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Can Marine Protected Areas Contribute to Reduce Vulnerability? Perspectives from Small-Scale Coastal Fisher Communities in Malaysia

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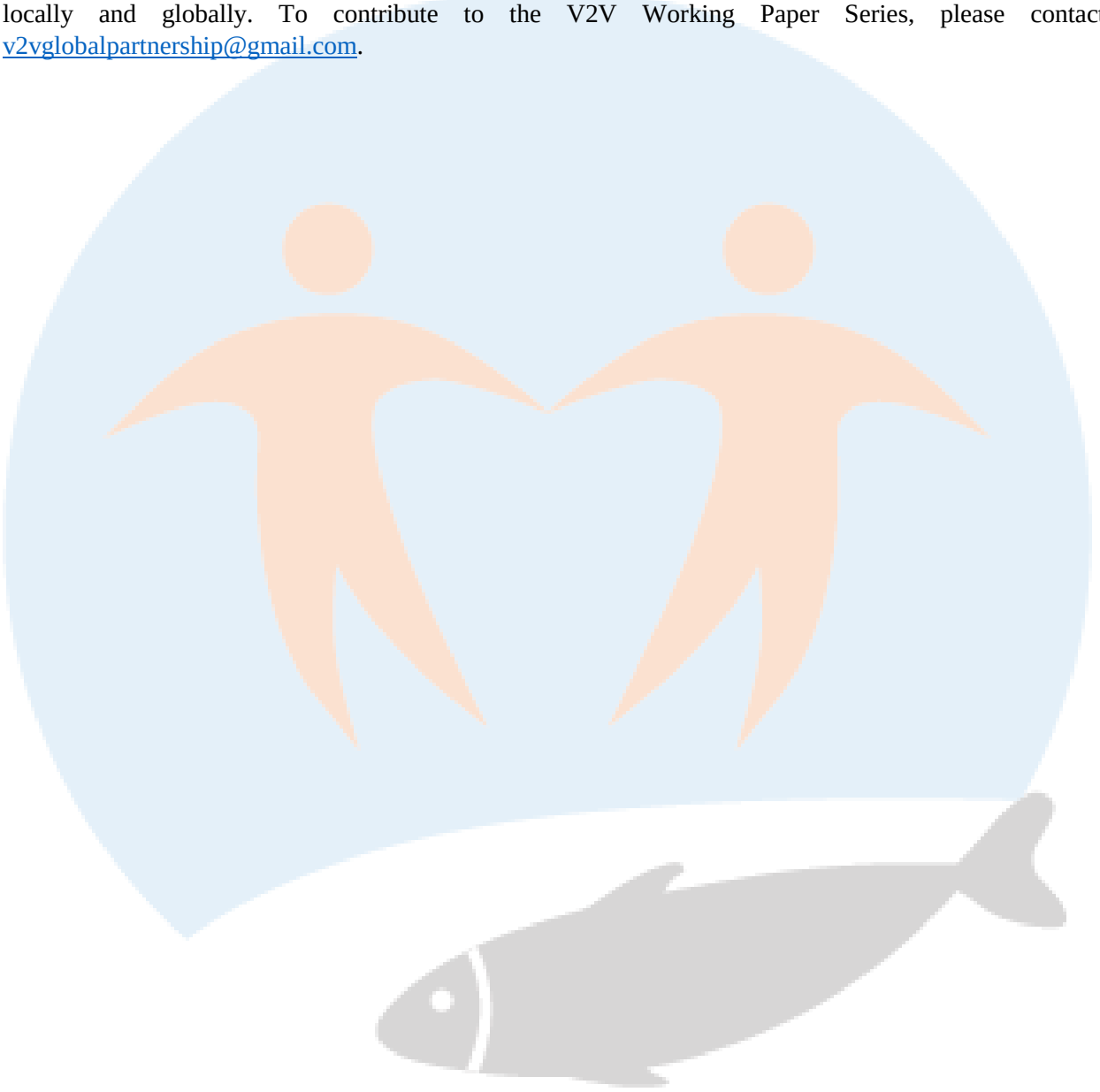

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Can Marine Protected Areas Contribute to Reduce Vulnerability? Perspectives from Small-Scale Coastal Fisher Communities in Malaysia

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Abstract

The islands in the east coast of Peninsular Malaysia are well-known for their rich coral reef ecosystems. The government of Malaysia has established several Marine Protected Areas (MPAs) to enable overexploited marine resources to recover and to conserve coral reef ecosystems. While fishing activities have been restricted in the no-take zone within MPAs since the 1990s, massive tourism development has taken place in the marine parks over the last decades. Most fishers have changed their occupations from fishing to ecotourism-based activities. Previous studies have found that ecotourism contributes substantially to the local economy, however, MPAs have adversely impacted the livelihoods of small-scale fishers due to lack of capacity to adapt to MPA-related changes (i.e., social, ecological and governance). The objective of the study reported in this paper was to evaluate the impact of MPA management on the livelihoods and conservation objectives of the small-scale fishers. The data for the study was obtained through face-to-face interviews with 212 local fishers from two islands using a structured questionnaire. The results of the study show that small-scale fishers have restricted access to fishing due to the fishing ban in the no-take MPA areas. Although fishers are allowed to catch fish outside the MPA boundary, they are unable to go far away from the shore with their small fishing boat and gears. Weak enforcement to protect the resources from commercial fishers (trawling), poor understanding of no-take MPA regulations, and lack of local participation in MPA management are responsible for ineffective management. The results of the study suggest that relevant agencies need to give priority to encouraging local participation in the decision-making processes of MPA management. The no-take MPAs are seen as threats to the small-scale fishers' livelihoods based on the different levels of vulnerability and the development of tourism establishments in marine parks. Benefits from MPAs could be realized if low-income fishers could participate in the management of MPAs and receive support for human and institutional capacity building and empowerment.

