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Research Paper

The growth rate of Black-tailed Gull chicks is negatively related to total mercury of female parents on Kabushima (Kabu Island), Japan

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ABSTRACT. The mercury (Hg) contamination at high concentrations affects the physiological state and behavior of animals, however, the effects of low Hg exposure on avian breeding success and the impact on the growth of chicks that depend on feeding from their parents are unclear. We investigated the effects of maternal Hg concentrations on breeding success in a colony of Black-tailed Gulls (*Larus crassirostris*) breeding on Kabushima, northeastern Honshu, Japan, in 2018 and 2019. Total Hg concentrations in blood cells in females were 2.48 ug/g dry weight ± 0.55 (1.28–3.28) in 2018 and 2.42 ug/g dry weight ± 0.55 (1.87–3.29) in 2019. In our two-year field study, female parents did not differ in Hg concentrations between two years, but δ15Ns, i.e., the difference in diet, were significantly lower in 2019 than those in 2018. The difference in δ15Ns could be related to difference in fledging success between two years (90% and 40% in 2018 and 2019, respectively). However, the results of this study showed that Hg exposure was not significantly associated with clutch size, hatching success, or nest success in the two years with different diets and was not significantly associated with any reproductive parameters at δ15N. Hg exposure was significantly negatively correlated with chick weight gain (g/day), while blood Hg accumulation in female Black-tailed Gulls was below the threshold for direct effects on breeding success. However, there was no noticeable abnormal behavior when feeding the chicks at their Hg exposure levels, under the current level value. Although the breeding numbers of Black-tailed Gulls are not thought to be declining at colonies around Japan at the moment, Hg contamination may threaten their numbers in the future.

Le taux de croissance des poussins de Goélands à queue noire est lié négativement au taux de mercure des parents femelles sur Kabushima (île Kabu), au Japon

RÉSUMÉ. La contamination par le mercure (Hg) à des concentrations élevées affecte l'état physiologique et le comportement des animaux. Cependant, les effets d'une faible exposition au Hg sur le succès de reproduction et l'impact sur la croissance des poussins dont l'alimentation dépend des parents ne sont pas clairs. Nous avons examiné les effets de la concentration de Hg contenue dans les femelles sur le succès de reproduction de Goélands à queue noire (*Larus crassirostris*) nichant en colonie sur Kabushima, au nord-est de Honshu, au Japon, en 2018 et 2019. La concentration de Hg dans les cellules sanguines des femelles était de 2,48 ug/g de poids sec ± 0,55 (1,28-3,28) en 2018 et de 2,42 ug/g de poids sec ± 0,55 (1,87-3,29) en 2019. Au cours des deux ans de notre étude sur le terrain, les concentrations de Hg contenues dans les parents femelles ne différaient pas entre les deux années, mais les δ15N, c'est-à-dire la différence de régime alimentaire, étaient significativement plus faibles en 2019 qu'en 2018. La différence de δ15N pourrait être liée à la différence du succès d'envol entre les deux années (90 % et 40 % en 2018 et 2019, respectivement). Toutefois, nos résultats ont indiqué que l'exposition au Hg n'était pas significativement associée à la taille de la couvée, au succès d'éclosion ou au succès de nidification au cours des deux années avec des régimes alimentaires différents, et n'était pas significativement associée à des paramètres de reproduction à δ15N. L'exposition au Hg était significativement corrélée négativement au gain de poids des poussins (g/jour), tandis que l'accumulation de Hg dans le sang chez les Goélands à queue noire femelles était inférieure au seuil d'effets directs sur le succès de reproduction. Or, aucun comportement anormal n'a été observé lors de l'alimentation des poussins à leur niveau d'exposition au Hg, sous la valeur du niveau actuel. Bien que l'on ne pense pas que les effectifs reproducteurs de Goélands à queue noire soient actuellement en diminution dans les colonies du Japon, la contamination par le Hg pourrait représenter une menace à l'avenir.

