island in a rowboat, I saw single such birds on four occasions. It's possible that one or two of these were from the nesting pair. Immature birds near the nesting territory were seen twice: two birds (second-summer and third-summer birds, respectively) on 13 July, and a single third-summer bird (possibly the same one as before) on 24 July. The resident pair chased these birds from the nest when present. By this time the chicks were often left alone at the nest while their parents foraged. These young birds left the nest and wandered around the area. The age differences of the «outsiders» were clearly visible. They were socially mature but physiologically immature. Their participation in «community life» was expressed mainly in the fact of their presence near a nesting pair.

These birds were not observed again. They were replaced by three other gulls that appeared older (fourth-summer birds). Juvenile markings could only be discerned up close and were not immediately evident. However, their behavior betrayed them. In comparison with the described subadults, these gulls were more developed, both socially and physiologically. They visited the nesting area in the period between 13 July-23 August (up until my departure from the island; it is certainly conceivable that they lingered there longer). These visits were regular and occurred when the nesting pair were absent—otherwise the visitors were chased away. The chicks were usually

ignored by these immature birds but responded to the interloper's approach by hunching and hiding among grasses or rocks. On occasion the chicks were direct persecuted (on foot and not very aggressively), which resulted in the chicks being expelled from the area around the nest. The chicks would either leave on foot or, if possible, fly off. These immature birds also aggressed any Black-tailed gulls that happened to be sitting on nearby rocks.

Although there were ample available nest sites in the area, it is likely that these young birds, in preparation for breeding in future years, needed a full range of conditions for "training," including rivals and competitors. They probably needed the struggle for territory, or at least a simulation of this conflict. For lack of the real thing, the chicks seemed to fill this need. On a few occasions the chicks were observed to attack and chase these interlopers, who did not fight back as right was not on their side.

Once chicks were dutifully chased off, the training «pair» transitioned to a role of "domestication" and to courtship which followed a pattern. Sometimes they ended this with a copulation attempt, most actively instigated by the female. The male involved in this exercise varied. Sometimes, in fact, a male *L. schistisagus* from an adjacent, failed nest initiated copulation. Sometimes the interaction ended in a fight; usually the initiator here was a male.

In the end, the chicks stopped returning to their nest site. If not for these "interlopers" they would have stayed longer. They met their parents at a communal, mixed-species resting spot most occupied by Black-tailed gulls and cormorants. This resting spot was located on a cape a few dozen meters from the nest, and the parents continued to care for them there. The entire community of Mongolian gulls (the family and well as the maturing individuals) spent this night in this mixed-species communal area. The parents would, when necessary, periodically lunge toward the non-breeders who generally kept their distance.

Obviously, the existence of a functioning family and the successful breeding was an extremely important factor for the maturation of the subadults and the formation of their «adult» behavior. They remained in the colony for at least two months, during which three distinct behavioral periods were discernable:

1. The period of low activity. The chicks were small and guarded by their parents.

2. Peak activity. The grown chicks wandered freely about the territory of the site. The subadults, in the absence of the nesting pair, actively invaded the nest territories limits and tried to defend it from both the chicks and neighboring Black-tailed gulls.

3. Attenuation of activity. The family left the nest territory and relocated to neutral territory (the mixed-species group). The subadults then occupied the nest territory completely.

The maturing birds behaved like fully-mature ones when they arrived in spring—this was a clear indication they would attempt to breed the following year. The resulting experiences gave them certain advantages over other birds attempting breeding for the first time.

There is reason to think that the non-breeding female of the subadult pair was physiologically mature. Evidence of this is in the duration and frequency of visits to the nesting site of the breeding pair as well as her sexual activity (in particular her interactions with the male Slaty-backed gull). This activity initiated copulation attempts that did not fully come to be. Her partner was markedly less active and mating attempts were aborted; perhaps he had not yet reached sexual maturity. However, the birds did not attempt to create their own nest site; instead choosing to use the site already established by the mature pair and gradually displaced the already-feathered chicks. There were no attempts to build a nest on their own. Sexual activity was maintained at least until 23 August.

Breeding Phenology

In 2004, studies on Furugelm Island began on 19 June. The nest by this new gull species was discovered that very day. The family of 2 adults and 3 juveniles (later only two juveniles) stayed in the vicinity of the nest until at least the date of my departure from the island (23 August). Non-breeding birds were also seen during this period at various places in the colony; apparently these birds were familiarizing themselves with this new place. The nest, which the chicks left at the age of 7-10 days, was located on a small rocky crest, which was flattened at the top and covered with short grasses. This was surrounded by coastal slopes of varying steepness interspersed with rocky

outcroppings and cliffs. On these nearby slopes were solitary nests of slaty-backed and Black-tailed gulls to form a mixed-species colony.

Nesting in this season apparently began late. The chicks had already fledged by 16 August but remained close to the nest site, and the family group was still on the island on 23 August, by then spending nights in the mixed-species resting site with several dozen other birds (Black-tailed and Slaty-backed gulls and Temminck's cormorant *Phalacrocorax capillatus* and others).

