



Breeding performance and site fidelity of Lesser Black-backed Gulls *Larus fuscus* and Herring Gulls *L. argentatus* carrying GPS-PTT's, Wadden Sea island of Vlieland, breeding season 2011

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Lay-out: Dries Oomen

Photo front cover: adult female Herring Gull fitted with satellite transmitter and colour ring green 'FAAA' at nest in enclosure, May 25th 2008 Vliehors, Vlieland. © Peter de Boer.

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Contents

1. Introduction	5
2. Methods	6
2.1 Fieldwork	6
2.2 Data storage and analysis	7
3. Results	8
3.1 Operation of satellite transmitters and observations	8
3.2 Breeding success	9
3.3 Retrapping of gulls	11
4. Discussion	12
4.1 Operation of satellite transmitters	12
4.2 Breeding success satellite fitted gulls versus control group	12
Acknowledgment	13
Literature	14

1. Introduction

In 2007 a research project was initiated on movement of gulls fitted with satellite transmitters on Vlieland, The Netherlands (Ens 2007, Ens *et al.* 2008, Ens *et al.* 2009). In all, 14 Lesser Black-backed Gulls *Larus fuscus* and 12 Herring Gulls *Larus argentatus* carry or carried a GPS-PTT, including cases where a transmitter was removed from a bird and attached to a new bird.

In 2011 the breeding performance of Lesser Black-backed and Herring Gulls on Vlieland was studied by SOVON

Dutch Center for Field Ornithology, commissioned by the Institut für Vogelforschung (IfV) in Wilhelmshaven. Main goal of the research was to compare the breeding success of gulls fitted with satellite transmitters to the success of gulls in a control group. A second goal was to try and retrap gulls with transmitters that were not operating anymore, in order to remove the transmitters. The field work was carried out from April until the middle of August 2011.

2. Methods

2.1 Fieldwork

Fieldwork was carried out between the end of April and halfway August 2011. Visits were made on the following days in April: 18, 19, 27; May: 5, 6, 7, 13, 14, 19, 25; June: 1, 2, 8, 9, 17, 18, 23, 24, 30; July: 7, 8, 14, 24, 25 and August: 14, 15.

The main colony is situated in a military area on the western half of Wadden Sea island Vlieland, called the *Vliehors*. Because of the military nature, the area was inaccessible during working hours from Monday to Friday 12:00. Hence, visits were made in early mornings, late in the evening and during weekends. The *Vliehors* is a 1500 ha large sandbank with old dunes in the central part. These old dunes offer breeding grounds for several coastal breeding birds, of which Herring and Lesser Black-backed Gulls are by far the most common. The surrounding sandbank is flooded during monthly spring tides and therefore physically rough terrain. A small 4WD-vehicle was used for transport to the colony.

During visits, gulls were checked for colour rings and whether or not they carried a GPS-PTT transmitter (all birds with a transmitter also carried a colour ring).

Dense vegetation and the sheer size of the mixed colony (an estimated 582 pairs of Lesser Black-backed Gull and 446 pairs of Herring Gull breeding in up to 1.3 m high Marram grass *Ammophila arenaria* made it difficult to locate gulls carrying a GPS-PTT. Herring Gulls preferred more dense vegetation on slopes of dunes, mainly covered in Marram grass. The preference of Lesser Black-backed Gulls differed from the preference of Herring Gulls. The Lesser Black-backed Gulls preferred to breed in depressions in the dunes, dominated by Sand sedge *Carex arenaria*, Hedge bindweed *Convolvulus sepium* and Marram grass. Extensive searches for gulls with transmitters were therefore needed. We directed these searches for the nesting location of birds carrying a transmitter by means of fixes of their GPS, communicated through the Argos satellites. Besides these directed searches, the colony was also systematically searched for birds carrying failing transmitters using a 20-60x telescope. In order to catch birds with failed transmitters, cages of wire netting were used. Additionally, nylon loops were placed over nests.

Apart from nests of birds carrying a transmitter, we



Picture 2. View on the main colony in the research area, *Vliehors*, Vlieland, May 2010

also examined nearby nests of unmarked birds as a control group. Nests were marked with numbered poles. The content of nests was checked once or twice a week. During checks, number of eggs and young were noted. To prevent young from roaming around freely and hiding in inaccessible locations, enclosures (of wire netting) were placed round the nests just before the hatching.

Young were ringed with stainless steel rings shortly after hatching. Biometric measurements of young (head, wing and mass) were taken on a weekly basis. Young close to fledging were ringed with a colour ring as well. The colour rings were obtained from Kees Camphuysen of the Royal Netherlands Institute for Sea Research *NIOZ*. Prey remains were collected on a weekly basis in the direct vicinity of the nests and stored at the *NIOZ* for future analysis.

