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Necessity and capability of an information sharing network for efficient and effective control of invasive alien raccoon

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Abstract: The common raccoon (*Procyon lotor*) has been designated as an invasive alien species, and an eradication program has been undertaken in Japan to curtail damage to native ecosystems, agriculture loss, and property damage. The raccoon is already naturalized in 39 of Japan's 47 prefectures and is recognized as a nationwide problem. To control raccoons, cooperation between and among prefectures and municipalities is needed; however, currently, they individually control the raccoons. Prefectures neither cooperate with contiguous prefectures nor do they share information about raccoon control. Building up a nationwide control framework (for the purpose of promoting cooperation and sharing information) is helpful to overcome such a situation. We investigated the actual demand for an information sharing network and the situation of each region. Hence, we discussed the necessity for and the prefecture's capability of an information sharing network. We administered a questionnaire survey of 47 prefectural administrative officers. We received answers from 41 prefectures, 25 of which are controlling prefectures (CP) and 16 are non-controlling prefectures (NCP). Many prefectures hoped for an information sharing network; moreover, in terms of the functions of a network, regardless of whether it is a CP or a NCP, respondents demanded and hoped for information sharing and discussing their difficulties. The regional status of the raccoon, budget, and number of administrative officers were difficulties encountered by both CP and NCP, while procedure for control was highly difficult for NCP. Many CP implemented efforts to through trapping within procedure, though the following were implemented less than through trapping: monitoring after trapping, technical development, revision of the control plan. Almost all prefectures did not feel that controlling was effective. Furthermore, there were no quantitative data on effectiveness of control. Results from current situation indicate that scientific control programs on the basis of adaptive management are not functioned. We concluded that an information sharing network is needed. When constructing a network, it is important to note that the following are necessary: functions that lighten some of the burden of administrative officers, analysis of valuable information on issues such as invasion and distribution, and support for prefectures that find control difficult.

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INTRODUCTION

Invasive alien species (IAS) come to be recognized as a large-scale and serious problem because of the range of their spread and improving public awareness. IAS are a subset of alien species whose establishment and spread economically and environmentally harm ecosystems, habitats, and species (GISP 2001). The common raccoon (*Procyon lotor*) has been designated as an IAS (*IAS is a legal term in the Invasive Alien Species Act, it is somewhat different from the GISP definition of an IAS.) by the Japanese government under the Invasive Alien Species Act of 2004, and a raccoon eradication program has been conducted against causing damage to native ecosystems (e.g., preying Japanese crayfish (Hori and Matoba 2001)), agriculture loss (e.g., more than 350 million yen in Japan (Ministry of Agriculture, Forestry and Fisheries of Japan 2011)) and property damage (e.g., important cultural assets such as shrines and temples (Kawamichi et al. 2010)). The raccoon, which has been naturalized in Japan as a result of escape from captivity and irresponsible releases since the 1960s, is a mammal native to North America (Ikeda 2000). Now, raccoon invasion has become a nationwide problem and have already naturalized in 39 of Japan's 47 prefectures (There is information from all prefectures including temporary sighting of raccoons (Ministry of the Environment 2011, National Institute for Environmental Studies 2010)). Many local governments tackle the issue of raccoon control in Japan.

To control raccoons, cooperation between and among prefectures and municipalities is needed. However, currently, prefectural and municipal governments individually control raccoons, and almost all organizations use casual and palliative approaches of control. Control measures are introduced only after damage to crops come to light (Ikeda 2000), and control is difficult if damage in municipalities is low. Prefectures neither cooperate with contiguous prefectures nor share information about raccoon control, even if it is information on basic methods, outcomes or lessons (Ikeda et al. 2004, Ministry of the Environment 2012). There are no activities preformed to collect and distribute information about raccoon control and promote cooperation among local governments. Many prefectures do not even try to control the raccoons, and this lack of control is mostly due to lack of information, i.e., these prefectures are not aware of even the basic methods of control, not to mention effective methods. As a result, control for the purpose of eradication is still difficult. Building up a nationwide control framework is needed to overcome the current situation.

