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Community-based sandfish sea ranching in the Philippines: Exploring social factors influencing success



97

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Community-based sandfish sea ranching in the Philippines: Exploring social factors influencing success

Editors

Nicholas McClean and Michael Fabinyi



2022

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Cover: Mr. Roberto Gonzales Jr, a sandfish ranch co-manager in Buyayawon, Mercedes, Eastern Samar, inspects a sandfish.

Photo: Mark Anthony Perandos



Foreword

The mariculture of sea cucumbers, and in particular sandfish (*Holothuria scabra*), is regarded as an economically attractive enterprise to meet several challenges faced by small-scale coastal fishing communities in the Philippines.

Assessments in the Philippines have found that the volume of most fisheries has either stagnated or declined since the 2000s across multiple species. In the face of ongoing, strong market demand for fishery products, increasing environmental pressures and a lack of viable alternative livelihood pathways, institutions for sustainability and fisheries governance have in many cases been unable to successfully manage capture fisheries across the tropics.

The Australian Centre for International Agricultural Research (ACIAR) is mandated under the ACIAR Act (1982) to work with partners across the Indo-Pacific region to generate the knowledge and technologies that underpin improvements in productivity, sustainability and food systems resilience in the agriculture, fisheries and forestry sectors. We do this by funding, brokering and managing research partnerships for the benefit of partner countries and Australia.

Together with partners from science institutions in Australia and the Philippines, ACIAR has supported the development of sandfish mariculture in the Philippines, with projects focusing on production and management systems and increasing technical skills to support community-based production.

This technical report is one outcome among many from research into sandfish mariculture in the Philippines since the early 2000s and trials of community-based sea ranches since 2007, of which ACIAR has been a significant contributor. The report is a practical resource that can inform future work on community-based sandfish mariculture in the Philippines, and elsewhere.

Community-based sandfish sea ranching is still in its early stages in the Philippines, but potentially can contribute to livelihoods and to help replenish wild stocks. The learnings and outcomes of the research behind this report are a fine example of how ACIAR supports scientists and smallholder farmers and fishers to build knowledge to manage natural resources and food production systems more sustainably, for better livelihoods, in this instance for coastal fishing communities.



Andrew Campbell

Chief Executive Officer, ACIAR

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Contributors

1 Introduction: Exploring the human dimensions of sandfish mariculture

Nicholas McClean¹, Michael Fabinyi¹ and Marie Antonette Juinio-Meñez²

¹Climate, Society and Environment Research Centre, University of Technology Sydney

²The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

2 Community-based sandfish sea ranching in Barangay Victory, Bolinao, Pangasinan Province (Luzon node case study)

Marie Antonette Juinio-Meñez¹, Karl Angelo F Lambio¹, Glycinea MD Peralta¹, Rona Cabanayan Soy¹, Olivier Josh Caasi¹, Tirso Catbagan and Linnea V. Tanchuling²

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

²College of Social Work and Community Development, University of the Philippines Diliman, Quezon City, Philippines

3 Community-based sandfish sea ranching in Panglit Island, Masinloc (Luzon node case study)

Marie Antonette Juinio-Meñez¹, Minin J Sinsona¹ and Marie Antonette Paña-Tautho¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

4 Community-based sandfish sea ranching in Barangay Sablig, Anda (Luzon node case study)

Marie Antonette Paña-Tautho¹, Bryan Dave Rodriguez, Minin J Sinsona¹, Olivier Josh Caasi¹ and Marie Antonette Juinio-Meñez¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

5 Pilot community-based ocean nursery rearing and local government buy-back in Barangay Imbo, Anda (Luzon node case study)

Minin J Sinsona¹, Bryan Dave Rodriguez¹ and Marie Antonette Juinio-Meñez¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

6 Sandfish sea ranching and community organising in Barangay Poblacion, Kauswagan (Mindanao node case study)

Wilfredo H Uy¹, Emmylou A Emperador¹, Anabelle Dece A Espadero¹, Danisa Mae Calimot¹, Heidie Amor A Parcia¹ and Allyn Duvin S Pantallano¹

¹Mindanao State University at Naawan, Poblacion, Naawan, Misamis Oriental 9023

7 Sandfish sea ranching and community organising in Barangay Tubajon, Laguindingan (Mindanao node case study)

Wilfredo H Uy¹, Emmylou A Emperador¹, Anabelle Dece A Espadero¹, Danisa Mae Calimot¹, Heidie Amor A Parcia¹ and Allyn Duvin S Pantallano¹

¹Mindanao State University at Naawan, Poblacion, 9023 Naawan, Misamis Oriental, Philippines

8 Participatory research and bringing back the sandfish in Maliwaliw Island, Eastern Samar (Eastern Visayas node case study)

Margarita T. de la Cruz¹, Janine L. Villamor¹, Rose Jane P. Diodoco¹ and Jonh Rey L. Gacura¹

¹Guiuan Development Foundation, Inc. Guimbaolibot Ave., Brgy. 10, Guiuan, Eastern Samar 6809 Philippines

9 Establishment of a community-based sandfish sea ranch in Barangay Polopiña, Concepcion, Iloilo, Philippines (Western Visayas node case study)

Jon Altamirano¹, Jee Grace Suyo^{1,2}, Roselyn Baylon¹ and Raisa Joy Castel¹

¹Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC/AQD), Tigbauan, Iloilo 5021, Philippines

²University of the Philippines Visayas, Miagao, Iloilo 5000, Philippines

10 Identifying the social conditions for successful mariculture: Discussion and comparison

Nicholas McClean¹ and Michael Fabinyi¹

¹Climate, Society and Environment Research Centre, University of Technology Sydney

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- ‘Expansion and diversification of production and management systems for sea cucumbers in the Philippines, Vietnam and northern Australia’ (FIS/2010/042)
- ‘Increasing technical skills supporting community-based sea cucumber production in Vietnam and the Philippines’ (FIS/2016/122).

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Acronyms and abbreviations

ACIAR	Australian Centre for International Agricultural Research
BALAT	Balat Aquaculture and Livelihood Association of Tubajon
BFAR	Bureau of Fisheries and Aquatic Resources
CBNRM	community-based natural resource management
cm	centimetre
DOST	Department of Science and Technology (Philippines)
DOST-PCAARRD	Department of Science and Technology – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
g	grams
GDFI	Guiuan Development Foundation Inc.
ha	hectare
IEC	information education campaign
IUCN	International Union for Conservation of Nature
KaSeA	Kauswagan Sea Ranchers Association
kg	kilogram
LGU	local government unit
MMA	Maliwaliw Multipurpose Association
MAO	Municipal Agricultural Officer
MENRO	Municipal Environment and Natural Resources Officer
MOA	Memorandum of Agreement
MPA	marine protected area
MSUN	Mindanao State University Naawan
NGO	non-government organisation
NIPSC-Concepcion	Northern Iloilo Polytechnic State College, Concepcion Campus
PCAARRD	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development
PHP	Philippine peso
PO	people’s organisations
SB	Sangguniang Bayan
SBMA	Sablig Barangay Multipurpose Association
SEAFDEC/AQD	Aquaculture Department, Southeast Asian Fisheries Development Center
SILOSFA	Sitio Looc Small Fisherfolk Association
SMMVI	Samahan ng Maliliit na Mangingisda sa Victory, Inc.
UPMSI	University of the Philippines Marine Science Institute
USD	United States of America dollars



Summary



Summary

This technical report explores the question: under what conditions can sustainable, community-based sandfish sea ranching be established in tropical coastal environments? More specifically, it reflects on the experiences of 8 sites in the Philippines where a particular model was implemented over a 10-year period.

Based on a comparative analysis of these cases, important strides have been made through applying the model across diverse project sites. The wider project of establishing community-based sea ranching remains an attractive livelihood development option in coastal tropical areas. However, the success of the model varied, and considerable challenges need to be addressed.

In most cases, ecological and social aspects of projects delivered positive outcomes. Economic outcomes, while present, were more limited. This, combined with local social factors that varied between sites, impacted on participation and support for sandfish mariculture in communities over time.

Based on this, we derived 3 overarching findings:

- Community-based sea cucumber sea ranching is likely to be more successful when taking a diagnostic approach to applying broad models and approaches in specific communities. While generalised models and approaches retain much value in guiding new project sites in particular, applying a well-refined diagnostic framework allows local-level key factors in project planning and implementation to be addressed.
- Community-based sea ranches tend to experience substantial blockages due to the long grow-out phase. Further efforts to develop sea ranches should focus on navigating the long grow-out period and the harvest phase to find ways to translate culture techniques into meaningful livelihood benefits for communities.
- Economic returns are likely the single most important factor in maintaining participation and support for sea ranches at the local level. However, multiple factors influence the success of sea ranching from a social perspective.

More detailed findings on these key issues can help to develop a diagnostic framework for applying existing models and approaches to community-based sandfish sea ranching.

Integrating with local livelihoods

Key findings

At this stage, community-based sea ranching is more likely to serve as a supplemental livelihood activity, rather than a main source of income. Its chief value is likely as an addition to a broader livelihood portfolio.

Projects are therefore most likely to generate sustainable livelihood benefits in 1 of 3 scenarios:

- Sandfish mariculture diversifies livelihoods in ways that meaningfully reduce risk (for example, providing an occasional or backup source of income to draw on if other livelihood options fail), or alleviating periods of low income.
- Livelihoods provide adequate and stable incomes already, and community members can invest time and labour into a project for future reward.
- Investors further up the value chain are willing to invest in ranch development, either through:
 - sourcing juveniles for grow-out from community-managed nurseries
 - employing community members directly for their labour to manage grow-out in sea ranches and post-harvest processing.

Integrating with wider fisheries governance systems

Key findings

The interaction between sea ranching and wild capture sea cucumber fisheries, and the effective management of wild stocks, have a major impact on the success of sea ranching initiatives. Projects are therefore most likely to succeed where:

- local and provincial government authorities:
 - prioritise sea cucumber fisheries management
 - develop integrated management approaches that view community sea ranches as an important part of sustainable and viable wild catch fisheries, ideally integrating actions at the local, provincial and national levels
- fishers in the community are aware of the potential benefits of sandfish mariculture for wild catch fisheries, and can absorb reductions in potential fishing grounds with harvest regulation of wild stocks based on size limits, until sustainable spillover benefits are realised
- key, influential stakeholders in the fishery (for example, traders) actively support the project and communicate the benefits of sandfish ranching among their networks.

Integrating with community-level governance systems and the need for equitable benefit sharing

The internal characteristics of people's organisations (PO), and the quality of their external relationships, are key influences on project success. Equitable benefit sharing, including among community members experiencing economic hardship and between women and men, is likely to be a key influence on project success.

Projects are therefore most likely to succeed in the following scenarios:

- Where POs have prior experience in community-based environmental or natural resource projects and have well established relationships within the community and with local government relevant to these issues.
- Where clear, active and well-tested internal decision-making and conflict management resolution mechanisms exist in POs to settle disputes and challenges as they arise.
- Where existing collaborative relationships with municipal local government units (LGUs), barangay councils and the wider community support the resolution of challenges and disputes as they arise.
- In contexts where appropriate PO partners do not already exist, communities are supported to build capacity and an enabling environment for successful community-based organisations through the project.
- Where the equitable participation and sharing of benefits occurs within projects, including consideration of issues surrounding gender and socio-economic status.

- Where the drivers of poverty in the community are well understood, and project planning accounts for acute hardship in the community, particularly where coastal fisheries provide a poverty alleviation function for groups without access to other livelihoods.

A diagnostic framework for community-based mariculture projects

Based on the findings, we have developed a draft diagnostic framework (Table 5) for assessing how suitable a community is to do mariculture, particularly sandfish sea ranching. A range of methods can be used to aid in diagnosis, such as:

- community consultations
- social-economic surveys
- the use of household data
- livelihoods mapping
- key informant interviews
- cost-benefit economic analysis
- catch and landings data
- stock status of key species
- analysis of management effectiveness and governance systems.

Ideally, this framework would be refined and expanded through:

- testing in the field
- further studies of existing community-based mariculture initiatives, and the social factors influencing their success.

1 Introduction: Exploring the human dimensions of sandfish mariculture



Credit: Mark Anthony Perandos

1

Introduction: Exploring the human dimensions of sandfish mariculture

Nicholas McClean¹, Michael Fabinyi¹ and Marie Antonette Juinio-Meñez²

¹Climate, Society and Environment Research Centre, University of Technology Sydney

²The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

This technical report collates information on current progress to establish sea ranching of sandfish (*Holothuria scabra*) in the Philippines. It:

- summarises key issues relating to establishing community-based sea-ranches
- presents 8 short case studies examining various aspects of projects conducted over the last 10 years
- reflects on lessons learned in the development of sustainable approaches to community-based sea ranching.

The aim of this technical report is to provide a practical resource that can inform future work on community-based sandfish mariculture in the Philippines, and elsewhere.

This technical report is one outcome among many from research into sandfish mariculture in the Philippines since the early 2000s, and trials of community-based sea ranches since 2007. A consortium of Australian and Philippines research and community-based organisations did the research and trials with significant funding from the Australian Centre for International Agricultural Research¹ among other organisations.

The Australian Centre for International Agricultural Research (ACIAR) specifically supported the development of sandfish mariculture in the Philippines through:

- ‘Expansion and diversification of production and management systems for sea cucumbers in the Philippines, Vietnam and northern Australia’ (FIS/2010/042) and the follow-on project
- ‘Increasing technical skills supporting community-based sea cucumber production in Vietnam and the Philippines’ (FIS/2016/122).

This technical report itself grew out of a 3-day workshop of consortium partners held in Manila in May 2019. The workshop focused on developing strategies for enhancing and monitoring the social and economic benefits that flow from community-based sandfish aquaculture projects to participating communities. To help with future stages of program implementation, progress to date was mapped out in field sites. Publishing these as short, accessible case studies with some analysis of progress so far provides a valuable potential resource for future efforts.

¹ Where funding for specific phases of pilot projects has been provided by other organisations, these are stated in the cases themselves.

This technical report covers progress within the consortium on establishing and running community-based sea ranches. As such, the emphasis is on key issues and lessons learned about the social, economic and governance aspects of community-based sandfish mariculture. Establishing the technical process of sandfish culture has been a critical outcome of the long-term investment made by the research consortium and funding bodies over many years (Hair et al. 2012). However, we do not seek to present these issues in any detail here, other than where successful sandfish culture has led to benefits flowing to communities.

The guiding question for this technical report is: under what conditions can sustainable, community-based sandfish sea ranching be established in tropical coastal environments, and particularly in South-East Asia?

Eight case studies of sea ranching presented in this report document:

- aspects of these efforts that were both successful and unsuccessful
- lessons learned while developing projects from the ground up
- potential strategies for addressing issues encountered while implementing sea ranches.

Sandfish mariculture is still in early stages in the Philippines. There are many aspects of this process still to be worked through, and some of the projects presented are either in their infancy or have ceased operating. We do not therefore present these cases as a definitive answer to our guiding research question. Rather, this technical report collates and records experiences to date and is a valuable resource to the consortium's ongoing efforts, and to other practitioners seeking to develop similar community-based mariculture projects in the Philippines and elsewhere.

1.1 Coastal livelihoods in the tropics – a role for sandfish mariculture?

Throughout the tropics, small-scale fishers face significant social, economic, and ecological challenges in maintaining viable livelihoods (Allison et al. 2011; Béné and Friend 2011; Jentoft and Eide 2011). For example, in many parts of the Philippines, overfishing and habitat degradation has meant that fishers typically fish further distances, for longer periods of time, for lower catches of smaller fish (Padilla et al. 2003; Muallil et al. 2014). Technological developments, increased populations, higher market demands and livelihood needs along the coastlines have combined to the extent that the 'frontier' of many tropical capture fisheries is rapidly closing or has closed (Butcher 2004; Belhabib et al. 2018).

A recent assessment of fish catch across the Philippines found that the volume of most fisheries had either stagnated or declined since the 2000s (Anticamara and Go 2016). Similarly, a national assessment of Philippines fisheries as far back as 2003 was explicitly titled 'Philippine fisheries in crisis' (Green et al. 2003), highlighting multiple fishery declines and other environmental pressures. In the face of ongoing, strong market demand for fishery products, and a lack of viable alternative livelihood pathways, institutions for sustainability and fisheries governance have, in many cases, been unable to successfully manage capture fisheries across the tropics. Many of the most detrimental effects of fish declines were felt by coastal, small-scale fishing communities (Berkes et al. 2006; Palomares and Pauly 2019).

To help address these challenges, mariculture of sea cucumbers, in particular *Holothuria scabra* (sandfish), has been promoted as a new livelihood activity

that can also help to replenish wild stocks (Purcell et al. 2013, Hair et al. 2012, Bell et al. 2008). Culturing of sea cucumbers began in India (James 2004) and the Pacific (Battaglione et al. 1999) during the 1990s and has expanded since the 2000s in the Philippines (Gamboa and Juinio-Meñez 2003). Much technical research on optimising sea cucumber mariculture remains ongoing, such as that related to:

- simplification of hatchery production methods (Militz et al. 2018)
- genetic risks
- broodstock management
- feeding
- predation
- disease and parasites (Hair et al. 2012; Purcell et al. 2012).

Globally, 38% of sea cucumber fisheries are over-exploited (Purcell et al. 2013). In many cases sea cucumber fisheries have either steeply declined or collapsed (Friedman et al. 2012; Eriksson et al. 2018). As slow-moving animals, fishers easily harvest them. They are also susceptible to the Allee effect, where population densities fall below the minimum threshold required for reproduction based on broadcast spawning (Bell et al. 2008). *Holothuria scabra* is 1 of 7 sea cucumber species listed as endangered on the IUCN Red List (Hamel et al. 2013).

Sandfish mariculture is therefore a way to meet market demand for sandfish while replenishing fast-diminishing wild stocks. Sea cucumbers are highly valued in markets in Hong Kong, mainland China and other countries where there are significant

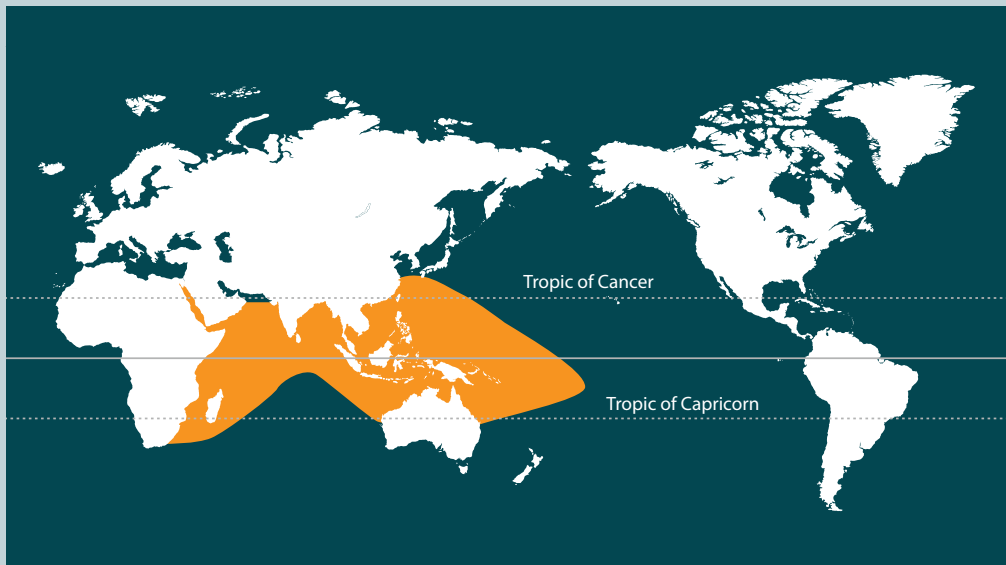


Figure 1 Natural range of *H. scabra* (from Bell et al. 2008 with permission to reproduce from Elsevier)

numbers of ethnic Chinese. Sandfish are the most highly priced tropical sea cucumber species. In 2016 in Hong Kong, sandfish averaged prices of USD369.00/kg, reaching maximum prices of USD1,898.00/kg (Purcell et al. 2018). Between 1996 and 2011:

- the number of countries supplying sea cucumbers to Hong Kong (a major import hub) expanded from 35 to 83 (Eriksson et al. 2015)
- prices for sea cucumbers in China increased faster between 2011 and 2016 than the general consumer price index (Purcell et al. 2018).

Market demand for sea cucumbers is strong and increasing. The ability to meet this demand through cultured species is an economically attractive idea.

There are 3 basic models for mariculture, which map across to sea cucumber mariculture:

- restocking
- stock enhancement
- sea ranching.

Table 1 explains these models.

Table 1 Goals/models of sandfish mariculture (information collated from Bell et al. 2008, Lorenzen 2008, Juinio-Meñez et al. 2012a)

Model	Mechanism	Intended benefits	Model of investment
Public restocking of wild populations	Hatchery rearing of juveniles and seeding into protected no-take zones or aggregating wild populations into no-take zones.	Restocking through spillover where depletions have led to population collapses due to the Allee effect.	Public investment as part of a wider marine conservation strategy.
Public enhancement of wild populations	Hatchery rearing of juveniles and seeding into protected no-take zones.	Stock enhancement through spillover where natural limitations (for example, in recruitment) lead to limited production.	Public investment as part of a wider fisheries management strategy.
Private sea ranching and sea pens	Hatchery rearing of juveniles and seeding into sea ranches or sea pens. Use and harvest rights granted to releasing private entity.	Rearing of sea cucumbers to be sold on the open market. Spillover enhancing or restocking wild populations is a secondary benefit.	Private investment or public-private partnership to deliver both private (economic) and public (fishery-related) benefits.

The ability for sandfish mariculture to generate environmental and social benefits is closely tied with how it is governed and how it contributes to local livelihoods (Lorenzen 2013, Purcell et al. 2012, Eriksson et al. 2012, 2018b, Hair et al. 2019, 2020). For example, numerous authors note that for stock enhancement through mariculture to succeed it must:

- achieve the biological/environmental objectives of fisheries management
- contribute to economic, social and institutional objectives of a range of potential actors (Lorenzen 2008; Bell et al. 2008).

Importantly, 'enhancements enter into complex fisheries systems and, to be successful...need to add value to, or outperform, alternative measures...This is possible only under certain conditions and may require transformations in multiple biological-technical as well as market and institutional attributes of the fisheries system.' (Lorenzen 2008)

These insights highlight practical challenges that are acute in low-income areas, and where effective fisheries governance systems are absent (Hair et al. 2020; Eriksson et al. 2012; 2018; Purcell et al. 2013; Juinio-Meñez et al. 2012a,b; Robinson and Pascal 2009). For this reason, awareness is increasing that establishing initiatives at the community level is critical to achieve such beneficial outcomes (Purcell et al. 2012; Eriksson et al. 2012; Juinio-Meñez et al. 2012b; Robinson and Pascal 2009).

This growing body of work highlights the complex interdependence of biological/ecological and social, economic and institutional issues. Despite this, there are limited assessments on how specific mariculture programs have connected with:

- local livelihoods
- wider fisheries management systems
- local forms of governance.²

Hair et al. (2016) note that 'further research is needed to elucidate which...human factors are most useful in predicting the quality of potential sea ranch sites.' This current technical report seeks to contribute to this topic.

In the next section, we describe a community-based model for sandfish sea ranching that was developed specifically for the Philippines. We also discuss how it has sought to address 3 broad challenges:

- integrating with local livelihoods
- fisheries governance systems
- community level dynamics.

1.2 A community-based model for sandfish sea ranching in the Philippines

Sandfish mariculture in the Philippines began in the early 2000s. It was initially focused on biophysical and production aspects. Since then, work has expanded to include a sustained focus on management systems such as sea ranching, and later, household-based and ocean nursery grow-out approaches.³

2 This in contrast to wild capture sea cucumber fisheries, for which more extensive social and governance related studies have been undertaken (Barclay et al. 2019, Hair et al. 2019). Hair et al. (2020) is a notable recent exception.

3 This early work was supported by key institutions including ACIAR and WorldFish, and subsequently the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD). In 2012 DOST-PCAARRD introduced the Industry Strategic S&T Program (ISP) for Sea Cucumber in 2012, covering a range of programs relating to culture, capture fisheries and processing. ACIAR also has specifically supported the development of production and management systems for sea cucumbers, including those which this monograph focuses on.

For the unique context of the Philippines, a community-based approach was identified as the most appropriate means of successful sea ranching (Juinio-Meñez et al. 2012a). Prior to 2007, there were few attempts at community-based sea ranching of sea cucumbers. Instead, most attempts were focused on re-stocking or stock enhancement with sea pens or sea ranches. Because these projects required much larger areas to meaningfully achieve their goals (Purcell et al. 2012), they were usually under the auspices of state fisheries or conservation agencies.

During the first sea ranch establishment (Victory in Luzon in 2007), a model or framework for establishing community-based sea ranching was developed based on the Philippine conditions characterised by the open access nature and multiple users of municipal waters in the Philippines. The framework was designed to minimise social conflict, diversify livelihood options and grant preferential use rights to small-scale fishers (Juinio-Meñez et al. 2012b) (Figure 2).

Sea ranches that used this framework were intended to exhibit some broad elements. Each pilot sea ranch was to be established over 5 hectares (ha) of inshore waters, divided into 2 zones:

- A 1 ha sea ranch as a nursery/grow-out area for juvenile sandfish, reared in a hatchery and transplanted to the sea ranch.
- A 4 ha buffer zone for gleaning a variety of invertebrates, excluding sandfish.

Broadly speaking, the model was based on Bell et al.'s (2008) 'private-public partnership' model (see Table 1). Sea ranches were to be developed through granting exclusive private use rights over the 5 ha zone.

This would aim to generate both:

- private benefits accruing to the rights holders, as income from selling marketable sandfish
- public benefits as enhanced wild stocks and subsequent increases in landed catch due to spill-over.

Wider ecological benefits from healthier sandfish stocks were also intended from the initiative.

Pilot initiatives were designed to demonstrate a successful model of sea ranch development that could continue to be independently financially viable. They would not need external development aid, government or research funding. Private investment by buyers and traders of sandfish could sustain the sea ranches, for example.

The community-based initiatives were envisaged as a partnership between the research consortium partner at the node level and a community-based people's organisation (PO). In this case, community members who expressed interest during consultation in taking part in the initiative had 2 options. They could either work within an existing PO or establish a new sandfish-oriented PO as the basis of the partnership with the consortium.

In the pilot phase, the consortium provided materials, and in some cases, financial incentives. Labour and time were invested by PO members. In all sea ranch sites, the main activities included:

- juvenile sandfish releases
- monitoring of sandfish survival
- guarding of sea ranches
- maintenance where this was required (repair, cleaning of sea pens) and monthly meetings with technical assistance from project staff.

To be recognised in law and enable regulation enforcement, local government officials in the barangay and municipal levels needed to support the granting of exclusive private use rights to the PO to establish the sea ranch. Because of the largely open-access nature of coastal fisheries in the Philippines, and municipal-level jurisdiction over coastal waters, this was necessary to secure the PO's rights to establish and benefit from the sea ranch.

Next, we discuss:

- the 3 key challenges for sandfish mariculture
- how this community-based model of sea ranching responds to these challenges in the Philippines.

