

Republic of Palau

FY2021 Ex-Post Evaluation Report of Technical Cooperation Project (SATREPS<sup>1</sup>)

“Project for Sustainable Management of Coral Reef and Island Ecosystems:  
Responding to the Threat of Climate Change”

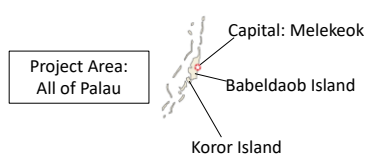
External Evaluator: Keisuke Nishikawa, QUNIE CORPORATION

## 0. Summary

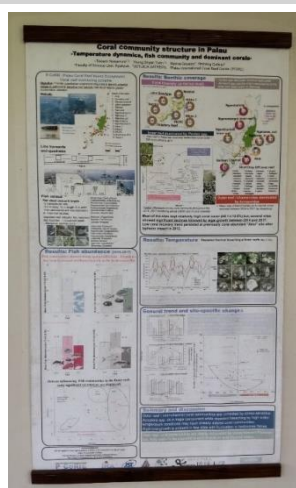
This project aimed to strengthen the capacity of implementing agency in Palau to conduct research on coral reef island ecosystems and to sustainably maintain them. The project was highly relevant at the time of planning and completion, as it was consistent with Palau's development plans and needs, as well as with Japan's ODA policy toward the Pacific and Palau at the time of planning. The project purpose and outputs were largely achieved, and the formulation and implementation of policies for the management of coral reef island ecosystems in Palau were confirmed after the project completion, as seen in a case where the research outcomes have been utilized with a few exceptions and have contributed to the formulation of a new policy. Therefore, the effectiveness and impact of the project are high. Regarding the implementation of the project, the project period was within the plan, but the project cost exceeded the plan, so the efficiency of the project is fair. The sustainability of the project effects is judged to be high, since there were no concerns regarding policy and political commitment, the institutional and organizational aspects of the implementing agency and their capacity to conduct research and awareness-raising activities were sufficient, and there were no major financial issues.

In light of the above, this project is evaluated to be highly satisfactory.

## 1. Project Description



Project Location (All of Palau)



Exhibition panels displaying the research outcomes of this project

<sup>1</sup> Science and Technology Research Partnership for Sustainable Development

## 1.1 Background

Although coral reefs cover less than 1% of the total ocean area, they are home to more than 93,000 species, making them an area of extremely high biodiversity. Palau is located in an area of the world with a high diversity of reef-building coral species, and the importance of preserving the country's coral reef ecosystem is internationally recognized. The Government of Palau has positioned the development of tourism using the natural environment as the mainstay of its economic development, and the conservation of coral reef ecosystems is an important issue. However, it is necessary in recent years to develop and implement comprehensive measures for the management of coral reef island ecosystems due to the increase in land development and tourism use and the effects of climate change.

Through researches focusing on the Okinawa Islands, the University of the Ryukyus has demonstrated that global warming and ocean acidification, in addition to local-scale environmental impacts associated with development activities, cause a decline in coral reef biodiversity and ecosystem services, resulting in significant losses to the islands' economy, society, and culture. In addition, the University had an active relationship with the Palau International Coral Reef Center (hereinafter referred to as "PICRC"), the counterpart institution of this project, through the acceptance of graduate students and trainees, discussions in the International Coral Reef Initiative, and other activities.

Against this backdrop, the Government of Palau has proposed this project to Japan as a SATREPS project, with the aim of proposing comprehensive policy options for the management of coral reef island ecosystems through the promotion of collaborative scientific research and human resource development between the University of the Ryukyus and PICRC as the implementing institution, and the request was approved.

## 1.2 Project Outline

Overall Goal		To have the results of this project utilized for policy formulation and management of the coral reef and island ecosystems in Palau <sup>2</sup>
Project Purpose		Capacity of sustainable management of coral reef and island ecosystems in Palau is enhanced <sup>3</sup> .
Outputs	Output 1	Scientific data systems needed for self-sustained monitoring of the environment and coral reef and island ecosystems are acquired and organized.
	Output 2	Natural science and social science data are analyzed and evaluated to extract knowledge and ideas that can contribute to the

<sup>2</sup> As explicitly stated in the indicator for the Overall Goal, it refers to the utilization in the formulation and implementation of policies "by the Palauan government."

<sup>3</sup> It refers to the strengthening of the research and sustainable management capacity of the Palauan research institutions: the Palau International Coral Reef Center (PICRC) and the Palau Community College (PCC).

		sustainable management of coral reef and island ecosystems under the influence of climate change.
	Output 3	A wider understanding in the general public for biodiversity, ecosystem services, and the conservation of coral reef and island ecosystems is created.
	Output 4	Human resource development is achieved through the sharing of expertise and knowledge necessary for the conservation of coral reef and island ecosystems.
	Output 5	Documentation of policy options/proposals that support/contribute to the conservation of coral reef and island ecosystems is finalized.
Total cost (Japanese Side)		356 million yen
Period of Cooperation		April 2013 – March 2018
Target Area		All of Palau
Implementing Agency		Palau International Coral Reef Center (PICRC), Palau Community College (PCC)
Organization in Japan		University of the Ryukyus, Japan Wildlife Research Center, Tokyo Institute of Technology
Related Projects		<p>&lt;JICA&gt;</p> <p>[Technical Cooperation]</p> <p>Palau International Coral Reef Center Strengthening Project (2002-2006)</p> <p>The Capacity Enhancement Project for Coral Reef Monitoring (2009-2012)</p> <p>[Grant Aid]</p> <p>The Project for Construction of Palau International Coral Reef Center (1999)</p> <p>&lt;Other international organizations and aid agencies&gt;</p> <p>[National Oceanic and Atmospheric Administration]</p> <p>Supporting socioeconomic monitoring of Marine Protected Areas (MPAs) through community participation through the Micronesia Conservation Trust (MCT)</p> <p>[EU]</p> <p>Supporting the climate change educational program (Global Climate Change Alliance) through the University of the South Pacific</p>

### 1.3 Outline of the Terminal Evaluation

#### 1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

One of the three indicators set for the Project Purpose had already been achieved, and the activities for the other two indicators were also implemented in the final year of the project (5th Year) and the indicators were expected to be achieved by the end of the project.

