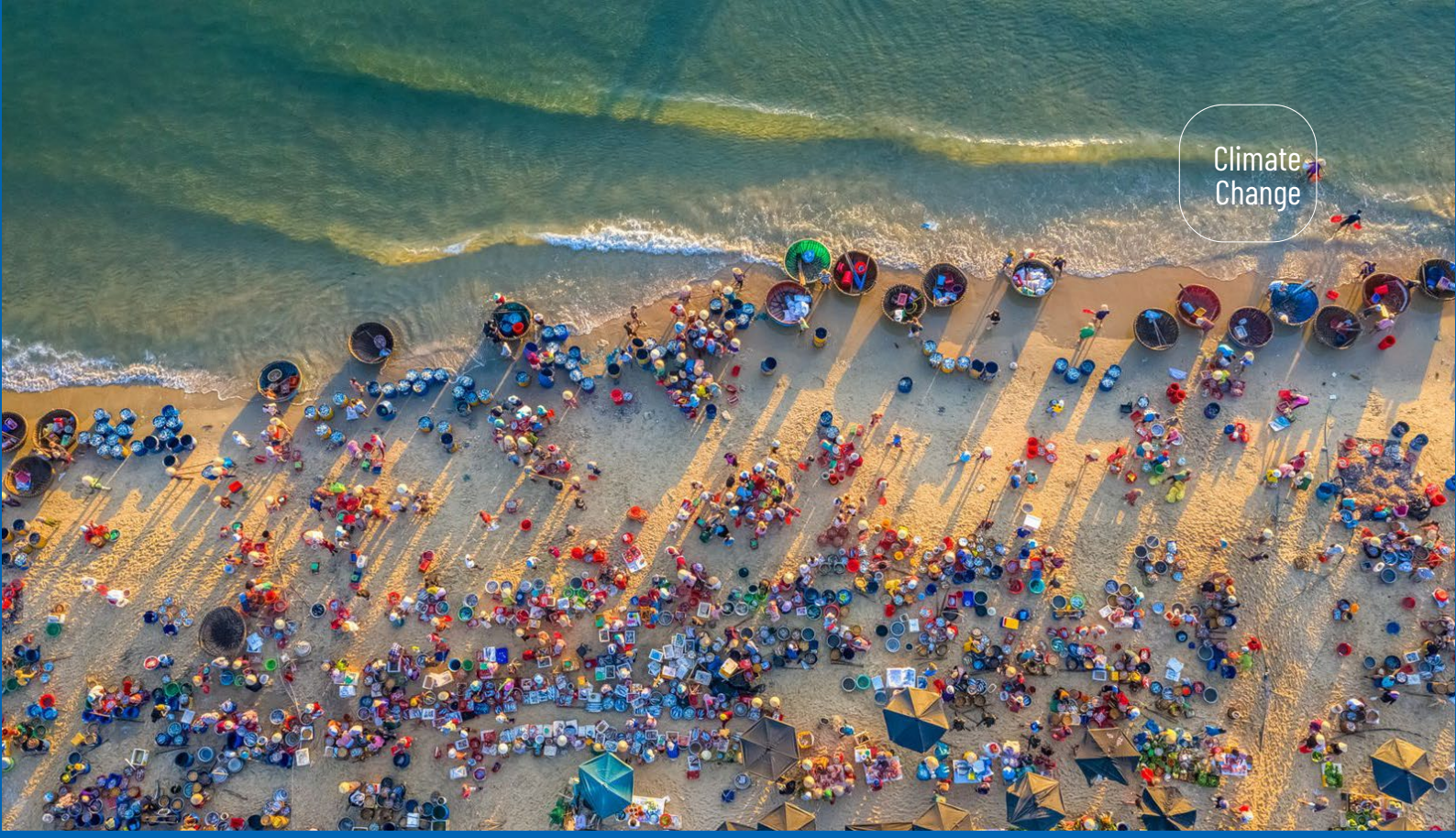

Vietnam
Climate Change Impacts & Small-scale Fisheries

A Case Study of Adaptation and Resilience

Written by
Than Thi Hien,
Hoang Ngoc Son
& Hoang Thi Ngoc Ha

International Collective in Support of Fishworkers
ICSF

A fishing market in Tam Tien commune, Quang Nam province, Vietnam, by Vo Hong Ron