In 2005, chicks started hatching on 24 May and peaked at the end of May and start of June. Flying chicks of different ages were observed in mid-July. Family groups tended to leave the island in early August, but in 2005 this occurred earlier: on 26 July I observed a group of six adults and three juveniles in Ekspeditsiya Bay that had apparently already left the Furugelm Island colony some 30 km away. And by the end of August there were only a few birds left on the island.

The late nesting by the first pair of Mongolian gulls to ever nest on Furugelm Island may be due to the fact that they came to an area unfamiliar to them, and had to spend some time getting to know the territory and adapting to it. It could also be that this was their first breeding attempt, and therefore were not experienced enough to nest in a timely fashion. The difference in breeding phenology, comparing the first and subsequent years, was about three weeks. A comparison of the timing of reproduction of three gull species (based on date of first hatching in 2009; ocular estimate) revealed the following: Mongolian gulls hatched first (01 June), followed by Black-tailed gull (06 June) and Slaty-backed gull (20 June). A full clutch consisted of three eggs (n=30 nests).

Food Items and Feeding Behavior

Although no specific study was conducted to examine food items, causal visual observations of chick feeding (26 June - 21 August, 2004) are given in Table 1. The regurgitated portion (at the time of feeding) ranged from a single down feather from a

Black-tailed gull to a relatively large or medium-sized fish or several medium-sized objects. In addition, accumulations of fish bones were discovered at the nest sites, but no Black-tailed gull chick fragments were found in 2004.

In 2009, we conducted a comparative analysis of dry food fragments left after chick feedings at the nests of Mongolian gulls (n=5) and Slaty-backed gulls (n=7). Fragments were collected 08-14 July 2009; during this time the chicks were already quite large. All food debris was cleared after each visit so the subsequent visit would only record fresh prey deliveries (Tables 2, 3).

This analysis revealed some fundamental differences in Mongolian gull diet in the year of first breeding and five years later. In 2004, the nesting pair fed their chicks primarily fish (Table 1), but by 2009 Black-tailed gull chicks occupied an important component of their diet. Consequently, this species acquired a new food resource (Table 1) when it found itself in this new situation. Black-tailed gull chicks are also an important food source in the Slaty-backed gull diet (Table 2).

Judging by the diminutive size of the discarded leg bones², the Black-tailed gull chicks had been taken from the nest. The main hunting technique used by both Mongolian and Slaty-backed gulls was regular patrolling. The birds flew low over the colony, following the uneven terrain and coastline. I once observed an adult Mongolian gull suddenly appear from behind a rock ledge where it had approached unseen by hugging the cliff. It snatched a downy Black-tailed gull chick sitting in the open then disappeared again after an abrupt turn. The parents pursued. The whole event was over in seconds—surprise and speed paid off.

A more common observation was the aftermath of a hunt—the prey item being consumed. The gulls swallowed small prey items whole or pulled it apart with jerking motions before swallowing and bringing to the nest. With fledged chick the process was more complicated. On 06 July, 2009, I observed an adult Mongolian gull bring a live, fledged juvenile Black-tailed gull to the nest; it had apparently found it

2) Remnants typically contains a skeleton of the entire limb

3) Level of threat to *Platalea minor* increases many times when parents are forced to leave nest with clutch or small chicks due to people disturbance (tourists, photographers and so on). Cases of spoonbills' clutch mortality caused by the activity of large gulls reported for the island of Dokdo (DPRK) by Chong et al. (1996).

somewhere nearby. The young bird was bitten and beaten against the rocks. Two large Mongolian gull chicks approached to about 10 m, then all three continued the attack together. With the onset of twilight I could not see how this event concluded, but can surmise that the Black-tailed gull was eventually killed and consumed.

On Furugelm Island, the appearance of a new nest predator can be deleterious to rare nesting species, such as the Black-faced spoonbill *Platalea minor*, which also nests on the island. On 20 July, 2010 a passing gull swooped down on a spoonbill nest with chicks. The response by the spoonbill parents was instantaneous—both rushed toward the threat and chased the gull off³.

The uneven coastline and undulating terrain clearly contributes to hunting success in the colony. Surprise attacks are not as effective in open country. I witnessed an unsuccessful attempt of kleptoparasitism on the cattle egret *Bubulcus coromandus*, which foraged in a wet meadow along the freshwater Doritseni Lake, some 24 km from the colony. One of the cattle egrets caught a frog and held it in its beak. A Mongolian gull flew up and sat a few meters away, making no attempt to snatch the frog. Apparently, the situation was not in its favor, and the gull understood this. The open space excluded the possibility of a surprise attack. When the egret swallowed the frog, the gull immediately flew off.

The Mongolian gull is apparently still acclimating to this new environment, including through adaptation to unusual food resources. One day I watched an adult gull standing on a rock at the water's edge feeding on skeleton shrimp *Caprella* sp. There was a fledged juvenile with this adult, which at first begged then started to feed itself. On another occasion, an adult bird stood in the swash zone collecting invertebrates. It stood on a rock and leaned down into the water. Skeleton shrimp are common supplemental food for Black-tailed and Slaty-backed gulls, and are only available when there are large waves pushing ashore. It is noteworthy that these other gull species have found another way of harvesting this resource. As a rule, they feed slowly by floating along the edge of the shore—and it seems that from the water they are able to harvest more of these invertebrates as the gulls are more mobile and have a better view underwater

(before the waves break). It is possible that with time the Mongolian gulls will get better at it as well.