#### 1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation

The indicator for the achievement of the Overall Goal was that "Recommended policy alternatives proposed by the project are adopted by Palauan government as part the adaptation to climate change," which was expected to be "achievable" since the implementing agencies were aiming to prepare and submit proposals to policymakers for the adoption by the FY2019/2020.

#### 1.3.3 Recommendations from the Terminal Evaluation

The following recommendations were made to the Palauan side in the terminal evaluation study.

- (1) The leadership of PICRC and PCC has played an important role in the implementation of the project activities, and this leadership should be maintained for the continuation of the project activities and the achievement of the Overall Goal.
- (2) PICRC has acquired advanced knowledge and information on coral reef island ecosystems and their sustainable management through the implementation of the project and has made progress in capacity building, and will further consider becoming a Center of Excellence to promote sustainable management of coral reef island ecosystems in the Asia-Pacific region.
- (3) By fully recognizing the importance of communications with the general public, PICRC will consider securing human resources such as communication specialists in the scientific field and the funding source for that purpose.

## **2. Outline of the Evaluation Study**

### 2.1 External Evaluator

Keisuke Nishikawa, QUNIE CORPORATION

### 2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: July, 2021 – June, 2022

Duration of the Field Study: October 17, 2021 – November 8, 2021

### 3. Results of the Evaluation (Overall Rating: A<sup>4</sup>)

#### 3.1 Relevance (Rating: ③<sup>5</sup>)

##### 3.1.1 Consistency with the Development Plan of Palau

In 1996, immediately after Palau's independence in 1994, the country formulated the *Palau National Master Development Plan* (PNMDP 2020) as a long-term development plan up to 2020, with the goals of economic independence and environmental and cultural protection. At the time of planning of this project, the *Medium-Term Development Strategy* (2009-2014) was effective based on this long-term plan, and environmental conservation was positioned as one of the highest priority development issues in the strategy.

In addition, the *Protected Areas Network Act (PAN Act)* was enacted in 2003, which set a framework for the national government to manage protected areas established by each state from the perspective of environmental conservation. As a result, protected areas were designated nationwide. Furthermore, this concept was extended to other Micronesian countries, and a joint policy declaration document called the "Micronesia Challenge" was adopted in 2006 to address environmental conservation on a regional basis.

Upon completion of the project, these policy directions were checked, which confirmed that the *PAN Act* remained in effect, and also that there has been no change in the Republic of Palau Public Law 7-42, enacted in 2008, which introduced "green fees" and created the PAN Fund to help achieve the goals of the Micronesia Challenge. In addition, various other policy frameworks, strategies and action plans were developed during the implementation period of the project, as shown below.

##### *Palau Climate Change Policy* (2015)

This, as one of the climate change adaptation activities, is to “conduct detailed site-specific studies on the effects of ocean acidification on marine ecosystems and fisheries.”

##### *Revised National Biodiversity Strategy and Action Plan* (2015-2025)

This is a framework aiming to enable the efficient and sustainable use of natural resources and biodiversity to meet today's development needs while protecting them for future generations.

##### *Palau National Marine Sanctuary Act* (2015)

This designates 80% of the Exclusive Economic Zone as a marine protected area, prohibiting fishing and extraction of other resources, and imposes strict restrictions on fishing in the remaining 20% of the zone.

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<sup>4</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>5</sup> ③: High, ②: Fair, ①: Low

*Palau Responsible Tourism Policy Framework (2017-2021)*

The action plan for this framework includes “determining the level of acceptable impact on the environment, culture, and region of Palau and establishing a range of sustainable carrying capacities.”

Thus, the mid-2010s saw the presentation of policy direction on climate change action, the development of a strategy and action plan in the area of biodiversity, the enactment of a law on marine protection, and the development of a policy on the promotion of sustainable tourism; and it confirmed the development of a coherent direction for the conservation of Palau's natural environment.

Therefore, this project, which aimed to improve the research and management capacity of the ecosystem, was consistent with these policy directions both at the time of planning and at the time of completion.

### 3.1.2 Consistency with the Development Needs of Palau

At the time of planning this project, Palau had positioned tourism development utilizing its rich natural environment, including coral reefs, as the mainstay of its economic development, and conservation of the coral reef ecosystem was an important national policy issue. On the other hand, there were concerns in Palau that the health of the coral reef ecosystem was being compromised by the conversion of natural forests to agricultural land, destructive fishing methods and overfishing, land development, rising sea water temperatures and ocean acidification, and other factors. In fact, large-scale coral bleaching was reported in Palau waters in 1998 and 2010.

At the time of project completion, Palau was located in an area of the world with a high diversity of reef-building coral reefs, and the importance of preserving the country's coral reef ecosystem was internationally recognized. However, Palau's coral reefs were exposed to both human-induced pressures, such as overfishing, the effects of many divers and others, and the effects of coastal development, and natural pressures, such as climate change and large-scale coral bleaching. In addition, there were concerns about the loss of coral reef ecosystems due to increased land development and tourism use for economic growth and the effects of climate change. To achieve sustainable socioeconomic development, comprehensive measures for the management of coral reef island ecosystems through community-based environmental management and data-based national environmental management were needed.

Thus, the needs for the conservation and sustainable use of Palau's coral reefs were very high both at the time of planning and at the time of completion. As a project that meets the

need for ecosystem conservation, this project can be said to have been in line with Palau's development needs.

