

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN FOR THE IMPLEMENTATION OF THE BELIZE
NATIONAL LIONFISH CONTROL MANAGEMENT STRATEGY

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DEDICATION

To my beloved mother in heaven, you have been my greatest
inspiration

To my parents, MICHAEL and ALLISON MCKENZIE who have
taught me to never give up.

To my very best friend LETICIA ARZU who has support me
every step of the way.

To my siblings who have always motivated and encouraged me.

To OMIQUE RAMOS who has always believed in me on days I
thought about quitting, and who has supported me from the very
beginning

Many thanks to all of you

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Firstly, I would like to thank God for the privilege of achieving this success and for giving me strength on the days and nights I felt like giving up.

I must thank my tutor for providing feedback and guiding me through this process

Thank you to all my friends and colleges who have supported me and encouraged me. Your kind words are much appreciated

Finally, I would like to thank all my colleagues at Blue Ventures

ABSTRACT

The primary objective of this document is to develop a project Management Plan for the Implementation of the Belize Lionfish Control Management Strategy. Lionfish is an invasive species with the potential to disrupt the balance of marine ecosystems. Over the past two decades, they have been invading coral reefs throughout the Western Atlantic, Gulf of Mexico, and the Caribbean. Lionfish have no known predators, and they literally eat everything! Their rapid population growth is an imminent threat to biodiversity and marine-based livelihoods which warranted an urgent call for action.

Best practices, tools, frameworks, and techniques will be outlined in this comprehensive document that will ultimately guide the project management team with the appropriate project management methodologies that would help to promote a successful project outcome.

Using a multi-stakeholder participatory approach, and adaptive management, the implementation of this national strategy should result in the reduction of lionfish populations in Belize fish replenishment zones and increase connectivity and networking between stakeholders who utilize and manage these areas.

Key words: Project Management, Project Management Plan, Invasive Species Management, Lionfish

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ABBREVIATIONS AND ACRONYMS

BAS	Belize Audubon Society
BCMR	Bacalar Chico Marine Reserve
BTB	Belize Tourism Board
BV	Blue Ventures
CCMR	Caye Caulker Marine Reserve
FAMRACC	Forest and Marine Reserves Association of Caye Caulker
FOSC	Friends of Swallow Caye
GOB	Government of Belize
GUZ	General Use Zone
HCMR	Hol Chan Marine Reserve
MPA	Marine Protected Area
NTZ	No Take Zone
PADI	Professional Association of Diving Instructors
PHMR	Port Honduras Marine Reserve
<i>PMBOK® Guide</i>	A Guide to the Project Management Body of Knowledge
PMI	Project Management Institute
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Assessment
SACD	Sarteneja Alliance for Conservation and Development
SEA	Southern Environmental Association
SFA	Sarteneja Fishermen Association
SWCMR	South Water Caye Marine Reserve
TIDE	Toledo Institute for Development and Environment
TL	Total Length
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

The invasion of alien lionfish (*Pterois spp.*) throughout the Western Atlantic, Gulf of Mexico, and Caribbean over the past decade is one of the top threats to biodiversity and marine-based livelihoods in the region. Native to the Indo-Pacific and Red Sea, the distinct appearance of lionfish sees them prized by aquarists around the world. In fact, the red lionfish (*Pterois volitans*) was among the most imported live marine tropical fish to the USA in 2005. This international trade, and the subsequent release of imported individuals, is considered the most likely route by which red lionfish became established in the Tropical Western Atlantic.

The first confirmed lionfish sighting was in Turneffe Atoll, central Belize, in December 2008, and this sighting was closely followed by more reports from Glover's Reef Atoll, Lighthouse Reef Atoll and Ambergris Caye. The invasion of northern Belize was followed by the invasion of southern Belize was one of the last areas to become invaded with lionfish. By August 2009 lionfish could be found throughout most of the coastal zone of Belize. Lionfish are now present throughout the Belize Barrier Reef Reserve System UNESCO World Heritage Site

Lionfish have the potential to disrupt the balance of marine ecosystems and overpopulation of this species can even compromise the health of coral reefs. Population control and management of invasive species is an uncharted territory here in Belize. The need to address this urgent problem led to the development of the Belize National Lionfish Control Management Strategy. This national strategy is a result of preliminary studies of lionfish populations that have been conducted on coral reef sites across Belize.

This project titled "The Implementation of the Belize National Lionfish Control Management Strategy seeks to reduce lionfish population densities in critical fish stock replenishment zones across three Marine protected areas in Belize. The project is being led by Blue Ventures, a non-profit marine conservation organization, in conjunction with the Belize Fisheries Department and other key stakeholders in the Conservation, Fisheries and Tourism sectors. The Implementation of this strategy involves a 3-year project that has a budget of \$165,000.00 (BZE) with a 5% contingency reserve.

This main driver for this project is a multi-stakeholder participatory approach, and adaptive management style. This approach is to first of its kind to be used in the Caribbean and Latin American Region. Successful completion of this project through effective project management should result in the reduction of lionfish populations in Belize fish replenishment zones and in increased connectivity and networking between stakeholders who utilize and manage these areas. Results of successful completion of this project should also produce economic opportunities for marine resource users. Fishers and members of the Fisher-Folk community should see an introduced market opportunity for both domestic and international sale of whole lionfish. Even though stakeholder engagement and participation are critical for the success of this project, all project management areas were included in the development of this comprehensive Project Management Plan.

The General objective of the Final Graduation project was to develop a comprehensive project management plan for the Belize National Lionfish Control Management Strategy. This was achieved by executing the specific objectives which included: the development of a scope management plan that would define the work and activities required to complete all the deliverables of the project that would meet the expectations of project stakeholders; the development of a schedule management plan that would establish a coherent timeline for each activity that would allow the project team to successfully complete the project within the allocated timeline of 3 years; the development of a cost management plan that would account for all project expenses that are aligned with the approved project budget of \$165,000 BZE with a 5% contingency reserve; the development of a quality management plan to guide the project team to ensure that all the project deliverables meet the acceptance criteria outlined by the project stakeholders. Given the scientific nature of this project, quality in data collection and other technical aspects are critical for a successful project outcome. Also included in the specific objectives are: the development of a project resource plan to account for all internal and external resources that would be required to execute the project; the development of a communications plan to maintain transparent and open two-way communication throughout the duration of this project; the development of a risk management plan to identify, account for, manage, monitor, and mitigate risks that are associated with this project; the development of a procurement plan that accounts for all the products and services that are required for the execution of this project, and the methodology by which they would be sourced; the development of a stakeholder management plan to ensure that all project stakeholders are engaged and that their interests and active participation are maintained throughout the duration of this project.

Primary and secondary information sources were used to compose the Final Graduation Project. Both qualitative and quantitative research methods were used to develop each management plan that corresponds to the specific objectives of the FGP. Additionally, descriptive, and analytical research methods and data were used to make classifications, comparisons and to focus on factual and readily available information for analysis and critical evaluation in key project areas.

The Blue Venture Belize Team is pioneering this unique approach to invasive species management with the aim of the method being replicated in other countries burdened with the lionfish invasion. It is the hope that the project team will utilize this comprehensive document which includes the best tools, techniques, and practices to increase the likelihood of a favorable project outcome for the Implementation of the Belize National Lionfish Control Management Strategy. To successfully complete all project activities, it is recommended that Blue Ventures should contract an experienced project manager to support the Conservation Science Manager, Field Program Manager and other members of the science department who would become key members of the project team.

1 INTRODUCTION

1.1. Background

In late 2015 and early 2016, social and ecological studies were carried out to inform the development of an updated lionfish management strategy for Belize. The results of these surveys were reviewed in June 2016 by a small group of stakeholders involved in lionfish management, who described the need for a participatory approach to controlling lionfish populations in Belize. The findings from the studies lead to the development of the Belize National Lionfish Control Management Strategy published in 2019. Now, Blue Ventures, in collaboration with the Belize Fisheries Department and other stakeholders seek to implement this strategy in marine protected areas across Belize.

The lionfish is an invasive species with the potential to disrupt the balance of marine ecosystems. Over the past two decades, they have been invading coral reefs throughout the Western Atlantic, Gulf of Mexico, and the Caribbean. Lionfish have no known predators, and they literally eat everything! Their rapid population growth is an imminent threat to biodiversity and marine-based livelihoods which warranted an urgent call for action. The implementation of this national strategy should result in the reduction of lionfish populations in marine protected areas and increased connectivity and networking between stakeholders who utilize and manage the selected priority sites.

The implementation of this strategy requires a project management plan to guide the relevant agencies with the appropriate tools, techniques and best practices that are needed to achieve the project's deliverables and to increase the likelihood of a successful project outcome.

1.2. Statement of the problem

Population control and management of invasive species represent uncharted territory herein Belize. The development of the Belize National Lionfish Control Management Strategy results from preliminary studies of lionfish populations that had been conducted on reefs across Belize.

The health of Belize's reefs and biodiversity have been compromised due to the prevalence of invasive lionfish. This invasion warranted an urgent call for action by the government, and NGOs that focus on the protection and preservation of Belize's marine resources. To address this problem, proper and effective planning must be done to implement the strategy across Belize. A project management plan must be developed to ensure that all considerations are made to the approach of the strategy.

1.3. Purpose

Effective invasive species population control and management require proper planning, investigation, and thorough research. A detailed and comprehensive project management plan is needed to outline the required processes, tools and techniques that would be needed for the successful implementation of the Belize National Lionfish Control Management Strategy.

This project management plan is a comprehensive document that explores and details the ten knowledge areas of project management. The Project Management Institute (PMI) defines it as a "formal approved document that defines the overall plan for how the project will be executed, monitored and controlled." (Project Management Institute, 2017). The knowledge areas of project management that are being investigated and developed in this plan include project scope management, schedule management, cost management, quality management, resource management, procurement management and stakeholder management.

The Belize National Lionfish Control Management Strategy was developed following research conducted by Blue Ventures, in partnership with the Belize Fisheries Department and other various stakeholders. Blue Ventures (the leading project implementation agency) along with the Belize Fisheries Department (GOB) both realized the need for a project management plan for the implementation of lionfish control management strategy. The strategy features a participatory approach which requires active participation of stakeholders within the marine conservation, fisheries, and tourism sectors of Belize.

The approach needed and magnitude of this project require diligent and effective planning for successful implementation and execution. Therefore, the primary objective of creating the project management plan for this project is to consider and outline all the factors, tools, techniques, and methodologies needed to engage stakeholders and drive their participation for the successful implementation of the Belize National Lionfish Management Strategy.

1.4. General objective

To develop a comprehensive Project Management Plan for the successful implementation of the Belize National Lionfish Control Management Strategy.

1.5. Specific objectives

1. To develop a Project Charter for the Final Graduation Project to provide authority to the project manager to commence the project.
2. To develop a scope management plan that would define project's scope, and ensure that all management processes are aligned with the project scope
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to favorable project outcomes, including timely completion
4. To develop a cost management plan to effectively track, monitor and control the project's budget, ensuring that the project does not exceed the project budget.
5. To develop a project quality plan that would define the quality policies, procedures, and determine project and stakeholder requirements for successful completion of the project.
6. To develop a project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.
7. To develop a communications management plan that includes the processes necessary to ensure that the information needs of the project and its stakeholders are met.

8. To develop a thorough risk management plan that identifies project opportunities, project risks, and effective responses to identified risks.
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful project completion.
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

Blue Ventures is a science-led social enterprise that develops transformative approaches for nurturing and sustaining locally led marine conservation. The organization works in partnership with coastal communities in places where the ocean is vital to the culture and economy. Currently, Blue Ventures operates on a global scale with teams based in Belize, the United Kingdom, Comoros, Tanzania, India, Indonesia Madagascar, Kenya, Papua New Guinea, Mozambique, Timor Leste, Philippines, Somalia, and Thailand.

Blue Ventures has a range of marine management models designed to address the barriers between communities and conservation by integrating community-led resource management with community health and alternativelivelihood initiatives that benefit both people and nature. The main goal of the organization is to place community at the heart of conservation and to improve the quality of life of small-scale fisheries.

2.1.1 Company/Enterprise Background

Blue Ventures has maintained a permanent presence in Belize since 2010, supporting diverse fisheries and conservation efforts from its base in Sarteneja Village which is Belize's largest fishing community. As well as leading a ten-year comprehensive MPA monitoring and evaluation program in Bacalar Chico Marine Reserve. The scope of work has also included working with coastal stakeholders across the country to develop a national strategy for invasive lionfish management throughout marine protected areas in Belize.

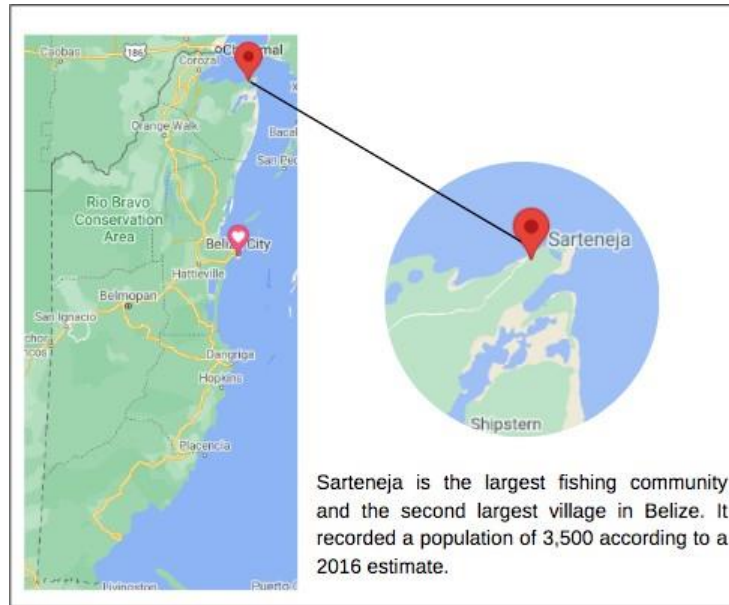


Figure 1 Map of Sarteneja Village, Belize (Source Google maps, 2021)

Through this work, the Belize team has developed strong partnerships with the Belize Fisheries Department, MPA managers, fishing cooperatives and fishers' associations, and supported the establishment of a commercial scale domestic lionfish fishery. Additionally, the team has delivered training in coral reef and lionfish monitoring methods to six MPA authorities in Belize, continue to build capacity for the inclusive and adaptive management of invasive lionfish through the National Lionfish Working Group and are helping establish management targets and indicators for the management authority of Turneffe Atoll Marine Reserve, which is Belize's largest MPA.

2.1.2 Mission and vision statements

a. Mission Statement

The lionfish invasion affects the entire tropical and subtropical eastern seaboard of the Americas, but targeted control of lionfish enables recovery of biomass, abundance, and diversity of native reef fish populations, including commercially important species. During consultations for Belize's National Lionfish Management Strategy, it had been noted that strong interest among all MPA stakeholders across Belize exists for involvement in lionfish management.

Therefore, the mission is to scale up lionfish control as a catalyst for community and fisher engagement in co-management through the implementation of the Belize National Lionfish Control Management Strategy (Belize National Lionfish Control Strategy, 2019).

b. Vision Statement

The team's vision is to harness the interest of stakeholders in lionfish management to bring lionfish control to scale, to achieve locally led participatory lionfish control throughout the entire Belize MPA network by 2025, and to share skills and experiences through the existing National Lionfish Working Group. Given the interest in this approach beyond Belize's borders, the aim is to also support partners to share their experiences with other MPA management bodies in the LAC region (Belize National Lionfish Control Strategy, 2019).

2.1.3 Organizational structure

The Blue Ventures Belize team is relatively small compared to teams operating in other countries. Despite the size, the organizational structure follows the same trend and hierarchical features. The complete organizational structure can be observed in the figure below.

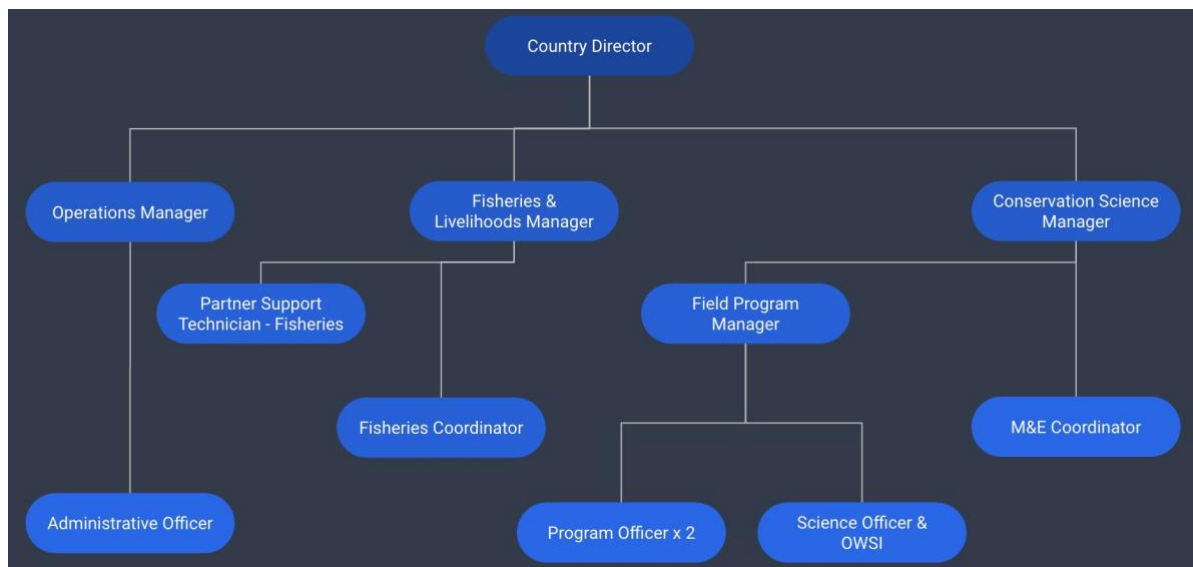


Figure 2 Organizational chart of Blue Ventures Belize Team (Source Ronalee McKenzie - Fisheries Coordinator, Blue Ventures)

Each BV team has a Country Manager that represents the team in global upper management meetings. The Country Manager is directly responsible for all operations and projects executed by the team in its respective country. In Belize, the country manager is supported by the Operations Manager, Fisheries and Livelihoods Manager, and the Science and Conservation Manager.

2.1.4 Products offered

Blue Ventures works to restore the world's oceans and improve the livelihoods of traditional fishing communities. Informed by two decades working alongside coastal communities across the Indian Ocean and further afield, the organization partners with small-scale fishers and community organizations to address overfishing and safeguard ocean life in beneficial ways.

A participatory approach is taken to design, scale, strengthen and sustain fisheries management and conservation at the community level. Blue Ventures promotes networking by bringing partners together to advocate for reform and share tools and best practices to support fishing communities across the globe.

Specific products offered as a result of capacity building include:

1. Workshops and trainings offered to fisher associations
2. Scuba dive training (PADI Open Water and PADI Advanced Open Water)
3. Scientific Diving Training
4. First Aid Training
5. Training in data collection

Training and capacity building initiatives are delivered to key partners and stakeholders based on the selected priority site. This process will enhance the capacity of co-management agencies and fisher led associations to drive up their participation in fisheries management and marine conservation.

2.2 Project Management Concepts

The Project Management Institute (PMI) defines the term project as a “temporary endeavor undertaken to create a unique product, service or result” (PMI p.90, 2017).

The goal of a project, regardless of its size or nature, should deliver a product or service that meets the needs of the project's stakeholders and beneficiaries. Some highly complex projects can take years to complete, and smaller scaled projects can be completed within a week.

Regardless of its complexity, all projects are executed to solve a distinct problem, create opportunities, or bridge gaps that have been identified. From a business perspective, Bannerman (as cited in Bento, Gomes & Romão, 2019), defines the term project as “a discrete, multidimensional activities that serve as vehicles of change for promoting an organization's investments with the objective of obtaining business benefits and improved internal processes”.

The journey to develop and establish a business can be classified as a project. Similarly, developing and delivering a product or service to a specific market base is also a clear example of a project in a business / entrepreneurial environment. Projects are not restricted or exclusive to one specific discipline, instead they can be diverse in scope, size, cost, and impact. Therefore, the Implementation of the Belize National Lionfish Control Management Strategy is a project with the potential for country wide impact since the overall objective of the project promotes improved health of Belize's barrier reef.

2.2.2 Project Management

The development and execution of a project from start to finish requires a set of specific processes and procedures. The processes and framework used to design, develop, and execute a project describes the act of “Project Management”. Though project management principles and processes may vary, the guide developed by the Project Management Institute (PMI) titled “A Guide to Project Management Book of Knowledge (2017) is most adopted and its principles are practiced globally. PMI defines project management as “the application of knowledge, skills, tools, and techniques to project activities to meet project requirements” (PMI p.94,2017).

The PMBOK® Guide developed by PMI is a robust and comprehensive document that details all the processes, tools and techniques needed to successfully manage a project from its initial stages to the very end.

There are various management processes outlined by PMI and they all correlate with the different knowledge areas of project management. The PMBOK® Guide serves as the blueprint for effective project management techniques and is widely recognized as the standard for project management.

The realm of project management dates to the 1950s, however, much growth was noticeable between 1960 to 1985 when the size and complexity of projects changed and formal processes had to be put into place (Kerzner, 2009 as cited in Lo, Shen, & Chen, 2017). In recent times, project management has become a popular and respected field of work, where working professionals can establish successful careers as project managers and project management experts.

2.2.3 Project Lifecycle

All projects have a beginning and an end. The processes required to design, develop, execute, and close a project describes the project life cycle. The Project Management Institute (PMI) defines the project life cycle as "a series of phases that a project abides by from inception to completion" (PMI, p. 65, 2017). PMI has outlined five distinct processes that contribute to the project's life cycle. The process group includes Initiating, Planning, Executing, Monitoring and Controlling, and Closing.

2.2.4 Project Management Process

Effective project management features a wide array of processes that should be considered to achieve the desired project outcome. The Project Management Institute (PMI) defined 49 project management processes that are divided into five distinct process groups. PMI defines a project management process as a "systematic series of activities directed toward causing an end result where one or more inputs will be acted upon to create one or more outputs" (PMI, p. 88, 2017). The illustration below is an excerpt from the PMBOK® Guide, which displays the project life cycle concept and processes.

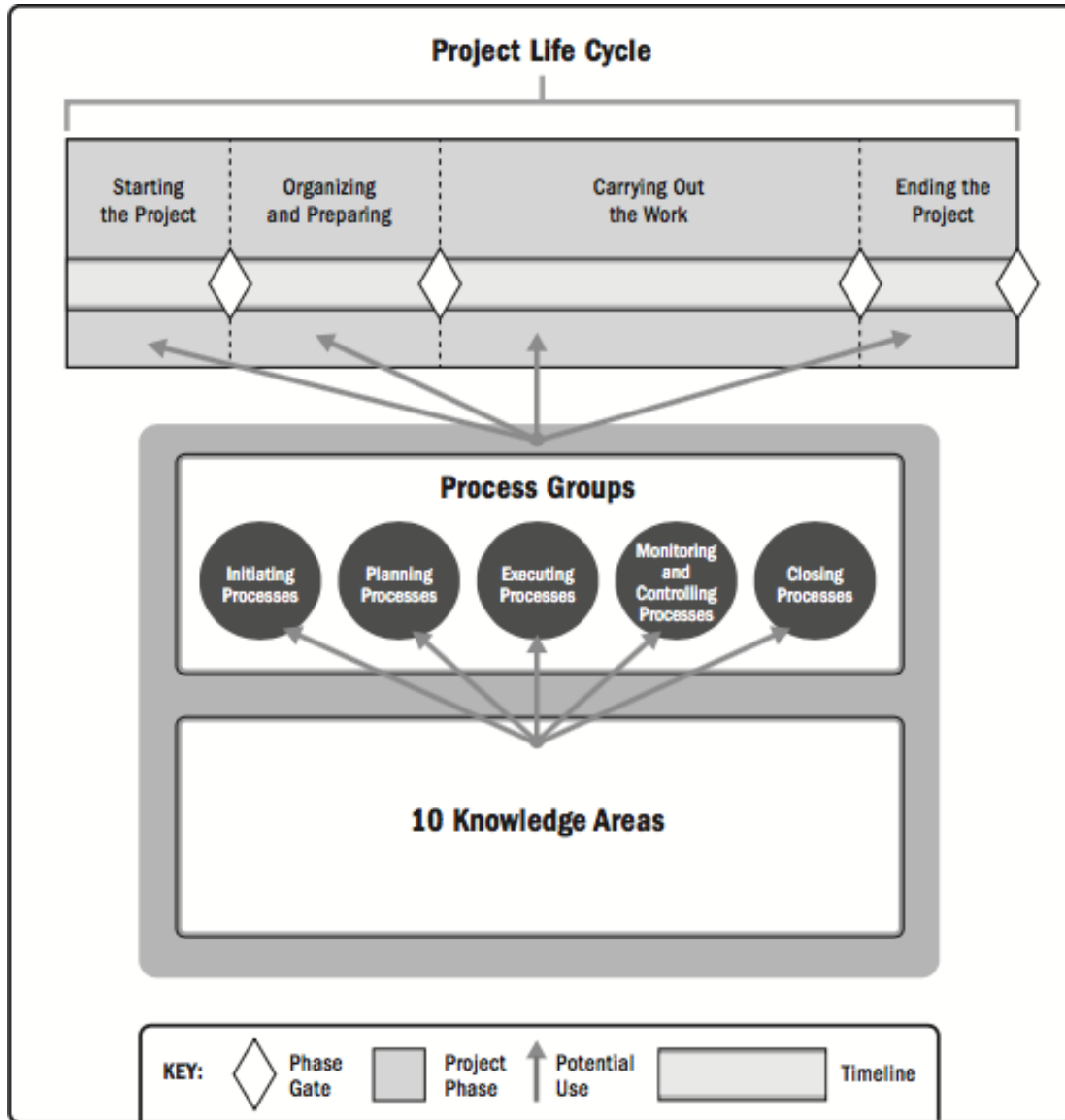


Figure 3 Project Life Cycle (Source PMI, p .18, 2017)

Figure 4 displays the project management process groups.



