

Country Name	Comparative Studies of the Reproductive Biology and Early Life History of Two Tuna Species Yellowfin Tuna and Pacific Bluefin Tuna for the Sustainable Use of These Resources
Republic of Panama	

I. Project Outline

Background	<p>Tuna fishery is an important industry for the Republic of Panama (hereinafter referred to as “Panama”), which generates valuable foreign exchange earnings for the country. However, in recent years, tuna resources show a decreasing trend and the excessive fishing pressure is said to be a major cause of the problem. Therefore, sustainable resource management of the species is highly required.</p> <p>Tuna resources are migratory species distributing widely in the Pacific Ocean and these resources are exploited by a large number of coastal countries of the Ocean. Tunas are normally found in offshore and open seas because of its nature, and which makes difficult to obtain research samples, this is why there are many unexplained points on their biological information.</p> <p>In this project, the research was conducted with the Achotines Research Institute in Los Santos Province (the institute is operated by the Tuna Commission (IATTC), and some facilities and equipment are also used by the Panama Aquatic Resource Authority (ARAP)), aiming at accumulating biological information and conducting research to make more effective and accurate resource management prediction by comparing and contrasting two species of tuna, thereby contributing to sustainable resource management of Tuna.</p>												
Objectives of the Project	<p>Through identification of spawning characteristics of Yellowfin tuna (YFT) and Pacific Bluefin tuna (PBF), establishment of a method to identify maternal life of YFT, identification of critical factors to affect the survival of YFT and PBF in their early life history and development of fingerling production technologies, the project aimed at adequately obtaining and synthesizing scientific knowledge and information on the reproductive biology and early life history of two tuna species, which are fundamental for the sustainable use of these resources, thereby strengthening resource management of two tuna species in Panamanian waters and IATTC jurisdiction area.</p> <ol style="list-style-type: none"> Expected Overall Goal: Resource management of two tuna species in Panamanian waters and IATTC jurisdiction area is strengthened. Project Purpose: Scientific knowledge and information on the reproductive biology and early life history of two tuna species, which are fundamental for the sustainable use of these resources, are adequately obtained and synthesized. 												
Activities of the Project	<ol style="list-style-type: none"> Project Site: Los Santos Province Main Activities: 1) Identification of spawning characteristics of YFT and PBF, 2) Establishment of a method to identify maternal life of YFT, 3) Identification of critical factors that affect the survival of YFT and PBF in their early life history, 4) Development of fingerling production technologies, etc. Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Panamanian Side</td> </tr> <tr> <td>1) Experts: 48 persons</td> <td>1. Staff Allocated: 28 persons</td> </tr> <tr> <td>2) Trainees Received: 21 persons</td> <td>2. Land and facility: an office space in the Aquatic Resources Authority of Panama and facilities and equipment for experiments</td> </tr> <tr> <td>3) Equipment: fish cage, freezer for feed storage, survey vessel, etc.</td> <td>3. Local expense: cost for utility and equipment such as laptop and refrigerator, etc.</td> </tr> <tr> <td>4) Local expense: cost for project activities</td> <td></td> </tr> </table> 			Japanese Side	Panamanian Side	1) Experts: 48 persons	1. Staff Allocated: 28 persons	2) Trainees Received: 21 persons	2. Land and facility: an office space in the Aquatic Resources Authority of Panama and facilities and equipment for experiments	3) Equipment: fish cage, freezer for feed storage, survey vessel, etc.	3. Local expense: cost for utility and equipment such as laptop and refrigerator, etc.	4) Local expense: cost for project activities	
Japanese Side	Panamanian Side												
1) Experts: 48 persons	1. Staff Allocated: 28 persons												
2) Trainees Received: 21 persons	2. Land and facility: an office space in the Aquatic Resources Authority of Panama and facilities and equipment for experiments												
3) Equipment: fish cage, freezer for feed storage, survey vessel, etc.	3. Local expense: cost for utility and equipment such as laptop and refrigerator, etc.												
4) Local expense: cost for project activities													
Project Period	April 2011 – March 2016	Project Cost	(ex-ante) 374 million yen, (actual) 402 million yen										
Implementing Agency	Aquatic Resources Authority of Panama (ARAP) Inter-American Tropical Tuna Commission Achotines Laboratory (IATTC Achotines Laboratory)												
Cooperation Agency in Japan	Kindai University												

II. Result of the Evaluation

I Relevance
<p><Consistency with the Development Policy of Panama at the Time of Ex-Ante Evaluation ></p> <p>The project was consistent with Panama’s development policies of “The Policy on the Aquatic Resources of Panama for Fisheries and Aquaculture” (2010) and “National Strategy for aquaculture development” (2010) aiming at promotion of sustainable management of marine resources and promotion of development and diversification of aquaculture.</p> <p><Consistency with the Development Needs of Panama at the Time of Ex-Ante Evaluation ></p> <p>The project was consistent with Panama’s development needs of necessity of accumulating efficient biological information and conducting a study that contributes to more effective and accurate predictions of resource management for the sustainable use of tuna resources.</p> <p><Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation></p> <p>The project was consistent with Japan’s ODA policy² for Panama setting “environmental conservation” as one of the three priority</p>