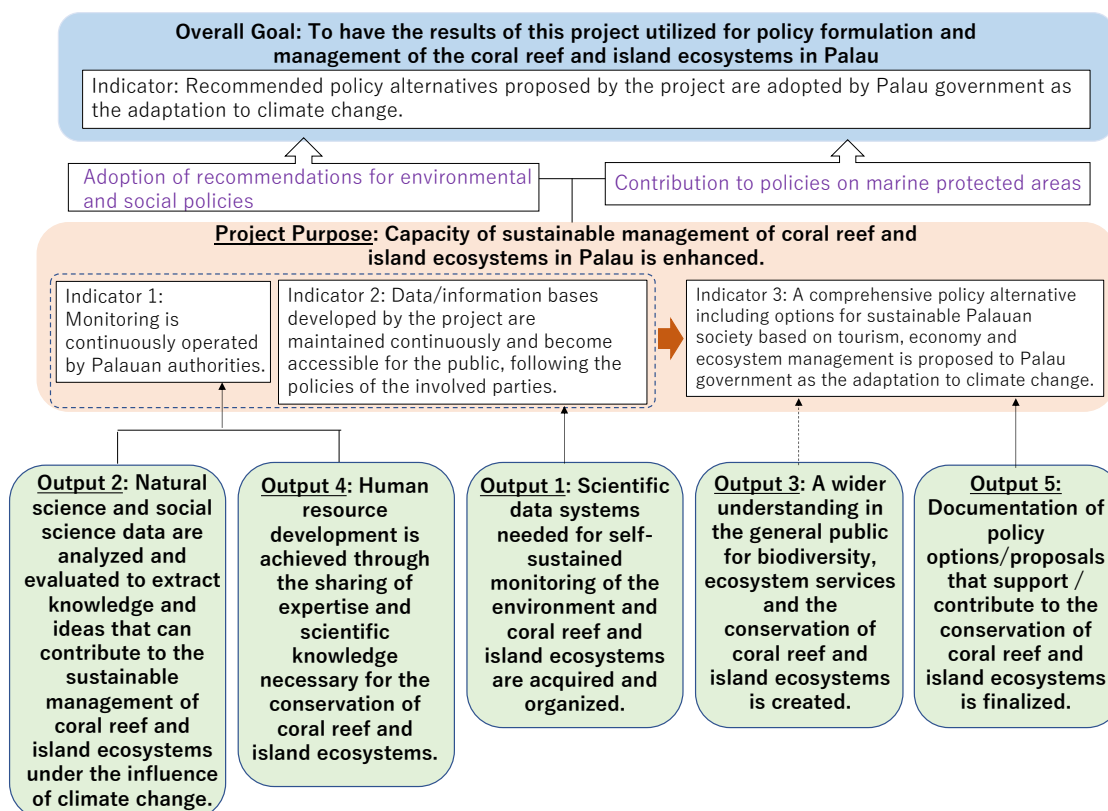
### 3.1.3 Consistency with Japan's ODA Policy

Japan had identified the "Environment and Climate Change" area as one of the priority areas for the Pacific region at the 6th Pacific Islands Leaders Meeting held in 2012. In addition, the *Country Assistance Policy for the Republic of Palau (2012)* stated that Japan would place emphasis on support for environmental conservation in order to preserve coral reef ecosystems, and specifically, in the attached "Rolling Plan" of the policy said that Japan would support PICRC's efforts to strengthen its coral reef monitoring function and protected area network and would support the promotion of the Micronesia Challenge, and that Japan would promote natural environment conservation.

Therefore, it can be said that this project was in line with Japan's ODA policy for the Pacific region at the time of planning. In addition, the Country Assistance Policy for Palau more specifically set out support for coral reef conservation, which made this project highly consistent with Japan's ODA policy at the time of planning.

### 3.1.4 Appropriateness of the Project Plan and Approach

A conceptual diagram of the causal relationship between the project Outputs, Project Purpose, and the Overall Goal is shown in Figure 1. The Project Design Matrix (PDM) was changed twice during the implementation of this project. However, there were consistently no changes to the Overall Goal, Project Purpose, and the five Outputs, and only minor changes were made to the extent that some of the indicators for Output 1 and Output 2 were reorganized. The changes did not have negative impacts on the achievement of the Project Purpose and Outputs of the project, and it was judged that there were no problems.



Source: Prepared by the evaluator

Figure 1: Relationship between Outputs, Project Purpose, and Overall Goal of This Project

It was confirmed that this project was consistent with Palau's development plans and needs at both the times of planning and completion, as well as with Japan's ODA policy toward the Pacific region and Palau at the time of planning. In addition, there were no problems with the project plan and approach.

Therefore, it is judged that the relevance of this project is high.

### 3.2 Effectiveness and Impact<sup>6</sup> (Rating: ③)

In this project, it was aimed to strengthen the research and sustainable management capacity of the implementing agencies on island ecosystems through (1)organizing scientific data systems necessary for monitoring, (2)identifying knowledge and issues conducive to sustainable management of ecosystems, (3)fostering public understanding of ecosystem conservation and services, (4)sharing expertise and knowledge necessary for ecosystem conservation, and human resource development, and (5)making policy recommendations conducive to ecosystem conservation. Based on it, it was expected, after the completion of the project, that the implementing agency would formulate and implement policies for the management of coral reef island ecosystems in Palau. This

<sup>6</sup> Sub-rating for Effectiveness is to be put with consideration of Impact.



section examines the status of achievement of the Outcomes, the Project Purpose, and the Overall Goal.

### 3.2.1 Effectiveness

#### 3.2.1.1 Project Output

The project was expected to generate the project outcomes in the above five areas (1) to (5).