The Role of Protection

Without question, the federally-protected status of Lake Khanka and Furugelm Island play an important role in the establishment of breeding Mongolian gulls there. The first noticeable rise in species abundance occurred shortly after the 1990 creation of Khankaiskii Zapovednik. In 1988 there were ~40 nesting pairs and by 1992 this had risen to ~300 pairs (Glushchenko et al., 2011). The disturbance factor was markedly reduced following reserve establishment. The main colony of this species on Lake Khanka, at Sosnovii Island, was ~ 1 km from shore, and between 3-10 km away from two human settlements. Improved protection may have played a part in the observed positive population trend in subsequent years (Fig. 2).

Furugelm Island had already been protected for more than a quarter century by the time Mongolian gulls began nesting there, so human disturbance was already virtually eliminated, and space- and food-availability were not limiting factors.

CONCLUSION

In the second half of the 20th Century and into the 21st, a new nesting species from the *L. argentatus* superspecies complex was detected in several geographically-separated points of the Russian Far East. This is apparently Mongolian gull *L. (smithsonianus) mongolicus* colonizing the periphery of the Asian continent from its normal breeding range in the interior of the continent. The observed expansion was preceded by a period of strong population growth in the main breeding range and sequential expansion to adjacent inland habitats. Due to its significant distance from the main population, the emergence of isolated settlements at Lake Khanka in the 1970s cannot be considered «normal» colonization, but rather as an isolated growth. The location of this breeding site along seasonal migration routes of gulls suggests that the process of colonizing the new region may be closely associated with the migration process. A possible contributor to success here was that a significant number of birds passed these areas during migration over many years. By the end of

the 20th Century, the Lake Khanka settlement had proliferated to almost 2,000 pairs, which apparently set the stage for the next phase of expansion to the Lower Amur River basin (Lake Udyl in 2003) and the Sea of Japan (Peter the Great Bay in 2004).

Population dynamics over the years have been positive; the numbers of these gulls have steadily increased and the colonists have occupied two types of habitat: coastal sea islands and large freshwater lakes, with two local populations of Mongolian gulls in the Yellow Sea and Lake Khanka, with a population in Lower Amur River basin and Peter the Great Bay currently in formation. Further expansion into the region through colonization of freshwater bodies of water in the lower reaches of the Amur River basin and adjacent coastal waters (from Chikhachova Bay to Schastya Bay and northern Sakhalin Island) cannot be excluded, as this whole area is visited during the autumn migration.

Successful establishment of Mongolian gulls in Peter the Great Bay was facilitated by a number of factors:

- 1) total safety in the breeding season (the birds are within the confines of federally-protected areas);
- 2) ample nesting habitat;
- 3) availability food resources; and
- 4) relatively low number of potential competitors (Slaty-backed gulls).

The settlement on Furugelm Island increased from one to 72 breeding pairs over a 9 year period (2004-2012). Based on available food resources, the species has acclimated to an area ~50 x 40 km. Additional habitat exists, and at least one attempt has been successful, but so far only within Peter the Great Bay.

The apparent founding group on Furugelm Island consisted of 7 birds of varying age: a pair of breeding adults and five younger birds of different maturity. The nesting area of the only breeding pair became a training ground for behavioral learning by the immature birds. A functioning nesting site was apparently extremely important for the maturation of the subadults, who practiced their «adult» behavior and established ties with island as a site for future breeding.

The settlement of a multi-species waterbird colony on Furugelm Island by a new, large gull species did not pass unnoticed or without some loss from the other inhabitants. This gull is a capable and active predator and a competitor with Slaty-backed gulls. In their second year nesting on the island, Black-tailed gull chicks began to play a significant role in Mongolian gull diet. If the population growth of this new predator continues long enough, it will inevitably affect the state of the population of Black-tailed gulls and consequently the overall structure of the colony.

The biological traits of note of this new colonist include relatively early nesting (earlier than Black-tailed gulls and much earlier than Slaty-backed gulls) and a preference to foraging mainly in water bodies on the mainland and coastal shallows. Perhaps this is related to the fact that this species has an inland origin.

Further monitoring of the development of Mongolian gulls in the Russian Far East is extremely important to understand basic ecological processes. Given that Furugelm Island has a long history of biological monitoring and is notable as a site where species establish new settlements, makes it an ideal model study area for further research. The same could be said about the Peter the Great Bay as a whole. It is important to continue to monitor bird colonies on Furugelm Island with an emphasis on the problem of relations between “invasive” and native species, as well as to identify new settlements in the Peter the Great Bay and the Sea of Japan as a whole.

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4) It is quite possible that in addition to the occupation of the Furugelm island this gull could populate the nearby North Korean island Arsom, where there is a significant seabird colonies (Sonobe, 1987). This island is located 40 km southward from the Islands Furugelm (Fig. 9).