2.2 Data storage and analysis

Results from nest checks and biometrics were stored in a database (digital nest scheme, '*Digitale Nestkaart*', SOVON Dutch Center for Field Ornithology). Breeding data of birds with transmitters was stored in the SARA database of the University of Amsterdam (UvA). The *breeding success* in this study is the number of fledged young per pair overall (including failed breeding attempts). A young is considered *fledged* when it left the enclosure on its own account.

Breeding success per nest was calculated using the software of the digital nest scheme. Young disappeared from enclosures because they were predated, because they escaped or because they fledged. The most likely outcome was stored in the database. Ring readings were reported to Kees Camphuysen (Royal *NIOZ*) and stored in his database.

3. Results

3.1 Operation of satellite transmitters and observations

In total 14 Lesser Black-backed Gulls and 9 Herring Gulls were fitted with satellite transmitters in 2007. In 2008 an additional 3 Herring Gulls were fitted with satellite transmitters.

The start of the breeding season is set at the first field day; in this case the 18th of April 2011. At that time only 3 out of 14 Lesser Black-backed Gulls transmitters were still sending signals; in the remaining 11 cases either the transmitter and/or the bird died, table 1. All Lesser Black-backed Gulls that were localized by GPS-signal were observed either in the colony or on the nearby roosts. Furthermore two Lesser Black-backed Gulls with a non-sending GPS were observed several times in the colony and nearby roosts. Of these two birds 'MAFS' occupied a nest in the eastern part of the colony. Of 'FAFD' the breeding status remained unclear, as no nest was found. Presumably the bird didn't have a nest.

On January 10th 2012 out of 14 GPS-PTT's on Lesser Black-backed Gulls just one was still running. In Herring Gull the rate of functionality is lower with currently not a single GPS-PTT in the air.

For Herring Gulls the operation score was comparable to Lesser Black-backed Gulls. By the 18th of April 2011 only 3 out of 11 transmitters were still functioning.

In table 1 and table 2 the information received from the satellite transmitters is compared to the field observations. Five out of 11 birds carrying transmitters with which we lost contact (both Lesser Black-backed and Herring Gull) were observed in the field after we lost contact. In contrast, all 6 gulls carrying functional transmitters were also observed in the field.

Table 1. Operation of satellite transmitters and observations on breeding status of Lesser Black-backed Gull in the colony in 2011. Values on observations and breeding status are coded as follows: + = yes, ? =uncertain, - = no. In grey bars ptt without signal after April 18th 2011. 'Last signal' refers to the status on January 10th 2012. The subsequent columns on signal ptt and visitor site indicate whether the ptt was still sending signals after April the 18th 2011 and whether these signals were from the breeding colony. The final three columns indicate whether or not the bird was visually observed, defended a territory and made a nest.

code	bird id	year ptt	last signal	signal ptt > April 18 th	visitor site > April 18 th	observed	territory	nest
MAFA	41745	2007	2-7-2009	-	-	-	?	?
MAFM	41749	2007	11-10-2010	-	-	-	?	?
MAFR	41752	2007	12-7-2010	-	-	+	+	+
MAFU	41757	2007	25-9-2011	+	+	+	?	-
FAFC	41758	2007	22-6-2008	-	-	-	-	-
MAFT	41762	2007	9-1-2012	+	+	+	+	+
MAFS	41763	2007	1-8-2009	-	-	-	?	?
MAFP	41764	2007	21-6-2011	+	+	+	+	+
MAFK	41767	2007	25-10-2010	-	-	+	+	+
FAFA	41771	2007	24-1-2010	-	-	-	?	?
FAFD	41773	2007	7-4-2009	-	-	+	?	?
MAFB	41775	2007	28-7-2010	-	-	+	+	+
FAFL	41780	2007	29-10-2007	-	-	-	?	?
MAFD	41781	2007	2-6-2009	-	-	+	?	?

3.2 Breeding success in 2011

In total 58 nests of 31 Lesser Black-backed Gulls and 27 Herring Gulls were monitored in 2011 to determine the breeding success. Out of 31 Lesser Black-backed Gulls, 24 nests were of birds in the control group.

In total breeding success of 8 different Lesser Black-backed Gulls with GPS-PTT's was studied (table 3). In seven birds it was determined with certainty whether they had a nest and were actually breeding or not; only two of these birds managed to raise young (in both cases one chick).

Bird 'MAFR' held territory in the central colony for several weeks. It was mated and seen copulating as well. After two weeks a nest hollow was created, no eggs were laid however.

Bird 'MAFU' was a visitor to the colony in both April

and May. No nest was found, the bird might have held territory.

