Feathers of tracked seabirds reveal a spatial pattern of marine pollution

Watanuki Y[1], Yamashita A[1], Ishizuka M[2], Ikenaka Y[2], Nakayama SMM[2], Ishii C[2], Yamamoto T[3], Ito M[3], Kuwae T[4], Trathan PN[5]

[1]Graduate School of Fisheries Sciences, Hokkaido University, Minato-cho 3-1-1, Hakodate 041-8611, Japan ywata@fish.hokudai.ac.jp, [2]Graduate School of Veterinary Medicine, Hokkaido University, [3]National Institute of Polar Research, [4]Port and Airport Research Institute, [5]British Antarctic Survey

Support: JSPS(2024100102, 20519002, 24370016)

Mercury (Hg) has long been public concern
Feathers of seabirds are useful unit for monitoring regional scale pattern of Hg pollution

Monteiro & Furness 1995, Burger & Gochfeld 1995, Burger et al. 2007, Ramos et al. 2009Bond & Lavers 2011

But we have to be careful

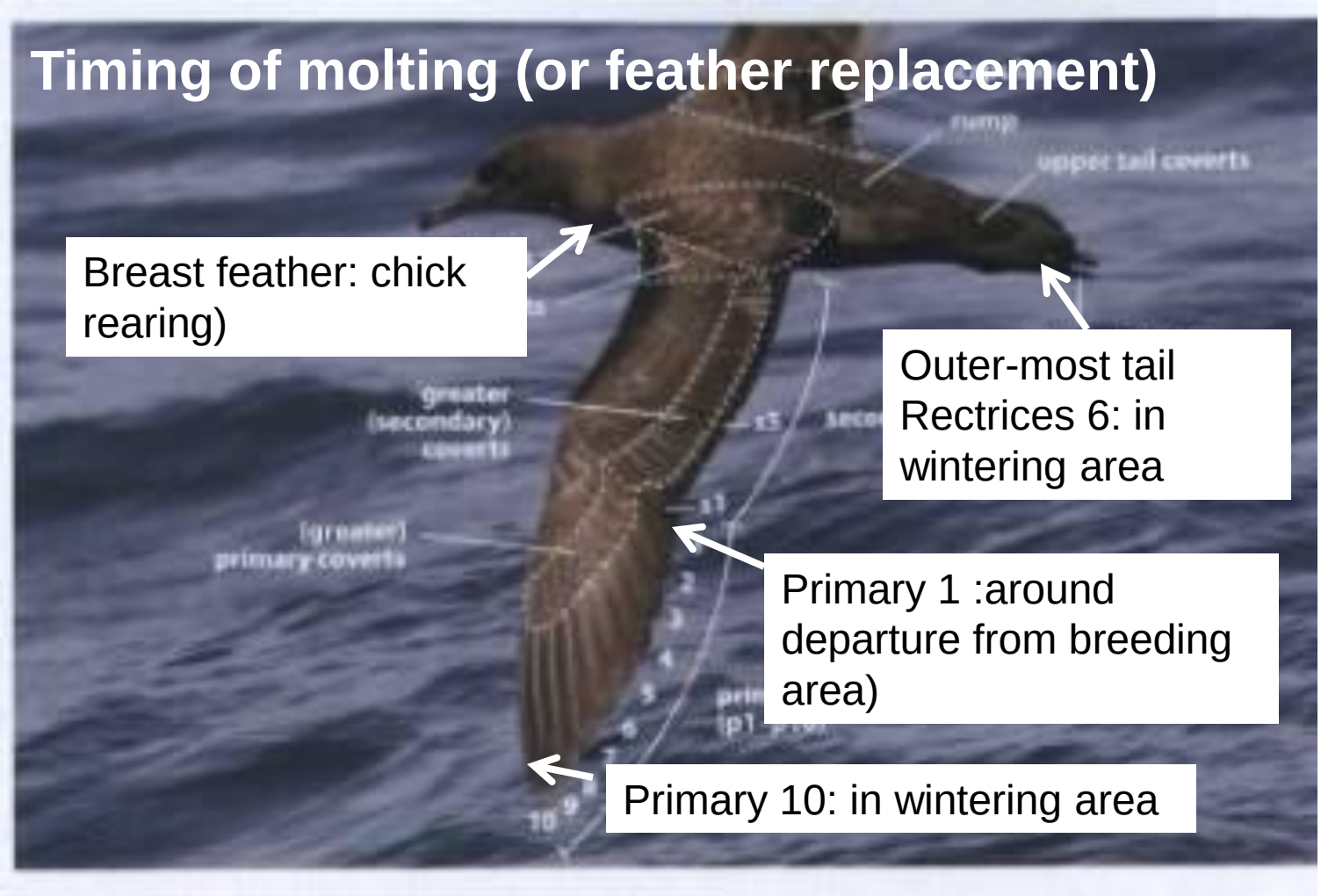
Integrate pollution over large range (Furness 1993).