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August 2025

Written by
Than Thi Hien,
Hoang Ngoc Son &
Hoang Thi Ngoc Ha

Editorial Team:
Sopan Joshi
Siddharth Premkumar
Ahana Lakshmi

Designed by:
Ramu Aravindan

Published by:
International Collective in Support of Fishworkers (ICSF) Trust
No:22, First Floor, Venkatrathinam Nagar, Adyar, Chennai 600 020, India
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Email: icsf@icsf.net
Website: https://www.icsf.net/
ICSF Archives/Digital Library: http://icsfarchives.net/
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Climate Change

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Contents

List of Figures

List of Tables

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Background

Vietnam boasts a coastline spanning from north to south, measuring 3,260 km and ranking 27th globally among coastal nations. The country's fisheries sector encompasses various categories, including nearshore, coastal (deeper than 20 metres), off-shore in shallow waters (above the depth of 50 metres), and deep-sea fishing (beneath the depth of 50 metres). Small-scale coastal fishing, involving traditional gear and millions of households, plays a pivotal role in the sector's development, but is highly vulnerable to climate change impacts such as rising sea levels, temperature increases, storms, high tides, and extreme weather events.

Vietnam has formulated and executed various strategies, plans, and programmes to address climate change, alongside sector-specific initiatives at national and local levels. Notable examples include the Climate Change Action Plan, Green Growth Action Plan, and efforts to integrate climate considerations into sectoral strategies and plans. Despite these efforts, gaps persist in the implementation, particularly concerning small-scale fisheries (SSF), with limited research on impact assessments in marine capture fisheries. For this specific case study, we focus on analysing the impacts of climate change on small-scale fishing communities and exploring any challenges and opportunities to improve the adaptation strategies for the coastal fishing community.

Objectives

The overall objective of the case study is to understand climate change adaptation measures at various levels and how they benefit fishing communities. It highlights the perspective of SSF communities on how climate change impacts their access to fisheries resources and livelihoods, and then makes recommendations for building resilience.

The case study also set out to:

- Review key policies and programmes at the national and local levels on climate change in the context of SSF and strategies adopted
- Document how climate change adaptation programmes are developed and designed for community participation, especially of the most vulnerable fishing communities
- Provide a clear narrative on the impact of climate change and adaptation measures from the perspective of SSF communities
- Assess the capacity of SSF communities to respond to the threat of climate change impacts and to make use of available financing mechanisms
- Provide recommendations for support to advance SSF communities to climate change adaptation, and to promote climate resilient fisheries

Research design and methodology

The case study provides a national, sub-national (comparing general characteristics of SSFs in the northern, central and southern regions), and provincial overview on the current status of climate change impacts on SSF communities operating both inland and in marine fisheries. It uses several methods of data collection to establish the larger institutional context, to identify the key actors involved in these processes and develop a coherent documentation of ground-up stakeholder experiences and perspectives.

A review of key legislation, policies and programmes was conducted at multiple levels, along with literature reviews on local and national implementation of climate change policies and programmes targeting or affecting SSF communities directly or indirectly. Interviews were undertaken with actors directly involved in the planning, implementation, monitoring and feedback process; they included entities from the Ministry of Natural Resources and the Environment (MoNRE), the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE), the Ministry of Agriculture and Rural Development (MARD), the Vietnam Institute of Fisheries Economics and Planning (VIFEP), the sub-department of fisheries, and the Vietnam Syndicate for Workers in Fisheries.

The case study has drawn from focus group discussions (FGDs) with community members in the Tam Tien commune on their experiences, practices and perceptions of climate change impacts and adaptation measures in relation to their community. It includes feedback from 10 people with backgrounds in fisheries; in particular, aquaculture, trade, processing and tourism. It includes interviews with the key informants (KIIs) representing commune organizations like the Women's Union, the Farmer's Union and the People's Committee. The case study used the MEL4SSF Handbook as a reference in the selection of respondents and formulation of KII questions and FGD guide questions.

The site

The case study took place in Quang Nam province, located along Vietnam's south-central coast. The area, which is home to active fishing communities, is considered high risk, in terms of being prone to the effects of climate change. The Tam Tien commune is situated in the province's Nui Thanh district. It features an 8-km coastline and is known for its rich biodiversity, notably the 64-hectare Ba Dau coral reef, which is inhabited by key coral reef species like lobsters, groupers, rabbitfishes, shellfish and crabs. The commune has 3,800 households with 14,118 people who are heavily reliant on nearshore and coral reef fishing for livelihoods.

