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

Development of Technologies for Supporting Construction and Maintenance of Power Plants with Consideration to Biodiversity Conservation

Background and Objective

According to the Environmental Impact Assessment Law amended in 2011, the assessment of biodiversity impact must be conducted in the planning stage, and the results of environmental conservation measures must be published. In addition, wind-power generation was added as a new target project regulated by the Law. Furthermore, introduction of regulatory biodiversity offsets*1 and assessment of the environmental impact of power plants on marine ecosystems have been discussed at government level and technological developments is needed so as to adapt to such new regulations and systems. The target of this research is to develop useful technologies related to biodiversity assessment and conservation to help enable the smooth construction, renewal, and operation of power plants.

Main results

1 Developing a method for estimating inhabitation likelihood of principal animal and plant species*2

The environmental impact assessment in the planning stage should be carried out using a simple method based on existing data. Principal animal and plant species listed in Red Data Books (RDBs) are targeted, however, existing data on their distribution were mostly insufficient for the impact assessment at the range of planned project areas for power plants. The research team developed a method for estimating the inhabitation likelihood of principal species in target project areas using existing data on animal distribution and vegetation maps of the surrounding areas (Fig. 1). By this method, it is possible to narrow down the number of principal species likely to be inhabiting planned project areas from among the many principal species found in a wider range indicated by existing data (V13004).

2 Development of a technique for estimating the biomass of seaweed beds

Among the marine ecosystems, seaweed beds are high bio-productive, and thus provide key habitats for various organisms. Assessing the biomass of seaweed beds during a flourishing period is a necessary element of impact assessment, but it is time-consuming and costly to carry out diving surveys. The research team developed a numerical model for estimating the biomass of seaweed beds during a flourishing period using publically available data (*e.g.,* amount of solar irradiance, water temperature, transparency) provided by a public institution, and verified the validity of the model through comparison with observed values (Fig. 2). The developed model enables mapping of the biomass of seaweed beds in target marine regions, reducing the time and cost of impact assessments.

3 Development of a simple survey technique for flying birds

The impact of wind-power-generating facilities on flying birds should be incorporated in environmental impact assessment due to growing public concern regarding the collision of birds with wind-power-generating facilities. To obtain the data required for such an impact assessment, flying birds have been observed manually, however, this requires considerable effort and suffers large observation error. Using the system for monitoring flying birds developed in FY2012, the research team developed software for obtaining images of the flight path of an individual bird simultaneously recorded from two different directions using two cameras so as to produce 3D stereo-imaging of the bird flight path. This 3D imaging software for flying birds enables the acquisition of accurate data on their routes and altitudes, which are difficult to measure manually (Fig. 3). The validity of this software will be demonstrated through comparison with the results of future field surveys with the aim of reducing human labor required in the impact assessment on birds.

*1 When the ecosystems in the project areas cannot be satisfactorily preserved, the negative impact of power plants on the ecosystems in the project areas can be mitigated by creating and developing similar ecosystems at other sites.
*2 Principal species refer to the Species designated by the laws and regulations of the government and municipalities as being critically endangered or easily affected by changes in the environment.