¹ SATREPS: Science and Technology Research Partnership for Sustainable Development

areas.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the time of Project Completion>

The Project Purpose was achieved by the time of project completion. Scientific and technical information applicable to resource management of tuna species, such as reproductive biology and early life history, was synthesized through the project and disseminated domestically and internationally by the following means: 34 publications (research paper, article and book), 70 conferences, the website in Japanese, English and Spanish, and 26 regional seminars/workshops. It was noteworthy as a highly remarkable achievement that the project achieved the partial cycle (from bloodstock to juveniles) of YFT cultivating for the first time in the world.

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have been continued since the project completion. The scientific and technical information produced by the project has been used for 6 research projects implemented by the IATTC, the ARAP, the University of Miami, the International Seafood Sustainability Foundation (ISSF), the University of Southern Mississippi, and the University of Texas. For example, the research project in collaboration with the ISSF is developing advanced sonar for tuna seiners to identify target species and reduce bycatch of juveniles by using biological information of tuna species identified by the project.

The research facilities and equipment provided by the project have still been maintained at the IATTC Achotines Laboratory and used for the research projects mentioned above.

<Status of Achievement for Expected Overall Goal at the time of Ex-post Evaluation>

The Expected Overall Goal has been partially achieved at the time of ex-post evaluation. As described above, research projects using the project outputs are ongoing in a collaboration between the ARAP or the IATTC and other institutions. Although it is too early to say that the overall goal, the strengthening of resource management of two tuna species, has been completely achieved at the moment, the impact of the project is concluded to be huge in that scientific and technical knowledge about the genetic information, reproductive biology and early life history of tuna species, which are vital for the sustainable resource management of tuna species in the future, were piled up, and the knowledge is expected to be used for future resource management at a practical level.

In terms of the utilization of research outcomes, the IATTC has been engaging in existing long-term research projects to secure population of tuna in the future. It is also expected that full cycle cultivating and other sustainable resource management method will be developed and practiced by the IATTC and the ARAP.

<Other Impacts at the time of Ex-post Evaluation>

Some positive impacts were confirmed at the time of ex-post evaluation. For instance, researchers of the IATTC and the ARAP improved their research capacity by receiving trainings from Japanese researchers and visiting Japan for training. Especially, the training regarding rearing juveniles of YFT helped the researchers to improve their technical capacity of monitoring and others.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is high.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results
(Project Purpose) Scientific knowledge and information on the reproductive biology and early life history of two tuna species, which are fundamental for the sustainable use of these resources, are adequately obtained and synthesized.	1. Synthesis of scientific and technical information applicable to resource management of tuna species, which is disseminated by means of - publications - website - regional seminars/workshops	Status of the Achievement: Achieved (Continued) (Project Completion) • Scientific and technical information application to resource management of tuna species was synthesized and disseminated by the following means: ➢ 34 publications (research paper, article and book) ➢ 70 conference presentations ➢ The website in Japanese, English and Spanish ➢ 26 regional seminars/workshops (Ex-post Evaluation) • The scientific and technical information produced by the project has been used in the following research projects. ➢ IATTC “Tuna Biology and Ecology” (2017-Present) ➢ ARAP “Snapper Biology and Ecology” (2018) ➢ ISSF “Calibration of Advanced Sonar” (2018-2021) ➢ University of Miami “Effect of Ultraviolet Light and Elevated CO ² on Tuna Eggs” (2019) ➢ University of Southern Mississippi “Genetic Studies of Tuna” (2018-2019) ➢ University of Texas “Genetic Studies of Yellowfin Tuna and Analysis of Tuna Eggs related to Fatty Acid in Diet” (2019-Present)
(Expected Overall Goal) Resource management of two tuna species in Panamanian waters and JATTC jurisdiction area is strengthened.	1. Resource management measures elaborated based on the project outputs (improved biological information on two tuna species).	(Ex-post Evaluation) Partially Achieved • It is too early to evaluate whether resource management measures are completely strengthened at the moment, in fact, there is no strategic policy etc. established after the project. However the research projects using the research outputs of the SATREPS project are ongoing in a collaboration between the ARAP or the IATTC and external institutions. Through and after the SATREPS project, the genetic information and

² Ministry of Foreign Affairs “ODA Databook” (2011)

suitable methods of sustainable resource management have been collected and synthesized for future resource management.

Source : JICA internal document, Terminal Evaluation Report, Questionnaire and interview to the ARAP and the IATTC

3 Efficiency

Although, the project cost slightly exceeded the plan (ratio against the plan: 107%), the project period was within the plan (ratio against the plan: 100%) and the outputs were produced as planned. Therefore, the efficiency of the project is fair.