Difficult to identify polluted areas.

Bio-magnification? (Bearhop et al. 2000, Bond 2010).

Confounding trophic effects.

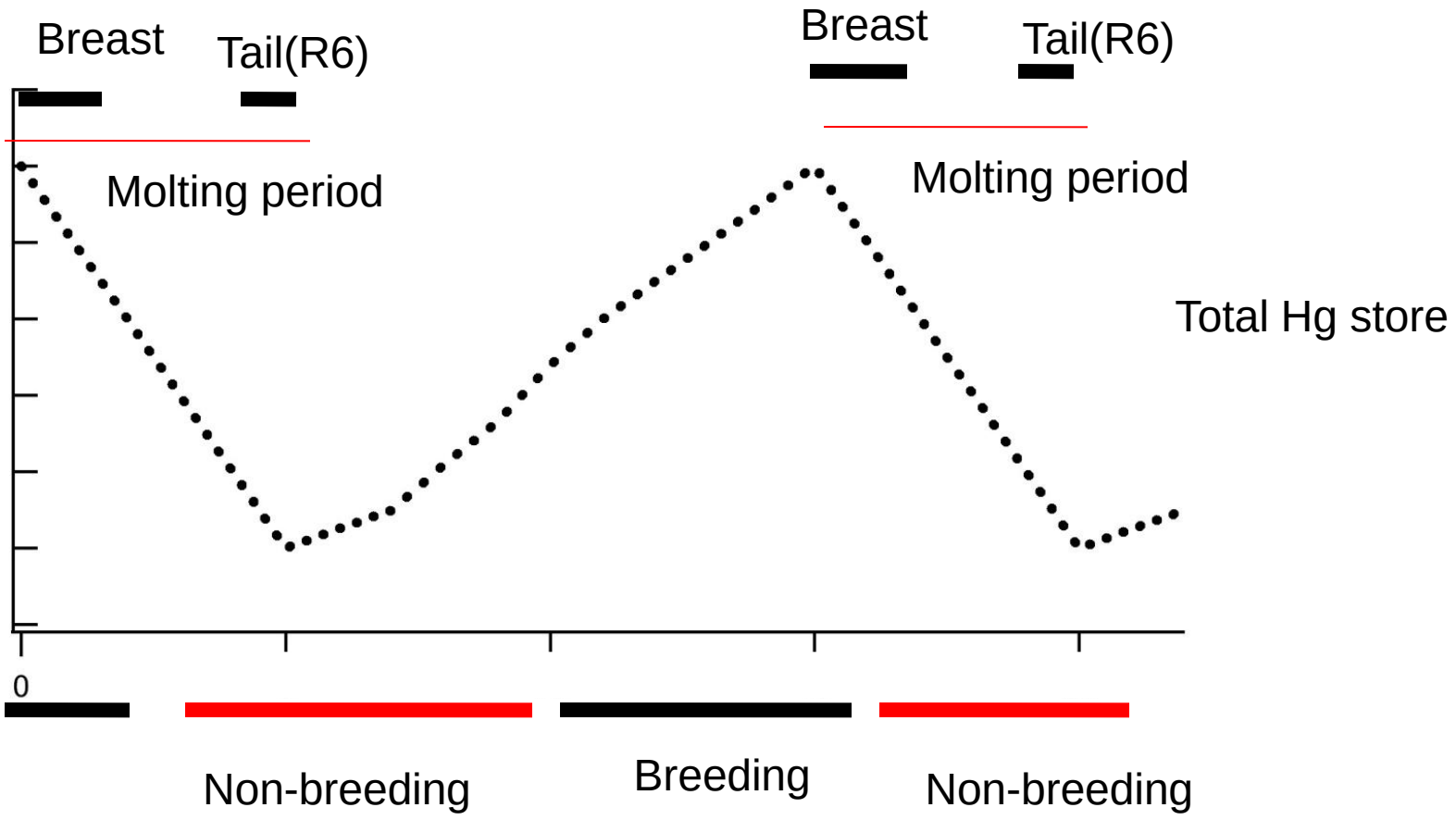
Different feathers grow at different period of the year