An information sharing network has many advantages, for example, sharing outcomes and lessons from each prefecture, establishing management and setting its goals that reflect particular situations through the analysis of accumulated information about control, discussing and finding solutions with colleagues, enhancing and collecting information about distribution, constructing a social regime by facilitating information dissemination, and improving public awareness. By learning about and using raccoon control information from each prefecture, we can efficiently and effectively control raccoons and simultaneously save time and money. As a result, we can expect far-reaching strategy from the initial invasion to the final phase of control and improve control in each prefecture and municipality.

The purpose of this research is to discuss the necessity of an information sharing network and its capability to take efficient and effective control of invasive alien raccoons by investigating the

actual demand for an information sharing network and the situation (current situation and difficulty) of each region.

METHODS

We administered a questionnaire survey on 47 prefectural administrative officers who are in charge of alien species management and who worked mainly for the Department of Environment. When we needed more detail about their answers or their answers were insufficient, we asked for the necessary information by e-mail. This study was pretested on students from the Department of Regional Science, Graduate school of Letters, Hokkaido University. After the pretesting, the questionnaires were sent via mail to the participants in December 2012. Our questionnaire consisted of 3 topics: demand and hope for a network, difficulties of control, and current situation of alien management in each prefecture. We use a 5-point scale, multiple choice, and open questions. In the 5-point scale, 1=Strongly Hope, 5=Don't Hope at All in the demand and hope for a network section; in the difficulties of control section, 1=Very Difficult, 5=Not at All Difficult. We used open questions when we needed a number of opinions. In addition, respondents who answered 1 or 2 to a previous filter question were asked additional questions for further details.

RESULT AND DISCUSSIONS

We received answers from 41 prefectures, 25 of which are controlling prefectures (CP), 16 are non-controlling prefectures (NCP) (response rate=87.2%).

• Demand and hope for a network

More than 70% (n=18) of CP and 90% (n=14) of NCP hoped for an information sharing network. Fig. 1 shows the results of the answers about what officers demand and hope for in terms of functions of a network. We also asked an open question on the exceptions of what they demand and hope for; however, we did not receive many responses to this question. The following were highly hoped for: sharing of anecdotal reports, sharing and talking about difficulties, and sharing of methods. As for anecdotal reports, regardless of whether the respondents are CP or NCP, control methods, control result, and accumulated outcomes, and lessons were high in demand (Fig. 2). Similarly, in terms of sharing methods, regardless of whether CP or NCP, every method was highly demanded, except that for CP, demand for consensus building was low (Fig. 3). Many prefectures hoped for an information sharing network; moreover, in terms of functions of the network, regardless of whether CP or NCP, respondents demanded and hoped for information sharing (anecdotal reports, methods, and difficulties) and discussion about difficulties. NCP highly hoped more than controlling 5-point scale and multiple choice, which suggests that they might need a variety of information about control for future use through an information sharing network.