Key Words: *Black-tailed Gull; Larus crassirostris; Sanriku coast; top predator; marine pollution; mercury exposure; seabird*

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INTRODUCTION

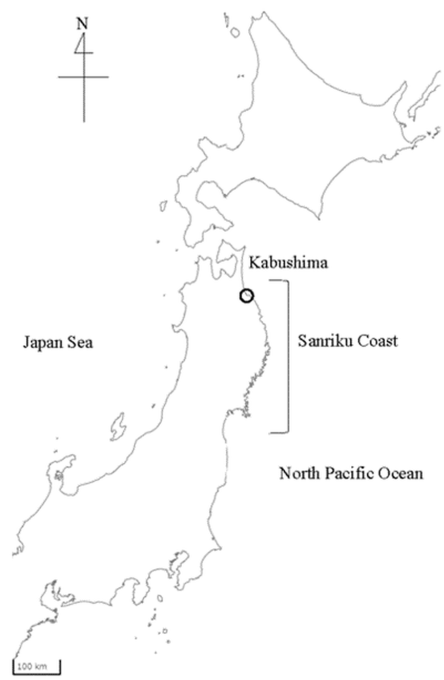
Increases in anthropogenic mercury (Hg) emissions into the environment can lead to potential adverse health and reproductive effects on wildlife (Wolfe et al. 1998, Burger and Gochfeld 2002, Scheuhammer et al. 2007, Tan et al. 2009). As many seabirds are long-lived marine top predators, they accumulate high levels of Hg in their bodies from their prey (Wiener et al. 2002). High concentrations of Hg are known to have adverse effects on the reproductive success of seabirds (Burger and Gochfeld 2002). Even low levels of Hg contamination disrupt avian breeding and behavior through abnormal alteration of the endocrine system, causing some birds to skip breeding completely, or increase the number of incubation recesses, and decrease the number of chicks successfully raised (Tartu et al. 2013, 2016, Whitney and Cristol 2018, Hartman et al. 2019, Mills et al. 2020). Therefore, Hg at low levels may have lifetime fitness consequences. However, little is known about the effect of low Hg exposure on chick quality, which is affected by parental feeding behavior. To better understand the impact of such exposure, it is necessary to observe detailed parental breeding performance, such as chick growth, under field conditions.

Marine organisms living in the higher Hg concentration region of the North Pacific Ocean are expected to experience elevated Hg contamination due to bioaccumulation and biomagnification of environmental Hg (Furness and Camphuysen 1997, Burger and Gochfeld 2002, Niizuma et al. 2021). Anthropogenic emissions of Hg in Asia have increased over the past several decades, and are still increasing, due to increased economic activity in East Asia and increased atmospheric Hg deposition in the Pacific Ocean (Pacyna et al. 2006, Driscoll et al. 2013, Lamborg et al. 2014, UNEP 2018). The surface water Hg concentration in the North Pacific Ocean is higher on the western side, especially off Japan's Sanriku Coast, located in northeastern Japan (Fig. 1), than in other waters (Sunderland et al. 2009). In fact, Black-tailed Gulls (*Larus crassirostris*) breeding in the colony on Kabushima (Kabu Island), at the northernmost point of the Sanriku Coast, accumulate total Hg in their body tissues at higher levels than other Laridae species (Goto et al. 2018). Our concern is that the current level of Hg contamination in Black-tailed Gulls could be negatively related to their breeding success, especially chick growth, through abnormal parental behavior due to mercury pollution.

In addition to the effects of Hg, individual differences in diets, which are assessed by nitrogen stable isotope values (δ^{15}N), may also influence their breeding performance (González-Medina et al. 2018). δ^{15}N represents the trophic level concentrated in both prey and biomarkers, allowing us to understand individual dietary differences (Wada et al. 1987, Hobson and Welch 1992). The effects of Hg on breeding performance, which is under the control of the parental diet, is of great interest.

During a two-year field study of Black-tailed Gulls, we investigated the effects of Hg concentrations in female parents on their breeding performance. We conducted the study over two years to account for environmental differences between years. In this study, we collected blood samples from breeding females to analyze Hg concentrations and δ^{15}N ratios. We examined the effect of dietary differences on chick growth through the δ^{15}N of their mothers. We also measured the clutch size, hatching success, fledgling success, and chick growth of each of the breeding females. We predicted that females with higher mercury concentrations would breed less successfully than those with lower concentrations, or that under current levels of Hg contamination of females, no negative effects of Hg on breeding success would be detected. We also predicted that chicks of female parents with higher Hg concentrations would grow more slowly than those of female parents with lower Hg concentrations.

Fig. 1. Map showing the study region and the location of the Kabushima study site (O).