Keywords Marine protected areas ● No-take zone ● Coral reefs ● Vulnerability ● Governance ● Peninsular Malaysia

1. Introduction

Marine Protected Areas (MPAs) are suggested as useful tools to conserve marine habitat and biodiversity particularly fisheries and coral reefs (Islam et al., 2017; Len et al., 2013; Mora et al., 2006; Halpern, 2003). The no-take zone (NTZ) concept is a limited prohibition technique of management that prohibits any form of extractive activities in the protected area. Marine Protected Area (MPAs) with NTZ concept also permanently set aside from direct human disturbance where all methods of fishing and extraction of natural materials, dumping, and dredging or construction activities are prohibited. As well, these areas strictly prohibit the removal of any resources, living or dead. Malaysia is rich in marine resources with approximately 3600 km2 of coral reef areas. The idea of a marine protected area (MPA) was first initiated by the Department of Fisheries Malaysia (DoFM) in the 1980s. Subsequently, most coral reef islands were gazetted as a Marine Park by 1994 under the Fisheries Act 1985 which was amended as Marine Parks and Marine Reserve Order 1994 (Kaur & Basiron, 2010). The government has established and gazetted 42 MPAs in offshore islands in Peninsular Malaysia since the 1980s (Cheung et al., 2002; Islam et al., 2013). The MPAs in Malaysia are protected areas of the sea with a one or two nautical miles no-take zone from the shore at the lowest tide where fishing is prohibited (Islam et al., 2017).

The Department of Marine Park has imposed a set of rules and regulations to protect and conserve marine biodiversity especially the fisheries and coral reefs. However, fishing restrictions in the no-take zone have created a serious problem for the livelihoods of fishing households. The lack of understanding of the concept of MPA and the NTZ has created apprehension among various stakeholders who are affected directly or indirectly by MPAs. Several studies show that despite the many potential benefits of MPAs, the great majority do not meet their management objectives and merely "paper parks" (Halpern, 2003; Mora et al., 2006; Jameson et al., 2002). The key difficulty in assessing MPAs generally is that their aims and intended benefits vary and they may have many, often conflicting goals. Very few studies have simultaneously addressed ecosystem and economic considerations in the selection and assessment of potential MPA sites (Brown, 2001; Ami et al., 2005; Marion Dalton, 2004).

Ecological goals include fisheries improvements, habitats, biodiversity or endangered species protection (Roberts & Hawkins, 2000). The socio-economic goals can include improving food security, supporting employment, increasing environmental awareness and knowledge, decreasing conflict and minimizing local costs (Pomeroy et al., 2007; Sanchirico et al., 2002). Governance goals usually relate to adequate representation of all stakeholders including minority groups in the management of MPAs (McField & Kramer, 2007; Pomeroy et al., 2004). In Malaysia, after more than 20 years of establishment, the functions of MPAs and NTZ as a management tool in increasing the economic, social and ecological benefits in coastal water and stakeholders have not been comprehensively heard and need to be reassessed. The major challenges to MPA governance are first, the lack of jurisdictional coordination and second, the lack of integration among governmental agencies in the centralized management (Islam et al., 2017; Jones et al., 2011). The MPAs in Malaysia have been established by the government in a way that excludes local fishers from participation in the management and decision-making.

A recent study shows that local participation in management is an important factor that may contribute significantly to the good governance of MPAs in Malaysia (Islam et al., 2017). Local fishers in marine parks are no longer involved in fishing as their main source of income. In some marine parks, however, fishers renew their licenses to continue fishing outside the MPA area. However, fishers are moving towards tourism activities due to stringent fishing restrictions in the marine park areas. Despite imposing NTZs in MPAs, the progress in resource conservation and protection is insignificant. The study investigates how NTZs in MPAs affect the livelihoods of small-scale fishers in two islands: Tioman Island and Redang Island.

The objective of the study is to evaluate the impact of no-take MPAs on the socio-economic condition of local fishers in Malaysia. This paper is organized as follows: first, we provide an overview of the social, ecological and governance framework of marine protected areas. Second, the methodology and data source are presented; third, we present the results of the study; fourth, we present discussions and conclusions.

1.1 Social, ecological and governance framework of marine protected areas

The role of governance and management of marine protected areas **(**MPAs) has been widely discussed in recent years. Governance can be defined as power, sharing responsibility, set of relationships, transparency and accountability (Abrams et al., 2003; Kooiman & Chuenpagdee, 2005). Governance refers to the structures, institutions, and processes that determine decision-making and implement environmental management (Lockwood, 2010; Bennett & Dearden, 2014a). Several authors have highlighted that there is a set of principles for good governance; including, but not limited to democracy, participation, responsiveness, legitimacy and compliance, transparency, accountability, subsidiarity, and direction (Grafton et al., 2007; Béné & Neiland, 2006; Jentoft, 2005; Nielson et al., 2004). Good governance facilitates the effective management of MPAs and achieves social and ecological benefits (Bennett & Dearden, 2014b). Akindele et al. (2012) has added that good governance appears along with civil society, human rights and sustainable development.

MPA governance benefits might be judged by stakeholders, managers, or scientists based on the levels of participation in decision-making, impacts on local community livelihoods, or changes in the abundance of fish (Christie, 2004; McClanahan et al., 2006; Bennett & Dearden, 2014a). An effective governance system fosters participation to incorporate diverse perspectives on MPA functions, fisheries and biodiversity conservation. No-take MPAs can lead to unintended social and economic consequences in the short run; for example, fishers with no alternative source of income, are the most affected by MPA. The importance of understanding the incentives that encourage local people to participate in conservation has been highlighted by Jones et al. (2013). Studies have highlighted that participation can promote good governance that facilitates the management of MPAs (McField & Kramer, 2007; Béné & Neiland, 2006; Pomeroy et al., 2005). Wilson (2003) argued that participation can increase compliance if the participation is transparency and some real decisions are made through bargaining and compromise. Gray (2005) endorsed that participation leads to more effective and efficient results to achieve fairer and more equitable benefits for different groups.