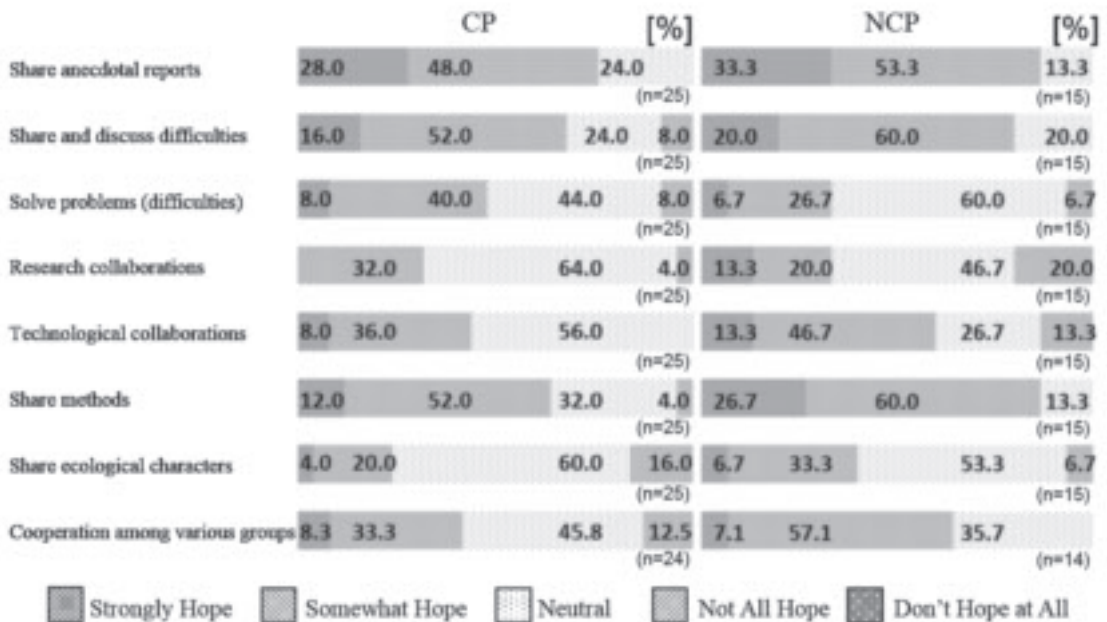


Fig. 1. Results of the 5-point scale about what officers demand and hope for in terms of functions of a network. Each question is written to the left of the graphs. Answers from CP are on the left and NCP on the right (n is the total number of respondents for each question).



Fig. 2. Multiple choice results of multiple answer about the kind of anecdotal reports officers demand for. Each option is written to the left of the graph (N is the total number of respondents, n is the number of respondents for each option).

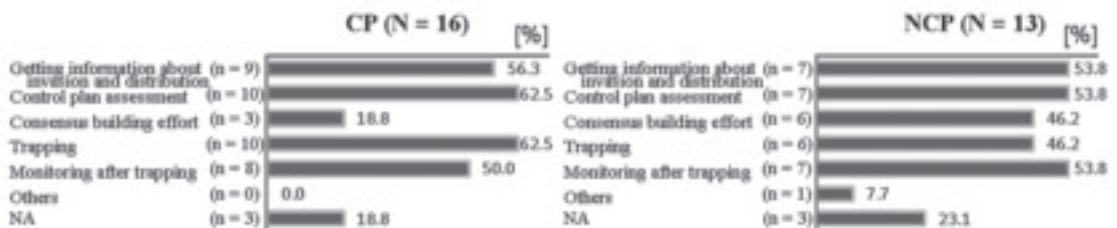


Fig. 3. Multiple choice results on the kind of methods officers demand for. Each option is written to the left of the graph (N is the total number of respondents, n is the number of respondents for each option).

• Difficulties of control

Fig. 4 shows the results of the answers on the kind of difficulties an officer faces in CP. In NCP, we asked about their difficulties in terms of future control. The following were highly difficult for the latter: regional status of raccoons, budget, and the number of administrative officers. NCP considered procedure for control as difficult for purposes of future control. As for the regional status of the raccoon, the prefecture encounters or will encounter unknown population and density, ecological damage in CP, and distribution in NCP (Fig. 5). We received answers to the open questions. In terms of budget and number of administrative officers, the following are problematic: high priority of native animal damage prevention and cutting on budget and staff. In connection with difficulty about unknown procedure for control, we asked what kind of procedure was difficult (N=25 in CP, N=15 in NCP). Monitoring after trapping (52.0%, n=13), technical development (48.0%, n=12), getting information about invasion and distribution (36.0%, n=9) and revision of the control plan (36.0%, n=9) were highly difficult in CP. In NCP, getting information about invasion and distribution (73.3%, n=11), technical development (73.3%, n=11) and monitoring after trapping (66.7%, n=10) were highly difficult. These difficulties might not exist individually, but are closely related to each other (e.g., some difficulties are caused by budget cuts).

