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Applying Ostrom's common resource management principles to analyze institutional factors for the failure of the volunteer tourism program for green sea turtles conservation in Lanyu (Orchid Island), Taiwan

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ABSTRACT

Chelonia mydas (green sea turtles, GST) in Lanyu (Orchid Island), Taiwan, affect the behavioral evolution of land-based organisms in Lanyu, and they are also important for the study of evolutionary biology. However, threats to their survival are increasing. To protect GST, conservation organizations have recruited volunteer tourists to assist in the implementation of a GST conservation program. However, the volunteer tourism program for GST conservation did not achieve the expected results, and it even caused serious social conflicts and threatened the survival of GST. In this study, the volunteers and the local Tao people were interviewed to understand the views of both parties, and the interview data were analyzed using Ostrom's common resources management principles. The results showed that two mechanisms led to the neglect: the appropriate authorities in the Taiwan government did not provide sufficient funds, and the government was unable to integrate and coordinate the conservation activities. The research results suggest that government authorities should provide sufficient funds and communication resources to assist conservation organizations in making use of local ecological conservation mechanisms and that conservation organizations should report the results of volunteer tourism programs to the Tao people and assist in cleaning the beach.

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Introduction

Volunteer tourism is an activity for the purpose of volunteer work, with multiple positive impacts on the social environment, as can be observed in ecological conservation volunteer tourism. During their volunteer tour, volunteer tourists can carry out species conservation, assist ecological conservation organizations in restoring endangered species and protecting biodiversity (Brightsmith, Stronza, & Holle, 2008; Palacios, 2010; Wearing & Neil, 2000), and engage in services (Barbieri, Santos, & Katsube, 2012) that promote and support the residents in tourism destinations through ecological conservation organizations and conservation activities. Positive examples include Mon Repos in

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Australia, Tortuguero National Park in Costa Rica, and the turtle volunteer tour in Ubatuba, Brazil. In these programs, turtle conservation organizations recruit volunteers to engage in conservation activities such as ecological monitoring, species conservation, artificial breeding, and habitat patrolling and maintenance to assist in the restoration of sea turtles at the tourist destinations (Senko, Schneller, Solis, Ollervides, & Nichols, 2011). These international volunteer tourism experiences in turtle conservation have become references for the conservation of *Chelonia mydas* (green sea turtles, GST) in Lanyu, Taiwan.

Threats to the survival of GST in Lanyu have been increasing dramatically with the rapid development of tourism, the transformation of land use in coastal areas and the interference of tourists. Since 1997, to protect the GST population and its spawning habitats in Lanyu, the official authority (Forestry Bureau) of Taiwan have commissioned the GST Conservation Organization (hereinafter referred to as the conservation organization) with funds to assist in monitoring research and conservation activities in Lanyu. However, the limited funding is not sufficient for the conservation needs. Therefore, volunteer tourists to protect GST (hereinafter referred to as conservation volunteers) were recruited to assist in the implementation of the GST conservation plan in Lanyu (hereinafter referred to as the conservation volunteer tourism program). After introducing this conservation volunteer tourism program, threats to the survival of GST in Lanyu continued to exist. Occasionally, local aborigines (Tao people) resisted or protested against the conservation activities, demonstrating that the conservation volunteer tourism did not achieve the expected results and even triggered serious social conflict and threatened the survival of GST.

The conservation of GST in Lanyu is crucial not only because GST is an endangered species but also because it participates in the evolution of other species in Lanyu. Huang, Lin, Dubey, and Pike (2013) and Pike et al. (2016) found that GST in Lanyu caused the behavioral evolution *Eutropis longicaudata* parental care in Lanyu, confirming that marine creatures affect the behavioral evolution of terrestrial organisms. This was the first time that marine creatures in Taiwan were found to affect the behavioral evolution of terrestrial organisms. Examples of related studies in other parts of the world are rare; therefore, these observations provide an important reference for the study of the behavioral evolution in reptiles and the unique ecological impact of GST in Lanyu.

Because GST in Lanyu affect the behavioral evolution of terrestrial organisms in Lanyu and similar observations regarding GST in other regions are rare, GST in Lanyu are important for studying evolutionary biology, and therefore, their conservation is of the utmost importance. To help the conservation organization fully apply its strategy to successfully conserve GST, it is necessary to understand the conservation volunteer tourism program and investigate the causes of confrontations and conflict. In this study, conservation volunteers and the Tao people were interviewed to understand the views of both parties. Because GST conservation is common resource management, Ostrom's common resource management principles (Cox, Arnold, & Tomás, 2010; Ostrom, 2015) were used to analyze the interview data. The results are expected to provide practical suggestions for the conservation of GST and new academic research arguments for conflicts between volunteer tourism society and aboriginal culture based on a case study.

