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Article

Factors influencing attachment toward Fukushima-gata lagoon: Analyzing changes in the lifestyle of regional residents

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Abstract: The growing shortage of human resources to manage landscape in the water environment has led to problems concerning preservation of the landscape in Japan. To cultivate people with awareness about preserving the landscape, it is important to understand the process of how a region's residents develop an attachment toward the water environment in their area. This paper identified factors influencing the attachment of residents toward the Fukushima-gata lagoon, Niigata prefecture, Japan, as a case study while focusing on changes in the lifestyle of the regional residents. The findings are as follows: (1) The target households frequently used Fukushima-gata lagoon for "fishing and for picking edible wild plants" and "gathering reeds to make thatched roofs" before "the reclamation project was carried out by the government in Fukushima-gata lagoon." They also frequented Fukushima-gata lagoon for "walking and cherry blossom viewing" after "the reclamation project" was implemented. (2) Even the fact that distance from the lagoon to their place of residence increased after the project did not lose their attachment to the lagoon. (3) It was suggested that the project contributed to increase the attachment of regional residents towards Fukushima-gata lagoon because of multiple factors such as "playing in the water," "livelihood opportunity," "recreational use," and so on. (4) Changes in the attachment of regional residents toward Fukushima-gata lagoon before and after the reclamation project was carried out by the government corresponded to "changes in the lifestyle of the local residents" before and after the project.

Keywords: Fukushima-gata lagoon; attachment; changes in lifestyle; actual condition of use

1. Introduction

1.1. Research background

The growing shortage of human resources to manage landscape in the water environment in Japan has led to problems concerning preservation of the landscape. To cultivate people with awareness about preserving the landscape, it is important to understand the process through which regional residents become attached to the water environment. Previous studies have reported on the factors that led residents to develop an attachment toward their water environment. Multiple factors such as the distance between the home and the target area [1], the number of years of residence in the area [2] , and so on have been mentioned. However, these are based on research results evaluated at a specific point in time, and corresponding changes in regional residents' lifestyle have not been examined, and therefore, an integrated research referring to changes in attachment and the formation factors of attachment is lacking [3].

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Fukushima-gata lagoon in Japan meets the conditions to make it a suitable target site. First, "The government reclamation project for Fukushima-gata lagoon" [4] (hereinafter referred to as reclamation project) was conducted in the 1960s leading to an increase in the distance between the settlement adjacent to the water area subject to reclamation and the visible outline of Fukushima-gata lagoon. In some of the previous studies, the focus of the research was on how distances or time of travel changed individually for the local residents from their residence to the water environment, depending on the changes in their lifestyle, which included regional residents' moving. On the other hand, in the case of Fukushima-gata lagoon, as the area of Fukushima-gata lagoon decreased due to the "reclamation project" and its visible outline changed, being a region where changes in distance and required time, which were previously reported as variables with a large influence, occur for all target settlements, however, it is able to handle as invariables in this research. Therefore, it became easier to consider the influence of other factors responsible for a change in their living arrangements. In addition, the lifestyles of regional residents living in a settlement around the Fukushima-gata lagoon changed dramatically. Therefore, the target area is considered to be an area suitable for examining factors influencing attachment based on changes in lifestyle.

Incidentally, Fukushima-gata lagoon, in Niigata prefecture, Japan, has an area of 362 ha before the reclamation project and an area 262 ha in 2018 [4] (Figure. 1). Fukushima-gata lagoon lies in the alluvial plain [5], and the altitude of the surrounding area is 0m to 5m [6]. Figure 2 shows land use around Fukushima-gata lagoon.

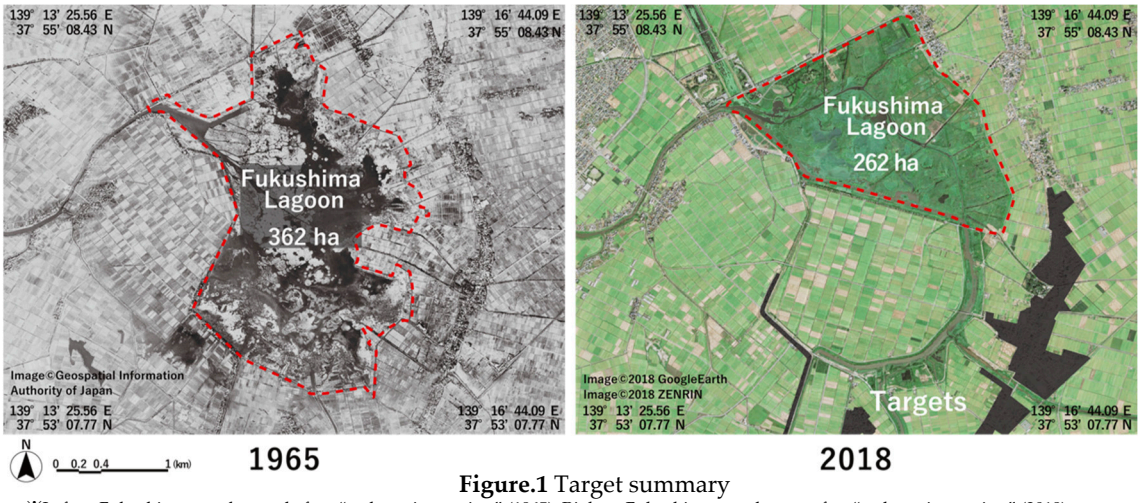

Figure.1 Target summary

※Left ： Fukushima-gata lagoon before "reclamation project" (1965), Right ： Fukushima-gata lagoon after "reclamation project" (2018)
※Red dotted line ： Outlines of Fukushima-gata lagoon
※The target village (black filled range) made expressions that do not specify villages from ethical consideration.

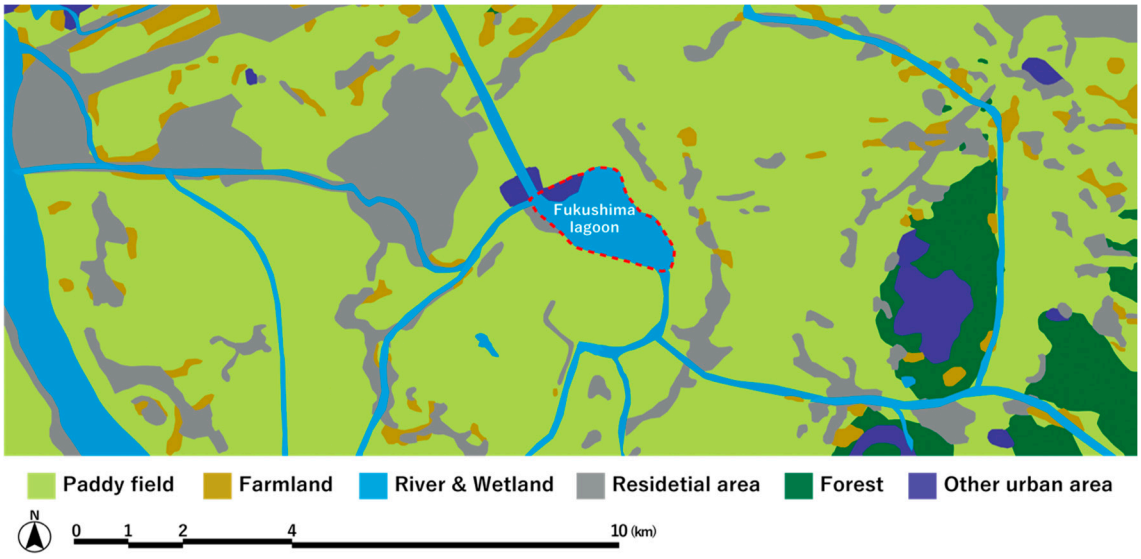

Figure 2. Land use around Fukushima-gata lagoon

※Based on the "National Land Numeral Information Land Use Subdivision 100 m Mesh Data (2014)", clear figures were prepared using QGIS 2.18.2.

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1.2. Research objectives

Settlements around Fukushima-gata lagoon that had apparently undergone changes in the life style of regional residents were chosen for this study. The aim of this research was to understand the level of attachment of regional residents toward the Fukushima-gata lagoon and how these residents used (Note 1) the lagoon before and after the reclamation project. In addition another aim was to understanding the corresponding relationship between the changes in attachment and changes in lifestyle as factors influencing their attachment toward the lagoon.

2. Literature Review

Previous studies related to this study, are roughly classified into two categories: 1) Research related to Fukushima-gata lagoon, and 2) Research related to the formation of attachment toward the water environment and the area.