• Current situation of alien management

More than half of all prefectures had one administrative officer in charge of alien species

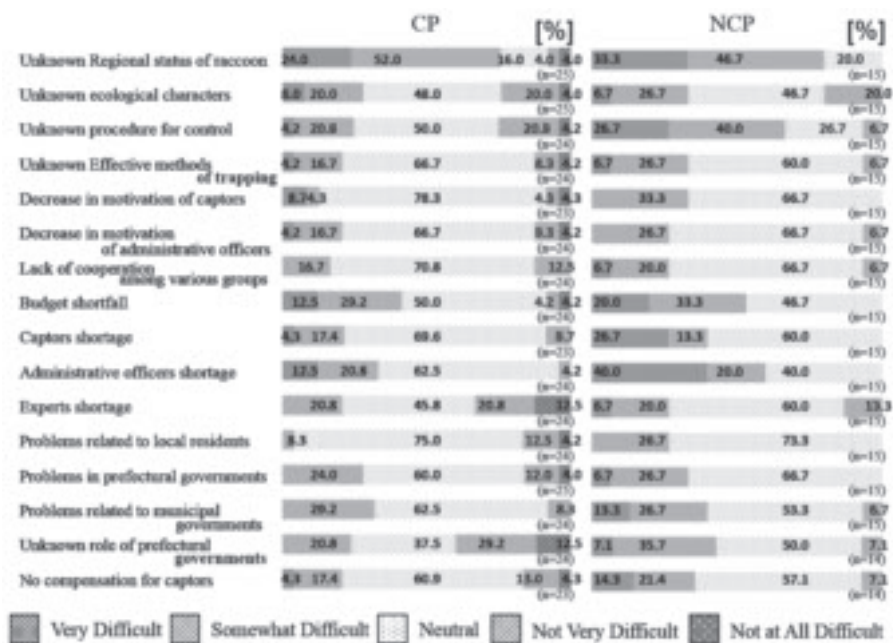


Fig. 4. Results of the 5-point scale on the kind of difficulties officers encounter in CP and their predictions on the difficulties their prefectures will probably encounter in NCP. Each difficulty is written to the left of the graphs. Answers from CP are on the left, and NCP on the right (n is the total number of respondents for each question).

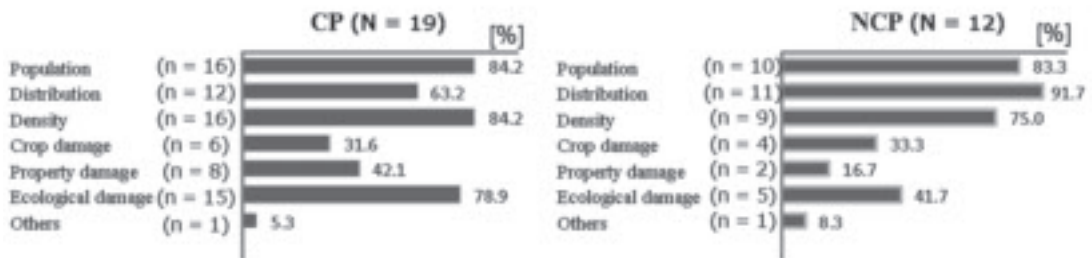


Fig. 5. Multiple choice result on difficulty details due to the regional status of the raccoon. Each option is written to the left of the graph (N is the total number of respondents, n is the number of respondents for each option).

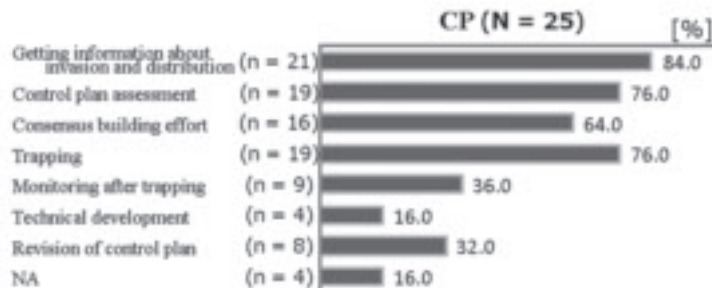


Fig. 6. Multiple choice results raccoon control procedure of CP. Each option is written to the left of the graph (n is the number of respondents for each option, N=25).

management (n=23) and more than 80% of prefectures had one or two officers (n=33).

