National marine ecosystem monitoring program(KOREA)
- Shorebird research method-

Ministry of Oceans and Fisheries has legislated the national marine ecosystem monitoring program (shorebird research) since 2015, has standardized research subjects and methods by establishing research guidelines, and has been building a database by securing quantitative data of results. The purpose of this study is to utilize as basic data for conservation and management policies of shorebird diversity in coastal wetlands through identifying temporal, spatial, and long- and short-term fluctuations of the shorebirds and constructing systematic data.

1.1. Research Period

The research is to be conducted twice in fall and winter, and additional research will be performed if needed.

1.2. Research Area

☐ The shorebird research has been conducted on 34 major coastal wetlands and migratory bird habitats in Korea. They include 18 locations within 3 west coast areas such as Ganghwado Island and Garorimman Bay, 9 locations within 2 south coast areas such as Suncheonman Bay and Deukryangman Bay, 6 locations on the east coast such as Geojin and Mukho, and 1 location in Jeju area (Table 1, Figure 1).
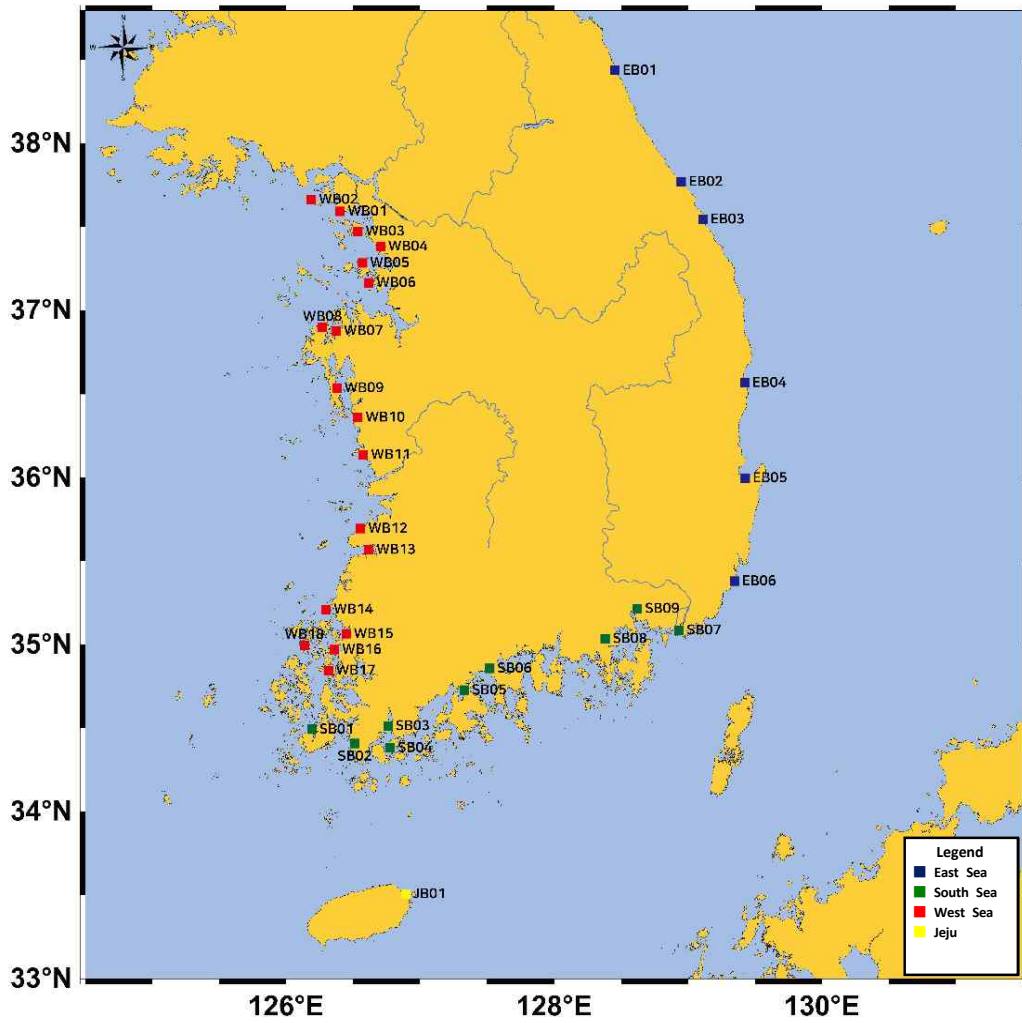
1.3.1. Field Research

☐ The shorebird field research has been performed in accordance with "The National Marine Ecosystem Monitoring Program Protocol" (Ministry of Oceans and Fisheries, 2019).

☐ The scope has been selected for each research area with a focus on where habitat conditions for the shorebirds are good, and to include land lines for the existing tidal flat ecology research.

☐ For the field research, the research route has been chosen along with the costal lines as per the National Marine Ecosystem Monitoring Program Protocol. 2 or more groups of two people have performed the line census at the same time two hours before and after high tide. In the case of the areas where the tide is concentrated, telescopes have been used to conduct the point count.