METHODS

Study Site, Study Species, and Field Experiments

Field studies were carried out from 28 April to 30 June in 2018, and 28 April to 5 July in 2019, on Kabushima (Kabu Island; 40° 32′N, 141°33′E), Aomori Prefecture, Japan (Fig. 1). Approximately 30,000–35,000 Black-tailed Gulls breed on the island (Yoda et al. 2012).

In order to investigate the effect of Hg contamination on breeding success, we studied 16 nests in 2018 and 23 in 2019. We used snare traps to catch 16 incubating females in 2018 and 23 in 2019 from their nests and investigated their breeding success. As male and female Black-tailed Gulls have identical plumage, but differ in size (Chochi et al. 2002), the smaller females were identified in comparison with their larger mates during the period when both parents remained at their nest after egg-laying. In both 2018 and 2019, we were able to discern 10 identical breeding females (i.e., 10 nests of same female parent) and undertake a study on their reproductive success. We limited our pool of female parents to a minimum so as to minimize disturbance at the colony and to reduce any impact on their breeding attempts.

We took 1 ml blood samples from the wing veins of the gulls, then released them on their nests. We placed each blood sample in a heparinized tube. After centrifugation (5 min, 6200 rpm), we stored the blood cells and the serum in a 0.5 ml plastic screw cap vial with an O-ring (Asahi Techno Glass Co.) at -20 °C until the analysis.

Reproductive Success

Study plots were visited daily (between 8:00–12:00 h local time) from the start of laying on 28 April until the last chicks fledged on 30 June in 2018 and 5 July 2019, respectively. Study nests were indicated with pegs (30 cm tall, 5 cm wide), and eggs were marked using a waterproof felt-tip pen. Clutch size was defined as the number of eggs per nest. When egg remnants were found around nests or eggs disappeared, they were assumed to have been predated. Eggs that failed to hatch within seven days of the first chick in a clutch were recorded as unhatched. Hatching success was defined as the number of eggs hatched per nest. After hatching, a 30 cm wire mesh (φ 8 mm) was placed around each nest plot to prevent chicks from escaping. In 2019, chicks were ringed (with colored plastic rings) and weighed every five days from one day old to 30 days old, using a spring balance. Chick growth rate (g/day) was defined as the slope of the linear regression between 4 and 21 days of age because the chicks of large gull species grow almost linearly (Watanuki 1992). The chicks were assumed to fledge at 30 days of age. Fledging success was defined as the number of nests with one or more fledglings over the total number of nests studied.

Hg and Nitrogen Stable Isotope Analysis

Blood cells were freeze-dried to constant mass for 48 h and then ground to a fine powder using an electric crusher (TK-AM5, Titec) operating at liquid nitrogen temperature (Tomita et al. 2015). Concentrations of total mercury in dried blood cells were determined using a Direct Thermal Decomposition Mercury Analyzer (MA-3000; Nippon Instruments). Mercury atomic absorption standard solution (1005 mg/L, Kanto Kagaku Co., Ltd.) was diluted 1000 times and 100,000 times with L cysteine solution to prepare the standard solution. After preparation of the calibration standards using the standard solution, total mercury concentration was measured by thermal decomposition.

Dried blood cells were sealed in tin capsules for combustion. The nitrogen-stable isotopic values of dried blood cells were measured using a gas-source isotopic values mass spectrometer (ANCA-GLS and Hydra 20-20, Sercon Ltd., UK). The nitrogen isotope ratio of L-alanine M9R2064 (AZ100: δ^{15}N-Air = 1.79 ± 0.2%) was used as a working standard. All samples were run in duplicate. Isotope ratios (δ^{15}N) were shown as deviations from atmospheric nitrogen in parts per thousand (‰, Coplen 2011):

$$\delta^{15}N = (R_{sample}/R_{standard}) - 1$$

where R is the isotopic ratio ($^{15}N/^{14}N$). Analytical reproducibility during the overall measurements was better than ±0.2%.

Statistical Analysis

All statistics were performed using R. 4.1.2 (R Development Core Team, Vienna, Austria). To consider whether to pool data, we initially ensured the inter-annual difference of total Hg concentration, δ^{15}N, and reproductive parameters (clutch size, number of hatchlings per nest, and fledging success). We used generalized linear mixed models (GLMM, glmer, or lmer functions in the lme4 package; Bates et al. 2015) to test for between-year differences in total Hg concentration in blood, δ^{15}N as the parental trophic level, clutch size, the number of hatchlings per nest, and fledging success, where years were explanatory variables, and individual identity was a random effect. We designated Gaussian (δ^{15}N), using an identity link function, Gamma (Hg concentration) and Negative binomial (clutch size and the number of eggs hatching) using a log link function, and Binomial (fledging success: 0 = no fledgling, 1 = one or more chicks fledged) using a logit link function as the error distribution. In the GLMM for the number of hatchlings per nest, clutch size was offset after logarithmic transformation. For analyzing inter-annual differences, intra-individual changes were calculated separately from the overall dataset.