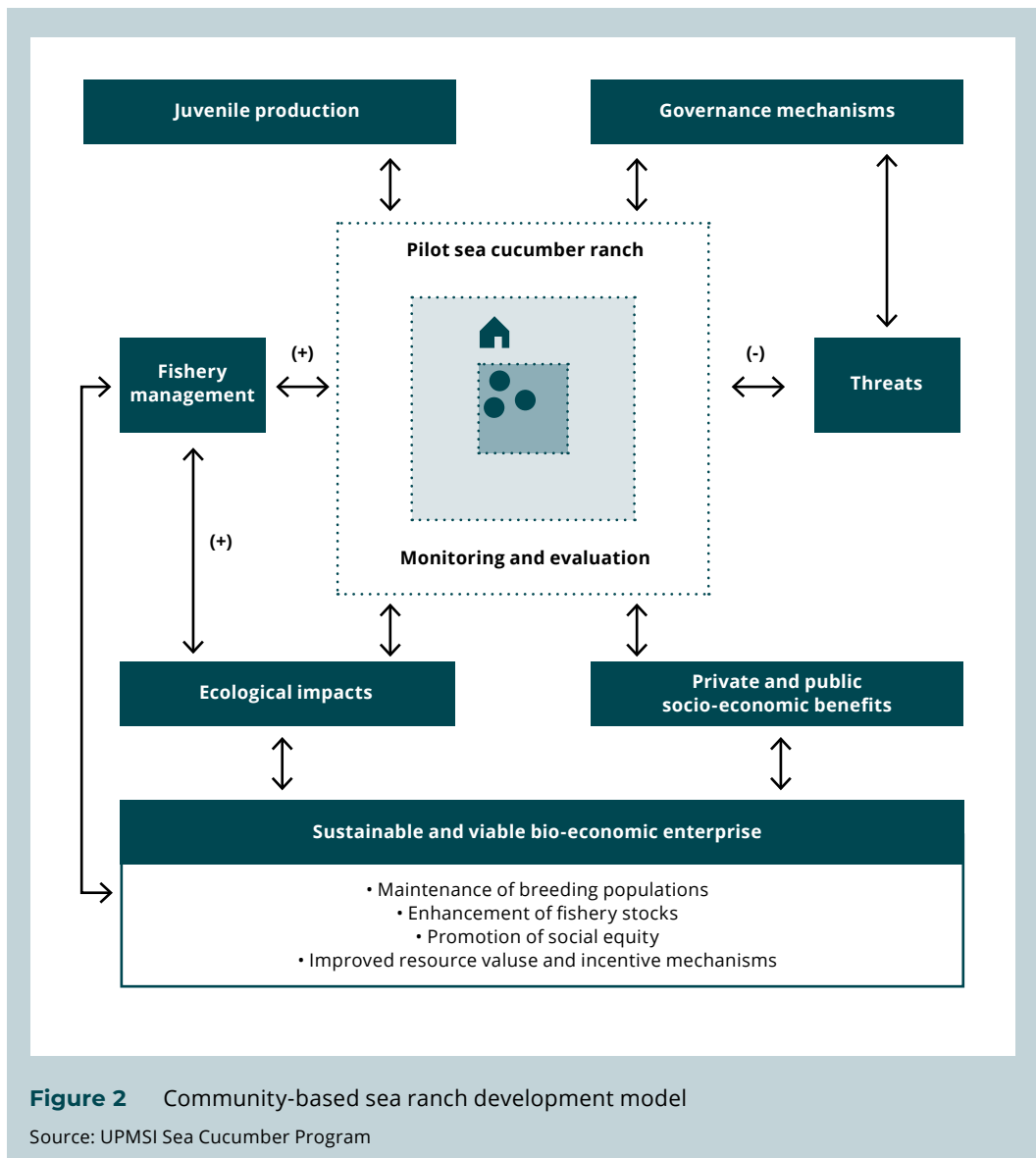


Figure 2 Community-based sea ranch development model

Source: UPMSI Sea Cucumber Program

1.3 Coastal livelihoods in the Philippines

Coastal regions of the Philippines are, in general, densely populated. Small-scale natural resource-based livelihoods are common. Coastal household livelihoods are highly diverse and flexible, with households pursuing different livelihood activities depending on:

- season
- availability
- individual circumstances and preferences.

Various forms of fishing remain a dominant livelihood activity for many poorer residents along the coasts (Eder 2009; Fabinyi 2012).

In regional centres, commercial fishing boats such as trawlers, purse seines, liftnets and other large-scale vessels employ crew. In more rural areas, various types of small-scale fishing are prevalent. They use both motorised and non-motorised craft in inshore municipal waters. These small-scale fisheries often meet living needs and provide the means to purchase basic food items through the sale of fish (Fabinyi et al. 2017). Common types of small-scale fishing prevalent in the coastal Philippines include:

- hook and line (using different types of bait and lures)
- various types of gillnets
- fish traps
- beach seines.

Gleaning along the intertidal zones is common and is often practised by women and children. Spearfishing, blast fishing, compressor fishing, and cyanide are also common methods.

In addition to fishing, the Philippines is one of the world's largest exporters of seaweeds. Coastal residents often have seaweed plots, while in some areas, such as

around Pangasinan, fish farming for milkfish is widespread. Household sari-sari stores (mixed-good stores) are a common feature of coastal barangays, and households also often grow some fruits or vegetables. Depending on access to land, some households may practise a mixed livelihood portfolio of farming and fishing, combining multiple livelihood activities (Eder 2003).

In rural areas, wage labour in the agricultural sector, such as in rice plantations, is common. In areas closer to urban regions, wage labour opportunities, such as in construction or transport sectors, are more common. While tourism provides increasing opportunities to pursue wage labour, this can often come at the expense of more traditional agricultural and natural resource-based livelihoods (Fabinyi 2010).

How did the model seek to address this context?

Adopting a small-scale and community-based approach in the first instance was a response to:

- the high level of dependence on fishery-based livelihoods in coastal communities
- the resulting highly contested nature of coastal resources.

Juinio-Meñez et al. (2012a) specifically refer to this when they highlight 'minimizing inherent social conflict' as an intended advantage of the model.

In 2007 small-scale community-based sea ranching was a novel development relative to previous efforts at sandfish mariculture, which represented an adaptation to the Philippines context. Restocking or stock enhancement has been considered for invertebrate fishery management. However, there have been limited efforts given the high technical and financial resources needed (Juinio-Meñez, 2004, 2016).

Large-scale restocking and sea ranching are generally not yet widely practised in

tropical developing countries (Kitada 2017). Moreover, there are many challenges with allocating private use rights for large areas of nearshore waters for restocking with high proportions of coastal populations that depend on marine resources. This was considered not feasible in the Philippines. Meanwhile the use of concrete ponds such as in Vietnam, which largely eliminates issues of resource contestation (Duy 2012; Purcell et al. 2012) is also not feasible in the Philippines, with no existing infrastructure.

Beginning with small 5 ha zones was therefore most likely to get initial support for sandfish mariculture in the highly contested coastal zone. Delivering economic benefits to both participants and communities in the immediate surrounding area was a way to ensure that the exclusive use rights over the 5 ha could be offset by spillover benefits from the sea ranch.

In doing so, the model also seeks to provide a new type of livelihood to members of the PO. A key challenge is the long grow-out period of between 9 and 18 months to attain high market value. This could be addressed through 2 pathways.

Firstly, private use rights over public resources (inshore municipal waters) creates an incentive for PO members to input their labour and their time upfront. In return, they get a long-term economic gain once sandfish grow to a marketable size and can be sold on the open market. PO members:

- self-organise within the PO
- negotiate with municipal local government units (LGU), barangays and the consortium partner
- maintain and clean sea ranches
- guard the sea ranch and participate in monitoring activities voluntarily, assuming future economic gains.

Secondly, in some cases, the model has short-term financial incentives to maintain PO member involvement through the grow-out period. This could be in the form of an agreed buyback of reared sandfish prior to the 18-month period through either:

- local government or research partners
- buying back stock to support stock enhancement
- development of hatchery broodstock.

In other cases, paying wages for labour may also be negotiated, most commonly for sea ranch construction/maintenance, and sea ranch guarding.

It is important to note that the project did not intend to restrict socio-economic monitoring of livelihoods only to income. An instrument and survey design were developed for a socio-economic baseline study, adopting the sustainable livelihoods approach (*Sustainable Livelihood Guidance Sheets*, IDS 1999). In this approach, livelihoods are the activities that people carry out to earn a living, and include all the different elements that contribute to, or affect, their ability to ensure a living for themselves and their households.

1.4 Coastal fisheries management in the Philippines

In the Philippines, sea cucumber fisheries have changed from selling lower volumes of higher-valued species, to higher volumes of lower-quality product (Akamine 2001). There are multiple reports of sea cucumber depletion in some localities (Olavides et al. 2010; Juinio-Meñez et al. 2012; Jontila et al. 2018; Fabinyi 2018). As a result, they are usually a part of mixed-species fisheries, caught by fishers diving on reefs or by gleaners in inter-tidal zones. Because they are scarce and high value, and buyers are not selective, sea cucumbers tend to be

harvested regardless of size, quality or species. The Philippines is one of the largest exporters of sea cucumbers globally, and in 2018 it was the tenth most valuable fishery export from the country, accounting for 311 MT, worth USD6.7 million (DA-BFAR 2019). This is much lower than export volumes from the 1980s and 1990s (Choo 2008).

At the formal level, fisheries in the Philippines are overseen by the Bureau of Fisheries and Aquatic Resources (BFAR), within the Department of Agriculture. BFAR is responsible for managing fisheries. However, since the local government code passed in 1991, control over fisheries has decentralised to LGUs.

The Fisheries Code, implemented originally in 1998 (RA 8550) and revised in 2014 (RA 10654) is the primary legislative instrument to manage fisheries at the national level. Commercial fishing is only permitted in waters beyond 15 km from the shoreline. Fisheries within these 15 km is permitted only for municipal fishers (defined as using a vessel less than 3 gross tons). Municipal governments are therefore responsible for managing fisheries and mariculture in municipal waters.

The key tool for managing the sea cucumber fishery is BFAR Administrative Circular 2013-249. It specifies a requirement for licensing among collectors and traders, and a 5 cm size limit. However, implementation and enforcement of such national laws are vulnerable to many challenges facing small-scale fisheries regulation more generally in the Philippines (Christie et al. 2009; Eder 2009; Fabinyi and Dalabajan 2011).

As well as working with fisheries management agencies, sea cucumber mariculture in the Philippines must also work with a complex landscape of policy actors in both government roles and wider society.

At the municipal level, particularly relevant actors include:

- the *Sangguniang Bayan* (legislative council)
- the municipal fisheries and aquatic resource management council (MFARMC)
- the municipal BFAR office
- the Coastguard
- in some cases, the Bantay Dagat (sea warden).

At a lower level of governance, the barangay captain and *kagawads* (village officials), and the barangay fisheries and aquatic resource management council (BFARMC) also tend to have significant input into decision-making processes. Other agencies, such as various types of POs (for example, trading associations, fishers' associations, women's associations) may also play a role.

Effective management is also key for sandfish within the ranch itself. Ultimately, the 2 main determinants of price for sandfish are size and quality of processing (Purcell et al. 2014; Fabinyi et al. 2017; Barclay et al. 2019). This is particularly so for sandfish, where the effect of length on price is not linear, but exponential. In a study of Hong Kong and southern Chinese markets in 2011, Purcell (2014) found that:

- processed sandfish less than 8 cm long would sell for less than USD165.00 per kg
- processed sandfish of 12 cm sell for USD840.00 per kg.

Given the price increases associated with small increases in size, the incentive to poach can quickly become very strong. This is a key aspect of most analyses of sea ranching thus far (Hair et al. 2020; Purcell et al. 2012; Eriksson et al. 2012). Having an effective way to ensure that sandfish are protected from fishing until they reach an economically viable size is therefore an important pre-requisite for the overall success of any enterprise.

How did the model seek to address this context?

In the first instance, sandfish mariculture tries to address the challenges of wider fisheries systems by demonstrating stock enhancement/restocking benefits via spillover. The community-based model was premised on this assumption. Ideally, spillover would occur to a degree where long-term economic benefits outweigh short-term incentives to harvest.

More specifically, this community-based model sought direct agreements between the PO and LGUs within BFAR to support the initiative and grant private use rights to the PO. In most cases, this process also requires support from leaders in the local barangay. In this way, community-based sea ranching should be integrated into the LGU strategy for sea cucumber fishery management, as the primary government unit responsible for managing municipal waters, and for managing fisheries in this area. Support from the LGU and the local barangay also implies, though does not ensure, a degree of support within the wider community and among sandfish fishery stakeholders for the sea ranch. Regular monitoring of the sea ranch by researchers with community managers provided direct evidence that a spawning population has been established and maintained in the sea ranch through the release of cultured juveniles, and that there is natural recruitment of wild juveniles (Juinio-Meñez et al. 2013).

The specific issue of poaching was to be addressed at the project level, primarily through PO members guarding the sea ranch, enforcing private use rights granted by the LGU. In some cases, this was done based on financial payments from the wider project. In others, PO members agreed to do this voluntarily, anticipating sufficient returns from the sale of marketable sandfish in the future. Ideally, wider fisheries enforcement efforts by the LGU

would support arrangements to pursue penalties against poachers found to be violating the private use rights granted to POs.

1.5 Community-level governance and equitable benefit sharing

Livelihoods development and marine/ fisheries conservation efforts each have long histories in the Philippines. Key issues are relevant to addressing community-level dynamics within sea ranching and mariculture projects around:

- the importance of accounting for local governance dynamics due to the highly decentralised nature of resource governance in the Philippines
- the need to consider the distribution of impacts from project activities among different groups in the community (Christie et al. 2009).

Firstly, the willingness to engage in genuinely collaborative, multi-agency and community-based approaches is, in the first instance, seen as being critical for the overall success of livelihoods and conservation initiatives. For example, marine protected area implementation in the Philippines has shown that community involvement in designating and actively managing marine protected areas (MPA) increases:

- their legitimacy
- their value to local communities
- their overall likelihood of success.

In an assessment of ecosystem-based management and marine protected area networks in the Philippines, Christie et al. (2009) concluded that feasibility and success of MPAs in the Philippines

'is directly dependent on the effectiveness of participatory planning,

inter-institutional collaboration, capacity development, consistent and fair enforcement, conflict identification and resolution, and distribution of benefits, *at the local scale.*' (Our emphasis)

This finding is echoed in assessments of sandfish mariculture initiatives outside the Philippines (Eriksson 2012; Purcell et al. 2012).

In the Philippines the primary form of community-based organisation is the people's organisation (PO). POs are enshrined in Article 15 of the Philippines constitution as a legitimate vehicle of governance, defined as '...bona fide associations of citizens with demonstrated capacity to promote the public interest and with identifiable leadership, membership, and structure.' It is up to the PO what their purpose, membership, leaders and structure should be.

Secondly, the nature of social relations within coastal communities can impact strongly on operating a variety of coastal development and conservation initiatives. They can also influence outcomes for particular groups. For example, an increasing recognition in the fisheries field is that women's participation in coastal fisheries has been under-acknowledged. Their active engagement in fisheries and livelihoods initiatives stands to increase the likelihood of success and is a basic issue of equity (Weeratunge et al. 2010). This is reflected in a growing body of literature in the Philippines (Siar 2003; Kleiber et al. 2014), including the fact that many women are gleaners who harvest sea cucumbers in the Philippines.

Another relevant example is the general acknowledgement in the fisheries field of the high level of involvement of migrants in coastal and small-scale fisheries. This is frequently linked to situations of lower socio-economic status, including instances of poverty linked, in part, to landlessness

(Eder 2009; Knudsen 2012). This is reflected in examples from the Philippines showing how the impacts of MPAs have highly differentiated impacts on different groups of fishers (Eder 2009; Fabinyi et al. 2010).

How did the model seek to address this context?

Most obviously, the model addresses this context by being an explicitly community-based approach to sea ranch implementation. It uses the standard approach in the Philippines, where POs are the vehicle for community-level implementation. Granting private use rights over municipal waters was a novel aspect of this approach, in the context of community-based initiatives. This is in addition to identifying a group of interested community members who were willing to participate within a PO to implement the sea ranch. At the same time, this has strong parallels with MPA designation, in terms of:

- the exclusionary basis of this designation
- the potential impacts on marine resource users in the coastal zone.

Conflict resolution, participation, decision-making and leadership were all generally understood to be issues of importance. However, these aspects were left to POs to determine as an internal matter, reflecting standard approaches to community-based conservation/resource management in the Philippines.

Social equity was an explicit element of the model, relating to the wider social dynamics within communities, and the potential for different impacts on different groups. Primarily, this was focused on ensuring that both PO members and wider participants in the fishery each derived benefits from sea ranches. Both men and women participated in POs and were paid for their labour and contributions to sea ranches.

There was no specific emphasis in the model on social equity among different socio-economic groups. There was also no intention that benefits would explicitly flow to groups experiencing economic hardship or displacement, where this might be relevant. However, fisheries livelihoods are frequently accessed by people in marginal economic circumstances. So, the consortium reasonably expected (and supported the rationale for program development) that any benefits flowing to the wider fishery would result in benefits for people in marginal economic circumstances, even if they could not be specifically targeted.

1.6 A multi-sited comparison of model implementation

From 2007 to the present, this community-based model of sandfish sea ranching has been implemented in 8 sites across the Philippines, and a modified version was implemented in one other site. These sites were located within 4 nodes based in Luzon, Western Visayas, Eastern Visayas, and Mindanao.

Figure 3 shows the locations of these nodes and sites, while Figure 4 displays the timing of implementation and the duration of sea ranches in each site.

These projects were implemented in 2 phases. Phase 1 was focused on the Luzon node and began in 2007, continuing to 2011. Phase 2 expanded to include the Eastern Visayas, Western Visayas and Mindanao, and went from 2012 to 2017. Phase 3 began in 2019 and has continued efforts in all nodes, but focuses on new approaches to mariculture, and in some cases new sites for sea ranching.

Sites were initially selected for their suitability in terms of biophysical characteristics and based on community consultation. Proceeding depended on enough community members:

- expressing interest in participating in the sea ranch
- being willing to participate as part of a PO.

A step-by-step process for sea ranch establishment was developed early on based on the model described above (UPMSI 2010). This included:

- the initial biophysical screening
- community consultation
- developing LGU agreements
- site establishment
- sandfish release
- monitoring and harvest.

However, in practice the implementation of these steps across sites was quite varied.

The next 8 case studies describe these varied experiences, drawing on the experiences and knowledge of the project teams involved, and using data from project monitoring and socio-economic research. A broad common structure for these cases came from the initial social-economic team meeting in May 2019. It was then adapted and applied as the specific details of each case emerged. These cases cover 7 of the 8 trials of the sea ranch model described here, and a trial of a community-based ocean nursery grow-out and government buyback project.



Figure 3 Map of project node locations

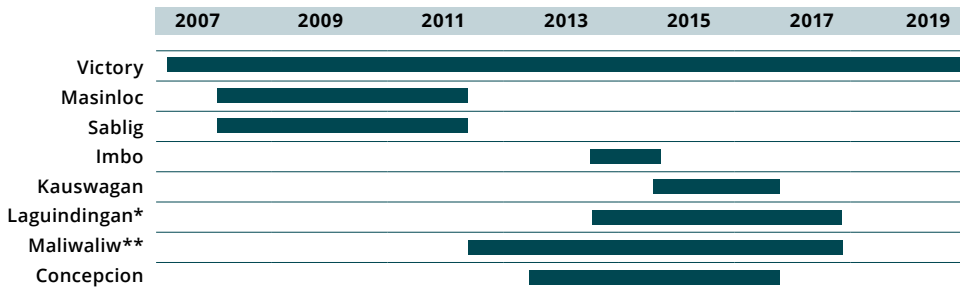


Figure 4 Timeline of community-based sea ranching projects in the Philippines

**Household based mariculture has continued in this site with former members of the PO.*

*** Communal sea ranching continues to be implemented by this community and the PO, however at a different site.*

There are several limitations to this study. Firstly, by drawing on the experiences of project node leaders and staff, this is not an independent review of the success of these projects. Instead, it gathers knowledge and views from within the project team with existing data and uses these to develop tools and resources for future efforts.

Secondly, some of the authors of the case studies, as well as the editors, were not part of the projects at the time of implementation. In some cases, staff responsible for implementing community engagement processes and socio-economic research did not stay in the project team due to a 2-year funding gap between Phase 2 and Phase 3. As a result, some key knowledge holders were not available for this technical report. This means the full implications of research already done for example, on village-based livelihoods, have not been explored as much as they might have been if those staff members could interpret and analyse these data.

Such considerations must be left to a future effort in which all previous socio-economic data collected across nodes can be pooled and systematically analysed by the current team. Despite these limitations, we have made all reasonable efforts to:

- transparently relate the processes of implementation
- present available evidence
- formulate findings based on these sources, regarding the successes achieved and challenges faced.

1.7 References

- Alcala AC and Russ GR (2006) No-take marine reserves and reef fisheries management in the Philippines: a new people power revolution, *AMBIO: A Journal of the Human Environment*, 35(5):245–255. <https://doi.org/10.1579/05-A-054R1.1>
- Allison EH, Ratner BD, Åsgård B, Willmann R, Pomeroy R and Kurien J (2012) Rights-based fisheries governance: from fishing rights to human rights. *Fish and Fisheries*, 13(1):14–29. <https://doi.org/10.1111/j.1467-2979.2011.00405.x>
- Anticamara JA and Go KT (2016) Spatio-temporal declines in Philippine fisheries and its implications to coastal municipal fishers' catch and income. *Frontiers in Marine Science*, 3:21. <https://doi.org/10.3389/fmars.2016.00021>
- Barclay K, Fabinyi M, Kinch J and Foale S (2019) Governability of High-Value Fisheries in Low-Income Contexts: A Case Study of the Sea Cucumber Fishery in Papua New Guinea. *Human Ecology*, 47(3):381–396. <https://doi.org/10.1007/s10745-019-00078-8>
- Battaglene SC, Seymour JE and Ramofafia C (1999) Survival and growth of cultured juvenile sea cucumbers, *Holothuria scabra*. *Aquaculture*, 178(3-4): 293–322. [https://doi.org/10.1016/S0044-8486\(99\)00130-1](https://doi.org/10.1016/S0044-8486(99)00130-1)
- Belhabib D, Greer K and Pauly D (2018) Trends in industrial and artisanal catch per effort in West African fisheries. *Conservation Letters*, 11(1): conl.12360. <https://doi.org/10.1111/conl.12360>
- Bell J, Purcell SW and Nash WJ (2008) Restoring small-scale fisheries for tropical sea cucumbers. *Ocean and Coastal Management*, 51(8-9):589–593. <https://doi.org/10.1016/j.ocecoaman.2008.06.011>
- Béné C and Friend RM (2011) Poverty in small-scale fisheries: old issue, new analysis. *Progress in Development Studies*, 11(2):119–144. <https://doi.org/10.1177/2F146499341001100203>
- Berkes F, Hughes TP, Steneck RS, Wilson J A, Bellwood DR, Crona B, Folke C, Gunderson LH, Leslie HM, Norberg J and Nyström M, (2006) Globalization, roving bandits, and marine resources. *Science*, 311(5767):1557–1558. <https://doi.org/10.1126/science.1122804>
- Brown EO, Perez ML, Garces LR, Ragaza RJ, Bassig RA and Zaragoza EC (2010) *Value Chain Analysis for Sea Cucumber in the Philippines*. Studies & Reviews 2120. The WorldFish Center, Penang, Malaysia
- Butcher JG (2004) *The closing of the frontier: A history of the marine fisheries of Southeast Asia, c. 1850–2000* (No. 8). Institute of Southeast Asian Studies.
- Choo PS (2008) The Philippines: a hotspot of sea cucumber fisheries in Asia. In V. Toral-Granda, A. Lovatelli and M. Vasconcellos (eds). *Sea cucumbers. A global review of fisheries and trade*. *FAO Fisheries and Aquaculture Technical Paper*. No. 516. Rome, FAO.
- Christie P, Pollnac RB, Oracion EG, Sabonsolin A, Diaz R and Pietri D, (2009) Back to basics: an empirical study demonstrating the importance of local-level dynamics for the success of tropical marine ecosystem-based management. *Coastal Management*, 37(3-4):349–373. <https://doi.org/10.1080/08920750902851740>
- Cinner JE and Bodin Ö (2010) Livelihood diversification in tropical coastal communities: a network-based approach to analyzing 'livelihood landscapes'. *PloS one*, 5(8):e11999. <https://doi.org/10.1371/journal.pone.0011999>
- Department of Agriculture - Bureau of Fisheries and Aquatic Resources (DA-BFAR) (2018) Fisheries statistics, DA-BFAR, accessed May 6, 2020
- Duy ND (2012) Large-scale sandfish production from pond culture in Vietnam. *Asia-Pacific Tropical Sea Cucumber Aquaculture. ACIAR Proceedings*, 136:34–39.
- Eder JF (2003) Of fishers and farmers: Ethnicity and resource use in coastal Palawan. *Philippine quarterly of culture and society*, 31(3):207–225.
- Eder JF (2009) *Migrants to the coasts: Livelihood, resource management, and global change in the Philippines*. Wadsworth, CT: Cengage Learning.

- Eriksson H, Robinson G, Slater MJ and Troell M (2012) Sea cucumber aquaculture in the Western Indian Ocean: challenges for sustainable livelihood and stock improvement. *Ambio*, 41(2):109–121. <https://doi.org/10.1007/s13280-011-0195-8>
- Eriksson H, Österblom H, Crona B, Troell M, Andrew N, Wilen J and Folke C (2015) Contagious exploitation of marine resources. *Frontiers in Ecology and the Environment*, 13(8):435–440. <https://doi.org/10.1890/140312>
- Eriksson H, Friedman K, Amos M, Bertram I, Pakoa K, Fisher R and Andrew N (2018 a) Geography limits island small-scale fishery production. *Fish and fisheries*, 19(2):308–320. <https://doi.org/10.1111/faf.12255>
- Eriksson H, Troell M, Brugere C, Chadag M, Phillips M, and Andrew N (2018 b) A diagnostic framework for equitable mariculture development in the Western Indian Ocean. Australian Centre for International Agricultural Research: Canberra, ACT. 36 pp. ACIAR Monograph No.204.
- Fabinyi M, (2010) The intensification of fishing and the rise of tourism: competing coastal livelihoods in the Calamianes Islands, Philippines. *Human Ecology*, 38(3):415–427. <https://doi.org/10.1007/s10745-010-9329-z>
- Fabinyi M (2012) *Fishing for fairness: Poverty, morality and marine resource regulation in the Philippines*. Canberra: ANU Press.
- Fabinyi M and Dalabajan D (2011) Policy and practice in the live reef fish for food trade: a case study from Palawan, Philippines. *Marine Policy*, 35(3):371–378. <https://doi.org/10.1016/j.marpol.2010.11.001>
- Fabinyi M, Knudsen M and Segi S (2010) Social complexity, ethnography and coastal resource management in the Philippines. *Coastal Management*, 38(6):617–632. <https://doi.org/10.1080/08920753.2010.523412>
- Fabinyi M, Dressler WH and Pido MD (2017) Fish, trade and food security: moving beyond 'availability' discourse in marine conservation. *Human ecology*, 45(2):177–188. <https://doi.org/10.1007/s10745-016-9874-1>
- Friedman K, Eriksson H, Tardy E and Pakoa K, (2011) Management of sea cucumber stocks: patterns of vulnerability and recovery of sea cucumber stocks impacted by fishing. *Fish and Fisheries*, 12(1):75–93. <https://doi.org/10.1111/j.1467-2979.2010.00384.x>
- Gamboa R and Juinio-Meñez MA (2003) Pilot-testing the laboratory production of the sea cucumber, *Holothuria scabra* (Jaeger) in the Philippines. *The Philippine Scientist*, 40:111–121.
- Green SJ, White AT, Flores JO, Carreon III MF and Sia AE (2003) *Philippine fisheries in crisis: A framework for management*. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines. Accessed May 6, 2020.
- Hair CA, Pickering TD and Mills DJ (2012) *Asia-Pacific Tropical Sea Cucumber Aquaculture: Proceedings of an International Symposium Held in Noumea, New Caledonia, 15–17 February, 2011*, 136:1–209. Australian Centre for International Agricultural Research, Canberra.
- Hair C, Foale S, Kinch J, Yaman L and Southgate PC (2016) Beyond boom, bust and ban: the sandfish (*Holothuria scabra*) fishery in the Tigak Islands, Papua New Guinea. *Regional Studies in Marine Science*, 5: 69–79. <https://doi.org/10.1016/j.rsma.2016.02.001>
- Hair C, Foale S, Kinch J, Frijlink S, Lindsay D and Southgate PC (2019) Socioeconomic impacts of a sea cucumber fishery in Papua New Guinea: Is there an opportunity for mariculture? *Ocean & Coastal Management*, 179:p104826. <https://doi.org/10.1016/j.ocecoaman.2019.104826>
- Hair C, Foale S, Daniels N, Minimulu P, Aini J and Southgate PC (2020). Social and economic challenges to community-based sea cucumber mariculture development in New Ireland province, Papua New Guinea. *Marine Policy*, 117:p103940. <https://doi.org/10.1016/j.marpol.2020.103940>
- Hamel JF, Mercier A, Conand C, Purcell S, Toral-Granda TG and Gamboa R (2013) '*Holothuria scabra*'. *IUCN Red List of Threatened Species*. 2013: e.T180257A1606648. Accessed May 6, 2020. [doi:10.2305/IUCN.UK.2013-1.RLTS.T180257A1606648.en](https://doi.org/10.2305/IUCN.UK.2013-1.RLTS.T180257A1606648.en)

- James DB (2004) Captive breeding of the sea cucumber, *Holothuria scabra*, from India. *FAO Fisheries Technical Paper*, 463:385–395.
- Jentoft S and Eide Aeds. (2011) *Poverty mosaics: Realities and prospects in small-scale fisheries*. Springer Science & Business Media.
- Juinio-Meñez MA (2004) 'Invertebrate Stock Enhancement' in *In Turbulent Seas: The Status of Philippine Marine Fisheries*. Department of Agriculture, BFAR. Coastal Resources Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines.
- Juinio-Meñez MA, de Peralta GM, Dumalan RJP, Edullantes CM and Catbagan TO (2012 a) Ocean nursery systems for scaling up juvenile sandfish (*Holothuria scabra*) production: ensuring opportunities for small fishers in Hair C A, Pickering T D and Mills D J (Eds.), *Asia-Pacific Tropical Sea Cucumber Aquaculture. ACIAR Proceedings*, 136. Australian Centre for International Agricultural Research, Canberra.
- Juinio-Meñez MA, Paña MA, de Peralta GM, Olavides R D, Catbagan T O, Edullantes C Mand Rodriguez B D (2012 b) Establishment and management of communal sandfish (*Holothuria scabra*) sea ranching in the Philippines in Hair C A, Pickering T D and Mills D J (Eds.), *Asia-Pacific Tropical Sea Cucumber Aquaculture. ACIAR Proceedings*, 136. Australian Centre for International Agricultural Research, Canberra.
- Juinio-Meñez MA, Evangelio JC, Olavides, RD, Paña MA, de Peralta GM, Edullantes CM, Rodriguez BD, Casilagan IL (2013). Population dynamics of cultured *Holothuria scabra* in a sea ranch: Implication for Stock Restoration. *Reviews in Fisheries Science* 21(3-4): 424-432. <https://doi.org/10.1080/10641262.2013.837282>
- Juinio-Meñez MA (2016) Approaches in rebuilding sea urchin and sea cucumber populations in the Philippines. in Hajime K et al. (Eds.) *Consolidating the Strategies for Fisheries Enhancement in Southeast Asia*. Proc. Symp. *On Strategy for Fisheries Resources Enhancement in the Southeast Asian Region*, Pattaya, Thailand, 27–30 July 2015. Training Department, Southeast Asian Fisheries Development Center, Samutprakan, Thailand.
- Juinio-Meñez MA, Tech ED, Ticao IP, Gorospe JR, Edullantes CMA and Rioja RAV (2017) Adaptive and integrated culture production systems for the tropical sea cucumber *Holothuria scabra*. *Fisheries Research*, 186:502–513. <https://doi.org/10.1016/j.fishres.2016.07.017>
- Kitada S (2018) Economic, ecological and genetic impacts of marine stock enhancement and sea ranching: A systematic review. *Fish and Fisheries*. 19:511–532. <https://doi.org/10.1111/faf.12271>
- Kleiber D, Harris LM and Vincent AC (2014) Improving fisheries estimates by including women's catch in the Central Philippines. *Canadian Journal of Fisheries and Aquatic Sciences*, 71(5):656–664. <https://doi.org/10.1139/cjfas-2013-0177>
- Knudsen M (2012) Fishing families and cosmopolitans in conflict over land on a Philippine island. *Journal of Southeast Asian Studies*, 43(3):478–499. <https://doi.org/10.1017/S0022463412000355>
- Lorenzen K (2008) Understanding and managing enhancement fisheries systems. *Reviews in Fisheries Science*, 16(1-3):10–23. <https://doi.org/10.1080/10641260701790291>
- Lorenzen K, Agnalt AL, Blankenship HL, Hines AH, Leber LM, Loneragan NR and Taylor, MD (2013) Evolving context and maturing science: aquaculture-based enhancement and restoration enter the marine fisheries management toolbox. *Reviews in Fisheries Science* 21:13–221. <https://doi.org/10.1080/10641262.2013.837358>
- Militz TA, Leini E, Duy NDQ and Southgate PC (2018) Successful large-scale hatchery culture of sandfish (*Holothuria scabra*) using micro-algae concentrates as a larval food source. *Aquaculture Reports*, 9:25–30. <https://doi.org/10.1016/j.aqrep.2017.11.005>
- Muallil RN, Mamauag SS, Cababaro JT, Arceo HO and Aliño PM (2014) Catch trends in Philippine small-scale fisheries over the last five decades: The fishers-perspectives. *Marine Policy*, 47, pp.110–117. <https://doi.org/10.1016/j.marpol.2014.02.008>
- Olavides RDD, Edullantes CMA and Meñez, MAJ (2010) Assessment of the sea cucumber resource and fishery in the Bolinao-Anda reef system. *Science Diliman*, 22(2).