Figure 4 PMI Project Management Process Group Infographic (Source: Ronalee McKenzie, 2021)

2.2.5 Project Management Knowledge Areas

Project Management stretches across ten knowledge areas that the Project Management Institute had defined in the PMBOK® Guide. These are the key aspects of project management that can determine the failure or success of projects. PMI defines a knowledge Area as “an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques.” These ten (10) Project Management Knowledge Areas are essential components to properly manage a project (Goncalves, Wangenheim, Hauck & Petri, 2017).

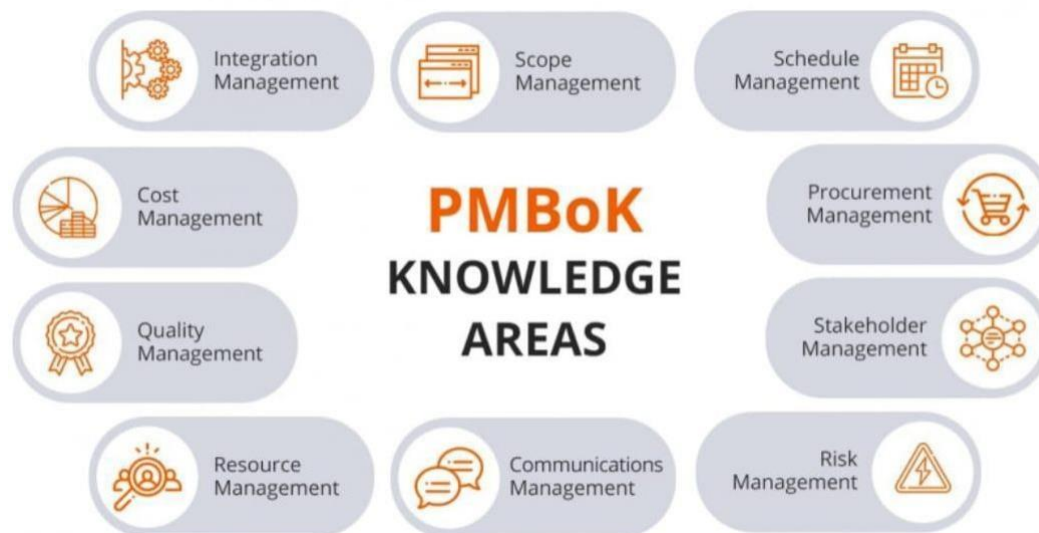


Figure 5 The ten knowledge Areas of Project Management (Source QTA 2017)

Each knowledge area is an integral part of the project management framework. Project Integration management is the first knowledge area that defines and streamlines the project management process groups. The second knowledge area is Project Scope Management. The processes in this area are centered in defining the work that is required to successfully complete the project’s objectives. Project Schedule Management is the third knowledge area outlined by PMI and refers to the processes that relate to the timeframe of the given projects. These processes help to ensure that the project’s deliverables are met before the project’s deadline. The fourth knowledge area is Project Cost Management.

Though all knowledge areas are vital, project cost management is a key indicator for effective project management. This knowledge area includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so the project can be completed within the approved budget (PMI p. 91 2017). Project Quality Management is the fifth knowledge area outlined by PMI. The processes that relate to project quality management correspond to the planning and managing of project requirements to satisfy the needs of the stakeholders involved in the project. Project Resource Management is the sixth knowledge area and the processes within this area directly relate to identification and acquisition of the resources needed to successfully execute and complete a project. The seventh project management knowledge area outlined by PMI is Project Communication Management. The processes in project communication management coordinate and streamline all forms of communication between the project's stakeholders and beneficiaries. Project Risk Management is the eighth knowledge area of project management. The processes associated with this area include the identification of risks and the planning of appropriate responses to the risks that have been identified. This knowledge area also explores potential opportunities for the project. The ninth project management knowledge area is project procurement. The processes in this area involve the outsourcing of products and/or services that are needed for successful project completion. The final project management knowledge area outlined by the PMI is Project Stakeholder Management. The processes in this area relate to the identification of the people, groups, or organizations that could impact or be impacted by the project. In this process, stakeholder engagement is essential, especially for projects that are driven by multiple organizations/businesses.

While, all knowledge areas will be considered for the implementation of the Belize National Lionfish Control Management Strategy, emphasis will be given to Project Communication and Stakeholder Management since the project features a participatory approach which is heavily dependent on the active participation and engagement of project stakeholders.

2.3 Other applicable theory/concepts

2.3.1 Lionfish Focused search Survey (LFS)

The implementation of the Belize National Lionfish Control Management Strategy is a project that aims to control lionfish populations within Marine Protected areas in Belize. The strategy was developed because of research conducted between 2009 and 2014.

PRINCIPAL INVESTIGATOR (YEAR)	SURVEY DETAILS	KEY RESULTS
Courtney Cox, University of North Carolina at Chapel Hill (2009-13)	<ul style="list-style-type: none"> • National-level surveys • 12-15m: spur-and-groove • 14-19 sites annually 	<ul style="list-style-type: none"> • Greatest densities observed in 2011, when mean density was 159 ± 46 fish.ha⁻¹ • Sites with greatest densities were in Turneffe Atoll and South Water Caye Marine Reserves
Blue Ventures (2014)	<ul style="list-style-type: none"> • Bacalar Chico Marine Reserve • 1-5m: patch reef (2 sites) • 8-15m: spur-and-groove (3 sites), fringing (1 site) • 18-30 m: spur-and-groove, fringing (1 site each) 	<ul style="list-style-type: none"> • Mean density was 27 ± 9 fish.ha⁻¹ • Greatest density (57 ± 18 fish.ha⁻¹) at the deep fringing reef site
Southern Environmental Association / Blue Ventures (2014)	<ul style="list-style-type: none"> • Gladden Spit and Silk Cayes Marine Reserve • 8-15m: spur-and-groove, wall (1 site each) • 18-30 m: spur-and-groove (1 site) 	<ul style="list-style-type: none"> • Mean density was 235 ± 68 fish.ha⁻¹ • Greatest density (550 ± 150 fish.ha⁻¹) at the deep site.

Figure 6 Lionfish focused search surveys carried out in Belize between 2009 and 2014. (Source: Belize National Lionfish Control Management Strategy, 2015)

LFS is a scientific diving research method that is used to record the size, behavior, and population abundance of lionfish within a given reef area. Between October and December 2015, data were collected using the LFS method at fifty coral reef sites, located within five MPAs: BCMR, CCMR, HCMR, PHMR and SWCMR. These five MPAs were chosen to be representative of the variable conditions, uses and intensity of coral reef use across Belize, and to include prioritized coral reef conservation areas [55]. All five are multiple use MPAs. For this study, all zones were classified as either No Take Zone (NTZ), where no fishing is permitted, or General Use Zone (GUZ), where commercial fishing is regulated, and all recreational activities are permitted.

3 METHODOLOGICAL FRAMEWORK

3.1 Information sources

The composition of a project management plan requires credible and accurate information. Relevant information that is related to the project can be sourced in many ways. The two categories of information sources are classed as “primary” and “secondary” information sources. The implementation of the Belize National Lionfish Control Strategy is a project that is scientific in nature, therefore. Both primary and secondary information sources will be pooled to complete a thorough and detailed Project Management Plan for this marine conservation-based project.

3.1.1 Primary sources

The Healey Library defines primary information sources as immediate, first-hand accounts of a topic, from people who had a direct connection with it. Primary sources can include:

- Texts of laws and other original documents
- Newspaper reports, by reporters who witnessed an event or who quote people who did.
- Original research, datasets, and survey data, such as census or economic statistics.
- Photographs, video, or audio that capture an event.

For the development of the FGP, the primary sources would include:

- Personal interviews
- Scientific surveys
- Internal emails
- Staff meetings
- Internal company policies
- Government legislation documents
- Internal reports and best practice tool kits

3.1.2 Secondary sources

Unlike primary source information, secondary information sources are “removed” in some way from their original form (Arora, n.d.) or as defined by Ashikuzzaman (2018), sources which are either compiled from or refer to primary sources. McQuade Library (2019). Examples of secondary information sources include articles, journals, and books.

Secondary information sources that will be used for the composition of the project management plan will include:

- Scientific journals and publications
- Scientific data
- PMBOK® Guide (sixth edition)
- Internal M&E reports

Chart 1 Information sources (Source: Compiled by author, R. McKenzie, December 2021)

Objectives	Information sources	
	Primary	Secondary
1. To develop a project charter that will formally authorize the project and provide the project manager with the authority to utilize resources for project completion.	<ul style="list-style-type: none"> • Personal interviews • Internal emails • Staff meetings • Internal company policies • Government legislation • Internal reports and best practice tool kits. 	<ul style="list-style-type: none"> • Scientific Journals and publications made. • Scientific data • PMBOK® Guide (sixth edition) • Internal M&E reports
2. To develop a scope management plan that would define project's scope and ensure that all management processes are aligned with the project scope.	<ul style="list-style-type: none"> • Personal interviews • Internal emails • Staff meetings • Internal company policies 	<ul style="list-style-type: none"> • PMBOK® Guide sixth edition • Published research papers

Objectives	Information sources	
	Primary	Secondary
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Government legislation ● Internal reports and best practice tool kits 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK® Guide sixth edition ● Internal M&E reports
4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Government legislation ● Internal reports and best practice tool kits. 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports
5. To develop a project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Internal reports and best practice tool kits. 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports
6. To develop an effective project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Internal reports and best practice tool kits. 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports

Objectives	Information sources	
	Primary	Secondary
7. To develop a communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Internal reports and best practice tool kits. 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports
8. To develop a risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.	<ul style="list-style-type: none"> ● Internal emails ● Staff meetings ● Internal company policies ● Government legislation 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Internal reports and best practice tool kits 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.	<ul style="list-style-type: none"> ● Personal interviews ● Internal emails ● Staff meetings ● Internal company policies ● Internal reports and best practice tool kits 	<ul style="list-style-type: none"> ● Scientific Journals and publications made. ● Scientific data ● PMBOK Guide sixth edition ● Internal M&E reports

3.2 Research methods

The University of Pretoria describes research methods to systematically solve or answer a research problem. The “research method” refers to the tools and processes that are used to conduct research. There are research methods that can be used to investigate. Types of research methods include:

3.2.1 Analytical Research Method

Analytical research is a common research method used by students involving critical thinking skills using information that pertains to the ongoing investigation. Kumar described that “the researcher has to use facts or information already available and analyze these in order to make critical evaluation of the material” (as cited in Dudovskiy, 2018).

3.2.2 Qualitative Research Method

The Qualitative research method is heavily dependent on primary information sources and focuses on understanding a research query as a humanistic or idealistic approach. Though quantitative approach is a more reliable method as it is based upon numeric and methods that can be made objectively and propagated by other researchers. Qualitative method is used to understand people’s beliefs, experiences, attitudes, behavior, and interactions” (Gibson G, 2017).

3.2.3 Quantitative Research Method

Quantitative research is the most common research framework in the social sciences. While other research frameworks, such as qualitative research, can be subjective, quantitative research is more objective. It studies processes through numbers, and often, the goal of the research is to produce statistics. The information researchers collect using quantitative methods allows them to perform analyses that can be simple or complex, such as showing the connections made between data, calculating averages of percentages, or using inferential statistics to generalize a large population. Researchers use specific methodologies, such as experiments, questionnaires, and structured observations to collect the data they use for quantitative research.

An analytical research method will be used to develop the project management plan for the Implementation of the Belize Lionfish Control Management Strategy.

Chart 2 Research methods (Source author McKenzie December 2021)

Objectives	Research methods
	Analytical Method
<p>1. To develop a project charter that will formally authorize the project and provide the project manager with the authority to utilize resources for project completion</p>	<p>Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a project charter, and all other components of the final graduation project deliverable.</p>
<p>2. To develop a scope management plan that would define project's scope and ensure that all management processes are aligned with the project scope.</p>	<p>Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to define the project's scope and objectives.</p>
<p>3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.</p>	<p>Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a robust and efficient schedule management plan as a component of the final graduation project deliverable.</p>
<p>4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.</p>	<p>Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a well-defined cost baseline and cost management plan.</p>

Objectives	Research methods
	Analytical Method
5. To develop a project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a project quality plan.
6. To develop an effective project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop an effective project resource management plan as a component of the final graduation project deliverable.
7. To develop a communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a robust project communications management plan.
8. To develop a risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a thorough and risk management plan and risk register.
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop a project procurement plan.

Objectives	Research methods
	Analytical Method
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.	Literature, publications, articles, and journals related to the project will be sourced and analyzed. Critical thinking skills and thorough analysis of all sources will be used to develop an effective stakeholder engagement plan.

3.3 Tools

Project Management tools are processes, platforms and frameworks that can be used to improve the efficacy of the approach taken to manage a project regardless of its size or scope (PMI, P. 120, 2017). PMI outlines six categories of tools and techniques that can help improve the efficiency and effectiveness of project management. These are:

1. Data Gathering Tools and Techniques
2. Data analysis tools and techniques
3. Data representation tools and techniques
4. Decision-making tools and techniques
5. Communication skills tools and techniques
6. Interpersonal and team skills tools and techniques

PMI defines a tool as “something tangible, such as a template or software program, used in performing an activity to produce a product or result” (PMI, p 94, 2017). A technique, according to PMI is a defined systematic procedure employed by a human resource to perform an activity to produce a product or result or deliver a service, and that may employ one or more tools” (PMI, p 94 2017).

For the development of the project Management Plan for the implementation of the Belize National Lionfish Control Strategy, a combination of project management tools and techniques will be used to maximize the impact and credibility of the document.

Chart 3 Tools (Source author McKenzie December 2021)

Objectives	Tools
1. To develop a project charter that will formally authorize the project and provide the project manager with the authority to utilize resources for project completion	Brainstorming, Check lists, Interviews, Expert Judgment, Meetings, Leadership, Templates, document analysis, Monday Project Management Software, Microsoft Office Software
2. To develop a scope management plan that would define the project's scope and ensure that all management processes are aligned with the project scope.	Brainstorming, Check lists, Interviews, Expert Judgment, Meetings, Leadership, Templates, document analysis, Monday Project Management Software, Microsoft Office Software, Requirements Management Plan template, Work Breakdown Structure, Scope Management Plan template.
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.	Meetings, Interviews, Critical path method, expert judgment, Project Management Software, Earned Value Analysis, Reserve Analysis, Trend Analysis, Variance Analysis, Performance Reviews.
4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.	Meetings, Interviews, Critical path method, expert judgment, Project Management Software, Earned Value Analysis, Reserve Analysis, Trend Analysis, Variance Analysis, Performance Reviews, Cost of quality, Performance index
5. To develop a project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	Brainstorming, Check lists, Interviews, Expert Judgment, Meetings, Leadership, Templates, document analysis, Communication Technology, Expert Judgement, Meetings, Problem Solving, Problem Solving, Monday Project Management Software, Microsoft Office Software, Inspection, Planning, Audits, Reporting, flow charts.

Objectives	Tools
6. To develop an effective project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.	Brainstorming, Check lists, Interviews, Expert Judgment, Meetings, Leadership, Templates, document analysis, Communication Technology, Expert Judgement, Meetings, Problem Solving, Organizational Theory, Pre-assignment, Problem Solving, Monday Project Management Software, Microsoft Office Software, organizational charts.
7. To develop a robust communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met	Meetings, open communication, emails, texts, leadership, active listening, presentations, data representations, networking, communication matrix, templates
8. To develop a thorough risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.	Meetings, Planning, leadership, Analogous Estimating, Contingent Response Strategies, Expert Judgement, Project Reporting, Representations of Uncertainty, Risk Categorization, Source Selection Analysis, Strategies for Opportunities, Strategies for Project Risk, Strategies for Threats, Monday Project Management Software Risk Register template.
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.	Brainstorming, Check lists, Interviews, Expert Judgment, Meetings, Leadership, Templates, document analysis, Communication Technology, Expert Judgement, Meetings, Problem Solving, Organizational Theory, Pre-assignment, Problem Solving, Monday Project Management Software, Microsoft Office Software, organizational charts.

Objectives	Tools
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.	Mind Mapping, Prioritization/Ranking, Stakeholder Engagement Assessment Matrix, Stakeholder Mapping/Representation, Communication, Cultural Awareness, Leadership, Networking, Observation/Conversation, Political Awareness, Stakeholder Register template, Stakeholder Engagement Assessment Matrix

3.4 Assumptions and constraints

Common terminology in the realm of project management includes assumptions and constraints. In the context of project management, assumptions are factors or outcomes assumed to be true without evidence. The PMI defines the term assumption as “a factor in the planning process that is considered to be true, real, or certain, without proof or demonstration” (PMI, p. 32, 2017). In contrast to definitions, PMI describes the term “constraint” as “a limiting factor that affects the execution of a project, program, portfolio, or process” (PMI, p. 35, 2017). Regardless of the project’s size, or scope, all projects are subjected to constraints and assumptions.

The project assumptions and constraints for the development of a Project Management Plan for Implementation of the Belize National Lionfish Control Strategy have been identified for each specific objective based on the 10 knowledge areas of project management.

Chart 4 Assumptions and constraints (Source author McKenzie December 2021)

Objectives	Assumptions	Constraints
1. To develop a project charter that will formally authorize the project and provide the project manager with the authority to utilize resources for project completion	It is assumed that the project's objectives and project deliverables are well defined and specific to the project.	The requisite information needed to complete a project charter have not been completely sourced.

Objectives	Assumptions	Constraints
2. To develop a scope management plan that would define the project's scope and ensure that all management processes are aligned with the project scope.	It can be assumed that the project's scope management plan is well defined and meets the project criteria.	The time frame given to complete the scope management plan may not be sufficient enough to include all details.
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.	It is assumed project schedule management should be fully completed within 4 months.	The development of the FGP should be completed within 4 months which limits the room for error.
4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.	It can be assumed that the project budget estimation is accurate.	The project's budget and funding is directly dependent on grants received which affects the accuracy of the budget.
5. To develop a project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	It can be assumed that the project quality management plan is well defined and meets both the project and stakeholder requirements.	Project and stakeholder requirements may be subject to change.
6. To develop an effective project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.	It can be assumed that the tools and techniques used for resource management will be sufficient to yield a favorable project outcome.	The absence of well-defined roles and responsibilities may adversely affect the project resource management plan.

Objectives	Assumptions	Constraints
7. To develop a robust communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met	It can be assumed that all stakeholders will be considered in the development of the communications management plan	Stakeholders may lose interest in the project and display reluctance in engagement.
8. To develop a thorough risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.	It can be assumed that all project risks are identified and registered.	Risk mitigation plans may fail which may cause a delay in the project.
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.	It can be assumed that the estimated project cost is accurate and accounts for the financial capital needed to procure all goods and services needed to successfully complete the project.	Due to the Covid-19 pandemic, prices of goods and services may fluctuate and inflate.
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.	It can be assumed that all stakeholders will be considered in the development of the Stakeholder engagement plan	Stakeholders may lose interest in the project.

3.5 Deliverables

Project deliverables refer to all the outputs tangible or intangible that are submitted within the scope of a project.

PMI describes project deliverables as “any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project” (PMI, p. 41, 2017). Developing a Project Management Plan for the implementation of the Belize National Lionfish Control Management Strategy will yield 10 deliverables that correspond to the 10 knowledge areas of Project Management.

Chart 5 Deliverables (Source author McKenzie December 2021)

Objectives	Deliverables
1. To develop a Project Charter for the Final Graduation Project deliverable.	Complete a Project Charter that defines the objectives, goals and scope of the project.
2. To develop a scope management plan that would define the project's scope and ensure that all management processes are aligned with the project scope.	Well defined Scope Management Plan which outlines the work required to deliver the project's outputs.
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.	Well defined Project Schedule Management Plan which outlines timeline needed to successfully complete the project activities, milestones and deliverables.
4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.	Well-rounded and effective Cost Management Plan which outlines the tools and techniques that are required to maintain effective financial control of the project capital and its resources.
5. To develop a project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	Well defined and credible Quality Management Plan which outlines both the project requirements that are needed to satisfy the stakeholders' expectations.

Objectives	Deliverables
6. To develop an effective project resource management plan that would allow the project team to identify, acquire, and manage the resources needed for a favorable project outcome.	Well-rounded Resource Management Plan with Organizational Structure and Resource Structure Breakdown (RBS) which outlines the roles and responsibilities and plans that are needed to plan and manage the project's resources.
7. To develop a robust communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met	Effective Communications Management Plan which outlines the best processes and tools to streamline communication among the project's stakeholders.
8. To develop a thorough risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.	Well defined and reliable Risk Register and Risk Management Plan that identifies categorizes all the potential project risks.
9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.	Well-rounded and efficient Procurement Management Plan which outlines the best acquisition processes for outsourcing the products and services needed to successfully complete the project.
10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.	Effective and well-defined Stakeholder Register and Engagement Plan that outlines the best practices, tools, techniques and processes needed to keep stakeholders engaged and satisfied.

4 Results

4.1 Project Charter

4.1.1 Introduction

The implementation of the Belize National Lionfish Control Management strategy is being led and implemented by Blue Ventures alongside the Belize Fisheries Department. This strategy is the first of its kind in Belize, modeling a participatory approach to invasive species management. This unique approach capitalizes on the connectivity between marine protected areas in Belize and the co-management agencies responsible for the oversight and protection of these areas. The lionfish invasion affects the entire tropical and subtropical eastern seaboard of the Americas because they have no native predators in the Atlantic and Caribbean region. Therefore, their prevalence is a great threat to the biomass and abundance of fish and other native marine species that inhabit coral reefs. In late 2015 and throughout 2016, studies were conducted within marine protected areas in Belize to investigate the abundance of lionfish in these areas. The results indicated that an alarmingly high population of the invasive lionfish were thriving in reefs throughout Belize. The urgent need for a response to this invasion led to the development of the Belize National Lionfish Management Strategy.

4.1.2 Purpose

The purpose of this project is to implement the Belize National Lionfish Control Management strategy using an adaptive participatory approach to reduce lionfish density within priority sites of Belize's MPA networks. The reduction of invasive lionfish populations will lead to improved reef health and recovered biomass of native reef fish that play an integral role in maintaining the overall health and integrity of Belize's Barrier Reef.

4.1.3 Scope

The successful implementation of this strategy will lead to improved health of Belize's Barrier Reef. Given current technological barriers to controlling lionfish beyond safe diving limits, the implementation of this strategy focuses on lionfish control in shallow reefs (to 18m), both inside and outside of no take zones.

However, general recommendations are also made for control in deep, non-reef environments:

The implementation of this strategy seeks to ensure that:

1. Management is participatory and adaptive.
2. Lionfish populations are maintained below levels that affect nativespecies.
3. Recommended actions for lionfish management consider direct and indirect outcomes to maximize socioeconomic benefits.

The Implementation of the project will include the following milestones:

1. Establish a multi-stakeholder Lionfish Working Group (LWG) to coordinate lionfish management, monitoring, and evaluation.
2. Establish at least one seafood processing facility to purchase lionfish from fishers by 2022.
3. Establish a lionfish tourism certification scheme that adequately addresses associated risks, supports the needs of marine tour operators, and supports lionfish management priorities.
4. Register by 2023 all lionfish tournaments with the LWG to raise awareness about the lionfish invasion, provide economic benefits to host communities, and record data to national databases.
5. Establish lionfish control in Belize's no take zones (NTZ)
6. Conduct consistent education and outreach programs about lionfish with a wide range of stakeholders.
7. Increase the value of lionfish catch through diversified product markets.
8. Ensure adequate funding is available for consistent implementation of lionfish control activities, as well as monitoring and evaluation.

9. Conduct research and monitoring to fill identified knowledge gaps about lionfish ecology, management, and markets, and evaluate lionfish control actions.
10. Finalize and implement a National Lionfish Monitoring Plan, which uses the Lionfish Focused Search method.
11. Prioritize lionfish population assessment at one of Belize's atolls.
12. Establish a method and database to enable the systematic monitoring of lionfish landings through fishery and tourism industries, as well as lionfish tournaments.

4.1.4 Intended Audience

This participatory approach to invasive lionfish management requires active participation from stakeholders representing the fisheries, NGO, and tourism sectors. The intended audience of this document includes the project management team, personnel from the Belize Fisheries Department, Turneffe Atoll Sustainability Association, Blue Ventures, Hol Chan Marine Reserve, Caye Caulker Marine Reserve, Wabafu Fishermen's Association, and all other associates of the project team.