Local peoples' incentives to cooperate in resource management are a useful way to understand the management and governance of MPA. There is a need to match good governance principles with effective management. Good governance of MPAs may lead to better allocation and use of decision-making power, sharing responsibility, relationships, transparency and accountability (Heylings & Bravo, 2007; Abrams et al., 2003). Coulthard et al. (2011) highlighted that social wellbeing is a valuable analytical tool when thinking about governance in the context of artisanal fisheries.

The empowerment of fishers is important for establishing their user rights and achieving fair benefits. Nielson et al. (2004) defined empowerment as a mechanism to give participants a chance to influence their own future within the fishing communities. Sowman et al. (2003) stated that empowerment is secured when resource users are in a position to participate as equal partners in negotiations, give input on management decisions and ultimately achieve self-control. Jentoft (2005) argued that empowerment would be concerned with the redistribution of the power and it works at a group level, as well as the community and national level. The study added that empowerment must occur at both an individual and collective level for fishery co-management to become sustainable (Jentoft, 2005). Capacity building and strengthening institutional capacities are both necessary to empower fishers. Empowerment is concerned with providing stakeholders with greater social awareness, to gain autonomy over decision-making, to achieve self-reliance, and to

establish a balance in community power relations (Pomeroy, 2001; Wiber et al., 2009). Again, Wiber et al. (2009) reported that inter-community linkages should be encouraged and developed from the outset as this will result in a more resilient local capacity. Fishers are empowered when it becomes possible for them to sustainably manage their fishery. Capacity building is one way this can be accomplished (Jentoft, 2003; Jentoft, 2005).

Governance under state property rights can establish and regulate access to resources. The main obstacle to achieve conservation goals is ensuring funds to manage resources. Top-down management is ineffective due to lack of resources for enforcement which results in further marginalization of vulnerable fisheries groups (Diegues, 2008; Sunde & Isaacs, 2008). In Malaysia, the government has initiated the management of the MPAs since the 1980s. But the coastal-marine resources are not well protected due to lack of enforcement capacity. In a participatory governance approach, decisions are made collectively, allowing local people to exercise their powers in terms of openness, participation, accountability, effectiveness and coherence (Gray, 2005). In this approach, users gain social power through relationship building, sharing understanding among diverse stakeholders, and discussing solutions together (Heylings & Bravo, 2007). Ganatsas et al. (2013) has pointed out that policy-makers need information on the strengths and weaknesses of their management to improve the management of marine protected areas. Lack of information on natural resource management may lead to unsustainable outcomes (Thondhlana et al., 2012).

In Malaysia, coral reef health is affected by human pressures and factors such as coral bleaching, lack of awareness among the fishers and other tourism operators. Understanding how top-down governance can protect and conserve resources through the implementation of MPAs in Malaysia is yet to be uncovered. This study was conducted in two MPAs in the east coast of Peninsular Malaysia, *Pulau Tioman* and *Pulau Redang* marine parks. The Tioman marine park is relatively old and massive tourism development has taken place, while the Redang Island is important for coral reef-based tourism and fisheries activities. The study investigates how no-take MPAs contribute to the socio-economic conditions of local fishing communities in Malaysia.

1.2 The study area: biophysical and social characteristics

The *Pulau Tioman* (Tioman Island) island is one of the Marine Parks located in the eastern archipelago of the marine parks off the east coast of Peninsular Malaysia; the marine area around Tioman Island and eight other nearby islands have been declared as marine parks / marine reserves. The Tioman Island is also the largest island on the east coast of Peninsular Malaysia, which is located in the South China Sea, 32 km from Mersing, Johor and 80 km from Kuala Rompin, Pahang. In 1994, Tioman Island was gazetted as marine protected area (MPA) under the Fisheries Act 1985 (Amended 1993) to protect and conserve marine resources from being damaged by human activities. Activities such as fishing, collecting sands or dead corals, littering, polluting, anchoring on reefs and others are strictly prohibited under the Fisheries Act 1985 as the activities could harm and destroy the marine environment.

With a diverse coral reef ecosystem and inter-tidal habitats, Pulau Tioman is a breeding, nursing and feeding ground for numerous fish species, sea turtles and other resources. The island has currently about 3,314 people living in the seven villages. The development of the tourism industry in the island is under the jurisdiction of the Tioman Development Authority (TDA), while the administrative services of the island is undertaken by the District Office of Rompin. The majority of the population of Tioman Island has shifted from fishing to tourism-related activities; the only fishing community is found in Kampung Mukut with 220 fishing households. Prior to the establishment of MPA, local residents were involved in fishing. However, the majority of the island inhabitants have adopted various tourism activities after the establishment of MPA and tourism activities expanded significantly since the mid-90s. At the same time, a massive physical infrastructure has been developed in Pulau Tioman over the last decade.

The *Pulau Redang* (Redang Island) consists of 9 islands in the archipelago off the Eastern Coast of Peninsular Malaysia. It is located in Mukim Batu Rakit in the District of Setiu in the South China Sea. It is listed among the ten most beautiful islands in Malaysia and it has become one of the most attractive tourist destinations in the country. The terrestrial topography of Redang Island is divided into two, with 70% of the hills are found in the eastern side of the island and the rest of the hills on the western side. Redang Island boasts attractive marine resources such as coral resources, fish, turtles and other marine lives become the saleable tourism products for the state.