- Padilla JE, Mamauag S, Braganza G, Brucal N, Yu D and Morales A (2003) Quezon City: WWF–Philippines. Accessed May 6, 2020.
- Palomares MLD and Pauly D (2019) Coastal Fisheries: The Past, Present, and Possible Futures in *Coasts and Estuaries*. Elsevier.
- Purcell SW, Hair CA and Mills DJ (2012) Sea cucumber culture, farming and sea ranching in the tropics: Progress, problems and opportunities. *Aquaculture*, 368:68–81. <https://doi.org/10.1016/j.aquaculture.2012.08.053>
- Purcell SW, Mercier A, Conand C, Hamel JF, Toral-Granda MV, Lovatelli A and Uthicke S, (2013) Sea cucumber fisheries: global analysis of stocks, management measures and drivers of overfishing. *Fish and Fisheries*, 14(1):34–59. <https://doi.org/10.1111/j.1467-2979.2011.00443.x>
- Purcell SW (2014) Value, market preferences and trade of Beche-De-Mer from Pacific Island sea cucumbers. *PLoS one*, 9(4): e95075. <https://doi.org/10.1371/journal.pone.0095075>
- Purcell SW, Williamson DH and Ngaluafé P (2018) Chinese market prices of Beche-De-Mer: Implications for fisheries and aquaculture. *Marine Policy*, 91:58–65. <https://doi.org/10.1016/j.marpol.2018.02.005>
- Siar SV (2003) Knowledge, gender, and resources in small-scale fishing: the case of Honda Bay, Palawan, Philippines. *Environmental Management*, 31(5):0569–0580. <https://doi.org/10.1007/s00267-002-2872-7>
- Weeratunge N, Snyder KA and Sze CP (2010) Gleaner, fisher, trader, processor: understanding gendered employment in fisheries and aquaculture. *Fish and Fisheries*, 11(4):405–420. <https://doi.org/10.1111/j.1467-2979.2010.00368>

2 Community-based sandfish sea ranching in Barangay Victory, Bolinao, Pangasinan Province (Luzon node case study)



2

Community-based sandfish sea ranching in Barangay Victory, Bolinao, Pangasinan Province (Luzon node case study)

Marie Antonette Juinio-Meñez¹, Karl Angelo F Lambio¹, Glycinea MD Peralta¹, Rona Cabanayan Soy¹, Olivier Josh Caasi², Tirso Catbagan and Linnea V Tanchuling²

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

²College of Social Work and Community Development, University of the Philippines Diliman, Quezon City, Philippines

2.1 Introduction

The first communal sea ranch was established in 2007 at Barangay Victory, in Bolinao municipality, Pangasinan province. It was funded by the Australian Centre for International Agricultural Research (ACIAR) and the Department of Science and Technology (DOST). The community-based sea ranch development model was put forward in the early stages of consultation and development at Victory. It then became the basis for communal sea ranch establishment elsewhere.

Victory is at the southeastern coast of Santiago Island with a total population of about 1,320 individuals (2015 Census) making up 345 families and 304 households. The people in Victory generally speak Bolinao, Ilocano, and Filipino. Fishing and farming are the primary source of livelihood for most of the households.

A 5-ha sea ranch site was established by the University of the Philippines Marine Science Institute (UPMSI) in partnership with the local People's Organisation (PO), Samahan ng Maliliit na Mangingisda sa Victory,

Inc. (SMMVI) (Figure 5). The SMMVI was approached to be project partner due to its previous involvement with UPMSI. The PO was established in 1999 through the Marine Ecosystem Project of the Haribon Foundation. It has a track record of initiating and implementing community-based coastal resource management projects.

Developing acceptable and appropriate local governance mechanisms is critical for public and private benefits and to manage potential conflicts. Community engagement followed initial project set up to determine an appropriate location of the sea ranching site in Victory. This included 2 rounds of consultations after the bio-physical assessments.

The first consultation was with the local chief executives at the municipal level and another at the PO level. Consultation with SMMVI presented the objectives of the project, proposed site and the implementation mechanisms. Further consultation with the local government representatives from the municipality of Bolinao discussed the potential economic benefits of sea cucumbers.

To help get a resolution from the *Sangguniang Bayan* (local legislative branch of the local government), a public validation was done in Victory. After the public validation, there was a planning workshop at the Bolinao Marine Laboratory. The activity aimed to:

- identify specific roles and responsibilities of the partner organisation and the project staff in implementing the sea ranching projects
- come to a common understanding regarding the management of the project.

The SMMVI and the project staff agreed during the participatory operational planning to formalise the partnership.

Socio-economic baseline studies were an integral part of the sea ranching project feasibility assessment. The core objectives

of the project involved testing the viability of sea ranching sea cucumbers as a livelihood and fishery management option.

So, it was necessary to include individuals both directly involved and not involved in the project. This established benchmarks to compare future improvements within the context of individuals' and households':

- livelihood enhancement (i.e. contribution to household income)
- improvement in the household's well-being and standard of living
- changes in the degree of dependence on the natural and fishery resources and livelihood diversification
- changes in perceptions and commitment to natural and fishery resource management.

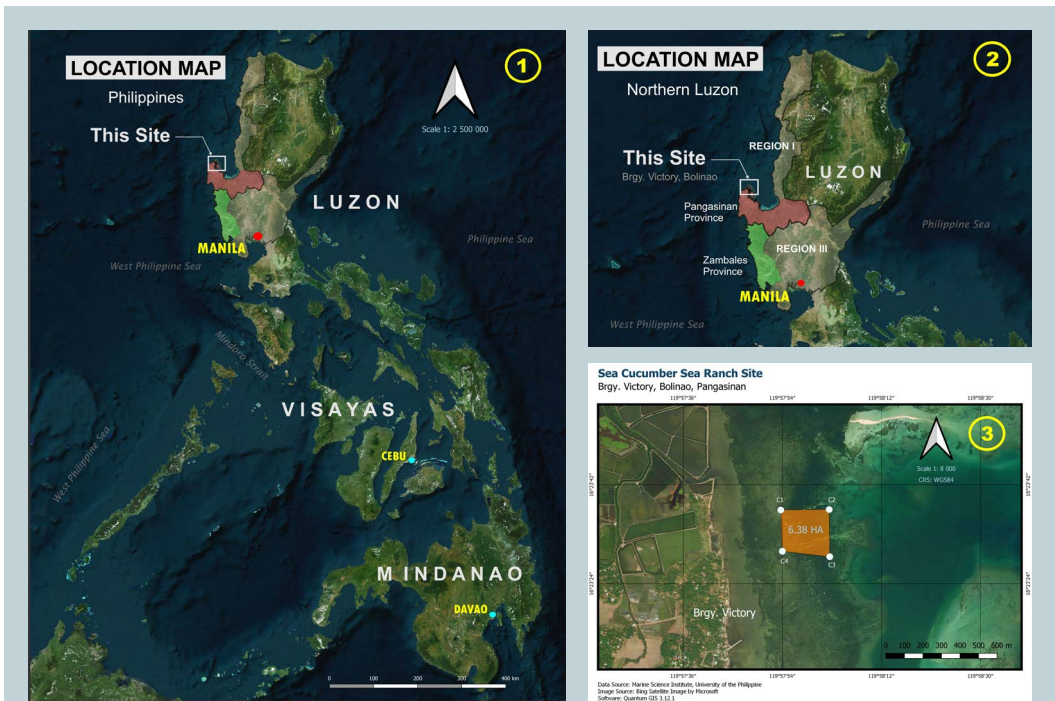


Figure 5 Locator map for Victory sea ranch

Source: UPMSI Sea Cucumber Program

2.2 Interventions

Establishment phase (2007 to 2013): Socio-economic baseline profiling

From January to March 2008, 12 PO members directly involved in the project were interviewed, including 18 non-PO residents of Victory. Socio-economic profiling interviews generated baseline data. This formed a basis for socio-economic indicators for the project and as inputs for information education campaign (IEC) activities.

All households lived below the poverty threshold and had low educational attainment. For the members directly involved in the project, socio-economic surveys showed their main sources of income were:

- fishing (67%)
- farming (27%)
- salt-making (6%).

Secondary sources of income included:

- mat-weaving
- contractual labor
- entrepreneurship
- poultry farming.

The average annual income in Victory was PHP13,600.00, which is substantially lower than Sablig, a nearby site discussed in the next chapter.

Partner households involved in fishing earned at least USD227.00 to USD1300.00 annually. Secondary sources of income often generated an extra USD136.00 annually. This income was substantially supplemented by keeping and eating catch. Monthly household expenses varied among partners, but generally most of the budget was allocated towards:

- food (40%)
- other expenses (24%)
- education (8%).

Most households revealed that they had loans with monthly interest rates ranging from 2% to 10%. Household credits varied in use, but were generally for daily needs, livelihood cost/investment, or for medicine/hospitalisation.

Community engagement and PO participation

On 28 August 2007, a consultation was held with SMMVI. Most of the council of leaders and members attended. The key agenda of the consultation was to present to the PO:

- the initial objectives of the project
- the proposed site
- the mechanisms of implementation.



Figure 6 Participatory site selection with community members

Source: UPMSI Sea Cucumber Program

The PO's experiences on various resource management projects, specifically on sea cucumbers, were discussed during the consultation, relating to sea ranching and managing sea cucumber fisheries. The PO leaders and members responded positively to the proposal. The project's objectives matched their long-term need to embark on a viable and sustainable livelihood project. A total of 12 households at the consultations unanimously agreed to become household partners in the project implementation.

Relations with local government

On 29 August 2007, there was a consultation with local government representatives from the municipality of Bolinao, attended by:

- the Mayor, a *Sangguniang Bayan* member who heads the Environment Committee
- the Municipal Agriculture Officer
- the Municipal Planning and Development Officer.

During the consultation, information on the sea cucumber research program funded by DOST, DA-BAR and ACIAR was provided. It also presented what was needed for implementation from the local government. After hearing the potential economic benefits of sea cucumbers, the attendees all responded positively. They offered their assistance for immediate implementation. Financial resources were also offered to facilitate the future development of other sea cucumber sea ranching sites.

Acceptance of the project within the wider community

The SMMVI President wrote a letter to the Barangay Captain of Victory. It asked for his:

- permission for the exclusive use of 5 ha of municipal waters in the barangay
- endorsement of the sea ranching of sea cucumbers project to the Municipal Mayor.

The process could have taken several months to finish through the regular local legislative process. Fortunately, the Mayor granted a permit for the project to use 5 ha so construction of structures and other preparations could begin immediately. Also, the chairperson of the Environment Committee sponsored a resolution declaring and designating the sea ranch site as the experimental site for sea ranching of sea cucumbers.

Subsequently, the *Sangguniang Bayan* (local legislative body) of Bolinao unanimously approved and passed Resolution 2007-49. The resolution provided:

- legitimacy to the project
- a mandate to the partner PO and UPMSI to hold exclusive rights of access to the 5 ha declared and designated as the experimental site for sea ranching of sea cucumbers.

Agreement on rules and compliance with rules

The partnership agreement between the UPMSI Sea Cucumber 'Sandfish' (*Holothuria scabra*) Project Leader and staff and the SMMVI leaders and members included these provisions:

- agreed goals and objectives of the project
- partnership principles
- protocols
- biannual review of the partnership agreement.

The key principles in the partnership agreement were:

1. Active and voluntary participation (with the understanding that participants could withdraw from the project upon prior notice).
2. Input and contributions from both male and female PO members would be duly recognised and compensated.

3. The undertaking should promote sustainable livelihood alternatives and enhanced fisheries resource management.

Further, local partners agreed that:

- sharing prospective monetary returns would be based on the time spent by the member household engaged in sea ranch activities
- 10% of the total revenue will be contributed to the village funds.

The partnership agreement also included:

- clarifications of roles and responsibilities
- communication and coordination mechanisms
- operations
- regulations (release of >3 g juveniles, quarterly monitoring, harvest of sandfish weighing >500 g each, total volume should be >100 kg wet weight).

Considering communal sea ranching was a pilot effort, the partners viewed the initiative as a collaborative participatory action research initiative. They thought work plans and regulations should be regularly reviewed and modified as needed.

Conflicts and conflict resolution

In seeking a resolution from the *Sangguniang Bayan*, a public validation was conducted in Victory on 9 October 2007. Major issues raised during the forum revolved around the fear that the sea will be barricaded. This would limit community residents who weren't involved in the project's entry and use of the fishery resources in the designated area. It was clarified that 4 of the 5 ha designated as the experimental site would allow gathering of shells, mollusks and other marine animals or plants. However, gathering of sea cucumbers would be prohibited so the project staff could monitor and collect data for the experiment. The remaining 1 ha would be a no-take, no entry zone because

it is the area where the juveniles would be released. Hence, no fishers would be allowed entry, including members of the partner organisation and the project staff, except to do monitoring and repair work. Further, the boundaries of the 5-ha sea ranch were demarcated only with markers to enable small boats to pass through.

The discussions and clarifications made by the project staff, supported by *Sangguniang Bayan* members, appeared to address the fears of some community members. However, there were still others who were not convinced. It was reiterated that the project would not limit the use of legal traditional fishing around the 1 ha no-take zone of the sea ranch.

Knowledge, skills, and capacity building activities

In March 2008, the project staff conducted a workshop for children in Victory. It was called Basic Awareness on Marine Ecology Focusing on Sea Cucumbers. More than 20 children aged 10 to 12 attended, mostly from *Purok Taguig*. The session exposed the children to the basic concepts and processes of marine ecology. It also promoted the ecological importance of marine animals, especially sea cucumbers. The project staff hope to replicate this activity in the other *purok* of Victory after the positive response from the children involved.

The release and monitoring of juveniles in the sea ranch determined the feasibility of the site for long-term rearing and sea ranching. Juveniles were provided by the project, including technical and logistical resources. The project partners were then responsible for guarding, site maintenance, and assistance during release and monitoring. Grow-out experiments were conducted as a preliminary assessment of a sea ranch site. They had a primary goal of harvesting mature sandfish (>320 g), which would become a profitable venture for the community involved.

Monthly meeting and quarterly monitoring

Monthly meetings were scheduled for community partners to discuss and clarify issues and concerns, and to foster transparency and unity among members. One of the major shared tasks of partners was guarding. The PO discussed and scheduled guarding tasks among themselves, based on their availability. Incentives were provided for members who guarded at night. Other members who could not commit to guarding had to attend other activities in the sea ranch. The commitment of the PO to other coastal resource management activities helped

strengthen their group commitment in managing the sea ranch.

Quarterly monitoring of sandfish in the sea ranch was also a shared task of the PO in Victory. Members were required to help in monitoring the released juveniles in the sea ranch. Together with the project staff, the PO helped lay transects, measure the sandfish, and return them back to their designated zones.

Upon reaching marketable sizes, the sandfish were harvested, processed, and eventually sold to a local buyer. All profit was distributed among PO members according to the investment in time and effort by each of the member households.



Figure 7 Juvenile release of sandfish at Victory sea ranch

Source: UPMSI Sea Cucumber Program



Figure 8 A monthly project meeting being held at Victory where results of sea ranch monitoring were presented

Source: UPMSI Sea Cucumber Program

2.3 Results

Phase I (2007–2013)

In total, about 48,000 juveniles (>3 g) were hatchery reared by UPMSI and released in the sea ranch within 6 years. Sixteen months after the Victory sea ranch was established, 13,299 juveniles were released, and 3,089 individuals were monitored. Estimated survivorship was 23% for the first 17 months.

Another release after 7 months included 17,047 juveniles. Within 3 years (2007 to 2010), a total of 22,713 juveniles were released in the sea ranch. The estimated biomass in the sea ranch after a year and half reached over 1000 kg.

Unfortunately, growth was substantially affected by a major storm in the area in 2009. Only about 580 individuals were retrieved in the monitoring. After the storm, the estimated survival in the sea ranch was reduced to 3.4%. This decreased the quality of the sea ranch affecting growth rates and survival (Juinio-Meñez et al. 2013). The effects were felt over a year and the total harvest and income from the dried products were minimal. Between 2010 and 2013, 25,394 more juveniles were released.



Figure 9 Sandfish monitoring and harvest from Victory sea ranch

Source: UPMSI Sea Cucumber Program

Benefits

Despite the challenges from storm damage, ecological, social and economic benefits were achieved during the first 7 years (2007 to 2013). In 2010, a mass spawning event occurred in the sea ranch during regular site visits and about 38 sandfish were observed to spawn.

Continued efforts to maintain the sea ranch beyond the initial 3-year project duration were primarily attributed to the observed establishment and maintenance of a spawning population in the sea ranch. This was tracked by the SMMVI partners during monitoring activities. Sandfish attained the average size at sexual maturity of approximately 180 g in less than a year after initial release and mass spawning events in the sea ranch were regularly observed

thereafter. This was a major ecological success, while the continued enthusiasm and participation of community members was evidence of social success.

In 2008, a trial harvest at the site saw 127 sandfish >280 g processed. It yielded 1.3 kg dry biomass worth PHP1,670.00 (USD38.74). Mean live weight of individuals harvested was 240 g, the lowest value compared to the other Luzon pilot sea ranch sites. A subsequent harvest in 2009 saw a total of 1,646 sandfish with weights ranging from 81 g to 520 g processed, and yielded only 6.8 kg dry biomass, worth PHP9,370.00 (USD217.35). Despite a greater number of individuals harvested, this generated a relatively low income due to the small sizes of sea cucumbers processed. Periodic harvest and processing of sandfish from the sea ranch by PO members continues.



Figure 10 A PO member boiling sandfish during the processing stage

Source: UPMSI Sea Cucumber Program



Figure 11 Drying sandfish during the processing stage

Source: UPMSI Sea Cucumber Program

Post Phase 1

Fishers in the adjacent areas often attributed an increase in sea cucumber catch to the sea ranch – an important aspect of the project benefits. This was evidenced by focus groups and a local trader’s landed catch data. The increased landed catch was an economic public benefit from the sea ranch. The consortium, the PO and the wider community alike viewed this as greater than the private benefits for the rights holders, which was an unexpected outcome.

When the sea ranch project started in 2007, there were very few remaining sandfish collected in the area. In 2013, about 5 years after the sea ranch started, the sea ranch managers started getting expressions of gratitude from community members. This included from village officials who did not initially support the establishment of the sea ranch. There were anecdotal accounts of a substantial increase in the landed catch of sandfish collected in areas adjacent to the sea ranch. This was confirmed during a focus group discussion at the village with sea cucumber collectors and via landed catch monitoring in 2015. Records of the major buyer of sea cucumbers in the area during the peak collection period (April to June) in 2015 indicated that estimated monthly landed catch ranged from 713 kg to 1644 kg. Sandfish comprised most of the landed catch. This volume is within the lower estimated landed catch recorded during the peak of sea cucumber collection in the area in April to June 1998, when the recorded landed catch was 1146 kg to 1902 kg per month.

In addition to financial returns, there were important non-monetary social benefits, which are highly valued by the partners. The sea ranch became a learning site for many local and foreign groups. The success of the project reflected the dedication of the local partners. It opened other opportunities for

support for the group, including invitations from development works to join other projects. For example, the SMMVI was recently actively working with DENR in mangrove planting projects in the area.

The communal sea ranch also strengthened bonds particularly among the active member households. Project staff were told by the members that monthly meetings helped improve the cooperation and coordination within their group. Visitations and study tours in the sea ranch also benefitted the PO as the members received donations and honoraria for being responsible for the sea ranch resources. These visits also gave the sea ranch managers a sense of pride for what they are doing. Through the sea ranch, the managers felt that they were achieving the vision, mission and goals of their organisation on conservation and improved management of marine resources, to ensure benefits for future generations.

Support from the local government unit

The local government unit (LGU) of Bolinao is aware of the sea ranching project in Victory and continually provides financial incentives to the community. A monthly salary from the LGU was proposed when the leader of the Victory PO was engaged as a member of the Bantay Dagat in 2011. The Bolinao LGU agreed and required the PO to submit their necessary documents, including reports related to sea cucumber sea ranching and its impacts. Each month, the SMMVI received PHP2,500.00 through their president. This amount was equally divided among members who guarded the sea ranch. As well as providing financial support to the PO, the LGU has consistently renewed the permit for limited exclusive use and research for the Victory sea ranch to the present.

2.4 Lessons learned and new strategies

The results led to sufficient social, economic and ecological outcomes for the community for project partners to agree to continue the sea ranch into a second phase. These key lessons were learned across the life of the project.

Commitment to co-operative effort and working through problems

Managing the sea ranch was only possible through:

- the commitment and persistence of the PO members
- the research partnership/technical support for the establishment and maintenance of the sea ranch
- the implementation of good governance mechanisms.

Monthly meetings and feedback of the monitoring results gave partners the opportunity to make timely, informed decisions on how to address various issues that arose (for example, poaching and impact of typhoons). The meetings also resolved conflicts and maintained the enthusiasm to achieve a common goal.

Monitoring and feedback of results of sandfish population in the sea ranch is essential for sustainability

The density of sandfish increased rapidly in the first year of operation. Juveniles (5 g to 7 g) reached sexual maturity within 7 to 10 months. Survival was estimated at 39%, with density reaching 302–1119 ind ha⁻¹.

Sea ranch partners also observed sandfish spawning within the sea ranch. This demonstrated that a viable population of sandfish can establish within the site, which was a major incentive for partners to continue sea ranching activities.

For partners, the regular monitoring and feedback during monthly meetings:

- deepened their understanding of the opportunities and challenges of maintaining the sea ranch
- brought out ways to work together to address individual and collective needs.

Programmed releases of juveniles and selective harvesting of sea cucumbers (>320 g, for example) continue to maintain a viable population in the sea ranch and increase economic returns for partners.

Threats to economic viability

Heavy rainfall and typhoons have affected the Victory sea ranch (for example, in 2009). This, in turn, resulted in a decrease of at least 70% of the total biomass in the sea ranch over 7 months. The negative impact of typhoons on the growth of sandfish may be attributed to drastic changes in environmental factors and habitat modification.

Quarterly monitoring data of the sea ranch shows that heavy rains affect overall salinity, halting sandfish feeding. Changes in sediment quality were also observed. Sediment became coarser and coral rubble was present on the surface, causing a decrease in the weight of individual sandfish (Juinio-Meñez et al. 2013).

Aside from natural disturbances, poaching within the sea ranch is also a threat to the sea ranch rights holders. During the first 3 years after establishment, gleaners (including children from adjacent villages) were caught poaching during the day and night by members of the PO on guarding duty. First-time offenders were given:

- an orientation and explanation about the objectives, and the local regulations of harvest and access in the sea ranch
- a warning not to repeat the offence.

Additional information education campaign activities were conducted to inform the village officials in Victory and adjacent villages. Because of repeated poaching, residents of one of the adjacent villages (Dewey) were banned from gleaning in the sea ranch.

The PO members had a system for 24/7 guarding. Each member household did 3 or 4 days of guarding duty. Women guarded during the day, as the sea ranch can be monitored from the coast. Men did the guarding duty at night at the guard house inside the sea ranch. The PO members were not compensated for their time except for the nominal share from the monthly honoraria given by the LGU (PHP2,500.00), divided equally among the household members who guarded for the month. The project provided coffee, sugar, flashlight/lamps, and payment for labour and materials to maintain the guard house and markers, and to build bamboo rafts to ease access to the guard house and for monitoring the sea ranch.

Despite these considerable efforts, poaching did ultimately affect economic returns and income from the sea ranch. Poaching can be addressed with improved governance mechanisms to mitigate and manage social conflicts. Through the years, the level of vigilance and regularity of guarding changed. The next sections discuss these issues in more detail.

The movement of sandfish outside the sea ranch area also affected the harvestable biomass and potential income. Future studies could determine environmental factors affecting habitat quality.

Stricter rules in sea ranch guarding, reprimanding those who enter no-go zones with appropriate penalties

PO members who guard the sea ranch often encounter fishers that enter the sea ranch in zones where fishing is not allowed. In these situations, the guarding PO usually takes the

name of the violator and lets them go with a warning. A more effective system would require violators to be reported to the Bantay Dagat for proper follow up.

Regular updates to the barangay and LGU initiated by the PO and guided by the project staff

Regular meetings with the barangay should be held to inform the officials on the status and activities within the sea ranch. The project staff had already met the newly elected barangay captain. Members of the PO should also be involved in these meetings to help coordinate future activities in the sea ranch.

Scaling up

Communal sea ranching has the potential to be a source of supplemental income. It is a way the PO can achieve its goal to contribute to coastal and fisheries resources management by rebuilding the depleted fishery stock of sandfish. These benefits can only be scaled up if the LGU makes sea ranching part of an integrated sea cucumber fishery management scheme.

2.5 Postscript: Dynamics among local partners and the importance of leadership (current situation)

The passing of the president of Samahan ng Maliliit na Mangingisda sa Victory, Inc. (SMMVI), Ka Artem, in 2018 has threatened the effective governance system of the communal sea ranch. Prior to the establishment of the sea ranch, Ka Artem had been involved in various coastal resource management projects with SMMVI. He dedicated his time to guarding the sea ranch when other members were unable to do so, while actively participating in all aspects of the project. He was highly respected by all the members of the PO, as well as other community members.