1) Studies related to Fukushima-gata lagoon reported on vegetation surveys [7], subsurface exploration [8], ecological surveys of wild birds [9], flood control plans [10], and natural environment plans [11]. In addition, the Niigata City Lagoon Environment Research Institute for Environmental Studies (Note 2) has published various investigational reports on the Fukushima-gata lagoon [12-13]. Therefore, we contacted the institute about the presence or absence of survey material on actual usage of Fukushima-gata lagoon, but the institute has not conducted any survey on the actual manner in which Fukushima-gata lagoon was used. Therefore, information on how the regional residents made use of the Fukushima-gata lagoon is insufficient.

2) Studies related to the formation of attachment toward the water environment and the area reported various influencing factors including age [14-15], number of years of residence [2, 15-20], distance and travel time [1,21], visit frequency [17, 22-23], participation in the regional community [24-27], initiatives for preservation [22-23 , 28-30], and recreational use [31-33]. These factors related to lifestyle describe the formation of attachment. However, these results present the actual lifestyle situation at a certain point in time; the changes in lifestyle that form the research objectives in this study have not been examined. Therefore, accumulation is considered insufficient for studies examining changes in attachment and the formation factors of attachment corresponding to changes in the lifestyles of regional residents.

For the purposes of this study, we will use the term “attachment” to advance discussion. The term “place attachment” is often used in terms of attachment to specific places such as water environments and regions [14, 16-17]. In previous studies, “place attachment” had two common definitions as follows: (1) positive emotions an individual holds regarding a specific place, and (2) an active relationship between an individual and a specific place. Because the focus in this study is on Fukushima-gata lagoon and the regional residents around it, the definition of “attachment” can be stated as follows: (1) positive emotions that regional residents hold toward the Fukushima-gata lagoon, or (2) the relationship between regional residents and Fukushima-gata lagoon formed by positive emotions regional residents have toward Fukushima-gata lagoon. Incidentally, although the term “attachment” is not used, “regional identity” is cited as a similar concept, and there are many studies based on this concept [1,3, 34-36]. In previous studies, “regional identity” has three common definitions, as follows: (1) the attachments a resident forms in a certain region, (2) a sense of belonging toward the region, known as attachment, and (3) the common aspects shared in the regional community. Attachment is a positive emotion toward the target area, whereas regional identity includes not only attachment toward the target area but also a sense of belonging in the target area. Therefore, even though regional residents do not have a positive emotion toward the target area, examples are recognized where landscapes specific to a region are recognized as regional identity [33]. To cultivate persons who are conscious about preserving the landscape, it is important to understand the process through which regional residents form attachments to their water environment.

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3. Case study

To formulate hypotheses and clarify variables, we first conducted an interview survey of local residents who were familiar with Fukushima-gata lagoon before the reclamation project. We obtained the participants' consent to publish the data for academic purposes on the condition of maintaining anonymity of the interviewee.

3.1. Interview survey

The interview survey was conducted for three regional residents around Fukushima-gata lagoon, Mr. A, Mr. B, and Mr. C, from among the residents engaged in the preservation activities of Fukushima-gata lagoon and residents holding posts in the neighborhood association (Table 1). The three respondents interviewed for this survey were born and raised in the area around Fukushima-gata lagoon, and they frequently used the Fukushima-gata lagoon both before and after the reclamation project; hence, it is assumed that all three have an attachment toward the Fukushima-gata lagoon.

Table 1. Outline of the interview survey.

Interviewees	Regional residents around Fukushima-gata lagoon	
	Mr. A, Mr. B	Mr. C
Survey dates	June 24, 2017 June 30, 2018	July 16, 2018 July 31, 2018
Implementation method	Direct interview	
Question item	1) The attributes of the target person 2) Changes in Fukushima-gata lagoon before and after "reclamation project" 3) The use of Fukushima-gata lagoon before and after "reclamation project"	

Our interviews with both Mr. A and Mr. B were held on June 24, 2017 and June 30, 2018, and with Mr. C on July 16, 2018 and July 31, 2018. Our interview survey lasted 2 to 3 hours per interview and was carried out twice.

Using a semi-structured interview format, we asked respondents about 1) attribute information, 2) changes in Fukushima-gata lagoon before and after the reclamation project, and 3) the actual condition of use of the Fukushima-gata lagoon by the respondents before and after the reclamation project (Table 2).

3.1.1. Attribute information of the respondents interviewed

Regarding the occupation of the respondents interviewed, Mr. A was a farmer, Mr. B and Mr. C were working for a private enterprise. At the time of the interview survey, Mr. A and Mr. B had retired and Mr. C was an incumbent. The "role" of respondents interviewed refers to their role in the target area. Mr. A and Mr. B were engaged in the preservation activities of Fukushima-gata lagoon and Mr. C served a post at the neighborhood association where he lives. Common among the responses of the respondents interviewed are "I am participated in the preservation in Fukushima-gata lagoon and the planning of events", "I have lived around Fukushima-gata lagoon area for over 60 years, since I was a child."

3.1.2. Changes in Fukushima-gata lagoon before and after the reclamation project

The common response to changes in Fukushima-gata lagoon before and after the reclamation project was as follows: "Residents reclaimed plants and fish, and the landscape of Fukushima-gata lagoon changed." In addition, Mr. A and Mr. B testified that "the Fukushima-gata lagoon before reclamation project was a place for daily living" and "we sold fish and plants to earn income."

Table 2. Results of interview survey

Targets	Mr.A	Mr.B	Mr.C
Question item			
Profession	Farmer	Private enterprises	Private enterprises
Post	Environment preservation volunteer	Environment preservation volunteer	Neighborhood association officer
Residence years	60 - 70 years	60 - 70 years	60 - 70 years
Changes in Fukushima-gata lagoon	・Plants have decreased ・Landscape got worse ・Flood measures were implemented ・Fish and birds cease to be caught ・It became difficult to earn income at the Fukushima lagoon	・Vegetation has changed ・Number of fish has decreased ・Area diminished, the scenery changed ・Fukushima lagoon is no longer a place of life	・Landscape has changed ・Water got dirty and fish decreased ・Embankment increased due to flood control ・Road was improved along the embankment ・Many tourists came from the downtown to see the cherry blossoms ・Number of tourists increased and the amount of garbage increased
Actual condition of use of the Fukushima-gata lagoon	・In the past I sold fish and birds I picked up but now I can not sell ・I picked Wild rice and sold it, but I have not taken it since Wild rice has decreased ・I was fishing on my own ship ・When I was a child I played swimming ・Compared with the past, fish did not sell but it is still frequently on board the boat	・I used to live in fishery, but now it is difficult to earn income ・In the past I took a sparrow and ate it but now I can not catch it ・When I was a child, I took a boat and competed with my friends ・Before national reclamation I was swimming in the estuary and playing ・I used to ride a boat to fish in the past but now it is only riding at the event	・I used to mow yoshi and sold it in old days ・My parents used the lagoon water for agricultural water ・In the spring we will see the cherry blossoms in the south of Fukushima lagoon ・I picked lotus fruit and fish, sold it and living ・I often walk around Fukushima lagoon, often look back at Fukushima lagoon and remember old Fukushima lagoon

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3.1.3. Actual condition of use of the Fukushima-gata lagoon before and after reclamation project by the interviewed respondents.

Among the responses obtained about the actual condition of use by the interviewed respondents of Fukushima-gata lagoon before and after the reclamation project, many were related to daily life, such as getting on a boat for "fishing, picking edible wild plants, gathering reeds for thatched roof."

It was possible to get a harvest by riding in the boat ". There was a difference in the three respondents' response regarding the use of Fukushima-gata lagoon after the reclamation project. Mr. A frequently used to get on the boat even after the reclamation project, but no longer for fishing or picking edible wild plants. Mr. B used to take the boat only for guiding tourists to Fukushima-gata lagoon after the reclamation project. Mr. C did not use the boat after the reclamation project, and answered "I only go to Fukushima-gata lagoon for walking and for the scenic view." Before the reclamation project, their relationship with Fukushima-gata lagoon was as a means of living, common to the three respondents; but after the reclamation project, changes in individual lifestyles of the local residents influenced them to make a different use of the Fukushima-gata lagoon.