GLMMs were also used to investigate whether variation in reproductive parameters (clutch size, number of hatchlings per nest, and fledging success) was related to total Hg concentration in blood or δ^{15}N, with each reproductive parameter designated as an explanatory variable, while individual identity and years were considered as random effects to account for the repeated identities of females between years. We used Gaussian error distribution (δ^{15}N) with an identity link function and Gamma error distribution (Hg concentration) with a log link function.

To examine whether total Hg concentration in blood and/or δ^{15}N influence offspring growth rates, we used a GLMM (Gaussian error distribution with identity link function) with chick growth rate and number of chicks assumed to have fledged in 2019 as response variables, total Hg concentration in blood and δ^{15}N as explanatory variables, and nest identity as a random effect.

We used the likelihood-ratio test to assess the significance of each explanatory variable in all models using the Anova function in the car package (Fox and Weisberg 2011). The results were considered significant when $P < 0.05$.

RESULTS

Total Hg concentrations in females were 2.48 μg/g dry weight ± 0.55 (1.28–3.28) in 2018 and 2.42 μg/g dry weight ± 0.55 (1.87–3.29) in 2019. The difference between years was not statistically significant; however, the δ^{15}N of female parents was significantly higher in 2019 than in 2018 (Table 1). None of the reproductive parameters (i.e., clutch size, number of hatchlings per nest, and fledging success) of female Black-tailed Gulls differed significantly between 2018 and 2019 except for fledgling success in nests examined in two consecutive years (Table 1).

None of the differences in clutch size ($x^2 = 4.616$, $df = 2$, $P = 0.099$), number of hatchlings per nest ($x^2 = 2.260$, $df = 2$, $P = 0.323$), or fledgling success ($x^2 = 0.279$, $df = 1$, $P = 0.598$) were affected by total Hg concentration (Fig. 2a–c). Similarly, there were no differences in δ^{15}N in relation to clutch size ($x^2 = 3.091$, $df = 2$, $P = 0.213$), number of hatchlings per nest ($x^2 = 0.681$, df

Table 1. Summary of total mercury (Hg) concentration in blood, nitrogen stable isotope ratio (δ15N), and reproductive parameters for Black-tailed Gulls (*Larus crassirostris*), 2018–2019. The results of the generalized linear mixed models for the inter-annual differences of each parameter are also shown.

	Dataset[†]	2018	2019	χ^2 (*df*)	*P*
Total Hg concentration (µg/g dry weight)	All data	2.48 ± 0.55	2.42 ± 0.38	0.002 (1)	0.963
	Repeated data	2.35 ± 0.63	2.44 ± 0.48	0.272 (1)	0.602
δ^{15}N (‰)	All data	11.97 ± 1.09	12.97 ± 0.53	14.623 (1)	0.0002
	Repeated data	12.11 ± 1.14	13.05 ± 0.35	6.240 (1)	0.012
Clutch size (eggs)	All data	2.38 ± 0.62	2.09 ± 0.60	0.489 (1)	0.484
	Repeated data	2.50 ± 0.52	2.00 ± 0.67	0.621 (1)	0.431
Number of hatchlings (per nest)	All data	1.88 ± 0.62	1.70 ± 0.56	0.575 (1)	0.448
	Repeated data	1.90 ± 0.57	1.60 ± 0.52	0.022 (1)	0.881
Fledging success (%)[‡]	All data	94	48	3.043 (1)	0.081
	Repeated data	90	40	23.53 (1)	<0.0001

[†] All and repeated data represent the datasets of all nests (16 in 2018 and 23 in 2019) and 10 nests measured in both 2018 and 2019, respectively.
[‡] Nests with one or more chicks fledged

= 2, P = 0.712), or fledgling success (x^2 = 0.000, *df* = 1, P = 0.998) (Fig. 2d–f, Appendix 1 for details).