Research methods

Survey method

Because this study involved sensitive topics such as cultural taboos and conservation conflicts, to enhance the credibility of the research (Decrop, 1999; Gavin, Solomon, & Blank, 2010; Jones, Andriamarivololona, & Hockley, 2008; Nuno & St. John, 2015), the triangulation method was used to combine a variety of research methods. Participatory observation as well as semi-structured and open interviews were used to collect opinions from both parties on the current issues of the conservation volunteer tourism program. During the field investigation, we visited *GST* spawning habitats, observed the habitat environment, and investigated the interaction between the conservation volunteers and the Tao people, to understand the complex relationship between the *GST* conservation activities and the life of the Tao people. Additionally, we participated in tourism activities, such as patrolling beaches, recording the landing of mother turtles and making conservation tools, with conservation volunteers and interacted with the conservation volunteers and with the tribal residents. In addition, to understand the details of the phenomena found in the field observation data and other social phenomena that were difficult to observe but significantly affected the relationship between the conservation volunteers and the Tao people, this study performed semi-structured interviews and open interviews.

Sampling method

The research subjects of this study are the Tao people and the conservation volunteers. Because the characteristics of these two samples are different, this study used a different sampling methods for each group. Conservation volunteer sampling was conducted by census. All individual volunteers involved in the conservation volunteer tourism program in 2013 were included as respondents. The snowball sampling method was applied for the Tao people, mainly because not all Tao people had contact with the conservation organization; random sampling may have led to difficulties finding respondents who understood the research topic. Snowball sampling resulted in four referral types: 'resident referral', 'volunteer referral', 'expert referral', and 'individual searching'. 'Resident referral' indicates a referral by an interviewed resident, thus effectively finding the appropriate respondents and reducing the rate of rejection. 'Volunteer referral' refers to Tao people who had direct contact with the conservation organization and were referred by the conservation volunteers. 'Expert referral' indicates Tao people who understand the traditional culture, the field research methods, and the volunteer activities and who were referred by experts participating in long-term anthropological research or volunteer activity planning in Lanyu. 'Individual searching' refers to Tao people highly involved in *GST* conservation work; the participation of these interviewees could increase the diversity and representativeness of the data sources. This multiple sampling approach is in line with the data triangulation approach recommended by Decrop (1999) to ensure the credibility of interview data.

A total of 31 interviewees were included in this study. Among them, 21 respondents received the semi-structured interview (including ten conservation volunteers and 11 Tao people), nine respondents received the open interview, and one respondent received the email interview. The ten conservation volunteers were 20–26 years old and included

four males and six females. Their education level was college or above. They were all from Taiwan, as non-local residents. Twenty Tao people were included as respondents; they were 30–68 years old and included 16 males and four females. Additionally, a person in charge of the conservation organization was included. The following letter codes were applied to the respondents: V, for volunteer; LR, for ‘resident referral’; LV, for ‘volunteer referral’; LS, for ‘expert referral’; and LI, for ‘individual searching’.

Research results

Interaction between the Tao people, GST, and GST habitats

The Tao people regard *GST* as an evil spirit. The *GST* habitat itself is considered a taboo. The beach where *GST* lay their eggs and the traditional cemetery of the Tao people are quite close or even overlap, so these areas are considered as the living space of evil spirits. Importantly, the sand and soil in the cemetery and the surrounding areas are regarded by the Tao people as the flesh and blood of Tao ancestors. Therefore, bringing this sand and soil to the tribe would be considered by the tribe as a curse.

The sand of the tomb cannot be brought to a house because the sand there is mixed with the flesh and blood of dead people. If you bring the soil back home, it is equal to bringing the evil spirits home. If you want to curse others, take the sand of the grave and spread in their house. (LS018)

The Tao people believe that all disasters and illnesses are from evil spirits. Therefore, anything related to evil spirits, such as the cemetery or the woods of Indian Barringtonia, cannot be mentioned, nor can they be approached; touching them will cause a disaster. In the traditional language, the term for *GST*, ‘irang’, means the curse of others. The Tao people also have a mythical story about diseases that are caused by coming in contact with *GST*. Therefore, *GST* is regarded as one of the sources of evil spirits and diseases. These taboos prohibit the Tao people from interfering with and hunting *GST*, which was recognized by the conservation volunteers.