The population of Redang Island has increased from 1,340 in 1999 to 1,847 in 2015 (District Office Kuala Nerus); the population is made up of 831 males and 1,016 females. In general, the livelihood of the community in the island is mainly sea-based, with fishing, marine tourism-related operations, and public services. Since the development of the tourism sector, a massive physical infrastructure has been developed, particularly, in the last decade. Nine resorts, chalets and homestays are operating in the village area, 10 in Long Beach, two in the Kalong Bay and two more at the Bakau Bay (District Office Kuala Nerus). Most of the tourism establishments in Long Beach are owned by outsiders and only two are local operators, this situation is seen as creating an unequal distribution of benefits to the local population. Although the majority of the population is involved in tourism activities, there are about 200 part-time fishers who fish during non-peak seasons or during the monsoon season when tourism activities come to almost a standstill. Still, there are 20 traditional artisanal fishers who fish full-time. The main tourism activities include SCUBA diving, swimming and snorkeling. However, during the monsoon season from November to March almost all resorts, restaurants and shops on the islands are closed to tourists and all of the water activities are suspended.

2. Methodology

The study employs the theoretical framework of common property resource systems (Berkes, 1989; Ostrom, 1990) and the role of institutions that set rules for resource use (North, 1990; Hodgson, 2006; Young, 2009). The success of MPAs depends on perceptions of the effectiveness and quality of management and governance policies, institutions, and processes (Pomeroy et al., 2004; Lockwood, 2010; Hind et al., 2010; Webb et al., 2004).

2.1 Data source and sampling

The survey was conducted in two contiguous islands in the east coast of Peninsular Malaysia, Tioman in Pahang and Redang in Terengganu. The data was obtained from a survey involving 212 respondents from various stakeholder groups. The participants were directly and indirectly interested in the establishment of the MPAs of Tioman Island and Redang Island. The perceptions of the respondents from both islands are used as the main variable to review the justifications of the functions for the MPA establishment. The study is conducted on various stakeholder groups located in several villages. They are engaged in different economic activities, representing users of the resources of the MPAs (fishers, tourist workers, boatmen, tourist guide), operators (traders, chalet managers, diving operators, boat maintenance) and experts (officials, managers, researchers, local leaders, NGOs). Data is also obtained from secondary sources to capture the effectiveness and benefit to stakeholders. Cooperation is obtained from the Marine Park Department (DOMP), Reef Check, Tioman Development Authority (TDA) and Department of Fisheries Malaysia (DOFM) to get access to the relevant dataset. The development of the questionnaire consists of several stages. Several Key Informant Surveys (KIS) and Focus Group discussions (FGD) are conducted to improve the questionnaire and to gather other pertinent information related to this study.

2.2 Questionnaire and survey design

The questionnaire consists of four sections. Section A solicits data on respondent backgrounds which include demographic information, occupation, working experience and household size. Section B collects data on fishing activities, information on assets and fishing location. In section C the respondents were asked to state their opinions on whether NTZ implementation affected their livelihoods. Section D collects data to gather opinions related to issues and effects of MPAs implementation, relevant training obtained and total income.

2.3 Measurement of variables

Several literatures show local resource users who have developed effective social norms and collective control over harvesting were able to increase returns that can ensure resource sustainability (Grafton, 2005). Several authors have mentioned that governance of MPAs is supportive when local communities believe that there is a synergy between conservation and resource use to support the livelihoods of local communities (Pomeroy et al. 2005). The synergy between conservation and socio-economic development is a fundamental issue in MPA governance as it controls human activity through rights frameworks (Parks et al., 2006). Studies indicate that improving marine resource management is responsive to a set of elements of good governance such as democracy, participation, responsiveness, legitimacy, compliance, transparency, accountability, subsidiarity, and direction. Other studies used a number of variables to measure governance index and social capital index (Krishna, 1999; Grootaert & Narayan, 2004, Islam et al., 2011; Kabir et al., 2013).

The socio-economic indicators used in this study represent a mixture of a multitude of variables that are not easily measured directly. A common method for measuring socio-economic conditions is the Principal Component Analysis (PCA) that allows the reduction of a number of variables into one or fewer variables. PCA is based on a multiple correlation principle and can explain the variance of the dependent variable. The principal component selects factors with eigenvalues greater than one and they are considered significant. The weight associated with each principal factor is the normalized value of the factor loading of each variable for the factor from the factor analysis (Islam et al., 2011; Krishna, 1999). Factor analysis including the PCA is used to extract the significant variables.

2.4 Linear regression model specification

Multiple regression analysis was carried out to examine the significant relationships among the various factors of the social, ecological and governance indicators. The equation is specified and estimated separately for Tioman and Redang MPA sites by using the Ordinary Least Square technique. Multiple regression analyses were carried out to examine the significant relationships among the various factors. The model is presented in equation (1). The dependent variable (Y) in the model consists of social, ecological and governance factors.

The independent variables (X_j) include selected factors of all indicators, the dependent variable is regressed against selected factors from the social, ecological and governance indicators. In addition, the model also includes several independent variables (Z_k) that represent the socio-demographic characteristics of the stakeholders.

$$Y = \alpha + \beta_j X_j + \gamma_k Z_k + \mu \quad (1)$$

where α, β_j and γ_k are estimated coefficients and μ is the error term.

The formula for the computation of the values of these variables for each respondent is as follows:

$$X_{ij} = \sum_{k=1}^{m} V_{ijk} W_{kj} \quad (2)$$

where

X_{ij} = the weighted value of the j factor of the management effectiveness indicator for respondent i;

V_{ijk} = the observed value of variable k for factor j and respondent i;

W_{kj} = the weight associated with variable k and factor j;

i = number of observations

j = principle factors of the management effectiveness indicators;

k = variables included in the constitution of factor j.

The definitions and explanations of these variables are presented in Table 1.

