



Citizens promote the conservation of flagship species more than ecosystem services in wetland restoration



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ABSTRACT

Assessing the non-market value of biodiversity conservation is crucial to justify it economically. Using a choice experiment on wetland restoration in Hokkaido, northern Japan, we assessed the willingness of citizens to pay for different ecological statuses of a flagship species (absence, occasional occupancy, permanent occupancy, and breeding) and other principal conservation targets (establishment of a birdwatching station and wetland sizes). The results showed that the fundraising potential of the flagship species surpassed those of other conservation targets, irrespective of its ecological status, highlighting the superior publicity generated by charismatic species. We also showed that upgrading ecological status from occupancy to breeding did not result in additional financial support. Our study emphasizes that, although publicizing ecologically important statuses such as breeding is critical for successful conservation efforts, focusing much effort on flagship species rather than other conservation targets may be important to increase the economic value of conservation practices if such species are available.

1. Introduction

Successful biodiversity conservation requires stable and reliable public support because all conservation practices inevitably need persistent budgets (Christie et al., 2006; Addison et al., 2016; Bennett et al., 2016). A promising approach to economically successful conservation is the assessment of non-market values of biodiversity conservation in monetary terms because unraveling these values can help to develop sustainable budget systems (White et al., 2001; Veríssimo et al., 2011; Di Minin et al., 2013; Yamaura et al., 2016a). However, most studies still evaluate the effectiveness of conservation practices primarily based on ecological aspects (Iftekhhar et al., 2016).

Flagship species are species used to raise financial support and public awareness for conservation actions, and it is well appreciated that economic values of flagship species can enhance their conservation as well as broader biodiversity conservation (Caro and O'Doherty, 1999; Caro, 2010; Veríssimo et al., 2011). Although several studies have shown that the economic values of flagship species vary depending on the population size and public awareness of the species (e.g., Richardson and Loomis, 2009; Jacobsen et al., 2012; Morse-Jones et al., 2012), the economic value of conservation practices for flagship species

with different ecological statuses (e.g., occupancy or breeding) remains an open question. Unraveling this is critically important to make conservation with flagship species both ecologically and economically sound, because the differences between the ecological statuses can be vital for species' long-term persistence (Donovan and Thompson, 2001; Schlaepfer et al., 2002; Battin, 2004), and loss of species might accelerate the estrangement of people from nature (Miller, 2005).

Another longstanding issue is the relative value of flagship species compared with other key conservation targets, such as habitat metrics and ecosystem services (but see Kontoleon and Swanson, 2003). Metrics such as habitat type and size can be reliable proxies for various components of biological communities, and the importance of ecosystem services has been recognized from both ecological and social aspects (Ferraro and Kiss, 2002; Banks-Leite et al., 2011); however, the fundraising potential of these may be relatively poor compared with those of flagship species. This suggests that conservation practices based on these targets may lack sustainable financial support. Therefore, comparisons of monetary values among conservation targets are crucial to conduct economically efficient conservation practices.

The present study compared non-market values in monetary terms among conservation practices, focusing on different statuses of flagship

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Table 1

Attributes and corresponding levels used in the choice experiment and socio-economic and ecological knowledge questions. In the CE, we presented three profiles with different levels of the five attributes to each respondent and repeated this kind of choice task for seven times.

Attributes	Levels
Status of the red-crowned crane	Occasional occupancy/permanent occupancy/breeding/absence
Wetland area	25 ha/50 ha/75 ha/100 ha/125 ha
Bird-watching station	Yes/no
Option to enable suspension of flood-control function	Yes/no
Annual amount of tax payment for a restoration plan	100 JPY/500 JPY/1000 JPY/2000 JPY/5000 JPY
Observation experience of the red-crowned crane	Yes/no
Knowledge of endangered species	Yes/no
Knowledge of umbrella species	Yes/no
Gender	Male/female
Age	10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70~
Income	~2000,000 JPY/~4000,000 JPY/~6000,000 JPY/~8000,000 JPY/~10,000,000 JPY/~12,000,000 JPY/~14,000,000 JPY/~16,000,000 JPY/~18,000,000 JPY/~20,000,000 JPY/~22,000,000 JPY/22,000,000 JPY~