First, with regard to the outcome of organizing a scientific data system necessary for continuous monitoring of coral reef island ecosystems and the marine environment, related activities were conducted and various databases, protocols, and manuals were developed. It was planned that the database developed would be made available to the public, but it cannot be said that the access by the public was sufficient. However, the scientific database was not intended to be generally accessible, but rather developed as the specialized data for researchers. Therefore, it was not necessarily necessary to make the database itself available to the public. The PICRC website has a page where some of the analysis results from the database are made available to the general public<sup>7</sup>, and this has played a certain role in fostering understandings. Therefore, although the database is not necessarily made open to the public, it can be said that the database necessary for monitoring was organized.

With regard to the identification of knowledge and issues conducive to the sustainable management of coral reef island ecosystems under the effects of climate change through natural and social scientific analysis and assessment, through the activities of this project, research results have been externally published well above the target<sup>8</sup>. As a result of the research activities, PICRC's research capacity has improved and it has the ability to continue its own research using the equipment procured under this project.

As for the efforts to increase understanding of the conservation of coral reef island ecosystems, biodiversity and ecosystem services among the local population, panel displays on activities were conducted to inform aquarium visitors about the activities. The number of aquarium visitors is shown in Table 1, and although the majority of visitors are from overseas (mainly tourists), 337 to 581 Palau residents, equivalent to 2 to 3% of the total population (during the project period), visited the aquarium every year, which seems to have led to a certain spreading of understandings<sup>9</sup>. It was also confirmed that many

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<sup>7</sup> <https://picrc.org/works/#dataVis>

<sup>8</sup> The goal was to have at least one research outcome reported each at a Japanese or international academic conference and in an international journal by the fourth year of the project. The results were seven presentations at Japanese academic conferences, ten presentations at international academic conferences, and one peer-reviewed paper in an international journal.

<sup>9</sup> The layout of the aquarium was changed after the project was completed, and at the time of the ex-post evaluation, the panel displays related to the activities had been removed. However, panels related to some of the project's research outcomes remained on the wall outside the aquarium.

seminars and workshops were held for Palauan stakeholders and residents during the project period.

Table 1 Number of Visitors to Palau Aquarium

	2014	2015	2016	2017	2018	2019	2020	2021
Residents in Palau	337	581	473	474	492	549	131	212
Overseas visitors	1,884	3,343	4,191	3,295	3,707	3,585	702	145
Total	2,221	3,924	4,664	3,769	4,199	4,134	833	357

Source: Information provided by PICRC

In terms of human resource development, it was also expected that the project team would share the expertise and knowledge necessary for the conservation of coral reef island ecosystems in this project, and that PICRC personnel would be trained. In this regard, by the time the project was completed, experimental protocols in molecular biology and physiology had been developed and used by PICRC, and it was confirmed that the project's research outcomes were published in peer-reviewed international journals, one in 2016 and two in 2018.

The fifth output was that policy recommendations conducive to the conservation of coral reef island ecosystems would be made, and the following achievements were identified

- (1) Data and information on environmental response were defined and included in technical reports.
- (2) Several recommendations on the reduction of environmental impacts were made by each research group<sup>10</sup> established in this project.
- (3) The outcomes of each research were submitted to academic journals and presented at conferences, and were also compiled into technical reports published by PICRC, and a policy summary for policy makers was also prepared, summarizing the policy recommendations from the technical reports. Finally, in March 2018, just before the completion of the project, they were submitted as a policy recommendation package to the Palauan states, the PAN Secretariat, and the Ministry of Natural Resources, Environment and Tourism.

Based on the above, it can be judged that the outputs set for this project have been achieved as a whole.

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<sup>10</sup> The project included activities by six groups: the Biological Change Group, the Biodiversity Group, the Environmental Change Group, the Socio-Economic Evaluation Group, the Human Resource Development Group, and the Public Awareness Group.

### 3.2.1.2 Achievement of Project Purpose

The Project Purpose of this project was “Capacity of sustainable management of coral reefs and island ecosystems in Palau is enhanced.” Table 2 summarizes the indicators to measure the level of achievement and the actual achievements.

Table 2 Achievement of Project Purpose

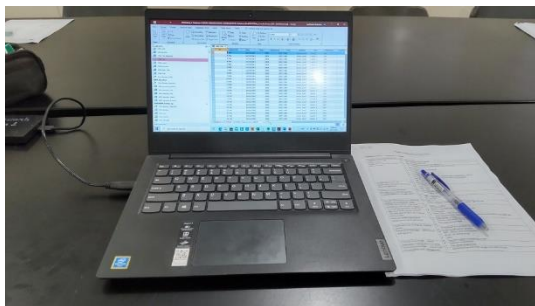
Purpose	Indicator	Actual
Project Purpose	1. Monitoring is continuously operated by Palauan authorities.	Protocols and manuals for coral reef monitoring were developed through the activities of this project. They have been shared with the Palau side, and monitoring activities based on them were being conducted. Specifically, the monitoring of permanent quadrats in order to measure areal changes in reef-building coral cover in the inner bay area of the coral reef, the acquisition of environmental data by using water temperature loggers, and the measurement of water quality were being conducted.
	2. Data/information bases developed by the project are maintained continuously and become accessible for the public, following the policies of the involved parties.	The database was developed, and was managed and utilized within the implementing agency. On the other hand, due to its specialized content, the database was not made available to the public.
	3. A comprehensive policy alternative including options for sustainable Palauan society based on tourism, economy and ecosystem management is proposed to Palauan government as the adaptation to climate change.	In addition to the technical report, policy recommendations were prepared and ultimately submitted as a policy recommendation package to the Palauan states, the PAN Secretariat, and the Ministry of Natural Resources, Environment and Tourism in March 2018.