The site in Victory has always been exceptional compared to the other subsequent sea ranch sites because of committed and dedicated leadership that bound the group together. In his passing, his brother, Enrico Caasi, is now the SMMVI acting leader. Frequent conflicts regarding the distribution of supplies and incentives are now arising between members. Project staff handle these issues during monthly meetings, allowing members to share their views and stories. Facilitated and open communication has helped minimise the tension among members, providing a platform to air issues and resolve them. In contrast to the previous effective internal conflict management between members, there is now more dependence on project staff to manage conflicts.

The PO members still guard consistently and conduct daily observations in the sea ranch (for example, what needs to be repaired). Bamboo markers are commonly lost or stolen in the sea ranch and need to be replaced immediately. Monthly meetings address these concerns, providing funds necessary to maintain or replace structures in the sea ranch. The project staff allow the PO to schedule these repairs on their own. The repairs are expected to be done prior to the next monthly meeting. However, PO members still wait for confirmation from project staff before they start the repairs. So, these tasks are often delayed and carried over the next months. Improved decision-making skills and leadership of the group could help them to be a more effective partner in the sea ranch.

The commitment of PO members in sea ranch activities, such as juvenile releases and quarterly monitoring, has been relatively low compared to the initial phase. Prior to every activity, the PO is notified to encourage attendance and support for the project staff. Most of the time PO members have other commitments and cannot participate in the activities.

Older PO members still consistently attend the quarterly monitoring. Younger PO members have recently said they prefer to do salaried work instead of volunteer work in the sea ranch. Part of the PO's duties are guarding, site maintenance, and to assist in juvenile releases and monitoring with the support of the project staff. To increase interest, small incentives could be given to PO members who are willing to do the activities. The lack of harvest in the sea ranch may have also been a factor in the gradual decrease in involvement among POs. The last mass harvest was conducted in February 2018, with the POs earning a total of PHP1,100.00.

References

- Juinio-Meñez MA, Paña MA, de Peralta GM, Olavides RD, Catbagan TO, Edullantes CM and Rodriguez BD (2012 b) Establishment and management of communal sandfish (*Holothuria scabra*) sea ranching in the Philippines in Hair CA, Pickering TD and Mills DJ (Eds.), Asia-Pacific Tropical Sea Cucumber Aquaculture. *ACIAR Proceedings*, 136. Australian Centre for International Agricultural Research, Canberra.
- Juinio-Meñez MA, Evangelio JC, Olavides RD, Paña MA, de Peralta GM, Edullantes CM, Rodriguez BD and Casilagan IL (2013) Population dynamics of cultured *Holothuria scabra* in a sea ranch: Implication for Stock Restoration *Reviews in Fisheries Science*, 21(3-4): 424–432. <https://doi.org/10.1080/10641262.2013.837282>



3 Community-based sandfish sea ranching in Panglit Island, Masinloc (Luzon node case study)



3

Community-based sandfish sea ranching in Panglit Island, Masinloc (Luzon node case study)

Marie Antonette Juinio-Meñez¹, Minin J Sinsona¹ and Marie Antonette Paña-Tautho¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

3.1 Introduction

Masinloc was the site of the second communal sea ranch, established in 2008. Masinloc is a first-class municipality in the province of Zambales, Philippines, roughly 100 km south of the original site at Victory. It has a population of 47,719 (2015 Census). Panglit Island is a 20-ha marine protected area (MPA). The 5-ha sea ranching site for sea cucumbers was established inside the MPA in 2008. The island is a part of Barangay San Lorenzo, Masinloc municipality, Zambales province and its people speak Sambal or Tagalog.

The partners involved in the establishment of the sea ranch initially were the Marine Protected Area Management Council of Panglit Island, Research and Development Committee. The site was chosen primarily because of biophysical suitability and the interest of community members and other local organisations involved in community-based coastal resource management initiatives (CBCRM). Panglit was also managed by the Bantay Dagat (sea wardens).

Fishery resources are coastal communities' main source of income. Socio-economic profiling shows that People's Organisation (PO) members

rely heavily on fishing (90%) with an income ranging from PHP10,000.00 to PHP60,000.00 per month. Other sources of income include farming and salt making, with an average income of PHP6,000.00 to PHP10,000.00. For monthly expenses, all members assigned a significant portion of their budget to food (40%) followed by others (24%), education (8%), and health (7%).

Sources of credit within the community include relatives and sari-sari store credit. Members use loaned credits mostly for daily needs or for business/livelihood investment or expenses. Most of the members have pending credit with a monthly interest rate ranging from 2% to 8%. Project appraisals, team building and educational tours with the community partners and the local government unit (LGU) supported learning in the site.

3.2 Interventions

In general, the project was carried out in a similar manner to the Victory site regarding:

- community consultations
- the placing of the sea ranch site
- partnerships with the local government and the consortium.

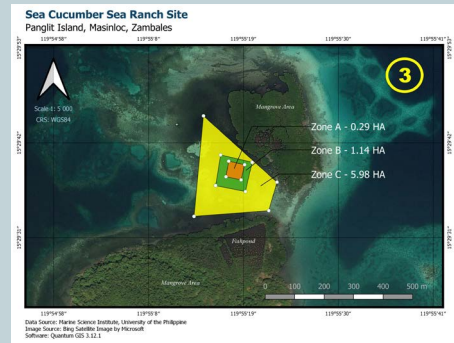


Figure 12 Locator map for Masinloc sea ranch
Source: UPMSI Sea Cucumber Program



Figure 13 Sea pen at Masinloc, with PO members undertaking release of cultured juveniles
Source: UPMSI Sea Cucumber Program

Presentations to the LGU and village community members proposed designating 5 ha to be used as a sea ranching site and clarified its implications for other resource users. Community orientation and public validation also informed stakeholders in the nearby communities about the project. Local government presentations were included on granting permits and resolutions for using the 5 ha for sea ranching activities. Project and local partners also did participatory planning exercises to level off expectations and make an implementation plan.

As a result of these, community members were aware of the activities and the rationale of the project, including local executives and legislative officials. Potential environmental and economic benefits of managing their sea cucumber fisheries were discussed. Management initiatives were also considered aside from the exclusive use rights of the sea ranch site.

A new PO was established to be the implementing partner, and a partnership agreement was developed between the PO and UPMSI, which included:

- underlying principles
- responsibilities
- mode of operation
- rules and regulations.

These largely followed the principles outlined in the Victory case. Importantly, this partnership also involved a sharing arrangement on prospective monetary returns. The arrangement was based on each member's time investment to sea ranch activities, rather than paying honoraria or wages for work done. Of the total revenue, 10% was to be contributed to the village fund. This was the last step in the initial phase, and the agreement was signed by 25 PO members from Panglit Island, while LGU representatives stood as witnesses.

Monthly meetings happened on the first Saturday of every month. These regular meetings were used to:

- discuss issues and concerns about the management of the project
- evoke participatory action research through consensus decision making with the PO.

A grow-out experiment was completed in the sea ranch site as the core of the project work, including the release of juveniles. The project provided juveniles and technical and logistical resources. The project managers were responsible for guarding, site maintenance, and assistance during juvenile releases and monitoring. Monitoring was done every quarter to track the growth and survival of released individuals, with the aim to harvest mature sandfish (>320 g). Grow-out experiments also help to determine the feasibility of a certain site for long-term sea ranching and result in economic gains for the community.

PO members guarded the sea ranch voluntarily, anticipating future financial returns from the sale of sandfish. The performance of the sea ranch managers was assessed 12 to 16 months after the establishment of each site. Socio-economic surveys were conducted during the project to produce a baseline data set. Perception surveys were also conducted at the beginning and end of the project. These gained insights from individuals on the contribution of the project to their community and to assess the potential for sustainability of the sea ranch into the future.

3.3 Results

In Panglit, 12,472 juveniles were released over a 12-month span – the least across the 3 pilot sea ranch sites in Luzon. It took 3 major releases in Masinloc to complete the target number of juveniles (10,000) for the



Figure 14 Monthly meeting of the PO at Sitio Panglit, Masinloc

Source: UPMSI Sea Cucumber Program

second year (2009) of the project, with an excess of 2,472 juveniles. In March 2010, a total of 1,247 sandfish were monitored with an apparent survival rate of 10%. Some sandfish grew to size at sexual maturity (200 g) in less than a year. Mass spawning was observed and natural recruitment in the sea ranch site was documented from the quarterly monitoring of the sandfish population in the sea ranch.

The highest estimated survival rate of 14% was seen 10 months (at the third monitoring) after the initial release of juveniles in the area. The lowest survival rate of 1% was seen 23 months after (at the eighth monitoring). Low apparent survival in the site may be attributed to poaching in the area. Despite a high number of households guarding, the actual number of days when the sea ranch was guarded was lower than in Victory and Sablig. The distance from their respective households to the guardhouse was a primary reason in lower guarding levels.

282 individual sandfish were harvested in Panglit with a mean wet weight of 176–750 g in March 2011. A total dried weight of about 2.4 kg was processed with an estimated value of PHP6,451.00 or USD149.64. While this represented a poor economic return, it was sufficient to demonstrate the viability of the site for grow-out of juveniles to marketable size.

PO members as project stakeholders were important for the project implementation, and participation was initially strong. Barangays near the site were aware of the project during early consultation and were amenable to private use rights of the sea ranch to make the sea ranch a success. In general, the sea ranch was widely viewed as providing an option for fisher communities to supplement their livelihood. This was a view that PO members also held and was their main motivation for participating in the project. Over the course of the project, local partners saw increased sandfish, as well as other organisms in the area, which they attributed to the presence of the sea ranch.

On average, PO members spent at least 8 hours a day guarding the sea ranch. Twenty out of 26 families in Panglit were involved in guarding the sea ranch. Members in Masinloc needed to take a boat to get to the sea ranch for their guarding duties. There was a 20% increase in effort from year 1 (153 days) to year 2 (184 days). The majority also thought that the sea ranch had potential to be a supplemental source of income if sandfish grew to marketable size. When asked how they were going to spend the extra income if the sea ranch succeeded, the most common answer among members was to supplement their main livelihood, for example to buy *lambat* (fishing nets) for fishing.

Despite some challenges, support from the LGU was positive in this site throughout the project. Most PO members guaranteed continued participation in future phases of the sea ranch given the increase of sandfish in the sea ranch.

Perception surveys found that community members were aware and compliant with sea ranch regulations. However, PO members also said violators illegally entering the sea ranch was a primary issue in the success of the sea ranching. Despite frequent poaching, PO members stayed optimistic. This was due to the success of the grow-out phase in terms of productivity and growth rates. They also reported that greater cooperation among their group and the wider community could be the key for the project's success.

3.4 Lessons learned and new strategies

The PO in Masinloc was not as organised compared to those in Victory and its system of guarding was more lenient. There were weaker relationships among members. At times, members only acted when told by leaders and did not take initiative or make decisions on their own.

A major factor in the lack of guarding in Panglit was the distance of the sea ranch from members' residences, which most of the time required boat travel. Also, an inquiry conducted by the LGU validated that outsiders, some of whom were known by the PO, were gathering the sandfish in the sea ranch. Meetings were conducted to address the concern, which was resolved by placing the sea ranch under the direct supervision of the Bantay Dagat (sea warden), overseen by the LGU. Financial incentives were agreed to be given to the Bantay Dagat, partly from the sea ranch income. It is not clear, however, if this led to a decrease in poaching.

The PO was in its early stages in Masinloc, so the bond between members was not yet strong. Improved management strategies may have helped mend commitment issues among members and lessen conflicts. Agreements among local partners and the LGU should have had consequences for PO members involved in poaching in the sea ranch. In Panglit, it would have been beneficial for everyone involved if PO members and LGU officials renewed their commitment for the long term.

The interventions demonstrated the viability of the area for sea ranching. Growth was positive, evidenced by the high mean weight of sandfish in the sea ranch (372 g) by the third year (2011). Income was generated from harvest, although limited. But this clearly demonstrated the feasibility of growing sandfish to marketable size in the sea ranch. Effective guarding was constrained by:

- the effort and cost to travel daily to the sea ranch site
- inconsistency of leadership in guiding the members in implementing the project.

Also, a spawning population was established and maintained in the sea ranch for the duration of the study.

4 Community-based sandfish sea ranching in Barangay Sablig, Anda (Luzon node case study)



Credit: University of the Sunshine Coast

4

Community-based sandfish sea ranching in Barangay Sablig, Anda (Luzon node case study)

Marie Antonette Paña-Tautho¹, Bryan Dave Rodriguez, Minin J Sinsona¹, Olivier Josh Caasi¹ and Marie Antonette Juinio-Meñez¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

4.1 Introduction

The sea ranch site in Barangay Sablig in Anda municipality was established in 2009. The municipality is in Pangasinan province and consists primarily of Cabarruyan Island with 18 barangays, as well as surrounding islets. It has a total population of 39,504 people (2015 Census). The people of Anda mostly speak Bolinao, Ilokano, and Pangasinan.

The Sablig Barangay Multipurpose Association (SBMA) was the primary partner of the project. The site was chosen mainly on:

- biophysical suitability
- interest of community members and other local organisations involved in community-based coastal resource management initiatives.

The SMBA and nearby fishers managed the Barangay Sablig sea ranch.

Most partner households in Sablig relied on fishing, but they also had other sources of livelihood. Barangay Sablig had more diverse livelihood options compared to other sea ranching sites. Respondents were either involved in:

- farming (40.9%)
- mat weaving (9.1%)
- marine product selling (4.5%)
- informal/salaried employment (13.6%).

Of the partner households in the site, 47% depended solely on the sea as their main source of livelihood. The average monthly total income in Sablig was PHP21,800.00. Food was a major allocation of a household's annual budget, then others (24%), and education (14%). Most of the household partners also had credit with a monthly interest rate ranging from 2% to 10%. Loaned credits were generally used for the household's daily needs and business/livelihood expenses.

In general, the project was carried out in a similar manner to the Victory site regarding:

- community consultations
- the placing of the sea ranch site
- partnerships with the local government and the consortium.

Social preparation included presentations on:

- designating 5 ha of the exclusive use as sea ranching site
- clarifying the implications of the sea ranch for other resource users.

Community orientation and public validation also informed stakeholders in the nearby communities about the project. Local government presentations on granting permits and resolutions for using the 5 ha were included to generate their support.

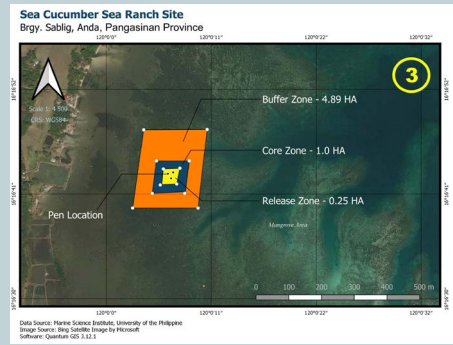


Figure 15 Locator map for Sablig sea ranch
Source: UPMSI Sea Cucumber Program



Figure 16 Guardhouse at the Sablig sea ranch
Source: UPMSI Sea Cucumber Program

The partnership agreement included:

- underlying principles
- responsibilities
- mode of operation
- rules and regulations.

This partnership also involved a sharing arrangement on prospective monetary returns based on how much time members invested in sea ranch activities. Of the total revenue, 10% was to be contributed to the village funds. This was the last step that was signed by PO members from Brgy. Sablig, Anda while local government unit (LGU) representatives stood as witnesses.

4.2 Intervention

The sea ranch site in Sablig was established as an experimental one co-managed by the SBMA and Brgy. Council in 2008. Socio-economic baseline assessment was

conducted in the community, including surveys and focus group discussions. Some surveys were done with the project staff and students from the University of the Philippines College of Social Work and Community Development.

Monthly meetings were scheduled across sites to regularly:

- facilitate discussions
- clarify issues and concerns
- foster transparency and unity among members.

Over time, some partners were not able to keep doing the different tasks (for example, guarding or monitoring). Guarding was the major shared task in the sea ranch. These tasks were part of the equity share arrangement agreed to in the partner agreement, so were not paid. Instead, the income generated from the harvest was to be divided among the group.



Figure 17 Pen construction for the Sablig sea ranch

Source: UPMSI Sea Cucumber Program

Performance of the sea ranch managers was assessed 12 to 16 months after the establishment of each site. Data were derived from the daily records at each site, which indicated the member/household in charge of guarding for each date from 2008 to 2011.

Subsequent releases of juveniles were done in Sablig to determine the feasibility of the site for long-term rearing and sea ranching of sandfish. Juveniles were provided by the project. Project partners were responsible for guarding, site maintenance, and assistance during juvenile release and monitoring. The primary aim was to harvest mature sandfish (<320 g), resulting in economic gains for the community involved. Monitoring was done quarterly to track the growth and survival of sandfish.

4.3 Results

In 17 months, 15,548 juveniles were released in Sablig. A total of 1,555 individuals were monitored in April 2010, indicating a survival rate of 10%, similar to Masinloc. Although survival and growth were relatively low in the sea ranch, mature broodstock (>320 g) were ready to be harvested between 1 and 2 years after the initial release. In November 2010, 479 individual sandfish were harvested with a mean wet weight of 320 g to 750 g, more than at Victory. A total dried weight of approximately 6 kg was processed with an estimated value of PHP12,721.00 (USD295.00).

Like Victory, during quarterly monitoring natural recruitment happened in the sea ranch. This was based on the presence of juveniles without fluorochrome-stained spicules.



Figure 18 Boiling sandfish during the processing phase

Source: UPMSI Sea Cucumber Program

A mass spawning event was also observed in the sea ranch site on 23 February 2010. At around 11:00 AM, 5 male spawners were observed by the sea ranch guards. About an hour later, one female spawner followed. Also observed:

- 15 individuals spawned inside a 100 m² pen, 1 to 5 m from each other.
- 23 other spawners were in the nursery and buffer zones.

An estimated ratio of 5 male spawners to 1 female spawner was recorded on the site. The presence of a large spawning population and their spawning synchrony can be a factor for fertilisation success in the sea ranch.

Most respondents to the perception survey thought that the sea ranch could be a supplemental source of income if the sandfish grew and survived to marketable size. This happened to an extent. Growth to maturity occurred, and there were some small economic returns. The perception surveys and focus group discussions showed that having a sea ranch in the area raised awareness and increased local communities' knowledge of the ecological and economic value of sea cucumber resources. Despite many challenges, having exclusive use and harvest rights, and the initial successes, helped sustain local PO members' interest. PO members also reported communal management of the sea ranch as:

- strengthening cooperation
- gaining further support from the LGUs and other community members.



Figure 19 Cleaning dried sea cucumber

Source: UPMSI Sea Cucumber Program

Sea ranch guarding was better in Sablig compared to Masinloc, but not as good as in the Victory sea ranch. 19 out of 22 households participated in the guarding. As in Victory, the sea ranch in Sablig is relatively close to the members' homes in contrast to the sea ranching site in Masinloc.

The SBMA members employed a different guarding scheme, which involved:

- women on guard duty in the morning
- men guarding in the evening.

Time spent guarding was equal in the first year. There was a decrease in guarding the following year. The sharp decrease over 3 quarters shows that, despite the proximity of the site, the members invested less effort to guard it. Of all the activities the ranch managers did, guarding the sea ranch accounted for most of the time invested in the sea ranch.

There were reports of poaching in the site but there was no information on who or whether they were locals.

4.4 Lessons learned and new strategies

The PO in Sablig was not particularly organised. Compared to the POs in Victory and Panglit, which were more focused on coastal resources management, the Sablig PO was a neighbourhood livelihood association in its early stages of conception. This may explain why the bond among members was weak and may have led to leniency with guarding. If the project re-starts a sea ranching site in Sablig, partners should establish a renewed mode of agreement. There must be governance mechanisms for improving commitment among POs to address possible conflicts between members.



Figure 20 Sandfish harvested from the sea ranch after drying

Source: UPMSI Sea Cucumber Program

Further, approaches to addressing external issues (such as poaching) should be determined to attain fair use of the sea ranch. If guarding was more consistent, the losses from poaching (when the animals were larger) may have been reduced and the PO could have had greater yield and income.

The more diverse source of livelihoods in the area may also have been a factor for the decrease in participation. The PO members from Sablig had more sources of income compared to Victory and Sablig. This may have affected the effort they invested in the sea ranch, even with the sea ranch being closer to their homes.

Despite the constraints, the sandfish juveniles in the sea ranch grew to harvestable size (>320 g) after 17 months.

Mass spawning was observed and documented in the sea ranch as well. Natural mass spawning events show that the sea ranch functions as a reproductive reserve. This could provide positive ecological impacts on the restoration of stocks in areas where larvae produced during natural spawning events in the sea ranch can disperse and settle in suitable juvenile habitats outside the sea ranch.

While estimated survival was lower than in Victory, growth in this site was quite high. The income generated from the harvest, although limited, demonstrated the feasibility of sea ranching in the site. Harvests from the site were lower compared to Victory, yet slightly higher than Masinloc.



Figure 21 Operational planning meeting for Sablig sea ranch

Source: UPMSI Sea Cucumber Program

5 Pilot community-based ocean nursery rearing and local government buy-back in Barangay Imbo, Anda (Luzon node case study)



5

Pilot community-based ocean nursery rearing and local government buy-back in Barangay Imbo, Anda (Luzon node case study)

Minin J Sinsona¹, Bryan Dave Rodriguez¹ and Marie Antonette Juinio-Meñez¹

¹The Marine Science Institute, University of the Philippines Diliman, Quezon City, Philippines

5.1 Introduction

A 10-ha restocking site was established in Brgy. Imbo, Anda, Pangasinan on 27 February 2014. As a new site, the factors that affected the growth and survival of juvenile sandfish (*Holothuria scabra*) were yet to be investigated. The site was chosen mainly on:

- biophysical suitability
- the interest of community members and other local organisations involved in community-based coastal resource management initiatives.

Biophysical monitoring for the restocking site was done with the local government unit (LGU) from November 2013 to January 2015. Community-based nursery rearing of sandfish was first pilot-tested in this site from November 2013 to March 2015. The objective was to rear juveniles (> 3 g) to be restocked on site. Post-settled juveniles from UPMSI hatchery were reared in 12 floating hapas managed by people's organisations (PO) in Brgy. Imbo to complement production from the floating hapas UPMSI maintained.

Like most localities, fishery stocks of sandfish in the Bolinao-Anda reef system had been overexploited. In Brgy. Imbo, the goal was to establish a sandfish restocking site, rather than to develop a community-based sea ranch, as in other sites.

The aims were to:

- leverage greater public investment that can also supplement income for small-scale fishers
- establish a reproductive reserve to help rebuild natural stocks, as part of the LGU's fishery management efforts.

Establishing a restocking site under local government management, with local POs participating, was explored in Anda rather than granting exclusive use rights to the PO. The PO members were involved in producing juveniles to be released in the restocking site managed by the LGU. The guarding of the sea ranch site was assigned to the Bantay Dagat (sea wardens) who were paid by the LGU of Anda.

The main livelihood for the community is fishing. Mixed species of fish are caught using gillnet, hook and line, fish traps, spearfishing, and gleaning. Most of the respondents had no secondary source of income. Those who did made it from:

- planting watermelon
- raising animals
- culturing groupers (lapu-lapu) from a sponsored initiative
- selling corn
- making sal
- carpentry
- plumbing
- fabricating motorcycle parts.

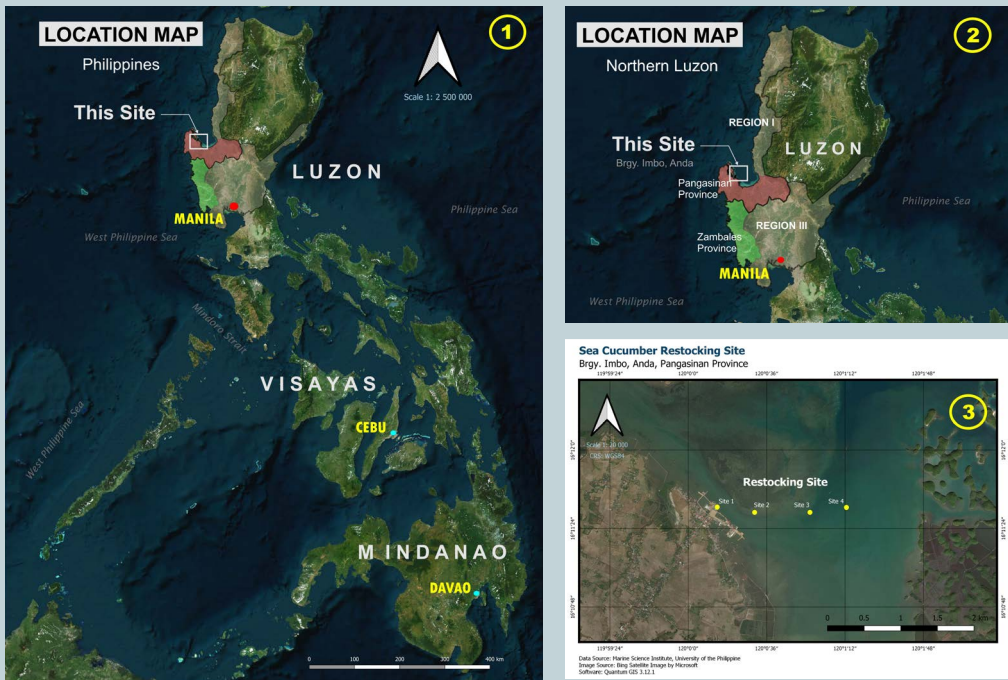


Figure 22 Locator map for Imbo pilot ocean nursery

Source: UPMSI Sea Cucumber Program



Figure 23 Construction of floating hapa bamboo frames at Imbo

Source: UPMSI Sea Cucumber Program

Monthly incomes ranged from PHP1,000.00 to PHP4,000.00 per month. The most common language spoken is the local Bolinao or Ilokano dialect.

Based on interviews with collectors, 25 respondents reported 11 sea cucumber species that are commonly harvested, including sandfish. However, as stocks had dwindled, sea cucumbers were no longer considered a primary source of income. When available or encountered, sea cucumbers were harvested by gleaning or freediving. Size limits were also not observed.

5.2 Interventions

After initial scoping for probable sites and community partners, a 10-ha area in Barangay Imbo, Anda was selected as an ideal area for restocking sandfish. The project was introduced to the different stakeholders. The mayor then signed an Executive Order establishing the area as

a restocking site. The site is managed by the LGU through the Municipal Agricultural Officer (MAO).

LGU officials of Anda, Pangasinan led the launch of the 10-ha restocking site in Brgy. Imbo in 2014. Regular engagement with local partners gave them and project staff the opportunity to develop a more dynamic relationship. Potential environmental and economic benefits of managing their sea cucumber fisheries were explained and management initiatives were considered for the restocking site.

To increase the production of juveniles, local partners were trained on sandfish production using floating hapas by the UPMSI team. Juveniles were reared in the outdoor hatchery facility of the University of the Philippines' Bolinao Marine Laboratory in Pangasinan, northwestern Philippines, until reaching a minimum size of 5 mm. They were then released into floating hapas at a stocking density of 1000 juveniles per hapa.



Figure 24 Deployment of floating hapas for community nursery rearing

Source: UPMSI Sea Cucumber Program



Figure 25 Meeting of PO members and consortium staff

Source: UPMSI Sea Cucumber Program

Each hapa net (2 m x 1 m x 1.2 m) was made of fine nylon mesh (1 mm) and tied to a floating frame made of bamboo. The floating frames were secured to the seafloor with ropes tied to each corner and blocks of concrete were used as sinkers. Juveniles were reared in the floating hapas for 2 cycles of 21 days per cycle. Nets were changed and densities of juveniles in each hapa were reduced to about 250 juveniles per hapa after the first cycle.

Community-based ocean nursery rearing was piloted in the Imbo restocking site, along with a juvenile buy-back scheme supported by the LGU. For every sandfish that weighed >3 g, the POs were paid PHP1.00. For each sandfish that weighed <3 g, they were paid PHP0.70. This provided supplemental income to the POs.

An information and education campaign about the biology and ecological importance of sea cucumbers, and the significance of the restocking site, was done in Imbo Elementary school. It was supported

by the MAO in October 2015, and about 120 elementary students were present.

In March 2015, before juveniles were released, a baseline perception survey was conducted at the Brgy. Imbo site. It included socio-demographics and perception about the:

- resources in the area
- sea cucumber resources
- sea cucumber biology
- coastal resource management initiatives
- restocking of sandfish.

The survey included those who were not directly involved in the project. A series of meetings between the Brgy. Council and the 2 POs involved introduced the project and joined them in the different project activities. Barangay officials of Anda, Municipal Agriculturist's Office officials, sea cucumber traders and processors participated in training activities. Sea cucumber traders and processors were trained on rearing juvenile sandfish in

ocean nursery systems. In March 2015, sea cucumber traders and processors were also advised on restocking, existing laws and sea cucumber fisheries management planning for Anda, Pangasinan.

