Wintering Waterbird Monitoring in the Republic of Korea

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1. Migration of bird

Birds are international resource, because every year an estimated 50 billion birds make migratory journeys, along a network of routes that encompasses the whole world. Sometimes traveling tens of thousands of kilometers, crossing continents and oceans, migratory birds have become so well adapted to this task that they can traverse the largest deserts and seas, the highest mountains and expanses of ice.

Many of the bird populations migrate between the northern breeding areas and southern non-breeding areas and in doing so, regularly cross the borders of two, three or more countries. Others move locally, within or across national boundaries largely in response to the availability of feeding and roosting sites. Thus they depend on a large network of different habitats throughout their range to complete their annual cycle. Migrations of most birds follow some similar general orientations, even if different species and populations have considerably different migration strategies.

For identifying bird populations, connected to East Asian Flyway, it is necessary to delineate population boundaries based on the movements of individuals and other migration studies. A study of the movement of individuals normally relies on identifying individuals using a variety of standard marking techniques: banding (ringing) with metal bands and/or colour bands/flags, neck collars, nasal tags, radio/satellite transmitters, etc.

Many bird species are ecologically dependent on wetlands for at least some parts of their annual cycle. Many species use a wide range of wetlands, from the high arctic tundra, temperate bogs, rivers and estuaries, freshwater or saline lakes, and ponds or swamps, to coastal lagoons and inter-tidal coastal areas such as mudflats, bays and the open sea. Wetlands on which these birds depend are usually highly productive habitats and thus relatively small areas may support large concentrations of waterbirds.

2. Current status of migratory birds in the Republic of Korea

The Republic of Korea possesses a variety of wetlands along the south and the west coast. These wetlands have tremendous global significance for conservation because they serve as breeding, resting and wintering sites for migratory and rare bird species in the East Asian region. Recognizing the importance of the wetlands, the Korean government has enacted relevant Acts including the Wetland Preservation Act and is setting up and implementing a number of policies.

However, due to mounting development pressure and contamination by human activities, the wetlands continue to be degraded. Without taking prompt and appropriate actions, these wetlands and migratory and rare bird species inhabiting them may face extinction.

The Republic of Korea has over 281,544 hectares of tidal flats, 13,000km of shoreline, 2,900 islands, and some of the globally important and unique natural wetlands, which provide habitats for an extremely wide range of biological diversity. In addition to serving as habitats for endangered or endemic plants and animals, these

wetlands act as crucial staging and breeding areas for migratory bird populations, including many globally threatened species, in the East Asian-Australian flyway. These wetlands also supply rice, protein, medicine, energy, and raw materials for local communities.

More than 50 internationally important bird species were identified as migrating through the wetlands of the Republic of Korea. Among these, the Black-faced Spoonbill and the Chinese Egret, whose main breeding and resting grounds are located on the west coast of the Korean peninsula, are considered the most important species, since their world populations are estimated at about 900 individuals and 2,500 individuals, respectively.

The wintering population and staging population of the Red-crowned Crane (*Grus japonensis*) and the White-naped Crane (*Grus vipio*) in the wetlands in the Republic of Korea exceed 30% of world population, and the wintering population of the Baikal Teal (*Anas formosa*) and the Bean Goose (*Anser fabalis*) in the wetlands of the Republic of Korea range from 50~95% of the world population.

Despite the measures currently planned or being carried out, the biodiversity of others are more site-specific. Consequently, a comprehensive demonstration of methods to secure conservation of globally significant biodiversity will need to involve appropriate mechanisms at the central level to complement actions undertaken at specific sites.

3. Birds as good indicators of environment change

Birds have been used to assess and monitor the environment throughout the history. Birds are one of the best, and in some cases the only indicators of environmental change. Conservation biologists and ornithologists have used changes in bird populations and communities, and changes in bird behavior and reproductive ability serving as natural bio-monitor to (1) examine the long-term affects of habitat fragmentation and introduced species, (2) monitor water quality, (3) indicate the health of marine fishery stocks, and (4) identify environmental pollutants.