Table 1

Definition of variables for various socio-economic index constructions

Variable	Description
Dependent Variable	
Empowerment of local communities (EMP)	Looking for the pledge by the local communities to guarantee that the functions of the establishment of the marine parks are fulfilled.
Independent variable	
No-Take Zone MPA Management (NTZM)	Stakeholder willingness, perception and decision regarding the expansion of No-Take Zone in MPAs and their awareness about MPA benefits towards the local community.
Resource Protection and Conservation (RPC)	The communities believe that the process of conservation must benefit them in terms of increase in fish stocks, quality of fish found in the enlarged areas of the coral gardens, regeneration of the fish resources near the boundaries of the MPAs.
Governance and local participation (GLP)	MPA boundary is clearly defined so that the communities are able follow the rules and regulations formulated to protect resources and the tourists also are benefitting from the establishment of the marine park and thus are abiding by the rules and regulations.

3. Results

3.1 Results of the descriptive analysis

The results of the study show that the average age of the fishers is 56 years compared to the tourism business operators whose average age, which is 36 years. The tourism sector in Tioman Island has been developed much earlier compared to Redang Island. A larger proportion of the population in Tioman Island has shifted to the tourism industry (57.94% of the respondents). Fishing is a part-time occupation for the local people during the monsoon period when the tourism operations are closed.

Fishing is still an important economic activity in the islands. About 35% of the respondents in Redang Island are involved in fishing and predominantly fish outside the NTZ. The majority of the population in Redang Island have obtained SPM certificates. Household size for fisher households is relatively larger in Redang island (six people) compared to Tioman Island where fisher households have average three members. About 38% of the sampled fishing households are affiliated with voluntary associations, such as village development committees, environmental groups, religious groups, fisher association, chalet operator association, parent-teacher association, and political organization. The majority of the sample (43% in Tioman Island and 33% in Redang Island) indicate that they are local residents. About half of the tourism business workers are not from the islands while 68% of respondents report that they have alternative income source besides fishing. The fishers have 25 years fishing experience, and tourism workers have 9 years of

experience in tourism activities. Fishers use small outboard engine boat (*sampan*) as the main vessel for fishing, about 62% of respondents used hook and line, 16% used fish trap and 22% used drift net for fishing.

3.2 Statistical analysis on perception in MPA benefits

Factor analysis is conducted to construct a measurement index and factors are extracted from the correlation matrix through principal component analysis (PCA).

3.2.1 Management of no-take MPA

The factor consists of 10 variables explaining 11.2% of the variance in the data set. The most important variables constituting the judicious concept of the MPA management index are presented in Table 2. The communities believe that the process of conservation benefits them in terms of an increase in fish stock; better quality of fish; regeneration of fish resources near the boundaries of the MPAs; potential spillover effects; and shifting to the more stable tourism sector.

Table 2

No-Take Zone MPA Management (NTZM)

Statements	Factor Loading
1. The management of the marine parks by the department is well planned	.635
2. The enforcement of the rules and regulations is effective	.627
3. The establishment of the marine parks has augmented the economies of the local communities	.593
4. Stocks of fish have increased since the establishment of the NTZ in marine park	.586
5. Associated authorities involved in the management of the activities in the NTZ in marine park are carrying out the tasks effectively	.521
6. Development in the islands produces more benefits to the local residents with the creation of the marine parks	.494
7. The No-Take Zone limit of 2 nautical miles is effective	.488
8. The development of the marine park has so far provided a balanced sharing of the resources among stakeholders	.485
9. NTZ areas of marine park for the protection of marine resources are constantly monitored by the relevant authorities	.475
10. Coral gardens have expanded in the marine park	.470

The purpose of the formation of the NTZ is accepted by the communities; at the same time it has created some concerns among the small-scale fishers who do not have the necessary assets to go beyond the 2 nm to do their fishing activities. Since these small fishers are fully dependent on fishing for their livelihood (communities in Kampung Mukut, Tioman Island), the NTZ forms an inflexible restriction to their fishing activities as a source of income particularly if the no-take rules are enforced. The communities have pleaded to the relevant authorities that some flexibilities be afforded to them to fish in NTZ during the monsoon season.

3.2.2 Resource Protection and Conservation

Resource Protection and Conservation account for 7.18% of the total variance and it is comprised of four variables (Table 3). The government is adopting the limited prohibition technique for the management of

the MPAs, which makes the consumptive use of the resources within the MPAs prohibited. This technique allows marine resources and corals within the protected areas to be replenished, leading to both the quantity and quality of the fish being protected. The restocking of fish resources in the marine park has also created unwanted attraction when illegal fishing activities by fishers from outside the area became more widespread. Small-scale fishers have voiced their dissatisfaction to the relevant agencies when trawlers began encroaching into their fishing zones.

At the same time, the communities have taken various collaborative steps since the establishment of the MPA to ensure that corals are rehabilitated, so that they may grow healthier. NGOs, local universities and volunteer associations all participate in collaborative activities such as seabed cleaning, recycling of plastic materials, isolating locations for boat parking bays, awareness campaigns to prevent tourists from stepping on corals and ensuring the protection of assets.

Table 3

Resource protection and conservation (RPC)

Statements	Factor Loading
1. Protection of healthy corals and other marine lives are vital for the socio-economic sustainability of local communities in the islands	.553
2. Awareness programs on conservation and caring for the marine resources in the park should be extended to local people	.530
3. Fishing activity in the marine park has increased	.520
4. Fishers from outside the area often carry out fishing activities near the boundaries of the marine parks	.458

3.2.3 Governance and local participation

This factor explains 5.72% of the variance (Table 4). Three variables are included which suggest that the communities are following the rules and regulation formulated to protect the resources; the same goes with the tourists who are benefitting from the establishment of the marine park and thus are abiding by the rules and regulations. Economically, the communities are getting benefits from the numerous tourism-related businesses. The communities agree that an increase in tourism will pollute the waters. To this end, proper waste disposal systems by chalets and restaurants must be followed to overcome the effects of sewage discharges into the sea. The development of the tourism industry derived from the establishment of the marine park in Tioman Island and Redang Island has also produced some undesirable consequences; the most significant if these is the heightened dependence of communities on outside markets, which created a spike in prices (Ahmad, et al., 2018). Even so, the communities still hold strongly that their participation is essential to ensure that the conservation of marine resources will help sustain the tourism industry which has become the main source of their livelihood. During the monsoon season (November to January) the tourism businesses in both islands come to almost a standstill; the communities feel that some flexibilities could be afforded to them to carry out the fishing activities within the marine parks during that time. Especially, as they insist, if the fishing techniques they employ are non-destructive to the marine resources.