They believe that *GST* is also an evil spirit. (V1001)

Therefore, the main threats to the survival of *GST*, such as commercial hunting (Van Houtan & Kittinger, 2014), accidental catch during fishing (Koch, Brooks, & Nichols, 2007; Senko, Mancini, Seminoff, & Koch, 2014), and use of eggs and meat as food (Van Houtan & Kittinger, 2014), do not exist in Lanyu.

Results of the analysis by Ostrom’s common resource management system

Clear boundaries

Common resource management is primarily about reducing externalities. The use of outsiders can be excluded by clearly defining the eligibility of the rights holder (Principle 1A). The application of this rule can reduce externalities and reduce the possibility of a tragedy of the commons. This rule is mainly a specification for people, but if the distribution range of resources is not clear, it will also affect the definition of the rights holder as well as law enforcement and resource monitoring. Therefore, explicit delineation of resource distribution (Principle 1B) is an important measure to reduce externalities.

This principle is deeply rooted in the traditional culture of the Tao people, but the conservation volunteer tourism violated this principle. The main cause of this violation is the *GST* eco-tourism program developed by the volunteer tourism organization followed the successful experiences of other international sea turtle conservation programs.

Traditionally, *GST* is an evil spirit for the Tao people. This taboo clearly prohibits the Tao people from entering *GST* habitats, let alone contacting, interfering with, or hunting *GST*.

There (the beach) is the grave area, and we (Tao people) will not go to that place (the beach). (LI005)

We believe that *GST* are growing freely in this place; they have activities here, live here, and lay eggs here. We Tao people never interfere with their activities. (LI010)

This cultural phenomenon and specific restriction are observed by the *GST* conservation volunteers:

The local residents are less likely to come down (the beach) because they believe that *GST* is an ominous thing and is considered an evil spirit. (V1002)

Because their cemetery is right next to the beach, they do avoid everything on the beach as a taboo, including sand. (V1001)

However, the *GST* eco-tourism blurred the boundaries.

They (conservation organization) promoted ecological sightseeing of *GST*, so that many tourists want to see *GST*. (LI010)

From another prospective, many tourists want to see *GST* because they are famous. Few local aborigines (Tao people) came to see *GST*, only tourists did that. (V1009)

Once the sign (*GST* habitat sign) was set up, the tourists would know where the *GST* lay their eggs. (LI005)

Due to the promotion of *GST* eco-tourism, the original rights holders had changed from no one to any tourist, that is, Principle 1A was completely abandoned.

In addition to weakening Principle 1A, Principle 1B was also changed by conservation volunteer tourism. One of the duties of the conservation volunteers is to move the eggs, that is, to transfer the eggs produced by *GST* from the original habitat to other beaches. Moving eggs is one of the international conservation measures for sea turtles (van de Merwe, Ibrahim, & Whittier, 2005), but in Lanyu, it blurred the distribution of resources because the conservation organization was opposed by the local people; therefore, the conservation volunteers had to be sneaky when moving eggs. Accordingly, the *GST* habitat after the egg was transfer could not be announced and identified.

Once we went to Dongqing Bay to place egg nests and laboratory equipment. We saw the patrol personnel of the Lanyu Marine Conservation Association, so everyone began to hide things. But we did not tell them that we were doing research on *GST*; we told them instead that we were doing research on the groundwater level. (V1016)

Congruence between appropriation rules and local conditions

This principle includes planning for conservation measures that fit the local society and the environment (Principle 2A), with benefits commensurate with conservation inputs

(Principle 2B). The core of Principle 2A is to reduce the trade costs and ensure the conservation measures are in line with the local society and environment so as to reduce the inconvenience to people caused by adaptation to conservation measures and reduce people's negative reactions to the conservation measures. Principle 2B is to use conservation benefits as an incentive for public participation in conservation.

The conservation volunteer tourism program also violated this principle. The conservation volunteers must access the beaches that have *GST* activity in order to execute conservation events such as calculating the number of landing turtles and their nests (Troëng & Rankin, 2005), installing transmitters on *GST* (Hart, Zawada, Fujisaki, & Lidz, 2013), and transferring eggs (van de Merwe et al., 2005). Each of these events expose evil spirits and violate the cultural taboo of the Tao people (see Sections 3.1 and 3.2.1 for details). The violation of Principle 2A is self-evident. The benefits generated for the residents are not acceptable to the residents, that is, Principle 2B does not exist.