3.2. Formulating Hypotheses

From the results of the interview survey, it was suggested that the usage of Fukushima-gata lagoon is different before and after "reclamation project". From the above, it is thought that before "reclamation project" use is related to concerning eating (catch fish and plants) and concerning housing (getting reeds for building materials), but after "reclamation project" the use related to concerning eating and concerning housing has been greatly reduced. As a Hypothesis based on the above, We assume Hypothesis 1 that Fukushima-gata lagoon after "reclamation project" has largely diminished use related to concerning eating (catching fish and plants) and concerning housing (getting reeds for building materials), and it is rarely used by regional residents.

In the previous research, [1,21], it is mentioned that the distance to the target area and the time of travel will affect the formation of attachment to the target area. As a Hypothesis based on the above, let us assume Hypothesis 2 that attachment to regional residents of Fukushima-gata lagoon disappeared because the connectivity between the settlement and Fukushima-gata lagoon declined.

In addition, due to differences in the use of Fukushima-gata lagoon after "reclamation project" by the subjects of the interview survey, we classified the use of Fukushima-gata lagoon as "Playing in the water", "Livelihood opportunity " and "Recreational use". As a Hypothesis based on the above, we assume Hypothesis 3 that "factors of playing in the water · Livelihood opportunity · recreational use are involved in forming attachment towards Fukushima-gata lagoon".

4. Research Design and Method

The flow of this study is shown in Figure 3 . In this study, we selected survey target villages from the vicinity around Fukushima-gata lagoon and conducted a questionnaire survey to gather data necessary for verifying Hypothesis.

4.1. Targets

The targets are the settlements shown in Figure 1 (37 households in total). The criterion for selection of the target was it is assumed that residents' use of the lagoon greatly changed before and after the "reclamation project," because the distance of their settlement from the waterfront of Fukushima-gata lagoon (max 2.25 km) greatly changed after the "reclamation project."

4.2. Questionnaire Survey

In order to clarify the corresponding relationship between Fukushima-gata lagoon use condition before and after the reclamation project and the degree of attachment toward Fukushima-gata lagoon, we visited all households (37 households) of the settlement with the cooperation of the neighborhood

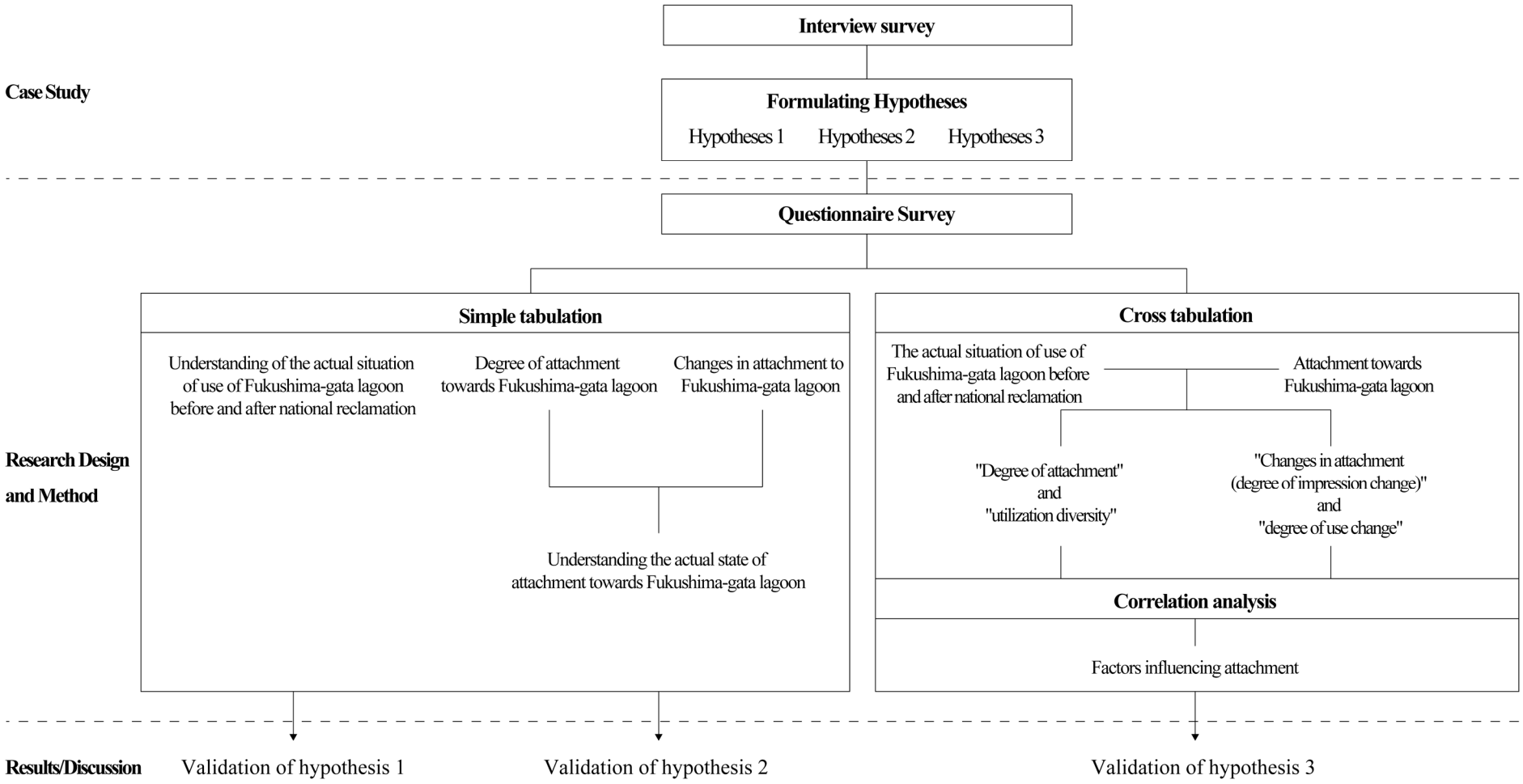

Figure 3. Flow of this study

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194 association and distributed and collected a questionnaire (Response rate 83.7%). The outline of the
195 questionnaire survey is as shown in Table 3, and the question contents are as shown in Table 4. In
196 addition to the basic attributes of the respondents, the question items were about the impression
197 evaluation and use of Fukushima-gata lagoon before and after the reclamation project and their
198 grasp of the actual condition.

199 **Table 3.** Outline of questionnaire survey

Date of implementation	August 2018
Target	All households of target village (37 household)
Implementation method	Self-written questionnaire survey
Answer method	Selection formula / Free description formula
Distribution / collection method	Distribution / collection by visit
Number collected	31 household (Response rate 83.7%)

200 **Table 4.** Questionnaire survey question contents

1. Respondent attribute (Gender/Age/Profession/Family structure/Residence years)
2. Frequency of visiting Fukushima-gata lagoon
3. Events and gatherings held in the area and their participation status
4. Impression evaluation (change in attachment) before and after "reclamation project" for Fukushima-gata lagoon
5. Usage situation before and after "reclamation project" of Fukushima-gata lagoon [Play in the water],[Boarding the boat],[Fishing],[Hunting wild birds],[Catching fish],[Sell reeds as building material], [Walking],[Photography],[Viewing to Fukushima-gata lagoon],[Observation of animals and plants] etc. All 26 items

201 Regarding the publication of the survey and survey results, we obtained consent for publication
202 only for academic purposes after ensuring that the target settlement remains unspecified.

203 *4.3. Analysis method*

204 The actual situation of Fukushima-gata lagoon use before and after the reclamation project could
205 be grasped by a simple tabulation of the questionnaire survey. Next, regarding the change and
206 formation factors of attachment toward the Fukushima-gata lagoon, we considered the relationship
207 between variables by cross tabulation of the objective variable, "attachment to Fukushima-gata
208 lagoon" and the explanatory variable, "the actual situation of Fukushima-gata lagoon before and
209 after the reclamation project." In addition, to examine the relationship between "attachment to
210 Fukushima-gata lagoon" and "multiple living factors," the utilization diversity (the number of types
211 of use in the answer of the questionnaire) as multiple living factors is used as a surrogate index and
212 correlation analysis was carried out. Regarding the measurement of attachment, we assume that
213 households that frequently visited Fukushima-gata lagoon are those who have attachment toward
214 the Fukushima-gata lagoon. Specifically, "frequency of visits to Fukushima-gata lagoon" was set to
215 "degree of attachment."
216 In addition, in this study, "change in attachment" refers to a change in the impression evaluation
217 of Fukushima-gata lagoon before and after the reclamation project. Impression change degree for
218 Fukushima-gata lagoon before and after reclamation project was calculated; it was considered "0
219 when no change was observed, and 1 was added when there was a change in the impression about
220 "landscape" "water transparency" and "flood countermeasure." It was set as an index that takes
221 values from 0 to 3. Similarly, "degree of change in use " was calculated as the degree of change in the
222 use of Fukushima-gata lagoon before and after the reclamation project. The degree of use change is
223 set to "0 when there is no change in usage before and after the reclamation project" and the value is
224 increased by 1 when there is a change in the use of Fukushima-gata lagoon before and after
225 reclamation project at 27 levels ranging from 0 to 26 It was used as an indicator. Thereafter, to examine
226 the relationship between "change in attachment to Fukushima-gata lagoon" and "change in use of
227 Fukushima-gata lagoon before and after the reclamation project," correlation analysis was conducted
228 between "impression change degree" and "degree of use changes.