Source: Terminal Evaluation Report, Completion Report, and information provided by the implementing agency

Through the implementation of this project, the monitoring methods and data analysis supported by the project were incorporated into the normal operations of the implementing agency, and the capacity to monitor and analyze changes in coral reefs was enhanced, as well as to develop and manage the database. Policy recommendations were also made to the Palauan government (central and state). Specifically, a "Science and Policy: Dialogue with OEK Members" was held at PICRC in July 2017, and the "Science Policy Dialogue: Call for Action" (declaration) was signed. In December of the same year, field briefings with interpretation into Palauan were held in the states of Airai and Koror, and the “Paradise of Nature,” authored by the project members and Palauan stakeholders, was

published. The guidebook was distributed free of charge to all Palauan high schools to contribute to science-based policies from an educational perspective.

As a whole, the project was largely successful in monitoring of research contents, developing and maintaining databases<sup>11</sup>, and making policy recommendations, and it can be said that the Project Purpose was achieved at the completion of the project.



Database developed in this project  
(PICRC)



Laboratory with DNA analysis equipment  
(PCC)

### 3.2.2 Impact

#### 3.2.2.1 Achievement of Overall Goal

The Overall Goal of the project was “To have the results of this project utilized for policy formulation and management of the coral reef and island ecosystems in Palau.” Output 5 and the Project Purpose (Indicator 3) already stated that policy recommendations would be made within the project period, and as a result of activities in the final year of the project (5th Year), this was achieved at the time of project completion. It was expected that these efforts would be continued after the completion of the project, and the status of achievement at the time of ex-post evaluation (three and a half years after the completion of the project) is shown in Table 3.

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<sup>11</sup> As noted in "3.2.1.1 Project Output," although the database was developed, it was not made open to the public because of its specialized contents.

Table 3 Achievement of Overall Goal

Goal	Indicator	Actual
Overall Goal	Recommended policy alternatives proposed by the project are adopted by Palauan government as the adaptation to climate change	<ul style="list-style-type: none"> <li>- In April 2020, Palau passed and implemented a law banning the export of coral reef fish. The scientific evidence for this law came from researches by PICRC.</li> <li>- The State of the Environment Report (2019) published by the National Environmental Protection Council reports on the current status and challenges related to coral reefs as a marine environment, with the majority of the data provided by PICRC. It is perceived that the data will lead to an accurate understanding of the current situation, which is necessary for policy making.</li> <li>- After the completion of this project, the collaborative international research continued, with three peer-reviewed papers published in academic journals (2019, 2020, and 2021).</li> </ul>

Source: Terminal Evaluation Report, information provided by the implementing agency

After the completion of the project, a law banning the export of reef-dwelling fish was passed in 2020, as described in Table 3, which was one of the items listed in the "Science Policy Dialogue: Call for Action" signed with the Palau Congress in 2017 (banning excessive fish harvesting in the reef). This is a concrete example of the achievement of the Overall Goal, as the scientific basis for its enactment was provided by the research of PICRC. In addition, it can be said that the publication of the 2019 State of the Environment Report, reporting on the current status and issues related to Palau's coral reefs, provided basic information for policymaking. According to PICRC, the outcomes of the research on sea level rise in Melekeok State conducted under this project have been indirectly utilized in Palau's disaster management policy. Furthermore, PICRC attended various government meetings on environment and tourism to provide data and opinions from a professional perspective, and has also taken on the role of the secretariat of the Palau National Marine Sanctuary since 2019<sup>12</sup>, and played a central role in the Our Ocean Conference<sup>13</sup> held in Palau in 2022. Thus, PICRC has been actively involved in activities related to marine conservation. In this way, it can be said that the information collected and analyzed by PICRC through monitoring and other means is greatly utilized for policy making and analysis of Palau's environment.

On the other hand, the establishment of a framework for how the various recommendations would be reflected as policies after the completion of the project was not necessarily sufficient. Therefore, there was no particular policy dialogue with the

<sup>12</sup> The Palau National Marine Sanctuary Act (effective from 2020) designates 80% of the Exclusive Economic Zone as a no-take zone with the aim of restoring fishery resources.

<sup>13</sup> An international conference focusing on marine environmental issues such as marine protected areas, sustainable fisheries, marine pollution and the impact of climate change on the oceans. It has been held annually since 2014 (although it had been postponed since 2020 due to the global spread of COVID-19).

Congress as was seen during the project implementation period, and not many of the policy recommendations presented were actually adopted and implemented. However, in JICA's Technical Cooperation Project “Project for Enhancement of Integrated Management of Coastal Ecosystems in Palau for Strengthening their Resilience to Climate Change” (PICRC is the counterpart organization), which started in 2022, the project aims to enhance the capacity for integrated coastal ecosystem management, including measures to address the impact of terrestrial activities on marine areas and to carry out environmental conservation along coastal areas for a long term, in collaboration not only with PICRC but also with other government agencies. Therefore, further enhancement of the research, monitoring, education, and awareness-raising capacities for coral reefs strengthened through this project, and promotion of environmental conservation and sustainable use of coral reefs, will lead to further development of the achievements of this project<sup>14</sup>.

Based on the above, the Overall Goal was largely achieved.

It was also confirmed that the outcomes generated through the activities of the project also continued to be generated after the completion of the project. The main results were as follows.

#### Status of Utilization of Research Outcomes

Activities other than molecular biological experiments have been continued since the project was being implemented.

#### Capacity building and development of researchers

Efforts are underway to develop a protocol for socioeconomic monitoring in the Micronesian region, with PICRC playing a leading role.

#### Ongoing Status of Related Research

Monitoring of coral reefs (monitoring of changes in reef-building coral cover in permanent quadrats, acquisition of environmental data by using water temperature loggers, and measurement of water quality) and socioeconomic impact analysis are mainly continued.

#### Status of new studies derived from research findings

Socio-economic survey and ecosystem survey in the marine protected areas in Airai

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<sup>14</sup> The research outcomes of sea level rise, typhoon intensification and ecosystem services, which were the research targets of this project, are linked to the achievement of the Overall Goal in the new project, and the activities to create environmental education materials are linked to the enhancement of public relations, education, and dissemination activities in the new project. In this way, there is an awareness of the linkages between this project and the new project, and further development of the outcomes of this project is expected.