The conservation organization introduced a *GST* eco-tourism program in Lanyu, which was expected to produce economic benefits through tourism activities and motivate the local residents to change their attitude toward *GST* (Pegas & Stronza, 2010). Local businesses in Lanyu can benefit from rental, dining and accommodation expenses of the volunteers, representing a direct contribution of conservation volunteers to the income of local businesses. However, the development of guided tours and activities related to *GST* in Lanyu has not been popular thus far because most local people still regard *GST* as an evil spirit:

They (Tao people) believe that *GST* is an evil spirit, so the local residents are not likely to take people to see *GST*. (V1002)

Only the Tao people who are less constrained by the traditional taboos were engaged in *GST* eco-tourism. However, the operators of the *GST* eco-tourism lacked specifics regarding traditional taboos, leading to serious conflict:

Some local tourism operators (Tao people) also took visitors to see the *GST* in order to make money. These operators are mostly bad guys because they (violated the traditional taboos). (LI005)

Once a local tour guide took the tourists down (the beach), I was urged to confirm whether the *GST* was laying eggs. I replied to him that the *GST* had not yet laid eggs, but he still secretly took the tourists into the spawning area of the *GST*. (V1007)

The tour guide directly took the camera and turned on the flash to shoot the *GST* while laying egg. (V1006)

These phenomena indicate that the economic incentive regarding *GST* in Lanyu (Principle 2B) does not exist and does not meet the local needs (violation of Principle 2A).

The incentives that residents require are simple: research results and assistance for environmental maintenance:

Feedback is not about sponsoring us with money but providing your research report. (LR010)

This research (conservation volunteer tourism) is also very helpful to Lanyu, but the residents could not feel it. Instead, if you just pick up rubbish and clean the beach, we will feel that you are helping us in addition to doing research. (LR014)

Collective-choice arrangements

This principle emphasizes that the affected stakeholders should be participants in resource conservation planning (Principle 3). The purpose is to resolve conservation issues at the communication and coordination phase, rather than finding that the conservation measures are difficult to implement at the execution phase. When the opinions of the stakeholders are fully expressed, respected, properly recognized and integrated into the conservation measures, the stakeholders should be naturally more willing to comply with and cope with the conservation measures.

Similar to the previous principles, the common traditional taboos shared by the Lanyu Tao people shaped their consensus of *GST*, but Principle 3 was not evident in the conservation volunteer tourism. First, the Tao people did not participate in the conservation volunteer tourism from the beginning:

We Tao people did not join a conservation organization like yours. (LR030)

When they came here, there was no good explanation or communication. (LR010)

Also, we did not observe their interaction with the local residents. (LR028)

Misunderstandings and conflicts arose due to the lack of interaction. A minor manifestation was dissuasion by words:

One uncle said every time: 'You (conservation volunteers) don't go any further'. (V1004)

More seriously, the conservation volunteers were insulted by the residents.

The Tao people took pictures of us (conservation volunteers) and reprimanded us for contacting the turtles on the beach. (V1005)

Sometimes, the situation even escalated to aggressive attacks, such as throwing beer bottles at the volunteers:

When we watched the sea turtles spawning on the beach, some residents were throwing bottles at us. (V1001)

The conservation organization was not oblivious of the reaction of the Tao people, but its responding measures were not to resolve the problem with communication; instead, the problem was treated with concealment and deception:

Once we went to Dongqing Bay to place egg nests and laboratory equipment. We saw the patrol personnel of the Lanyu Marine Conservation Association, so everyone began to hide things. But we did not tell them that we were doing research on *GST*; we told them instead that we were doing research on the groundwater level. ... I think, why ... when encountering a local patrolman, we need to hide the fact. (V1016)

Such concealment and deception further hindered the opportunities for the organization to communicate with the local people. The crux of solving this problem lies not with the conservation volunteers but with the person in charge of the conservation organization. The conservation volunteers expressed their expectation for the implementation of Principle 3:

I think the voice of the local residents is worth listening to, and it is worth thinking about what they said ... I think we can listen more to the ideas of some local aborigines. Maybe many of

their ideas are actually very good ... I think we can contact them more, interact with each other and understand each other, to find out the best way. (V1009)

However, the person in charge thought that:

We (conservation organization) are an organization for wildlife *ecology* research, not a social service organization. The object of our work is the turtles, not the residents. The residents' problems should be solved by the experts in a sociology department. (O3001)

Therefore,

disputes with the local residents often occurred. (V1016)

The local people also believed that the volunteer organization should not work in secret and that the person in charge should take responsibility for communication:

That is the teacher's (person in charge) job, and the young people (conservation volunteers) should not take the responsibility. They must face to the tribe. This is supposed to be a good thing, and it should not be turned into a bad one. (LR005)

The residents suggested that the person in charge can let everyone know through the public media in Lanyu:

By the Lan'en Biweekly, radio ... everyone will know that someone is doing this ... slowly we will accept it. (LR014)

The local residents also wanted to participate in the turtle conservation:

You can find local people to do research with you and participate in your research project. (LR010)

Monitoring

Monitoring data (Principle 4) are the bases for assessing the effectiveness of conservation. Using monitoring data, the status of the turtle community can be understood, and appropriate action can be taken.