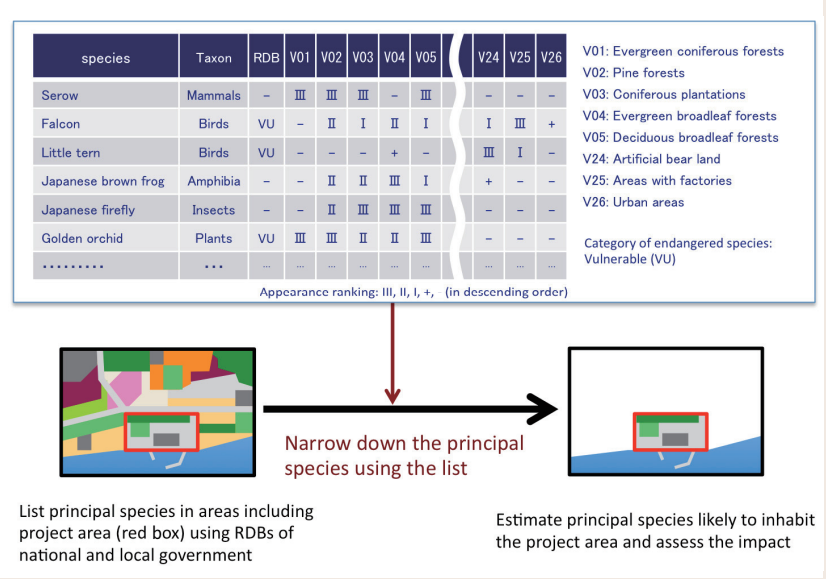

Fig. 1: Method of estimating likelihood of inhabitation of principal species

The presence/absence of principal species in 26 vegetation cover types, including pine forests and areas with factories, was examined and a list of principal species for estimating the likelihood of their inhabitation in each area was developed on the basis of the survey results of principal species reported in 49 previous nationwide power plant assessments (upper table). Number of species targeted in an impact assessment were narrowed down from among the many principal species by comparing the list with a vegetation map (lower figures).

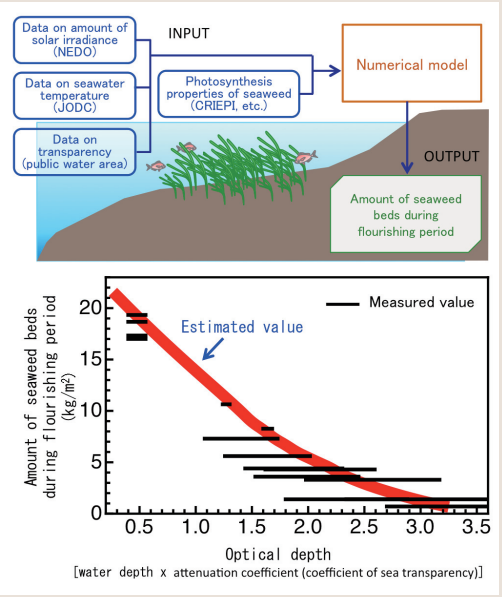

Fig. 2: Numerical model for estimating biomass of seaweed beds

Environmental data, such as the amount of solar irradiance, seawater temperature, and transparency, are entered into the model to calculate the amount of seaweed beds during a flourishing period (upper figure). The ecosystem of *Ecklonia cava* beds has been surveyed in detail in Japan (Kanagawa, Shizuoka, and Mie). The biomass of *E. cava* beds during a flourishing period (the maximum at each depth in each site) obtained by the survey were compared with estimated results, confirming that the amount of seaweed beds can be estimated using the developed model (lower figure).

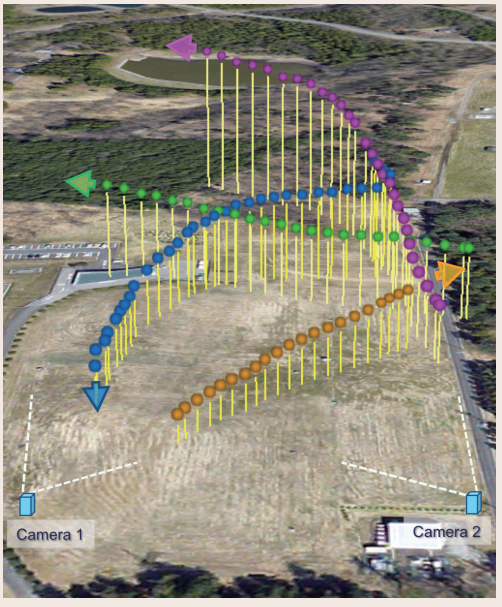

Fig. 3: Stereo-imaging determination of flight paths

The routes and altitudes of individual flying birds can be measured from video footage simultaneously recorded using two cameras. (Filled circles of each color and yellow lines represent the flight path and altitudes of individual flying birds, respectively.) It is possible to accurately assess how birds fly in the vicinity of rotating wind turbines and increase the reliability of estimations on the collision of birds with wind turbines.