**Supplementary Material**

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Appendix S1

**Survey method**

Migration seasons were classified according to the occurrence of passage migrants and wintering birds in Bohai Bay and the surrounding areas: northward migration (spring) occurred from March to June and southward migration (autumn) from July to November; boreal winter counts were made from December to February (Yang et al. 2011, Li et al. 2013). To survey the saltpans, we drove along the perimeter roads and counted from the roads or pond levees, while the tidal flats were surveyed from a dike close to the sea. Waterbirds were counted using telescopes (25-60\* magnification eyepieces) and/or binoculars (8 \* 30 magnification). The schedule of waterbird counts and sample sizes are shown in Table 1.

Northward migration counts During northward migration in 2015 and 2016, the numbers of waterbirds in the saltpans were monitored regularly at both high and low tides, as well as on the tidal flats at low tide (the same days as the low tide counts in the saltpans). Low tide counts started 3 h before the lowest tide and typically lasted 6 h, thus covering the main period of the low tide. The high tide counts of saltpans included both inland and nearshore ponds, but low tide counts excluded the nearshore ponds since these ponds supported few birds at low tide. In the case of the tidal flats, the low tide counts focused on the abundant or important species (Red Knot Calidris canutus, Great Knot Calidris tenuirostris, Grey Plover Pluvialis squatarola, Bar-tailed Godwit Limosa lapponica, Black-tailed Godwit Limosa limosa, Eurasian Curlew Numenius arquata, Sanderling Calidris alba, Relict Gull Larus relictus, and Asian Dowitcher Limnodromus semipalmatus) in 2015 and shorebirds (not gulls, terns and others) were counted in 2016 owing to logistical constraints. Shorebirds (especially Red Knots and Great Knots) were the most abundant waterbirds in northward migration on the tidal flats, so the number of birds in these counts should be close to the total waterbird numbers (see results).

Additionally, in the northward migration of 2013 and 2014, we included data from counts carried out only in the inland ponds. Unfortunately, all counts in 2013, as well as three counts in 2014, were incomplete and they were performed independent of the tidal cycle (a further five counts in 2014 were complete but independent of the tidal cycle), i.e., a single count included the high period, a part of the low tide period, and covered only inland ponds (Table 1). Lastly, we also included data from the counts on the tidal flats at low tide during northward migration 2014, which considered all waterbird species and were carried out on the same days as the low tide counts in the saltpans. All inland pond counts in northward migration only focused on the north inland ponds because the south inland ponds had restricted access.

Southward migration and boreal winter counts We performed counts in the inland ponds and on the tidal flats in southward migration 2013-2016, as well as in boreal winter 2013. Owing to logistical constraints, the counts on the tidal flat were made before or after the counts in the inland ponds, and the surveys of saltpans were not performed according to the tide. Unfortunately, we did not count nearshore ponds, because we could not catch high tide in these ponds. We did not survey the Zuidong tidal flats because there were few birds and a high level of disturbance from people working on the tidal area. The counts of inland ponds in 2013 (southward migration and boreal winter) and in 2016 (southward migration) included both the north and south inland ponds, but other counts only focused on the north inland ponds.

During high tide, all tidal flats are submerged, so waterbirds have to move into saltpans for roosting or feeding (the previous experience in the study site allowed us to know all large feeding and roosting sites in saltpans). In each round of counts, the maximum number of a species in the study area was obtained from the high-tide counts in the saltpans or from the total number of the synchronized low-tide counts on tidal flats and in saltpans. On 16 May 2013, the Global Flyway Networks (GFN) team counted 96,000 birds in a single pond in the Nanpu Saltpans (Hassell et al. 2013); the maximum counts of two species (Red Knot and Red-necked Stint) were taken from this count. To estimate a species’ habitat usage, the number in the saltpans or on the tidal flats was divided by the maximum number in the study area (times 100%).

At times the saltpans and tidal flats supported too many large flocks to be counted during a single tidal cycle, and counts were made over two consecutive days, or in a very few cases three consecutive days (only four counts). To avoid double counts in the saltpans, the ponds counted the previous day were checked for apparent changes in numbers. If the number of birds obviously changed in the ponds already surveyed, we were conservative and used the maximum count in a single day; if there was no obvious change, we summed the counts in the different areas from the consecutive days, considering the magnitude of any resultant double-counting to be small. Bird names follow the BirdLife Checklist Version 9.1 [(http://datazone.birdlife.org/species/taxonomy)](http://datazone.birdlife.org/species/taxonomy).

References

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Appendix S2. Composition of waterbird communities in different habitats and seasons. The times of counts are shown in parentheses, data shows top ten species.