From Howell 2012

The breast feather reflects Hg store but the tail feather reflects current exposure in the non-breeding ranges

based on Ramos et al. 2009ab, Monteneiro & Furness 2001

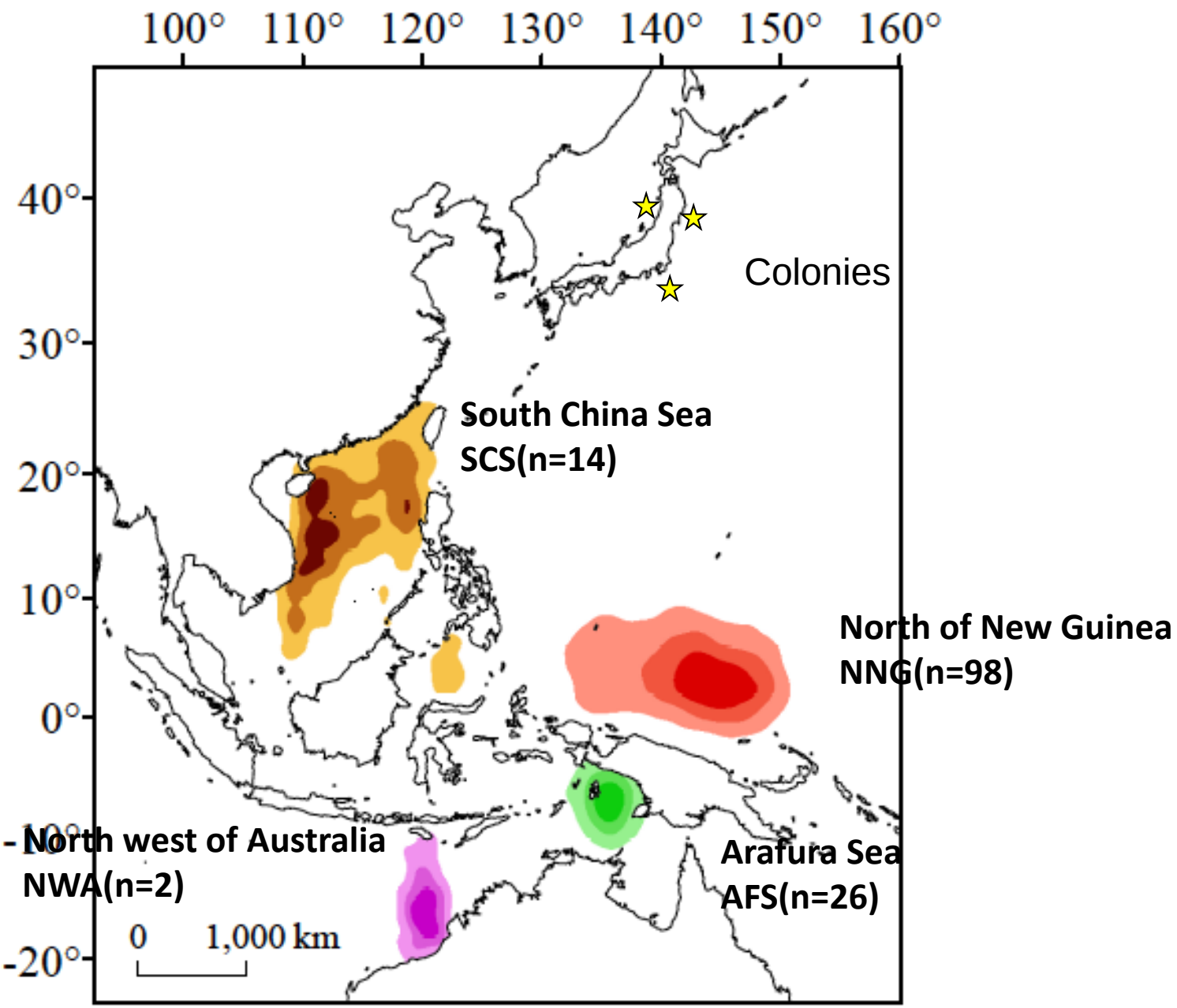


To identify polluted ocean and evaluate impact,

