Priority Subjects — **Further Improvement of Facility Operations and Maintenance Technologies**

Development of Technologies for Supporting Construction and Maintenance of Power Plants from the Viewpoint of Biodiversity Conservation

Background and Objective

According to the Environmental Impact Assessment (EIA) Law amended in 2011, an assessment of biodiversity must be conducted at the planning stage of a project and results of conservation measures must be published. In addition, wind-power generation has become subject to the EIA Law. The necessity of biodiversity offsets*1 and assessment of the environmental impact of power plants on marine ecosystems has started to be discussed at government level, increasing the necessity of technological developments related to the further introduction of regulations and systems. The target of this research is to develop technologies related to biodiversity assessment and conservation to help enable the smooth construction, renewal, and operation of power plants.

Main results

1 Development of an assessment method for important species*2 used in the environmental impact statement at the planning stage

In the amended EIA Law, the impact assessment on important species must be conducted at the planning stage. We analyzed the habitat of important species recorded in past environmental assessment reports and developed a method estimating the probabilities of occurrence of those species in the planned project areas using published vegetation information (Fig. 1). Using this method, it is possible to estimate the distribution of important species from vegetation maps without additional surveys, even in the project areas where little species information has been published.

2 Development of an efficient survey technique for flying birds

The impact of wind-power generating facilities on birds should be predicted and assessed as a part of EIA as the collision of birds with wind-power generating facilities is a concern. To obtain data required for the impact assessment, flying birds have been visually observed; however, this requires considerable effort and the error is large. We developed a system for monitoring flying birds with the purpose of establishing an efficient and high-precision survey method (Fig. 2). In this system, several time-sync cameras continuously monitor flying birds to automatically record their images. We also developed software for detecting flying objects (Fig. 3) to extract only the flight path of flying birds from the recorded images. The system combined with the software enables the flight path of flying birds to be drawn automatically and the total number of flights to be counted from the images without the need for manual work. The future goal is to develop software for obtaining the flight path of birds three-dimensionally using recorded images in order to further facilitate the survey of flying birds.

3 Development of a habitat assessment method for mitigation measures

We have been conducting studies on habitat assessment using genetic indicators to improve the effectiveness of mitigation measures, such as the transfer and transplantation of important animals and plants from the project areas to alternative areas. The Japanese brown frog, one of the important species in the EIA, was used as an example. Genetic analysis was carried out using the DNA collected from the eggs from different populations of Japanese brown frogs located at various sites, and quantitatively evaluated the connectivity among multiple populations. This technique may enable identification of optimum habitat conditions and priority habitats for conservation (Fig. 4).

*1 "Biodiversity offsets" refer to mitigation measures such as a creation of equivalent habitats outside a project area when the negative impact to habitats at the project area cannot be avoided or fully compensated.
*2 "Important species" refer to the species designated by laws and regulations by the government and municipalities as being critically endangered or vulnerable to environmental changes.

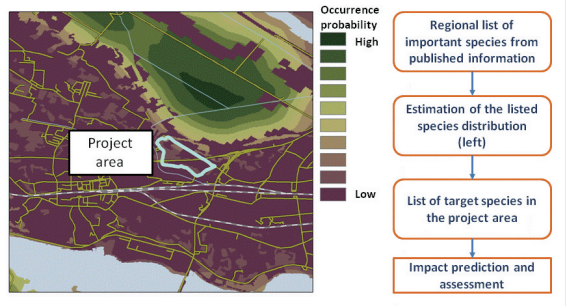

Fig. 1: Estimation of the distribution of important species at the planning stage

The estimated distribution of important species, which should be assessed at the planning stage, can be mapped in and around the project area (left). From the published information which suggests the existence of many important species in the whole region, the list of target species for the estimated distributions of those species in the project areas is extracted. This enables efficient impact assessment of power plants at the planning stage (flowchart, right).

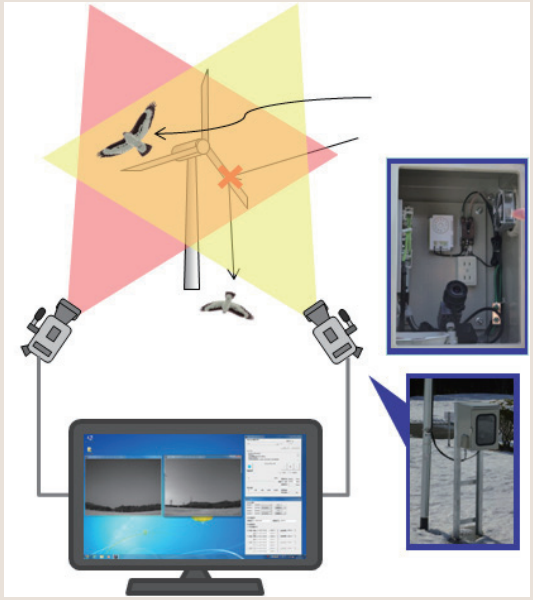

Fig. 2: Outline of the system for monitoring flying birds

A system was developed in which up to four time-sync cameras monitor flying birds to automatically record their images. The future goal is to develop software for obtaining the flight path of flying birds three-dimensionally using the recorded images from several cameras and to develop a system to easily determine the position and altitude of flying birds required for wind power assessment.

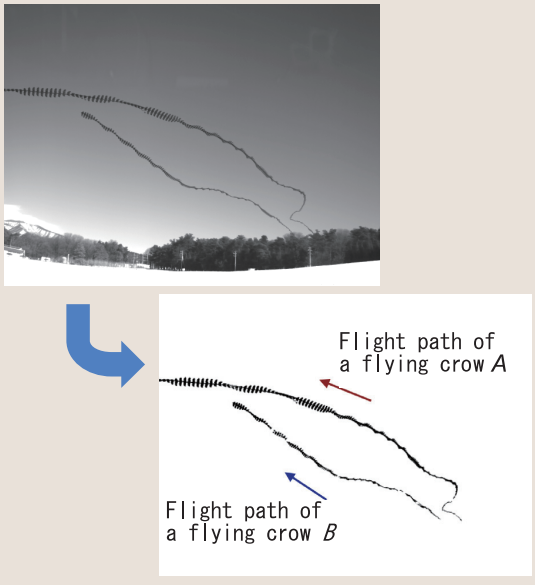

Fig. 3: Flight path of flying crows extracted using software

Using the software for detecting flying objects, the flight path of flying birds recorded for a certain period of time can be extracted to automatically draw the flight path of birds on a single image (the upper figure indicates an example of the flight path of two crows). The monitoring system for flying birds and the software enable us to draw the flight path of flying birds automatically and count the total number of flights in the entire recorded image.

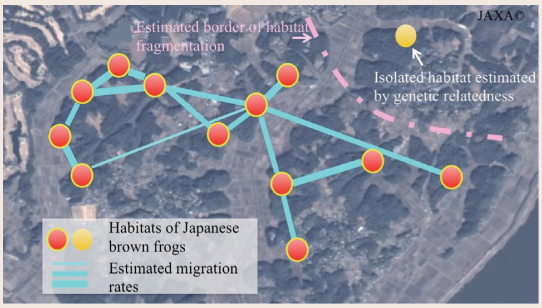

Fig. 4: Habitat assessment by genetic analysis

Genetic analysis was carried out using approximately 260 samples collected from 13 habitats. Connectivity among multiple habitats such as immigration and emigration rates of individuals was estimated qualitatively, based on genetic relatedness among habitats. Isolated habitats (upper right) and principle source habitats can be identified. The result may enable further development of effective conservation measures.