Table 4

Governance and local participation

Statements	Factor Loading
1. Tourists accept and conform to rules and regulations stipulated for the conservation of resources in the NTZ in marine park area	.548
2. The marine parks have created positive influences on the economies of the local island fishers	.523
3. Discretionary allowances should be granted to the small fishers who use appropriate non-destructive tools to catch fish within NTZ in the marine park boundaries	.512

3.2.4 Empowerment of local communities

This factor is obtained by merging 4 single variables having similarities pertaining to the pledge by the local communities to guarantee that the functions of the establishment of the marine parks are fulfilled. The factor accounts for 17.48% of the total variances (Table 5). The development of the tourism sector is a direct benefit of the establishment of the marine park in both locations. Although fishing will not be fully left out of the lives of the communities, more than 46% of the communities are involved either directly or indirectly with the tourism businesses. The types of employment in the tourism sector include boatmen, housekeeping workers, chalet managers, restaurant workers and technicians; with youth being the population who gains the most from tourism. As the tourism industry in Tioman Island matured compared to that in Redang Island, it can be observed that most of the tourism business in Tioman Island is owned by the local communities; in Redang Island, the majority of the tourism businesses are owned by outside investors. The tourism industry has created opportunities for the younger generation with opportunities in chalet establishment, transportation services, food and beverage services and recreational services (Aswani, et al., 2018). Still, the communities feel that the tourism development as a result of the establishment of the marine park has helped to further sustain the conservation of the marine resources.

Table 5

Empowerment of local communities

Statements	Factor Loading
1. Local youths are employed in many of the tourism-related business operations	.538
2. Most of the chalet operations are locally owned.	.570
3. The establishment of the marine park does not disrupt the sustainability of the natural resources	.489
4. The NTZ in marine park is important for education and research on the marine lives and the corals	.450

3.3 MPA impact on social, ecological and governance of fisheries

Mean difference score was obtained based on respondents' rating on a five-point Likert scale on various social, ecological and governance. T-tests were used to compare their ratings between Tioman and Redang. Table 6 presents the value of various factors. The results show that the mean values for the three important factors are relatively higher in Tioman compared to Redang. The mean values of resource protection and conservation, empowerment of local fishing communities and household income are significantly different. The results indicate that resource protection and conservation of the coral reef fisheries in the MPAs is very important; however, the importance of fishers' participation in the conservation of marine resources has not been effective in the MPA management.

Table 6

Mean difference values of important factors, Redang and Tioman

Factors	Redang	Tioman	Redang-Tioman	t-Statistics
	Mean Score	Mean Score	Mean difference score	
No-take zone MPA management	3.45 (0.67)	3.39 (0.63)	+0.06	0.65
Resource protection and conservation	3.56 (0.74)	3.81 (0.69)	-0.25	2.54**
Governance and local participation	3.48 (0.64)	3.34 (-0.65)	+0.14	1.41
Empowerment of Local communities	3.54 (0.56)	3.89 (0.57)	-0.35	4.51***
Household Income	2.82 (0.86)	3.27 (0.39)	-0.45	4.84***
N	105	107		

*** Statistically significant at 1% level

The results indicate that the empowerment of local fishers in participating in MPA management is the important factor raised by the participants in Tioman. Access to fishing is one of the more pressing concerns among local fishers whose livelihoods have been affected by no-take MPA rules. The relatively higher mean value of the MPA governance and judicious perceptions on NTZ indicate that these factors are important in Redang Island. However, the results suggest that the goal of the no-take MPAs to enhance fisheries and improve livelihoods has not been realized due to ineffective governance, weak enforcement and limited access local fishers to decision-making. The no-take fishing rules have been implemented in the MPA areas without adequate discussions with the local fishing community and fishery agencies. Although fishing is strictly prohibited in the MPA areas, enforcement of the no-take regulation is relatively poor in MPA areas where the fishing community is large (for example in Tioman).

3.4 Regression analysis results

Multiple regression analyses are performed to examine whether there is significant relationships among the various factors for effective management of no-take-zone MPAs. In the regression analyses, the selection of the independent variables to be included in the model, the general to the specific approach of model selection is followed. The variables as presented in Table 7 obtained the values of R^2, adjusted R^2, F-statistics. The F-statistics are significant at the 1% level, indicating that all the models provide overall goodness of fit. Similarly, the R^2 values for all the estimated equations are moderate, ranging from 12% to 21%. The results for the estimates of each model are presented in Table 7.

The results show that the coefficients of judicious management of MPA (NTZM), resource protection and conservation (RPC), governance and participation (GLP) and fishers income (HMI) are positive and statistically significant (Table 7). In Redang, the coefficients of resource protection and conservation (RPC) and household monthly income (HMI) are positive and statistically significant. In Tioman, only the coefficient of judicious management of MPA (NTZM) is positive and statistically significant. The number of significant coefficients was relatively higher for the Redang compared to the Tioman.

The significant relationship between empowerment and no-take MPA management indicates that good governance for MPA management can contribute to local fisher's empowerment and access to employment in Tioman. The relationship between empowerment and resource protection is significant in Redang. This suggests that successful enforcement of resource protection laws encourages positive views and increases willingness of local stakeholders to participate in decision-making. The significant relationship between governance and empowerment shows that clear management rules make for effective governance, as it reduces stakeholders' confusion with regard to regulation enforcement. As well, compliance will be encouraged, reducing resource conflicts, thereby enhancing stakeholders' willingness to participate in management decision-making and empowerment.