4.1.5 Overview

4.1.5.1 Project Title and Description

Project Title: The Implementation of the Belize National Lionfish Control Management Strategy

Project Description

The implementation of the Belize National Lionfish Control Management Strategy is a multi-stakeholder participatory approach to invasive species management. It is the first of its kind to be implemented in Belize since the project heavily relies on active participation from the project's stakeholders.

Lionfish are not native to Belizean waters. The first confirmed sighting of lionfish occurred in 2008. Since then, their population has grown beyond what the reef can sustain. Dense populations of these invasive species have the potential to devastate the health and integrity of Belize's Barrier Reef. Studies conducted in late 2015 and 2016, have led to the development of the Belize Lionfish Control Management Strategy, which is designed to reduce lionfish populations to a threshold that the reef can maintain.

The main purpose of this project is to successfully implement this strategy in MPA networks across Belize. The goal is for the strategy to be implemented, adapted, and owned by the Belizean Government and local marine resource users.

Project Manager: To Be Determined

Project Duration: Three Years [January 2022 - March 2025]

Project Budget: \$165,000 BZD with 5% Contingency Reserve

Chart 6 Total Budget (Source author McKenzie December 2021)

Total Cost Estimate	\$ 165,000.00
Contingency Reserve (5%)	\$ 8,250.00
Cost Baseline	\$ 173,250.00
Management Reserve (0%)	
Total Project Budget	\$ 173,250.00

4.1.5.2 Business Case

Belize is home to the second largest Barrier Reef in the world. The Meso-American Reef extends throughout parts of Mexico, Honduras, and Guatemala, However, most of it is uniquely positioned within the borders of Belize. This vibrant and exquisite reef provides shoreline protection and immeasurable ecosystem services to all the countries that it claims. Both the Fisheries and Tourism sectors are the backbone of Belize's economy.

There are almost 3000 fisherfolk who directly depend on Belize's marine resources for food security and as their primary source of income. Belize's fisheries and agriculture sectors contribute 11.7 % while the tourism sector contributes to 12% of the country's GDP. Therefore, it is imperative that marine conservation remains a priority. Invasive lionfish have the potential to completely compromise the health of the reef.

Alarming high densities of these invaders can potentially devastate the populations of small juvenile reef fish that play an integral part in maintaining reef health. Studies conducted in late 2015 and early 2016 revealed that lionfish populations were beyond what critical reef sites could tolerate. If this problem is not addressed with an urgent response, it won't be long before fishers start to see a decline in the fish stocks that they rely on

Belize Fisheries Department developed and launched the Belize National Lionfish Control Management Strategy. This project seeks to successfully and effectively implement this strategy which has been uniquely designed and features sound evidence to support its approach.

Belize's economy and people depend on a healthy thriving reef. Successful implementation of this project will ensure improved resilience of the reef and help to restore and recover populations of juvenile fish that have been adversely affected by the invaders.

4.1.5.3 Project Stakeholders

Chart 7 Project Stakeholders (Source author McKenzie February 2022)

Stakeholder	Responsibility	Power Level	Interest Level
The Belize Fisheries Department (GOB)	The Belize Fisheries Department is one of the implementing agencies providing clear guidance on the legal aspects of the project's framework and ultimately authorizes all decisions that depend on usage, permits and access to MPAs.	High	High
Blue Ventures (BV)	Blue Ventures is a primary research investigator and implementing agency of the project.	High	High

Stakeholder	Responsibility	Power Level	Interest Level
The Project Management Team	The project Management Team is ultimately responsible for the successful implementation of this project.	High	High
Project Sponsor	The project sponsor is primarily responsible for the seamless transition between project phases. According to PMI, the project sponsor role can be divided into three components: Governance, Vision, and Value. In governance, the sponsor must maintain the project's organizational priorities. The sponsor must define the project's success criteria and in value the sponsor must maintain project quality.	High	High
Project Funders	Project funders include the Mesoamerican Reef Fund (MAR Fund) and the Summit Foundation.	High	High
National Fishermen's Cooperative	National Fishermen's Cooperative, with Blue Ventures' intervention, will potentially develop a new export market for whole lionfish.	High	High
Turneffe Atoll Sustainability Association (TASA)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	High	High
Northern Fishermen's Cooperative	Northern Fishermen's cooperative with Blue Ventures' intervention will potentially develop a new export market for whole lionfish.	Medium	High
Hol Chan Marine Reserve (HCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
Bacalar Chico Marine Reserve (BCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
Sarteneja Alliance for Conservation and Development (SACD)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
South Water	MPA Co-management agency that will	Low	High

Stakeholder	Responsibility	Power Level	Interest Level
Caye Marine Reserve (SWCMR)	adapt the Belize National Lionfish Management Strategy		
Southern Environmental Association (SEA)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
Caye Caulker Marine Reserve (CCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
Port Honduras Marine Reserve (PHMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High
Wabafu Fishermen's Association	Organized Fisher-led association that will represent the diversity and adaptability of this strategy.	Low	High
Belize Tourism Board (BTB)	Marketing agency that will engage in lionfish tournaments and marketing campaigns.	Low	Medium
Tour Operators	Members of the tourism sector that will integrate tours and engage in tournaments.	Low	Medium
Fisherfolk	Fishers will engage in the newly established lionfish export market, as well as the domestic market.	Low	High
Fishing Communities	Fishing communities will engage in economic stimulation because of newly established lionfish market.	Low	Low

4.1.5.4 Project Objectives and Deliverables

4.1.5.4.1 Project Objectives

- I. Implement lionfish control management strategy in identified priority sites that have the highest lionfish population density.

- II. Enable the participation of diverse local resource users in marine management decisions through quarterly Lionfish Working Group meetings to ensure the project engages stakeholders and marine resource users.
- III. Reduce lionfish population densities in Belize's fish replenishment zones.
- IV. Conduct research and monitoring to fill identified knowledge gaps about lionfish ecology, management, and markets, and evaluate lionfish control actions.
- V. Establish a method and database to enable the systematic monitoring of lionfish landings through fishery and tourism industries, as well as through lionfish tournaments.

4.1.5.4.2 Project Deliverables

The expected project deliverables are listed below:

D-1: Establishment of multi-stakeholder Lionfish Working Group.

D-2: Established and fully trained 10 member Lionfish Brigade for Turneffe Atoll Marine Reserve.

D-3: Established and fully trained 10 member Lionfish Brigade for the Northern Belize Coastal Complex.

D-4: Established and fully trained 10 member Lionfish Brigade for South Water Caye Marine Reserve.

D-5: Established long term monitoring program in selected MPAs.

D-6: Two completed technical reports after one year of implementation in Tunreffe Atoll Marine Reserve and Northern Belize Coastal Complex.

D-7: Established framework and processes for continuous local marine resource user engagement such as Lionfish tournaments and derbies.

4.1.5.4.3 Project Risks, Constraints and Assumptions

The risks identified are listed below:

Chart 8 Project Risks (Source author McKenzie March 2022)

Risk	Mitigation Strategy	Probability	Impact
Health and Safety - A major component of this project is in water scuba diving training. The risks associated with field work and scuba diving are	A detailed risk assessment will be conducted prior to all dive training. In addition, all stakeholders participating in training must be cleared by a medical physician before participating. Medical evacuation routes, protocols and procedures will be established and shared with all participants.	Medium	High
Environmental- Natural disasters such as hurricanes and major storms may occur during the implementation of this strategy and cause a delay.	All in-water activities will be postponed in the event of a natural disaster.	Medium	High
Poor Communication- There is a risk of inadequate, and poor communication between project stakeholders. Poor communication and low engagement can lead to project schedule delays.	Quarterly meetings between project stakeholders and members of the Lionfish Working Group (LWG) will be prioritized throughout the project duration.	Low	High
Project Execution - There is a risk that the execution of project activities can cause project delays which can reduce the interest that stakeholders have in this project.	Maintain project schedule by proper planning and by utilizing effective time management and project management tools and techniques.	Medium	High

4.1.5.4.4 Project Constraints

The project constraints are listed below:

Chart 9 Project Constraints (Source author McKenzie March 2022)

Time	The implementation of the Belize National Lionfish Control Management Strategy is scheduled to commence over a 4-year period. The main driver for successful implementation of this strategy is the active participation from the project's stakeholders. Completing the project's milestones will directly depend on effective communication and time commitment by stakeholders. A time constraint exists if some of the project's stakeholders do not have the capacity to participate in the execution of the project's objectives.
Scope	The scope of this project cannot be modified or adjusted since the nature of this project is scientific and it directly depends on data that has been collected in 2015 and 2016.
Budget	The budget for this project is \$165,000 BZD which has been secured through two separate grants. Marine conservation initiatives such as this are typically funded through grants that are fixed. For this reason, the project cannot exceed its budget.
Quality	The quality of training that will be delivered in this project is constrained by the time commitment of the project's stakeholders. Project Milestones include the delivery of scuba diving and scientific diving training which is the foundation for quality and accurate data collection.
Risk	Risks that are associated with this project have been identified and categorized as high, medium, and low. The risks that are high probability and high impact will be closely monitored to allow for timely mitigation.

4.1.5.4.5 Project Assumptions

The project constraints are listed below:

Chart 10 Project Assumptions (Source author McKenzie March 2022)

Project Assumptions
The project's deliverables are aligned with its scope.
Blue Ventures has already secured grants from funders to cover the complete project budget.

Project Assumptions
The project management team will be available for site visits throughout the duration of the project.
The Belize Fisheries Department authorized research permits for research and monitoring programs in selected marine protected areas.
The project's stakeholders are aware of the project's objectives and expected outputs.

4.1.6 Project Authorization

The project sponsor has the authority to provide approval for the project charter and all management plans.

4.2 Scope Management Plan

4.2.1 Introduction

Project Scope Management is the foundation of a project management plan because it defines in the detail, the work that is required to successfully complete a project and achieve a desired project outcome. In addition to outlining the work that is required, the Scope Management Plan should also outline the tools and techniques that will be used to determine how the project scope is developed, controlled, and validated. The PMI describes the first step in effective Scope Management as the identification, definition, and documentation of the project's objectives as well as the selection of the best approach to achieving the project's objectives (PMI, p. 129, 2017). The integral components of a scope management plan include the following:

- Scope Management Approach
- Scope Statement
- Work Breakdown Structure
- Roles and Responsibilities
- Scope Baseline
- Scope Verification

- Scope Change Control
- Scope Acceptance

The approach used to develop this scope management plan followed the six-step process of Project Scope Management which includes: Plan, define project requirements, define project scope, develop project work breakdown structure, scope validation, and finally define scope control. Expert judgment, checklists, document analysis and brainstorming were techniques used to develop the scope management plan for the implementation of the Belize National Lionfish Control Management Strategy.

4.2.2 Scope Management Approach

The project's scope management approach is used to establish the boundaries of the project by defining what requirements are included in the project and what requirements are excluded from the project. The scope management approach for the Implementation of the Belize National Lionfish Control Management Strategy will be developed and managed by the project manager and project team. The project manager and project team will use the project charter, and expert judgment to develop and define the scope statement. Under the direction of the project manager, the scope statement will be shared with the project's primary stakeholders to confirm the project's objectives and requirements. After confirmation of final project deliverables and project requirements, the project team will then develop the Work Breakdown Structure (WBS), and the WBS dictionary which will describe the work activities that are required to successfully complete the project's deliverables. Following the development of the WBS, the project team will review, finalize, and approve all documents that measure the project's scope and deliverable quality. To avoid scope creep, the project manager will develop a change management plan to ensure that proposed scope changes do not adversely affect the project. The project sponsor will assume the responsibility of accepting and approving any requests to make changes to the project's scope. After the changes are accepted, the project manager is then responsible to update all relevant documents indicating that the changes have been accepted and will be integrated in the scope management plan.

The final component of the scope management approach will be to establish a scope verification process. The project manager will work with the project's sponsor and with representatives of the project's implementing agencies to develop a process that will ultimately verify the successful completion of all project deliverables.

4.2.3 Roles and Responsibilities

Chart 11 Scope Management Roles and Responsibilities (Source author McKenzie March 2022)

Role	Responsibility
Project Sponsor	<ul style="list-style-type: none"> • Provide final approval of scope management plan • Approve or reject change requests • Review / modify project deliverables • Assist with defining deliverable acceptance criteria
Project Manager	<ul style="list-style-type: none"> • Review / modify project deliverables • Lead the development of project WBS • Assist with defining deliverable acceptance criteria • Assume full responsibility for scope management • Update / modify project documents • Inform project stakeholders of scope any changes.
Project Implementation Agency	<ul style="list-style-type: none"> • Assist with the confirmation of project deliverables • Assist with the development of the scope verification process.
Technical Lead	<ul style="list-style-type: none"> • Provide technical advice to the project manager regarding scope change and scope verification
Project Officer	<ul style="list-style-type: none"> • Assist the project manager in an administrative capacity

4.2.4 Project Scope Statement

Blue Ventures, along with the Belize Fisheries Department has recognized the critical importance of addressing the lionfish invasion that has been observed in key fish replenishment zones across Belize's marine protected area networks.

Studies conducted in late 2015 and 2016 lead to the development of the Belize National lionfish Control Management Strategy. This project seeks to implement this strategy by engaging marine resource users and stakeholders in a collaborative effort to reduce lionfish populations in Belize's fish replenishment zones.

4.2.4.1 Project Description:

The purpose of this project is to implement the Belize National Lionfish Control Management Strategy which had been launched in early 2019. Blue Ventures, a global non-profit organization teamed up with the Belize Fisheries Department to address the lionfish invasion which has been adversely impacting coral reef sites across Belize. High populations of lionfish have the potential to compromise the health and integrity of coral reefs. Fisher folk, and marine resources alike, cannot afford to be subjected to the negative impacts that invasive lionfish can have on Belize's marine ecosystem. As a response to the invasion, this project features a participatory approach that engages stakeholders and marine resource users to reduce the high-density lionfish populations in Belize's critical fish replenishment zones.

4.2.5 Scope Baseline

4.2.5.1 Project Deliverables:

- D-1: Establishment of multi-stakeholder Lionfish Working Group.
- D-2: Established and fully trained 10 member Lionfish Brigade for Turneffe Atoll Marine Reserve.
- D-3: Established and fully trained 10 member Lionfish Brigade for the Northern Belize Coastal Complex.
- D-4: Established and fully trained 10 member Lionfish Brigade for South Water Caye Marine Reserve.
- D-5: Established long term monitoring program in selected MPAs.
- D-6: Two completed technical reports after one year of implementation in Turneffe Atoll Marine Reserve and Northern Belize Coastal Complex.
- D-7: Established framework and processes for continuous local marine resource user engagement.

4.2.5.2 Project Exclusions

Chart 12 Project Exclusions (Source author McKenzie March 2022)

Activities that are excluded from this project
1. Project does not include preliminary research of lionfish populations
2. Project does not include grant proposal submissions to secure funding
3. Project does not include the launch of the Belize National Lionfish Control Management Strategy
4. Project does not include surveys to be conducted one year after the implementation in Northern Belize Coastal Complex and South Water Caye Marine Reserve

4.2.5.3 Project Acceptance Criteria:

1. Project must be completed within the schedule of three years
2. Project must be executed within the project's budget of \$165,000 Belize dollars.
3. All project deliverables must be met as described in the project requirement tractability matrix.
4. Project must maintain a participatory approach to engage diverse marine resource users.

4.2.6 Project Work Breakdown Structure

The project's WBS features work packages that have been developed using the project deliverables outlined in the project charter. A WBS is a project management tool that compartmentalizes the work activities that are required in such a way that the project manager can clearly monitor and track (PMI p. 156, 2017). The WBS that has been developed for the Implementation of the Belize National Lionfish Management Strategy has been categorized into four components which include: Project Management, Governance, Training and Development, and Project Closure.

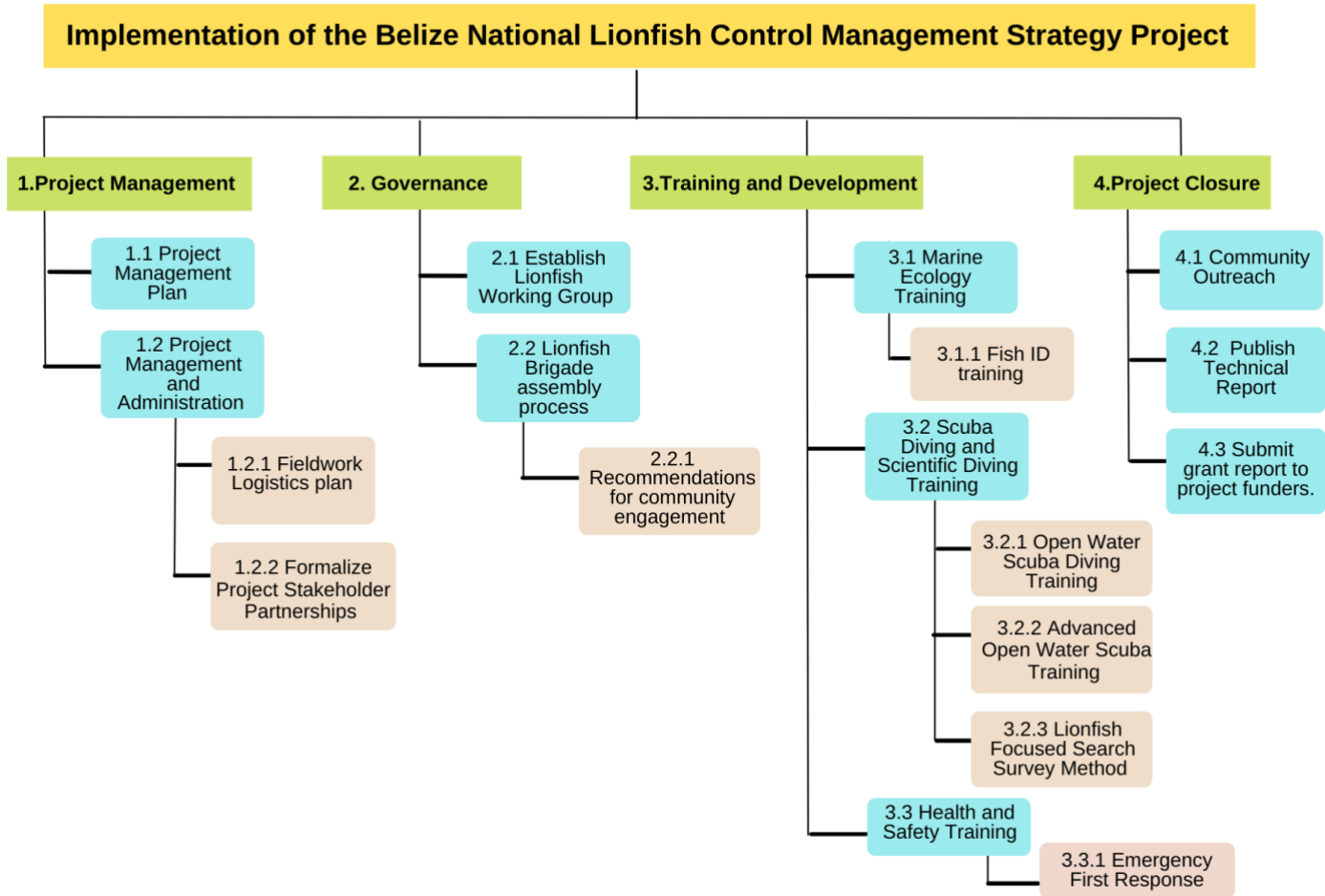


Figure 7 Work Breakdown Structure. (Source Author Ronalee McKenzie, April 2022)

The project Work Breakdown Structure Dictionary is detailed below.

Chart 13 Work Breakdown Structure Dictionary (Source author McKenzie April 2022)

Level	WBS Code	Element Name	Description of Work	Deliverable	Budget
1	1	Project Management	Establish a project management framework that will foster a favorable project outcome for the successful implementation of the Belize National Lionfish Management Strategy		\$ 8,000.00
2	1.1	Project Management Plan	Develop a comprehensive and detailed project management plan for the implementation of the Belize National Lionfish Control Management Strategy	Project Management Plan	\$ 4,000.00
2	1.2	Project Management and Administration	Ensure that the project's framework has proper management and administrative processes aligned with the protocols and procedures mandated by Blue Ventures		\$ 10,000.00
3	1.2.1	Fieldwork Logistic Planning	Develop a detailed fieldwork logistical plan that includes equipment procurement, risk assessments and medical evacuation plans	Medevac Plan	\$ 8,000.00
3	1.2.2	Formalize Stakeholder Partnerships	Formalize stakeholder partnerships by signing a Memorandum of Understanding between Blue Ventures and requisite project stakeholders.	Signed MOU	\$0.00

Level	WBS Code	Element Name	Description of Work	⁶⁰ Deliverable	Budget
1	2	Governance	Ensure good governance is maintained while executing this project.		\$0.00
2	2.1	Establish Lionfish Working Group	Establish a multi-Stakeholder Lionfish Working group to have quarterly meetings and provide recommendations	Active Lionfish Working Group	\$0.00
2	2.2	Establish Lionfish Brigade Assembly Process	Establish impartial 10 member lionfish brigade assembly process. Determine requirements and pre-requisites to become a member of the brigade.	Impartial lionfish brigade assembly process	\$0.00
3	2.2.1	Review recommendations for community engagement	Review technical recommendations provided by the Lionfish Working Group		\$0.00
1	3	Training and Development	Facilitate capacity building of the project's key stakeholders	Increased capacity of key stakeholders	\$0.00
2	3.1	Marine Ecology Training	Improve knowledge of basic marine ecology concepts		\$ 10,000.00
3	3.1.1	Fish Identification Training	Conduct Fish ID training for Caribbean / Atlantic reef species		\$ 10,000.00
2	3.2	Scuba Diving and Scientific Diving Training	Provide Technical training and certification in PADI scuba diving courses		\$ 30,000.00
3	3.2.1	Open Water Scuba Diving Training	Conduct PADI Open water scuba diving certification course to brigade members	PADI Open Water Certification	\$ 30,000.00

Level	WBS Code	Element Name	Description of Work	⁶¹ Deliverable	Budget
3	3.2.2	Advance Open Water Scuba Diving Training	Conduct PADI Advanced Open Water scuba diving certification course to brigade members	PADI Advance Open Water Certification	\$ 30,000.00
3	3.2.3	Lionfish Focused Search Survey Method Training	Conduct technical scientific diving training on Lionfish Focused Search Survey Method to brigade members	LFS Scientific Diving Certification	\$0.00
2	3.3	Health and Safety Training	Provide health and safety training to lionfish brigade members		\$0.00
3	3.3.1	Emergency First Response Training	Conduct First Aid, and Emergency First Response training to lionfish brigade members	First Aid and EFR Certification	\$ 10,000.00
1	4	Project Closure	Ensure that the project's approach is adaptive and replicable		\$0.00
2	4.1	Community Outreach	Conduct engagement visits to communities that have been included in this project.	Community assessment	\$ 15,000.00
2	4.2	Publish Technical Report	Publish technical report that outlines the status of lionfish population densities after one year of project implementation.	Technical Report on the project's results	\$0.00
2	4.3	Submit grant report to project funders	Submit Grant report to the project's founders to account how the grant was spent and share the outcome of the project.	Grant Report	\$0.00
Total					\$165,000.00

4.2.7 Scope Verification

The Project Management Institute defines scope verification as the process that formalizes the acceptance of all completed project deliverables (PMI, p.165 2017). Scope verification is a key component of the project management plan because it essentially confirms that the completed deliverables accurately meet the objectives of the project. The project's scope can be verified at any point throughout the duration of the project. Some inputs that are required for scope validation include: Scope Management Plan, Requirements Traceability Matrix, verified deliverables and Work Performance Data.

In the context of this project, decision making is the technique used to develop the template for verification of scope by the project manager as the project progresses. The WBS will be used to complete the delivery verification matrix template, and the project manager will assess the quality of each deliverable before signing the deliverable acceptance document. The following template was proposed for this purpose.

Chart 14 Delivery Verification Template (Source author McKenzie April 2022)

PROJECT						
Implantation of the Belize National Lionfish Control Management Strategy						
WBS Level	WBS ID	WBS Element Name	Planned Deliverable	Deliverable Submitted	Variance	Comments

4.2.8 Scope Control

Scope control can be described as the process of monitoring all the factors that impact the project's scope baseline. (PMI, p. 167, 2017). For the implantation of the Belize National Lionfish Control Management Strategy, the project manager and the project team are directly responsible for monitoring and addressing all factors that have the potential to adversely impact the project's scope.

All proposed scope changes should be submitted to the project manager via a change request form. The project manager then has the authority accept or reject the proposed scope changes. Should there be any approved amendments to the project scope, the project manager and the project team will then be responsible for updating all relevant project documents and communicating all approved scope amendments to the project's stakeholders.

4.2.9 Project Requirements

Project requirements are used to ensure that deliverables of the project and the product are satisfying the needs of the project's stakeholders and project beneficiaries. The project requirements for the Implementation of the Belize National Lionfish Management Control Strategy have been identified using various methods such as focus groups, interviews, and questioners. These requirements were then analyzed and documented in the requirements traceability matrix below.