species and other principal conservation targets. To achieve this, we conducted a choice experiment (CE) on a wetland restoration project in Hokkaido, northern Japan, and evaluated the willingness to pay (WTP) of citizens for four different statuses (absence, occasional occupancy, permanent occupancy, and breeding) of a flagship species, as well as for restoration with a birdwatching station, varied wetland sizes, and an option to suspend flood-control measures. We used the red-crowned crane *Grus japonensis* as our focal flagship species for two reasons: 1) the name, appearance and habitat of the red-crowned crane are potentially well known by many national citizens, especially those in our study region, because this species is a symbol of good fortune and thus not only a variety of products including Japanese traditional crafts but also several local governments and organizations use it as their symbol (Harris, 1994; Wild Bird Society of Japan, 2011). This is an important feature for flagship species (Caro and O'Doherty, 1999; Caro, 2010; Veríssimo et al., 2011). 2) This species has been used to raise funding for conservation actions and environmental awareness for a long time (i.e., the species has been practically used as a flagship species). For example, Wild Bird Society of Japan has established 20 protected areas with the total of 2516.9 ha in eastern Hokkaido for their habitat protection (Wild Bird Society of Japan, 2011), all of which are purchased by donation from members of the society. Based on the results, we discuss how flagship species can be used to raise financial support to conserve ecologically important components and ecosystem services.

2. Materials and methods

2.1. The flagship species

The red-crowned crane is a large crane species (body length: 140 cm, wingspan: 240 cm) distributed across the Korean peninsula, northeastern China, the Russian Far East, and Hokkaido, northern Japan. The population in Hokkaido experienced a drastic decline by the mid-20th century due to widespread replacement of wetlands with agricultural lands. Since then, its population has been increasing gradually due to intensive conservation activities, and its current population size is estimated to be over 1000 individuals. They occur residually in wetlands across Hokkaido, except for in its southern region. The red-crowned crane is considered an endangered species in Japan and is the prefectural bird species of Hokkaido. In addition, our previous study has shown that the species may act as an umbrella species for wetland birds due to its specialized habitat requirements and large home ranges (Higa et al., 2016).

2.2. The focal restoration project

To prevent severe damage to agriculture and residents by unpredictable floods, a flood control project was conducted in central Hokkaido, northern Japan (42°55'12"N, 141°42'02"E). A total of 200 ha of agricultural land in this area was purchased by a national organization and replaced with a flood-control pond. As a consequence, wetland vegetation such as Manchurian wild rice *Zizania latifolia* has grown, and several wetland animals, such as waterfowl and dragonflies, have started to recolonize the pond. Therefore, the pond is expected to provide suitable habitats for diverse wetland organisms. Currently, no biodiversity maintenance is being conducted in the pond. However, future directions for this project to restore wetlands are under consideration.

2.3. The choice experiment to measure willingness to pay

The CE uses a stated preference methodology to estimate values of non-market goods and services (Adamowicz et al., 1998; Louviere et al., 2000). In the CE, we designed a scenario providing a hypothetical flood-control pond with additional features, including non-market values of wetland biodiversity and functions. The CE included the following four attributes (Table 1): 1) the red-crowned crane with four levels (occasional occupancy, permanent occupancy, breeding, and absence). We used these four levels because these statuses may be suitable to represent the habitat quality of a species (Sergio and Newton, 2003; Senzaki et al., 2015). 2) A birdwatching station with two levels (establishment and no establishment). The attribute was included to explain the recreational values of the pond with increasing bird abundance or species richness due to restoration plans. This attribute can also separate the value of increased bird abundance due to restoration from the value of the red-crowned crane itself. 3) Wetland sizes with five levels (25, 50, 75, 100, and 125 ha). This attribute was included because habitat area is a key landscape metric for biodiversity conservation, including species richness and abundance (Yamaura et al., 2016b). The levels of this attribute were decided based on the current sizes of natural wetlands around the study area (Senzaki and Yamaura, 2016) and the largest wetland size (200 ha) that can realistically be restored in Japan. 4) Annual tax payments needed to introduce preferred plans. For this attribute, we used five levels [100, 500, 1000, 2000, or 5000 JPY (Japanese yen; 100 JPY equals approximately one US dollar)].

During times of flooding, the habitat of red-crowned crane and birdwatching station are assumed to be underwater. The option to suspend the flood-control function allows managers to wait to open the floodgates until the last possible moment. This option appeals to

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