Bird 'MAFT' had a nest in the eastern part of the colony. Out of three eggs three young hatched. Predation in the juvenile stage led to failure of the brood.

Bird 'MAFP' had a nest in the eastern colony. Three eggs were laid and all hatched. Eventually one young fledged, which was color ringed as well.

Bird 'MAFK' had a nest with three eggs in the eastern colony. In the egg stage the nest was predated, probably by birds.

Bird 'FAFD' did not have a nest, it held a territory though.

Bird 'MAFB' had a nest in the eastern colony, laid 3 eggs and raised one young, which was color ringed.

Bird 'MAFD' was observed once on the eastern roost. No nest was found, nor was any indication of such obtained.

Table 2. Operation of satellite transmitters and observations on breeding status of Herring Gull in the colony in 2011. Values on observations and breeding status are coded as follows: + = yes, ? = uncertain, - = no. In grey bars ptt without signal after April 18th 2011. 'Last signal' refers to the status on January 10th 2012. NB one bird was put down, from another the GPS-PTT removed. The subsequent columns on signal ptt and visitor site indicate whether the ptt was still sending signals after April the 18th 2011 and whether these signals were from the breeding colony. The final three columns indicate whether or not the bird was visually observed, defended a territory and made a nest.

code	bird id	year ptt	last signal	signal ptt > April 18 th	visitor site > April 18 th	observed	territory	nest
MAFF	41747	2007	10-6-2010	+	-	-	?	?
FAAB	41750	2008	17-8-2010	+	+	-	?	?
MAFL	41754	2007	25-8-2007	-	-	-	?	?
FAFH	41755	2007	24-10-2007	-	-	-	?	?
MAFJ	41765	2007	19-9-2009	-	-	-	?	?
FAFJ	41766	2007	31-8-2011	+	+	+	?	-
FAFM	41772	2007	6-10-2007	-	-	-	?	?
MALA	41776	2008	19-5-2010	+	+	+	+	+
FAAA	41779	2008	28-10-2011	+	+	+	+	+
FAFB	41782	2007	15-6-2007	-	-	-	?	?
FAFF	41816	2007	21-10-2009	-	-	-	?	?

Table 3. Breeding success of individual Lesser Black-backed Gulls with satellite transmitters in 2011. Values for 'Nest' are coded as follows: 1= nest found, 0= nest uncertain, -1= no nest present.

code	Nest	eggs	hatched	fledged	failure stage	failure cause	remarks
MAFR	1	0					central colony, empty nest
MAFU	-1						visitor colony April, May, poss. territory, no nest
MAFT	1	3	3	0	young	predation	colony east, plain, nest 58
MAFP	1	3	3	1			colony east, plain, nest 51
MAFK	1	3	0		egg	predation	colony east, nest 11
FAFD	-1						colony east, territory
MAFB	1	3	3	1			colony east, nest 57
MAFD	0						No nest found, observed once roost east

In total three different Herring Gulls with GPS-PTT's were checked to determine their breeding success, table 4. Of these birds, only three had a transmitter that was still functioning: FAFJ, MALA and FAAA.

Bird 'FAFJ' showed low site fidelity during the breeding season. According to the GPS-signals the bird spent a considerable amount of time in both the Vliehors colony as in the Kroon's Polders. The latter is a salt marsh area holding a large gull colony as well. The place where the bird was tracked is known as a gull roost, representing non-breeding birds mainly. No nest was found in both places, successful breeding can be ruled out because of the short presence in both places.

Bird 'MALA' was a successful breeding bird in 2011.

The nest in the central colony held 3 eggs, which all three hatched and resulted in one fledged young. Bird 'FAAA' had a nest with 3 eggs in the central colony. None of these eggs hatched due to predation.

In order to establish whether there is any difference in breeding success between birds with GPS-PTT's and birds in the control group, both have been compared, table 5.

In Lesser Black-backed Gull breeding success was higher in the control group (0.38 young/pair) than in GPS-birds (0.29). Similarly, Herring Gulls with transmitter showed a lower breeding success (0.33 young/pair) than birds in the control group (0.54). Small sample sizes should be taken into account though.

Table 4. Breeding success of individual Herring Gulls with satellite transmitters in 2011. Values for 'Nest' are coded as follows: 1= nest found, 0= nest uncertain, -1= no nest present.

code	Nest	eggs	hatched	fledged	failure stage	failure cause	remarks
FAFJ	-1						poss. territory Kroon's Polder's, 3,9 km East
MALA	1	3	3	1			central colony, nest 23
FAAA	1	3	0	0	egg	predation	central colony, territory, no nest found

3.3 Retrapping of gulls

In 2011 the majority of the transmitters had stopped communicating with the ARGOS satellite, either because the bird died and the transmitter ended up in a position that it could not be charged by the sun or contact the satellite, or the transmitter died. We are certain the latter happened in at least 4 Lesser Black-backed Gulls in 2011. We attempted to catch birds carrying non-functioning transmitters in order to remove them.