The Tao people consider *GST* to be evil spirits, so *GST* were not monitored, that is, Principle 4 did not exist in the traditional conservation mechanism of the Tao people. In contrast, a main task of the conservation volunteers was to monitor and implement Principle 4. The volunteers must go to the beach where *GST* come ashore to calculate the number of turtles and nests, install transmitters on *GST*, and carry out conservation work such as egg transfer.

The main work is to go to the beach to see if there are any *GST*. (V1002)

We are scheduled to go to the beach every day. Our main work is performed on the beach, including looking for turtles and checking if the turtles have landed. (V2003)

In the evening, I went to the beach to see if there were any *GST* coming ashore. (V2006)

If *GST* are found ashore, the conservation volunteers must collect samples from the mother turtle and the turtle eggs on the beach.

We need to look for mother turtles that have spawned, label them and collect samples. (V2006)

We took *GST* tissue for genetic analysis, measured the carapace and other basic body data, and measured the diameter and weight of the eggs. (V2003)

Therefore, Principle 4 is a major constituent of the conservation volunteer tourism program. However, monitoring data for *GST* in Lanyu was not disclosed and was not reported to the Tao people.

Graduated sanctions

This principle (Principle 5) is to deter illegal offenders. Traditionally, the Tao people who violate taboos are subject to various forms of punishment. However, some of the punishments were no longer effective for the Tao people engaged in *GST* eco-tourism. The tourists who come to the island for *GST* eco-tourism are not subjected to the norms of the Tao traditional culture, and their misconduct is not subject to any restrictions.

Tao punishment for violating *GST* conservation is quite strict, including a curse on the soul.

If seeing this *GST*, the family will suffer bad luck. Eating a turtle will result in no production in the Taro field. (LR018)

and the condemnation of public opinion

The local residents will search for the residents who violated the tradition. For a first-time offender, a warning will be given; For a recidivist, curse will be committed. (LR018)

The *GST* conservation promoted by the conservation volunteers introduced a way to use *GST*, breaking the taboos of the Tao people, including maintaining a certain distance from *GST* and allowing them to naturally breed. Only the Tao people who are less bound by traditional taboos are likely to engage in *GST* eco-tourism. However, the operators of the *GST* eco-tourism lacked specifics regarding traditional taboos, leading to serious conflict:

Some local eco-tourism operators also took visitors to see *GST* in order to make money. These operators are mostly bad guys because they violate the traditional taboos. (LI005)

For those eco-tourism operators who violate taboos, the penalty has not been rescheduled, so the problem of misconduct was often heard:

Once a local tour guide took the tourists down (to the beach), I was urged to confirm whether the *GST* was laying eggs. I replied him that the *GST* had not yet laid eggs, but he still secretly took the tourists into the spawning area of the *GST*. (V1007)

The tour guide directly took the camera and turned on the flash to shoot the *GST* while laying egg. (V2006)

The interference from the tourists is even greater, and there are no norms or penalties:

The tourists are not very familiar with this species and have insufficient public morals. When they watched the *GST*, they sometimes caused damage. For example, they did not follow the rules on the beach and interfered with the *GST* that landed ashore to lay eggs. (V1009)

When the tourists go to see the *GST*, no one is responsible for protecting the *GST* and enforcing rules for the tourists. (LI010)

Conflict resolution mechanism

In conservation, differences in opinions between the stakeholders, between the conservation organizations, and between the conservation organization and the stakeholders are inevitable. In this case, a mechanism to quickly and cost-effectively address problems arising from different opinions is necessary (Principle 6). Traditionally, for the Tao people, the cost of harming *GST* has been internalized, affecting the health of their families and the production of their own farming. If there are still violations, the issues will be resolved by public condemnation. Therefore, Principle 6 has been reflected in the traditional mechanism of the Tao people. A conflict resolution mechanism between the Tao people and the conservation organizations and within the conservation organizations has not yet been established.