The growth rates of gull chicks in 2019 averaged 18.6 g/day ± 4.3 (11.7–26.0). Chicks being reared by mothers with higher total Hg concentrations had significantly slower growth rates than those raised by mothers with lower concentrations (Fig. 3a, x^2 = 5.724, *df* = 1, P = 0.017). At the high end of the range of total Hg concentration, the predicted growth rate calculated from the GLMM model was equal to 67% of that at low end. Chick growth was not affected by the δ^{15}N of their mothers (Fig. 3b, x^2 = 1.713, *df* = 1, P = 0.191).

DISCUSSION

In our two-year field study, we found that the δ^{15}Ns of female parents was significantly higher in 2019 than in 2018. The difference in δ^{15}Ns, suggesting a dietary difference of female parents between the years noted in previous studies (Deguchi et al. 2004, Kwon et al. 2013), could be related to differences in fledging success between the two years. However, despite the fact that diets of the female parents differed between the two years, Hg exposure was not significantly related to any of the reproductive parameters of clutch size, hatching success, or nest success. This result was different from one of our initial predictions, that females with higher Hg levels would have lower reproductive success than females with lower levels. Adverse effects of Hg on behavior, reproduction, physiology, and health in birds generally tend to occur at 1.0 µg/g wet weight of blood-equivalent total Hg concentration, and more substantial impairments to health and reproduction occur at approximately 2.0 µg/g wet weight (Ackerman et al. 2016). Converting published Hg toxicity benchmarks among birds into blood-equivalent total Hg concentrations based on Ackerman et al. (2016), the lowest observed effect level of blood-equivalent total Hg concentration was 0.2 µg/g wet weight. If avian blood is assumed to contain 80% water, as indicated by Bell (1957), our Black-tailed Gulls would accumulate 0.256–0.656 µg/g wet weight total Hg in their blood, which is below the threshold for direct effects on breeding success, indicating that they should show normal breeding behavior to their chicks under the current level of Hg exposure.

However, Hg exposure had a significant negative relationship with chick growth rate. This may be because the sensitivity to lower levels of Hg contamination and their impacts on reproductive success may differ among species and sexes of seabirds. For example, male Grey-headed Albatrosses (*Thalassarche chrysostome*) that breed successfully have lower levels of Hg in their contour feathers than those that failed. Females of the same species that breed successfully and failed have similar levels of total Hg to successful males, thus Hg contamination does not relate to the breeding success of females (Mills et al. 2020). Wandering Albatrosses (*Diomedea exulans*) that had higher concentrations of Hg than Grey-headed Albatrosses, showed no significant effect of Hg on hatching success or fledging success (Bustamante et al. 2016). Hg concentrations in both sexes of the Antarctic Petrel (*Thalassoica antarctica*) (0.42–2.71 µg/g dry weight in blood) were not found to be related to hatching success (Carravieri et al. 2018). Black-legged Kittiwakes (*Rissa tridactyla*) breeding in Svalbard, Norway, had similar Hg levels in their blood to our gulls (Tartu et al. 2013, 2016). Male and female kittiwakes that skipped breeding had higher total Hg blood concentrations than those that bred (Tartu et al. 2013), and male kittiwakes that raised only one chick successfully had higher total Hg concentrations in their blood than those that raised two chicks successfully, but this difference did not apply to females (Tartu et al. 2016). Although we did not measure Hg concentration in male gulls, the lack of a relation to Hg on the reproductive success of female Black-tailed Gulls was similar to that observed in two species of albatrosses and in Black-legged Kittiwakes. It is not clear why the effects of Hg exposure on reproduction differ between sexes or species; however, the differences may be related to differences between sexes or among species in their foraging areas, trip lengths, and trip frequencies. Chick growth was not related to the δ^{15}N of female gulls in this study. This result suggests that the provisioning behavior of female parents was not related to their own diet, which is a different result from that found by González-Medina et al. (2018). Among seabirds, variation in parental provisioning rates influences the growth rate of chicks (Morbey and Ydenberg 1997), so the negative relationship of the Hg exposure of females to chick growth rate suggests that parents with higher Hg concentrations would provide less food to their chicks than parents with lower concentrations. The absence of a consistent relationship between

Fig. 2. Relationships between total mercury (Hg) concentrations in blood, nitrogen stable isotope (δ15N) ratios, and reproductive performance of female Black-tailed Gulls (*Larus crassirostris*) in 2018 and 2019 (combined). Error bars represent standard deviation.