Table 7

Regression Results for the relationships between empowerment of local communities and other variables for Redang and Tioman MPAs in Malaysia

Independent Variables	Description	Tioman	Redang	All
NTZM	MPA Management	.256** (.086)	.107 (.085)	.204** (.064)
RPC	Resource protection	.013 (.078)	.225** (.076)	.184** (.058)
GLP	Governance and Participation	.080 (.089)	.044 (.064)	.109* (.061)
HMI (LogMontInc)	Households' monthly income	.058 (.066)	.377** (.137)	.095* (.051)
(Constant)	-	2.167*** (.453)	1.283* (.65)	1.677*** (.315)
R square	.213	.128	.161	.168
Adjusted R square	.191	.093	.127	.152
F statistics	9.650	3.665	4.700	10.526
Significant	0.000	.008	.002	.000
N	220	104	102	212

Dependent variable: Empowerment of local communities (EMP).
Significance levels one asterisk (*) at the 10% level, two asterisks (**) at the 5% level, three asterisks (***) at the 1% level

The significant relationship between household income and empowerment indicates that greater access to income will increase the empowerment of the local fishers in the no-take MPAs in Malaysia. Small-scale fishing households and other stakeholders in Pulau Tioman, feel that they are at the losing end of the development of the MPAs; unequal distribution of the impacts of the MPAs is one of the unsatisfactory situations often cited among the small traditional fishers (Ahmad et al., 2018). The development of the tourism sector directly benefits people, although fishing still supplements the livelihoods of local communities.

The main findings of the study are that the purpose of the NTZ is generally accepted but it has created concerns among small-scale fishers who do not have the necessary assets to go beyond the 2 nm for fishing activities. The majority of the respondents report that fishers' interests should be considered for establishing strict MPA rules. Most respondents agreed that local people are willing to participate in formulating and implementing MPA rules if they are called for support. Some flexibility should be afforded to them to carry out the fishing activities within the NTZ of the marine parks during the monsoon season. As mentioned above, Tioman's businesses are owned by the local communities; in Redang Island, the majority of the tourism businesses are owned by outside investors. The communities feel that tourism development as a result of the establishment of the marine has helped to further sustain the conservation of the marine resources.

A zoning plan has been developed in Tun Mustapha Marine Park for multiple uses of MPA resources in Sabah, Malaysia (WWF, 2013). Several zones have been identified for different purposes through consultations with fishers, local communities, stakeholders, and government agencies. Multiple-use community-managed zones allowed fishers for non-destructive small-scale fishing activities and tourism activities. Similar zoning can be developed in the fishery-dominated marine parks in Peninsular Malaysia.

4. Conclusions

A correctly designed and effectively managed MPA plays an important role in the protection of ecosystems, in enhancing or restoring the marine and fisheries resources and in achieving social and economic development (Dudley, 2008). The general objective of this study is to determine the roles of MPAs and NTZ for the sustainability of natural resources while increasing the economic, social and environmental benefits to local communities in Tioman and Redang islands. The stakeholder communities in both study sites approve the establishment of the MPAs and the deployment of the NTZ since they have benefitted from the conservation of corals and other marine resources in the MPAs.

The effective functions of the NTZ depend on the protection and conservation of marine resources to replenishment fish stock and the enforcement in terms of reducing the encroachment of the trawlers. The study suggests that communities do feel that they should take a more inclusive part in the management of MPAs.

The main conclusions of the study regarding these factors are listed below:

- The participation of local fishers, understanding fisheries and MPA regulations, management capacity are important factors that influence good governance for the effective management of the MPAs.

- Clear fishery rules are likely to reduce confusion among fishers with regards to the regulations enforced, encourage more compliance with regulations, reduce resource used conflicts, rule-breaking and allow for effective enforcement of regulations.

- In addition, creating separate zones within MPAs for subsistence fishing activities is likely to increase the willingness of local stakeholders to participate in MPAs' management decision-making, particularly with respect to the fishing and tourism sectors.

- Strictly enforced rules and regulations as well as better fisheries resource protection are likely to encourage higher compliance with the regulations and more positive views of local stakeholders with regards to the good governance and effectiveness of MPA management. These will increase their willingness to participate in the decision-making process of MPA management.