4.2.10 Project Requirements Traceability Matrix

Chart 15 Requirements Traceability Matrix (Source author McKenzie, May 2022)

Project Name		Implementation of the Belize National Lionfish Control Management Strategy				
ID	WBS Code	WBS Element Name	Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Priority
2	1.1	Project Management Plan	Project Management Plan	Detailed information about the project's objectives, scope, schedule, cost, stakeholders, requirements, and beneficiaries.	Effective project management to ensure the project is executed within its schedule and cost.	High
3	1.2.1	Fieldwork Planning Logistic	Medical Evacuation Plan	Detailed information and location of all planned training sites and scuba diving sites	Ensure that health and safety is prioritized throughout the project	High
3	1.2.2	Formalize Stakeholder Partnerships	Signed MOU	Signed memorandum of understanding between Blue Ventures, and the Turneffe Atoll Sustainability Association and other stakeholders who will receive dive training from Blue Ventures in exchange for participation in lionfish population research and monitoring.	Ensure that stakeholders participate in the project under a formal partnership.	High

Project Name		Implementation of the Belize National Lionfish Control Management Strategy				
ID	WBS Code	WBS Element Name	Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Priority
2	2.1	Establish Lionfish Working Group	Multi-Stakeholder Lionfish Working Group	The working group must include stakeholders from the fisheries, conservation and tourism sectors. In addition, the group must meet at least 4 times per year.	Impartial governance and compliance	High
2	2.2	Establish Lionfish Brigade Assembly Process	10 member lionfish brigade for each marine protected area.	Potential members of the lionfish brigade must be authorized by a medical physician to be considered. In addition, they must be 18 years or older and must be fully vaccinated.	Trained and skilled lionfish brigade to conduct dive survey and research.	High
2	3.1	Marine Ecology Training	Increased capacity of key stakeholders	Potential members of the lionfish brigade will receive marine ecology training and must pass the final test with a score of 70% or higher to become a member.	Trained and skilled lionfish brigade to conduct dive survey and research.	High
3	3.1.1	Fish Identification Training	Increased capacity of key stakeholders	Potential brigade members will receive fish ID training for Atlantic / Caribbean reef species and must pass the test with a score of 70% or higher to become a member.	Trained and skilled lionfish brigade to conduct dive survey and research.	High
3	3.2.1	Open Water Scuba Diving Training	PADI Open Water Certification	Potential brigade members will receive scuba dive training and must pass both written and practical tests to become PADI Open water certified	Trained and skilled lionfish brigade to conduct dive survey and research.	High

Project Name		Implementation of the Belize National Lionfish Control Management Strategy				
ID	WBS Code	WBS Element Name	Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Priority
3	3.2.2	Advance Open Water Scuba Diving Training	PADI Advanced Open Water Certification	Potential brigade members will receive scuba dive training and must pass both written and practical tests to become PADI Advanced Open water certified	Trained and skilled lionfish brigade to conduct dive survey and research.	High
3	3.2.3	Lionfish Focused Search Survey Method Training	LFS Certification	Potential brigade members will receive training in the lionfish focused searched dive training and must pass practical tests to become e a member.	Trained and skilled lionfish brigade to conduct dive survey and research.	High
3	3.3.1	Emergency First Response	First Aid and Emergency First Response Certification	Conduct First Aid, and Emergency First Response training to lionfish brigade members	Trained and skilled lionfish brigade to conduct dive survey and research.	High
2	4.1	Community Outreach	Community Assessments	Community scoping and community prioritization.	Community and stakeholder engagement	High
2	4.2	Publish Technical Report	Technical Report on the project's results	Lionfish population collected 1 year after implantation of the lionfish control plan.	Technical Report on the project's results	High
2	4.3	Submit grant report to project funders	Grant Report	Detailed project budget and expense reports	Grant Report	High

4.3 Schedule Management Plan

Project schedule management is the process required to manage the timely completion of all project activities (PMI, p.173, 2017). In accordance with this definition, the schedule management plan for the Implementation of the Belize National Lionfish Management Strategy has been developed to outline the approach needed to execute the project successfully within the estimated timeframe.

The schedule management plan is a key component of the project since it describes the time that will be required to complete each project activity. All project activities that are required for the successful completion of this project have been identified and documented. The development of this schedule management plan followed the 6-step process outlined by PMI:

1. **Plan Schedule Management** – The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.
2. **Define Activities** – The process of identifying and documenting the specific actions to be performed to produce the project deliverables.
3. **Sequence** – The process of documenting relationships among the project activities.
4. **Estimate activity durations** – The process of estimating the number of work periods needed to complete individual activities with the estimated resources.
5. **Develop Schedule** – The process of analyzing the activity sequences, durations, resource requirements and schedule constraints to create the project schedule model for project execution and monitoring and controlling.
6. **Control Schedule** – The process of monitoring the status of the project to update the project schedule and manage changes to the schedule baseline.

4.3.1 Schedule Management Process and Approach

The project schedule for the Implementation of the Belize National Lionfish Management Strategy was developed using information from the project charter, the project's Work Breakdown Structure and the WBS dictionary found in the project scope management plan.

The duration of each activity described in the WBS was used to develop the project schedule. A Gantt chart is one of the outputs of the schedule management approach that was developed for the Implementation of the Belize National Lionfish Management Strategy. Microsoft Projects is the software tool that had been used for the creation of the Gantt chart by inputting each task with the corresponding duration.

4.3.2 Schedule Monitoring

The schedule management plan developed for the Implementation of the Belize National Lionfish Management Strategy includes schedule monitoring and control measures so that the project manager and the project team is better able to track the project's schedule performance. The project team will conduct meetings on a bi-weekly basis to track the project's progress and assess the duration of project activities displayed in the Gantt chart. The project manager is then expected to provide quarterly reports to the project sponsor, as well as communicate any approved amendments to the project schedule to all the project's stakeholders. Any approved changes to the project schedule must also be updated in all relevant project documents by the project manager.

4.3.3 Project Schedule Metrics

Project metrics that will be used project schedule management for the Implementation of the Belize Lionfish Management Strategy will include:

1. Project schedule variance by activity
2. Estimate to Complete

3. New tasks added since the most recent report
4. Planned Vs. Actual Task Completion using Schedule Performance Index

Due to the nature of this project, this schedule management plan will not include earned value management as a metric. However, the Percentage of Tasks on time will be included in the monitoring approach. This will allow the project manager and the project team to measure and track the percentage of all project activities / tasks that are completed either ahead of time or on their planned date of completion.

4.3.4 Project Schedule Control

Project schedule control is the process of monitoring the status of the project to update the project schedule and manage any approved changes that might impact the schedule baseline (PMI, p. 321, 2017). This process begins at the schedule baseline of the project. Since the schedule management plan is developed directly using project activities outlined in the project scope management plan, any changes to the project's scope will directly trigger changes to the project schedule. The project manager with support from the project team is expected to closely monitor the project scope and address any foreseeable factors that would cause variances in the project's scheduled. Given the nature of this project, the following schedule techniques will be used for the Implementation of the Belize National Lionfish Management Strategy:

1. **Performance Reviews** – Performance reviews measure, compare and analyze schedule performance against the schedule baseline such as the actual start and finish dates, percent complete and remaining duration of work.
2. **Variance Analysis** – Variance analysis is commonly used to determine the causes of a variance as the difference between an actual result and an expected result.

3. **Resource Optimization** – Resource optimization involves the scheduling of activities and the resources required by those activities while taking into consideration both resource availability and the project time.

4.3.5 Control Thresholds

Control thresholds are used to measure a project's schedule performance. For the Implementation of the Belize National Lionfish Control Management Strategy, the project manager is expected to compile the following metrics to conduct schedule performance assessments periodically throughout the duration of the project.

Schedule Performance Index

If the project manager identifies that the schedule performance index has a variance between 0.9 and 1.0 or above 1.2 the project manager is expected to develop a detailed report outlining the reason for this exception and include a corrective management plan to ensure that the project is on schedule.

Chart 16 Project Schedule Variance (Source author McKenzie, May 2022)

Performance Measure	Green	Yellow	Red
Schedule Performance Index (SPI)	≥ 1.0	between 0.9 and 1.0	< 0.9

4.3.6 Project Schedule Change Management

There is a direct correlation between the project schedule management plan and the project scope management plan. Thus, the project schedule management plan has been developed using the project activities that are outlined in the scope management plan. For any approved changes in the project scope, the project manager is expected to consider and reflect these changes in the project schedule management plan. If the project manager determines that changes in the project schedule baseline will exceed the defined schedule threshold, then they are expected to submit a schedule change request to the project's sponsor.

The project manager is obligated to submit a schedule change request under the following terms:

1. The proposed change in project schedule is estimated to increase or reduce the overall project duration by 10% or more when compared against the schedule baseline.
2. The proposed schedule change is estimated to increase or reduce the work package duration by 10% or more when compared against the schedule baseline.

Following the approval of any schedule change requests, the project manager is then expected to record all changes by updating the schedule baseline and all the relevant project documents. The project manager is also expected to communicate all approved schedule changes to the project stakeholders.

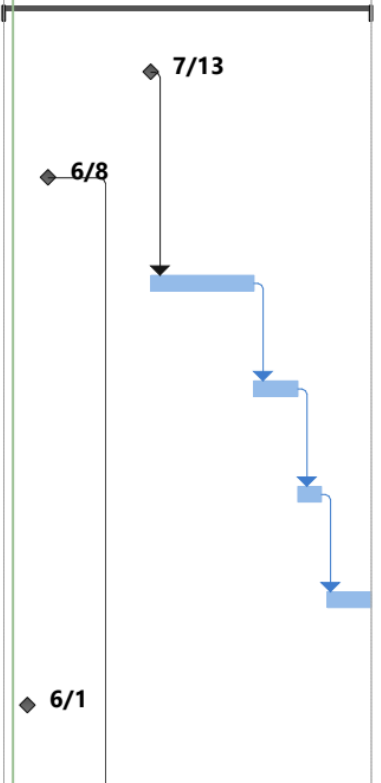
Chart 17 Project Schedule Activity List (Source author McKenzie, May 2022)

Task No.	Task	Duration	Start	Finish	Dependents	Milestone
1	Establish Belize National Lionfish Working Group	36 days	25/05/2022	13/07/2022		Yes
2	Establish Partnership with TASA (Signed MOU)	11 days	25/05/2022	08/06/2022		Yes
3	Fieldwork Logistics Planning For TAMR	25 days	06/06/2022	08/07/2022		No
4	Marine Ecology Training in TAMR	11 days	05/09/2022	19/09/2022		No
5	Emergency First Response Training in TAMR	6 days	20/09/2022	27/09/2022		No
6	Scuba Diving and LFS Training in TAMR	11 days	17/05/2023	31/05/2023		No
7	Establish Partnership with NBCC (Signed MOU)	6 days	06/09/2022	13/09/2022		Yes
8	Fieldwork Logistics Planning For NBCC	21 days	08/11/2022	06/12/2022		No
9	Marine Ecology Training in NBCC	8 days	18/01/2023	27/01/2023		No
10	Emergency First Response Training in NBCC	6 days	29/04/2024	06/05/2024		No
11	Scuba Diving and LFS Training in NBCC	19 days	09/02/2023	07/03/2023		No
12	Mid Control Plan Evaluation in TAMR	16 days	25/04/2023	16/05/2023	6 - Scuba Diving and LFS Training in TAMR	Yes
13	Establish Partnership with SWCMR Co-Managers (Signed MOU)	26 days	22/05/2023	26/06/2023		Yes

Task No.	Task	Duration	Start	Finish	Dependents	Milestone
14	Fieldwork Logistics Planning For SWCMR	26 days	12/06/2023	17/07/2023		No
15	Marine Ecology Training in SWCMR	10 days	14/08/2023	25/08/2023		NO
16	Emergency First Response Training in SWCMR	7 days	29/08/2023	06/09/2023		No
17	Scuba Diving and LFS Training in SWCMR	25 days	14/10/2024	15/11/2024		No
18	Mid Control Plan Evaluation in NBCC	8 days	17/04/2024	26/04/2024	10 - Emergency First Response Training in NBCC	Yes
19	End Control Plan Evaluation in TAMR	7 days	22/11/2022	30/11/2022	12 - Mid Control Plan Evaluation in TAMR	Yes
20	Mid Control Plan Evaluation in SWCMR	8 days	02/10/2024	11/10/2024	17 - Scuba Diving and LFS Training in SWCMR	Yes
21	End Control Plan Evaluation in NBCC	6 days	09/04/2024	16/04/2024	18 - Mid Control Plan Evaluation in NBCC	Yes
22	End Control Plan Evaluation in SWCMR	11 days	17/09/2024	01/10/2024	20 - Mid Control Plan Evaluation in SWCMR	Yes

The Gantt for the project is detailed below.

ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Qtr 2, 2022			Qtr 3, 2022			Qtr 4, 2022
							Apr	May	Jun	Jul	Aug	Sep	Oct
1		1	BLCMS Project	89 days	Wed 5/25/22	Mon 9/26/22							
2		1.1	Establish Belize National Lionfish Working Group	36 days	Wed 5/25/22	Wed 7/13/22							
3		1.2	Establish Partnership with TASA (Signed MOU)	11 days	Wed 5/25/22	Wed 6/8/22							
4		1.3	Fieldwork Logistics Planning For TAMR	25 days	Thu 7/14/22	Wed 8/17/22							
5		1.4	Marine Ecology Training in TAMR	11 days	Thu 8/18/22	Thu 9/1/22							
6		1.5	Emergency First Response Training in TAMR	6 days	Fri 9/2/22	Fri 9/9/22							
7		1.6	Scuba Diving and LFS Training in TAMR	11 days	Mon 9/12/22	Mon 9/26/22							
8		1.7	Establish Partnership with NBCC (Signed MOU)	6 days	Wed 5/25/22	Wed 6/1/22							



Project: ronalee fgp
Date: Sat 5/28/22

Task		Inactive Summary		External Tasks	
Split		Manual Task		External Milestone	
Milestone		Duration-only		Deadline	
Summary		Manual Summary Rollup		Progress	
Project Summary		Manual Summary		Manual Progress	
Inactive Task		Start-only			
Inactive Milestone		Finish-only			

ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Qtr 2, 2022			Qtr 3, 2022			Qtr 4, 2022
							Apr	May	Jun	Jul	Aug	Sep	Oct
9		1.8	Fieldwork Logistics Planning For NBCC	21 days	Wed 5/25/22	Wed 6/22/22							
10		1.9	Marine Ecology Training in NBCC	8 days	Thu 6/23/22	Mon 7/4/22							
11		1.10	Emergency First Response Training in NBCC	6 days	Tue 7/5/22	Tue 7/12/22							
12		1.11	Scuba Diving and LFS Training in NBCC	19 days	Wed 7/13/22	Mon 8/8/22							
13		1.12	Mid Control Plan Evaluation in TAMR	16 days	Thu 6/9/22	Thu 6/30/22					6/30		
14		1.13	Establish Partnership with SWCMR Co-Managers (Signed MOU)	26 days	Wed 5/25/22	Wed 6/29/22					6/29		
15		1.14	Fieldwork Logistics Planning For SWCMR	26 days	Wed 5/25/22	Wed 6/29/22							

Project: ronalee fgj
Date: Sat 5/28/22

Task		Inactive Summary		External Tasks	
Split		Manual Task		External Milestone	
Milestone		Duration-only		Deadline	
Summary		Manual Summary Rollup		Progress	
Project Summary		Manual Summary		Manual Progress	
Inactive Task		Start-only			
Inactive Milestone		Finish-only			

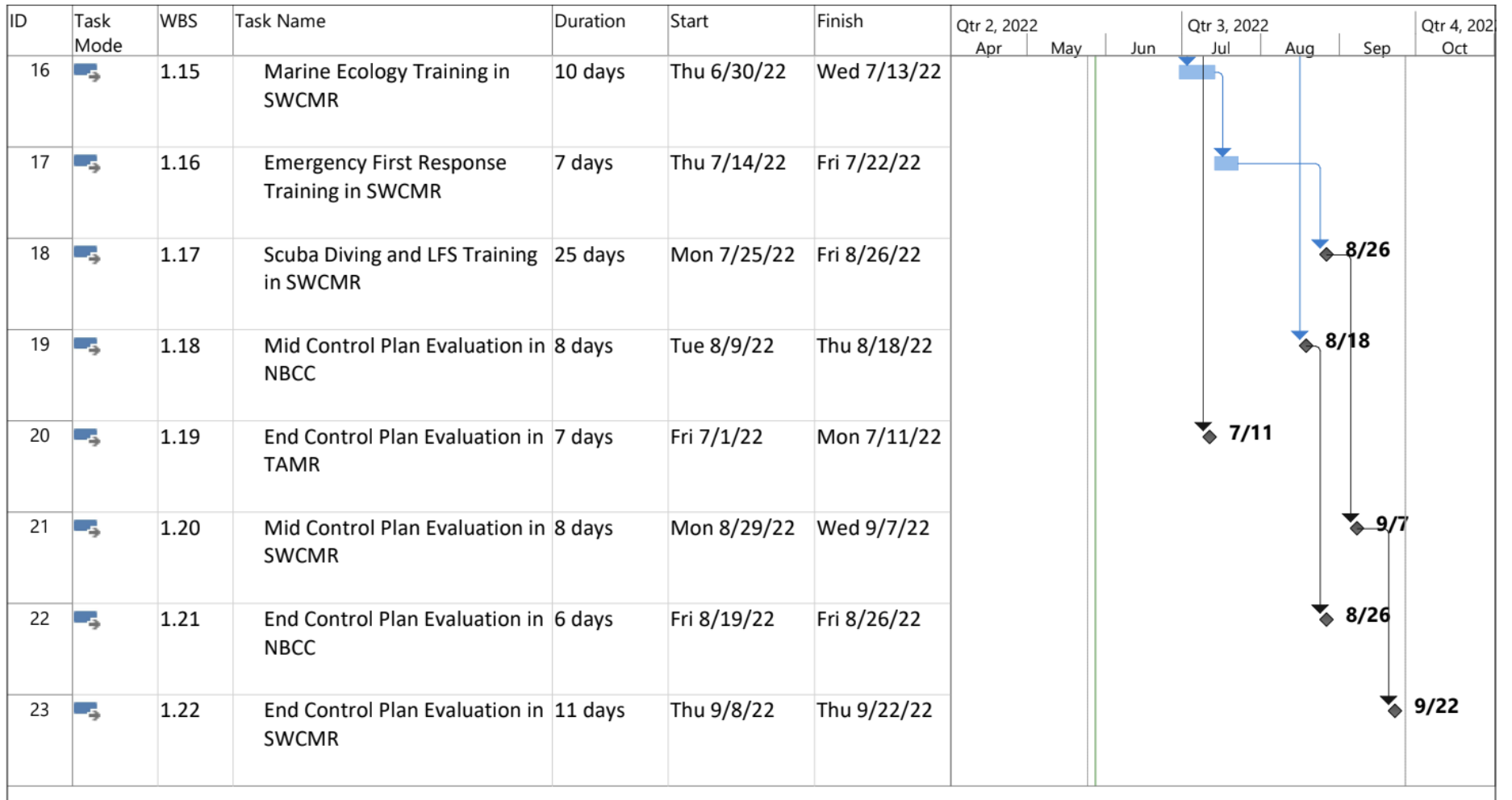


Figure 8 Gantt of the project. (Source Author Ronalee McKenzie, May 2022)

4.4 Cost Manage Plan

4.4.1 Introduction

The cost management plan provides a detailed outline of the estimated cost required for project completion, as well as the allocation and control of costs for all project activities. The cost management plan for this project was prepared using information from the project charter, as well as information directly sourced from the Belize National Lionfish Management Strategy. The primary objective of this plan is to guide the project manager and the project team by ensuring that the most appropriate cost management approach is taken so that all project activities are successfully completed within the approved budget for this project. The development of this plan followed the 4 step cost management processes outlined by the Project Management Institute which are:

1. Plan Cost Management – The process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled.
2. Estimate Costs – The process of developing an approximation of the monetary resources needed to complete project work.
3. Determine Budget – The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.
4. Control Costs – the process of monitoring the status of the project to update costs and manage changes to the baseline.

4.4.2 Scope

The cost management plan that has been developed for the Implementation of the Belize National Lionfish Management Strategy features both internal and external project costs components. The cost estimation techniques were used to determine the costs for each project activity. All costs were combined to develop the budget for this project.

Any approved changes to the project scope that would affect or impact the project cost should be communicated by the project manager, and the project manager is then expected to update all relevant project documents.

4.4.3 Cost Management Approach

In addition to following the 4-step process, the cost management approach that will be used for the Implementation of the Belize National Lionfish Control Management Strategy will see the creation of cost accounts at the second level of the project's Work Breakdown Structure. Creating cost accounts at this level will allow the project manager and the project team to have ease in cost tracking throughout the duration of this project. The cost management approach developed for this project will use Earned Value Management to measure and control the project's financial cost performance.

4.4.4 Cost Planning and Estimating

Existing resources of Blue Ventures and project stakeholders were consulted prior to the development of the cost management plan. Following this assessment, the resources and requirements needed to successfully implement the Belize National Lionfish Control Management Strategy were established and finalized through the cost estimating process. Cost estimations for this project included boat / vessel rental, boat fuel, scuba diving certification fees, facility rental, services, and contingency costs. All cost estimating for this project is done at the activity level which is reflected in the project's budget. The cost estimating process is a vital component of the cost management plan since it is used to develop the project's cost baseline and furthermore the project's budget. Blue Ventures had received funding from the Mesoamerican Reef Fund, as well as the Summit Foundation to execute this project. Given the nature of this project, and the interest of the project's funders, accurate cost estimating and reporting is required. For this reason, only the project funders will have the authority to make any changes to the project's cost baseline.

Restrictions of grants received to conduct this project prevented the inclusion of a management reserve, however a 5% contingency reserve is included in the total project budget

Chart 18 Activity Cost Estimates (Source author McKenzie, May 2022)

Total Cost Estimate	\$ 165,000.00
Contingency Reserve (5%)	\$ 8,250.00
Cost Baseline	\$ 173,250.00
Management Reserve (0%)	
Total Project Budget	\$ 173,250.00

4.4.5 Project Budget and Cost Baseline

The project budget for the Implementation of the Belize National Lionfish Management Strategy was developed using the combined costs for all the project's activities. The development of the project budget ultimately determines the project's cost baseline, which is then used to control and monitor the cost performance of the project. Additionally, the cost control process is used to compare the project's budgeted / estimated cost against the project's actual costs. Given the nature of this project, activity costs were determined prior to the submission of grant proposals. Key factors that were vital for the development of the project budget included:

- a. Contracts
- b. Project Schedule
- c. Activity Cost Estimates
- d. Scope Baseline
- e. Basis of Estimates

4.4.6 Cost Metrics and Cost Reporting

The project manager and the project team will be responsible for assessing and the project's cost and schedule performance using tools and techniques recommended by the Project Management Institute. The metrics that will be used measure performance include:

1. **Cost Variance** which will be reported bi-monthly by the project manager
2. **Schedule Variance** which will be reported bi-monthly by the project manager
3. **Cost Performance Index** reported quarterly by the project manager.
4. **Schedule Performance Index** which will be reported bi -monthly by the project manager.

If the schedule performance index or the cost performance index has a variance that lies between 0.1 and 0.2, the project manager is obligated file a report that details or justifies the reason for the exception. Additionally, if the project's schedule performance index or the cost performance index has a variance that is greater than 0.2, the project manager is also obligated to file a report that includes a corrective plan that would guarantee improvement of the project's cost and schedule performance.

Chart 19 Project Cost Variance Threshold (Source author McKenzie, May 2022)

Performance Measure	Green	Yellow	Red
Schedule Performance Index (SPI)	≥ 1.0	between 0.9 and 1.0	< 0.9
Cost Performance Index (CPI)	≥ 1.0	between 0.9 and 1.0	< 0.9

4.4.7 Cost Control

PMI defines Cost Control as the process of monitoring the status of the project to update the project costs and managing changes to the cost baseline (PMI, p. 491, 17). Given the spending limitations provided by the project funders for the Implementation of the Belize National Lionfish Control Management Strategy it is imperative that the project manager and the project team proactively engage in cost control activities throughout the duration of the project to control and monitor project costs.

Monitoring the project's performance and controlling project costs is, especially for projects of this nature, of critical importance to ensure a favorable project outcome. The project manager is ultimately responsible for developing cost reports and for providing updates on the cost performance of the project on a quarterly basis. The project manager and project team are expected to follow the following cost control procedure outlined by PMI:

1. Monitor cost performance of the project and provide quarterly updates
2. Identify and record all budget amendments
3. Include and implement approved budget amendments only
4. Report any changes to the project sponsor as well as the project's stakeholder

As a result of following this process, the project manager with support from the project team are expected to update relevant project documents such as the cost estimates and the risks register to reflect and cost changes that may have been approved by the project sponsor.

4.4.8 Project Budget

Analogous cost estimation and expert judgement were used to estimate the costs for each project activity, and then used to develop the budget for the Implementation of the National Belize Lionfish Management Strategy.