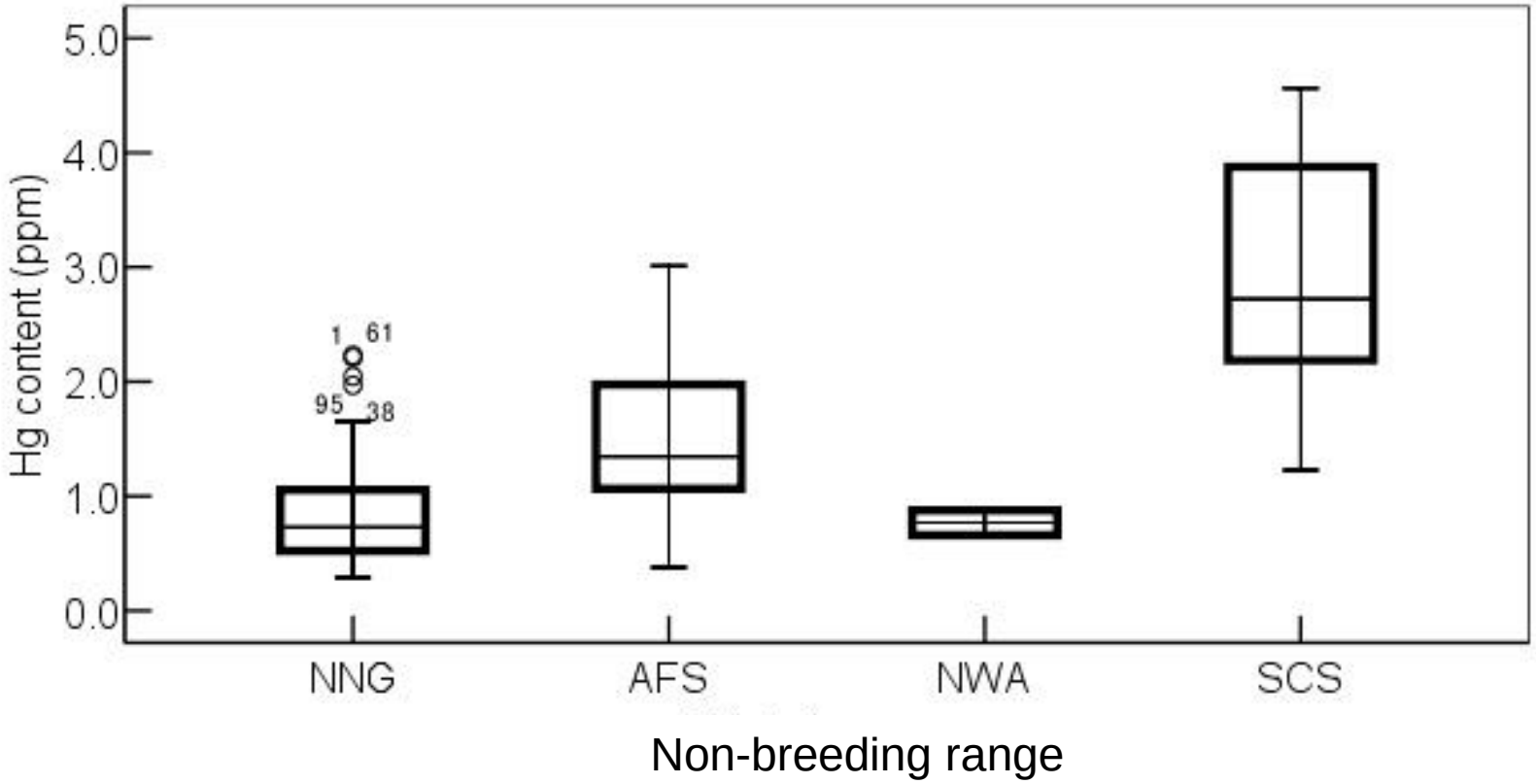
- Track birds for 1 year with geolocators
- Sample tail-feather when birds returned to the colony
- Hg and $\delta^{15}N$

Streaked Shearwaters *Calonectris leucomelas* breed in Japan and Korea and winter in south western N Pacific

Non-breeding ranges (Dec – Mar)