Subsequent juvenile (>3 g) releases were done in the restocking site in Imbo. A trial grow-out experiment was also conducted in Imbo, where a 200 m² circular pen was set-up in the shallow area of the site.

It was intended to be an intermediate grow-out pen. There, juveniles from the ocean nursery system in Imbo could be sand-conditioned and grown to larger sizes. This pen became the location for numerous releases of around 20,000 unconditioned juveniles. It was expected that on 3 months following release, juveniles would be visible inside the pen.

5.3 Results

Rearing and releasing juveniles

The project provided the community the sandfish spats for grow-out in the floating hapas. Project partners were also present for the monitoring of the floating hapas, along with PO and MAO representatives. Regular meetings were also held with PO and MAO members to keep the restocking project on track.

In 2014, a total of 13,504 juveniles larger than 3 g were released in the restocking site at Imbo. As at July 2015, a total of 16,367 juveniles were produced by the local partners, which earned them PHP15,500 from the LGU. In 2016, 6468 more juveniles were released in the restocking site. Community members acknowledged that their efforts in the sea ranch benefitted them (overall sandfish collected had increased). This was encouraging to the partners despite the low financial returns.

On the other hand, the trial grow-out experiment in sea pens as an intermediate grow-out system was not successful.

No juveniles were retrieved during the monitoring of the pens. This was very surprising considering that over 20,000 juveniles from the hapa nets were released in the pens. Several holes on the seafloor of various sizes were observed in the experimental site suggesting presence of predators. Aside from predation, the apparent high mortality may in part be due to the:

- unconditioned state of the juveniles
- handling stress considering they were released directly into the pens after harvest from the floating hapas.

There was also speculation that juveniles released into the site had been poached due to poor guarding. There were also disputes among the PO members that affected their cooperation and commitment to the project. The POs and the LGU heavily relied on project partners to lead all activities concerning the restocking site. They did not take responsibility or initiative. Independent validated reports confirmed that there were buyers of juveniles for sandfish grow-out projects in other municipalities and that hundreds of juveniles (30 g to 80 g) were procured from Anda through a barangay official and PO member involved in the early phase of the restocking site.

Community perception on restocking

Apart from a small number of respondents, the community in Brgy. Imbo was familiar with the restocking project. Interviewees said that the whole community, including themselves, would benefit from the increased stocks and larger sizes of sandfish that would come from the restocking site. However, they also recognised that some people might not follow the rules because the restocking site would affect their livelihoods. They also identified that strict guarding of the site would be necessary for its success.



Figure 26 Harvest of juvenile sandfish in the floating hapas

Source: UPMSI Sea Cucumber Program



Figure 27 Sorting and thinning out juveniles for restocking in floating hapas

Source: UPMSI Sea Cucumber Program

Community members stated that their knowledge of the project came from neighbours and other fishers. During the interview, the respondents were provided with a better understanding of the ecological, socio-cultural, and economic feasibility of the restocking site.

Community actions

Both men and women participated in activities to establish the restocking site. Women and men constructed pens and floating hapas that were used in the restocking site, while men monitored the site and hapas. Guarding the restocking site was also a duty of the Bantay Dagat in Brgy. Imbo. There had been reports the Bantay Dagat previously assigned to the site was not guarding at night.

LGU actions

The Anda local government signed an executive order that declared the restocking site in Brgy. Imbo, as well as size limits for harvest. This was to regulate harvesting the wild stock and cultured juveniles released in the restocking site. Continuous information and education went with the various activities of the UPMSI sea cucumber research program and local partners. These messages increased awareness of:

- the biology and ecology of sea cucumbers
- the project objectives of the sea ranch and restocking sites.

The LGU in Anda was actively involved in developing the management plan for the restocking site. A dialogue with the Brgy. Council of Imbo made guarding arrangements through the barangay. The LGU also provided funds to construct a floating guardhouse anchored inside the restocking site.

5.4 Lessons learned and new strategies

The pilot in Imbo was the first trial of a community-based ocean nursery rearing and LGU buy-back scheme. Rearing the juveniles on site was an excellent way to enable local partners and provided short-term economic returns by producing juveniles (>3 g) for restocking. The LGU investment was linked to livelihood development and the fisheries management program, as the LGU purchased the juveniles for release in the sea ranch. This is a particularly good model for LGU and local community partnership that can scale up production of release-size juveniles on site. Procuring post-settled juveniles from a hatchery should be more cost effective than procuring release-size juveniles from small fishers. The scheme made opportunities for local communities to participate in other phases of production, aside from grow-out to marketable size and post-harvest processing.

The site in Imbo may be explored by the project as a potential restocking site for future juvenile releases. Renewing partnership agreements with POs and LGU members, including the buy-back scheme, should be proposed and amended to ensure economic benefits for everyone involved. A stronger commitment from the POs and the LGU would ensure site guarding and safeguard the sandfish from poachers.

With the present knowledge of the restocking site, juveniles should be released in shallow areas for higher chances of survival in grow-out experiments. The site is heterogeneous and releasing juveniles should be done with extra care. Identifying predators is a must and should be addressed using other methods (for example, with underwater cameras).

6 Sandfish sea ranching and community organising in Barangay Poblacion, Kauswagan (Mindanao node case study)



6

Sandfish sea ranching and community organising in Barangay Poblacion, Kauswagan (Mindanao node case study)

Wilfredo H Uy¹, Emmylou A Emperador¹, Anabelle Dece A Espadero¹, Danisa Mae Calimot¹, Heidie Amor A Parcia¹ and Allyn Duvin S Pantallano¹

¹Mindanao State University at Naawan, Poblacion, Naawan, Misamis Oriental 9023

6.1 Introduction

A possible sandfish sea ranch site was established in 2015 at Kauswagan, Lanao del Norte Province. It was chosen to help restore lost production and to increase harvests to enhance market opportunities. The project in this pilot site aimed to:

- see whether sea ranching sandfish could diversify livelihoods
- use sea ranching and restocking to improve fisheries management and add value with aquatic resources
- build the capacity of local partners to culture and stock sandfish successfully.

Kauswagan is a coastal municipality in the province of Lanao del Norte. The municipality has a land area of 60.37 km², which constitutes 1.80% of Lanao del Norte's total area. Its population is 26,278 (2015 Census). This represented 3.89% of the total population of Lanao del Norte province, or 0.56% of the overall population of the Northern Mindanao region. Based on these figures, the population density is 435 inhabitants per km² (PhilAtlas 2019). The detailed survey of the probable sites indicated that Barangay Poblacion was the best site for sea ranching because it had extensive beds of seagrass and

relatively soft sediment for raising sea cucumbers.

Of the 70 survey respondents, most were aged 40 years or higher and most were female, since women were more often caring for children in the home while men did paid work. However, these women also engaged in subsistence fishing or farming.

Most of the respondents were married. Their responses on housing said:

- 83% had built semi-permanent dwelling units
- 59% were tenanted
- 36% owned
- 5% rented.

The average household income ranged up to PHP4000.00 a month. The survey showed that the lowest household income was PHP500.00, which is below the poverty threshold for a rural community. Their primary sources of income were:

- fishing (44%)
- farming (29%)
- other (24%).

Most (60%) of the respondents were aware of the sea ranch project. Only 46% were involved in the community livelihood association while the other 54% were not involved.

The coastal concerns in the site were:

- unpredictable weather
- decrease in catch due to increase in population
- increase in demand
- poaching
- illegal fishing
- strict implementation of policies.

6.2 Intervention

On 10 June 2015, before the sandfish sea ranch project's activities started, there was a presentation about it to the local government unit (LGU) and barangay communities. The presentation was about the project's aims and orientation of field surveys and monitoring. The availability of sandfish was assessed, and Poblacion sanctuary and Bagumbayan Sanctuary were surveyed.

Community consultation was then conducted. As the basis of community involvement in the sea ranch, a new people's organisation (PO) called Kauswagan Sea

Ranchers Association (KaSeA) was named as the project's beneficiaries. Training and immersion activities were provided to enable the community and encourage its members to actively participate. There was a buy-back mechanism implemented, with PHP1.00 offered for every juvenile that survived rearing after 60 days in the hapa. This was to maintain the members' interest in sandfish sea ranching in the months between initial release and the successful rearing of mature sandfish.

The capacity of fisheries technicians and personnel of LGU-Kauswagan and DA-BFAR PFO Lanao del Norte was built. They were trained in hatchery production and management in preparation for the LGU's future venture in sea cucumber production.

In October 2016, the project also trained KaSeA members on sea cucumber and seagrass identification and monitoring protocols. The training aimed to:

- raise awareness on the importance of these resources
- teach the basic protocols of monitoring for management purposes.

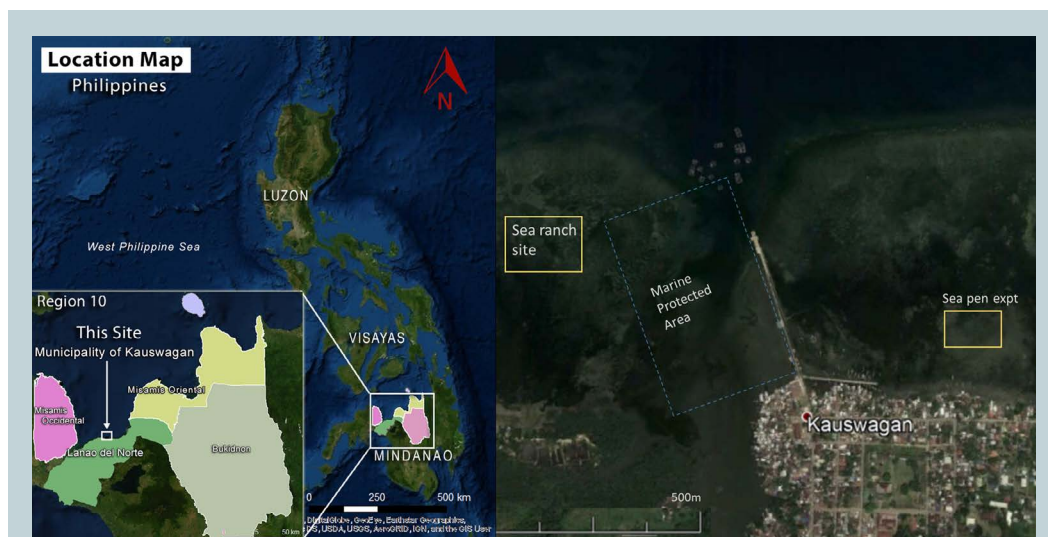


Figure 28 Locator map for Kauswagan sea ranch

Source: MSU Nawaan



Figure 29 Community consultation and focus group discussion

Source: MSU Nawaan



Figure 30 Training on sea cucumber and seagrass monitoring protocols among KaSeA members

Source: MSU Nawaan

6.3 Results

The project implemented buy-back mechanisms for the PO in Kauswagan with the community-based sandfish ocean floating nursery. The project agreed to buy back at a fee of PHP1.00 per juvenile that survived 60 days in hapas. KKaSeA earned a total of PHP5,378.00 from the 3 hapa experiments, each of which resulted in a successful buy-back.

The LGU-Kauswagan, Lanao del Norte has been supportive and was looking forward to a sustained partnership with Mindanao State University Naawan (MSUN). They gained a wider understanding of the fishery sector through the project. They also explored a possible joint venture for their fishery development, considering their existing hatchery in the locality, which is not currently operational.

Kauswagan had 4 successful spawning inductions with 119,216 juveniles (March 2018 production) plus early-stage juveniles produced at MSUN Hatchery. Manipulative experiments were conducted for ocean nursery systems using floating hapa cage experiments. One trial in Kauswagan had a 15% survival rate. Two experimental trials of modified submerged hapa cages used resulted in 38% and 9% survival rates. Sandfish nursery production in fishponds was also assessed and pursued with increasing juvenile production in the hatchery. However, they had poor survival rates from rapid salinity fluctuations during rainy seasons and a lack of pond management coordination.

Two more sea ranch sites were assessed and identified: in Poblacion and Kawit Kauswagan. Before establishing the final sea ranch area, grow-out experiments were conducted in each site where 200 juveniles (>3 g) were reared for 6 months in 100m² circular pens in triplicate. Biophysical parameters were also monitored based on

the agreed protocols with collaborators. As at March 2018, 20,052 juveniles were released in the sandfish sea ranch site in Kauswagan.

In January 2014, improvements to the university hatchery facilities were completed and had an estimated rearing capacity of 3 million eggs per production. In September 2017, the sea cucumber hatchery complex was expanded and had an additional rearing capacity of 4 million eggs, funded by Department of Science and Technology – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) under the Institutional Development Division (IDD) program. At the site, there was:

- monitoring of the growth and development of cultured sea cucumbers with local partners
- environmental monitoring on water quality
- control of predators and poachers
- sea ranch maintenance, including cleaning of holding pens for small juveniles.

6.4 Lessons learned and new strategies

A significant number of coastal residents have expressed interest in sandfish sea ranching, with 36 community members forming an association to participate in sandfish mariculture. The local government was also very supportive, due in part to a history of the municipal government operating a multi-species hatchery. However, there were difficulties in negotiating with the local government. The project's and community's request for a 5-ha area resulted in an allocation of only 1 ha of coastal area to the project.

The high level of gleaning and coastal resource use led to resistance from some community members to establish a full 5-ha area. Because of the complex negotiations, the agreement with the local government was slow. The project ended before the agreement could be formalised.

The estuary at Kauswagan had a very good broodstock of sandfish. However, the intertidal flat was more problematic than first thought. The flats were exposed under spring tides, and the deeper areas were rocky. A better site was identified; however, it is not ideal due to peace and order problems preventing access for researchers.⁴

The area was ultimately considered not suitable for sea cucumber sea ranching, even though there was full support from LGU officials and from the members of the associations. However, conflicts between user groups meant there was no barangay endorsement to the Sangguniang Bayan of Kauswagan. The proposal was to provide a 5-ha seagrass area fronting the Barangay Poblacion as a sea cucumber sea ranch for 3 years. It would recognise the members of KaSeA as the operator. This proposal was never ratified or implemented.

Going forward, selecting an existing association could be beneficial. An existing association might already have a goal. However, their teamwork will have been tested by time and members, despite different personalities, may be able to adjust. Another strategy could be to appoint only one family or household to manage the sea ranch. This would allow them to:

- divide the tasks among themselves
- carefully monitor the progress of the project.

It may be easier also to communicate with those responsible for the production and management of the project.

4 Mindanao has been the theatre for protracted armed conflicts since 1979 which has strongly impact on aid and development interventions in the island.

7 Sandfish sea ranching and community organising in Barangay Tubajon, Laguindingan (Mindanao node case study)



7

Sandfish sea ranching and community organising in Barangay Tubajon, Laguindingan (Mindanao node case study)

Wilfredo H Uy¹, Emmylou A Emperador¹, Anabelle Dece A Espadero¹, Danisa Mae Calimot¹, Heidie Amor A Parcia¹ and Allyn Duvin S Pantallano¹

¹Mindanao State University at Naawan, Poblacion, 9023 Naawan, Misamis Oriental, Philippines

7.1 Introduction

A sandfish sea ranch site was established in Tubajon, Laguindingan municipality, Misamis Oriental province to help increase the production of sea cucumber and offer livelihood opportunities to residents.

Laguindingan is in Northern Mindanao. In May 2010, it had a population of 21,822 covering a land area of 4,423 ha. It is a fourth-class municipality (PhilAtlas 2019). It is also where the domestic airport is situated. The infrastructure is a flagship project of the Cagayan de Oro-Iligan Corridor special development project, which covers the cities Iligan and Cagayan de Oro. Laguindingan has 3 coastal barangays: Mauswagon, Moog and Tubajon.

Among these barangays, Barangay Tubajon has the longest coastline at 143 km. Tubajon is rich in coastal resources. It has been a site for various scientific research and livelihood projects from both local and international agencies. It has a no-take Marine Protected Area (MPA) of 0.31 km², established 2002.

The area has an extensive seagrass bed estimated at 117 ha, with:

- seagrass cover ranging from 31–70%
- an estimated 31 ha planted with 2 mangrove species (*Rhizophora apiculata* and *R. mucronata*) in what was previously a seagrass bed (Fortes and Nadaoka 2015).

Mangrove rehabilitation efforts in the area started in 1992.

The coastal community residents were aware of the presence of sea cucumber in the area. They collected it only to consume and not for economic revenue. Some fishers were aware of sea cucumber trading in other areas, but they lacked the knowledge on the sea cucumber preparation and drying. Most of the fishers collected only fish and other species with high commercial value.

Based on a survey of 150 respondents, which were fairly distributed from 7 zones in Tubajon:

- 67% were 40 years old and above (the sample population averaged 47 years)

- 84% were female, as they were more likely doing unpaid care for children while men were in paid work
- women also engaged in subsistence fishing or farming
- 86% were married
- the average family had 4 to 5 members.

Most residents had built semi-concrete dwelling units. Their source of drinking water was a pipe waterworks system. The garbage disposal system was composting, and the common type of toilet facilities were water sealed/flush. The average household income ranged from PHP1,000.00 to PHP5,000.00 a month. The survey showed that the lowest household income was PHP1,000.00, which is below the poverty threshold for a rural community.

Residents generally did not find any reason to leave the area because of the rich marine and land resources. This meant that making money may not have been the primary way of living for some families.

Some of the commonly cultivated agricultural products in the community both for commercial and consumption are:

- corn
- tobacco
- horseradish
- sweet potato leaves
- sugar apple
- malabar nightshade
- taro plants.

Livestock includes cow, pig, goat and chicken. Fish and other marine resources include:

- 2 species of rabbitfish
- parrotfish
- emperor fish
- squid
- assorted shellfish
- sea urchins
- seaweeds.

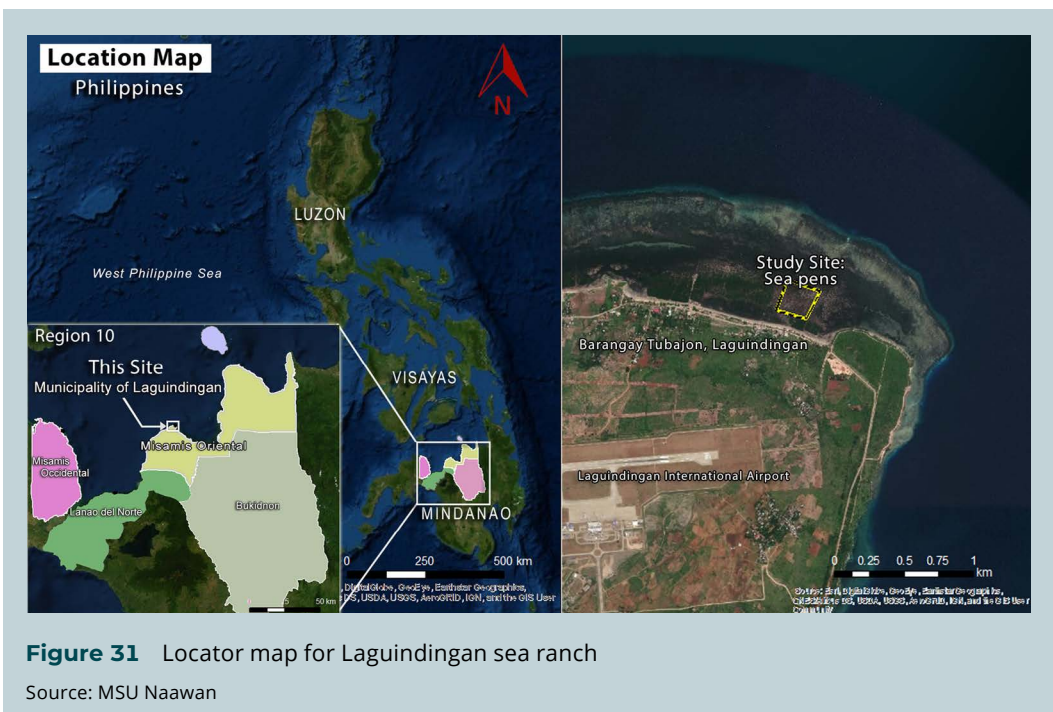


Figure 31 Locator map for Laguindingan sea ranch

Source: MSU Naawan



Figure 32 Monitoring activities at the sea ranch with the local community

Source: MSUN

Gleaning is also considered as a major source of food and income in coastal barangays. Other economic activities that contribute to household income are tobacco plantation and charcoal processing.

The government has several major coastal and tourist developments in the Cagayan de Oro-Iligan Corridor, including the new airport just inland from the coast in Laguindingan. Residents of Moog and Liberty were displaced by this airport, which led to increasing pressure on the coast as Barangay Tubajon became the relocation site for these people. People in Moog and Liberty were mostly tobacco farmers, and seldom produced other agricultural products because of poor soil conditions there. Although they were paid for their lands and were given a place for relocation, household income was greatly affected. The demand for marine resources increased significantly as these residents entered small-scale fisheries to alleviate economic hardship. In particular, the men started fishing while women began gleaning on the intertidal flats with good seagrass areas. This situation of Barangay Tubajon showed

the community needed ways to alleviate poverty, such as livelihood projects.

Barangay Tubajon had various existing community associations that differed in nature but were largely livelihood- and coastal-related. Some of these associations were initiated through research and local government projects that aimed to mitigate the impact of the growing demand for coastal resources. Around 95% of the residents were part of these associations. When interviewed, barangay officials claimed that these associations were helping the community. They had brought in additional income and contributed to policies on the municipal level. The Local Government of Laguindingan had introduced some livelihood assistance to alleviate poverty, promoting income-generating activities to fishers and women. These programs and projects included:

- financial assistance for livelihood
- material support (salt making at Purok 4)
- livelihood skills training (bangus food processing)
- material or financial assistance linked with market outlets (aquasilviculture, basket making).

Fishing is one of the residents' major sources of income. However, they have been catching less fish with the increasing population in the coastal barangays. This was caused by the relocation of the residents from Barangay Moog and Liberty where the airport is located. Fishers often experience low catch rate in fish and invertebrates in January to February, using:

- fishing net (bottom-set gillnet)
- hook and line
- multiple longline.

However, they have a high catch rate during December, January and February when the weather is stormy. Gleaning continues year-round. Given these factors, some resort to farming as an alternative source of income, which some find more reliable than fishing.

7.2 Intervention

Sandfish sea ranching was introduced as a new economic and coastal activity. The pilot sea ranch site in Barangay Tubajon was made official with a Memorandum of Agreement (MOA) signed on 1 December 2014. A series of meetings, including the barangay consultation, gathered a common view about the project. Balat Aquaculture and Livelihood Association of Tubajon (BALAT) was created as the initial adopter

and rights holder of sea ranching. BALAT members were trained to have the technical and management skills needed to manage a sea ranch by Mindanao State University – Naawan (MSUN), the consortium partner.

7.3 Challenges faced by BALAT

The association members

The sea ranch project was introduced to local government units (LGUs) and barangay communities by consortium partner staff. The nature of the project was presented, with the process of conducting field surveys and monitoring. One of the biggest decisions before the start of the project was whether to:

- create a new people's organisation (PO) to be the implementing partner for the site
- choose among the existing community associations.

Community members indicated that to create a new PO would prioritise the goals of the project. To choose an existing association might create a conflict of interest with establishing the sea ranch, as they would already be working toward independent goals.



Figure 33 Signing the Memorandum of Agreement

Source: MSUN



Figure 34 Launching the pilot site with officials of MSUN and the LGU

Source: MSUN

Some existing associations were initiated through research and local government projects, such as the small fisherfolks association, and the women's association. Given the priorities of the members may vary in different organisations, it was decided that creating a new association was a better choice.

This new association would actively involve women as well, in contrast to some of the existing marine oriented associations, which were largely made up of men. One of the main features of this PO was that it had more women than men active in the association. Technically, most of the work of a sea ranch site does not require physical strength. That meant female members expressed during meetings that they felt they could fully participate in the project. During the initial meeting of the association, it was discussed that having more women as members was not a problem. However, as the need for male labour force was also important, it was

then agreed that households should make up the membership of the organisation, as opposed to individuals. That way, each household could decide and put forward either male or female members as the tasks required.

The LGU supported and recognised the new association, and the members were then provided with training in sandfish culture. There were alternative activities while waiting for the production cycle of 9 months or more. These activities included:

- capacity building (information drive)
- sea ranch site viewing
- lectures.

Through these activities, the PO became known as an organisation trained in sandfish culture. These activities built the members' capacity while promoting the area as a pilot in Mindanao. Capacity building proved to be a positive opportunity to gather potential buyers of dried sandfish.

At the same time, a buy-back mechanism was also implemented, with PHP1.00 offered for every juvenile that survived after 60 days of hapa rearing. This was a strategy to maintain the members' interest and investment in sandfish sea ranching.

Involvement of the members

At the start, things went as planned until the end of the first production. A buy-back occurred, however there was a very low survival rate of around 10%, so the community received only a modest return on the investment of their time. The project team and PO generally understood a lack of cleaning and regular maintenance of the hapa contributed to the poor survival rate.

After this, conflict became more common within the PO. Members of the association were less regular in their guarding of the juveniles. Association members did this voluntarily, anticipating benefits from further buy-backs. Around this time, association members began to report poaching. This was attributed to people in surrounding villages and towns, however, there was no way for project staff nor association members to establish the source of poaching. It is not clear whether poaching began prior to the drop-off in voluntary guarding, or after.

As the project progressed, project meetings tended not to happen without the leadership of the project staff to organise and guide meetings and discussions. Because the project only had 2 staff, it was not possible to have a staff member in the village regularly and supporting the community with their challenges. A caretaker worked in the village to monitor resources in the coastal zone relating to the university's activities in the area. However, this role was not intended to support community organising within the sea ranch project. The caretaker was however a part of the PO and played the role of an informal liaison at times.

In the project team's opinion, the members' motivation and interest in the project over time was affected by:

- the conflict within the organisation
- the lack of short-term monetary returns.

Members reported issues to the project leader instead of discussing these things amongst themselves. This was evidence the PO was not functioning well. Some members were very dedicated throughout and continued to be involved in the project. However, resolving conflict is a necessary skill that bears a long-term benefit and a fundamental factor for an organisation's sustainability. One lesson that emerged from this process was that starting a new organisation from the ground up can be a very risky strategy. Despite the best efforts and intentions of the community members and the project team, this organisation did not function effectively.

A change of leadership may also have influenced the situation. The first president of the association was authoritarian, drawing on his military training to adopt a strict style of leadership. Some people supported this approach as it was effective in getting work done, however others felt it was quite demanding. After 2 years he left the project with no clear reason, and the vice-president took over. This led to an organisational culture change, including an increase in conflicts among PO members. The new leader appeared to have less success in uniting people to do the work required.

Results and lessons learned

Ultimately, creating a new association was a failure, and poaching worsened problems within the PO that were apparent from early on.

The sandfish project buy-back mechanisms earned a total of PHP1,457: a low return. However, Tubajon also had a total of 11 successful spawning events with 173,170 juveniles from the March 2018 production.

This was a highly successful outcome for ecological and stock enhancement.

The site continues to be active in the ongoing efforts to develop sandfish mariculture thanks to:

- the good biophysical characteristics of the site
- the sustained involvement of a few community members.

The outstanding challenge is the social sustainability of the project.

The lessons learned and new strategies from this project included these points:

- The community must understand the management system, appreciate the benefits and adopt the project to avoid conflicts. There should be full education of the potential benefits and full returns of sea ranch farming.
- Starting a new organisation from the ground up can be a very risky strategy for voluntary community organisations.
- Poaching can be a very difficult problem to address when economic drivers related to poverty and displacement lead to new entrants into coastal fisheries, including when sea ranches operate within open-access coastal zones.

The failure of the PO, and the challenges of poaching, resulted in a decision to trial a family approach to mariculture. That meant working closely with individual households who had kept a dedicated commitment to the project throughout, rather than work with a PO. Certain farmers had shown commitment to methodical work and accepted that income could not be fixed, but rather, the work would lead to a longer-term, more sustainable and continuous income.

7.4 References

Fortes MD and Nadaoka K (2015) The Coastal Ecosystem Conservation and Adaptive Management (CECAM) approach as an innovation to existing ICZM Frameworks.

Purcell SW, Hair CA and Mills DJ (2012) Sea cucumber, farming and sea ranching in the tropics: Progress, problems and opportunities. *Aquaculture*, 368:68–81. <https://doi.org/10.1016/j.aquaculture.2012.08.053>

PhilAtlas (2019) Regions of the Philippines, Population 2015, accessed 15 September 2019.