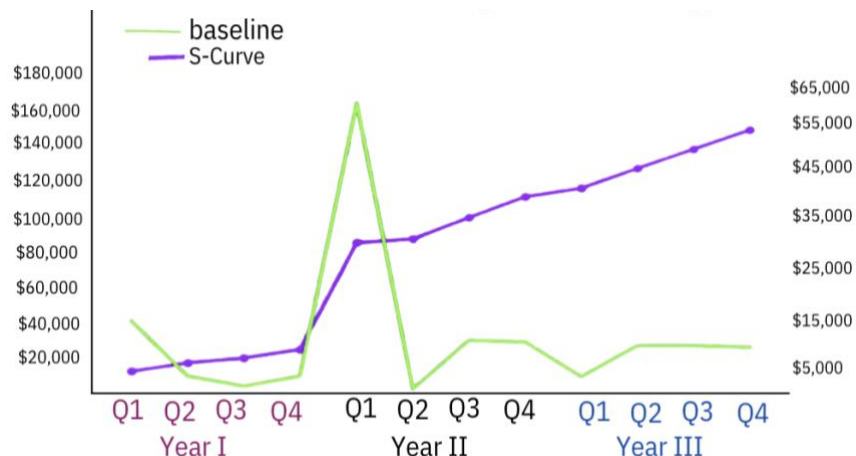


Figure 9 S Curve (Source Author Ronalee McKenzie, May 2022)

Chart 20 Project Budget (Source author McKenzie, May 2022)

WBS Code	Task Item	Description of Work	Unit of Measurement	Quantity	Cost	Subtotal	Total	Contingency Reserve	Cost Baseline
1	Project Management	Establish a project management framework that fosters a favorable project outcome for the successful implementation of the Belize National Lionfish Management Strategy	Months Worked	30	\$ 266.66	\$8,000.00	\$ 8,000.00	\$ 500.00	\$ 8,500.00
1.1	Project Management Plan	Develop a comprehensive and detailed project management plan for the implementation of the Belize National Lionfish Control Management Strategy	Months Worked	4	\$ 1,000.00	\$4,000.00	\$ 4,000.00	\$ 500.00	\$ 4,500.00
1.2	Project Management and Administration	Ensure that the project's framework has proper management and administrative processes that are aligned with the protocols and procedures mandated by Blue Ventures	Months Worked	36	\$ 27.77	\$10,000.00	\$ 10,000.00	\$ -	\$ 10,000.00

WBS Code	Task Item	Description of Work	Unit of Measurement	Quantity	Cost	Subtotal	Total	Contingency Reserve	Cost Baseline
1.2.1	Fieldwork Logistic Planning	Develop a detailed fieldwork logistical plan that includes equipment procurement, risk assessments and medical evacuation plans	Months Worked	6	\$ 1,333.33	\$8,000.00	\$ 8,000.00	\$ 250.00	\$ 8,250.00
1.2.2	Formalize Stakeholder Partnerships	Formalize stakeholder partnerships by signing a MOU between Blue Ventures and requisite project stakeholders.			\$ -	\$0.00	\$ -	\$ -	\$ -
2	Governance	Ensure good governance is maintained while executing this project.			\$ -	\$0.00	\$ -	\$ -	\$ -
2.1	Establish Lionfish Working Group	Establish a multi-Stakeholder Lionfish Working group for quarterly meetings and provide recommendations.			\$ -	\$0.00	\$ -	\$ -	
2.2	Establish Lionfish Brigade Assembly Process	Establish impartial 10 member lionfish brigade assembly process. Determine requirements and pre-requisites to become a member of the brigade.			\$ -	\$0.00	\$ -	\$ -	\$ -

WBS Code	Task Item	Description of Work	Unit of Measurement	Quantity	Cost	Subtotal	Total	Contingency Reserve	Cost Baseline
2.2.1	Review recommendations for community engagement	Review technical recommendations provided by the Lionfish Working Group			\$ -	\$0.00	\$ -	\$ -	\$ -
3	Training and Development	Facilitate capacity building of the project's key stakeholders			\$ -	\$0.00	\$ -	\$ -	\$ -
3.1	Marine Ecology Training	Improve knowledge on basic marine ecology concepts	Days of training	30	\$ 333.33	\$10,000.00	\$ 10,000.00	\$ -	\$ 10,000.00
3.1.1	Fish Identification Training	Conduct Fish ID training for Caribbean / Atlantic reef species	Days of training	30	\$ 333.33	\$10,000.00	\$ 10,000.00	\$ -	\$ 10,000.00
3.2	Scuba Diving and Scientific Diving Training	Provide Technical training and certification in PADI scuba diving courses	Days of training	30	\$ 1,000.00	\$30,000.00	\$ 30,000.00	\$ 2,000.00	\$ 32,000.00
3.2.1	Open Water Scuba Diving Training	Conduct PADI Open water scuba diving certification course to brigade members	Days of training	30	\$ 1,000.00	\$30,000.00	\$ 30,000.00	\$ 2,000.00	\$ 32,000.00
3.2.2	Advance Open Water Scuba Diving Training	Conduct PADI Advanced Open Water scuba diving certification course to brigade members	Days of training	30	\$ 1,000.00	\$30,000.00	\$ 30,000.00	\$ 2,000.00	\$ 32,000.00
3.2.3	Lionfish Focused Search Survey Method Training	Conduct technical scientific diving training on Lionfish Focused Search Survey Method to brigade members			\$ -	\$0.00	\$ -	\$ -	

WBS Code	Task Item	Description of Work	Unit of Measurement	Quantity	Cost	Subtotal	Total	Contingency Reserve	Cost Baseline
3.3	Health and Safety Training	Provide health and safety training to lionfish brigade members			\$ -	\$0.00	\$ -	\$ -	
3.3.1	Emergency First Response Training	Conduct First Aid, and Emergency First Response training to lionfish brigade members	Days of training	30	\$ 333.33	\$10,000.00	\$ 10,000.00	\$ 500.00	\$ 10,500.00
4	Project Closure	Ensure that the project's approach is adaptive and replicable				\$0.00	\$ -	\$ -	\$ -
4.1	Community Outreach	Conduct engagement visits to communities that have directly been included in this project.	No. of Communities	5	\$ 3,000.00	\$15,000.00	\$ 15,000.00	\$ 500.00	\$ 15,500.00
4.2	Publish Technical Report	Publish technical report that outlines the status of lionfish population densities following one year of project implementation.			\$ -	\$0.00	\$ -	\$ -	\$ -
4.3	Submit grant report to project funders	Submit Grant report to the project's founders to account how the grant was spent and share the outcome of the project.			\$ -	\$0.00	\$ -	\$ -	\$ -
Totals							\$ 165,000.00	\$ 8,250.00	\$ 173,250.00
Contingencies: All contingencies will be managed by the project manager and only will be spent after a cost justification. The project team will meet to decide on thresholds, triggers, and response strategies.									

Cost baseline for January⁸⁷ 2022 - December 2022

WBS Code	Task Item	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
3.2	Scuba Diving and Scientific Diving Training												
3.2.1	Open Water Scuba Diving Training									\$4,600.00			
3.2.2	Advance Open Water Scuba Diving Training									\$4,500.00			
3.2.3	Lionfish Focused Search Survey Method Training												
3.3	Health and Safety Training				\$ 1,000.00					\$3,000.00			
3.3.1	Emergency First Response Training									\$2,500.00			
4	Project Closure												
4.1	Community Outreach		\$ 2,500.00	\$ 100.00							\$1,500.00	\$ 500.00	
4.2	Publish Technical Report												
4.3	Submit grant report to project funders												
Cost Baseline per Month for 2022		\$ 6,200.00	\$ 6,400.00	\$ 3,100.00	\$ 4,600.00	\$ 2,700.00	\$ 1,700.00	\$ 3,700.00	\$ 2,500.00	\$ 4,600.00	\$3,900.00	\$ 3,200.00	\$ 2,400.00
Cumulative project costs for 2022		\$ 6,200.00	\$ 12,600.00	\$15,700.00	\$ 20,300.00	\$ 23,000.00	\$24,700.00	\$ 28,400.00	\$30,900.00	\$45,500.00	49,400.00	52,600.00	\$ 55,000.00

4.5 Quality Management Plan

4.5.1 Introduction

Project Quality Management Includes the process for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements to meet stakeholder objectives. Project quality management also supports continuous process improvement activities as undertaken on behalf of the performing organization (PMI p109, 2017). The development of the project quality management plan for the Implementation of the Belize National Lionfish Control Management Strategy followed the 3-step management process outlined by the Project Management Institute.

1. **Plan Quality Management** – The process of identifying quality requirements and/or standards for the project and its deliverables and documenting how the project will demonstrate compliance with quality requirements and standards.
2. **Manage Quality** – The process of translating the quality management plan into executable quality activities that incorporate the organization's quality polices into the project.
3. **Control Quality** – The process of monitoring and recording the results of executing the quality management activities to assess performance and ensure the project outputs are complete, correct and meet customer expectations.

Project Quality Management is a vital component for effective project management because it addresses the management of the project and the deliverables of the project. The project quality management plan for the Implementation of the Belize National Lionfish Control Management Strategy was developed using the project charter which outlines the project's deliverables and overall acceptance criteria. This Quality Management Plan will provide the project manager and the project team with the appropriate quality planning, monitoring, and controlling tools and techniques to ensure that all the project's deliverables will meet the expectations of the project stakeholders, funders, and beneficiaries.

4.5.2 Quality Management Approach

Given the scientific nature of this project, the quality approach that has been developed for the Implementation of the Belize National Lionfish Control Management Strategy focus on proper quality planning and quality control measures. The project manager with support from the project team are expected to follow the quality standards and requirements outlined by Blue Ventures. The quality standards must be aligned with policies and procedures established by Blue Ventures which is the organization that is primarily responsible for the Implementation of this strategy. In addition, the project manager and the project team must ensure that the execution of the project follows:

1. Grant requirements outlined by the project founders
2. National legislation and Statutory Instruments for marine protect areas in Belize
3. A Work Plan and budget that established in the Project Management Plan

The data collection and research components of this project relies heavily on the quality of data collection techniques, analysis, and reporting. During the development of this quality management plan, key quality objectives have been identified.

The quality objectives for the Implementation of the Belize National Lionfish Control Management Strategy are:

- a. Project deliverables support the improved project management proficiency.
- b. Deliverables meet the requirements of the project requirements that are outlined by the project sponsor, project manager, project stakeholders and project beneficiaries.
- c. Deliverables follow National legislations and Statutory Instruments for marine protect areas in Belize
- d. Project processes are performed efficiently and regularly documented and reported.
- e. Project processes are aligned with the standards, policies and procedures outlined by Blue Ventures.

While developing the quality management plan, in addition to identifying quality objectives, the quality acceptance criteria for each project deliverable were also established and are described in the chart below:

Chart 22 Project Quality Acceptance Criteria (Source author McKenzie, May 2022)

Deliverable		Acceptance Criteria
D-1	Establishment of multi-stakeholder Lionfish Working Group.	Active participation and engagement of working group members with representation from the Belize Fisheries Department, Civil Society Organizations, Fisher-led Associations, and organizations from the Tourism Sector.
D-2	Established and fully trained 10 member Lionfish Brigade for Turneffe Atoll Marine Reserve.	Ten-member brigade where each member has been trained and certified in Marine Ecology, Advanced Scuba Diving, Scientific Diving, Lionfish Survey Methods, and Emergency First Response.
D-3	Established and fully trained 10 member Lionfish Brigade for the Northern Belize Coastal Complex.	Ten-member brigade where each member has been trained and certified in Marine Ecology, Advanced Scuba Diving, Scientific Diving, Lionfish Survey Methods, and Emergency First Response.
D-4	Established and fully trained 10 member Lionfish Brigade for South Water Caye Marine Reserve.	Ten-member brigade where each member has been trained and certified in Marine Ecology, Advanced Scuba Diving, Scientific Diving, Lionfish Survey Methods, and Emergency First Response.
D-5	Established long term monitoring program in selected MPAs	Signed Agreement between Blue Ventures and the Co-Management Agencies for the selected Marine Protected Area, where Co-Management Agency agrees to institute a lionfish population monitoring program for one year following the Implementation of the lionfish control management strategy.
D-6	Two completed technical reports after one year of implementation in Turneffe Atoll Marine Reserve and Northern Belize Coastal Complex.	Technical reports completed reflecting lionfish population data for surveys conducted one year after the control strategy is implemented in Turneffe Atoll Marine Reserve (TAMR) and in the Northern Belize Coastal Complex (NBCC).

Deliverable		Acceptance Criteria
D-7	Established framework and processes for continuous local marine resource user engagement such as Lionfish tournaments and derbies.	Community visits and assessments in a minimum of 6 coastal / fisher communities in Belize, supported with a one-year calendar plan of activities for community engagement in lionfish tournaments and festivals.

4.5.3 Quality Metrics and Measurements

This quality management plan developed for the Implementation of the Belize National Lionfish Control Management Strategy features tools and techniques recommended by the Project Management Institute to measure the quality of the project deliverables. A quality metric describes a project or product attribute and how the control quality process will verify compliance to it (PMI p 123, 2017). The quality metric can be applied to several factors including project documents, processes, and project deliverables. While the quality metric describes the quality of the project or deliverable, quality control activities are included in the quality management plan to monitor and verify that that project deliverables meet the established project quality standards. The quality metrics used for the development for the project quality management plan for the Implementation of the Belize National Lionfish Control Management Strategy are described in the quality management chart below:

Chart 23 Project Quality Management (Source author McKenzie, May 2022)

Quality Area	Metric	Measurement	Threshold Tolerance
Risk	Average Aging of Risks	Total calendar Days for Active Risks/ Number of Active risks	Maximum of 3 unmitigated risks
Change Control	Number of opened and closed Change Requests	New change requests created, rejected, and closed in the reporting period	A maximum of 5 change requests for the project's scope

Quality Area	Metric	Measurement	Threshold Tolerance
Schedule	Schedule Performance Index	Earned Value / Planned Value	Schedule Performance Index must be equal to or greater than 1
Deliverable	Contractual Deliverable Timeliness	Number of Deliverables submitted on time / Total # of Deliverables (per reporting period)	Deliverables can be submitted a Maximum of 10 days after estimated due date.
Scope of Works/ Implemented Project Activities	Percentage of Compliance	Total Compliant Activities / Total Project Activities	A minimum of 70% compliance

4.5.4 Quality Assurance

The quality management plan that has been developed for the Implementation of the Belize National Lionfish Control Management Strategy includes quality assurance activities. The Project Management Institute describes Quality Assurance as the preventative steps that are taken to increase the likelihood of meeting project deliverables and achieving quality targets. In addition, quality assurance is used to determine a project's compliance with policies and procedures to guarantee that quality is continuously integrated throughout the project/product development of the. The project manager, with support from the project team, is expected to conduct the following proactive quality assurance activities:

1. **Transparent and open communication between the project team and the project's stakeholders** – Given the participatory approach of this project, it is imperative that the project team maintain transparent communication between all project stakeholders throughout the duration of the project.

2. **Scientific and Technical Training** - Given the scientific nature of this project, the project manager along with support from the project team must ensure that thorough scientific and technical training is conducted. Quality assurance is especially required for data collection, and reporting components of this project.
3. **Competency Assessments** – Competency assessments of the Lionfish brigade team must be determined to ensure that brigade members can effectively conduct the surveys and research needed to meet the project's deliverables.
4. **Quarterly Meetings** – The project team must facilitate quarterly meetings with members of the National Belize Lionfish Working Group to review recommendations for continued implantation of the Belize National Lionfish Control Management Strategy.

4.5.5 Quality Control

Control Quality is the process of monitoring and recording the results of executing the quality management activities to assess performance and ensure the project outputs are accurate and meet customer expectations. The key benefit of this process is verifying that project deliverables and work meet the requirements specified by the project's stakeholders (PMI, p 346 2017). The following quality control activities will be used for the Implantation of the Belize National Lionfish Control Management Strategy to ensure quality control of the project's deliverables:

1. **Risk Identification and corresponding risk mitigation** – The project manager with support from the project team is expected to use quality tools such as a Cause-and-Effect diagram to evaluate areas of risk and propose corresponding risk mitigation.
2. **Review Process** – The project manager, with support from the project team, is expected to conduct a review process for each project deliverable before it can be released.

Furthermore, the project manager is expected to critically assess each project deliverable against its acceptance criteria to determine if each deliverable will meet the expectations of the project sponsor, project stakeholders and project beneficiaries.

3. **Defined Milestones** – The project manager with support from the project team are expected to critically review the project milestones against the means of verification. The project manager and the project team are expected to provide evidence for each of the project's milestone before reporting that the project has met its milestones. If milestones have not been met, the project manager with support from the project team are obligated to propose corrective actions to ensure that all projects' milestones are formally met.

4.5.6 Quality Reporting and Change Requests

The development of the project quality management plan for the Implementation of the Belize National Lionfish Control Management Strategy considers activities that are required for quality reporting as well as actions that are required if change requests are made. The project manager and project team are expected to develop bi-monthly quality reports that should reflect the status of quality assurance and quality control activities. If any changes occur during the control quality process, the project manager is obligated to record these changes, and if necessary, to submit a change request. If changes to the quality control process are accepted and approved by the project sponsor, the project manager is then expected to update all relevant project documents and is also expected to communicate all changes to the project stakeholders.

4.6 Resource Management Plan

4.6.1 Introduction

Project Resource Management includes the process to identify, acquire, and manage the resources need for the successful completion of the project. These processes help to ensure that the appropriate resources are available to the project team at the right time and the right place (PMI, p. 439 2017). The project Resource Management plan followed the 6-step process outlined by PMI.

1. **Plan Resource Management** – The process of defining how to estimate, acquire, manage, and utilize physical and team resources.
2. **Estimate Activity Resource** – The process of estimating team resources and the type and quantities of material, equipment and supplies necessary to perform project work.
3. **Acquire Resources** – The process of obtaining team members, facilities, equipment, materials, supplies and other resources necessary to complete project work.
4. **Develop Team** – The process of improving competencies, team member interaction and the overall team environment to enhance project performance.
5. **Manage Team** – The process of tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project preformance.
6. **Control Resources** – The process of ensuring that the physical resources assigned and allocated to the project are available as planned, as well as monitoring the planned versus actual use of resources and performing corrective actions as necessary.

Though this project features a participatory approach to invasive species management, Blue Ventures is the organization ultimately responsible for the successful Implementation of the Belize National Lionfish Control Management Strategy, therefore this resource management plan has been developed primarily using the planned and available resources from Blue Ventures, the Belize team, as well as some recourses that are available from key project stakeholders. Please refer to the organizational structure illustrated in Figure 2.

4.6.2 Resources Allocated

The project team for the Implementation of the Belize National Lionfish Management Strategy will include:

1. Conservation Science Manager
2. Field Program Manger
3. Science Officer & PADI Open Water Scuba Instructor
4. Two Program Officers
5. Monitoring & Evaluation Coordinator

Chart 24 Project Resource Allocation (Source author McKenzie, May 2022)

Resource	Description	Source	Allocation
Project Team	Conservation Science Manager	Internal	Full-Time
	Field Program Manager	Internal	Full-Time
	2 Program Officers	Internal	Full-Time
	Science Officer and PADI Open Water Scuba Diving Instructor	Internal	Full-Time
	Monitoring & Evaluation Coordinator	Internal	Full-Time
Facilities	Blue Ventures Office Space	Internal	Full-Time
	Turneffe Atoll Marine Reserve Base	External	During lionfish Brigade Training Only

Resource	Description	Source	Allocation
	South Water Caye Marine Reserve Base	External	During lionfish Brigade Training Only
Equipment	Scuba diving gear	Internal	Full-Time
	Scuba diving oxygen tanks	Internal	Full-Time
	Marine Ecology training materials	Internal	Full-Time
	First aid training material	Internal	Full-Time
	Emergency first response training material	Internal	Full-Time
	Boat / vessel	External	During lionfish Brigade Training Only
	Laptop Computers	Internal	Full-Time
	Printer	Internal	Full-Time
	Lamination machine	Internal	Full-Time
Other	Teleconferencing - Zoom Account	Internal	Full-Time
	Project Management Software - Monday	Internal	Full-Time
	Data Visualization Tool- Tableau	Internal	Full-Time
	Communication Accounts - Google Suite	Internal	Full-Time

4.6.3 Resource Requirements

Resource requirements identify the types and quantities of resources required for each work package or activity in a work package and can be aggregated to determine the estimated resources for each package (PMI, p, 493, 2017). During the development of this project resource management plan for the Implementation of the Belize National Lionfish Control Management Strategy, it has been determined that each member of the project team will play a key role in effective management and execution of this project. In addition, it has been pre-determined that most of the resources required will be accessed internally with some resources such as facilities and equipment to be sourced externally.

4.6.4 Basis of Estimates

During the development of this project resource management plan for the Implementation of the Belize National Lionfish Management Strategy basis of estimates were considered and included. The basis of estimates describes the methods used to determine the estimated uses of the project's resources. This includes the following:

1. Assumptions associated with the estimate
2. Known constraints
3. Range of estimates
4. The confidence level of estimate
5. Documentation of identified risks influencing the estimate

Estimates for the Implementation of the Belize National Lionfish Control Management Strategy were defined using both analogues estimation and expert judgment. As described in the project resource requirements, it has been assumed that all pre-assigned internal resources will be made available for the duration and execution of this project.

4.6.5 Resource Breakdown Structure

A resource breakdown structure has been developed for the Implementation of the Belize National Lionfish Management Strategy to visually represent and categorize the resources that are required for the successful execution of this project.

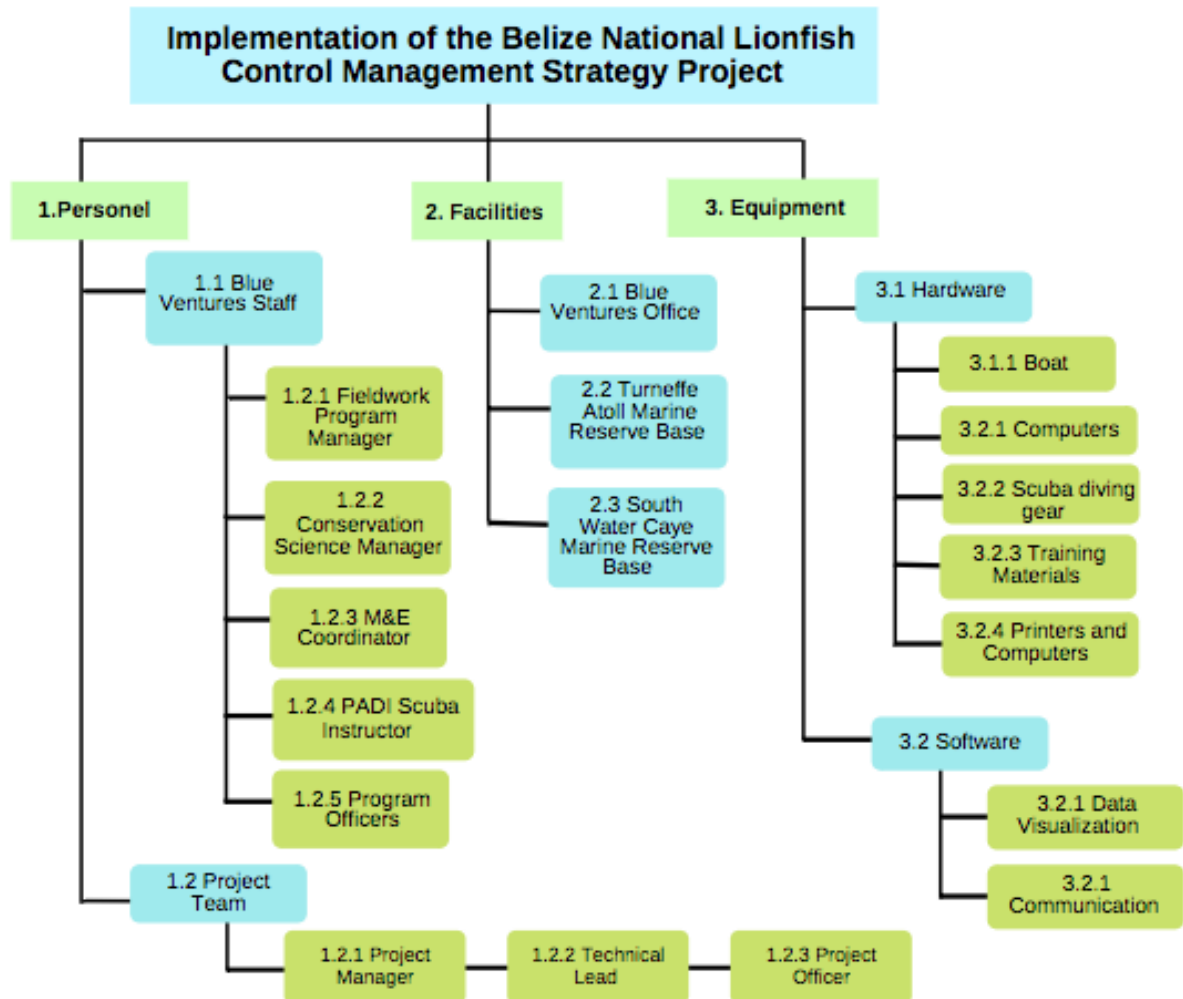


Figure 10 Resource Breakdown Structure (Source Author Ronalee McKenzie, May 2022)

4.6.6 Resource Histogram

The project resource plan includes a Resource Histogram which provides visual representation of the specific time and resources that will be required to successfully complete this project.