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5. Results

5.1. Respondent attribute information

5.1.1. Gender

The responses for gender from respondent households were as follows (Table 5): male: 74.2%, female: 22.6%, no answer: 3.2%.

Table 5. Gender (n=31)

Gender	Household
Male	74.2%
Female	22.6%
Unanswered	3.2%

5.1.2. Age

The age group of responding households (Table 6) did not have respondents in their 20s or younger. There were many respondents in their 60s and 70s, and 80.7% of the respondents were people in their 50s or older.

Table 6. Age (n=31)

Age	Household
9 years and under	0.0%
10′s	0.0%
20′s	0.0%
30′s	6.5%
40′s	12.9%
50′s	12.9&
60′s	32.2%
70′s	29.0%
80 years and over	6.5%

5.1.3. Profession

The respondents' occupation (Table 7) was farming (45.2%, including specialized farming and part-time farming) and working for private enterprises (45.1%). The response rate of farmers and those working in private companies was high. In addition, those who were working at the time of the survey were referred to as incumbents and those who had already retired were categorized as non-job.

Table 7. Profession (n=31)

Profession	Household		
	Incumbent (n=21)	Non-job (n=10)	Total (n=31)
Farmer	9.5%	10.0%	9.7%
Fisherman	0.0%	0.0%	0.0%
A conprevious farmer	38.1%	30.0%	35.5%
A conprevious fisherman	0.0%	0.0%	0.0%
Civil servant	0.0%	10.0%	3.2%
Self employed	9.5%	0.0%	6.5%
Private enterprises	42.9%	50.0%	45.1%

5.1.4. Family structure

The family composition of respondent households' (Table 8) was multi-generational (64.5%, two or three generations), couples (19.4%), and single persons (16.1%).

Family structure	Household
Single person	16.1%
Couple	19.4%
2 generations	35.5%

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3 generations	29.0%

Table 8. Family structure (n=31)

5.1.5. Residence years

Since the "reclamation project" of Fukushima-gata lagoon started from 1968 [4], it is considered that households with a residence years of 50 years or more at the time of survey are households who know Fukushima-gata lagoon before "reclamation project". "Households with residence years of 50 years or more: 67.8% "," Households with residence years less than 50 years: 32.2% "(Table 9).

Table 9. Residence years (n=31).

Residence years	Household
9 years and under	3.2%
10 - 19 years	3.2%
20 - 29 years	9.7%
30 - 39 years	3.2%
40 - 49 years	12.9%
50 - 59 years	16.2%
60 - 69 years	25.8%
70 - 79 years	22.6%
Over 80 years	3.2%

5.1.6. Participation in events / gatherings

The survey asked about households' participation in events and gatherings, and their frequency of participation. From the result (Table 10), the participation frequency in regional meetings was 61.3% and in festivals was 41.9%. The participation frequency in regional meetings was relative high er than around other settlements.[37] Based on the survey of Niigata City (2018), 68.6% of the residents did not participate in the Regional Community Council (Note 3) in northward Niigata city, where Fukushima-gata lagoon is located. Therefore, it was suggested that the target settlement is one in which there is a high participation rate in regional events / gatherings.

Table 10. Participation situation of events / gatherings (n=31)

Event	Frequency of participation	Residence years of less than 50 years (n=10)	Residence years of over 50 years (n=21)	Total (n=31)
Regional meeting	Almost every	80.0%	52.4%	61.3%
	Occasionally	0.0%	14.3%	9.7%
	1 or 2 times	0.0%	0.0%	0.0%
	Not participated	10.0%	14.3%	12.9%
	Unanswered	10.0%	19.0%	16.1%
Meeting to chat	Almost every	10.0%	14.3%	12.9%
	Occasionally	10.0%	14.3%	12.9%
	1 or 2 times	0.0%	4.8%	3.2%
	Not participated	10.0%	9.5%	9.7%
	Unanswered	70.0%	57.1%	61.3%
Emergency training	Almost every	20.0%	14.3%	16.1%
	Occasionally	0.0%	9.5%	6.5%
	1 or 2 times	0.0%	9.5%	6.5%
	Not participated	0.0%	19.1%	12.9%
	Unanswered	80.0%	47.6%	58.0%
Festival	Almost every	50.0%	38.1%	41.9%
	Occasionally	0.0%	9.5%	6.5%
	1 or 2 times	10.0%	0.0%	3.2%
	Not participated	10.0%	14.3%	12.9%
	Unanswered	30.0%	38.1%	35.5%

5.1.7. Impression changes in Fukushima-gata lagoon

Impression changes about Fukushima-gata lagoon before and after the reclamation project are related to changes in impressions about the "Landscape," "Water transparency," and "Flood

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countermeasure," which were rated as "Better than before the reclamation project," "Worse than before the reclamation project" or "No change." From the results (Table 11), as a common point of impression change, a certain number of respondents who have experience related Fukushima-gata lagoon before "reclamation project" even those households with less than 50 years residence in the area, because they moved from neighboring areas. In households with a residence of more than 50 years, for Landscape showed "No change" (47.6%), "Better than before the reclamation project" (28.6%), "Worse than before the reclamation project" (23.8%).Water transparency showed "No change" (42.9%), "Better than before the reclamation project" (33.3%), and "Worse than before the reclamation project" (23.8%); Regarding Flood control measures, "Better than before the reclamation project (38.1%), "No change" (38.1%), and "Worse than before the reclamation project" (23.8%).

Table 11. Impression changes in Fukushima-gata lagoon before and after "reclamation project"

	Residence years of less than 50 years(n=10)			Residence years of over 50 years(n=21)		
	Better than before "reclamation project"	Worse than before "reclamation project"	Not change	Better than before "reclamation project"	Worse than before "reclamation project"	Not change
Landscape	20.0%	10.0%	70.0%	28.6%	23.8%	47.6%
Water transparency	0.0%	10.0%	90.0%	33.3%	23.8%	42.9%
Flood countermeasure	20.0%	10.0%	70.0%	38.1%	23.8%	38.1%

Next, the "impression change degree" (Table 12) had an average value of 1.4 (standard deviation 1.4). Incidentally, since the responses of 4 households were incomplete, they were excluded from the population of impression change degree.

Table 12. Impression change degree to Fukushima-gata lagoon regarding "reclamation project" (n=27).

Impression change degree			
Average value	**Standard deviation**	**Max**	**Min**
1.3	1.4	3	0

5.2. Attachment towards Fukushima-gata lagoon and use of Fukushima-gata lagoon before and after "reclamation project"

The actual situation of attachment to Fukushima-gata lagoon and the actual use of Fukushima-gata lagoon are as described below.

5.2.1. Actual situation of attachment toward Fukushima-gata lagoon

The frequency of visits to Fukushima-gata lagoon after the reclamation project is considered an indicator clearly showing attachment to Fukushima-gata lagoon. We assume that any household visiting the Fukushima-gata lagoon, regardless of their frequency, has a sense of affection toward the Fukushima-gata lagoon. Households that answered "Do not go at all" have no attachment to Fukushima-gata lagoon.

The visiting frequency showing the degree of attachment was evaluated in 5 stages (Table 13). As a result, 80% of households with residence years of less than 50 years and 85.7% of households with a residence years of over 50 years were shown to have attachment toward Fukushima-gata lagoon. In aggregation by age group, the households that show attachment are as follows: 30s: 100%; 40s: 75.0%; 50s: 100%; 60s: 90%; 70s: 66.4%; and 80 years and older: 100% (Table 14).

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301

302 **Table 13.** Frequency of visit after "reclamation project" (n=31).