The Tam Tien commune has several advantages and opportunities for the development of small-scale fishing, including favourable natural conditions, human resources, production practices, and potential for eco-tourism, as well as initial support from non-governmental organizations. However, the commune also faces significant challenges from climate change and changes in local urban development planning. There are still many limitations in techniques, production technology, post-harvest logistics, and skills to respond to extreme natural disasters and environmental pollution.

This case study offers a clear narrative on the impacts of climate change and adaptation measures from the perspective of SSF communities. It assesses their capacity to respond to climate change threats and to utilize available finance mechanisms. Community-based

Traditional fishing in Tam Tien commune, Quang Nam province, Vietnam, by Vo Hong Ron

marine ecotourism is quickly emerging as a new development trend, but carries many risks. Stakeholders at various levels significantly influence SSF communities, especially fisheries management agencies, governments, local communities and businesses.

The case study provides recommendations for supporting SSF communities in climate change adaptation and promoting climate-resilient fisheries. The key findings of the case study inform the next steps in designing interventions, particularly in capacity development and technical support for climate change adaptation planning.

This must involve local governments, community groups, and relevant stakeholders to sustain small-scale fisheries in the context of climate change adaptation, food security, and governance. Additionally, it is important to recognize the significant roles that the young and female workforce play not only in the fisheries and community tourism activities, but also in the overall development of the locality. Therefore, gender issues need to be prioritized as a core area for improvement.

In summary, to enhance the resilience of the fishing community in the coastal communes of Nui Thanh, solutions should focus on simultaneously restoring and protecting marine ecosystem services, while improving resources such as human capital, financial support, science and technology, and policy.

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1. Introduction

1.1 Characteristics of SSF

Vietnam's Exclusive Economic Zone (EEZ) of about 418,000 sq km is shared by 28 coastal provinces. The country has four fishing grounds: (i) the Gulf of Tonkin in the north; (ii) the South China Sea in the centre; (iii) the country's south-eastern part; and, (iv) the Gulf of Thailand to the south-west. The continental shelf of Vietnam is broad and shallow in the north and south, while the central region is narrow and has a steep slope that drops to depths of up to 500 metres within 30-50 km of the coast.

Inland capture fisheries are predominantly focused on artisanal and subsistence fishing. They range from commercial operations that serve the local market to semi-commercial and seasonal fishing. Over 120 types of fishing gear, classified into 19 categories, are employed, predominantly in the Mekong River Delta. Characterized by manual operation and low selectivity, these gears—mostly handcrafted traps, handlines, gillnets, lift nets, and other traditional methods—reflect the artisanal nature of the industry. Fishing vessels, often small and constructed of wood or corrugated iron, are designed for a single person or a pair of fishers, and are typically used in rivers and reservoirs. The biodiversity in these waters is notable, with researchers identifying 544 species of freshwater fish. There are also about 700 species of invertebrates, many of which are endangered or rare and hold great economic and scientific value. However, the assessment of inland capture fisheries and comprehensive statistics on the total number of inland fishing vessels are not yet available to the public.

Marine capture fisheries in Vietnam are predominantly small-scale, utilizing a diverse range of fishing methods to harvest multiple species. The majority of this activity is concentrated in coastal waters where a variety of habitats are found, such as seagrass and algal beds, coral reefs, mangroves and estuaries. About 40 different types of fishing gear are in use and informally classified into eight main groups, including purse seines, drift nets, falling nets, trawl nets, traps, handlines, longlines, and other artisanal gears.

The fishing vessels utilized vary in size and can be categorized into three types: those under 12 metres; those ranging from 12 metres to less than 15 metres; and those larger than 15 metres. Currently, the term 'small-scale fishing vessels' is not officially mentioned in law or regulations. However, these SSF vessels are widely recognized as those operating in coastal and in-shore areas, with a maximum length of less than 15 metres.

As of December 31, 2022, Vietnam's fishing fleet totalled 86,820 vessels. They are distributed as follows: 44.34 per cent are 6-12 metres in length; 21.08 per cent are 12-15 metres; 31.68 per cent are 15-24 metres; and 2.9 per cent exceed 24 metres. The use of gillnets was most prevalent, making up 35.5 per cent of the fishing gear used, followed by trawl nets at 18.1 per cent, and handlines and longlines at 17 per cent. Artisanal fishing gear

accounted for 18.5 per cent, while purse seine comprised 7.6 per cent. Over the 2010-2020 decade, there has been a trend of decreasing use in most fishing gear types, with an average annual decline of about 3 per cent. Most registered fishing vessels larger than 15 metres are distributed in the central region and the south-western region.