Figure 35 Hapa setup with PO members

Source: MSUN

8 Participatory research and bringing back the sandfish in Maliwaliw Island, Eastern Samar (Eastern Visayas node case study)



8

Participatory research and bringing back the sandfish in Maliwaliw Island, Eastern Samar (Eastern Visayas node case study)

Margarita T de la Cruz¹, Janine L Villamor¹, Rose Jane P Diodoco¹ and Jonh Rey L Gacura¹

¹ Guiuan Development Foundation, Inc. Guimbaolibot Ave., Brgy. 10, Guiuan, Eastern Samar 6809 Philippines

8.1 Introduction

For centuries, sea cucumber fishing has been a common source of income for small artisanal fishers in the coastal areas of Samar Island. However, over the years, sea cucumber resources drastically declined. Trinidad-Roa (1987) cited in Choo et al. (2008) identified the causes of depletion of the resource as:

1. uncontrolled, non-selective harvesting
2. absence of guidelines for regulating collection
3. absence of hatchery efforts.

The biology and habitat of the sea cucumber also contribute to its exploitation. Sea cucumbers in general are bottom dwellers and are sedentary. Most of them do not have strong defence mechanisms, making gathering easier. Women and children collect these organisms.

In Eastern Visayas, Guiuan Development Foundation Inc. (GDFI) worked with Maliwaliw Multipurpose Association (MMA) as community partner.

Maliwaliw Island, Salcedo, Eastern Samar province was found suitable for sea cucumber ranching based on the site selection assessment conducted with the research team from UPMSI in 2012.

Sandfish have the best potential for mass production at low cost (Battaglione, 1999). For this reason, they have been extensively bred compared to other sea cucumber species (Purcell et al. 2012). In the Philippines, this collaborative project aims to address the issues raised by Trinidad-Roa (1987) by:

- producing good quality juveniles from hatchery
- developing grow-out technologies incorporating community-based/participatory approaches.

Participatory, community-based sea ranching projects would ensure the community partners, or the stakeholders would have the rights to the project's benefits (Junio-Meñez et al. 2011). With sea ranching and restocking, this project also aimed to provide ways to recover and restore livelihoods.



Figure 36 Map showing the sea cucumber sea ranch site on Maliwaliw Island, Salcedo, Eastern Samar

Source: Guiuan Development Foundation, Inc



Figure 37 Bottom-set hapa nets at the Maliwaliw project site, with a tropical storm brewing in the background

Source: Guiuan Development Foundation

Concerns of scientists and community that the project aims to address

Marine resources are the main livelihood source in Maliwaliw Island. Sea cucumber depletion has adversely affected the subsistence fishers who had been getting income from sea cucumbers, from the 1970s to the early 1990s. In the 1970s, local fishers claim that they gathered sea cucumbers by the boat load. The local market value of these species was very low in those years. Since there were no regulations restricting gathering sea cucumbers, this resource eventually became scarce. In particular, sandfish (*Holothuria scabra*), locally known as *kigo*, disappeared from the shallow waters of Maliwaliw. For over 3 decades, Maliwaliw fishers have no longer invested in sea cucumber gathering for their livelihood. There is great potential for the sea cucumber population to re-establish in the area and the planned sandfish project could be the way for this to happen.

The project started in April 2013. It aims to bring back the sea cucumber in selected sites by:

- developing commercial-scale hatchery and grow-out technologies for sandfish
- recognising the critical nature of adapting systems to social, institutional and bio-physical settings in a participating community.

Socio-economic conditions (poverty status, current livelihoods in the community, education levels, ethnic groups in the community)

Maliwaliw village has a population of 429, with a 1:1.16 female to male ratio based on the July 2016 Community-Based Monitoring System survey. The village population is young with the children and youth sectors comprising 69.23% of the total population. There are 99 households/families in the village. They are all engaged in fishing using simple, traditional fishing gears (gill

net, hook and line, fish corral, crab pots). Fish drying, particularly of boneless *dangit* (siganids) and *sapsap* (slipmouth), are also done by some families. Boneless dried fish fetch a good price even in the local market.

Maliwaliw has a primary school (Year K to Year 6) with 3 teachers and a total of 54 children enrolled (36 males and 18 females). After finishing Grade 6, the children continue their studies at the secondary schools in the town (Salcedo) or in Guiuan, Eastern Samar. A daycare facility is also available in the village for children aged 3 to 4 years. Literacy is high in the village as most parents emphasise their children's education.

The residents of Maliwaliw have a very strong sense of community and are open to ideas and changes. They belong to at least 2 major religious denominations (Roman Catholic and Iglesia Ni Cristo). The village has 4 *sitios* (districts):

- 2 along the coasts (Cabarasan, and Baybay).
- 2 on the center of the island (commonly referred to as the Barrio and Greenhills).

Residents along the coast have built their houses on a reclaimed mangrove area so that natural growth mangrove forest remains at the back of the settlements. This is a common practice among island dwellers as they want to be near the sea where they keep their boats and fishing gear.

Most of the Maliwaliw residents are active members of various community organisations. There are 7 people's organisations (PO) recognised in the barangay. Maliwaliw Multipurpose Association (MMA), organised by GDFI in 1993, is the only association duly registered with the Department of Labor and Employment, making it the only legal PO. The other groups were organised post-Typhoon Haiyan as a requirement of humanitarian international non-government



Figure 38 Project orientation meeting between project partners and the Maliwaliw Multi-Purpose Association

Source: Guiuan Development Foundation

organisation agencies for project assistance. Over the years, GDFI has provided a range of capacity-building activities for MMA members, mainly focused on:

- environmental protection
- resource conservation.

These activities have developed a keen sense of awareness of the importance of environmental management and protection, especially of marine resources, which form the MMA and community members' main source of livelihood.

A number of those who joined MMA and even became leaders of the organisation were former illegal fishers (blast fishers). They had realised they were destroying the marine habitats and resources, and the future of their children and grandchildren. These fishers and their families became staunch supporters of the project.

Basic information on site assessment and profiling (biophysical and social)

There were 3 potential sites preliminarily assessed for sea ranch site suitability:

- Barangay Guinob-an in Lawaan, Eastern Samar
- Barangay Camanga and Barangay Maliwaliw, both in Salcedo, Eastern Samar.

These sites were chosen because of the presence of strong POs organised by GDFI. PO involvement is vital in the implementation and success of any project in a community. The assessment was completed with assistance from UPMSI. Barangay Maliwaliw in Salcedo, Eastern Samar was the most suitable site of the 3 barangays. It was chosen to be the pilot sandfish sea ranch in Eastern Samar.

Within the 20 ha reserved area on Maliwaliw Island, 2 ranch sites were identified and approved for sandfish ranching. The ranch followed the community-based sea ranch development model. Each ranch was equally divided into 49-point grids in QGIS software with 40 m between each point, and was divided into 3 zones that spread outward:

- Zone A (50 m x 50 m) – the core zone and the release site.
- Zone B (100 m x 100 m).
- Zone C (225m x 225 m).

Each of the points was the sampling location for a parameter measurement such as:

- seagrass cover
- penetrability
- sediment particle-size composition
- sediment chlorophyll
- sediment organic matter.

Results showed one of the ranches located in the south-eastern side of Maliwaliw Island (Site 2) had approximately 20% seagrass cover dominated by *Thalassia-Halodule* species (Figure 37). The area also had an average penetrability of 4 cm, with mainly medium to fine grains. The other 5-ha ranch in the east side of the island (Site 1) had approximately 40% seagrass cover dominated by *Enhalus-Thalassia*. The area had also mainly medium to fine grains with an average penetrability of 7 cm.

8.2 Intervention

Community engagement and PO participation

On March 2013, GDFI sold the idea to establish a sea ranch for sandfish as part of its research and development program to the members of the MMA. Participation in research activities aimed at livelihood development was not new to MMA. For example, in the past they had also partnered with GDFI on developing mud

crab ranching technology. So, they were excited at the prospect of developing the protocols for a sea cucumber ranch and committed to participating fully in the project.

Relations with government

The idea of establishing a sea ranch for sandfish was also brought to the Barangay Council, which posed no objections to the planned project. A series of meetings with Maliwaliw Barangay Local Government Unit (BLGU) and MMA members were held to stress the important role of the PO and BLGU in the success of the project. Questions from participants were responded to and the meetings were very positive for the project.

With the Barangay Council having no objections, Prof. de la Cruz then negotiated for exclusive use rights of a portion of the shallow waters in Maliwaliw that were identified and mapped out for the project. LGU-Salcedo legislative members had an orientation on July 2013. The municipal council also had no objections. It was positive for such a project to be implemented in Maliwaliw.

Acceptance of the project within the wider community

GDFI was active in involving the local community and has continued engaging with the PO. Various GDFI projects and programs support the POs and the community (for example, mangrove crab ranching, women's livelihood, zero waste management). The community developed a sense of ownership over the project. For example, they closed the sea cucumber ranch sites to gleaners and placed signs on the boundaries to inform people of the sites. They understood the need to protect the sandfish so that the resource could be restored.

Families also developed conservation values, with family members protecting the sandfish. The community saw the long-term vision of the project and grasped the concept and importance of resource sustainability in their area. As years passed, they saw the results of their investment. They had an increase in sandfish numbers, alongside the recruitment of other species, furthering their understanding and appreciation of the intervention. The parents even started teaching their children (as young as 3 years old) about the sandfish project. These children also became engaged in the project, even assisting in the protection of the area in their own little ways.

Agreement on rules and compliance with rules

A Memorandum of Agreement (MOA) was drafted stipulating the project partners' roles and responsibilities in the project between:

- GDFI
- Bureau of Fisheries and Aquatic Resources (BFAR) Region 8
- LGU-Salcedo
- MMA.

The Local Chief Executive of Salcedo needed authorisation from the municipal council, locally known as Sangguniang Bayan (SB), to sign the MOA. For this, Prof. de la Cruz met with the SB in one of their sessions to present the project. After a long discussion with Prof. de la Cruz answering all the SB members' questions, the council approved the implementation of the project and the required legislative support. The LGU-Salcedo passed a municipal ordinance declaring 20 ha of identified sites in Maliwaliw Island for the exclusive use of GDFI and MMA, for the duration of its sea cucumber research project. BFAR agreed to provide 20,000 sea cucumber juveniles needed for the project.

The MOA was finally signed on 28 October 2013. GDFI adopted the 'Non-Government Organization (NGO)-National Government Agency (NGA)-Local Government Unit (LGU)-People Organization (PO)' model as the management strategy in Eastern Visayas. This meant actively engaging the PO in project implementation, as well as the LGU and BFAR.

Challenges

In July 2013, experimental pens (Figure 39) were erected in the 2 ranching sites in Maliwaliw:

- 6 in Site 1 (muddy substrate)
- 6 in Site 2 (sandy substrate).

The first quarterly monitoring of the pens was supposed to be done in November 2013 but was not done because of the threat of the incoming super typhoon. Knowing that an intense typhoon was about to hit Eastern Samar, MMA members reinforced the pens with additional ropes and posts. They even prioritised reinforcing the pens before securing their personal belongings. However, the force of super typhoon Haiyan washed out all the pens, and the entire stock of sea cucumbers in them was lost. But MMA members did not despair. Even before totally restoring their own shelters and livelihood, they actively participated in restoring the project. GDFI lost all its set-ups in Maliwaliw and the hatchery in BFAR 8-GMFDC was severely damaged.

Operations in the hatchery started in April 2014 and the first release of second-stage juveniles in the Site 2 ranch was in October 2014. Purchasing materials for erecting the nets was difficult after the onslaught of typhoon Haiyan. Prices of commodities had almost doubled. Wooden posts were hard to find as well because many tree branches were broken. Labour fees also increased because of the standard set by the international NGOs.

The project picked up again in 2015, after the impact of typhoon Haiyan began to lessen. Since then, MMA has been active in the maintenance, protection, and monitoring of the sea cucumber ranch in Maliwaliw. They have devised a strategy to manage the ranch, where MMA members take turns to guard the ranch, especially at night, on a weekly basis. Some members also help GDFI project staff monitoring the ranch and setting up other things like bottom-set hapa nets and pens.

Conflicts and conflict resolution

Sea cucumber ranches in Maliwaliw are closed to gleaners and signs were placed on the boundaries to inform people of the sites. However, gleaners from neighbouring barangays like Cantomoja and Cagaut repeatedly poached the ranch despite explanations and reproach

from MMA members. According to some MMA members guarding the ranch, night poachers sometimes were armed.

Things became difficult when Cantomoja barangay officials meddled with the poaching issue and took the side of the poachers from their barangay. First, they demanded documents from the Maliwaliw BLGU to prove that the Salcedo LGU approved the ranch establishment. The Maliwaliw barangay captain complied and showed them a copy of the MOA signed by the parties involved, including:

- the LGU, represented by the municipal mayor
- himself as the representative of the barangay.

He also showed them a map of Maliwaliw showing the location of the approved ranch sites.



Figure 39 Erecting experimental pens in heavy rain

Source: Guiuan Development Foundation

Cantomoja officials were not satisfied with the documents shown by the Maliwaliw barangay captain. Instead, they summoned Maliwaliw BGLU and MMA representatives to a meeting with the SB members in the municipal office. On 5 September 2016, the barangay captain, the MMA President, and the MMA Project manager sat in the SB members' meeting. The Municipal Environment and Natural Resources Officer (MENRO), Salcedo vice mayor, and members of Cagaut BLGU were also at the meeting.

During the meeting, Cantomoja barangay officials said they did not know about the sea cucumber ranch in Maliwaliw. They also suggested that MMA should place markers along the perimeter of the ranch so people would know that it is a closed zone for gleaning. However, MMA and Maliwaliw BLGU reasoned that putting permanent markers and fence around the ranch would not be possible because it was also a navigation area for the boats during high tide. Also, the project was introduced to the SB members in July 2013 and one of the SB members was from Cantomoja. After a long discussion, the Cantomoja officials apologised to the Maliwaliw group and promised to inform their constituents about the project.

The MMA President advised that poachers should pay a penalty. A compromise was reached, and a written agreement was created stating that:

- encroachment of poachers on the ranch sites is not allowed at any time
- such action will be penalised accordingly.

Both MMA and Cantomoja barangay officials signed the agreement in the presence of the SB members and MENRO officer. The MMA President thought Cantomoja barangay officials seemed to be hesitant in signing the agreement. However, the meeting had positive results. MMA members guarding the ranch observed that the number of poachers has since decreased.

Knowledge, skills, and capacity building activities

People involved in the sea cucumber ranching learned effective culture and grow-out methods slowly through a series of:

- orientations
- hands-on training
- coaching
- engagement in monitoring activities.

PO members actively participated in project activities such as:

- monitoring
- pen construction and maintenance
- hapa installations
- modifying pen construction (to make them sturdier)
- sediment sample collection
- conservation activities.

Since poaching was inevitable, guarding was another major shared task of partners. The MMA members discussed and scheduled guarding tasks among themselves, based on their availability. An incentive coming from the sea cucumber project was provided for members who guarded the ranch at night. Through coaching, orientations, and experience, the community became more knowledgeable of sea cucumber husbandry, improving productivity and governance.

8.3 Result

As at 2020, more than 10,000 juveniles were released in the sea ranch since the project resumed in 2014. Sandfish successfully grew to premium-grade size in the identified suitable site (Site 2) for sandfish ranching. The sandfish grew up to 640 g within one year in the pens with a 10.33% recovery rate. This showed grow-out production was a success. Small sandfish that were probably offspring of released sandfish in the ranch were found inside and outside

the ranch, indicating natural recruitment. Other species of sea cucumbers were also recruited in the area (such as *Stichopus horrens*, *Actinopyga echinites*, *Bohadschia marmorata*). MMA and other Maliwaliw residents see the ranch in their barangay as highly beneficial. They witnessed that stocks of sea cucumbers in their area were gradually returning 3 years after the project started. However, they think that selective harvesting is not yet practical. For them, increased releases without harvesting would be more likely to increase sea cucumbers in the area. Barangay Maliwaliw in general is not a sea cucumber-gathering community. So, for most of the residents, the primary goal of the project is restocking and increasing the population of sea cucumbers to what it was during the 70s and 80s. They also believe that the ranch is for their own benefit and that of their neighbouring barangays where sea cucumber gatherers/gleaners reside.

An example of this was when the PO members chose not to sell sandfish once they attained market size. Instead, they provided these to the local BFAR hatchery as broodstock, to support the provision of juveniles in the future to the sea ranch and for wider restocking purposes.

This was a voluntary re-investment of potential income into the long-term success of the program, for the benefit of the wider fishing community. This was not established as a regular program due to genetic risks with providing sea ranch-reared sandfish to the hatchery. However, this re-investment demonstrated:

- the strong community support for the program
- a willingness to forego short-term economic gains for longer-term benefits in the wider fishery.



Figure 40 Released juvenile sandfish inside the sea ranch

Source: Guiuan Development Foundation

8.4 Lessons learned and new strategies

Community-based projects are challenging. Unpredictable weather and other people's actions cannot be controlled. Hence, success of the sea cucumber project in Maliwaliw Island is dependent on local partners who are also stakeholders, like the MMA.

Disasters like Typhoon Haiyan can greatly affect the resolve to continue an activity that has been rendered useless. Recommencing the project from scratch is a very tedious thing to do, especially when also faced with putting back together what was destroyed by the event on a personal level. But with resolve and the cooperation of project partners, things moved on again and project implementation continued.

The community showed commitment to this project, looking for materials and setting up the pens again amidst their own personal concerns. They believed in the necessity to re-establish the sandfish ranch and the pen study. They saw the importance of enhancing the coastal fisheries especially after the devastating typhoon. Despite many challenges, involving the community in restocking and ranching projects was valuable. The stakeholders focused on environmental conservation and resource management, not solely on financial gain. This supported them to become more aware of the impacts of depletion of marine resources to their lives and livelihood as fishers.



Figure 41 Growth monitoring of juvenile sandfish

Source: Guiuan Development Foundation

Addressing pressing concerns of the neighbouring barangays through consultation-orientation and meetings was important for gaining their support for the project. Continued information education campaign (IEC) on selective harvesting (for example, >350 g) is important. The fishers should also be aware of the profit that they could make out of bigger sea cucumbers. This sparks the fishers' interest and patience to let the sea cucumber grow to marketable size and to premium grade.

Engaging all members of the community is a challenge, as fishers tend to participate in activities that would gain them more personal benefits and higher incentives. The strategy that will be used in the sea ranch expansion sites will be a 'family-approach', where interested families in the barangay will become co-managers of the ranch. Instead of giving them monthly incentives for guarding and monitoring, they will be provided materials. They can then set up their own pens and 100 sea cucumbers (for example, >80 g) for them to grow on their own. Their respective pens will be set up near the ranch so that guarding the ranch and managing their pens will become one job.



Figure 42 A large sandfish from the sea ranch site

Source: Guiuan Development Foundation

The co-managers should agree to the optimum weight to be harvested (for example, >500 g per individual sandfish). This way, the sea cucumbers would have been able to spawn already before they are harvested, thus restocking the area. Fishers will have higher direct economic gain and be able to contribute to rebuilding the depleted fishery stock of sandfish.

8.5 References

- Battaglione SC, Seymour JE and Ramofafia C (1999) Survival and growth of cultured juvenile sea cucumbers, *Holothuria scabra*. *Aquaculture*, 178(3-4):293-322. [https://doi.org/10.1016/S0044-8486\(99\)00130-1](https://doi.org/10.1016/S0044-8486(99)00130-1)
- Bell JD, Leber KM, Blankenship LH, Loneragan NR and Masuda R (2008) A new era for restocking, stock enhancement and sea ranching marine fisheries resources. *Reviews in Fisheries Science*, 16:1-9. <https://doi.org/10.1080/10641260701776951>
- Choo PS (2008) The Philippines: a hotspot of sea cucumber fisheries in Asia. In V. Toral-Granda, A. Lovatelli and M. Vasconcellos (eds). Sea cucumbers. A global review of fisheries and trade. *FAO Fisheries and Aquaculture Technical Paper*. No. 516. Rome, FAO.
- Juinio-Meñez MA, Paña MA, de Peralta GM, Olavides RD, Catbagan TO, Edullantes CM and Rodriguez BD (2012) Establishment and management of communal sandfish (*Holothuria scabra*) sea ranching in the Philippines in Hair CA, Pickering TD and Mills DJ (Eds.), *Asia-Pacific Tropical Sea Cucumber Aquaculture. ACIAR Proceedings*, 136. Australian Centre for International Agricultural Research, Canberra
- Unpublished Memorandum of Agreement between GDFI, LGU-Salcedo, and MMA. 2013.
- Purcell SW, Hair CA and Mills DJ (2012) Sea cucumber culture, farming and sea ranching in the tropics: Progress, problems and opportunities. *Aquaculture*, 368:68-81.
- Trinidad-Roa M J (1987) Bêche-De-Mer fishery in the Philippines. Naga, *The ICLARM Quarterly*, 15-17 October 1987.

9

Establishment of a community-based sandfish sea ranch in Barangay Polopiña, Concepcion, Iloilo (Western Visayas node case study)



9

Establishment of a community-based sandfish sea ranch in Barangay Polopiña, Concepcion, Iloilo (Western Visayas node case study)

Jon Altamirano¹, Jee Grace Suyo^{1,2}, Roselyn Baylon¹ and Raisa Joy Castel¹

¹Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC/AQD), Tigbauan, Iloilo 5021, Philippines

²University of the Philippines Visayas, Miagao, Iloilo 5000, Philippines

9.1 Introduction

The municipality of Concepcion in Iloilo, central Philippines, is among the best sources of seafood in the western Visayas region. Its population is just under 45,000 and fishing is their primary livelihood. Concepcion has one of the widest territorial waters (320 km²) in the Visayan Sea. Its jurisdiction spans across 17 islands and 18 (72%) of the 25 barangays/villages are coastal (Fernandez and Subade, 2015). In the recent decade, these islands gained popularity as a tourist destination for their clear waters and abundant underwater marine life. This is especially the case in areas close to at least 9 of its Marine Protected Areas (MPA) (Fernandez, 2006). One such island is called Igbon Island, where the village of Barangay Polopiña is located.

History of sea cucumber collecting/trading in Barangay Polopiña

People in Concepcion, particularly those from Barangay Polopiña, remember the abundance of wild sea cucumbers in western Visayas.

In the 1970s and 1980s, they recalled spending little to no effort to collect sea cucumbers of different species along the shallow coasts. They could collect and process as much as 4 sacks of dried cucumbers per month (about 30 kg per sack). Because of such volume, they could even sell directly to Cebu (>85 km away by sea), where one sack was sold at PHP1,000.00.

Despite the relatively low price compared to current prices of dried sea cucumbers, the financial turnaround was significant during that time. However, a couple of local trader/consolidators have noted a drastic decline in wild sea cucumber harvests in recent decades.

One consolidator has resorted to trading fresh fish and squid, while some sea cucumber fishers went on to farm seaweeds or be employed in bigger fishing vessels. The decline was particularly true for one of the most sought-after species: the sandfish (*Holothuria scabra*), locally known as *kiskisan*.

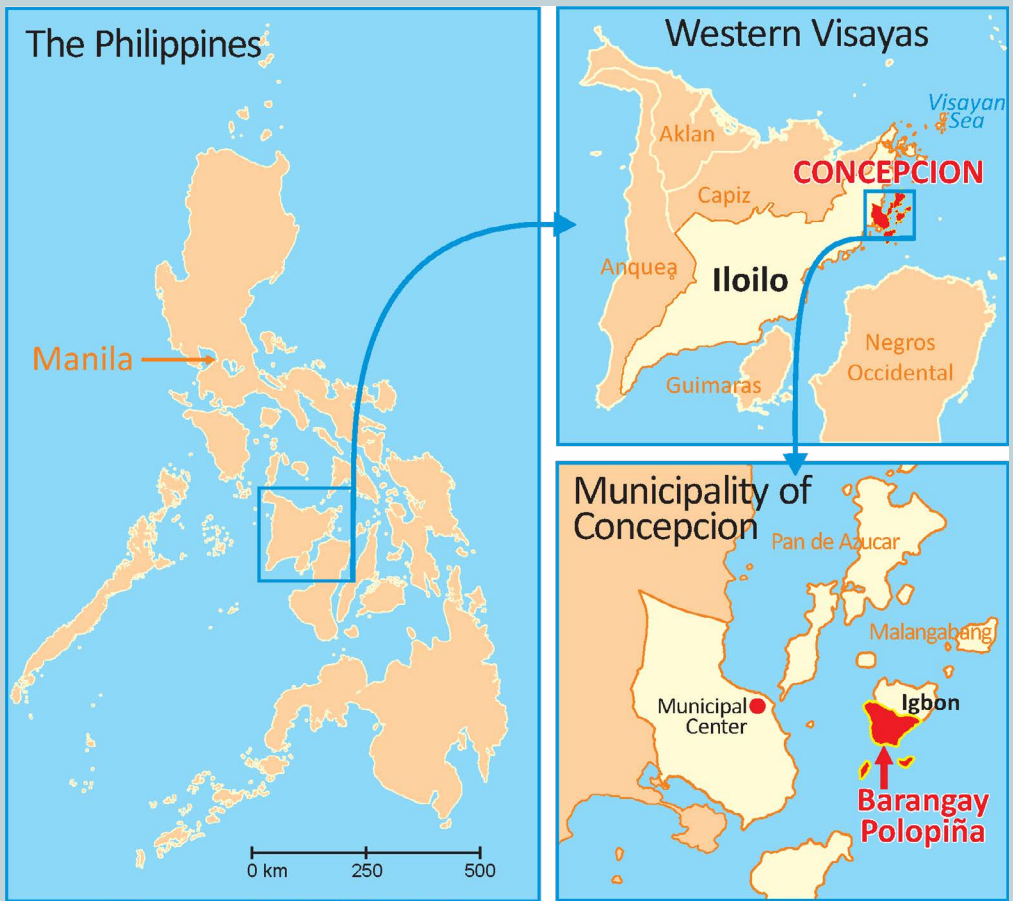


Figure 43 Map of the western Visayas region, highlighting the location of Concepcion, Iloilo and the sea ranch site at Brgy. Polopiña

Source: SEAFDEC/AQD Sea Cucumber Program



Figure 44 Wild sandfish (*Holothuria scabra*) in their natural habitat at Barangay Polopiña, Concepcion

Source: SEAFDEC/AQD Sea Cucumber Program

Concerns of scientists and the community that the project aimed to address

The project on community-based sandfish sea ranching at Concepcion primarily aimed to:

- enhance stocks of sandfish in the area
- diversify livelihood options among local fishers, with sea cucumbers from the sea ranch supplementing income, especially during the lean fishing seasons.

The project also aimed to find out if a sandfish sea ranch could establish and operate in the area through:

- biophysical and environmental assessments
- socio-economic profiling that included local community structure, organisation and management.

The project explored some capacity-building strategies through demonstration and collaboration. It was concerned with sustaining the active participation of local partner fishers in project activities.

Socio-economic conditions

In January 2014, participatory coastal resource and community mapping workshops were done at Barangay Polopiña. In these activities, community members mapped out their resources in relation to:

- location
- gender roles
- socio-economic structure and distribution.

They made various sketch maps of their village, indicating:

- the general locations of houses, village hall, chapels, ports, rice fields, childcare centre, primary schools, secondary school, cemetery, port, plazas and basketball courts
- divisions of the 8 smaller hamlets/districts (*sitio*), although the indications of boundaries were not accurate.

Barangay Polopiña was home to about 180 households. The participants identified the lack of reliable transport as a significant factor that restricted residents in going between different *sitio* and other villages.



Figure 45 Community resource mapping workshop at Barangay Polopiña, Concepcion

Source: SEAFDEC/AQD Sea Cucumber Program

The common natural resources in the village were:

- fruit trees, like mango and coconut
- agriculture products, such as rice, root crops, corn and banana
- resources in the sea, such as corals, seagrasses and beaches, which were mainly accessed by men.

The seasonal activity calendar showed the important activities, and the months when each activity was done. The calendar also highlighted the roles performed by men and women. The primary task of most men was fishing out at sea. Women and female children generally did household chores. Women also earned income from:

- storekeeping or vending
- working in a crab processing plant
- fabricating nipa palm shingles as roofing material – called *pamawod* locally.

Both men and women participated in *copra* (sun-dried coconut meat product) and charcoal making. Most of the people considered February, April, and December the ‘happy periods’, because of festivities like Valentine’s Day, religious celebrations or *fiestas*, and Christmas. September was regarded as the month of fish catch abundance. However, March and June were considered ‘stressful periods’ due to anticipated high expenses, particularly school fees.

The participants stressed that families in Barangay Polopiña were generally poor (90%) or middle class (10%). No prominently wealthy household was mentioned. A poor household was a simple house, commonly made of bamboo and nipa palm shingles for roofing. The household members had no stable source of income, often doing labour-related work for a small fee. A middle-class household typically had a house made of concrete and galvanised iron sheets for roofing. At least one household member had a steady income source or a small business.

The primary livelihood was fishing (84%), while others operated small businesses (7%). Some (9%) relied on remittances from other family members who were employed at the town, a nearby city, or abroad. On average, respondents earned PHP3,350.00 monthly. The combined income per household was PHP5,877.00. Many (44%) of the residents in village had their income supplemented by donations and amelioration allowances from:

- non-governmental organisations (NGOs)
- government organisations (like the Department of Social Welfare and Development)
- relatives.

