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Collaborative removal of an invasive alien aquatic weed by volunteering university students in collaboration with multiple stakeholder groups around Lake Biwa, Japan

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ABSTRACTS

Explosive growth and propagation of Water primrose *Ludwigia grandiflora* subsp. *hexapetala*, an invasive alien aquatic weed introduced from South America, has caused serious problems such as competitive exclusion of native species, obstruction in operation of commercial fisheries, and increased risk of river flooding. IVUSA (International Volunteer University Student Association), is a pioneering volunteer group in the removal of this invasive weed since 2013. We have carried out 62 removing activities so far, with participation of a total of 12,275 local people from governments, fisheries cooperatives, environmental NPOs, and individual residents. In Lake Biwa, Shiga Prefecture, the area of the lake surface covered with this invasive weed once reached almost 300,000 m² in 2016. A variety of stakeholders have carried out activities for its removal, resulting in a marked decrease to some 30,000 m² by the end of FY 2018. We will make continuous efforts toward the extermination of this invasive weed. In this presentation, we will make a historical review of our activities, highlighting the removal methods, the results of activity sequence, and the challenges in collaboration with various stakeholders.

Keywords: *Ludwigia grandiflora* subsp. *hexapetala*, Lake Biwa, removal activity, collaboration with various stakeholders

1. Introduction

1.1 *Ludwigia grandiflora* subsp. *hexapetala*

A water primrose or *Ludwigia grandiflora* subsp. *hexapetala* (hereinafter, called “water primrose”) is an amphibious weed introduced from South America. Water primrose is characterized by explosive growth and propagation, which cause problems such as competitive exclusion of native plants, habitat degradation for native aquatic animals, and negative impacts on cruising and commercial fisheries. In 2014, it was assigned as Designated Invasive Species stipulated in Invasive Alien Species Act by Ministry of the Environment. Water primrose has ability to regenerate from fragmental roots and stems which may be left even after large-scale removal activities in offshore areas and reed plantations. Thus, it is necessary to carefully remove roots and stems remaining underwater or underground by hand, and a lot of manpower are required to completely remove them.



Fig.1 *Ludwigia grandiflora* subsp. *Hexapetala*

1.2 Measures at Lake Biwa, Shiga Prefecture

Water primrose was first found in Akanoi Bay in the southern basin of Lake Biwa (Moriyama City, Shiga Prefecture) in 2009 with a coverage area of 142 m². In 2016, the coverage area of water primrose reached some 300,000 m², spreading all over the southern basin of Lake Biwa. Since 2012, collaborative activities to remove water primrose have been carried out by local NPOs, fishermen, residents. In addition, large-scale machinery removal was started in 2014, and patrolling and monitoring along shorelines, in particular where large-scale removal was conducted, resulted in its marked decrease to 32,000 m² by the end of FY2018. Thereafter, its coverage area has been continuously maintained at a similarly low density.

Along with such joint activities, IVUSA started its contribution in 2013. First, we focused on the problem of water primrose in Lake Biwa, and began its activities to remove water primrose. Currently, we are working in collaboration with various stakeholders such as local people from governments, fisheries cooperatives, environmental NPOs, companies and individual residents, taking advantage of their respective strengths. In this article, we will introduce our removal activities in collaboration with various stakeholders.

2. The growing situation of water primrose and removal activities in each time

2.1 The growing situation of water primrose and removal activities from 2009 to 2013

Before the coverage area of water primrose spread to 18,000m² in 2012, its invasiveness was not recognized seriously. In addition, the removal activity is hard enough for most of the people belonging to the environmental NPOs and local fisheries cooperatives.

In March 2013, when some students in our association participated in an activity to remove water primrose, they got a strong sense of crisis and planned a removal activity from the desire that "we want to protect Lake Biwa by the power of youth".

In April 2013, the first removal activity was carried out in Otsu City with 17 participants, including 14 students, Shiga Prefectural Government (hereinafter called "SPG"), Omi Wetland Research Group, and Lago Co., Ltd. We removed about 150m² of water primrose and packed them in mesh plastic bags. Thanks to SPG's help such as arranging that temporary storage place to put removed weeds for drying, transport, incineration disposal, and distributing long-bodied boots and long-length rubber gloves for us, our activity was able to start smoothly.

In June 2013, in Moriyama City, 4 stakeholders i.e. Akaoni-Biwako Environmental Citizens Initiative (environmental NPO), the city government, Tamazu-Ozu Fisheries Cooperative, and IVUSA (students) collaborated to form "Water Primrose Removal Project".