Bay, participation in ocean acidification research project, water quality survey in marine protected areas, and coral bleaching survey are being conducted as new research activities, by applying the research outcomes of this project.

#### Utilization and maintenance status of research equipment provided

All equipment has been utilized and maintained.

When checked at the time of ex-post evaluation, the activities newly introduced under the project were generally continued as described above. Although there has been no progress in opening databases to the public, the main reason is that specialized databases are rarely used and the need to open them to the public is not felt. Although a certain level of public access is considered necessary to deepen international research, there are some data that are not suitable for public access, so there should be no problem if they can be made available to the public on an as-needed basis. In addition, molecular biological experiments were no longer being conducted. This is partly due to the influence of the factor that the personnel and staff of PICRC are not sufficient to handle such experiments, and it is considered necessary to have another discussion among the parties concerned, including experts, on the necessity of continuation of the experiments.

#### 3.2.2.2 Other Positive and Negative Impacts

As other impacts, it was attempted in this ex-post evaluation to identify impacts on the natural environment, resettlement and land acquisition, and other unexpected positive and negative impacts.

##### (1) Impact on the natural environment, resettlement and land acquisition

This project aimed at capacity building through research on the conservation of coral reef ecosystems and contributes to the improvement of the marine environment, and has positive impacts on the natural environment in the medium to long term. No particular negative impact was observed during or after the project implementation. In addition, due to the nature of the project, resettlement and land acquisition did not occur. As a whole, it can be said that there were no problems in terms of environmental and social considerations.

##### (2) Other impacts

By the completion of the project, the following impacts were mainly observed to have been realized through the implementation of the project.

- Strengthening of the ecosystem monitoring capacity of the coordinators of the

Protected Areas Network and the rangers in Airai and Koror states (acquisition of ecosystem indicators and monitoring methods in line with the monitoring plan).

- Creation of opportunities for PCC students to engage in DNA analysis after the establishment of a molecular biology (DNA analysis) laboratory at PCC, and utilization of the laboratory by government agencies.
- Reduction of the cost and time for monitoring through semi-automation of the processing of photographic data using the technology introduced in this project.
- New findings on biodiversity: Discovery of an undescribed species of Zoantharia in 2016 (a scientific name given) during the activities of the project.

In the ex-post evaluation, the following opinions were mainly obtained from the Palau Visitors Authority, a newspaper publisher, and an NGO when they were asked about the impact of the project activities on the region other than the impacts mentioned above.

- The provision of information on the marine environment, including coral reefs by PICRC and newspaper coverage of the project's activities have increased the overall understanding of the local residents regarding marine ecosystems. It also became possible to quantitatively demonstrate the impact of the activities on the implementation of various projects in the communities.
- Through the provision of information on coral reef growth to diving operators, some of them came to obtain sustainable diving certification. It can be said that this is a positive impact on the promotion of the tourism industry.
- Educational programs such as coral planting and shellfish releases are beneficial to the diving industry. In community-visiting tours in each state, programs related to marine environment are provided and seafood is served for meals. In such occasions, information on the coastal marine environment can now be utilized.

As mentioned above, through the implementation of this project, it was confirmed that not only the technical capacity of the people involved was improved, but also the community and residents' understanding of the marine environment and the importance of its conservation was deepened, and a positive impact on the tourism industry and educational benefits were realized. It is considered that these are points that can be highly evaluated from the perspective of sustainable use of marine resources.

The Project Purpose and Outputs of this project have largely been achieved, and the effectiveness of the project is judged to be high. In addition, the Overall Goal was also



largely achieved, and the utilization of research outcomes has continued with some exceptions. These outcomes have been utilized in the planning and implementation of policies for the management of coral reef island ecosystems in Palau, and thus the impact of the project can be said to be high.

Therefore, the effectiveness and impact of this project are high.

### 3.3 Efficiency (Rating: ②)

#### 3.3.1 Inputs

The planned and actual results of this project are as follows.

Table 4 Project Inputs (planned and actual)

<b>Inputs</b>	<b>Plan</b>	<b>Actual</b>
(1) Experts	Long-Term: 1 Short-Term: 3-4/year	Long-Term: 1 Short-Term: 18
(2) Trainees received	Long-Term: 2	Long-Term: 2 Short-Term: 8
(3) Equipment	18 million yen	One research boat, water quality measurement related equipment, DNA analysis equipment, experimental water tanks and systems for acidification and global warming, etc. (approx. 72 million yen in total)
(4) Overseas Activity Cost	22 million yen	Approx. 75 million yen
Japanese Side Total Project Cost	344 million yen in total	356 million yen in total
Palauan Side Total Project Cost	Assignment of counterparts, provision of laboratory facilities, and necessary budgetary measures	Counterpart assignment: 29 persons (25 PICRC, 4 PCC), Project operation and management expenses: approx. 78 million yen (fees for research vessel, utilities, personnel expenses for researchers engaged in the project, laboratory and office expenses, etc.)

Source: Ex-ante Evaluation Summary, Completion Report, materials provided by JICA

#### 3.3.1.1 Elements of Inputs

This project mainly targeted PICRC researchers, and the Palauan side reported that the number of researchers involved was as expected and they bore the costs of the project as necessary. It can be said that the activities were generally carried out through the expected inputs.

The number of experts dispatched by the Japanese side exceeded the initial expectation, and according to the experts, it was mainly due to the increased opportunities to dispatch young researchers in various fields for field surveys and experiments. The increased number of trainees received also exceeded the plan due to the acceptance of not only long-term foreign students to the University of the Ryukyus, but also additional short-term trainees with the cooperation of JICA Okinawa Center.