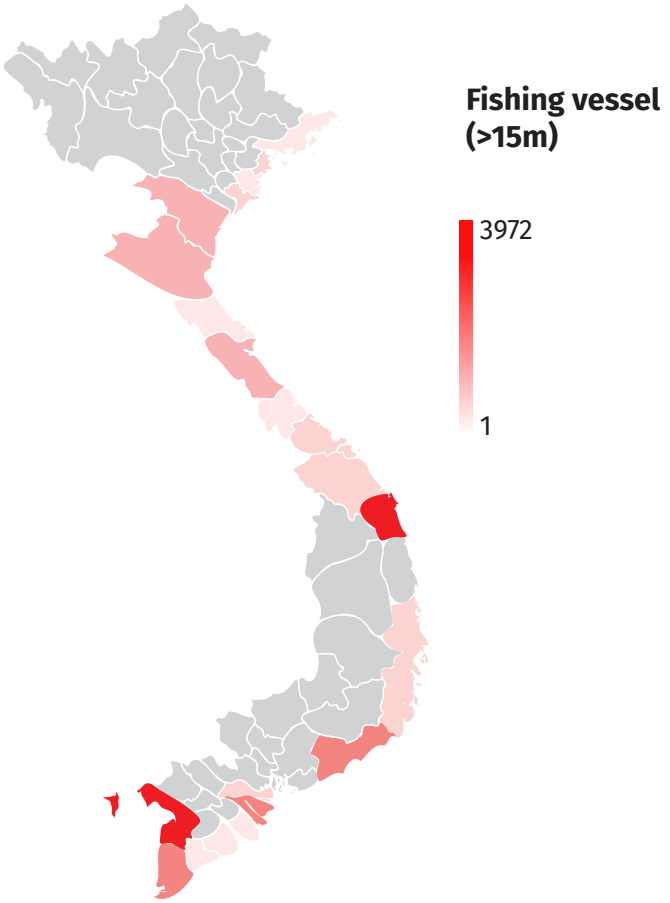

Figure 1. Distribution of registered fishing vessel (larger than 15m) by province

The Vietnamese government has supported aquaculture as a strategy to alleviate rural poverty, diversify rural economies, and boost seafood exports, contributing to the nation's socio-economic progress. Four key species dominate the aquaculture sector: iridescent shark catfish *(Pangasianodon hypophthalmus);* Nile tilapia *(Oreochromis niloticus);* tiger shrimps *(Penaeus monodon);* and white-legged shrimp *(Lipopenaeus vannamei).*

Some producers of the iridescent shark catfish, primarily cultivated in the Mekong River Delta (MRD) using intensive freshwater systems, have transitioned to Nile tilapia, which is also farmed in the delta and northern provinces. Shrimp farming, traditionally practised in brackish environments like coastal mangroves and saline rice fields in the MRD, has evolved from low-intensity tiger shrimp cultivation to more intensive production of the white-legged shrimp.

While traditional low-intensity methods persist among small-scale farmers, high-intensity systems have gained traction as a strategy to enhance production capacity. The adoption of high-intensity systems—characterized by greater stocking densities and higher feeding rates—has significantly boosted Vietnam's shrimp output. To further advance this sector, the Vietnamese government introduced a national action plan for the development of the shrimp industry. This plan promotes the participation in certification systems crucial for accessing lucrative international markets. A government resolution in 2017 emphasized the need for climate-resilient and sustainable agricultural practices—focusing on the restructuring of key sectors, including aquatics, fruit trees and rice, within specific agro-ecological zones and with aquatic products being a primary focus.

1.2 Impacts on marine capture fisheries

Climate change assessments, such as those by the Intergovernmental Panel on Climate Change (IPCC), have consistently identified Vietnam as a country highly vulnerable to climate change impacts, particularly due to its extensive coastline, river deltas, and high population density. Specific risks include rising sea levels leading to coastal flooding, more intense and frequent tropical storms, and increased flood and drought frequency.

