Impacts of long-term coastal reclamation on migratory bird populations in the East Asian-Australasian Flyway

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Worldwide state of shorebird populations



Arctic wader population trends by major flyway, based on CAFF 2005 for definition of Arctic and largely on WPE5 for population trends with minor adjustments for selected populations (three)

Importance of Yellow Sea intertidal habitat



Yellow Sea is a migration bottleneck



Loss and degradation of Yellow Sea intertidal habitat



Loss and degradation of Yellow Sea intertidal habitat



Loss and degradation of Yellow Sea intertidal habitat



Seto et al. 2012 PNAS

Quantifying intertidal habitat loss



Murray et al. 2012 Remote Sensing

Quantifying Yellow Sea intertidal habitat loss



Murray et al. 2012 Front. Ecol. Envir.

Bohai Bay, China



Bohai Bay, China



Yellow Sea intertidal habitat loss rate

- 28% decline in extent since 1980s
- 65% decline in extent since 1950s



Valiela et al. (2002) Bioscience | Achard et al. (2002) Science | Waycott et al. (2009) PNAS | Koh et al. (2011) PNAS | Miettinen et al. (2011) FREE.



Globally important shorebird sites

- 2001: East Asian Australasian
 Shorebird Action Plan
- Identified > 400 sites that met RAMSAR convention Criterion 6
- 2011: Expert panel developed consensus opinion about migratory conectivity among 1% sites.

Migratory connectivity networks



Iwamura et al. 2013 Proc. R. Soc. B

Migratory connectivity networks



Iwamura et al. 2013 Proc. R. Soc. B

How does Yellow Sea reliance affect population trends?



Defined Yellow Sea reliance as the proportion of the population that stages on Yellow Sea intertidal mudflats

100

6

Assess continental-scale population trends

- Data from BirdLife Australia's Shorebirds 2020 program and the Ornithological Society of New Zealand
- Volunteer counts run 1980's present
- Bayesian N-mixture models
- Estimate abundance informed by detection probability

Dramatic flyway-level population declines

-0.061 (-0.087, -0.037) -0.058 (-0.070, -0.046) -0.075 (-0.095, -0.055) 20 year decline = 69 % 20 year decline = 67 % 20 year decline = 76 %



Predictors of population trends

Phylogenetic comparative analysis



 Three common predictors of extinction risk: body size, breeding range size and generation time



Taxa that representations of the second seco



Studds et al. 2017 Nature Communications

Little difference in population trends among nodes



Taxa that rely more on Yellow Sea have greater declines



Studds et al. 2017 Nature Communications

Google Intertidal Project

• Nick Murray received funding by Google in 2016 to test the Google Earth Engine

Google Earth Engine

Data archive

Geospatial data archive

Analysis

Geospatial analysis platform using Google servers



Global distribution of intertidal flats

Tidal flats: 127,921 km²



Murray et al. in press

Global intertidal habitat trajectory



Murray et al. in press

Going forward....



 Migratory shored bird populations are crashing due to intertidal habitat loss

- Intertidal habitat loss has occurred throughout the world and continues in the Yellow Sea region
- The drivers of this loss are economic. Incentives to stop this pattern must also be economic