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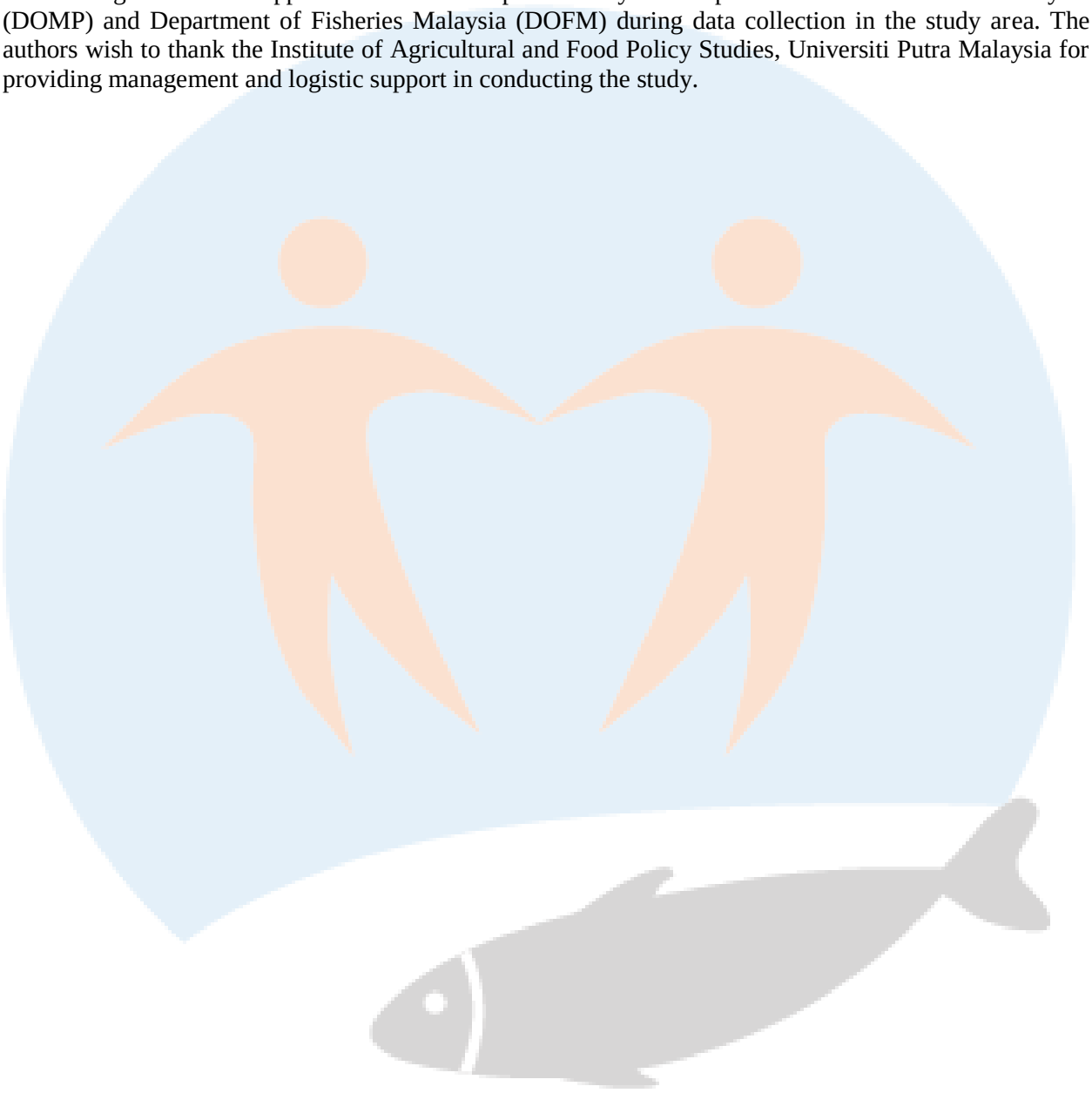

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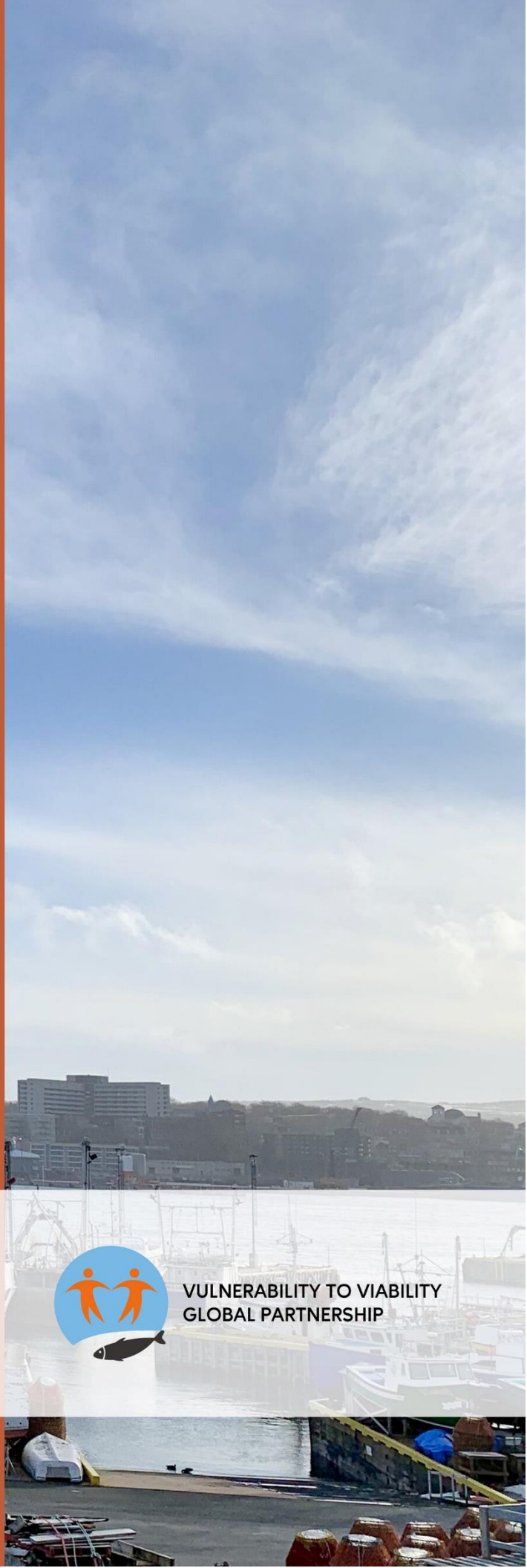
Vulnerability to Viability (V2V) Global Partnership

The Vulnerability to Viability (V2V) project is a transdisciplinary global partnership and knowledge network. Our aim is to support the transition of small-scale fisheries (SSF) from vulnerability to viability in Africa and Asia. Vulnerability is understood as a function of exposure, sensitivity and the capacity to respond to diverse drivers of change. We use the term viability not just in an its economic sense but also to include its social, political, and ecological dimensions.

The V2V partnership brings together approximately 150 people and 70 organizations across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand), six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania), Canada and globally. This unique initiative is characterized by diverse cultural and disciplinary perspectives, extensive capacity building and graduate student training activities, and grounded case studies from two regions of the world to show how and when SSF communities can proactively respond to challenges and creatively engage in solutions that build their viability. Further information on the V2V Partnership is available here: www.v2vglobalpartnership.org.



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