Saltpans Tidal flats

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Northward migration inland ponds low tide (15) | | Northward migration inland ponds high tide (14) | | Northward migration nearshore ponds high tide (6) | | Southward migration inland ponds (21) | | boreal winter inland ponds (3) | | Northward migration low tide (6) | | Southward migration (13) | | boreal winter (2) | |
| MS | 29.3 | BTG | 26.5 | RK | 32.1 | BHG | 19.0 | CSD | 92.5 | RK | 55.1 | DUN | 35.8 | RG | 45.4 |
| CS | 19.7 | MS | 22.8 | GK | 31.8 | CSD | 16.9 | HG | 2.4 | GK | 15.3 | KP | 21.0 | EC | 32.2 |
| BTG | 15.4 | CS | 12.0 | DUN | 9.1 | BWS | 11.2 | RBM | 1.9 | DUN | 8.0 | RG | 11.2 | DUN | 15.9 |
| RNS | 8.5 | RNS | 7.9 | CS | 6.7 | PA | 10.7 | CG | 1.8 | EC | 4.9 | EC | 8.0 | GP | 5.3 |
| PA | 6.8 | DUN | 7.0 | SAN | 3.5 | MS | 9.0 | EC | 0.8 | GP | 4.5 | GP | 7.5 | AHG | 0.5 |
| DUN | 5.1 | PA | 4.6 | GP | 2.8 | WWT | 7.8 | BHG | 0.5 | CS | 4.4 | BHG | 3.2 | KP | 0.3 |
| RK | 3.0 | RK | 4.1 | EC | 2.8 | SR | 5.8 | LG | 0.2 | KP | 2.7 | BTGU | 2.6 | BTGU | 0.2 |
| KP | 2.7 | WWT | 3.9 | RNS | 2.1 | STS | 5.0 |  |  | BARTG | 1.1 | PA | 1.6 | MG | 0.1 |
| BWS | 2.0 | BHG | 3.1 | MS | 1.9 | BTG | 4.8 |  |  | RG | 1.1 | BTG | 1.4 | CM | 0.1 |
| WWT | 1.4 | KP | 3.0 | BARTG | 1.5 | BNG | 2.0 |  |  | RNS | 0.8 | GK | 1.3 |  |  |

AHG = Arctic Herring Gull=Larus smithsonianus, BARTG = Bar-tailed Godwit Limosa lapponica, BHD = Black-headed Gull Larus ridibundus, BNG = Black-necked Grebe Podiceps nigricollis, BTG = Black-tailed Godwit Limosa limosa, BTGU = Black-tailed Gull = Larus crassirostris, BWS = Black­winged Stilt Himantopus himantopus, CG = Common Goldeneye Bucephala clangula, CM = Common Merganser Mergus merganser, CSD = Common Shelduck Tadorna tadorna, DUN = Dunlin Calidris alpina, EC = Eurasian Curlew Numenius arquata, GK = Great Knot Calidris tenuirostris, GP = Grey Plover Pluvialis squatarola, KP = Kentish Plover Charadrius alexandrinus, LG = Little Grebe Tachybaptus ruficollis, MG = Mew Gull Larus canus, MS = Marsh Sandpiper Tringa stagnatilis, PA = Pied Avocet Recurvirostra avosetta, RK = Red Knot Calidris canutus, RNS = Red-necked Stint Calidris ruficollis, SAN = Sanderling Calidris alba, STS = Sharp-tailed Sandpiper Calidris acuminata, WWT = White-winged Tern Chlidonias leucopterus,

RBM = Red-breasted Merganser Mergus serrator, RG = Relict Gull Larus relictus, SR = Spotted Redshank Tringa erythropus.