Frequency of visit	residence years of less than 50 years (n=10)	residence years of over 50 years (n=21)	Total (n=31)
Every day	0.0%	9.5%	6.5%
Once or twice a week	20.0%	19.0%	19.3%
Once or twice a month	20.0%	4.8%	9.7%
Once or twice a half-year	20.0%	23.8%	22.6%
Once a year	20.0%	28.6%	25.8%
Not go at all	20.0%	14.3%	16.1%

303 **Table 14.** Frequency of visit by age after "reclamation project" (n=31).

Frequency of visit	30's (n=2)	40's (n=4)	50's (n=4)	60's (n=10)	70's (n=9)	80 years and over (n=2)	Total (n=31)
Every day	0.0%	0.0%	0.0%	10.0%	0.0%	50.0%	6.5%
Once or twice a week	0.0%	25.0%	0.0%	30.0%	22.2%	0.0%	19.3%
Once or twice a month	0.0%	25.0%	25.0%	10.0%	0.0%	0.0%	9.7%
Once or twice a half-year	0.0%	25.0%	25.0%	20.0%	22.2%	50.0%	22.6%
Once a year	100.0%	0.0%	50.0%	20.0%	22.2%	0.0%	25.8%
Not go at all	0.0%	25.0%	0.0%	10.0%	33.4%	0.0%	16.1%

304

305 5.2.2. Actual situation of use Fukushima-gata lagoon before and after reclamation project

306 The actual situation of use of Fukushima-gata lagoon before and after the reclamation project is
307 described in Table 15.

308 **Table 15.** The actual situation of use of Fukushima-gata lagoon before and after "reclamation project"
309 (n=31).

Usage items	Household	
	Before reclamation project (n=21)	After reclamation project (n=31)
Playing in the water	57.1%	0.0%
Drink water in Fukushima-gata lagoon	9.5%	0.0%
COLL	66.7%	6.4%
OBSE	28.6%	16.1%
Hunting wild birds	19.0%	3.2%
Capture the fish	47.6%	3.2%
Boarding the boat	57.1%	0.0%
Laundry / washing	0.0%	0.0%
Participate in plant protection activities	4.8%	0.0%
Break	4.8%	12.9%
SELL	38.1%	3.2%
Viewing to Fukushima-gata lagoon	19.0%	9.6%
BURN	14.3%	12.9%
Used as agricultural water	14.3%	6.4%
Fishing	47.6%	3.2%
USEM	19.0%	0.0%
PART	4.8%	6.4%
Walking	19.0%	32.2%
Excursion	4.8%	0.0%
Running	0.0%	0.0%
Picnic	0.0%	0.0%
Photography	4.8%	16.1%
Drawing a picture	0.0%	3.2%

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Having a meal	0.0%	3.2%
Singing a song	0.0%	0.0%
Viewing cherry blossoms	19.0%	38.7%

Abbreviations: COLL: Collecting and selling Wild rice, Water chestnuts, lotus, OBSE: Observation of animals and plants, SELL: Sell reeds as building material, BURN: Burn a reeds to preserve the environment, USEM: Use mud in Fukushima-gata lagoon for rice fertilizer, PART: Participate in events and festivals held in Fukushima-gata lagoon.

Responses regarding the actual use before the reclamation project were collected only from 21 households who had lived near Fukushima-gata lagoon before 1968 when the reclamation project began. The following were the responses by those who used Fukushima-gata lagoon for sport or to earn a livelihood: "Collecting and selling wild rice, water chestnuts, lotus etc.: 66.7%," "Playing in the water: 57.1%," "Taking the boat on the waters: 57.1%," "Fishing: 47.6%," "Selling reeds as building material: 38.1%," and so on.

Actual situation of use after the reclamation project tended to be for recreational use such as "Viewing cherry blossoms: 38.7%," "Walking: 32.2%," "Observing animals and plants: 16.1%," and "Photography: 16.1%."

Next, based on the indications of previous studies, not only the above items but also the number of types of use as "Comprehensive indicators" was "Utilization diversity," and the proportion of corresponding households was calculated. Table 16 shows the utilization diversity before and after the reclamation project. Utilization diversity showed an average value of 4.9 (standard deviation 4.2) before the project and 1.8 (standard deviation 1.9) after the project.

Table 16. Utilization diversity before and after reclamation project (n=31).

Utilization diversity	Household	
	Before reclamation project (n=21)	After reclamation project (n=31)
13	4.8%	0.0%
12	4.8%	0.0%
11	0.0%	0.0%
10	9.5%	0.0%
9	4.8%	0.0%
8	4.8%	0.0%
7	4.8%	3.2%
6	9.5%	3.2%
5	9.5%	6.6%
4	9.5%	3.2%
3	0.0%	12.9%
2	9.5%	12.9%
1	4.8%	29.0%
0	23.7%	29.0%

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In addition, the degree of use changes in Fukushima-gata lagoon before and after the reclamation project (Table 17) had an average value of 4.4 (standard deviation 3.8).

Table 17. Utilization change of Fukushima-gata lagoon before and after "reclamation project" (n=27)

Degree of use changes			
Average value	**Standard deviation**	**Max**	**Min**
4.4	3.9	12	0

5.2.3. Cross tabulation of actual situation of use of Fukushima-gata lagoon before and after "reclamation project" and attachment towards Fukushima-gata lagoon.

Table 18 shows the cross-tabulation result of "Degree of attachment to Fukushima-gata lagoon" and "Actual situation of utilization of Fukushima-gata lagoon before and after the reclamation project." There was no difference in the response ratio of each question item based on the extent of attachment among households that showed attachment. On the other hand, households with a high degree of attachment tend to have higher usage diversity before the reclamation project in terms of utilization diversity, and households with "everyday" use tend to have average utilization diversity before the reclamation project of 9.5 (Standard deviation 0.7); households whose visiting frequency was nil had an average utilization diversity of 0.8 (standard deviation 1.8) before the project.

5.3. Relationship between degree of attachment towards Fukushima-gata lagoon and utilization diversity of Fukushima-gata lagoon

Considering that households with high visiting frequency tended to have higher utilization diversity before the reclamation project, to examine the relationship between "Degree of attachment toward Fukushima-gata lagoon" and "Multiple livelihood factors," we created a scatter plot of frequency of visits after reclamation and utilization diversity before and after the reclamation project (see Figure 4). Using a correlation analysis, the frequency of visits after the reclamation project and utilization diversity before the reclamation project had a correlation coefficient: $r = 0.7404151$, p-value: $p = 0.00012$, and was significant at the significance level of 0.1%. Meanwhile, the frequency of visits after the reclamation project and utilization diversity after the reclamation project had a correlation coefficient: $r = 0.3852044$, p-value: $p = 0.03236$, and was significant at a significance level of 5%.

5.4. Relationship between changes in attachment to Fukushima-gata lagoon and changes in use of Fukushima-gata lagoon

We now consider the impression changes toward "Landscape," "Water transparency," and "Flood countermeasure" as a change in attachment to Fukushima-gata lagoon. Table 19 shows the cross tabulation of "Changes in attachment toward Fukushima-gata lagoon" and "Actual situation of utilization of Fukushima-gata lagoon before and after the reclamation project."

Next, to examine the relationship between "Changes in attachment toward Fukushima-gata lagoon" and "Changes in utilization of Fukushima-gata lagoon before and after the reclamation project", cross tabulation of impression change degree before and after the reclamation project and degree of use changes before and after the reclamation project was implemented (Table 20). After conducting a correlation analysis, the correlation coefficient was found to be: $r = 0.5482957$, p-value: $p = 0.0014$, and it was significant at a significance level of 1%.

In addition, the following four groups were characteristic of the relationship between the degree of impression change before and after the reclamation project of target households and the degree of use change before and after the reclamation project. "(1) The group that showed no change in attachment or use" is one in which "Impression change degree has an average value 0.0 (standard deviation 0.0)," "Use change degree: average value 0.6 (standard deviation 0.5)." "(2) The group that showed a change in attachment or use is one whose impression change degree had an average value 3.0 (standard deviation 0.0),"and "Use change degree of average value 10.4 (standard deviation 1.1)." "(3) The group that showed change in attachment but no change in use has an Impression change

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degree with an average value 3.0 (standard deviation 0.0)“ and “Use change degree of average value 0.5 (standard deviation 0.7).“ “(4) The group whose attachment showed no changed and whose use changed” has an “Impression change degree of average value 0.0 (standard deviation 0.0)” and “Use change degree of average value 8.0 (standard deviation 1.4).”