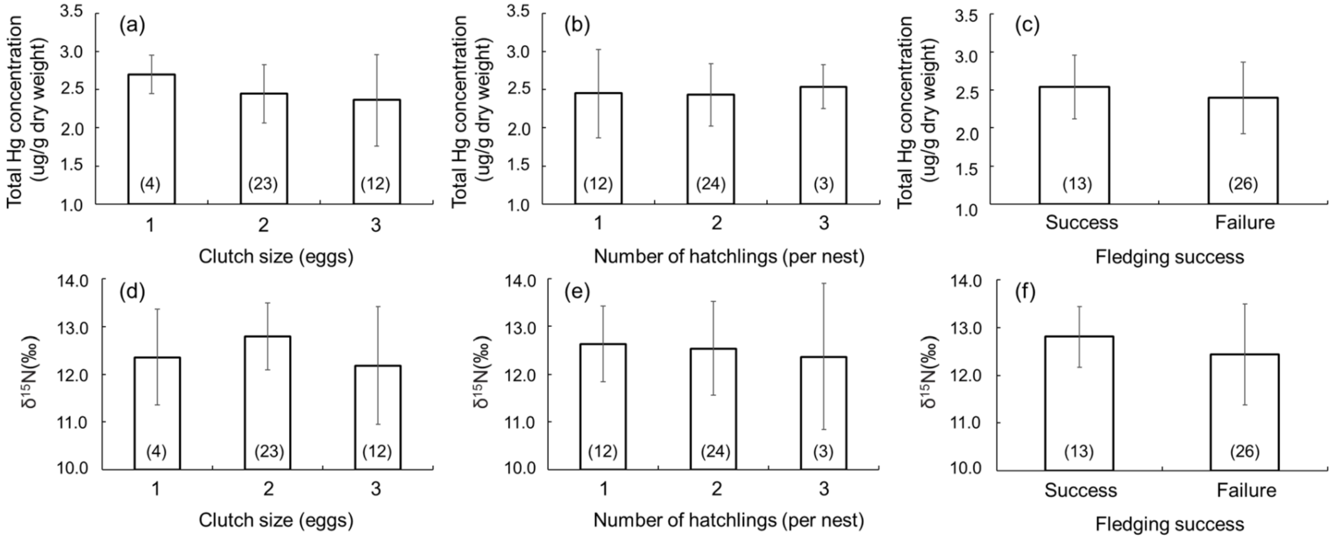
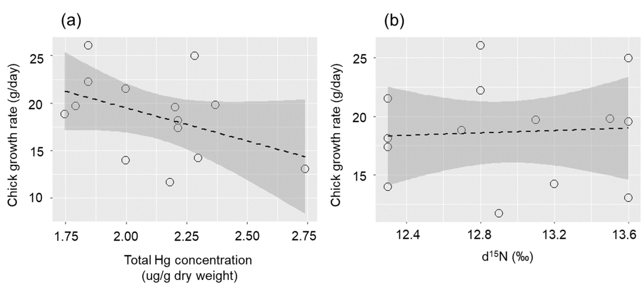


Fig. 3. Relationships between chick growth rate and (a) total mercury (Hg) concentrations in blood and (b) nitrogen stable isotope (δ15N) ratios. Circles represent raw counts and dashed lines and shaded areas represent the GLMM-estimated results ± 95% confidence intervals.



heavy metal contamination and breeding performance may arise from the disparate life history cycles and foraging habitats of the affected species. Seabirds that inhabit extensive oceanic domains may exhibit disparities in their intake of contaminants, owing to their proximity to human settlements and variations in foraging behavior that are contingent on sex and age (Hindell et al. 1999).