Appendix S3. Comparison of mean density (birds/km2) of waterbirds in saltpans (58 km2) with tidal flats (57 km2) during low tide synchronized counts in northward migration of 2014 and 2016 (Red Knot, Great Knot, Black-tailed Godwit, Grey Plover, Sanderling and Bar-tailed Godwit also contain counts of northward migration 2015, data of non-shorebirds only contain counts from northward migration 2014). Abundance in each habitat (in parenthesis) and total abundance are also shown. N indicates times of synchronized counts, species with total number over 200 are shown.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Species | Inland ponds | | Tidal flats | | N | Z | P | Total |
|  | Means | SE | Means | SE |  |  |  |  |
| Red Knot | 1.71  (99) | 1.64  (95) | 309.45  (17,639) | 64.69  (3,687) | 12 | -4.208 | 0.000 | 212,855 |
| Great Knot | 0.22  (13) | 0.22  (13) | 116.74  (6,654) | 26.32  (1,500) | 12 | -3.980 | 0.000 | 79,999 |
| Black-tailed  Godwit | 65.38  (3,792) | 26.64  (1,545) | 23.26  (1,326) | 20.41  (1,164) | 12 | -2.774 | 0.006 | 61,419 |
| Curlew  Sandpiper | 38.28  (2,220) | 16.16  (937) | 66.6  (3796) | 28.37  (1617) | 10 | -0.076 | 0.940 | 60,161 |
| Dunlin | 16.61  (963) | 11.24  (652) | 70.93  (4,043) | 23.06  (1,315) | 10 | -1.708 | 0.088 | 50,061 |
| Marsh  Sandpiper | 59.23  (3,436) | 22.63  (1,312) | 0.72  (41) | 0.48  (27) | 10 | -2.626 | 0.009 | 34,765 |
| Grey Plover | 0.00  (0) | 0.00  (0) | 26.91  (1,534) | 5.4  (308) | 12 | -4.442 | 0.000 | 18,404 |
| Red-necked  Stint | 20.69  (1,200) | 7.85  (455) | 9.62  (548) | 4.74  (270) | 10 | -1.494 | 0.135 | 17,482 |
| Eurasian  Curlew | 0.06  (4) | 0.06  (4) | 23.59  (1,345) | 13.71  (781) | 10 | -3.963 | 0.000 | 13,481 |
| Kentish  Plover | 7.1  (412) | 3.36  (195) | 13.5  (770) | 7.33  (418) | 10 | -0.605 | 0.545 | 11,815 |
| Pied Avocet | 19.41  (1,126) | 3.47  (201) | 0.72  (41) | 0.63  (36) | 10 | -3.810 | 0.000 | 11,664 |
| Sanderling | 2.42  (140) | 1.94  (113) | 12.96  (739) | 6.87  (392) | 12 | -0.652 | 0.514 | 10,549 |
| Bar-tailed  Godwit | 0.00  (0) | 0.00  (0) | 10.29  (587) | 2.53  (144) | 12 | -4.153 | 0.000 | 7,040 |

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| --- | --- | --- | --- |
| Sharp-tailed | 4.51 | 1.78 | 1.28 |
| Sandpiper | (261) | (103) | (73) |
| Black- | 5.62 | 0.99 | 0.01 |
| winged Stilt | (326) | (58) | (0) |
| Relict Gull | 0.00 | 0.00 | 4.44 |
| (0) | (0) | (422) |
| Mew Gull | 2.24 | 2.24 | 0.00 |
| (217) | (484) | (0) |
| Spotted | 1.84 | 1.45 | 0.02 |
| Redshank | (107) | (84) | (1) |
| Common | 1.75 | 0.91 | 0.08 |
| Shelduck | (169) | (78) | (7) |
| Ruddy | 0.03 | 0.01 | 1.57 |
| Turnstone | (2) | (1) | (89) |
| Broad-billed | 0.02 | 0.01 | 1.54 |
| Sandpiper | (1) | (1) | (88) |
| White- | 1.26 | 0.86 | 0.00 |
| winged Tern | (121) | (79) | (0) |
| Gull-billed | 0.16 | 0.14 | 1.03 |
| Tern | (15) | (13) | (98) |
| Common | 0.07 | 0.03 | 0.99 |
| Greenshank | (4) | (2) | (56) |
| Eastern | 0.00 | 0.00 | 0.76 |
| Curlew | (0) | (0) | (44) |
| Asian | 0.01 | 0.01 | 0.72 |
| Dowitcher | (1) | (1) | (41) |
| Terek | 0.01 | 0.00 | 0.59 |
| Sandpiper | (0) | (0) | (33) |
| Lesser Sand | 0.06 | 0.03 | 0.46 |
| Plover | (3) | (2) | (26) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 0.43  (25) | 10 | -1.288 | 0.198 | 3342 |
| 0.01  (0) | 10 | -3.594 | 0.000 | 3263 |
| 3.44  (318) | 6 | -2.796 | 0.005 | 2531 |
| 0.00  (0) | 6 | -0.073 | 0.942 | 1301 |
| 0.02  (1) | 10 | -2.773 | 0.006 | 1081 |
| 0.05  (5) | 6 | -1.655 | 0.098 | 1058 |
| 0.64  (36) | 6 | -2.061 | 0.039 | 914 |
| 1.26  (72) | 10 | -2.133 | 0.033 | 888 |
| 0.00  (0) | 6 | -1.451 | 0.147 | 728 |
| 0.44  (33) | 6 | -1.597 | 0.110 | 678 |
| 0.62  (35) | 6 | -1.348 | 0.178 | 606 |
| 0.44  (25) | 6 | -2.796 | 0.005 | 435 |
| 0.48  (27) | 10 | -0.977 | 0.329 | 418 |
| 0.33  (19) | 6 | -2.648 | 0.008 | 337 |
| 0.26  (15) | 10 | -1.665 | 0.096 | 294 |