Site selection, assessment and profiling

Some candidate coastal villages in Concepcion, Iloilo were initially assessed with the assistance of the local government and community partners. The aim was to identify a good pilot site for sea cucumber ranching. Polopiña, Tambaliza, Talotu-an, and Malioglog, were the 4 potential sites evaluated in October 2012, following general criteria.

Among the potential sites, Polopiña was the most promising site because it met the general suitability requirements. The area:

- was in a cove, generally protected from strong winds and rivers that might flood the site with freshwater
- had very good seagrass cover
- had suitable sandy-muddy substrate sediments (Altamirano et al. 2017).

Importantly, some wild sandfish were still there, which were eventually used as vital local producers of more juveniles for seeding. Equally important was an organised group of local fishers named Sitio Looc Small Fisherfolk Association (SILOSFA). Its members were cooperative and eager to participate in the project.



Figure 46 Members of the community and local government assisting with site selection

Source: SEAFDEC/AQD Sea Cucumber Program

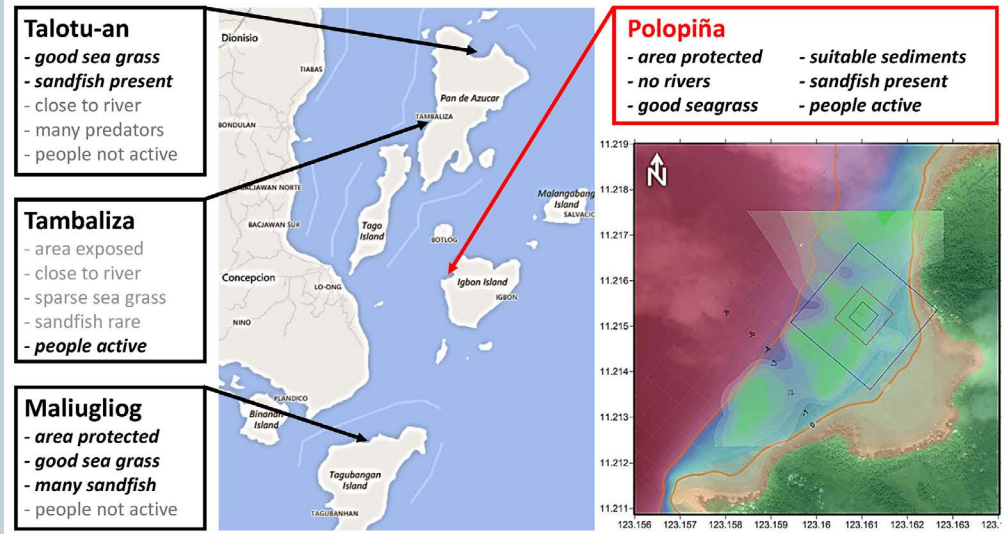


Figure 47 Potential sea ranching sites around Concepcion, Iloilo with general site descriptions (left), and coastal profile of Sitio Looc in Brgy. Polopiña (right)

Source: SEAFDEC/AQD Sea Cucumber Program

A more detailed biophysical survey to characterise the Sitio Looc site was conducted in June 2014. Various parameters were assessed, such as:

- seagrass cover
- substrate penetrability
- sediment size composition
- chlorophyll and organic matter content.

Results showed that seagrass cover of the site varied from 15% to 30%, dominated by seagrass *Enhalus acoroides*. Sediment total organic matter (TOM) was high at 7% to 10%. This was associated with mainly medium-fine particles in this site. Average chlorophyll content in this area was 2 ug/g.

9.2 Intervention

Community engagement and people's organisation (PO) participation

Initial meetings with SILOSFA happened in August 2013 to learn about the organisation's:

- history
- activities

- conflict-resolution strategies
- perceived effectiveness of the officers in carrying out their duties and responsibilities.

Four officers and 3 members participated in these meetings. The officers reported that there were about 100 members at the time of reorganisation in 2011. In 2014, this had declined to 36, then to only 29 active members in 2015.

SILOSFA members stressed that most of the members had shifted their priorities into rebuilding their families' livelihood because of the impact of Typhoon Haiyan. The typhoon devastated the islands in November 2013. Various forms of assistance from different organisations let community members take part in several projects that had better opportunities than SILOSFA. Similarly, the unequal distribution of the opportunities among the community members greatly affected the SILOSFA members' participation. Members who did not get assistance lost interest in the project. This resulted in a decline of numbers, with only a few volunteers continuing to assist with the activities.



Figure 48 Initial community meeting in Barangay Polopiña

Source: SEAFDEC/AQD Sea Cucumber Program

Relations with the government

A consultation with the local government officials of Concepcion, Iloilo was done in August 2013. During the consultation, the project proponents gave an overview of the collaborative sea cucumber research project of the Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC/AQD) and the Australian Centre for International Agricultural Research (ACIAR). The local government was positive towards the project. In October 2013, a Memorandum of Agreement (MOA) was signed between:

- SEAFDEC/AQD
- the Local Government of Concepcion
- the Municipal Fisheries and Aquatic Resources Management Council (MFARMC)
- the SILOSFA of Barangay Polopiña.

To strengthen governance, an Executive Order was signed by the Municipal Mayor of Concepcion in May 2014. This officially designated the 5 ha portion of the Sitio Loooc in Barangay Polopiña coastline as the pilot site for the community-based sandfish sea ranch. The Municipal Mayor then formed and led a Technical Working Group (TWG) to help manage the sea ranch site.

Relations with external partners

The sandfish sea ranching project managed by SILOSFA attracted some NGOs and the association was eventually granted extra projects. From 2015, SILOSFA was working with international NGOs such as Conservation International, Zoological Society of London and other organisations from 2015.

The project also initiated a collaboration with the local university: the Northern Iloilo Polytechnic State College, Concepcion Campus (NIPSC-Concepcion). A formal



Figure 49 Signing of the MOA among project partners at Concepcion, Iloilo

Source: SEAFDEC/AQD Sea Cucumber Program

2-year collaborative agreement started in May 2015. It aimed to enhance the capacity of NIPSC-Concepcion in locally producing hatchery-bred sandfish juveniles. The project helped NIPSC-Concepcion modify their existing hatchery and pond facilities for breeding and nursery culture of sandfish. Selected staff from NIPSC trained in the skills required for sea cucumber hatchery, nursery operations and management at SEAFDEC/AQD Main Station in Tigbauan, Iloilo. This enabled them to do the daily tasks needed for sandfish culture at NIPSC-Concepcion.

Acceptance of the project within a wider community

Results from the June 2014 household survey of 94 participants showed that:

- 67% knew about sea cucumbers, that these are collected in low tidal shores, and are processed and dried to be sold for a high price
- of the respondents that know about sea cucumbers, only 18% collected them through diving and gleaning
- among the various sea cucumber species, 2 were preferred – the dragonfish *Stichopus horrens* (locally known as *hanginan*) and the sandfish (*Holothuria scabra*), locally known as *kiskisan*

Half (50%) of the 94 respondents were aware of the sandfish sea ranching project in their community. Of these respondents:

- 85% knew about it through meetings held in the barangay
- 15% knew about it through their neighbours and local government officials
- 72% believed that they would benefit from the project through:
 - increased income (55%)
 - more knowledge about sandfish (17%)



Figure 50 Staff of NIPSC-Concepcion conducting hatchery production of sandfish

Source: SEAFDEC/AQD Sea Cucumber Program

- enhanced wild population of sandfish in their coastal area (14%)
 - providing an opportunity to partner with other organisations (7%)
 - promoting cooperation among residents (7%).
- 68% believed the fishers, residents and PO members were the primary beneficiaries of the project
 - 83% were willing to participate because of the prospect of increased income (57%) or the opportunity to gain more access to the resource (13%)
 - 25% wanted to know more about the project and sandfish processing methodologies
 - 4% wanted to engage in environmental/social projects.

When asked to identify the project-related activities they wanted to participate in:

- 51% would attend meetings
- 29% were willing to volunteer
- 14% wanted to be labourers
- 6% were willing to become an active local partner or leader.

The community residents broadly participated in the barangay-wide information, education, and communication campaign about the project. SILOSFA officers hung posters in public places for community residents' information. As the project progressed, local children became more interested in sandfish. Some even participated in light activities like monitoring sandfish stocks from nursery nets.



Figure 51 Local children helping in the monitoring of sandfish stocks from the sandfish nursery

Source: SEAFDEC/AQD Sea Cucumber Program

Agreement on rules and compliance with regulations

Survey results indicated that the majority (82%) of respondents agreed that access to project stocks should be regulated. The types of regulation methods preferred were:

- seasonal collection (75%)
- regulation on use of gears (51%)
- regulation on size (68%)
- setting of total allowable catch (35%).

However, these management options were not legally realised during the project.

The respondents were asked to rate their degree of trust toward local project implementers using a Likert scale of 1 to 10 (1 – least trustworthy and 10 – most trustworthy). Results were:

1. municipal level government (5.6)
2. the local village government (5.3)
3. SILOSFA (4.7).

They said that, although SILOSFA worked actively for the benefit of the community, their efforts were limited because of the lack of cooperation from the residents. There was more apparent trust with the local government because people believed that project implementation and management was an inherent part of their responsibilities.

To enhance security and deter potential poaching at the sea ranch site, the community agreed to build a watchtower with help from local partner fishers. A small patrol boat, equipped with a search lamp, was also refurbished for SILOSFA to aid in safeguarding the ranch site.



Figure 52 The watchtower and floating sandfish nursery at Polopiña

Source: SEAFDEC/AQD Sea Cucumber Program

Conflicts and conflict resolution

The primary concerns raised during the focus group discussion with SILOSFA were:

- poaching
- obstruction of navigational routes
- encroachment within the ranch by non-members.

The usual causes of conflict between and among members of the organisation were:

- grievances about the selection of particular member/s to participate in the project's activities
- the compensation or incentive to do labour for the project
- rumours and gossip.

The organisation had not established a conflict management scheme. Hence, some members and officers who were unsatisfied or had conflicts with subordinates decided to resign from SILOSFA.

Knowledge-, skills-, and capacity-building activities

The active members of the organisation participated in a range of activities such as:

- sea ranch site assessment
- constructing the holding pens
- stocking the sandfish juveniles
- monthly monitoring
- repairing and maintaining the sandfish floating nursery hapa nets and sea pens.

Members received some financial incentive from the project fund for most of these activities.

During the regular monthly monitoring, participants were briefed and oriented on what tasks were required and how to do them under researchers' guidance. The members were also trained to do tasks on their own, such as replacing floating nets and monitoring and maintenance work outside of the regular monthly schedule. In some cases, researchers also learnt from

the rich traditional knowledge, skillset and experiences of local partners. For example, it was the members' original idea to reinforce the nursery sea pens by attaching ship chains. This drove the nets more securely into the sediment to deter sandfish from escaping while buried. Some members were also skilled divers and could practice and enrich their diving skills during the project.

Social data collection

A baseline socio-economic survey was conducted in June 2014 with 94 respondent fishers, representing their households, to understand more about the composition of the community. They were grouped into:

- non-SILOSFA members (65)
- SILOSFA members (29) – the total number of organisation members at that time.

The average:

- age of the respondents was 47
- education level was at least primary school completion
- time living in the community was 37 years
- household size was 5.

Most (66%) were married and had 3 children. The community was mainly Catholic.

The respondents were primarily engaged in fishing (84%). They were involved in fishing as young as 15 and had been doing this livelihood for 29 years on average. More than half (57%) believed that the income they earned from fishing was not enough. Of these respondents, 83% said they could not engage in other income sources because of a lack of education, or because their families had always been in this occupation. Most (94%) used gillnet or longlines targeting squid, crabs, and sardines. Of the fishers:

- 73% had boats
- 27% said they borrowed the boat(s) from fish dealers in their barangay (they did not pay for the boat, but had to sell their catch to the boat owner).



Figure 53 SILOSFA members repairing nets and reinforcing sea pens

Source: SEAFDEC/AQD Sea Cucumber Program

9.3 Results

The regular consultations and meetings with the community and government have improved their general awareness and concern about the declining:

- wild stocks of sea cucumbers
- conditions of the environment.

They believed that the sea cucumber ranching project might help recover the population of sea cucumber in the coasts. It might also provide various supplemental benefits to the community and the municipality. They showed strong support through:

- their eagerness to make the Memorandum of Agreement (MOA) between partners in 2013
- their continuous assistance throughout the project.

The release of sandfish juveniles at the Sitio Looc site in Barangay Polopiña, Concepcion started in July 2014, ending in November 2016. Over those 2 years, a total of 16,975 sandfish juveniles were reared in the floating nursery sea pens and were eventually released in the sea ranch. In a good season with calm waters and only light rains, sandfish grew well. However, prolonged slow growth was recorded during seasonal adverse weather conditions (for example, heavy rainfall during wet season, or intense heat during summer). Monitoring data from the sea ranch during times of frequent typhoons in the area commonly yielded low recovery.

Natural predation might be high in this area. It is adjacent to some Marine Protected Areas (MPAs) which could harbour a diverse species of potential predators of sea cucumbers. Other factors that may have impacted mortality rates included:

- sandfish escaping from the damaged pens
- human interventions, like deliberate poaching or accidental trampling while gleaning.



Figure 54 Stocking floating *hapa* net nurseries with sandfish spats

Source: SEAFDEC/AQD Sea Cucumber Program

Conducting systematic monitoring of sandfish in the ranch was difficult because of the depth (ranging up to 4 m) of the site and the complexity of seagrass beds. As a result, there was not enough quantitative data to support the larger number of sandfish stocks within the ranch. However, there were multiple months when some big sandfish were recorded. Anecdotal reports from the local community also mentioned:

- increased sightings of large (harvestable) sandfish around the site
- greater numbers of sandfish juveniles occasionally seen in shallow edges of the cove.

Aside from sea cucumbers, the number of other resources like crabs, squid and various fish were also noted to have increased around the sea ranch. SILOSFA members did not collect sandfish from the site because they feared depleting the stocks early.

Hence, grow-out production in the sea ranch site was a challenge and the economic benefits were not yet realised during the short 3 years of project implementation.

The refurbished hatchery at the NIPSC-Concepcion demonstrated good hatchery production capability. It produced as much as 23 million larvae per batch. However, since the optimal capacity of the small hatchery was only for 500,000 larvae, most of the larvae were discarded. In 2016, the NIPSC-Concepcion hatchery produced 5,864 sandfish spats that were transferred to the sandfish floating nursery at Sitio Looc in Barangay Polopiña.

The collaboration of NIPSC with the project was also instrumental in granting their 'National Accreditation and Compliance' certificate for excellence in research and extension work.



Figure 55 Bigger sandfish collected from the sea ranch during monitoring

Source: SEAFDEC/AQD Sea Cucumber Program

SILOSFA is still active. However, the members' participation has continued to decline. The organisation's Chairman emphasised that the members' unsustainable involvement in the project activities was due to them having other opportunities. These included seasonal jobs like construction work, which offered relatively higher compensation. Some members also preferred to focus their efforts on new projects awarded by non-government organisations (NGO) that provided higher and quicker income.

9.4 Lessons learned and new strategies

A project evaluation workshop was conducted on 1 March 2017. Stakeholders that attended included:

- the Concepcion municipal and barangay government officers
- the Fisheries and Aquatic Resources Management Council (FARMC)
- NIPSC-Concepcion personnel
- SILOSFA members
- SEAFDEC/AQD.

The primary workshop objectives were to:

- determine the performance of the project, based on the perspective of each stakeholder
- identify gaps and actions needed for future engagements.

A rating system was used (1 – lowest, and 10 – highest) and were independently scored by stakeholder groups: (1) Government, (2) Researchers, (3) Community. All groups rated project performance on 'Environment improvement' highly (8.0 to 9.8). Government and Community groups rated 'Increase in fisheries stocks' highly (9.75-10.0), while the Researchers group rated this 7.6. This indicated that stocks were qualitatively observed to increase by fishers but were limited in quantitative data from monitoring sites. 'Community participation' and

'Government support' also had the low ratings of 7.4 and 6.8 by the Researchers group. This indicated that future engagements need more focus on social linkages. Some recommendations from the workshop were:

- strengthen law enforcement and support from the Government
- more information, education and communication (IEC) activities to all stakeholders
- increase and enhance the capacity of NIPSC hatchery
- consider other sites for establishment/ expansion of the sea ranch/nurseries.

To address the pressing concerns faced during the project, the biophysical team will:

- focus on identifying other potential sea ranch sites, adopting a modified criteria based on experiences from this pilot site
- use a more rigorous survey monitoring scheme to cover target areas, particularly adjacent to the nursery pens, in addition to regularly monitoring the sea ranch site.
- train local partners on properly documenting sea cucumber sightings, including outside of the scheduled monitoring calendar, to support anecdotal accounts.

The social team will focus on building the PO capacity and empowering leaders and members. Officers and members of the organisation, as well as the community residents, all need to shift their attitudes for the project to realise its potential. The PO's leadership must be reliable, committed, and dedicated to directing the group in effectively implementing the activities with a vision of the long-term goals and results.

The researchers will develop attractive sea ranching culture activities to encourage continuous active participation from the members. Alternative and diversified nursery and culture approaches can also be



Figure 56 An example of the Project Evaluation Workshop output by the researchers group
 Source: SEAFDEC/AQD Sea Cucumber Program

explored to increase and scale up sandfish production in the area (Junio-Meñez et al. 2017). Members will have specific tasks that are fit for their skills and experiences and will get related incentives for motivation.

Regular (for example, monthly) meeting activities will be held with all partner stakeholders (including the Government, researchers, and the community), in order to:

- update the progress of the study
- discuss and resolve conflicts between and among partners.

All partners will practise delivering constructive feedback to each other and encouraging members to do all tasks to a high standard. Meetings can also develop realistic management schemes like catch size, harvest frequency, and trading regulations that the local community residents agree to implement.

It is also crucial to analyse the roles of women and men in future engagements to identify more appropriate sets of activities for any gender (Suyo and Altamirano, 2016). Future work may focus on the production and marketing chains of the sea cucumber industry in the region.

This would determine the degree of men and women’s participation at different segments of the value chain. The results can then be used to establish interventions relevant to certain groups of stakeholders (for example, women). These interventions may include:

- training for women on sea cucumber processing
- formulating market access strategies that will promote the growth of the industry in the long term.

9.5 Acknowledgement

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9.6 References

- Altamirano JP, Recente CP, Rodriguez Jr JC (2017) Substrate preference for burying and feeding of sandfish *Holothuria scabra* juveniles. *Fisheries Research*, 186 (2): 514–523. <https://doi.org/10.1016/j.fishres.2016.08.011>
- Fernandez P (2006) The relevance of Governance Institutions in Marine protected area design and management: lessons from North-eastern Iloilo, Philippines. *Science Diliman*, 18(1): 18–24.
- Fernandez C, and Subade R (2015) Perceptions of Fishers towards Marine Reserves in Iloilo Coastal Communities, Central Philippines, *Asian Fisheries Science*, 28: 198-212.
- Juinio-Meñez MA, Tech ED, Ticao IP, Gorospe JR, Edullantes CMA and Rioja RAV (2017) Adaptive and integrated culture production systems for the tropical sea cucumber *Holothuria scabra*. *Fisheries Research*, 186: 502–513. <https://doi.org/10.1016/j.fishres.2016.07.017>
- Suyo JGB, Altamirano JP (2018) Mapping gendered spaces for sandfish resource Management in Guimaras, Philippines. *Fish for the People*, 16: 20–25.



Figure 57 The local community residents of Sitio Looc, Barangay Polopiña

Source: SEAFDEC/AQD Sea Cucumber Program

10 Identifying the social conditions for successful mariculture: Discussion and comparison



Credit: Mark Anthony Perandos

10

Identifying the social conditions for successful mariculture: Discussion and comparison

Nicholas McClean¹ and Michael Fabinyi¹

¹Climate, Society and Environment Research Centre, University of Technology Sydney

This technical report explores the question: under what conditions can sustainable, community-based sandfish sea ranching be established in tropical coastal environments? More specifically, it reflects on the experiences of implementing a particular model for community-based sea ranching in the Philippines.

The case studies in this technical report identify likely conditions for success and common challenges facing community-based sea ranching. An initial insight is that even with a model developed specifically for conditions in the Philippines, some areas had success, but this was highly variable.

Project establishment (including receiving active community support), release and monitoring were successfully implemented in most cases. Production rates were also, in most cases, sufficient to demonstrate the viability of sea ranches from a biophysical perspective. In theory, this should:

- support the financial viability of sea ranches
- lead to successful delivery of fishery and ecological benefits, where other social and economic factors do not intervene.

However, harvesting sandfish was much more variable because of irregular guarding and poaching being common problems across many sites. So, while social and ecological success tended to be more common (although results were still variable), high levels of economic success proved much harder to attain.

Qualitative assessments were made by project node leaders and social research staff on the overall economic, ecological and social success of the initiative. This assessment was based on key issues highlighted in the introduction, relating to:

1. effective integration with local livelihoods (economic dimension)
2. contributing to fish stocks and wider ecosystem health (ecological dimension)
3. community-level governance (social dimension).

The assessment was also based on the goals of the project to deliver new livelihood opportunities to coastal communities and to restore sandfish stocks, and considered in light of the sustainable livelihoods approach (SLA) approach taken, which integrates social and economic aspects to assess livelihoods.

Table 2 presents assessment criteria⁵.

⁵ It should be noted that these assessment criteria were developed for sea ranches as pilot activities. If a sea ranch was a fully established venture, the threshold for a high rating, for example, would be greater than it was for a pilot.

Table 2 Qualitative assessment criteria of pilot sea ranches

Qualitative assessment criteria of pilot sea ranches across economic, ecological and social dimensions		
Economic	High	Financial returns from harvest of marketable sandfish met expectations and demonstrated sea ranch viability
	Medium	Financial returns were below expectations but sufficient to encourage further efforts/investments by communities
	Low	Payment of wage labour or minimal returns on harvest/buy-back only
	Zero	No financial returns realised
Ecological	High	Spawning events occurred, and spillover was observed/reported
	Medium	Spawning events were observed sufficient to suggest spillover, though evidence was not documented
	Low	Spawning events may have occurred though not observed and/or unclear if these were sufficient to provide spillover
	Zero	No ecological benefits realised
Social	High	Support through all phases from PO, LGU, community. Conflicts could be resolved, and ongoing collaboration realised
	Medium	Support from all key actors was attained though some unresolved conflicts and difficulties occurred
	Low	Support from key actors not attained, or substantial drop-offs in support/participation over time strongly impacted project success
	Zero	No support from key actors prevented effective implementation

Table 3 summarises the cases relating to the success or failure of different aspects of the project across the 8 sites. These were the main assessed stages of sea ranch implementation:

- **Establishment:** Whether the project was successful in gaining the support of a community and a people’s organisation (PO), and the permission from the local government unit (LGU) to establish the 5-ha sea ranch.
- **Release:** Whether hatchery-reared juveniles were successfully released into the sea pen.
- **Effective monitoring:** Whether the growth of the juveniles was regularly monitored by the PO.
- **Production and grow-out:** Whether survivorship and growth rates were sufficient to demonstrate sea ranch viability from a biophysical perspective.
- **Regular guarding:** Whether regular guarding took place throughout the project.⁶
- **Harvest:** Whether a successful harvest occurred at the end of the grow-out phase.

Table 3 Qualitative assessment outcomes for pilot sea ranches

Site	Establishment	Release	Effective monitoring	Production and grow-out	Regular guarding	Harvest	Economic	Ecological	Social
Victory	Yes	Yes	Yes	Yes	Yes	Repeated harvests	Medium	High	High
Masinloc	Yes	Yes	Yes	Yes	Yes	1 x low volume	Medium	Medium	Medium
Sablign	Yes	Yes	Yes	Yes	Yes	1 x high volume	Medium	Medium	Medium
Imbo	Yes	Yes	Yes	Yes	N/A	No	Medium*	Low	Medium
Kauswagan (1 ha only)	Yes	Yes	No	No	Unclear	No	Low*	Medium	Low
Laguindingan	Yes	Yes	Yes	Yes	Unclear	No	Low*	Medium	Low
Maliwaliw	Yes	Yes	Yes	Yes	Yes	Yes – for broodstock	Medium**	High	High
Concepcion	Yes	Yes	Yes	No	Unclear	No	Low	Low	Low

* Income from juvenile buyback, not from harvest.

** In this case the PO members chose to forego income from sales of mature sandfish, instead providing these to the local hatchery as broodstock. Effectively this income was reinvested into the project by the PO, and the only income realised directly by PO members was from guarding/monitoring.

6 While it would be more desirable to be able to assess the effectiveness of guarding in deterring poaching, which is its purpose, this is not a link that can be established with any certainty due to the inherent difficulties of guarding itself, which is required to be '24/7' to be fully effective, and difficulties measuring its effects.

Table 4 summarises the basic socio-economic conditions of each site, based on information reported in the cases.

Table 4 Livelihoods and basic socio-economic data in pilot sea ranch sites

Site	Main livelihoods	Cash income	Median or average income below poverty threshold at time of survey*	% of provincial population living below poverty threshold at 2012*
Victory	Primary livelihood: fishing (67%). Secondary livelihoods: mat-weaving, labour, small business, poultry.	PHP1,100.00 per month	Yes	12.5%
Masinloc	Primary livelihood: fishing (90%). Secondary livelihoods: farming, salt making.	PHP10,000.00 to PHP60,000.00 per month	No	18%
Sablign	Primary livelihoods: fishing (47%), farming (41%). Secondary livelihoods: mat-weaving, seafood trading, wage labour.	PHP21,800.00 per month	No	9%
Imbo	Primary livelihood: fishing/fish rearing, principally as sole income. Secondary livelihoods: gardening/ animal husbandry, salt-making, wage labour.	PHP1,000.00 to PHP4,000.00 per month	Yes	9%
Kauswagan	Primary livelihoods: fishing (44%), farming (29%), other (24%).	PHP500.00 to PHP4,000.00 per month	Yes	41%
Laguindingan	Fishing/gleaning, agriculture, charcoal processing.	PHP1,000.00 to PHP5,000.00 per month	Yes	35%
Maliwaliw	Fishing, agriculture.	PHP1,000.00 per month	Yes	44%
Concepcion	Fishing, agriculture, small businesses.	PHP5,877.00 per month	Yes	37%

* Based on Philippines National Statistics Office data available at <https://psa.gov.ph/>

There are 3 broad conclusions from this initial overview analysis.

Firstly, the diversity of experiences documented in the case studies highlights a theme emerging from work elsewhere on sandfish mariculture (Eriksson et al. 2018). That is, 'blueprint' approaches, such as the broad models of Bell et al. (2008b), or even the community-based model developed for the Philippines discussed here, provide useful guides for how to approach sandfish sea ranching at a broad scale. However, they are insufficient on their own for addressing all the factors that impact on the success or failure of an initiative. There is a complex suite of factors that impact project success at the community level. A 'diagnostic' approach (Andrew et al. 2007), applying broad principles in context-specific ways and through context-specific processes of project planning and implementation, is required.

Secondly, the key challenge for sandfish sea ranching remains translating the promising progress in establishing sea ranches into successful harvests that deliver substantial livelihood and fishery benefits. This includes the demonstrated viable production and the strong support from communities for new sea ranch projects.

Thirdly, while economic returns are no doubt a critical aspect of maintaining community support, a wide range of other factors influence project success at the local level. Prominent factors include:

- market factors
- socio-economic dynamics
- internal dynamics of organisations
- the growth rates and productivity of sites
- relations with wider communities and government agencies.

These are the 3 broad key findings for this technical report:

1. Community-based sea ranching is likely to be more successful where a diagnostic approach to applying broad models and frameworks in specific communities is taken.
2. Further efforts to develop sea ranches must focus on effectively navigating the long grow-out period until the harvest phase, to find ways for available culture techniques to be translated into meaningful livelihood benefits for communities.
3. While economic returns are likely the single most important factor in maintaining participation and support for sea ranches at the local level, multiple factors influence the success of sea ranching from a social perspective.

There remain substantial insights from these cases to help:

- develop diagnostic approaches to sea ranch development
- address the challenges of the long grow-out period
- identify the factors likely to influence sea ranch success in a particular community.

To derive more detailed findings, the next sections structure this analysis around the 3 key issues addressed in the introduction and used for qualitative assessment:

- Integrating with local livelihoods.
- Fisheries governance systems.
- Community-level governance and benefits sharing.

10.1 Livelihood benefits of sandfish mariculture

Sea cucumber mariculture thus far has generated some, though not substantial, financial benefits at the household level. These have been through:

- harvests
- production of juveniles for buy-backs
- wages to PO members for constructing, maintaining and guarding the sea ranches.