In fact, the fundamental goal of sea turtle conservation is quite consensual. The attitude of the conservation organization is self-evident, but the Tao people also agree with the conservation of sea turtles:

I think it is very good to have someone do this conservation work. (LR028)

Of course, we also agree with the conservation of the sea turtles. (LR030)

However, there are different opinions on the conservation practices. For example, egg transfer was conducted by the conservation volunteers as one of the measures to preserve *GST*:

We will move the eggs. (V1001)

However, the Tao people do not think that the conservation volunteers should move the eggs:

Even if the turtle eggs are washed away by the waves, it is the consequence of the choice of the mother turtle. The mother turtle chooses to lay eggs here, and you should not move the eggs to other places to change the location where the young turtles hatch. (LS028)

Tao people still believe in nature. They do not think that the process of the *GST* laying eggs and hatching the eggs in a certain location should be interfered. (V1016)

and they believe that the work of conservation volunteers interfered with the *GST*:

We have always been in balance with the *GST*, but such balance is no more after the conservation organization came here. (LR014)

Outside researchers or volunteers have actually brought more interferences to the *GST*. (LS027)

The conservation volunteers also clearly realized that moving the turtle eggs is opposed by the Tao people:

They were very surprised that we moved the nest. (V1001)

He believed that we are disturbing the *GST*, which is not conservation at all, it is simply a hindrance. (V1004)

They also suggested:

We should let the local people understand more about what we are doing. (V1011)

These contents show that the conservation volunteers understood the conflict and the differences in cognition between conservation volunteer tourism and the local residents and understood the cultural factors that caused conflict and cognition. They have the willingness to improve this situation but are powerless to change it. It was indicated that the work experience of the conservation volunteers could not effectively assist the conservation organization in adjusting or amending the conservation volunteer tourism activities. Therefore, the obstacles of Principle 6 should mainly come from inside the conservation organization (see description in section 3.2.3).

Recognition of the right to organization

This principle emphasizes the value of traditional management mechanisms in managing common resources and believes that the impact and restriction of external management organizations on traditional management mechanisms should be minimized (Principle 7). However, the conservation volunteers and conservation organizations did not recognize the value of the traditional Tao culture regarding GST conservation. Some conservation volunteers believed that the Tao tradition is 'insufficient in conservation concepts':

The elderly may not have a good concept of conservation. (V1001)

Instead of educating the tourists, I think it is better to educate the local residents in Lanyu with the correct concept of conservation, which is more conducive to conservation. (V1009)

The person in charge of the conservation organization also said

They (Tao people) have their freedom to destroy the environment. (V3001)

We adhered to the position and principles of the research and did not involve the affairs of Lanyu. (V3001)

Accordingly, the person in charge believed that the issues regarding GST are caused by the Tao people. They did not integrate the traditional management mechanisms of the Tao people in the conservation and management of GST. Therefore, this principle naturally did not exist in the conservation volunteer tourism program.

Nested governance

This principle emphasizes that the mechanism of common resource management must exist concurrently at the levels of the community, local government, and central government and that these levels of management must be integrated and mutually support each other (Principle 8). However, the management mechanism for GST occurs only at two management levels: the community and the central government. In addition, the various levels of GST conservation work were not fully integrated. In particular, the central government did not provide sufficient resources to the conservation organizations. The head of the conservation organization said:

I used to work on the island for 8–9 years with no funding (from the government). (V3001)

This is not because the central government had no budget for conservation but because the conservation funds must be re-applied for and reviewed every year. Therefore, the organizations that can obtain funds may not be the same every year.

The conservation organizations are different year by year, and the co-organizations are different year by year. The instructors who can be hired are also not the same every year. (V1016)

Under this circumstance, it is naturally difficult for the conservation organization to establish a long-term and trusting cooperative relationship with the Tao people. The person in charge said:

The work in Lanyu is very hard, and the Tao people simply don't trust us. (V3001)

However, the personal experience of the conservation volunteers shows that the barrier between the Tao people and the conservation organization is not completely impossible to be eliminated, for example:

When we lived in Yeyin, people (local residents) often chat with us. They also asked about some of our work conditions or provided information on the turtles coming ashore. Their attitude was not bad. (V1007)

However, after the location of the workstation changed:

When we lived in Hongtuo, our relationship with the local residents of Hongtuo was not as close as with the residents of Yeyin. There were no neighbors next to the place where we were living (Hongtuo workstation). (V1002)

The conservation volunteers found that when the workstation was set up with the Yeyin tribe, they often met and chatted with the local residents. The topics ranged from daily life to *GST*, which did not cause the Tao people to react negatively. Some Tao people even shared *GST* information based on their observations. However, the experience in other places was completely opposite.