Many CP implemented efforts to through trapping (getting information about invasion and distribution, control plan assessment, consensus building effort, and trapping) within procedure, though the following were implemented less than through trapping: monitoring after trapping, technical development, revision of the control plan (Fig. 6). Indices of control effects were rarely set (68.0% of CP do not set indices). Almost all prefectures did not feel that control was effective. Furthermore, there were no quantitative data for effectiveness of control (Figs. 7, 8). These results indicate that scientific control programs on the basis of adaptive management are not functioned. The concept of adaptive management was introduced by ecologists such as C. S. Holling (1978) and C. Walters (1986). It provides a systematic approach that is focused on learning, which we suggest in the field of IAS management. The adaptive management approach recognizes uncertainty in nature and proposes a range of management alternatives to be tested and refined over time, through experimentation and monitoring.

There was no cooperation among prefectural governments (0.0%, n=0), but about half of CP cooperated with the researcher (47.6%, n=10). These answers about cooperation were from prefectures which had some cooperation of one or more groups (N=21).

CP collect information on habitat and invasion (12.0%, n=3), damage (12.0%, n=3), and both (76.0%, n=19); this information is shared by different departments in the prefecture (100.0%, n=25). In contrast, NCP do not collect (40.0%, n=6) information, and there is no interdepartmental sharing of information (60.0%, n=9). This suggests that some prefectures do not control

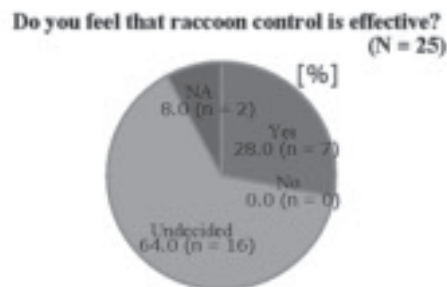


Fig. 7. Open question result on whether CP feel raccoon control is effective (n is the number of respondents for each option).



Fig. 8. Multiple choice result on the quantitative data that CP have on the effectiveness of raccoon control. Each option is written to the left of the graph (n is the number of respondents for each option, N=7).

raccoons; have no information on habitats, invasion and damage; and do not collect information.

CONCLUSION

An information sharing network is needed. More than 70% of CP and 90% of NCP hope for an information sharing network. The network can collect and accumulate a variety of useful information that is utilized by prefectures now or will be utilized in the future. By sharing and utilizing information, raccoon control becomes efficient and effective; consequently, prefectures can save money, time, and staff. Cooperation among prefectures can promote exchange of persons in charge of alien species management and control raccoons in the borders between prefectures. When we construct a network, it is important to note that the following functions are necessary to lighten some of the burden of administrative officers: analysis of valuable information such as those on invasion and distribution; and support for prefectures that find control difficult.

There is a widely acknowledged gap between the priorities of academic researchers and needs of practitioners in conservation biology (Stinchcombe et al. 2002; Knight et al. 2008). To overcome this gap, close collaboration between researchers and practitioners from basic research to control implementation (Cowling et al. 2008) is necessary, and this applies to the case of invasive alien raccoon control. We expect that this survey will be the first step towards collabo-

ration between researchers and practitioners.

FURTHER RESEARCH

In this survey, some prefectures responded that there were other groups implementing raccoon control. Thus, in some regions of Japan municipal governments implement raccoon control. We should administer a similar questionnaire survey on municipal governments to find out their difficulties in terms of control and their current status of raccoon control compared with prefectural governments. To improve the functions of a network, further studies are needed. We should investigate on how to lighten the burden of administrative officers and support local governments in raccoon control. In particular, we must administer a survey on the allocation of roles between municipal, prefectural and national government.

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