The community-based model applied in 7 of the 8 cases taken relied on PO members deferring financial returns for the length of the grow-out period. This meant a key criterion for economic success was whether the projects demonstrated viability, or at least sufficient promise for community members to maintain their participation. So far, no sites have proven sufficiently profitable to demonstrate standalone financial viability of community-based sea ranches. In 4 cases, economic returns were sufficient to create an incentive for community members to invest more time and effort. In 3 cases, returns were low to the point where most community members decided not to invest more time or effort. Although, in these cases certain individuals and households stayed motivated to participate. It is important to note that the community-based ocean nursery grow-out did provide a high level of economic return relative to the time invested. Time was much shorter due to the buy-back of juveniles being the main aim of the process.

The pilot case for community-based nursery rearing in floating hapas in Imbo did not get high financial returns. Returns were still sufficient to incentivise further involvement. Importantly, they were also high relative to the time, producing a return after only 2 months. This is a valuable and positive experience in the wider context

of community-based mariculture. It demonstrates a method for:

- providing additional income early in the production cycle
- creating incentives for public and private partnerships
- providing opportunities for small fishers in nursery production whether for sea ranching, restocking or stock enhancement (Juinio-Meñez et al. 2017).

The issue of guarding shows how community members equate how they choose to invest their time and effort to ensure they have sufficient income. At the sites that did not have high economic returns, livelihood-related factors that were reported as positively influencing guarding vigilance included:

- the direct observation of successful grow-out and high production rates (for example, Maliwaliw, Victory)
- the proximity of ranch sites to the homes of PO members (for example, Victory).

Strong drop-offs in guarding and participation happened where:

- the results of production and grow-out were viewed as below expectations
- communities had to invest more effort to guard sea ranches (for example, when they were further from their homes), or had other, readily available ways of getting income (for example, Concepcion, Sablig).

It is evident that project success will likely support sustained participation. Beyond this, these points also demonstrate that the labour and time involved in PO meetings, maintenance and guarding are likely significant enough to represent an opportunity cost for community members under most conditions. This opportunity cost must be taken seriously when addressing the causes of variable project progress. All but 2 of the project sites

engaged communities with large numbers of households likely living below the formal poverty threshold and relying on a mix of subsistence and cash livelihoods. There is a possibility however that these opportunity costs are not always substantial enough to prevent sustained participation, as there were cases where people persisted with these efforts regardless of low economic returns.

Community members appear to weigh participation in sandfish mariculture against a shifting array of income-generating and subsistence-based activities across the year. They likely look at immediate needs and the promise of future benefits. Seasonal fluctuations in livelihood incomes and expenses common to coastal livelihoods in the Philippines (Fabinyi 2012) may cause household-level financial stresses. These may also influence short-term choices about participation in different livelihood activities. It is not clear, for example, if poaching increases at the same time as periods of low income/livelihood stress. This is an issue that requires further research in sandfish sea ranching. However, the Philippines experience suggests that if sea ranching can address these periods of livelihood stress and risk, this may be a key to maintaining participation where economic returns are not sufficient to provide a standalone livelihood or main source of income.

Further to this, the issue of connections between participation, economic hardship and the delivery of economic benefits highlights a key concern raised by a number of authors. Community-based sea ranches involve those least able to bear the financial risk of sea ranch establishment, with coastal communities bearing that risk (Eriksson et al. 2012, Purcell et al. 2013). By contrast, external investors would be more well-suited to take on greater levels of financial risk than poor households. Such investment could potentially result in greater volumes

of sandfish, which would be appealing to buyers, and could generate greater profits from harvests. Investors could also provide consistent wages to participants in sea ranching, which may promote more consistent surveillance, monitoring and other work.

This was investigated to a degree during project activities at sites such as Victory (Marie Antonette Juinio-Meñez pers. comm.). The concept of 'production clusters' was also proposed and trialled elsewhere in the Philippines to develop effective, scalable production systems, and incentivise traders along the value chain to invest in sea ranch development (Juinio-Meñez et al. 2017). However, a key challenge for this approach was to attract investment from buyers who were committed to sourcing these premium-grade, large-sized sandfish. Currently, the market for sea cucumbers in the Philippines is not particularly selective (Brown et al. 2010). Traders in the Philippines who export largely to Hong Kong essentially buy sea cucumbers of any size and quality. There is minimal incentive for buyers to invest in sea ranches that defer returns for up to an 18-month grow-out. However, if investors are buyers of local wild caught sandfish, this may:

- see a disincentive for buyers to purchase undersized product
- positively influence compliance with minimum size regulations.

In general, these insights highlight that the success of sea cucumber mariculture is intimately tied to market factors, and the success of sea cucumber fishery management more broadly. The latter is discussed more in the next section.

Finally, non-financial benefits which support livelihoods also proved significant in the eyes of some POs. For example, there was improved relationships and co-operation as a result of PO membership, and improved levels of education and capacity. Maliwaliw

and Victory are the best examples of these, where social support was very high and non-economic benefits actively valued by PO members. Sandfish mariculture education in these interventions often revolved around improved skills and capacity at the household level. Households have gained:

- improved skills in sandfish mariculture
- improved knowledge about sandfish biology
- more widely transferable skills related to financial management.

In future, options may exist to expand knowledge of sandfish processing to a wider set of community members, providing options to 'upgrade' along the value chain (Purcell and Lalavanua 2017).

10.2 Key findings

Community-based sea ranching, at this stage of development, can serve as a supplemental livelihood activity, rather than a main source of income. Its chief value will therefore likely be in adding an element of positive diversification to a broader livelihood portfolio (Cinner and Bodin 2010; Torell et al. 2017; Hair et al. 2019).

Projects are therefore most likely to succeed in generating livelihood benefits in 1 of 3 scenarios:

- Livelihoods provide adequate and stable incomes already, and community members are, economically speaking, in a position to invest time and labour in a project for future reward.
- Sea ranching can provide an occasional or backup source of income that may be drawn on if other livelihood options fail, or alleviating periods of low income during the year.
- Investors further up the value chain are willing to invest in ranch development and employ community members directly for their labour.

10.3 Fisheries management and ecological benefits

Of great promise is that some cases reported wider fisheries and ecological benefits. This was generally expected to be a less likely or substantial outcome relative to benefits to PO members during the pilot stages of sea ranch development. However, in Victory, improved catches of sea cucumbers were regularly reported by community members, including fishers and traders, and were attributed by them to the sea ranch. A landings survey conducted by University of the Philippines – Marine Science Institute staff corroborated the increased catches (Marie Antonette Juinio-Meñez pers. comm.). These were considered by PO and community members to be the most significant benefits flowing from the sea ranch. This is a key example as it was also an important aspect of the social success of the project. PO members were regularly acknowledged for their contributions to the wider fishery, and the motivation to maintain involvement in the sea ranch was strong as a result.

In at least 2 other sites, sandfish were observed in areas adjacent to the ranching sites. Spawning was regularly recorded in 6 sites, and particularly in sites where growth rates and survivorship were good. While spillover benefits remain to be quantitatively linked to sea ranches where they occurred, progress nonetheless supports the general view that community-based sea ranching remains a viable way to deliver these benefits at a local scale.

In terms of the role of sandfish sea ranching within the wider fisheries management system, this was a challenging aspect of the project on 2 fronts:

- relationships with local governments at the LGU and barangay level

- conflict with coastal resource users, particularly gleaners who harvest wild sea cucumbers in the intertidal zone.

Support from the LGU was a key criterion for the social success of the pilot sea ranches. Most initiatives gained sufficient local government support to allow for the full 5-ha sea ranch area to be recognised in local ordinances. This required both the municipal Bureau of Fisheries and Aquatic Resources (BFAR) LGU and the local Barangay Council to provide their support. In one case the LGU co-invested in the sea ranch by paying the wages of PO members. In Maliwaliw, the BFAR government hatchery provided juvenile sandfish for the sea ranch. In the case of the ocean nursery rearing in Imbo, the LGU were a key implementing partner. In Victory, the LGU provides monthly support to the PO equivalent to a Bantay Dagat honorarium to help enforce the sea ranch.

Despite this positive support from most LGUs, this was not always sufficient to overcome what remains one of the most challenging aspects of coastal sandfish mariculture: interactions and conflicts with coastal resource users. In Kauswagan in the Mindanao node, an area of only 1 ha was recognised by the LGU, with strong support from the local mayor, but a lack of support from the local barangay. This was driven by a lack of wider community support, particularly among gleaners who relied on the coastal zone for livelihoods. Where support was forthcoming for the 5-ha area, resource-user conflict instead emerged during the project in the form of poaching, which proved to be a common challenge. Even where guarding happened 24 hours a day, and where sea ranches were close to PO members houses, such as in Victory, this was not sufficient to prevent poaching entirely. PO members, while having legal rights to enclose the 5 ha zone for private use, could not enforce these laws. In some cases, poachers' names were recorded and

passed on to the local Bantay Dagat. In at least one case (Masinloc), responsibility for guarding was transferred to the local Bantay Dagat. In some cases, as poaching emerged, support from within local government was challenged. For example, in the Maliwaliw case neighbouring barangay residents were responsible for poaching and enlisted the support of their council to challenge the legitimacy of the MOA signed between the PO and the municipality.

In general, the experiences of these cases reflect wider patterns regarding:

- Philippines fisheries management
- sea cucumber fisheries management in the tropics.

With fisheries management in the Philippines, there are limited capacities of government agencies. Enforcement has a lack of resources, which undermines the viability of sea ranching. Granting private use rights formalises the sea ranch as an aspect of local fisheries management systems. However, if these laws are insufficiently implemented, especially through systems of surveillance and enforcement managed by fisheries agencies, then sea ranches have a decreased likelihood of success.

Most cases presented here do not examine in detail the motivations of poachers, and in some cases the identity of poachers remained unconfirmed. However, it is noteworthy that all sites at the municipal level had poverty rates of at least 15%. Poverty rates of at least 60% were reported in Maliwaliw, which had protracted challenges with armed poachers.

In Laguindingan, villages displaced by airport development had lost access to productive land. They entered coastal fisheries, including gleaning in the intertidal zone, to alleviate the economic hardship cause by their displacement. This allegedly included poaching of sandfish from the sea ranch. These mirror wider studies,

for example from the Pacific, which note that sea cucumber fisheries provide a 'safety net' for coastal communities, where they contribute directly to basic needs for income or subsistence (Eriksson et al. 2017). Strong drivers related to poaching focused on poverty alleviation and economic hardship and responding to strong market demand (for any-sized sandfish) in a largely open-access system. This contributed to substantial difficulties in enforcing laws across tropical countries (Eriksson et al. 2015; Barclay et al. 2019).

In this context, a high degree of decentralisation for fisheries decision-making in the Philippines can have both good and bad consequences. The preferences of individual LGU leaders and administrations regarding fisheries hold significant sway (Eder 2005; Russ and Alcala 2009). This allows direct relationships of support to be readily brokered for sea ranch projects. Key decision makers on local resource management are accessible to community members. However, this can also lead to a highly unstable model of government partnership. Local resource users can broker similar relationships to undermine support for sea ranches where they perceive it to act against their interests. Also, LGUs frequently lack resourcing to properly implement surveillance and enforcement systems.

For sandfish mariculture, therefore, an ongoing challenge is to work at multiple levels of government to:

- implement sea cucumber management plans
- adopt sea ranches as a key aspect of delivering on sustainability and coastal livelihood priorities.

Since poaching drivers are complex, there are more strategies targeting enforcement of size limits further along the value chain emerging. They are perhaps the most effective means of managing fisheries and

impacts on sea ranches. In the Philippines, traders in regional centres represent 'pinch-points' (Steenbergen et al. 2019). Brown et al. (2010) pointed out that across the country there are only 50 firms involved in sea cucumber trade. Eriksson et al. (2015) has proposed similar mechanisms, where the government aggregates product from fishers and then auctions them to enforce size limits. The intended benefits of these measures would be to eliminate the incentive to poach undersized sandfish from sea ranches and in the wild. This would lead to greater numbers of spawning events in sea ranches. While this may not eliminate poaching from sea ranches, it may be a substantial reduction in the incentives.

10.4 Key findings

The interaction between sea ranching and wild-capture sea cucumber fisheries, and the effective management of wild stocks, have a major impact on the success of sea ranching initiatives. Projects are therefore most likely to succeed where:

- local and provincial government authorities prioritise sea cucumber fisheries management, and develop integrated management approaches that view community sea ranches as an important part of sustainable and viable wild catch fisheries, ideally integrating actions at the local, provincial and national levels
- fishers in the community are aware of the potential benefits of sandfish mariculture for wild catch fisheries and are in a position, economically speaking and in terms of stock status, to absorb reductions in potential fishing grounds until spillover benefits are realised
- key, influential stakeholders in the fishery (for example, traders) actively support the project and communicate the benefits of sandfish ranching among their networks.

10.5 Community-level governance and benefit sharing

Community interest in establishing a sea ranch was a prerequisite for any site. On the simplest level the work done over 10 years in the Philippines reflects what has happened elsewhere: there is considerable enthusiasm for sandfish mariculture among coastal communities and local governments alike.

The value of the specific experiences of these cases in relation to community dynamics is twofold:

- Firstly, to analyse how much support from the community and participation in the PO was maintained throughout projects, and whether there were any significant patterns that indicated success factors.
- Secondly, how benefits were distributed among certain groups in communities, and whether this gave insight into how mariculture can be better attuned to the needs and realities of coastal communities.

In general, while the community-based model's social success was mixed, there were some strong examples that provide valuable insights regarding the process of working with POs.

In the cases of Victory and Maliwaliw, a high level of support was maintained throughout the course of the project. They had strong participation in the PO, and good relations with LGUs and the wider community were maintained. This was despite having to confront the challenges of both poaching and damage from typhoons.

In Victory, early instances of poaching were overcome as the success of the project became clear. In fact, community

support for the sea ranch increased over time and was a major feature of the project. In Maliwaliw, armed poachers confronted PO members within sea ranch sites, and solicited the support of their local barangay to challenge the legal legitimacy of the sea ranch. However, the good relations that the PO members had in collaborating with the municipal LGU and their local barangay helped resolve this conflict, and end poaching. In both cases also, there was substantial damage to sea ranch infrastructure by typhoons. However, PO members picked up the pieces, rebuilt their sea pens, and continued with the work. Both POs continue to be involved in sea ranching today.

In the Luzon node, 2 sea ranches had medium social success. All achieved good support from POs, as well as the LGU, barangay and wider community members to facilitate the establishment and running of the sea ranch. However, in the case of Masinloc and Sablig, vigilance in guarding waned over time. Conflict with the wider community in the form of poaching was an issue that did not prevent the success of the project on economic and ecological issues. However, it was unresolved during the period of the pilot sea ranch.

Social success was considered low in 3 sites:

- in the 2 sites in Mindanao
- one site in the Western Visayas.

In Kauswagan, the PO and LGU were highly supportive. It got the low rating because they did not gain agreement with the local barangay to sign the MOU and grant the 5-ha area for the sea ranch. Wider community concerns regarding the loss of potential gleaning grounds therefore affected the ability of the site to perform a successful pilot. Laguindingan and Concepcion had successful project establishment, including the PO, LGU and barangay and the granting of the 5-ha area. However, over time there were steep

drop-offs in participation that affected the ability of the sea ranch to run successfully. In each case the establishment of the PO itself failed. In Laguindingan, poaching became a major issue that impacted on the PO. In Concepcion it was not clear if poaching or predation on sea cucumbers occurred. However, the reduction in numbers of sea cucumbers in the sea pens had a substantive impact on the project success in each case.

Mindanao pilots had challenges at the PO and community level. Importantly however, enough PO members or leaders in the LGU maintained an interest in sea ranching to seek trials to continue in their community. In Kauswagan, trials are no longer ongoing as the site proved, in time, to be unsuitable from a biophysical perspective. However, in Laguindingan, ongoing work on sandfish sea ranching has now focused on individuals and households who expressed a desire to continue despite the substantial challenges. In this case, household-based grow-out approaches are being trialled to develop an economically- and socially-sustainable model of sandfish mariculture.

The maturity of the PO was a key factor highlighted by the consortium members influencing the variable level of social success. In Victory and Maliwaliw in particular, the POs involved had longstanding histories of collaboration in marine-based natural resource and environmental-management projects. This was seen as being supportive of project success for 2 key reasons:

1. POs had longstanding relationships with external groups in their communities, including with fishers in the community, and LGUs at the municipal and barangay level. This allowed for positive discussions to be held externally, and based on a mutual sense of respect, whenever a challenge arose.

2. These POs already had existing, well-tested internal mechanisms for decision-making and conflict resolution. This meant that when challenges arose, PO members could establish their own position on these issues, and act internally to support a solution, when this was required.

In all other sites, except for Imbo, POs were either:

- adapted from an organisation with a previous scope that was not specific to marine coastal resources of conservation
- set up as a wholly new organisation.

Some substantial challenges, particularly those related to poaching, were unable to be resolved in these cases. However, it should not be assumed that where longstanding POs with experience in community-based natural resource management exist, that mariculture should not be trialled. Instead, these findings indicate that, to be successful, community-based sea ranching may need groundwork to be put in with communities where experienced POs do not exist. This is shown in emerging strategies at the household level in Laguindingan. By working with individuals and households, experience in mariculture can be built. Training and support can be provided to support the natural growth of a PO with adequate knowledge, skills and experience over time, rather than establishing a PO as the vehicle for 'trial and error' and for gaining that experience.

The final layer of analysis to draw out of these case studies relates to the distribution of benefits among different community members. In all case study sites, poverty was either in the communities themselves, or in the wider municipal area. The relatively limited economic benefits, and the nature of data collected, does not enable an analysis of how benefits from sea ranches flowed to communities experiencing economic hardship.

There was a:

- high dependence on marine resources for basic livelihoods in case study areas
- high prevalence of resource use conflict and poaching in case study sites
- wider prevalence of poverty within the municipalities and communities themselves.

These suggest that coastal resources provide a 'safety net' for some communities. Where benefits from sandfish can be directed towards community members experiencing economic hardship, incentives to support mariculture will likely increase, and incentives to poach will likely decrease.

A key case qualifying these points on 2 fronts is Laguindingan. In this case, poachers were believed to be recent migrants to the coast from inland. They had entered gleaning as a direct safety net – a means of alleviating poverty where other sources of income were not available. The driver of this process however was displacement from development projects inland driven by government policies. It is highly likely that these migrants were in an unusually acute situation which may make avoiding resource conflict difficult at a project level. It is therefore important to understand not only whether sandfish mariculture distributes benefits to those living below the poverty line, but also the drivers of that poverty.

Finally, a key aim of many of the sea ranches was to encourage and support the participation of both women and men in sea ranch activities. In some cases, such as in Laguindingan, women were the main participants and at times were in positions of leadership.

There are no detailed data reported on:

- the relative benefits flowing to women and men in cases
- the ways in which the benefits of increased household income interacted with community level gender relations
- whether the flow of benefits in relation to gender influenced project success.

However, in case studies presented it appears that women did benefit from their participation financially. This was viewed as an important principle within POs to ensure the smooth running of sea ranches from a social perspective. Further focus on the issues raised as a result of the sustained attempts to engage with both men and women in POs and the impacts of this would be worthwhile in future phases.

Based in these general insights, we can draw the general findings that the internal characteristics of POs, and the quality of their external relationships, are key influences on project success. We can also conclude that equitable benefit sharing is likely to be a key influence on project success, including both:

- benefit sharing with community members experiencing economic hardship
- fair sharing of benefits among women and men, according to their contributions to sea ranches.

Projects are therefore most likely to succeed in the following scenarios:

- Where POs have prior experience in community-based environmental or natural resource projects, and have well-established relationships within the community and with local government relevant to these issues.
- Where clear, active and well-tested internal decision-making and conflict management resolution mechanisms exist in POs to settle disputes and challenges as they arise.

- Where existing collaborative relationships with municipal LGUs, barangay councils and the wider community support the resolution of challenges and disputes as they arise.
- Where communities are supported to build micro-capacity and an enabling environment for successful community-based organisations through the project, where POs working in the community-based natural resource management (CBNRM) space that are appropriate partners do not already exist.
- Where the equitable participation and sharing of benefits occurs within projects, including consideration of issues surrounding gender, socio-economic status and status as migrants.
- Where the drivers of poverty in the community are well understood, and project planning accounts for acute hardship in the community, particularly where coastal fisheries provide a poverty alleviation function for groups without access to other livelihoods.

10.6 A diagnostic framework for community-based sandfish mariculture

Following Eriksson et al. (2018), we note that a diagnostic approach to developing sandfish mariculture is required to:

- account for the diversity of circumstances that mariculture projects must account for
- ensure that projects are addressing key principles which support the success of initiatives.

Table 5 represents a framework, based on the above findings, for identifying the key social characteristics of a site and the suitability of a community, or community-based organisation to enter into sea ranch development as an implementing partner.

Table 5 Diagnostic framework for assessing the feasibility of community-based sea ranching

Key issue	Condition	Methods for diagnosis
Economy and livelihoods	Do existing livelihoods provide adequate and stable incomes already? Are community members, economically speaking, in a position to invest time and labour in a project for future reward?	Community consultation, household livelihoods research.
	If not to the above, will sandfish mariculture diversify livelihoods in ways that meaningfully reduce risk (for example, by providing an occasional or backup source of income that may be drawn on if other livelihood options fail), or alleviating periods of low income during the year?	Community consultation, household livelihoods research.
	If no to the above, are investors further up the value chain willing to invest in ranch development and employ community members directly for their labour? Will investment lead to a viable return for investors under normal circumstances?	Consultations and interviews with traders. Value chain mapping, cost-benefit analyses.
	Are the drivers of poverty in the community well understood?	Key informant interviews. Community consultations.
	Does project planning account for acute economic hardship in the community as a risk to project success, and devise strategies to account for this? Particular attention should be paid to coastal fisheries providing a poverty alleviation function for groups without access to other livelihoods.	Project planning documents. Socio-economic data and surveys.

Table 5 Diagnostic framework for assessing the feasibility of community-based sea ranching

Key issue	Condition	Methods for diagnosis
Fisheries management	Do local and provincial government authorities prioritise sea cucumber fisheries management?	Consultations and key informant interviews with government, community and fishers.
	Do integrated management approaches that view community sea ranches as an important part of sustainable and viable wild catch fisheries exist?	Stock status and biological/catch data.
	Does sea cucumber fisheries management effectively co-ordinate actions at the local, provincial and national levels?	Key document analysis (legislation, policy, independent management reviews). Governance analysis.
	Are fishers in the community aware of the potential benefits of sandfish mariculture for wild catch fisheries?	Consultations and perception surveys with fishers.
	Are fishers in a position, economically speaking and in terms of stock status, to absorb reductions in potential fishing grounds until spillover benefits are realised?	Consultations and interviews with fishers. Historical catch data. Stock status. Profitability of fishing operations.
	Do key influential stakeholders in the fishery (for example, traders) actively support the project and communicate the benefits of sandfish ranching among their networks?	Key informant interviews with traders, government and community leaders. Perceptions surveys among communities, fishers.
Community governance and benefit sharing	Does the community-based partner organisation have prior experience in community-based environmental or natural resource projects?	Key informant interviews, community consultations. SWOT Analysis at the community level.
	Does the community-based partner organisation have well-established relationships within the community and with local government relevant to these issues?	

Table 5 Diagnostic framework for assessing the feasibility of community-based sea ranching

Key issue	Condition	Methods for diagnosis
Community governance and benefit sharing	Does the community-based partner organisation have prior experience in community-based environmental or natural resource projects?	Key informant interviews, community consultations. SWOT Analysis at the community level.
	Does the community-based partner organisation have well established relationships within the community and with local government relevant to these issues?	
	Does the community-based partner organisation have clear and well-tested internal decision-making and conflict-resolution mechanisms to settle disputes and challenges as they arise?	Key informant interviews, community consultations. SWOT Analysis at the community level.
	Do existing collaborative relationships with municipal LGUs, barangay councils and the wider community support the resolution of challenges and disputes as they arise?	
	Where experienced partner organisations with well-established collaborative relationships do not exist, do opportunities exist to build micro-capacity and an enabling environment for successful community-based organisations through the project?	Key informant interviews, community consultations. SWOT Analysis at the community level.
	Has project planning ensured the equitable participation and sharing of benefits within projects, including consideration where relevant of issues surrounding gender and socio-economic status?	
	Are the drivers of poverty in the community well understood?	Key informant interviews. Community consultations.
Does project planning account for acute hardship in the community as a risk to project success and devise strategies for this? Particular attention should be paid to coastal fisheries providing a poverty alleviation function for groups without access to other livelihoods.		

10.7 References

- Andrew NL, Béné C, Hall SJ, Allison EH, Heck S and Ratner BD (2007) Diagnosis and management of small-scale fisheries in developing countries. *Fish and Fisheries*, 8(3): 227–240. <https://doi.org/10.1111/j.1467-2679.2007.00252.x>
- Barclay K, Fabinyi M, Kinch J and Foale S (2019) Governability of High-Value Fisheries in Low-Income Contexts: A Case Study of the Sea Cucumber Fishery in Papua New Guinea. *Human Ecology*, 47(3):381–396. <https://doi.org/10.1007/s10745-019-00078-8>
- Brown EO, Perez ML, Garces LR, Ragaza RJ, Bassig RA and Zaragoza EC (2010) *Value Chain Analysis for Sea Cucumber in the Philippines*. Studies & Reviews 2120. The World Fish Center, Penang, Malaysia.
- Christie P, Pollnac RB, Oracion EG, Sabonsolin A, Diaz R and Pietri D (2009) Back to basics: an empirical study demonstrating the importance of local-level dynamics for the success of tropical marine ecosystem-based management. *Coastal Management*, 37(3-4): 349–373. <https://doi.org/10.1080/08920750902851740>
- Eder JF (2005) Coastal resource management and social differences in Philippine fishing communities. *Human ecology*, 33(2): 147–169. <https://doi.org/10.1007/s10745-005-2430-Z>
- Eriksson H, Robinson G, Slater MJ and Troell M (2012) Sea cucumber aquaculture in the Western Indian Ocean: challenges for sustainable livelihood and stock improvement. *Ambio*, 41(2):109–121. <https://doi.org/10.1007/s13280-011-0195-8>
- Eriksson H, Troell M, Brugere C, Chadag M, Phillips M, and Andrew N (2018) *A diagnostic framework for equitable mariculture development in the Western Indian Ocean*. ACIAR Monograph No.204. Australian Centre for International Agricultural Research: Canberra, ACT. 36 pp.
- Fabinyi M (2012) *Fishing for fairness: Poverty, morality and marine resource regulation in the Philippines*. Canberra: ANU Press.
- Hair C, Foale S, Kinch J, Yaman L and Southgate PC (2016) Beyond boom, bust and ban: the sandfish (*Holothuria scabra*) fishery in the Tigak Islands, Papua New Guinea. *Regional Studies in Marine Science*, 5: 69–79. <https://doi.org/10.1016/j.rsma.2016.02.001>
- Hair C, Foale S, Kinch J, Frijlink S, Lindsay D and Southgate PC (2019) Socioeconomic impacts of a sea cucumber fishery in Papua New Guinea: Is there an opportunity for mariculture? *Ocean & Coastal Management*, 179:p104826. <https://doi.org/10.1016/j.ocecoaman.2019.104826>
- Juinio-Meñez MA, Tech ED, Ticao IP, Gorospe JR, Edullantes CMA and Rioja RAV (2017) Adaptive and integrated culture production systems for the tropical sea cucumber *Holothuria scabra*. *Fisheries Research*, 186: 502–513. <https://doi.org/10.1016/j.fishres.2016.07.017>
- Perez M and Brown E (2012) Market potential and challenges for expanding the production of sea cucumber in South-East Asia. Hair CA, Pickering TD and Mills DJ (Eds.), *Asia-Pacific Tropical Sea Cucumber Aquaculture, ACIAR Proceedings*, 136, Australian Centre for International Agricultural Research, Canberra.
- Purcell SW (2014) Value, market preferences and trade of Beche-De-Mer from Pacific Island sea cucumbers. *PLoS one*, 9(4): e95075
- Purcell SW, Lalavanua W (2017) Postharvest processing of sea cucumbers in Fiji in Mangubhai S, Lalavanua W and Purcell SW (Eds.). *Fiji's Sea Cucumber Fishery: Advances in Science for Improved Management*. Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.
- Steenbergen DJ, Fabinyi M, Barclay K, Song AM, Cohen PJ, Eriksson H and Mills DJ (2019) Governance interactions in small-scale fisheries market chains: Examples from the Asia-Pacific. *Fish and Fisheries*, 20(4):697–714. <https://doi.org/10.1111/faf.12370>
- Torell E, McNally C, Crawford B and Majubwa G (2017) Coastal livelihood diversification as a pathway out of poverty and vulnerability: Experiences from Tanzania. *Coastal Management*, 45(3): 199–218. <https://doi.org/10.1080/08920753.2017.1303718>



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