Fig.2 Meeting with NPOs and fisherie

More than 90% of water primrose in Lake Biwa was distributed in Moriyama city, and it became recognized that the commercial fisheries and ecosystem were seriously damaged by water primrose.

Removal activities had been planned with the aim of restoring the rich ecosystem in Akanoi Bay, and in the first year, five removal activities had been carried out with a total of 261 people participating.



Fig.3 Cooperation activity in Akanoi Bay

We organized a local collaborative system and tried to carry out efficient activities, but we did not understand the overgrowing strength of water primrose.

2.2 Removal activities from 2014 to 2018

In March 2014, the Council for Controlling Invasive Aquatic Plants in Lake Biwa was established, in which IVUSA was invited to join. The distribution and coverage area of water primrose continued to spread and grow over the entire southern shore of Lake Biwa. However, no control measures for water primrose were taken except for the case in Moriyama City mentioned above. Counter plans were thus required for the entire Southern Lake.

Therefore, in September 2014, we, IVUSA planned and carried out a large-scale removal activity across Otsu, Kusatsu, and Moriyama Cities in an unprecedented large-scale, in which about 600 students participated in three days. As a result, water primrose with a total weight of 120 tons and area of 6,000m² was removed for 3 days. This large-scale activity could be carried out in collaboration with various stakeholders including the local governments, environmental NPOs, and fisheries cooperatives. This activity in the southern part of Lake Biwa had been carried out every year until 2018.

In addition, mechanical removal began in 2014, patrol monitoring was thoroughly carried out from 2016 by the local council. Furthermore, volunteer activities have been continuously carried out in collaboration with local stakeholders in each region. The area of the lake surface covered with water primrose once reached almost 300,000 m² in 2016, resulting in a marked decrease to some 30,000 m² by the end of FY 2018.



Fig.4 Large-scale activity



Fig.5 Mechanical removal

However, the problems had remained with the spread of distribution points throughout Lake Biwa and the lack of a decisive factor for removal measures against in the reed plantation area.

2.3 Removal activities from 2019 to 2021

Although the large carpets of water primrose were not found along the shore of the lake since 2019, its spatial distribution spread to the northern basin of the lake, satellite lakes and irrigation ponds. It is technically very difficult to remove water primrose in the reed plantation areas and floating spawning beds for fish located offshore in the reed.

In response to these problems, IVUSA carried out removal activities for this water primrose. In 2019, a large propagation of this water primrose was confirmed in the reed plantation areas in the northern basin of Lake Biwa in Takashima City.

Considering the danger of spreading throughout Lake Biwa, it was necessary to urgently remove this large propagation, and a removal activity was planned and carried out by 215 students and 87 general participants for three days.

In Moriyama City, many individuals of water primrose were growing in the reed plantation areas and in the floating spawning beds. Since this area is an important fish spawning area and a valuable fishery resource for local fishermen, IVUSA had regularly carried out removal activities 4 or 5 times a year in collaboration with local people from governments (Shiga prefecture, Moriyama city), a fisheries cooperative (Tamazu Ozu), an environmental NPO (Akanoi- Biwako Environmental Citizen's Initiative), private companies, and individual residents.

This invasive weed is also growing in the reed plantation areas in other cities and removal activities are required.



Fig.6 In the reed plantation

Fig.7 In the floating spawning bed

3.Cooperation with various stakeholders

We will introduce how to proceed our collaborative removal activities as follows.

3.1 Removal Procedure

(1) Collection of distribution information and consideration of removal area

The distribution information of water primrose was obtained from the SPG or the administrator and we select the places where manpower of students in IVUSA can be effectively utilized considering the danger of dispersal and the impact on the ecosystem.

(2) Preliminary field survey

Officers of SPG, local administrators and IVUSA students conduct a survey. We check the growing status of the invasive weeds, and how easy and safe removal work will be executed. In addition, we check the procedure and conditions required for the following processes such as temporary storage place, transportation, and disposal.

(3) Discussion with administrators and related parties

We explain to the related governments, administrators, and other local organizations about the plan of our removal activities, requesting cooperation, and proceeding prior arrangements such as land use and disposal.

(4) Removal activity

In collaboration with all participants, we carefully remove the weed with a large number of people mainly in the reed plantation areas, floating spawning beds where mechanical removal is difficult.

(5) Sun-drying

The removed invasive weeds are dried under the sun at temporary storage sites designated by the administrator so as not to lower the incinerator temperature of the disposal facility and reduce the weight of weeds.

(6) Transportation

After some weeks for drying, dried invasive weeds are transported to the disposal facility with the aid of governments or administrators.