6. Discussion

6.1. Attachment towards Fukushima-gata lagoon before and after “reclamation project” and use situation of Fukushima-gata lagoon

This study conducted a questionnaire survey (response rate 83.7%) on settlements (37 households) based on (1) the distances or time of travel from the residence to the waterfront of Fukushima-gata lagoon before and after the reclamation project, (2) attachment toward Fukushima-gata lagoon and (3) the actual situation of use Fukushima-gata lagoon.

Table 18. The extent of attachment Fukushima-gata lagoon and actual use situation of Fukushima-gata lagoon (n=31)

		Before reclamation project (n=21)														After reclamation project (n=31)													
		Playing			Livelihood opportunity			Recreational use					Utilization diversity				Playing			Livelihood opportunity			Recreational use					Utilization diversity			
	Usage items	Playing in the water	Boarding the boat	Fishing	COLL	Capture the fish	SELL	OBSE	VTF	Walking	PHO	VCB	Average value	Standard deviation	Max	Min	Playing in the water	Boarding the boat	Fishing	COLL	Capture the fish	SELL	OBSE	VTF	Walking	PHO	VCB	Average value	Standard deviation	Max	Min
	Degree of attachment																													
Frequency of visits	Every day	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	4.7%	0.0%	0.0%	0.0%	0.0%	9.5	0.7	10	9	0.0%	0.0%	3.2%	3.2%	3.2%	0.0%	3.2%	0.0%	0.0%	0.0%	0.0%	2.5	3.5	5	0
	Once or twice a week	19.0%	19.0%	9.5%	19.0%	19.0%	9.5%	9.5%	9.5%	4.7%	4.7%	4.7%	5.2	5.0	13	0	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	3.2%	0.0%	9.6%	6.4%	9.6%	2.5	2.2	6	0
	Once or twice a month	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.3	5.1	10	0	0.0%	0.0%	0.0%	3.2%	0.0%	0.0%	3.2%	3.2%	9.6%	6.4%	3.2%	3.7	3.0	7	1
	Once or twice a half-year	14.2%	19.0%	14.2%	19.0%	14.2%	9.5%	9.5%	4.7%	9.5%	0.0%	14.2%	5.0	4.2	12	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	3.2%	6.4%	0.0%	12.9%	1.7	1.8	5	0
	Once a year	9.5%	4.7%	4.7%	14.2%	4.7%	9.5%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4	2.1	6	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	3.2%	3.2%	3.2%	9.6%	1.3	1.3	3	0
	Not go at all	4.7%	4.7%	4.7%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8	1.8	4	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	0.0%	3.2%	0.6	0.5	1	0

Table 19. Changes in attachment towards Fukushima-gata lagoon and actual use situation of Fukushima-gata lagoon (n=21)

		Before reclamation project (n=21)														After reclamation project (n=31)													
		Playing			Livelihood opportunity			Recreational use					Utilization diversity				Playing			Livelihood opportunity			Recreational use					Utilization diversity			
	Usage items	Playing in the water	Boarding the boat	Fishing	COLL	Capture the fish	SELL	OBSE	VTF	Walking	PHO	VCB	Average value	Standard deviation	Max	Min	Playing in the water	Boarding the boat	Fishing	COLL	Capture the fish	SELL	OBSE	VTF	Walking	PHO	VCB	Average value	Standard deviation	Max	Min
	Changes in attachment																													
Landscape	Better than before reclamation project	14.2%	19.0%	9.5%	23.8%	14.2%	23.8%	14.2%	9.5%	9.5%	0.0%	14.2%	5.5	5.7	13	0	0.0%	0.0%	0.0%	4.7%	0.0%	4.7%	4.7%	9.5%	14.2%	9.5%	19.0%	2.7	2.7	7	0
	Worse than before reclamation project	19.0%	19.0%	14.2%	28.5%	23.8%	9.5%	14.2%	9.5%	4.7%	0.0%	4.7%	5.7	3.1	10	1	0.0%	0.0%	4.7%	4.7%	4.7%	0.0%	14.2%	4.7%	14.2%	4.7%	14.2%	3.6	2.5	6	0
	Not change	23.8%	19.0%	14.2%	19.0%	14.2%	9.5%	0.0%	0.0%	23.8%	0.0%	4.7%	2.1	2.9	9	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	0.0%	19.0%	9.5%	23.8%	1.0	0.9	3	0
Water transparency	Better than before reclamation project	23.8%	23.8%	14.2%	28.5%	19.0%	19.0%	9.5%	4.7%	9.5%	4.7%	14.2%	6.6	4.5	13	2	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	4.7%	0.0%	14.2%	9.5%	9.5%	2.0	2.1	6	0
	Worse than before reclamation project	19.0%	19.0%	14.2%	23.8%	19.0%	14.2%	19.0%	14.2%	4.7%	0.0%	4.7%	6.7	3.4	10	1	0.0%	0.0%	4.7%	4.7%	4.7%	0.0%	14.2%	9.5%	14.2%	4.7%	9.5%	3.8	2.8	7	0
	Not change	19.0%	19.0%	19.0%	19.0%	14.2%	9.5%	0.0%	0.0%	4.7%	4.7%	4.7%	1.4	2.7	9	0	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	4.7%	4.7%	19.0%	9.5%	23.8%	1.1	1.1	3	0
Flood countermeasure	Better than before reclamation project	23.8%	28.5%	23.8%	33.3%	23.8%	23.8%	14.2%	9.5%	4.7%	0.0%	9.5%	5.1	4.4	12	0	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	4.7%	9.5%	14.2%	4.7%	23.8%	1.9	2.4	7	0
	Worse than before reclamation project	19.0%	19.0%	4.7%	23.8%	19.0%	14.2%	14.2%	9.5%	9.5%	4.7%	9.5%	6.5	4.3	13	1	0.0%	0.0%	4.7%	4.7%	4.7%	4.7%	14.2%	4.7%	14.2%	9.5%	9.5%	4.0	2.3	6	0
	Not change	19.0%	14.2%	19.0%	14.2%	9.5%	4.7%	0.0%	0.0%	4.7%	4.7%	4.7%	1.5	2.7	9	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	0.0%	19.0%	9.5%	23.8%	1.1	1.0	3	0

Abbreviations: COLL: Collecting and selling Wild rice, Water chestnuts, lotus, OBSE: Observation of animals and plants, SELL: Sell reeds as building material, VTF: Viewing to Fukushima lagoon, PHO: Photography, VCB: Viewing cherry blossoms

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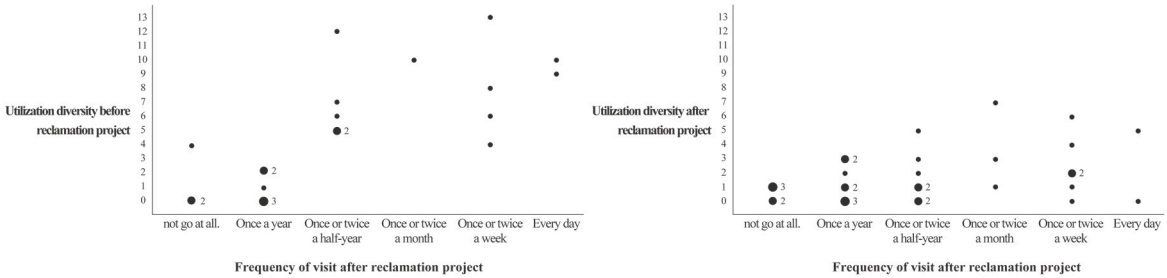

Figure 4. Frequency of visit after "reclamation project" and utilization diversity before and after "reclamation project".

(※Left：Utilization diversity before "reclamation project", Right：Utilization diversity after "reclamation project")

Table 20. Impression change degree before and after "reclamation project" and changes in utilization before and after "reclamation project"(n=27).

		Degree of use changes													Degree of use changes Total
		0	1	2	3	4	5	6	7	8	9	10	11	12	
Degree of impression changes	3	3.7%	3.7%	0.0%	0.0%	0.0%	7.4%	0.0%	3.7%	0.0%	7.4%	3.7%	3.7%	3.7%	37.0%
	2	0.0%	0.0%	3.7%	3.7%	0.0%	0.0%	0.0%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%
	1	0.0%	0.0%	0.0%	3.7%	0.0%	0.0%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.4%
	0	11.1%	14.9%	3.7%	3.7%	0.0%	3.7%	0.0%	3.7%	0.0%	3.7%	0.0%	0.0%	0.0%	44.5%
Degree of impression changes Total		14.8%	18.6%	7.4%	11.1%	0.0%	11.1%	3.7%	11.1%	0.0%	11.1%	3.7%	3.7%	3.7%	

Based on the survey results, "households with attachment toward Fukushima-gata lagoon: 83.9%," a certain degree of attachment towards Fukushima-gata lagoon after the reclamation project, were confirmed as the target settlement. Regarding the extent of attachment to Fukushima-gata lagoon, households with various degrees of attachment ranging from "once a year" to "every day" were confirmed.