If the conservation volunteers found that the location of the workstation could affect their interaction with the Tao people, why did they fix the workstation in Yeyin? The reason is that the government subsidy was not enough to set up a long-term workstation. For example, in reference to the government subsidy, the person in charge in 2015 said:

It was only \$200,000 (New Taiwan Dollar). (O3001)

Therefore, it is only possible to sign a lease contract for the workstation during the turtle spawning season. The location is dependent on the property that is available for rent each year, and the workstation could not be placed in an area suitable for interaction with the Tao people (Table 1).

Conclusion

Using Ostrom's common resource management principles to analyze the survey results regarding the *GST* volunteer tourism program in Lanyu, we found that the *GST* conservation volunteer tourism program in Lanyu violated most of Ostrom's common resource conservation principles. Although the principle of monitoring (Principle 4) was improved, this program blurred the resource boundary (Principle 1A, Principle 1B), did not respect for the rights of the local Tao people in participation (Principle 3) and management (Principle 7), and neglected the problems that may be caused by disputes (Principle 6). More serious impacts included changes in the local traditional culture (Principle 2) and the subsequent weakening of the penalty mechanism (Principle 5).

Table 1. Adaptation of Ostrom’s design principles for assessing Volunteer Tourism Program for Green Sea Turtles Conservation in Lanyu.

	Ostrom’s principles updated by Cox et al. (2010)	Tao’ Traditional Rules	Volunteer Tourism Program
Principle 1	Clearly-defined boundaries:		
	(A) Clear boundaries between legitimate users and nonusers must be clearly defined.	Present: Taboo clearly prohibits the Tao people from contacting, interfering with, or hunting <i>GST</i> .	Absent: Due to the promotion of <i>GST</i> eco-tourism, the original rights holders had changed from no one to any tourist.
	(B) Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.	Present: Taboo clearly prohibits the Tao people from entering <i>GST</i> habitats.	Absent: Moving eggs blurred the distribution of resources.
Principle 2	Congruence between appropriation rules and local conditions:		
	(A) Appropriation and provision rules are congruent with local social and environmental conditions.	Present: Each of these events expose evil spirits and violate the cultural taboo of the Tao people.	Absent: Each of conservation volunteers’ events such as calculating the number of landing turtles and their nests, installing transmitters on <i>GST</i> , and transferring eggs violates the cultural taboo of the Tao people
	(B) The benefits obtained by users from a commons are proportional to the amount of inputs.	Absent: There are no users of <i>GST</i> .	Absent: The development of guided tours and activities related to <i>GST</i> in Lanyu has not been popular thus far because most local people still regard <i>GST</i> as an evil spirit.
Principle 3	Collective-choice arrangements:		
	Most individuals affected by operational rules can participate in modifying the operational rules.	Present: The common traditional taboos shared by the Lanyu Tao people shaped their consensus of <i>GST</i> .	Absent: The Tao people did not participate in the conservation volunteer tourism from the beginning.
Principle 4	Monitoring:		
	Monitors who are accountable to the users monitor the condition of the resource.	Absent: The Tao people consider <i>GST</i> to be evil spirits, so <i>GST</i> were not monitored.	Partially Present: The volunteers must go to the beach where <i>GST</i> come ashore to calculate the number of turtles and nests, install transmitters on <i>GST</i> , and carry out conservation work such as egg transfer. However, monitoring data for <i>GST</i> in Lanyu was not disclosed and was not reported to the Tao people.
Principle 5	Graduated sanctions:		
	Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense).	Absent: The Tao people who violate taboos are subject to various forms of punishment.	Absent: Some of the traditional punishments were no longer effective for the Tao people engaged in <i>GST</i> eco-tourism. The tourists who come to the island for <i>GST</i> eco-tourism are not subjected to the norms of the Tao traditional culture, and their misconduct is not subject to any restrictions.
Principle 6	Conflict-resolution mechanism:		
	Appropriators have rapid access to low-cost local arenas to resolve conflicts between them.	Present: The issues of violating <i>GST</i> related taboos will be resolved by public condemnation.	Absent: A conflict resolution mechanism between the Tao people and the conservation organizations and within the conservation organizations has not yet been established.

(Continued)

Table 1. Continued.

	Ostrom's principles updated by Cox et al. (2010)	Tao' Traditional Rules	Volunteer Tourism Program
Principle 7	Minimal recognition of rights to organize:		
	The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.	Absent: There was no official acknowledgement of the taboos reeated.	Absent: The conservation volunteers and conservation organizations did not recognize the value of the traditional Tao culture regarding <i>GST</i> conservation.
Principle 8	Nested Enterprises:		
	Appropriation, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.	Absent: There were no interactions with other scaling levels of management.	Absent: There were no interactions with other scaling levels of management.