(7) Incineration disposal

The transported the invasive weeds is incinerated at the city facility.

(8) Patrol and monitoring

In the removed areas, the government and local people patrol and monitor to prevent regeneration of the invasive weed.



Fig.8 Each process of removal procedure

IVUSA and other stakeholders cooperate and divide roles of each in this procedure to remove it.

3.2 Collaboration in each region

To complete removal of invasive weeds, several treatment processes are required: A) Field survey and planning logistics of activities; B) Actual removal of weeds (including their arrangement for sun-drying); C) Transportation to storage site; D) Drying at storage site; E) Transportation to disposal facility; and F) Incineration disposal. Collaboration systems among stakeholders and their related activities (shown in alphabetical labels above) are summarized for respective regions as follows.

• Kusatsu City

IVUSA: A, B, C; SPG: A, B, D, E; Kusatsu City: B, F; Industrial waste disposal company: E.

Additional information : The removed weed is transported to the disposal facility with the cooperation of an industrial waste disposal company.

• Moriyama City

IVUSA: A, B ; SPG: B;Moriyama City: B, F; Tamazu-Ozu Fisheries Cooperative: A, B, D, E; Akaoni-Biwako Environmental Citizens Initiative (environmental NPO), B; Local residents: B; Private Companies: B, Additional information: Local NPOs become regional hubs, and fishermen provide ship operations and ports.

• Otsu City, Seta River

IVUSA: A, B; Biwako River Office of the Ministry of Land, Infrastructure, Transport and Tourism (hereinafter, called “MLIT”): A, B, D, E, F; SPG: B; Otsu City: B, F. Additional information : Since the Seta River is nationally managed, the regional river office and IVUSA collaborate to manage the activities.

• Otsu City, Lakeside Parks

IVUSA: A, B; SPG: A, B, D, E; Otsu City: B, E; Private companies: B; Local residents: B. Additional information : SPG and IVUSA lead and instruct other participants in removal activities based on knowledge accumulated through a lot of activities so far, such as how to distinguish and remove the invasive weeds.



Fig.9 Instruct company’s participants

• Takashima City

IVUSA: A, B, C; Kinki Bureau of the Ministry of the Environment (hereinafter, called “ENV”): B; SPG: A, B; Takashima City: B, D, F; Private companies: B. Additional information : Since it has a lakeshore with a rich ecosystem, there is a high awareness of the crisis in the area, and the cooperation of Takashima city is positive.

The role of each stakeholder in each region is shown in table below.

Table1.The role of each stakeholder in each region

	Moriyama City	Otsu City, Seta River	Otsu City, Lakeside Parks	Kusatsu City	Takashima City
IVUSA	A,B	A,B	A,B	A,B,C	A,B,C
SPG	B	B	A,B,D,E	A,B,D,E	A,B
City Government	B,F	B,F	B,E	B,F	B,D,F
Fisheries Cooperative	A,B,D,E	-	-	-	-
Environmental NPO	B	-	-	-	-
Local residents	B	-	B	-	-
Private company	B	-	B	E	B
MLIT	-	A,B,D,E,F	-	-	-
ENV	-	-	-	-	B

In this way, we are working in cooperation with each region by clarifying the division of roles.

4.Challenges for the future

The coverage area of this weed in Lake Biwa has reduced by the continuous efforts of various stakeholders, many weeds remain in places requiring manpower such as spread to the northern part of Lake Biwa and satellite lakes and ponds, the reed plantation areas, and floating spawning beds.

In order to solve such problems, early detection and removal are important. So, we will share the basic knowledge to all generations from kids to adults, researchers or companies etc, to raise awareness, and clarify the roles of each stakeholder such as removal, temporary storage, transport and disposal of this invasive weed in each region.

As IVUSA, we will work on providing environmental learning for children, distributing brochures, and making presentations at forums as dissemination activities.

Also, as a collaborative activity, we work with the local people from governments, fisheries cooperatives, environmental NPOs, and individual residents, and prompt many young people and companies to participate.

We will make a vibrant society with the energy of young people, and we will work for continuous efforts toward the extermination of this invasive weed.

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REFERENCE

- [1] The Shiga Prefectural Government, 「Document from the Council for Controlling Invasive Aquatic Plants in Lake Biwa」 2019,2021, <https://www.pref.shiga.lg.jp/ippan/kankyoshizen/shizen/>
- [2] Nakai, K: Historical Review on Projects Controlling Invasive Alien Amphibious Weeds in Lake Biwa, Shiga Prefecture, Journal of Water and Waste, Vol. 64, No7 pp. 488-494, 2021.