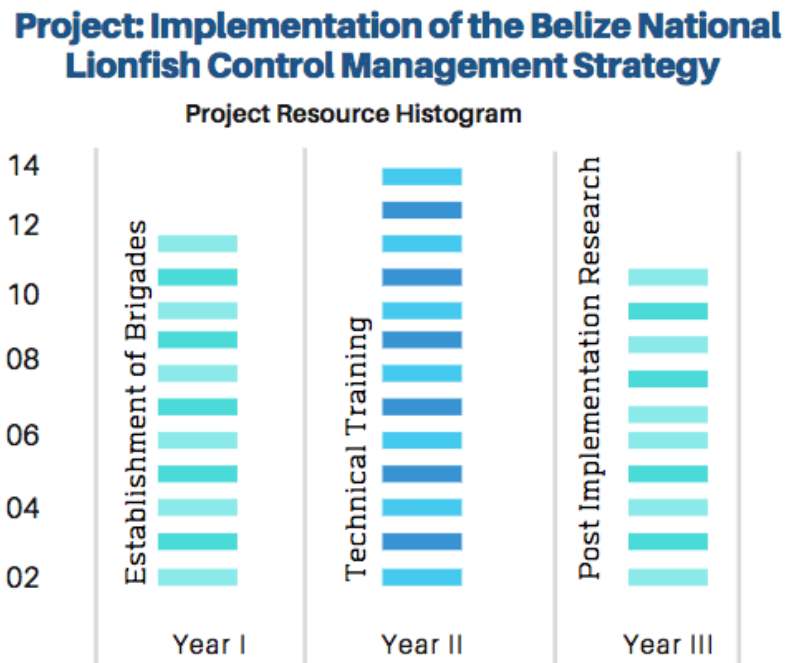


Figure 11 Project Resource Histogram (Source Author Ronalee McKenzie, May 2022)

4.6.7 Project Team Assignments

A Responsibility Matrix chart has been included in the project resource management plan for the Implementation of the Belize National Lionfish Management Strategy. RACI Matrix is a chart that describes the relationship of the responsibilities of the project team members and the project's tasks. The RACI matrix follows the key below:

- **(R) = Responsible** – this indicates that the task is within the immediate purview of the project team members who have specific roles and obligations.

The team members are expected to complete their assigned tasks on time and ensure that quality is maintained to meet the expectations of the project's stakeholders, funders, and project beneficiaries.

- **(A) = Accountable** – Accountability refers to the team members who would be held accountable for the results of the task regardless of if they perform the task or not. These team members are expected to ensure that project tasks are executed on time and that they meet the acceptance criteria defined by the project's stakeholders.
- **(C) = Consulted** – These are the team members who are consultants to the project. Consultants of the project are expected to provide technical advice to support the team in specialized knowledge areas that would increase the likelihood of a favorable project outcome.
- **(D) = Informed** – These are the team members who are interested in knowing the results of the task. These members have no obligation to complete or execute project tasks

Chart 25 Project Responsibility Matrix (Source author McKenzie, May 2022)

RACI Chart	Project Manager	Conservation Science Manager	Field Program Manager	Technical Lead	Monitoring and Evaluation Coordinator	Project Officer	Scuba Diving Instructor
Activity / Task							
Initiate project startup and Implement Project Management Plan	R	C	C	C	I	I	I
Coordination of Lionfish Working Group Quarterly Meetings	R	R	C	C	I	I	I
Development of Field Work Management Plan	A	C	R	C	C	C	C
Field work resource procurement	A	C	R	C	C	C	C
Development of Fieldwork Logistical Plan	A	C	R	C	C	I	C
Secure Partnerships with Marine Protected Area Co-Management Agency	A	R	C	C	I	I	I
Delivery of Marine Ecology Training	A	R	R	I	I	I	I

RACI Chart	Project Manager	Conservation Science Manager	Field Program Manager	Technical Lead	Monitoring and Evaluation Coordinator	Project Officer	Scuba Diving Instructor
Activity / Task							
PADI Open Water Scuba Diving Training	A	I	C	I	I	C	R
PADI Advanced Open Water Scuba Diving Training	A	I	C	I	I	C	R
Emergency First Response Training	A	I	C	I	I	C	R
Lionfish Focused Search Survey Training	A	C	C	C	I	I	R
Collation of lionfish population data	A	C	I	C	R	I	I
Data analysis and development of technical report	A	C	C	C	R	I	I
Development of grant report	A	R	C	C	I	I	I

4.6.8 Project Team Development and Performance Assessments

While developing the resource management plan, team development and competency assessments are essential for effective resource management, as well as for promoting quality assurance throughout the duration of this project. It has been proven that positive team engagement and capacity building will foster a productive work environment that would in turn enhance the overall performance of the project. The project manager is expected to encourage comradery among the project team and to ensure that the work environment remains positive, inclusive, and safe. To achieve this, the project manager will conduct the following team development activities:

1. Weekly team meetings / Check-ins
2. Bi-monthly capacity building exercises
3. Conflict management (if required)
4. Streamlined and transparent communication
5. Monthly team building exercises
6. Training opportunities

In addition, the project manager should conduct performance appraisals on an annual basis to evaluate the performance and technical capacity of the project team. The results from the assessment will determine contract renewals for team members who are employed by Blue Ventures on a fixed term contract.

4.6.9 Control Resources

Control resources describes the process of ensuring that physical resources assigned and allocated to the project are available as planned, as well as monitoring the planned versus actual utilization of resources and taking corrective action as necessary (PMI, p. 318, 2017). The development of the resource management plan includes the creation of actions and activities required for effective control resource management.

The project manager with support from the project team are expected to closely monitor the project's resource expenditures using the project budget. Should the project require additional resources the project manager must file a change request form since such a change has the potential to affect the project budget. If the request for additional project resources is approved by the project sponsor, the project manager is then expected to update all relevant project documents and is also expected to communicate all changes to the project stakeholders. For all changes in the project's resources, the project manager with support from the project team is expected to monitor changes using the following template:

Chart 26 Project Resources Net Change Template (Source author McKenzie, May 2022)

Control Resource Net Changes						
Project:		Implementation of the Belize National Lionfish Management Strategy				
No.	Resource	Resources Allocated	Resources Required	Resource Utilization	Net Changes	Justification
1						
2						
3						
4						
5						
6						
7						

4.7 Communications Management Plan

4.7.1 Introduction

Project Communications Management includes the processes that are required to ensure that the information needs of the project and its stakeholders are met through development of artifacts and implementation of activities that are designed to achieve effective information exchange (PMI, p. 379, 2017).

The development of this communications management plan for the Implementation of the Belize National Lionfish Management Strategy followed the 3-step management process outlined by the Project Management Institute.

1. **Plan Communications Management** – The process of developing an appropriate approach and plan for project communication activities were based on the needs of each stakeholder or group.
2. **Manage Communications** – The process of ensuring timely and appropriate collection, creation, distribution, storage, retrieval, management, monitoring, and the ultimate disposition of project information.
3. **Monitor Communications** – The process of ensuring the information needs of the project and its stakeholders are met.

While developing this plan, the key target audience of this project were identified and the main methods of communication between the project's stakeholders established. Additionally, this communications management plan details the frequency of communication between the project's stakeholders. This approach is aligned with a process to ensure that communication remains consistent and transparent throughout the execution of this project.

4.7.2 Communications Approach

The approach for effective communication for the Implementation of the Belize National Lionfish Management Strategy features key objectives that include:

1. Transparent and open communication between the project team and all the project's stakeholders
2. Timely communication between the project team and the project's stakeholders
3. Documented updates and communication (minutes of meetings) to be shared with relevant project stakeholders.

This approach will be accomplished using interactive communication, including feedback from the project's stakeholders. The project manager ensures that there is real time exchange of information using a two-way lateral communication model. Push, Pull, and small group communication methods can be used in the Implementation of the strategy.

4.7.3 Communications Matrix

An output of this communications management plan is the communications matrix. This matrix describes the requirements, platforms and frequency of communication that will be used for this project.

Chart 27 Communications Matrix (Source author McKenzie, May 2022)

Communication Type	Objective	Medium	Frequency	Owner	Deliverable	Audience
Kick off Meeting	Introductory meeting with the project manager and Blue Ventures Staff	In Person	Once	Blue Ventures	Agenda and Meeting Minutes	Project Team
Project Team Meeting	Revision of current project activities and status	In Person	Weekly	Project Manager	Agenda and Meeting Minutes	Project Team
Technical Meetings	Discussion of fieldwork activities and trainings	In Person	Bi-Weekly	Blue Ventures	Agenda and Meeting Minutes	Project Team
Monthly Project Status	Discussion of the status of ongoing and upcoming project activities	Virtual	Bi-Monthly	Project Manager	Agenda, Meeting Minutes, and project updates	Project Team and Project Sponsor
Staff Meeting	Progress update and feedback session with internal BV Staff	Virtual	Bi-Weekly	Blue Ventures	Agenda and Meeting Minutes	Project Team and Blue Ventures staff
Team Briefing	Revision of project activities with project team members only	In Person	Bi-Weekly	Project Manager	Agenda and Meeting Minutes	Project Team
Working Group Meeting	Feedback sessions with project stakeholders and members of the working group	Virtual	Quarterly	Blue Ventures	Agenda and Meeting Minutes	Project Team and members of the Belize National Lionfish Working Group

Communication Type	Objective	Medium	Frequency	Owner	Deliverable	Audience
Progress Report Meeting	Discussion of upcoming project activities	Virtual	Monthly	Project Manager	Agenda, Meeting Minutes, and Progress Report	Project Team and Project Sponsor
Close Out Meeting	Close off the project activities and review of lessons learned	In Person	Once	Project Manager	Agenda and Meeting Minutes	Project Team and Project Sponsor
Information Session	Presentation of project results and knowledge sharing	In Person	Once	Blue Ventures	Agenda and Meeting Minutes	Project team and community residents

4.7.4 Monitoring Communications

Monitoring communications is the process of ensuring the information needs of the project and its stakeholders are met (PMI, p. 388, 2017). While developing the communications plan key communication monitoring activities were identified. The project manager, with support from the project team, is expected to document updates, develop feedback reports as well as progress reports that should be shared with the project's stakeholders. The project manager must also streamline communication between the project team to ensure that all members of the project team are focused and understand their roles and responsibilities. It is recommended that the project manager utilize the Resource management, and Stakeholder engagement plans developed for this project for enhanced communication monitoring.

Work performance information is the output of monitoring communications. The work performance information details the way communication is performing by comparing the communications that were implemented versus communications that were planned (PMI, p. 392, 2017). The project manager, with support from the project team, are expected to periodically conduct work performance information assessments throughout the execution of this project using the following activities:

1. **Team meetings** – Share project updates and general knowledge exchange between project manager, project team and key project stakeholders.
2. **Observation** – The project manager is expected to observe and identify areas of improvement for communication and facilitate a discussion with the project team and key stakeholders on how communication gaps can be addressed.
3. **Stakeholder Audit** – A stakeholder audit will be done on an annual basis to ensure that valuable communication is being equally distributed between the project's stakeholders and beneficiaries.

4.7.5 Change Requests

Feedback provided from the project's stakeholders may result in proposed changes to the project's methods and frequency of communication. The project manager with support from the project team are expected to impartially address any suggested changes to the project's process, format, of frequency of communication. If the proposed communications changes are accepted by the project manager and supported by the project team, the project manager will update all relevant project documents and communicate all changes to the project stakeholders, assuming that the project's stakeholders are also in agreement with the proposed changes.

4.8 Risk Management Plan

4.8.1 Introduction

Project Risk Management includes the process of conducting risk management planning, identification, analysis, response implementation and monitoring on a project (PMI, p.345 2017). The objectives of project risk management are designed to increase the probability of a favorable project outcome. The risk management plan follows the processes outlined by the Project Management Institute.

1. **Plan Risk Management** – The process of prioritizing individual risks management activities for a project.
2. **Identify Risks** – The process of identifying individual project risks
3. **Perform Qualitative Risk Analysis** – The process of prioritizing individual risks for further analysis or action by assessing their probability of occurrence.
4. **Perform Qualitative Risk Analysis** – The process of numerically analyzing the combined effect of individual project risks and other sources of uncertainty in overall project objectives.
5. **Plan Risk Response** – The process of developing options and strategies to address risk exposure and to treat individual project risks.

6. **Implement Risk Response** – The process of implementing agreed-upon risk response plans.
7. **Monitor Risks** – The process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, and evaluating risk process effectiveness throughout the project.

Given the nature of this project, and the field intensive activities featured in this project, it imperative that the risk management plan outlines all that are associated with the project as well as suggested risk responses. PMI is clear that all projects regardless of size or nature have t risks:

Individual project risk –an uncertain event or condition that, if it occurs, has a direct effect on one or more project objectives.

Overall project risk –the effect of uncertainty on the project, arising from all sources of uncertainty including individual risks, representing the exposure of stakeholders to the implications of variations in project outcome both positive and negative.

4.8.2 Risk Management Approach

The risk management approach that has been developed for the Implementation of the Belize National Lionfish Control Management Strategy includes the process of identification, analysis, prioritization, and monitoring of risk. Though all projects have risks, the nature of this project and its project activities require critical risk evaluation, as well as the development of appropriate risk responses and risk mitigation action plans. The project manager with support from the project team must ensure that all potential project risks both negative and positive are accounted for in the project's risk breakdown structure and risk register. The project charter includes generalized project risks that are associated with project management; however, the project manager is expected to identify and analyze risks that are associated with the project activities.

The project manager along with the project team are expected to update and monitor the project's risk register which should account for all individual project risks.

For the first time in this region, an invasive species management plan has been developed using a participatory approach. Scuba diving and having to handle the venomous spines of lionfish alone produces many risks. Therefore, the project manager with support from the project team is expected to develop strategic responses for the risks that are associated with the project activities, and thoroughly outline preventative measures that can be taken to avoid risks where possible. Lastly, the project team is expected to identify areas of improvement by developing a lesson learned register for the implementation of this Lionfish control management strategy.

4.8.3 Risk Identification

Risk identification is the process of identifying individual project risks as well as sources of overall project risks and documenting their characteristics. The identified risks must then be categorized and grouped in the project's risk breakdown structure and accounted for in the risk register. The project risks that have been identified for the Implementation of the Belize National Lionfish Control Management Strategy were categorized and captured in the risk breakdown structure table below:

Chart 28 Risk Breakdown Structure Table (Source author McKenzie, May 2022)

RBS Level 0	RBS Level 1	RBS Level 2
0. All Sources of Project Risk	1. Management	1.1 Project Management
		1.2 Resource Management
		1.3 Organization
		1.4 Communication
	2. Environmental	2.1 Climate
		2.2 Hurricane
		2.3 Rough Weather
	3. Legal	3.1 Research permit approval
		3.2 Liabilities

RBS Level 0	RBS Level 1	RBS Level 2
	4. Health and Safety	4.1 Scuba Diving
		4.2 Lionfish Handling
		4.3 Faulty Equipment
	5. Technical	5.1 Equipment and Technology
		5.2 Data Collection
		5.3 Research accuracy
	6. Procurement	6.1 Scuba diving gear

4.8.4 Risk Breakdown Structure

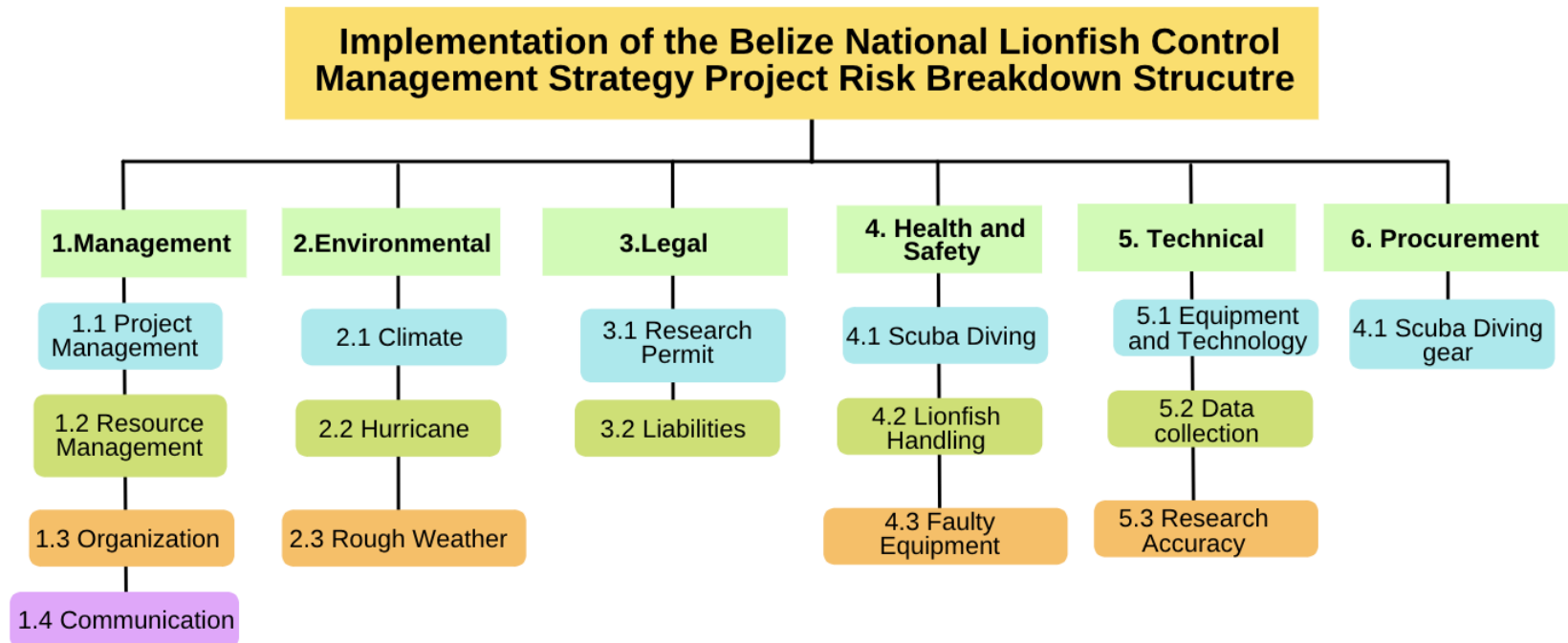


Figure 12 Risk Breakdown Structure (Source Author Ronalee McKenzie, May 2022)

4.8.5 Probability and Impact Scales

Following the risk identification process, the project management team is expected to analyze both the impact and probability of the risks using qualitative analysis. The process of qualitative analysis provides a clear geographical representation of how serious the risks are and the level of impact that they might have on the project employing this process provides the project manager and the project team with the information needed to prioritize and treat identified risks. The following Probability Scale describes the rating and corresponding interpretation that can both be used to characterize the probability of a specific risk occurring at some point throughout the execution of this project.

Chart 29 Probability Scale (Source author McKenzie, May 2022)

Probability of Risks	
Rating	Interpretation
1	Event is not expected to happen within the next 12 weeks and may only occur in exceptional situations
2	Event is expected to occur within 10-12 weeks
3	Event has an even chance of occurring at sometime within 6 weeks of the project
4	Event has occurred in past projects and is expected to happen in the next 4-6 weeks
5	Event is expected to happen within 4 weeks. It has occurred in past projects and conditions exist for it to occur in this project

4.8.6 Risk Impact

Included in the risk qualitative analysis is the risk impact. The chart describes the risk impact scale and corresponding for condition of each score. The chart focuses on the impact to the cost, schedule, and quality objectives of the Implementation of the Belize National Lionfish Control Management Strategy.

Chart 30 Impact Scale (Source author McKenzie, May 2022)

Impact on Project Objectives				
Impact Scale	Description	Schedule	Cost	Quality
1 (Very Low)	Impact is significant and may be safely ignored	Delay in delivery < 2 weeks	<\$5,500	Nonsignificant / noticeable difference in quality
2 (Low)	Impact is minor with appropriate mitigation responses	Delay in delivery 2 - 3 weeks	\$5,000 - \$10,000	Minor reduction in quality
3 (Moderate)	Impact is moderate and is broadly acceptable	Delay in delivery 3 - 4 weeks	\$10,000 - \$15,000	Critical areas of project are affected
4 (High)	Unfavorable event with negative and undesirable impact to project objectives	Delay in delivery 4 - 6 weeks	\$15,000-\$20,000	None - Acceptable quality
5 (Very High)	Highly unfavorable event, that would cause serious financial and schedule delays. Such an event would damage the project organization's reputation (intolerable)	Delay in delivery > 6 weeks	> \$20,000	None - Acceptable quality

4.8.7 Risk Analysis

All projects have risks that affect the project's objectives to some degree. The degree of impact of risks can be captured and then reduced to actable levels that meet the threshold of the project. While developing the risk management plan, risk scoring was considered. After identifying risks, they then be scored. The risk score is the value calculated that is a product of probability of risk occurrence and impact. The calculation of the risk score is used to determine their degree of impact, which is then use in the risk prioritization process. The following is the scoring template and key that will be used to score the risks that have been identified for the Implantation of the Belize National Lionfish Control Management Strategy.

Chart 31 Probability X Impact Table (Source author McKenzie, May 2022)

Probability X Impact Table			
Score	Category	Action	Description
1-6	Green	Tolerate & Monitor (Generally Acceptable - OK to Proceed)	Actions within the scope of the planned project and normal management attention should result in controlling acceptable risk
7-14	Yellow	Manage & Monitor (As Low as Reasonably Possible - Start Mitigation Efforts)	Special action and management attention may be required to control acceptable risk
15-25	Red	Mitigate (Intolerable - Seek Support, Place event on hold)	Significant additional action and high priority management attention will be required to control acceptable risk

The product of the probability of occurrence and the impact is used to develop a Probability and Impact Matrix (P x I). Opportunities and threats are represented in a common probability and impact matrix using positive definitions of impact for opportunities and negative impact definitions for threats (PMI, p 438 2017). The probability and impact matrix represents an output of planned risk management for the implementation of the Belize National Lionfish Control Management Strategy. The actions to be taken for each can be observed in Probability X Impact above (Chart 29).

Probability X Impact Matrix												
Threats						Opportunities						
Probability of Occurrence	Least Likely (1)	1	2	3	4	5	5	4	3	2	1	Least Likely (1)
	Unlikely (2)	2	4	6	8	10	10	8	6	4	2	Unlikely (2)
	Possible, Even chance (3)	3	6	9	12	15	15	12	9	6	3	Possible, Even chance (3)
	Likely (4)	4	8	12	16	20	20	16	12	8	4	Likely (4)
	Highly Likely (5)	5	10	15	20	25	25	20	15	10	5	Highly Likely (5)
	Very Low (1) Acceptable	Low (2) Tolerable	Moderate (3) Broadly Acceptable	High (4) Undesirable	Very High (5) Intolerable	Very High (5) Intolerable	Very High (5) Intolerable	Moderate (3) Acceptable	Low (2) Tolerable	Very Low (1) Acceptable		
Negative Impact on Project						Positive Impact on Project						

Figure 13 Probability X Impact Matrix (Source Author Ronalee McKenzie, May 2022)

4.8.9 Risk Register

After risks have been identified, they must be logged and accounted for in the project's Risk Register. The Project Management Institute outlines how all projects must maintain a risk register so that the project management team is able to track risks as well as the corresponding risk strategy for each. The risk register for the Implementation of the Belize National Lionfish Control Management Strategy includes the risks that have identified, the consequences of the risks, and their probability of occurrence and impact scores. Also included in the risk register for this project are the proposed mitigation strategies for each risk. The project management team is expected to monitor and update the risk register. New risks may arise as the project commences. The project manager should adhere to all parts of this risk management strategy to include and address all recently identified risks. The Risk Register below accounts for all risks that have been identified for this project:

Chart 32 Project Risk Register (Source author McKenzie, May 2022)

RBS Code	Cause	Risk	Consequence	Probability	Impact	[Probability X Impact]	Strategy
1.1	Limitation in project team technical capacity	Effective management and timely implementation of project	Project schedule delay	4	4	16	Mitigate: Technical and Project Management Training for Blue Ventures staff members who will form the to eliminate or lessen their existing limitations.
3.1	Belize Fisheries Department is reluctant to issue research permits for research data collection in No take zones.	Research permits are not issued by GOB in a timely manner	Project schedule delay	4	4	16	Mitigate: Maintain good partnership with the Belize Fisheries Department and request permits and permit justification well in advance prior to the start of the project.
2.2	Natural weather phenomenon	Hurricane season in Belize is June-November	Project Schedule delay	4	3	12	Accept: Hurricanes occur naturally. If a hurricane occurs, the risk of project delay will be accepted, and the project will resume when it is safe to do so.
2.3	Natural weather phenomenon	Boat capsizing, lost diver	Project schedule delay	6	2	12	Accepted: being at sea and Scuba diving in rough weather is very dangerous. All dives and in water training will be postponed during rough weather.
3.2	Liabilities for injury	Blue ventures is liable for all injuries that may occur during technical training	Additional project cost to compensate injured victims.	5	2	10	Transfer/Mitigate: Request brigade members to obtain divers insurance prior to receiving technical training.
4.1	Improper scuba diving techniques	Injury while scuba diving	Project schedule delay	5	3	15	Preventative: Conduct proper scuba diving safety briefing and

RBS Code	Cause	Risk	Consequence	Probability	Impact	[Probability X Impact]	Strategy
	or faulty scuba gear equipment		or additional project cost.				follow all safety protocols prior to all dives.
4.3	Faulty scuba diving equipment	Scuba diving injury	Minor – Severe injury	3	3	9	Preventative: Ensure that all scuba diving gear that is up to PADI standards and are new brand.
4.2	Improper lionfish handling techniques	Injury from venomous lionfish spines	Mild – Severe injury	3	3	9	Preventative: Thorough Lionfish safe handling training
5.2	Improper data collection techniques	Inconsistencies in data and population density trends	Inaccurate data	3	1	3	Preventative: Quality and thorough technical training in data collection and scientific diving survey methods
5.3	Improper data collection and data analysis techniques	Inconsistencies in data and population density trends	Scuba diving injury	3	1	3	Preventative: Quality and thorough technical training in data collection and scientific diving survey methods
6.1	Faulty scuba equipment	Scuba diving injury	Minor – Mild injury	2	2	4	Preventative: Preventative: Ensure that all scuba diving gear that is up to PADI standards and are brand new equipment.