With both tilting cages and slip knots (loops), in total over 30 catching attempts were made on selected nests of Herring Gull and Lesser Black-backed Gull. Tilting cages proved to be the most effective method, with catches of six Lesser Black-backed Gulls and four Herring Gulls. None of these birds carried trans-

mitters. In all cases, we caught the partner of a bird with transmitter. Apparently, transmitter' birds were very suspicious towards tilting cages, probably because of previous experiences. Therefore the use of slip knots was examined as well, to no avail however. Dense vegetation thwarted the use of a slip knot in the vicinity of nests.

If any future attempts are undertaken to retrap and remove transmitters, the use of a canon net is advised. Prior to the breeding season the gulls gather on massive roosts close to the breeding colony. In April up to six different transmitter birds have been observed there simultaneously. This high density could make canon netting a profitable method.

Table 5. Breeding success (young/pair) of satellite gulls versus control group in 2011

	Pairs/nests		young		breeding success	
	satellite	control	satellite	control	satellite	control
Lesser Black-backed Gull	7	24	2	9	0,29	0,38
Herring Gull	3	24	1	13	0,33	0,54

4. Discussion

4.1 Operation of satellite transmitters

The supplier of the Argos GPS-PTT's mentions an average lifetime of three years. At the start of the breeding season in 2011, 19 of the 25 transmitters had stopped working (11 out of 14 in Lesser Black-backed Gull and 8 out of 11 in Herring Gulls). All six birds with functioning transmitters were actually observed. In addition to this, five birds with non-functioning transmitters were observed, all of these birds were Lesser Black-backed Gulls.

Previously it was proposed that birds with failing GPS-PTT's most likely died, because they were not observed anywhere (De Boer & Ens 2010). Since we subsequently observed many birds with a non-functioning GPS-PTT, these birds should not automatically be presumed to be dead.

A specific problem occurs in Herring Gulls in winter time. The GPS-PTT's are being charged by a small solar panel on the back. Herring Gulls spend the winter time at a higher latitude where solar power is lower than at lower latitude, where Lesser Black-backed Gulls spent more of their wintering time. Consequently, the lower share of GPS-PTT's still working might be due to solar conditions on their wintering grounds. Based on the lifetime expectancy of three years, 6 GPS-PTT's still running after almost 4 years is quite a good score. In fact one transmitter is still working nowadays. Bird 'green MAFT' was still sending signals on January 9th 2012. This male Lesser Black-backed Gull got the transmitter in May 2007, which was still working 4 years and 8 months later!

4.2 Breeding success 'transmitter' gulls versus control group

In general, the measured breeding success is considered to be an underestimate of the actual breeding success. Enclosures are being used to fixate young for a short period close to the nest. On occasion adults take down the iron netting of the enclosure, enabling young to escape prematurely. Given the dense vegetation and the great intuitive drive of young to disperse on approach of danger, few young can be retrieved once escaped.

Of satellite fitted gulls breeding success of individual birds was measured. In the control group nests containing eggs were marked and the output determined. This means no territorial birds without nests were included in the control group. Hence the breeding success for the control group could be positively biased.

Numbers of breeding gulls with GPS-PTT's were low during 2009-2011 low, making a comparison of breeding success within a year to the control group tricky. Therefore numbers of the whole period 2009-2011 were added and compared, table 6. Since enclosures were only used from 2009 onwards, only these figures will be used, i.e. excluding data from 2007 and 2008.

The breeding success over three years was 0.33 young per pair in Lesser Black-backed Gulls with GPS-PTT's (N=21) versus 0.38 young per pair in the control group (N=72). In Herring Gull birds in the control group (0.56 young/pair, N=78) performed considerably better than birds with GPS-PTT's (0.40 young/pair, N=10).

Table 6. Breeding success (young/pair) of satellite gulls versus control group, numbers combined for 2009, 2010 and 2011

	Pairs/nests		young		breeding success	
	Satellite	control	satellite	control	satellite	control
Lesser Black-backed Gull	21	72	7	27	0,33	0,38
Herring Gull	10	78	4	44	0,40	0,56

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Kees Camphuysen (Royal NIOZ) again supplied us with the color rings, processed all observations of colour ringed gulls and provided observers with life histories.

Access to the military area 'Vliehors' was granted by the Dutch Ministry of Defense. Ron Reffeltrath and Henk Verbeek (Dutch Air Force) were very helpful contact persons in the field.

Accommodation was arranged by Carl Zuhorn of the State Forestry in their cottage '*Zwaluw*'.

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