We cannot exclude the possibility that low-level mercury contamination may have affected the hormonal balance of the female Black-tailed Gull parents. All of the female parents in this study had higher levels than Ackerman et al.'s (2016) lowest observed effect level of blood-equivalent total Hg. The values that we observed may cause alterations to parental behavior through disruption of hormone secretions (Burger and Gochfeld 2002), because Hg compounds absorbed into the body are distributed and accumulated in endocrine tissues under lower-level Hg exposure during the early process of accumulation in body tissues (Niizuma et al. 2021). The reproductive performance of Black-legged Kittiwakes may be impaired by Hg contamination disrupting gonadotropin-releasing hormone input to the pituitary or prolactin hormone (Tartu et al. 2013, 2016). Among incubating male Snow Petrels (*Pagodroma nivea*) with concentrations of Hg in their blood of 0.9–4.0 µg/g dry weight, increasing Hg concentrations were related to decreasing stress-induced prolactin concentrations (Tartu et al. 2015). It is known that prolactin mediates avian parental behavior such as incubation and provisioning (Schoech et al. 1996, Angelier and Chastel 2009, Tartu et al. 2015). Therefore, it is possible that the lower growth rate of Black-tailed Gull chicks observed in this study is a result of females with higher total Hg concentrations taking less care of their offspring because of abnormal prolactin secretion.

In conclusion, while Black-tailed Gulls may not currently experience remarkable fitness consequences at their current level of Hg exposure, our detailed observations have shown for the first time that the chicks of females with higher Hg concentrations grew more slowly than those of females with lower concentrations. Slow growth of young seabird chicks is considered to influence their quality or survival after fledging (Kitaysky et al. 2006). In addition to adverse effect of Hg through altered behavior of their female parents, chicks are also affected in several ways by Hg contamination through intake of foods, such as altered behavior, reduced growth rates, impaired immune function, and decreased survival (Spalding et al. 2000, Kenow et al. 2007, Ackerman et al. 2008, Heddle et al. 2020). Over many generations, any negative effects of Hg contamination on their breeding performance, through their behavioral changes, could be more considerable than at the current level. If anthropogenic Hg emissions into the environment continue at the current level, therefore, Hg contamination may threaten gull numbers in the future, even though the breeding numbers of Black-tailed Gulls are not thought to be declining at colonies around Japan at the moment.

Acknowledgments:

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Nest_ID	Year	Cluch_size	No. of hatchlings	No. of fledgelings	Total Hg concentration (μg/g dry weight)	$\delta^{15}N$ (‰)	Two-year repeated measurement
K01	2018	3	1	1	1.3215	11.2082	Yes
K02	2018	2	2	2	2.1405	12.7395	Yes
K04	2018	2	2	2	2.8275	13.3854	Yes
K05	2018	2	1	1	3.2825	12.8500	No
K06	2018	3	2	1	2.7145	12.3999	No
K07	2018	3	2	2	2.6550	9.5424	Yes
KH	2018	1	1	1	2.5005	11.4510	No
A01	2018	3	3	2	2.4985	10.6626	No
A02	2018	2	2	1	2.4225	10.3734	No
D01	2018	2	2	0	2.4785	11.7540	Yes
D02	2018	3	2	1	1.2750	11.6958	Yes
D03	2018	2	2	1	3.1645	13.0056	Yes
D04	2018	3	3	2	2.8400	12.8306	Yes
D05	2018	2	2	2	2.7305	12.7003	No
D06	2018	3	2	1	2.5940	11.9687	Yes
D07	2018	2	1	1	2.1765	12.9220	Yes
K01	2019	2	2	1	2.4960	13.5620	Yes
K02	2019	2	1	0	2.2180	13.3770	Yes
K04	2019	2	2	2	2.0750	12.7810	Yes
K07	2019	3	2	1	1.8845	12.7240	No
K08	2019	2	2	0	2.5060	13.1580	No
K09	2019	3	3	1	2.2695	13.6220	No
K10	2019	2	2	2	2.2390	12.3440	No
K11	2019	2	1	0	2.0635	12.4690	No
K12	2019	2	2	1	2.8160	13.5860	No
K13	2019	2	2	2	2.3830	12.2730	No
K14	2019	1	1	0	3.0710	11.5790	No
D01	2019	3	1	0	3.2880	13.1430	Yes
D02	2019	1	1	0	2.5970	12.9230	Yes
D03	2019	2	2	1	2.2870	12.9010	Yes
D04	2019	1	1	0	2.6275	13.4830	Yes
D06	2019	2	2	0	3.0805	13.1230	Yes
D07	2019	2	2	0	1.8670	12.4730	Yes
D08	2019	3	2	0	2.6585	12.7020	No
D09	2019	2	2	1	2.4735	13.5690	No
D10	2019	3	2	0	2.3515	13.7070	No

D11	2019	2	2	0	2.2005	12.5860	No
D12	2019	2	1	1	2.3480	13.2360	No
D13	2019	2	1	1	1.9175	13.0590	No