4.8.11 Risk Monitoring

Monitoring risks is the process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying new risks and evaluation risk process effectiveness throughout the project (PMI, p. 453, 2017). Risk monitoring directly follows the risk prioritization process since risk monitoring will consider the urgency of managing and mitigating the risks that have the highest probability of occurrence and impact scores. The project manager with support from the project team are expected to closely monitor all the risks that have been identified and to effectively implement risk mitigation strategies as required. The project manager is expected to document all risk responses and provide a detailed report on the outcome of the risk response and implementation of the risk mitigation strategy. This process should occur throughout the commencement and execution of this project. Regular team meetings facilitated by the project manager should be held to discuss project updates and progress that might include project risk updates. Team meetings will be the primary tool and technique used for risk monitoring and the outputs of this plan include the project risk register (chart 32) and project document updates with documented updates done by the project manager.

4.9 Project Procurement Management

4.9.1 Introduction

Project Procurement Management includes the process necessary to purchase or acquire products, services or results that are external to the project team (PMI, p. 459, 2017). The project procurement management plan that has been developed for the Implementation of the Belize National Lionfish Management Strategy follows the 3-step process outlined by the Project Management Institute.

1. **Plan Procurement Management** – The process of documenting project procurement decisions, specifying the approach, and the identifying potential sellers.
2. **Conduct Procurements** – The process of obtaining seller responses, selecting a seller, and awarding a contract.
3. **Control Procurements** – The process of managing procurement relationships, monitoring contract performance, making changes and corrections as appropriate, and closing out contracts.

In addition, this procurement management plan outlines the strategy used to acquire goods and services in a timely manner. Both the cost management plan as well as the schedule management plan were used to help develop this procurement strategy, ensuring that the goods and services secured for this project do not exceed the project's budget and will be delivered / acquired in time to meet all project activity deadlines.

4.9.2 Procurement Management Approach

The procurement management plan that has been established identifies the project manager as the person responsible for authorizing and managing all procurement agreements. However, the fieldwork manager must determine the project's fieldwork's logical plan which outlines all goods and services required to successfully complete the project's fieldwork activities.

Members of the project team are expected support the development of the fieldwork logistical plans since the project will be executed in three separate Marine Protect Areas in Belize. The project manager will ensure that the quality of goods and services acquired for this implementation project are aligned with the quality acceptance criteria that meet the expectations of the projects' stakeholders, funders, and beneficiaries. It is imperative for the project manager to ensure that all authorized procurement activities are transparent and maintain the integrity of the project and all stakeholders involved.

4.9.3 Procurement Definition

The items and services that are outlined in the chart below have identified as the goods and services that are needed for the Implementation of the Belize National Lionfish Management Strategy.

Chart 33 Procurement Reference Guide (Source author McKenzie, May 2022)

Project	Implementation of the Belize National Lionfish Control Management Strategy			
Category	Item / Service	Cost	Justification	Procurement Method
Facility	Accommodation in Turneffe Atoll Marine Reserve	\$ 4,000.00	Technical Training Base	Fixed Budget
	Accommodation in NBCC (San Pedro Town)	\$ 5,000.00	Technical Training Base	Fixed Budget
	Accommodation in NBCC (Caye Caulker)	\$ 5,000.00	Technical Training Base	Fixed Budget
	Accommodation in SWCMR (Tobacco Caye)	\$ 3,000.00	Technical Training Base	Fixed Budget
Equipment	Boat Fuel	\$ 4,000.00	Boat Fuel for transportation to all dive sites	Fixed Budget
	Scuba Diving Tanks	\$ 1,000.00	Additional Oxygen tanks for brigade members	Competitive Shopping

Project	Implementation of the Belize National Lionfish Control Management Strategy			
	Suba Diving Gear	\$ 15,000.00	Additional Scuba diving gear for brigade members	Competitive Shopping
	Laptop	\$ 1,900.00	Laptop for project management team to conduct administrative duties	Competitive Shopping
	Printer	\$ 750.00	For project management team to prepare training materials	Competitive Shopping
	Lamination Machine	\$ 200.00	For project management team to prepare training materials	Competitive Shopping
Personnel	Project Manager	\$ 4,000.00	Lead the project team	Fixed Budget
	Cook	\$ 4,500.00	Provide daily meals during technical training periods	Fixed Budget
Software	Tableau	\$ 1,200.00	Data visualization and reporting	Fixed Budget
	Monday	\$ 200.00	Project management efficiency	Fixed Budget
	Microsoft Office Suite	\$ 300.00	Project management efficiency	Fixed Budget
	Google Suite	\$ 200.00	Project management efficiency	Fixed Budget
	zoom	\$ 290.00	Virtual Communication	Fixed Budget

4.9.4 Types of Contracts to be used

Minimal contracts will be issued in the Implementation of the Belize National Lionfish Control Management Strategy since the bulk of the research has already been conducted. However, for the acquisition of human resources and personnel required to execute the project will be onboarded on fixed term contracts. Blue Ventures has a standardized fixed term contract agreement for all current employees including those who will be members of the project team. For the acquisition of goods required for the execution of this project, Firm fixed prices contracts will be used to ensure that there are no price deviations issued from the supplier. The project manager must ensure that the scope of work and duration of contracted services required for this project are clearly defined, and that no deviations are made unless approved scope changes are considered and implemented.

Finally, it is the obligation of the project manager to approve credible vendors that engage in a contractual agreement and who would be confirmed third party service providers for the execution of this project.

4.9.5 Procurement Risk and Procurement Risk Management

The project procurement process does involve some risks that should be considered and should be managed to increase the likelihood of a favorable project outcome. Procurement risks associated with the implementation of the Belize National Lionfish Management Strategy have been identified and the proposed risk response action for each are characterized in the chart below. The project manager with support from the project team are expected to follow the processes outlined in the risk management plan to address and management procurement risks to avoid major compromises to the project's cost, schedule, and quality.

Chart 34 Procurement Risk and Responses (Source author McKenzie, May 2022)

	Project	Implementation of the Belize National Lionfish Control Management Strategy
	Procurement Risk	Risk Response
1	Delays in the acquisition of additional scuba diving tanks	Source tanks from alternate supplier and utilize contingency for cost difference
2	Delays in the acquisition of technical training materials	Source materials from alternate supplier and utilize contingency for cost difference
3	Cost Deviations	Use of contingency with appropriate justification
4	The quality of the goods/services procured do not meet the requirements of the project	Source goods / services from alternate supplier and utilize contingency for cost difference

4.9.6 Cost Determination

Commonly, cost determination is dependent on the method of procurement used. Due scientific nature of this project, and the commitment of the project's stakeholders the methods of resource procurement are limited. The cost determination for products and services that will be outsourced for the Implementation of the Belize National Lionfish Control Management Strategy will follow the issuance of:

1. Request for Proposal – A Request for Proposal would be an open call to consultants that would be able to provide technical expertise in specific knowledge areas that are relevant to this project. The request for proposal will also be accompanied by a Term of Reference document. The TOR would outline in detail duties and responsibilities that are being outsourced as well as the corresponding budget.
2. Direct Contracting – Direct contractual agreements will specify the services that would be outsourced for the execution of this project. This method of procurement eliminates competition and is defined as “fixed term” contracting.

4.9.7 Standard Procurement Documentation

The project management team is expected to document all steps of the procurement process and procurement activities. While documenting tools and methodologies used for procurement management, the project manager and project team are expected to generate standardized procurement documents and templates which include:

1. Request for Proposal
2. Terms of Reference (TOR)
3. Request for Quotation
4. Contract Template
5. Letter of Intent
6. Budget Guidelines
7. Procurement Performance Evaluation

4.9.8 Procurement Constraints

There are some constraints that are associated with the project procurement process. This includes constraints to project cost, time, and procurement capacity.

1. Cost – The procurement process for this project must ensure that the acquisition of goods and services required for project execution does not exceed the budget that has been defined for this project. Cost deviations that may occur while outsourcing goods and services would negatively impact the project's outcome if the budget were to be exceeded.
2. Time – Given the scientific nature of this project, the time for the selection process of potential third-party vendors and external consultants is short.
3. Capacity – The project team does not include a member who specializes in resource procurement. The project team will rely on the capacity of the field program manager and program officer to support the project manager in all procurement management activities.

4.9.9 Contract Approval Process

After the project manager and project team has determined and confirmed their decision on the vendor and/or consultant selected for products and services that outsourced externally, the team then enters the contract approval process. The project manager with support from the project team are expected to prepare and issue the contract agreement to the selected vendors. The project manager is ultimately responsible for authorizing and approving all contracts prior to issuing them.

4.10 Decision Criteria

The decision criteria component of the procurement process outlines the factors and prerequisite qualifications that the project manager and the project team consider before finalizing their decision on the vendor that will be selected to provide goods and/services for this project.

The decision criteria for the Implementation of the Belize National Lionfish Control Management Strategy correlates to the contract type. Expert judgement of the project manager will be used to evaluate all TOR submissions, where the project manager will consider the budget. The cost reflected in the submission must not exceed the cost of the budget allocated. The project manager will assume the responsibility of approving and contracting external vendors only.

4.9. 11 Vendor Management

Effective project procurement management also includes the management of vendors who have been contracted for this project. The project manager with support from the project team are expected to maintain a well-organized record of contract files for all goods and services to be procured. The project team will also assume the responsibility of coordinating all procurement documentation processes expected to occur throughout the project's execution. The project manager with support from the project team are expected to monitor all awarded contracts for this project and assess the performance and quality of services / products that are being offered by the authorized and contracted project vendors. Vendor performance assessments will be conducted by the project manager, documented, and reported.

4.9. 12 Performance Metrics for Procurement Activities

The metrics that are listed below will be used to measure vendor performance.

1. Supplier Management
2. Product and/or service quality
3. Cost reduction
4. Efficiency of the competitive process
5. Efficiency of internal system processes

The template below will be used to score the performance of the vendors who would be contacted for this project. Following their performance assessment, vendors will be scored from a scale of 1-3 where a score of 1 is unsatisfactory, a score of 2 is acceptable, and a score of 3 indicates exceptional performance.

Chart 35 Procurement Vendor Performance Evaluation Template (Source author McKenzie, May 2022)

Project		implementation of the Belize National Lionfish Control Management Strategy				
Vendor		Product Quality	On Time Delivery	Documentation Quality	Development Time	Cost Per Unit
1						
2						
3						
4						
5						

4.10 Project Stakeholder Management

4.10.1 Introduction

Project stakeholder management includes the processes required to identify the people, groups or organizations that can either impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project (PMI, p. 503, 2017). The stakeholder management plan for this project follows the 4-step stakeholder management process outlined by the Project Management Institute.

1. **Identify Stakeholders** – The process of identifying project stakeholders regularly and analyzing and documenting relevant information regarding their interests, involvement, interdependencies, influence, and potential impact on project success.
2. **Plan Stakeholder Engagement** – The process of developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project.

3. **Manage Stakeholder Engagement** – The process of communication and working with stakeholders to meet their needs and expectations, address issues, and foster appropriate stakeholder engagement involvement.
4. **Monitor Stakeholder Engagement** – The process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through the modification of engagement strategies and plans.

The Implementation of the Belize National Lionfish Control Management Strategy offers a participatory approach to invasive lionfish management in Belize. The nature of this project directly depends on the active participation and engagement of the project's stakeholders. The development of this stakeholder management plan includes inputs from the project charter, communications management plan, resource management plan and the project's scope management plan. The purpose of stakeholder management in the context of this project is to ensure that all the stakeholders are adequately being engaged and that their needs are being met throughout the execution of this project. All project stakeholders for this project have been identified, accounted for, and logged in the stakeholder register below:

Chart 36 Project Stakeholder Register (Source author McKenzie, May 2022)

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
The Belize Fisheries Department (GOB)	The Belize Fisheries Department is one of the implementing agencies and they also provide clear guidance on the legal aspect of the project's framework and ultimately authorizes all decisions that depend on usage, permits and access to MPAs.	High	High	External	Increased Capacity for scientific research and technical skills and reduced lionfish population density
Blue Ventures (BV)	Blue Ventures is a primary research investigator and implementing agency of the project.	High	High	Internal	Successful project execution and newly established partnerships
The Project Management Team	The project Management Team is ultimately responsible for the successful implementation of this project.	High	High	Internal	Successful project execution and newly established partnerships

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
Project Sponsor	<p>The project sponsor is primarily responsible for the seamless transition between project phases. According to PMI, the project sponsor role can be divided into three components: Governance, Vision, and Value. In governance, the sponsor must maintain the project's organizational priorities. The sponsor must define the project's success criteria and in value the sponsor must maintain project quality.</p>	High	High	Internal	Successful project execution and newly established partnerships
Project Funders	<p>Project funders include the Mesoamerican Reef Fund (MAR Fund) and the Summit Foundation.</p>	High	High	External	Successful project execution withing allocated time and budget
National Fishermen's Cooperative	<p>National Fishermen's Cooperative, with Blue Ventures' intervention, will potentially develop a new export market for whole lionfish.</p>	Low	High	External	Domestic and international market for lionfish

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
Turneffe Atoll Sustainability Association (TASA)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	High	High	External	Increased Capacity for scientific research and technical skills
Northern Fishermen's Cooperative	Northern Fishermen's cooperative with Blue Ventures' intervention will potentially develop a new export market for whole lionfish.	Low	High	External	Domestic and international market for lionfish
Hol Chan Marine Reserve (HCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills
Bacalar Chico Marine Reserve (BCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
Sarteneja Alliance for Conservation and Development (SACD)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills
South Water Caye Marine Reserve (SWCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills
Southern Environmental Association (SEA)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills
Caye Caulker Marine Reserve (CCMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
Port Honduras Marine Reserve (PHMR)	MPA Co-management agency that will adapt the Belize National Lionfish Management Strategy	Low	High	External	Increased Capacity for scientific research and technical skills
Wabafu Fishermen's Association	Organized Fisher-led association that will represent the diversity and adaptability of this strategy.	Low	High	External	Increased Capacity for scientific research and technical skills
Belize Tourism Board (BTB)	Marketing agency that will engage in lionfish tournaments and marketing campaigns.	Low	Medium	External	Increased Capacity for scientific research and technical skills
Tour Operators	Members of the tourism sector that will integrate tours and engage in tournaments.	Low	Medium	External	Increased Capacity for scientific research and technical skills
Fisherfolk	Fishers will engage in the newly established lionfish export market, as well as the domestic market.	Low	High	External	Lionfish market and reduced lionfish population density

Stakeholder	Responsibility	Power Level	Interest Level	Category	Expectations
Fishing Communities	Fishing communities will engage in economic stimulation because of newly established lionfish market.	Low	Low	External	Reduced lionfish population density and economic growth opportunities

4.10.2 Stakeholder Engagement Approach

Stakeholder identification is the first step in effective stakeholder management. A stakeholder analysis must be conducted to assess the roles and responsibilities of all potential project stakeholders. The stakeholder analysis will also define the degree of interest, influence, impact, and power that the identified stakeholders might have in the project. The implementation of the Belize National Lionfish Control Management Strategy includes stakeholders from the marine conservation, fisheries, and tourism sectors of Belize. The stakeholders were identified, and subsequently assessed to determine the level of power and interest for each stakeholder. Analyzing and classifying the interest and power of the project stakeholders will provide the project manager with the relevant information that is required to determine the appropriate attention needed by key stakeholders. The power / interest grid for the Implementation of the Belize National Lionfish Control Management Strategy visually identifies the stakeholders who have the highest interest and impact to the project and can be observed below:

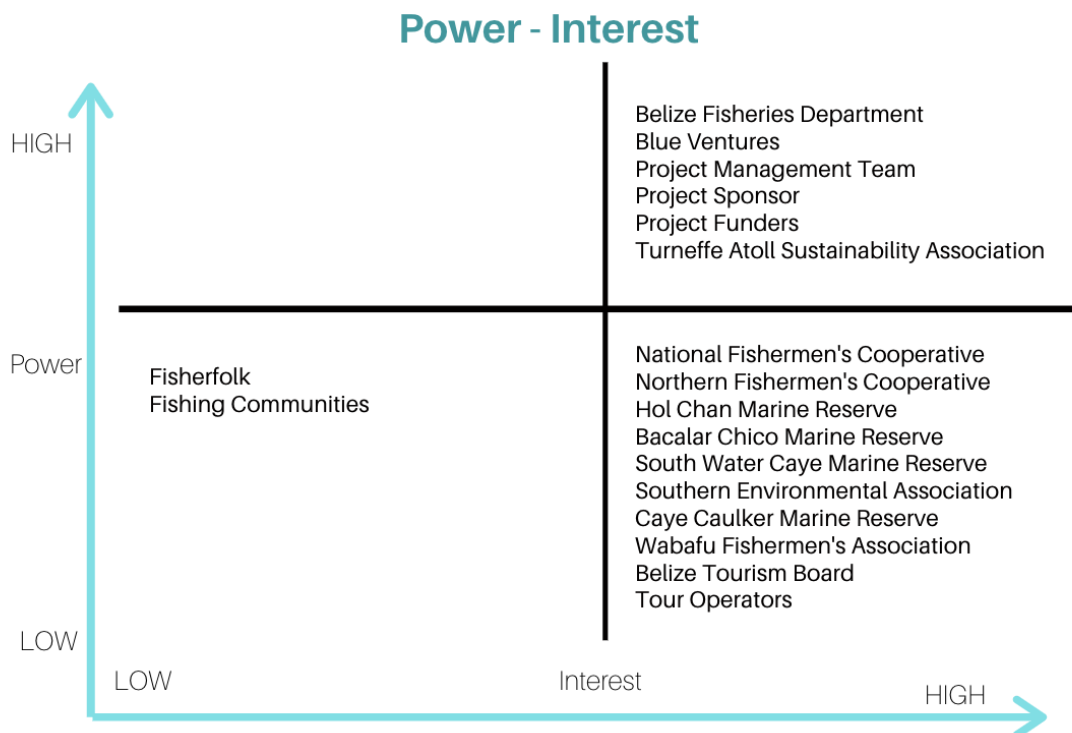


Figure 14 Power Interest Matrix (Source Author Ronalee McKenzie, May 2022)

4.10.3 Manage Stakeholder Engagement

Manage stakeholder engagement is the process of communication and working with stakeholders to meet their needs and expectations, address issues and foster appropriate stakeholder involvement (PMI, p 503, 2017). The tools and techniques used to manage stakeholder engagement for the Implementation of the Belize National Lionfish Control Management Strategy includes expert judgement and, feedback sessions and meetings. The project manager is expected to maintain effective communication skills to ensure that the project's stakeholders are supported, actively participating in the project (if required) and lastly to ensure that through good communication their interest in the project is maintained. The project manager and the project team are expected to utilize the communications management plan to maintain transparent and open communication throughout the stakeholder management process.

4.10.4 Monitor or Stakeholder Engagement

Monitor stakeholder engagement is the process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through modification of engagement strategies and plans (PMI, 517, 2017). Given the nature of this project and the level of stakeholder engagement required, the project manager is expected to use effective communication skills, leadership skills, and feedback sessions to monitor and assess stakeholder engagement for this project. The success of this project is highly dependent on the participation of key stakeholders, so it critically important for the project manager to manage and monitor stakeholder engagement to guarantee that their needs are being met.

5. CONCLUSIONS

1. A comprehensive Project Management Plan was developed for the Implementation of the Belize National Lionfish Control Management Strategy. The plan includes the best practices for project management, using recommendations outlined by the Project Management Institute. The project charter had been developed to provide full authorization to the project manager to commence the implementation of the project.
2. The Scope Management Plan has been developed to provide very specific project objectives and the project requirements that are needed to successfully implement the Belize National Lionfish Control Management Strategy in three Marine Protected Areas in Belize. This includes the work breakdown structure for all the project activities.
3. The Project Schedule Management Plan defines the timeline of activities outlined in the project scope. Schedule management is necessary to ensure that all project activities and project work are completed in a timely manner. The Implementation of the Belize National Lionfish Control Management Strategy is a three-year project what will be executed in three different project sites. The development of the schedule management plan for this project sought to ensure that all time management process recommended by the Project Management Institute were considered to avoid project delays where possible.
4. The estimated budget for the Implementation of the Belize National Lionfish Management Strategy is \$165,000 Belize dollars with a 5% contingency reserve. The Cost Management Plan for this project has been developed to ensure that all project activities and project work can be executed within the time and budget allocated for this project. Given the scientific nature of this project, funding had been secured through a grant proposal process. Funders for this project include: The Summit Foundation, and The Mesoamerican Reef Foundation. Grant restrictions outlined by both funders were considered and included in the cost management plan to ensure that all funding received could properly be accounted for.

5. The Implementation of the Belize National Lionfish Control Management Strategy using a multi-stakeholder participatory approach to invasive species management is the first of its kind to be implemented in Belize. Measuring the quality of the project's deliverables is essential for the success of this project. The Project Quality Plan that has been developed for this project outlines the quality management approach can ensures that project deliverables and results meet the acceptance criteria established by the project's stakeholders. The outcome of this project is largely dependent on the quality of data collected and research conducted on lionfish population densities after the control strategy is implemented in the selected marine projected areas.
6. The Project Resource Management plan was developed to optimize project management efficiency. The resource management plan considered assets that are both internal and external to Blue Ventures which is the project's executing agency. The project resource management plan also identified key personnel to either be included in or support the project team for the successful implementation of the Belize National Lionfish Control Management Strategy.
7. Blue Ventures values open and transparent communication. This organizational value, among other project management factors was used to develop the Communications Management Plan for the implementation of the Belize National Management Strategy. The communications plan outlined clear methods of two-way communication between the project team and the project's stakeholders, as well as the frequency of communication needed to keep stakeholders engaged.
8. All projects regardless of nature have risks. The risks associated with the Implementation of the Belize National Lionfish Management Strategy were identified, prioritized, and registered during the development of a robust Project Risk Management Plan. The risks that were identified for this project were scored based on their degree of impact and categorized accordingly. Additionally, the risk response strategy for each risk were developed and included in the risk management plan.

9. The implementation of the Belize National Lionfish Control Management Strategy is a fieldwork intensive project. The logistical coordination of field work activities includes the process of procuring goods and services that are required for the execution of such activities. A robust Project Procurement Plan was developed for this project to ensure that all goods and or services outsourced externally would be secured in a timely manner. The procurement plan provides guidelines that reduce the likelihood of a project delay.

10. The Implementation of the Belize National Lionfish Management Strategy Is a multi-stakeholder approach to invasive species management. This is a unique approach that relies on active participation and engagement from the project's key stakeholders. The Stakeholder Management plan developed for this project seeks to ensure all the project's stakeholders are identified, accounted for, and that their interest in the project is maintained throughout the project's execution.

6. RECOMMENDATIONS

The primary objective of the Final Graduation Project was to develop a comprehensive Project Management Plan for the Implementation of the Belize National Lionfish Management Strategy. The following recommendations correlate to the project management knowledge areas covered in the development of this Project Management Plan.

1. Blue Ventures should contract an experienced project manager to support the Conservation Science Manager, Field Program Manager and other members of the science department who would become key members of the project team.
2. The project team should critically utilize the project charter, and scope management plan to understand the deliverables and activities that are required to meet the expectations of the project's stakeholders and project beneficiaries.
3. The project manager and project team should seek support from Blue Venture's Administration and Finance Department to ensure that all expenses incurred throughout the duration of the project are aligned with organizational policies and are also aligned with the grant reporting requirements.
4. Even though there is a 5% contingency allocated for this project, it is recommended that the project manager closely monitor approved expenses to avoid exceeding the project budget.
5. All project activities are outlined in the project's scope. The project manager and project team should utilize both scope management plan and schedule management plan to coordinate all field work logistics required to effectively implement this control strategy.

6. Project quality is crucial for the success of the Implementation of the Belize National Lionfish Management Strategy. The outcome of this implementation project relies on high quality data collection and analysis. It is recommended that the project manager ensure thorough technical training is prioritized to increase the likelihood of a factorable project outcome.
7. Given the high value that Blue Ventures places on transparent and open communication, it is recommended that the project manager and the project team consider the safeguarding policies and procedures that are mandated by Blue Ventures.
8. The Implementation of the Belize National Lionfish Control Management Strategy is a fieldwork intensive project that includes technical training in scuba diving, and scientific diving research methodologies. Such high-risk activities require constant monitoring and attention by the project team. It is recommended that the project manager, as well as the field work manager conduct risk preventative actions where possible. This include conducting safety briefings, mission orders and risks assessments – all of which are aligned with Blue Ventures' health and safety procedures.
9. The procurement of all goods and services must meet organizational requirements mandated by Blue Ventures. It is recommended that the project manager seeks support from the Head of Operations for the BV Belize Team to ensure that payments for all goods and services being outsourced externally will be made in a timely manner.
10. Stakeholder Engagement is the main driver for the approach used to execute this project. Recommendations for effective stakeholder engagement include ensuring communication is inclusive, transparent and allows space for the project's stakeholders to provide feedback and suggestions where appropriate.