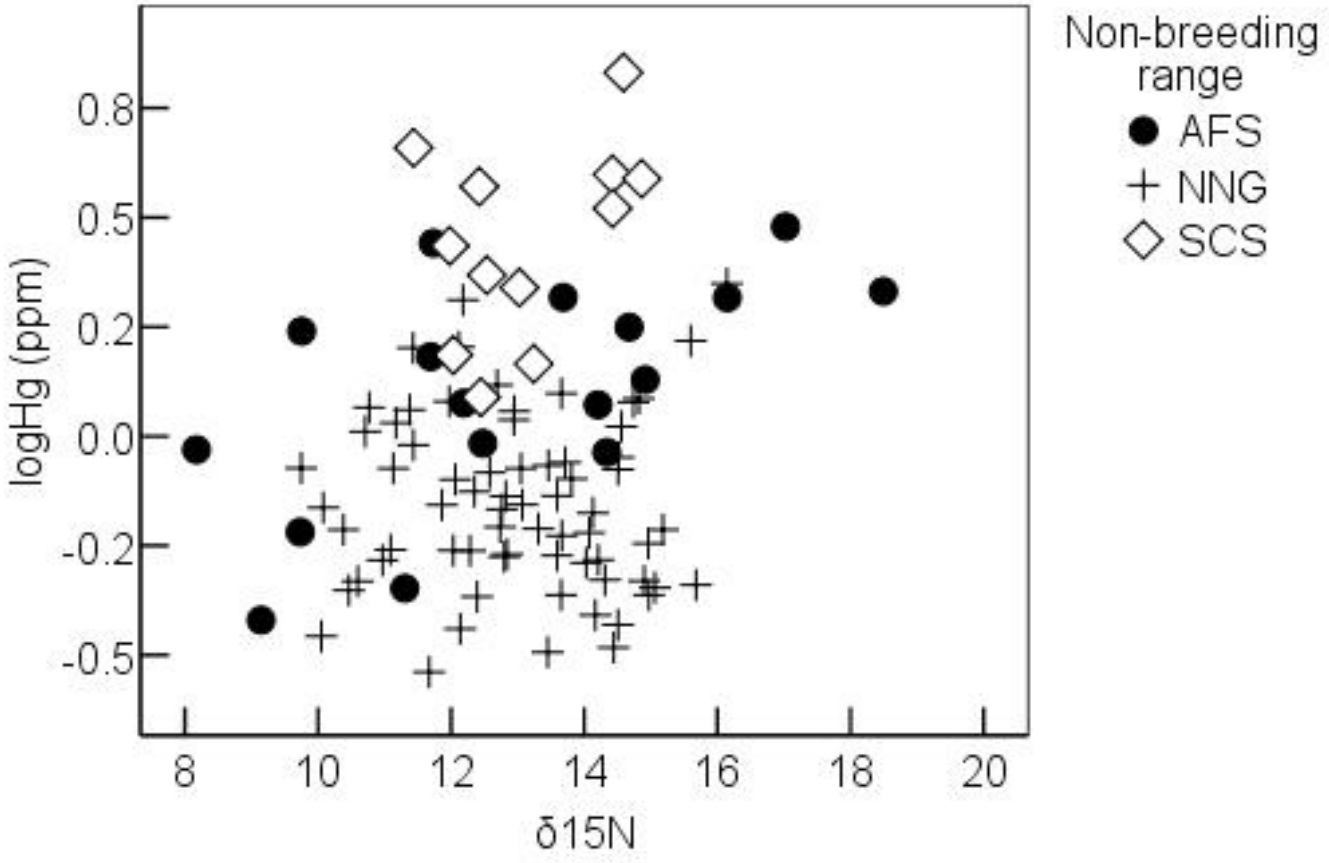


Hg in tail-feather



- Non-breeding range affected Hg in tail-feather ($P<0.001$, GLM)
- SCS>AFS>NNG=WA ($P<0.05$, post-hoc)

$\delta^{15}N$ weakly and positively affected Hg, but did not differ among non-breeding ranges



R^2=0.032, N=97, P=0.081

Conclusion

- Oceanic scale: Birds use different non-breeding ranges. Tail-feather which are replaced during non-breeding indicates that South China Sea is highly polluted with mercury
- Regional scale: Individuals used relatively small area within non-breeding range. Seabirds can be a regional scale (~500 km) monitor and indicate coastal region is polluted more than offshore region.
- Implication for conservation: Birds wintering in the South China Sea might suffer high pollution risk.