#### 3.3.1.2 Project Cost

With regard to the project cost, equipment provision and overseas activity costs significantly exceeded the plan. This is due to the fact that more equipment was installed for surveys and research than was planned. The examples include the installation of Palau's first laboratory equipped with genetic testing equipment and the introduction of a biological specimen storage facility. As a result, the overall project cost exceeded the planned amount (103% against the plan).

#### 3.3.1.3 Project Period

This project was implemented over a five-year period from April 2013 to March 2018. This project period was in line with the plan (100% against the plan).

In light of the above, although the project period was within the plan, the project cost exceeded the plan. Therefore, efficiency of the project is fair.

### 3.4 Sustainability (Rating: ③)

#### 3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

The *PAN Act*, *Palau Climate Change Policy* (2015), *Revised National Biodiversity Strategy and Action Plan* (2015-2025), and *Palau National Marine Sanctuary Act*, described in “3.1 Relevance,” remain in effect, and in addition, in April 2020, Palau passed and implemented a law banning the export of coral reef fish. This was enacted in response to the "Science Policy Dialogue: Call for Action," a declaration signed in July 2017 at a meeting where policy recommendations based on the project's findings were made. PICRC is also responsible for marine research, dissemination, and education, and will administer the Marine Sanctuary Act, which went into effect in January 2020. PICRC also continues

to be positioned as the institution responsible for marine ecosystem research in Palau and is involved in the formulation and implementation of various policies and strategies as mentioned above.

The *Palau Responsible Tourism Policy Framework (2017-2021)* will be reviewed as its coverage period has ended and the number of tourists declined due to the global spread of COVID-19, but the direction of sustainable tourism promotion will remain unchanged. In Palau as a whole, there has been no change in the policy direction emphasizing conservation of the natural environment and the role of PICRC, and the sustainability of policy and political commitment is judged to be high.

#### 3.4.2 Institutional/Organizational Aspect for the Sustainability of Project Effects

PICRC is positioned as a government agency that conducts research on the marine environment. Under the supervision of the Chief Executive Officer (CEO), PICRC is composed of three departments: Research, Aquarium, and Administration, with a total of 34 staff members. As to researchers, in addition to the CEO and the Director of Research, there are five researchers and six research assistants in the Research Department. In addition, as mentioned above, the Palau Marine Sanctuary management secretariat has also been established. PICRC has a sufficient number of researchers to conduct research activities, and there are no obstacles to research activities in terms of the structure and personnel.

Although PCC, where the DNA Laboratory is located, does not have an organized research program on coral reefs, it is the only organization in Palau that can conduct various DNA analyses, including coral reefs, as an educational and research institution. The genetic experiment-related equipment installed by the project is used not only by PICRC researchers, but also by PCC lecturers and students, the Ministry of Health and Human Services, and the Ministry of Agriculture, Fisheries and the Environment, etc.<sup>15</sup>

Based on the above, it can be said that there are no problems in the institutional/organizational aspect for the sustainability of the project effects.

#### 3.4.3 Technical Aspect for the Sustainability of Project Effects

It was confirmed that PICRC has been able to independently conduct ongoing monitoring of coral growth and distribution including in permanent quadrats, fostering of community awareness, educational activities in schools, and reporting of the results of coastal marine environment analysis at various meetings, by using the equipment provided. In addition, it was noted that within PICRC, weekly meetings among researchers, monthly

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<sup>15</sup> PICRC has an intension to use the laboratory's analytical equipment more frequently in its studies of environmental DNA in the Palau Marine Protected Area.

departmental meetings, and monthly all-staff meetings are held to share information and develop human resources in their daily activities.

Through the implementation of this project, PICRC is now able to provide quantitative data and analysis through more precise monitoring of coral reef conditions and management using a database. The technical capacity to continue research using this capability was considered sufficient at the time of ex-post evaluation.

From the above, while PICRC has not always been able to make policy recommendations to the Palau Congress, it has provided data on the marine environment to relevant agencies and conducted awareness-raising activities on environmental conservation in communities and schools, etc. It is considered that PICRC has sufficient technical sustainability.

#### 3.4.4 Financial Aspect for the Sustainability of Project Effects

PICRC's income and expenditure in recent years are shown in Table 5<sup>16</sup>.

Table 5 PICRC's Income/Expenditure and Net Assets at the End of the Fiscal Year

(Unit: US dollar)

Fiscal Year	2016/17	2017/18	2018/19
<b>Operating revenues</b>			
Grants	359,345	55,652	747,763
Facility user and facility fees	168,523	253,714	277,181
Contract service	146,601	166,929	201,309
Donations	216,961	196,510	178,736
Research facilities	128,877	32,460	128,004
Boat fees	48,561	91,157	79,864
Other	102,865	134,493	195,491
<b>Total</b>	<b>1,171,733</b>	<b>930,915</b>	<b>1,808,348</b>
<b>Operating expenses</b>			
Salaries, etc.	-693,118	-761,405	-813,117
Depreciation	-293,084	-276,772	-233,798
Supplies and printing	-167,405	-146,461	-151,667
Professional services	-133,632	-142,178	-51,710
Utilities	-96,641	-96,080	-123,941
Other	-374,448	-289,943	-430,649
<b>Total</b>	<b>-1,758,328</b>	<b>-1,712,839</b>	<b>-1,804,882</b>
<b>Operating profit/loss</b>	<b>-586,595</b>	<b>-781,924</b>	<b>3,446</b>
Appropriations	400,000	400,000	400,000
Investment income	27,956	21,973	42,959
<b>Net income/loss</b>	<b>-158,639</b>	<b>-359,951</b>	<b>446,425</b>
<b>Net position at end of year</b>	<b>1,728,823</b>	<b>1,368,872</b>	<b>1,815,297</b>

Note: Fiscal year is from October to September of the following year.