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Appendix 1: FGP Charter

PROJECT CHARTER	
Date:	Project Name:
November 8th, 2021	Project Management Plan for the Implementation of the Belize National Lionfish Control Management Strategy.
Knowledge Areas / PM Processes:	Application Area (Sector / Activity):
Knowledge Areas:	Marine Conservation Management, Biodiversity, Sustainability, Marine Ecology
1. Project Integration Management	
2. Project Scope Management	
3. Project Schedule Management	
4. Project Cost Management	
5. Project Quality Management	
6. Project Resource Management	
7. Project Communications Management	
8. Project Risk Management	
9. Project Procurement Management	
Project Stakeholder Management	
Process Groups:	
1. Initiating	
2. Planning	
3. Monitoring	
4. Controlling	
Project Start Date:	Project Finish date:
November 8th, 2021	June 7th 2022
Project Objectives (General and Specific)	
General Objective: To develop a Project Management Plan for the implementation of the Belize National Lionfish Control Management Strategy.	
Specific Objectives:	
1. To develop a Project Charter for the Final Graduation Project deliverable.	
2. To develop a scope management plan that would define project's scope and ensure that all management process is aligned with the project scope	
3. To develop a project schedule management plan that would define the best approach needed to maximize efficiency leading to a favorable project outcome that is completed on time.	
4. To develop a cost management plan to effectively track, monitor and control the project's budget to ensure that the project does not exceed the project budget.	
5. To develop project quality plan that would define the project's quality policies, procedures, and determine project and stakeholder requirements needed for successful completion of the project.	
6. To develop an effective project resource management plan that would allow the project team to	

- identify, acquire, and manage the resources needed for a favorable project outcome.
7. To develop a communications management plan that includes the processes that are necessary to ensure that the information needs of the project and its stakeholders are met.
 8. To develop a risk management plan that identifies project opportunities, project risks, and effective responses to the identified risks.
 9. Develop a procurement plan that identifies the processes necessary to purchase or acquire products and services needed for the successful completion of the project.
 10. To develop a stakeholder engagement plan that streamlines connectivity between stakeholders through identification, categorization, and engagement strategies.

Project purpose or justification (merit and expected results):

Blue Ventures has collaborated with the Belize Fisheries Department and other stakeholders to develop and launch the Belize National Lionfish Control Management Strategy in 2019 following research that has been conducted in 2015 and 2016. Lionfish is an invasive species with the potential to disrupt the balance of marine ecosystems. Over the past two decades, they have been invading coral reefs throughout the Western Atlantic, Gulf of Mexico, and the Caribbean. Lionfish have no known predators, and they literally eat everything! Their rapid population growth is an imminent threat to biodiversity and marine-based livelihoods which warrants an urgent call for action. The development of a thorough and robust Project Management Plan for the Implementation of the Belize National Lionfish Management Strategy will prompt effective invasive species management within marine protected areas in Belize, and promote the adaptability of the strategy in other regions that struggle with invasive species management.

Description of Product or Service to be generated by the Project – Project final deliverables:

The main deliverable of this project is the completion of a Project Management Plan for the implementation of the Belize National Lionfish Control Management Strategy. The Management Plan will feature the ten knowledge areas of project management:

1. Project Charter
2. Integration Management
3. Scope Management
4. Schedule Management
5. Cost Management
6. Quality Management
7. Resources Management
8. Communications Management
9. Risk Management
10. Procurement Management
11. Stakeholder Engagement

A subsidiary plan for each knowledge will be key components/ deliverables of the overall project management plan.

Assumptions:

Assumptions for the FGP (Development of a Project Management Plan) Include:

1. The project management plan for the implementation of the Belize National Lionfish Control Management Strategy will be completed in four months.
2. The completion of the Project Management Plan will feature all ten knowledge areas of Project Management.
3. The development of this robust Project Management Plan will prompt effective project management that will yield a favorable project outcome for the implementation of the Belize

National Lionfish Control Management Strategy.

4. Successful development of this Project Management Plan will lead to the successful completion of the MPM program.

5. The cost required to successfully complete this Project Management Plan is relatively low.

Constraints:

The completion of the Project Management Plan may include the following constraints: 1. Permission/ Approval is required to develop a Project Management Plan for a project that includes Government Officials as primary stakeholders.

2. The time required to complete the Project Management Plan leaves little room for error and delays.

3. The students only have one week to select a FGP topic and project.

4. Communication barriers may cause a delay in the provision of feedback/ corrections from tutor to student.

Preliminary Risks:

Preliminary risks at this stage includes:

1. Missing a deadline may result in delays and may adversely affect the FGP grade.

2. Contracting the SARS Covid-19 Virus can significantly impact the student's ability to complete the Project Management Plan within the four-month time frame.

3. Delays in the provision of feedback from the tutor would significantly reduce the student's time to make corrections where necessary.

4. Poor or lack of communication between tutor and student would result in inadequate FGP deliverables.

5. Selecting a FGP project without required approval / permission may result in legal consequences.

Budget:

The development of a Project Management Plan for the Implementation of the Belize National Lionfish Control Management Strategy has a budget of \$800.00 BZ.

This budget has the following breakdown:

Printing - \$300.00

Binding -\$100.00

Dissemination - \$300.00

Philologist- \$100.00

Total: \$800.00 BZE

Milestones and dates:

Milestone	Start date	End date
UCI Graduation Seminar Commencement	November 8th 2021	December 12th 2021
Submission of Project Charter and WBS	November 9th 2021	November 14th 2021
Submission of Chapter Introduction and FGP Schedule	November 15th 2021	November 21st 2021
Submission of Chapter 2 Theoretical Framework	November 22nd 2021	November 28th 2021
Submission of Chapter 3, Methodological Framework	November 29th 2021	December 5th 2021
Submission of Executive Summary and Bibliography	December 5th 2021	December 12th 2021
Completion of UCI Graduation Seminar	December 12th 2021	December 12th 2021
UCI Graduation Seminar Approval	December 19th 2021	December 19th 2021
UCI Final Graduation Project Tutorship	February 7th 2022	May 1st 2022

UCI Final Graduation Project Review	May 2nd, 2022	May 13th 2022
Final Graduation Project amendments	May 16th 2022	May 27th 2022
Presentation of Final Graduation Project to Examination Board	May 30th 2022	June 7th 2022

Relevant historical information:

Blue Ventures has maintained a permanent presence in Belize since 2010, supporting diverse fisheries and conservation efforts from its base in Sarteneja, Belize's largest fishing community. As well as leading a ten year comprehensive MPA monitoring and evaluation program in Bacalar Chico Marine Reserve, the scope of work has included working with coastal stakeholders across the country to develop a national strategy for invasive lionfish management and launching the multi-stakeholder National Lionfish Working Group, which coordinates the strategy's implementation

Through this work Blue Ventures has developed strong partnerships with the Belize Fisheries Department, MPA managers, fishing cooperatives and fisher associations, and has supported the establishment of a commercial scale domestic lionfish fishery. The organization has delivered training in coral reef and lionfish monitoring methods to six MPA authorities in Belize, and continues to build capacity for the inclusive and adaptive management of invasive lionfish.

Stakeholders:

Direct Stakeholders:

Blue Ventures
 Ronalee McKenzie
 FGP Professor – Carlos Brenes
 FGP Tutor
 FGP Reviewers
 FGP Board of Examiners
 UCI - Universidad para la Cooperación Internacional

Indirect Stakeholders

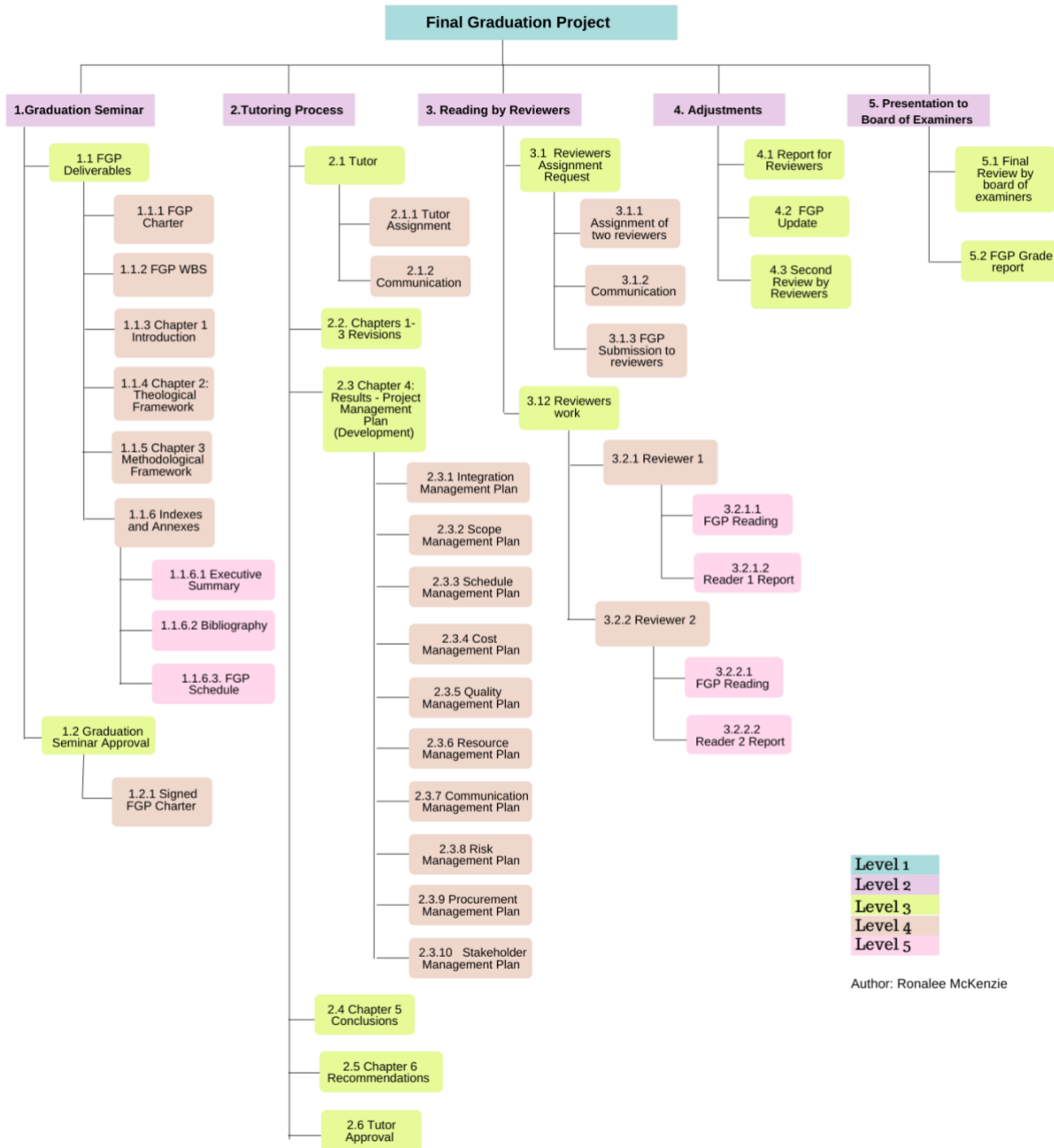
Belize Fisheries Department
 Government of Belize
 Turneffe Atoll Sustainability Association
 Fisher folk
 Marine Protected Area Agencies
 Tour Guides
 Community Members

Approval:

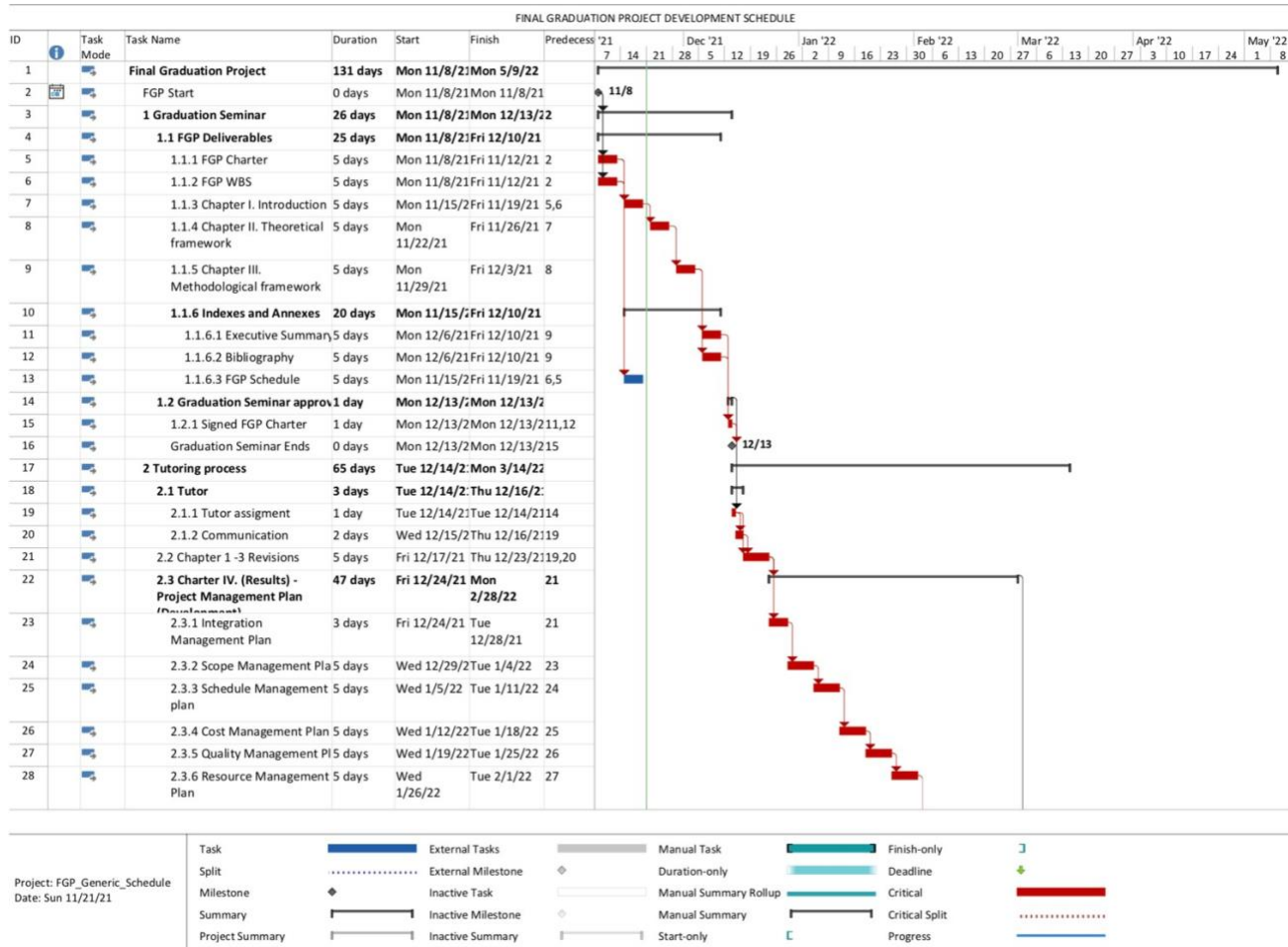
Project Manager: Ronalee McKenzie	Signature:
Authorized by: Carlos Brenes	Signature:

Appendix 2: FGP WBS

Work Breakdown Structure (WBS)
Final Graduation Project

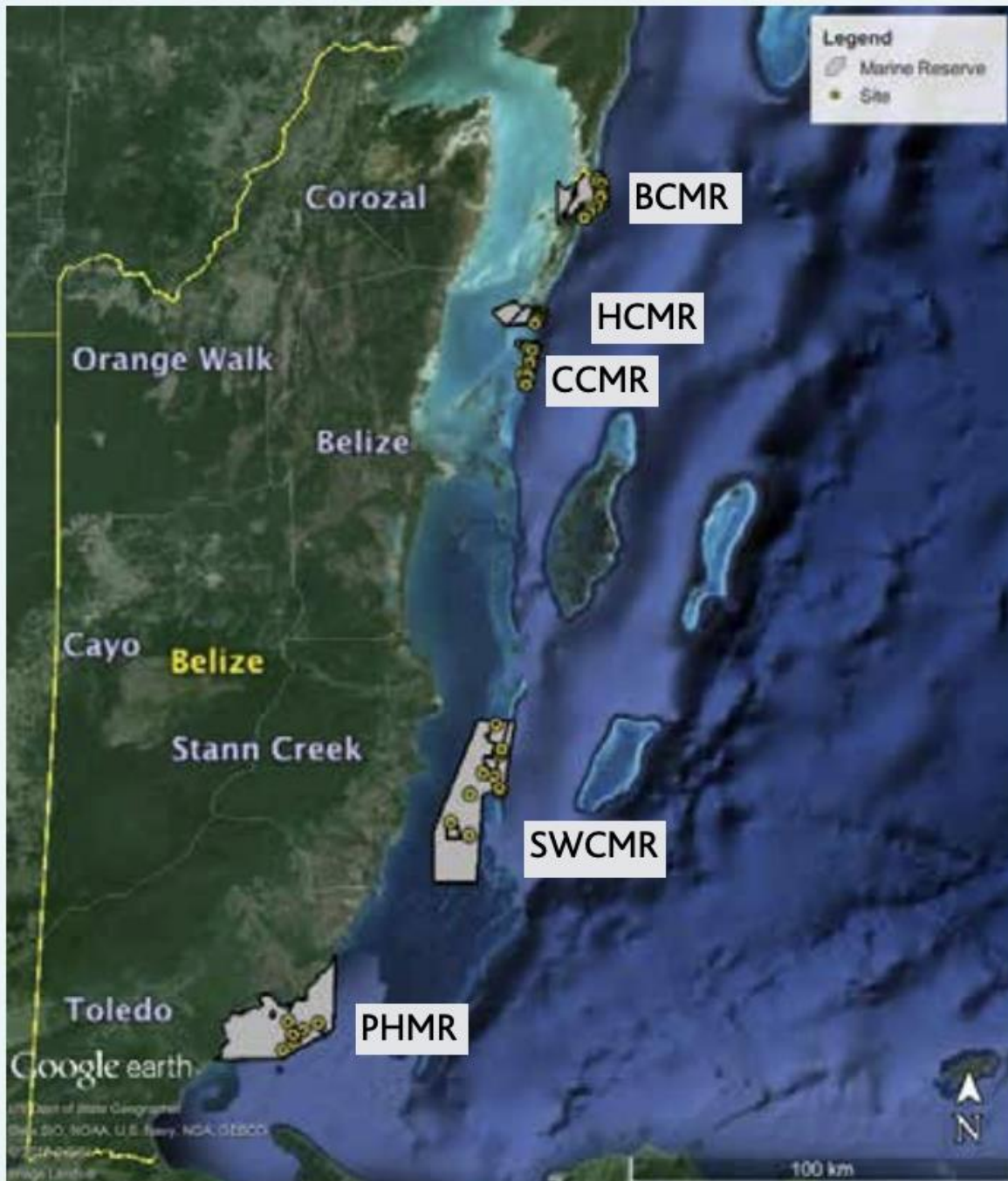


Appendix 3: FGP Schedule



Appendix 4: Lionfish Image

Appendix 5: Marine Protected Areas in Belize



Appendix 6: Key Strategy Indicators

2.7 Indicators for monitoring, evaluation and adaptive management

Twenty-one indicators have been prioritised for monitoring, evaluation and adaptive management. These were selected because of their relative importance (e.g. lionfish population density, number of restaurants serving lionfish) and feasibility (e.g. data already being collected through other programs). Description of methods for collecting and calculating these indicators are provided in [Chapter 3: Adopting A Coupled Human and Natural Systems Approach](#).

LIONFISH

N1. Lionfish Population

1. Average lionfish density (fish/ha)
2. Average lionfish size (cm)

H4. Lionfish Markets

3. Percent of restaurants that report serving lionfish
4. Percent of restaurants that report serving lionfish regularly (at least twice per month)
5. Median stated willingness to pay (WTP) for lionfish by restaurants (BZD/lb of fillet)
6. Percent of general public who have heard of lionfish
7. Percent of general public who have tried lionfish
8. Average WTP for lionfish by the general public
9. Average WTP for lionfish by tourists
10. Number of successful lionfish jewellers.

H5. Total Lionfish Catch

11. Total Lionfish Catch: Annual lionfish fishing mortality (F)

FISHING

H3. Fishing Communities

18. Fishers' level of knowledge about the lionfish invasion, lionfish safe-handling, and lionfish buyers
19. Fishers' perceptions of lionfish markets
20. Description of fishers targeting lionfish for commercial use, subsistence use, or control (i.e. killing lionfish and leaving it on the reef)

CONSERVATION AND ENVIRONMENT

N2. Coral Reefs

12. Prey fish biomass (hg/ha)
13. Mesopredator biomass (g/100 m²)
14. Lobster density (ind./ha)
15. Reef health (Reef Health Index score)
16. Percent of sites exceeding lionfish threshold density

N3. Traditional Fisheries

17. Lobster, Conch, and Finfish Landings (as reported through Managed Access programme)

ECONOMY AND GOVERNANCE

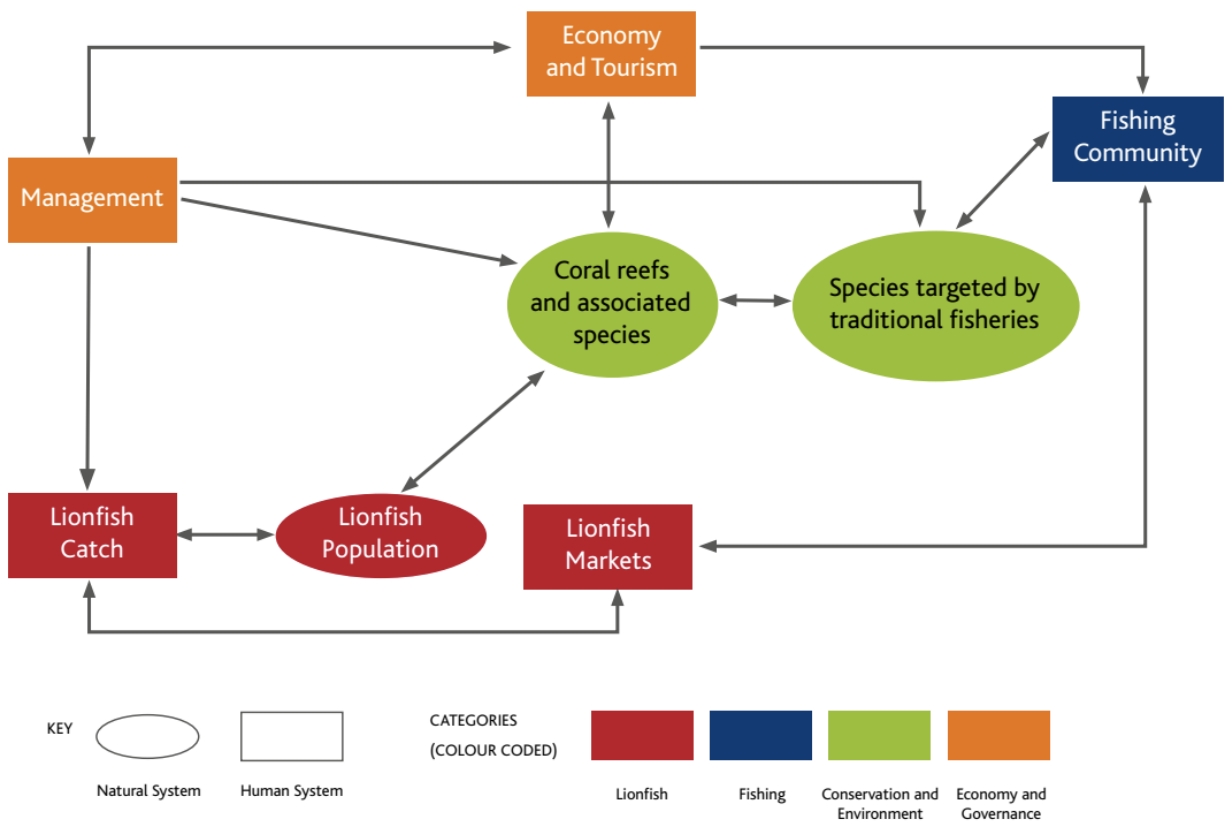
H1. Management

21. Total catch by lionfish tournaments

H2. Economy and Tourism

No indicators identified for monitoring of this system in the SEF

Appendix 7: Key Socioecological Framework



Appendix 8: PHILOLOGIST CREDENTIALS



Appendix 9: Revision Dictum

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6 June 2022

To Whom It May Concern:

This is to certify that I have reviewed the Final Graduation Project for master's degree candidate Ronalee McKenzie, including but not limited to:

- Spelling, grammar, and usage appropriate for candidates at the master's level
- Sentence structure, syntax, and overall development appropriate to Standard American English
- Formatting in APA style

This candidate has completed her project in accordance with the standard for proficiency in written English for the Master's in Project Management (MPM) Degree offered by the Universidad Para la Cooperación Internacional.

Respectfully,



Virginia L. Hampton