[Table 1] Locations by Shorebird Research Area

Category		No. of Areas (Location)	Research Area
West Sea	Gyeonggi Area	6	Ganghwado (WB01), Boleum/Jumun (WB02), Yeongjongdo (WB03), Songdo/Siheung (WB04)
			Yeongheung/Seonjae/Daebudo (WB05), Hwaseong (WB06)
	Chungcheong Area	5	Garorimman Bay (WB07), Wonbuk (WB08), Anmyeondo (WB09), Daecheoncheon Estuary (WB10), Biin/Janghang (WB11)
	Western Jeolla Area	7	Byeonsan (WB12), Gomsoman (WB13), Yeonggwang (WB14), Hampyeongman Bay (WB15), Muan (WB16), Aphaedo (WB17), Jeungdo (WB18)
South Sea	Southern Jeolla Area	6	Jindo (SB01), Haenam (SB02), Gangjinman (SB03), Gogeum/Yaksan/Sinjido (SB04), Deukryangman Bay (SB05), Suncheonman Bay (SB06)
	Gyeongnam Area	3	Nakdonggang Estuary (SB07), Danghangman Bay (SB08), Bongam/Sacheon (SB09)
East Sea	East Coast Area	3	Yeonghae (EB04), Hwanho (EB05), Jangan (EB06)
		3	Geojin (EB01), Gangreung (EB02), Mukho (EB03)
Jeju	Jeju Area	1	Jeju Seongsan (JB01)

- Line Census Method: It is a research method in which traffic lines are divided to avoid overlaps in research scopes, investigators either walk or drive along the divided traffic line, and they conduct either direct observation or indirect observation by listening to sounds of all birds within 100m in both directions around the research area.

- Point Count Method: It is a research method in which multiple research points are selected to include all research target areas and conduct either direct observation with the naked eyes or research equipment or indirect observation through sounds at the determined research point. Investigators usually stay at each point for about 10 to 30 minutes and collect and record as much observed data as possible.

□ Populations have been identified while the investigators were hiding and using a high-resolution telescope (20 to 60x), and repeat counting has been performed more two times or more to minimize an error in population estimates.

- Total Population Research Method: The total population is identified by dividing the total population into 10 to 20 unit groups.

- Each Species' Population Research Method: Start with the species with the largest population based on the total population research and use a counter to identity the population.

[Figure 1] Shorebird research station
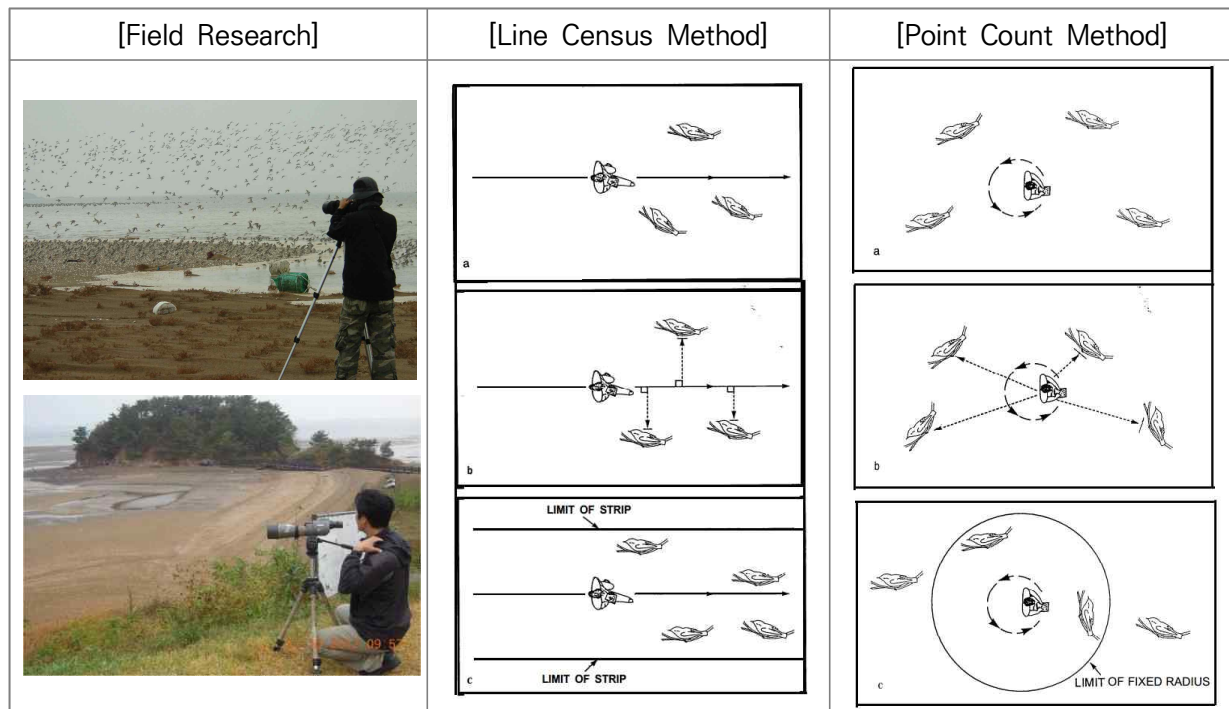
[Figure 2] Shorebird Field Research and Method Examples

☐ GPS coordinates have been obtained for legally protected species observed during the field research, and the observed points have been categorized based on the species and grades. If the population is large, the observed species are used to represent the data regardless of the populations.

1.3.2 Data Analysis

☐ To analyze the populations of the observed shorebirds, the maximum populations have been calculated and used based on the number of research conducted to avoid duplicate counts.

☐ The list of the shorebirds is based on the Checklist of Birds of Korea (The Korean Association for Bird Protection, 2009) in accordance with the National Marine Ecosystem Monitoring Program Protocol and references Birds of Korea (Lee et al., 2014), Sandpipers and Plovers of Korea (Park et al., 2013), and the cluster analysis is based on the following formula and reviews dominance and other factors.

* Dominance : Dom.

The index of McNaughton (1967) is used, and the dominance is the index indicating the degree to which each species is quantitatively dominant within a cluster.

Dom.(%) = (ni/N) × 100 (ni: each species' population, N: total population)