Source: Audit report (each year)

<sup>16</sup> Since PCC is not conducting coral reef research, the income and expenditures of PICRC were obtained (PCC is responsible for the utilities and maintenance costs of the DNA laboratory, but the amount was unknown).

The financial situation for the three fiscal years 2016/17 to 2018/19 shows that PICRC secures its own revenues two to five times the budget allocation from the government (appropriations), but its operating balance varies significantly depending on whether it can secure grants for research and other activities from outside sources. FY2016/17 and FY2017/18 recorded a final deficit and resulted in a decline in assets, but FY2018/19 saw a significant surplus.

Since PICRC conducts research and other activities according to the size of its operating revenues, it is not likely that significant deficits will continue for multiple years, and the government budget allocates \$400,000 annually. However, personnel costs are on a rising trend, and since it is not clear how the financial support from the U.S. to Palau will continue after 2024, there is a possibility that the amount of government budget allocation will be significantly reduced. PICRC needs to secure stable research grants from outside sources, etc., to further strengthen its income base. However, since the buildings and equipment obtained free of charge are recorded as depreciation expenses, the deficit is only at face value, and there seems to be no situation whereby the continuation of the project effects would be hindered by such expenses. Therefore, it is judged that there are no major financial challenges.

In Palau, where environmental conservation and sustainable use of the environment are regarded important, there were no concerns in terms of policy or political commitment in sustaining the effects of this project, and PICRC's institutional and organizational structure was adequate. PICRC's capacity to conduct research and awareness-raising activities was also adequate, and there were no major financial challenges.

Therefore, sustainability of the project effects is high.

#### **4. Conclusion, Lessons Learned and Recommendations**

##### 4.1 Conclusion

This project aimed to strengthen the capacity of implementing agency in Palau to conduct research on coral reef island ecosystems and to sustainably maintain them. The project was highly relevant at the time of planning and completion, as it was consistent with Palau's development plans and needs, as well as with Japan's ODA policy toward the Pacific and Palau at the time of planning. The project purpose and outputs were largely achieved, and the formulation and implementation of policies for the management of coral reef island ecosystems in Palau were confirmed after the project completion, as seen in a case where the research outcomes have been utilized with a few exceptions and have contributed to the formulation of a new policy. Therefore, the effectiveness and impact of the project are high.

Regarding the implementation of the project, the project period was within the plan, but the project cost exceeded the plan, so the efficiency of the project is fair. The sustainability of the project effects is judged to be high, since there were no concerns regarding policy and political commitment, the institutional and organizational aspects of the implementing agency and their capacity to conduct research and awareness-raising activities were sufficient, and there were no major financial issues.

In light of the above, this project is evaluated to be highly satisfactory.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Implementing Agency

Through the implementation of this project, new monitoring activities were conducted and a database was developed. This effort has continued after the completion of the project, and it is desirable to continue it so that the effects of long-term conservation of coral reef island ecosystems can be analyzed both physiologically and socioeconomically, and policy recommendations can be made at all times regarding the sustainable use of resources in a manner consistent with the goals of the SDGs. It is also expected that PICRC will play a leading role in achieving the Micronesia Challenge, not only within Palau, but especially in the Micronesian region. To this end, it will be important to explore ways to increase revenues, such as by undertaking research and survey work commissioned by external organizations and increasing donations, in order to stabilize the financial situation which tends to be affected by the amount of research grants.

### 4.2.2 Recommendations to JICA

The successor of this project, the "Project for Enhancement of Integrated Management of Coastal Ecosystems in Palau for Strengthening their Resilience to Climate Change" was launched in 2022. In order to strengthen the capacity to manage integrated coastal ecosystems considering the continuity between marine and terrestrial areas, it is important to examine what kinds of matters can be further developed by using the improved research capacity and data, as well as the technical outcomes of this project. In addition, it would be beneficial to go beyond analysis of the current situation and identification of issues, and to conduct policy-oriented activities to determine what kind of nature conservation and utilization measures Palau should take for the sake of its economic and social development. Therefore, it is important for JICA to provide active support to the project from the Global Environment Department and the JICA Palau Office so that the project will become more sustainable.

#### 4.3 Lessons Learned

##### Need to plan a project content with a stronger focus on policy recommendations and social implementation

As a SATREPS project is a joint project of the Japan Science and Technology Agency (JST) and JICA, it has a research-oriented aspect. At the same time, it also aims at contributing to the partner country in terms of development effects. Since the implementing agency of this project on the Palau side was an organization whose main activity was research, academic research was a major focus of the project. This in itself was an important work to clarify the actual situation of coral reefs. As for the application of the socioeconomic aspect to Palau, it was confirmed that a new policy linked to the "Science Policy Dialogue: Call for Action" was formulated and that PICRC was constantly providing scientific information to relevant agencies. However, while activities were conducted with an awareness of policy recommendations during the project period, it is considered that the policy recommendations would have been adopted more effectively if a mechanism had been established to continue making policy recommendations to promote both environmental conservation and economic and social activities in an independent manner at all times after the completion of the project. In light of the purpose of SATREPS, it is important to clarify what is positioned as "social implementation" at the time of project planning, during implementation and at the time of completion, and to consider a mechanism to link research outcomes to development effects over the long term.

Some examples are as follows: (1) holding regular consultations with the Palau National Congress to formulate policies for marine environmental conservation, including coral reefs; (2) developing a system to link research outcomes with private-sector technologies to continuously implement coral reef conservation activities; and (3) continuously disseminating policy recommendations by creating a financially independent mechanism that does not depend on budget allocation. Regarding (2), PICRC's research can clarify the status of improvement of the marine environment by utilizing the private sector's coral reef restoration technology, and through closely linking this to diving and eco-tourism, it is possible to promote both the environment and economic activities. Such a direction would ensure that SATREPS projects are not limited to academic research, but also lead to economic and social development in the partner country.

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