As for the reasons, there were internal problems within the conservation organization itself, and the government cannot be absolved from blame (Principle 8). The conservation organization enacted professionalism through conservation but lacked professionalism with regard to social issues, such as community and culture. This objective fact is not a target to be blamed, but it did hinder the work of conservation for volunteer tourism. However, this problem is not unsolvable, but the fundamental solution is not in the hands of the conservation organizations or the Tao people but in the appropriate authorities of Taiwan.

In terms of *GST* conservation in Lanyu, the appropriate authorities in Taiwan should develop a long-term conservation program and provide long-term and sufficient funds for conservation organizations to implement activities. For example, if the conservation organization has the funds to set up a long-term workstation in Yeyin, the opposition and conflict between the conservation volunteers and the Tao people can be greatly reduced. If it is impossible to provide funding to the conservation organization for a full year or for years of conservation workstation operation, the appropriate authorities can coordinate implementing the conservation plan through various conservation organizations in Lanyu so that the conservation workstation can be co-rented. Providing funding to the conservation organization for habitat management (such as cleaning the beach) can not only improve the opinion of the Tao people regarding the conservation organization but also make the conservation volunteer tourism more effective.

The appropriate authorities can also utilize senior scholars and experts on Tao culture and social communication to help solve the communication problems between the conservation organization and the Tao people, to assist in the integration of traditional cultural taboos and to respect the cultural taboos of the Tao people regarding *GST*. This practice can gain respect from the Tao people regarding the conservation organization and reduce the rejection and resistance of the Tao people to *GST* conservation work. When the cultural taboos regarding *GST* is emphasized and valued again, those who supervise violations of taboo norms can increase punishments to deter misconduct that interferes with *GST*.

The problems encountered in conservation volunteer tourism are expected to be eliminated through funds, manpower, and communication from the appropriate authorities; however, the problems have already changed the ecological culture of the Tao people.

The Tao people originally had myths, taboos, and social punishments related to not entering the *GST* habitat and not touching and not disturbing *GST*. These cultures are all affected and changed by the *GST* eco-tourism program promoted by the conservation volunteers. This cultural change directly threatens the survival of *GST*, as the on-shore spawning process of *GST* is subject to more human interference.

The *GST* eco-tourism program in Lanyu originated from a market incentive mechanism used by international turtle conservation. The case of Lanyu showed that the market incentive mechanism cannot be applied to the whole world and that its planning and adoption must consider the local conditions. However, the incentives that the Tao people expected are only that the conservation organization will report its research results to the Tao people and that the conservation volunteers will clean the beach during their work. These incentives are as easy to fulfill without the conservation organization needing to resort to external help. Ignoring these easy incentives and introducing the foreign experience led to very negative results. This problem stemmed from the fact that the person in charge neglected to understand the needs of the tribe, causing failure in achieving the original goal.

This study used Ostrom's common resource management principles to analyze the failure of the *GST* conservation volunteer tourism program in Lanyu. We found that the conservation volunteer tourism program caused cultural changes, which threatened the survival of *GST*, failed to provide market incentives, and lacked internal communication within the conservation organization. These problems, which have rarely been discussed in the literature, can be used as a guide for subsequent volunteer tourism and ecological conservation research. We also found the crux of cruxes, i.e. the failure of the government. The Taiwan authorities provided funds to attract conservation organizations to Lanyu, but the funds were not sufficient to solve the problems created by the conservation work itself; after the problems occurred, the appropriate authorities did not provide the necessary assistance. Therefore, superficially, the *GST* conservation issue in Lanyu is the conflict between the Tao people and the conservation organization, but in essence, it is the lack of competent authority regarding *GST* conservation. We suggest that conservation organizations develop and implement the conservation measures that are in line with the customs of the local people. Additionally, the competent authorities should provide funds and communication resources on their own initiative to help conservation organizations make good use of local ecological conservation mechanisms and to promote constructive conservation volunteer tourism. In the event of insufficient resources, the conservation organization should at least report to the Tao people by sending the results of the volunteer tourism program and clean the beach to the best of their ability so that they can rely on their own efforts to reduce the confrontation and conflict with the Tao people.

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Notes on contributor

Tzu-Ming Liu is currently conducting research related to stakeholders' understanding and involvement in the sustainable tourism development process. His research interests include spatial economic analysis, tourism demand, sustainable tourism development, indigenous community development, and impacts of climate change on tourism.

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