Next, regarding the actual situation of Fukushima-gata lagoon use, 93.5% of households responded saying they use the Fukushima-gata lagoon for various purposes, and hence, we conclude that the Fukushima-gata lagoon was a water environment for the livelihood of the residents of the region. Households that responded that they had used Fukushima-gata lagoon before and after the reclamation project were "Before reclamation project: 76.2%" and "After reclamation project: 70.9%." According to previous research [13, 38], as a use before the reclamation project, "They used to hunt various birds such as sparrows, swallows, etc.," "Collect reeds for harvesting as material for roofing and as an income source," "Many households owned at least one small boat, which was indispensable for their living, such as for fishing of crucian carp and shrimp and for transporting harvested rice." "In addition to agricultural work, they used to catch fish for self-consumption and did several side jobs, picked water chestnuts and lotus, cut reeds," and so on. In the interview survey, we obtained testimonies on enjoying Playing in the water, such as "I practiced swimming in Fukushima-gata lagoon when I was a child," "I took a boat and competed with my friends in rowing." However, after the reclamation project, "I walk around Fukushima-gata lagoon in the morning and the evening and remember how I played in Fukushima-gata lagoon in the good old days" or "When spring comes, I see the cherry blossoms on the south side of Fukushima-gata lagoon," "People living in urban areas come to view cherry blossoms as well," and so on. There are many trends in the recreational useal

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use of Fukushima-gata lagoon, and this led to a decrease in the harvesting of reeds, use of boats, catching fish, hunting of wild birds, and playing in the water.

According to the Ministry of the Environment of Japan [39], the use of water by residents and for industrial activities as an indicator of a healthy water environment is positioned as an important factor. Based on the research of this study the use of both was confirmed in the Fukushima-gata lagoon, but after reclamation project, fishing for livelihood and collecting aquatic plants drastically reduced. According to the article [40] published in the Asahi Shinbun on June 29, 1989, "In a survey conducted after the reclamation project, the aquatic plants that characterize Fukushima-gata lagoon have declined drastically, and about 200 species of plants recorded before the reclamation project were not confirmed." The habitat was considered adversely affected by the lack of diversity of water quality and water environment after the reclamation project, which resulted in a decrease in the number of species. As a background to this, Japan, at the time of reclamation project (1968), was going through a period of high economic growth, and environmental preservation in the regional context was not given sufficient importance. Also, in the interview survey (Table 2) of this study, since it was seen that "the water transparency of Fukushima-gata lagoon deteriorated due to the reclamation project and no fish was acquired," the project apparently caused damage to the diversity of the natural environment of Fukushima-gata lagoon, affecting the lives of the regional residents around and led to a drastic decrease in plant harvesting and fishing for a livelihood.

6.2. Factors influencing attachment towards Fukushima-gata lagoon

Based on previous studies, in the relationship between the use of a single body as a behavioral act and the formation of attachment, it has been reported that it is not a single factor, but complex factors that have contributed to the formation of attachment. Therefore, to examine the relationship between "Attachment towards Fukushima-gata lagoon" and "Complex living factors," the correlation using substitution index as utilization diversity (the number of types of use in the answer result of the questionnaire) as a compound life factor analysis was carried out. A positive correlation was found between utilization diversity, which is a complex factor, before and after the reclamation project. This point agrees with the report of previous studies. However, a strong correlation was seen between utilization diversity and attachment before the reclamation project. While previous studies are based on the survey results at a certain point in time, the results of this study examined the utilization diversity both before and after the reclamation project. Therefore, utilization diversity before the reclamation project, that is, "complex factors concerning industrial use such as utilization of playing in the water, harvesting of reeds, use of a boat," and "Composite factor on recreational useal use such as walking and cherry blossom viewing" also contributed to the formation of attachment toward Fukushima-gata lagoon. These findings are novel and not been reported so far. In addition, "Composite factors concerning industrial use such as playing in the water and harvesting reeds and use of boats" are those that can be considered on the premise of "preservation of diverse natural environments in Fukushima-gata lagoon," described in the preceding paragraph. Therefore, it is suggested that "preservation of diverse natural environments in Fukushima-gata lagoon" contributes to "formation of attachment toward the future Fukushima-gata lagoon."

Moreover, it is stated that in other previous studies, the distances or time of travel to the target area are important factors influencing attachment toward the target area. In this study, from the viewpoint of changes in lifestyle, only the settlement where there were changes in the separation from waterfront after the reclamation project where the influences of the distance / the required time were invariables, was investigated. Therefore, not only the distance or time of travel but also the utilization diversity before the reclamation project may have influenced the formation of attachment to Fukushima-gata lagoon (Figure 5).

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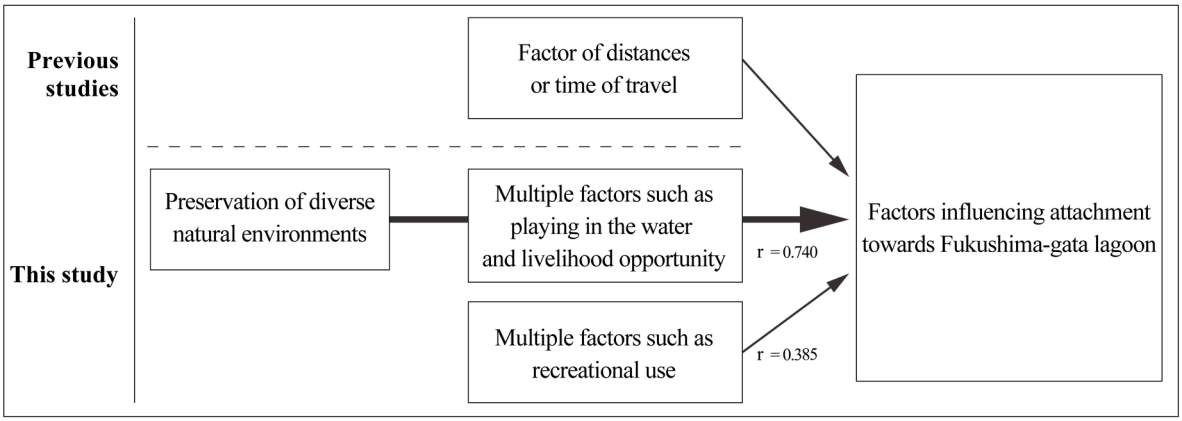

Figure 5. Factors affecting the formation of attachment.

Next, we examined the factors influencing attachment, with the change in attachment at two points as an objective variable, a fact that has not been reported in previous studies. To see the corresponding relationship between "Change in attachment towards Fukushima-gata lagoon" and "Changes in lifestyle conditions of regional residents," "Degree of impression change as a change in attachment" and "Degree of change in use before and after the reclamation project was found to have a positive correlation after conducting a correlation analysis (r = 0.54). Therefore, we investigate whether causal relation is established between "changes in attachment (impression change degree)" and "changes in use." Since the correlation is positive, it is based on "(1) the group that not change attachment or use" as the starting point, and a linear relationship with the end point at "(2) the group that changed attachment or use." Furthermore, since the correlation coefficient is 0.54, it is considered that there is also the influence of "(3) the group whose attachment changed and use did not" and "④ the group whose attachment did not change and use changed." Below, we consider whether a causal relation is established based on the actual situation of the above four groups. First, households belonging to "(1) the group that not change attachment or use" have used little of Fukushima-gata lagoon, regardless of before and after the reclamation project. Therefore, in this study, they are "households that had no attachment to Fukushima-gata lagoon" and this agrees with the characteristic of the origin of the above correlation. Second, households belonging to "(2) the group that changed attachment or use," "Playing in the water and livelihood opportunity" before reclamation project declined and an increase was in "Recreational use" after the reclamation project. In addition, as a content of change in attachment (impression), there was a tendency for "deterioration of water environment and improvement of safety." Therefore, the increase in "Recreational use" caused by the improvement of sidewalks and revetment along with the decrease in "Playing in the water and livelihood opportunity " due to "Deterioration of water environment" and improvement of safety was a feature of the end point. This feature is based on the content of usage actualities discussed so far, and "The landscape got worse, fish and birds ceased to live" because of "The way the embankment was built." This was obtained in the interview survey (Table 2). It agreed with the testimony. Thiry, households belonging to "(3) the group whose attachment changed and whose use did not" used the Fukushima-gata lagoon sparingly before and after the reclamation project. Therefore, in this study, they were considered "households that do not have attachment to Fukushima-gata lagoon." Therefore, the relationship is not linear relation between the origin and the end point of the above correlation, as it has contributed to the decrease of the correlation coefficient. Fourth, households belonging to "(4) the group whose attachment did not change and use changed" led to a decrease in "Playing in the water and livelihood opportunity," but after reclamation project almost all of Fukushima-gata lagoon they did not use, and they did not visit. There are many elderly people in this group of respondents. For them, "It has become difficult to visit Fukushima-gata lagoon due to a change in distance or time of travel / deterioration of physical function due to aging," or "I am not interested in playing in the water and livelihood opportunitytry as seen before state reclamation," or "they have a bad impression and there is no attachment to Fukushima-gata lagoon." Therefore, it is not positioned in the linear relation between the origin and