4 Sustainability

<Policy Aspect>

“National Action Plan for Sustainable Fisheries” (2016-2018) and “National Strategic Plan Panama 2030” (2017-2030) aim at the sustainable use of aquatic resources, with an ecosystem approach and transparent, coherent, equitable and participatory management, which guarantees the social and economic well-being of the fisheries and Aquiculture sector. As the project aimed to strengthen resource management of tuna species in Panamanian waters and IATTC jurisdiction areas, the project deemed purposeful for the national policies.

<Institutional/Organizational Aspect>

There have not been any major changes in the institutional/organizational arrangement of the implementing agencies for the use and management of scientific and technical information applicable to resource management of tuna species produced by the project. There has been a cooperation between the ARAP and the IATTC for over 35 years, and they have initiated and continued new projects together with external institutions at the Achotines Laboratory using the results of the project into future joint activities. According to the ARAP and the IATTC, the number of the staff allocated to the ARAP and the IATTC is 2 researchers for the ARAP and 15 researchers and technicians for the IATTC. The organizations have a certain number of the staff for on-going investigations.

Additionally, the principal equipment provided by the project are maintained in good condition and appropriately safekept at the laboratory based on the agreement between the IATTC and the ARAP.

<Technical Aspect>

Through the implementation of the project and on-going research projects, the researchers of the ARAP and the IATTC have sustained the knowledge and skills necessary to continuously carry out research projects related to the scientific and technical information applicable to resource management of tuna species. As for the operation and maintaining of the research facilities and equipment provided by the project, all staffs have acquired the knowledge through the project and new research projects.

The guidelines (Experimental method of the distinction of sex by volume of hormone in small independent fin of PBF and larval and juvenile rearing of YFT) developed by the project have been continuously used for the new projects. For example, biologists at Achotines Laboratory are continuously using the guidelines for their research on distinguishing sex of YFT and keep contact with Kindai University.

<Financial Aspect>

The budget for the activities of the IATTC Achotines Laboratory is 390,000 US Dollars per year. 70% of the budget is provided by the IATTC and the remainder is obtained through outside grants from external institutions and joint research projects. The budget is sufficient for on-going investigations. The ARAP and the IATTC have been trying to secure the budget to maintain the Laboratory's infrastructure and equipment in excellent condition.

<Evaluation Result>

In light of the above, no problem has been observed in terms of the policy, Institutional/Organizational, technical and financial aspects of the implementing agency. Therefore, the sustainability of the effectiveness is high.

5 Summary of the Evaluation

The project achieved the Project Purpose aiming at adequately obtaining and synthesizing scientific knowledge and information on the reproductive biology and early life history of two tuna species and has partially achieved the Overall Goal aiming at strengthening resource management of two tuna species in Panamanian waters and IATTC jurisdiction area. As for sustainability, the implementing agencies have had a sufficient number of staff, the necessary knowledge and skills and secured a sufficient amount of budget for research projects related to tuna species. In terms of efficiency, although the project cost slightly exceeded the plan, the project period was within the plan. It was confirmed that the outcomes were produced as planned.

Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- The social impact through the project (contribution to local fisheries and the fishery sector, etc.) was limited because of the nature of SATREPS, focusing on research only; therefore, realizing such social impact is considered to be a next activity. It would be recommendable to involve local fishers and companies during project and include components of technical transfer to them so that the future project can contribute directly to local communities to have social impact.

Lessons Learned for JICA:

- It was difficult to provide a long-term training in Japan to counterparts because the counterpart researchers were unable to be away from their institutes for a long time. In this regard, the project developed technical manual about larval and juvenile rearing of YFT so that the counterparts were able to follow up the research during the absence of Japanese researchers and after the project. The development of detailed scribed manual is quite effective for sustainability of project.
- The outcomes of the project have been widely recognized and been used internationally. It was because of having IATTC as a counterpart, which is worldwide well-known international organization that has great influence on tuna resource management, also ARAP who is leading a development of the fishery and aquiculture sector in Panama. In addition, with the effort of Kindai University, IACCT, ARAP and JICA, the project was widely publicized in Panama and Japan through various articles on newspaper and TV programs and press tours, which was effective to get wide public understanding of the project. Therefore, the advertisements with counterparts are impactful in order to expand the project outputs and get public understanding.
- In this project, partnership with a regional organization (i.e. the IATTC) was advantageous in terms of facilitating follow-up research efforts and wider dissemination of research findings. However, research work of the IATTC was meant to deal with a regional issue of

tuna resource management and did not directly address the issue of national interest of the implementing country. In this project, additional ARAP researchers were involved to learn skills of studying reproductive biology and early life history of fish species. It is noteworthy that the impact and benefit to the country should be considered even in the project with international organization.



Returning cultured juvenile tuna from sea cage to land based tank



Collecting information on the reproductive biology