It is clear why we can use birds as important indicators of environmental change:

- Birds are easy to study. Many species are easily identified, detected, and return to traditional breeding sites yearly, so large amounts of data can be reliably gathered from scientists and a concerned public alike.

- Birds are well known organisms. Because the biology, ecology, behavior, and evolutionary histories of many birds have been extensively studied, scientists have a foundation to ask the most pertinent questions, base hypotheses, to obtain answers, and to cultivate solutions. This background knowledge reduces risk of misinterpretation, allowing scientists to use birds, sensitive to stresses in predictable ways, as a proxy measure of environmental change. Furthermore, this background knowledge yields cost-effective research, since studies using other groups of animals often requires several years of basic data gathering before monitoring can begin.

- Birds integrate and accumulate environmental stresses over time because they are usually high level in the food chain and have relatively long life-spans. Thus birds can be used as indicators of unexpected environmental problems, when declining numbers and breeding success of birds such as the White-tailed Eagle (*Haliaeetus albicilla*), Osprey (*Pandion haliaetus*), Golden Eagle (*Aquila chrysaetos*) and Black Kite (*Milvus migrans*).

- Bird populations and communities, and bird behavior and reproductive success often reflect closely the stability of an ecosystem. Thus long-term monitoring programs like AWC help reveal declines in population numbers and changes in species' ranges resulting from human-induced causes, providing information crucial to making land management decisions.

- Birds hold widespread public interest. Great number of birders in North America and European countries tell, that second most popular outdoor activity after gardening spend billions of dollars annually on birding supplies. Volunteer birders participating in citizen science programs form a powerful resource to gather data about population trends over a broad geographical range.

4. Asian Waterbirds Census in Korea

Asian Waterbirds Census in Korea was started from 1988 and coordinated by Prof. Won and later The Korean Association of Wildlife Conservation chaired by Prof. Won (1988-1998) and National Institute of Environment Research (from 1999). In early stage, the coverage was relatively low due to not only financial problem but also lacking of trained peoples. According to economic growth and increase of birdwatchers and graduated school students by the expansion of public interest to bird, the infra-structure was adequate for whole country survey in late 90's. From 1999, waterbirds census were coordinated, funded and implemented by government. The results from the census have been used in many cases by not only Government but also private company.

From many years experience, some new sites were added and some sites were divided or integrated for data quality management. Currently, 118 sites have been selected and monitored by 128 surveyers (64 teams). Every team was given a map which shows the boundary of census and a standardized report form. The census was conducted same day with one day pre-census if needed. This simultaneous census makes the output more reliable because big population of Baikal teal which is now the most abundant species in Korea, move to and fro day by day. Most participants report their result by e-mail with standardized form and this helps the easy creation of data base.

But there are still many sites which needs to be censused in order to grasp the situation of wintering waterbirds of whole Korea. There lies many possible errors by the different ability of participants and also by weather condition. Supplementary single species census for Cinerous(Black) Vulture, Black-faced Spoon-bill, Crane species were conducted to calibrate errors above mentioned. And also intensive research or survey for a single site have been conducted

Table 1. Details of Wintering Waterbirds Census in Korea

Year	Sites Surveyed	No.of Participant	Result		
			Species	Individuals	Dominant Species
1988~ 1998	10~26	1~12	-	-	-
1999	69	84	178	1,068,256	Mallard (340,581), Baikal Teal (230,508), Spot-billed Duck (103,108), White fronted Goose (61,328), Bean Goose (37,464)
2000	100	105	186	1,184,694	Mallard (434,472), Baikal Teal (211,954), Spot-billed Duck (147,936), Pochard (61,184), Shelduck (44,396)
2001	114	122	189	964,150	Mallard (264,118), Baikal Teal (185,699), Spot-billed Duck (93,369), Shelduck (44,710), Pochard (33,070)
2002	118	128	175	932,258	Baikal Teal (287,206), Mallard (255,421), Spot-billed Duck (62,051), Bean Goose (31,866), White fronted Goose (30,428)
2003	118	128	189	975,531	Baikal Teal (303,165), Mallard (250,048), Spot-billed Duck (55,118), White fronted Goose (33,583), Herring Gull (29,608)