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503 the end point of the correlation, which contributes to the reduction of the correlation coefficient.
504 Based on the above, not only a positive correlation is noticed between "change in attachment (degree
505 of impression change)" and "change in utilization," but also in "Starting from a household where
506 attachment toward Fukushima-gata lagoon cannot be seen regardless of reclamation." It was
507 suggested that the causal relationship of linear relation with the end point of "Decrease in playing in
508 the water and livelihood opportunity due to deterioration of water environment, increase in
509 recreational useal use accompanying improved safety" was established. Previous studies have
510 reported that complex factors contribute to influencing attachment [17,23], but these are factors of
511 attachment formation at a certain point of time, and changes in attachment factors have not been
512 adequately studied. From the viewpoint of "Change in attachment" handled in this study, it is
513 suggested that not only the influence of factors at a certain point in time but also "the dynamic change
514 of complex factors" may influence attachment. This is significant as knowledge contributing to the
515 study of the problem of "elucidation of the formation factors of attachment considering changes in
516 lifestyle of regional residents" pointed out by Watanabe (Table 21).

517 **Table 21 Relationship between degree of changes in impression and degree of changes in utilization**

		Degree of use changes: High	Degree of use changes: Low
Degree of impression changes	High	Playing in the water and livelihood opportunity decreased due to deterioration of water environment Recreational use increased due to improving safety	Little use
	Low	Little use after reclamation project due to factors such as changes in distance or time of travel	Little use

518

519 *6.3. Hypothesis validation*

520 Based on the above discussion, we will verify Hypothesis.
521 Hypothesis 1: "Fukushima-gata lagoon, had been largely used as a means of food (for catching
522 fish and edible plants) and housing (getting reeds for building materials), but after the reclamation
523 project, has hardly been used by regional residents." This was not supported. Based on the findings
524 of this study, although the use related to food and housing decreased greatly, recreational use use
525 was confirmed, and hence, Hypothesis 1 was not supported.
526 Hypothesis 2: "Attachment of regional residents toward Fukushima-gata lagoon disappeared
527 because the connectivity between the settlement and Fukushima-gata lagoon declined" was not
528 supported. Based on the findings of this study, 83.9% of households continued to have attachment to
529 Fukushima-gata lagoon after the reclamation project, despite a decrease in connectivity. Therefore,
530 in the target settlement, Hypothesis 2 was not supported.
531 Hypothesis 3: "Factors of playing in the water … livelihood opportunity … recreational use are
532 involved in forming attachment toward Fukushima-gata lagoon" was supported. Based on the
533 findings of this study, "Composite factors of playing in the water and livelihood opportunity" and
534 "Complex factors of recreational use" showed a positive correlation with attachment toward
535 Fukushima-gata lagoon. Therefore, "Hypothesis 3 was supported." In particular, a strong positive
536 correlation was found between "Factors of playing in the water · livelihood opportunity" and
537 "Attachment toward Fukushima-gata lagoon." It was suggested that the preservation of diverse
538 natural environments of Fukushima-gata lagoon, which is a prerequisite for the use of playing in the

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water / livelihood opportunity, may become a condition to form attachment toward Fukushima-gata lagoon in the future.

6.4. Limitations

This study has the following three limitations.

First of all, in this research, emphasis is placed on clarifying correspondence between attachment to Fukushima-gata lagoon before and after "reclamation project" and grasp of actual usage of Fukushima-gata lagoon and attachment towards Fukushima-gata lagoon and changes in attachment and changes in lifestyle ,We conducted a survey. However, as to factors influencing attachment towards Fukushima-gata lagoon, since various factors are considered to be complex factors and attachment towards Fukushima-gata lagoon is thought to be formed, in the above discussion on factors of attachment towards Fukushima-gata lagoon, We could not identify factors influencing attachment.

Next, in this study, only the village where the distance to the waterfront in Fukushima-gata lagoon changed the most was examined. However, it is most desirable to compare the village where the distance to the waterfront of Fukushima-gata lagoon has not changed, and to compare it with the village where the distance changed the greatest, but it could not be achieved by the research of this research.

Also, in this study, we used indicators of "Landscape", "Water quality" and "Flood countermeasure" as impression changes in Fukushima-gata lagoon. However, as shown by the Ministry of the Environment of Japan [39], it is assumed that factors relating to "Five senses" greatly influence the changes in impression for Fukushima-gata lagoon. Since this study does not deal with "Five senses" as an indicator of impression change toward Fukushima-gata lagoon, we did not consider the changes in impression regarding the "Five senses."

The above limitations will be considered as future subjects for study.

7. Conclusions

In this study, we aimed to clarify the actual situation of attachment toward Fukushima-gata lagoon and the actual situation of Fukushima-gata lagoon before and after the reclamation project, and to clarify the corresponding relationship between the changes in attachment as factors influencing attachment toward Fukushima-gata lagoon and changes in lifestyle. As a result, the following four points were clarified.

1. Use of Fukushima-gata lagoon was mainly related to food (capturing fish and plants) and housing (catching reeds used for building materials) before the reclamation project, but after reclamation project, food and housing use greatly decreased, and recreational use (walking and cherry blossom viewing) became the main use.
2. Attachment toward Fukushima-gata lagoon did not disappear or decrease due to the change in the distances or time of travel to Fukushima-gata lagoon in the target settlement.
3. Multiple factors contributed to influencing attachment toward Fukushima-gata.
4. A corresponding relationship was seen between "Changes in attachment towards Fukushima-gata lagoon" and "Changes in lifestyle of regional residents" before and after the reclamation project.

Our findings lead to a key suggestion for preservation of the future water environment. In order to cultivate persons who preserve Fukushima-gata lagoon, it is necessary to preserve water environments that can be put to various uses. These water environments attract residents and contribute to increase the sustainability of preserving water bodies such as the Fukushima-gata lagoon.

Author Contributions: D.O. and R.F. conceived, designed and conducted the interview survey, designed and conducted the questionnaire survey, analyzed the data; D.O. conceived, wrote the paper.

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Abbreviations

COLL: Collecting and selling Wild rice, Water chestnuts, lotus

OBSE: Observation of animals and plants

SELL: Sell reeds as building material

VTF: Viewing to Fukushima-gata lagoon

BURN: Burn a reeds to preserve the environment

USEM: Use mud in Fukushima-gata lagoon for rice fertilizer

PART: Participate in events and festivals held in Fukushima-gata lagoon

PHO: Photography

VCB: Viewing cherry blossoms

Note

1. "Use" in this study refers to a situation where activities are carried out for some purpose, such as "To play" or "To collect resources"
2. The Niigata City Lagoon Environment Research Institute for Environmental Studies : It is an organization established in 2014 with the objective of surveying and researching lagoons, building a network, collecting information, and sending lagoon information, and acting as contact. https://www.city.niigata.lg.jp/kurashi/kankyo/kataken/kataken_gaiyou.html (accessed on 6 January 2019).
3. Regional Community Council : For the purpose of community development and promotion of citizen autonomy by collaboration between citizen and city, it is an organization composed of various groups, mainly based on elementary school district or junior high school district, centering around each neighborhood association and neighborhood association. https://www.city.niigata.lg.jp/kurashi/shimin/community/comkyou.html (accessed on 6 January 2019).

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