According to a VIFEP study, with a temperature rise of 0.8° Celsius, a 12.3 per cent increase in rainfall, a 16.7 per cent increase in storms and tropical depressions, and a rise of 14.3 cm in the sea level, Vietnam's marine capture fisheries could lose approximately 599,071 tonnes valued at Vietnamese Dong (VND) 14,572 billion (at 2010 constant prices). By 2050, if the temperature rises by 1.9° C, rainfall increases by 16.9 per cent, storms and tropical depressions increase by 20 per cent, and the sea level rises by 22.4 cm, losses could escalate to about 816,307 tonnes, equivalent to VND 19,855 billion (1 VND = 0.000039 USD). Meanwhile, a 2021 assessment report by MoNRE on the impact of climate change on the fisheries sector in Vietnam's northern and north-central provinces pegged economic loss for the marine capture fisheries sector due to change in temperature by 2050 at about VND 410 billion (based on 2012 comparative prices, discounted at 3 per cent each year.)

The composition of marine catches is shifting, characterized by a notable decline in moderate to large-sized fish and an increase in small, tiny fish, or "trash fish", in the catch. This phenomenon is thought to occur when fisheries in a given ecosystem, having depleted the large predatory fish on top of the marine food web, turn to increasingly smaller species, eventually ending up with previously spurned small fish and invertebrates. This practice disrupts marine ecosystems, reduces biodiversity, and threatens the sustainability of fisheries.

However, it remains unclear whether these changes in Vietnam's waters can be attributed to climate change, overfishing, or a combination of both. Further research is needed to better understand the causes.

The vulnerability ascribed to the effects of climate change, as defined by the IPCC in 2001, is a measure of the extent to which a system—be it natural, social, or economic—might be negatively affected by climate change or might struggle to adjust to its harmful impacts, such as climate variability and extreme weather events. The vulnerability index is composed of three primary factors: exposure (E), which is the degree to which a system is exposed to climate change impacts; sensitivity (S), which is the degree to which a system is affected by these exposures; and adaptive capacity (AC), which is the ability of the system to cope with the adverse effects and make necessary adjustments.

The VIFEP study also indicates that Vietnam's waters show a high degree of vulnerability to climate change. The central region of Vietnam has been identified as the most vulnerable, followed by the Tonkin Gulf, the south-eastern region, and the south-western region. The vulnerability index scores and rating are shown in Table 1.

Table 1. Vulnerability index by province

	Province/Region	E	S	AC	V	Damage index
I	**Tonkin Gulf**	**0.67**	**0.52**	**0.88**	**0.44**	**Medium**
1	Quang Ninh	0.28	0.66	0.27	0.55	Medium
2	Hai Phong	0.29	0.57	0.69	0.39	Low
3	Thai Binh	0.43	0.57	0.45	0.52	Medium
4	Nam Dinh	0.38	0.61	0.48	0.50	Medium
5	Ninh Binh	0.38	0.59	0.33	0.55	Medium
6	Thanh Hoa	0.43	0.69	0.57	0.52	Medium
7	Nghe An	0.30	0.62	0.70	0.41	Low
8	Ha Tinh	0.45	0.71	0.48	0.56	Medium
9	Quang Binh	0.42	0.84	0.52	0.58	High
II	**Central region**	**0.64**	**0.67**	**0.52**	**0.60**	**High**
10	Quang Tri	0.42	0.66	0.50	0.53	Medium
11	Hue	0.32	0.59	0.41	0.50	Medium
12	Da Nang	0.24	0.59	0.44	0.46	Medium
13	Quang Nam	0.34	0.68	0.62	0.47	Medium
14	Quang Ngai	0.40	0.65	0.58	0.49	Medium
15	Binh Dinh	0.36	0.62	0.82	0.39	Low
16	Phu Yen	0.37	0.70	0.58	0.50	Medium
17	Khanh Hoa	0.32	0.86	0.73	0.48	Medium
18	Ninh Thuan	0.31	0.62	0.57	0.45	Medium
19	Binh Thuan	0.21	0.61	0.58	0.42	Low
III	**Southeast region**	**0.21**	**0.51**	**0.13**	**0.53**	**Medium**
20	Ba Ria Vung Tau	0.26	0.41	0.53	0.38	Low
21	Ho Chi Minh City	0.70	0.56	0.47	0.60	High
22	Tien Giang	0.39	0.52	0.32	0.53	Medium
23	Ben Tre	0.33	0.58	0.50	0.47	Medium
24	Tra Vinh	0.28	0.53	0.55	0.42	Low
25	Soc Trang	0.34	0.57	0.29	0.54	Medium
26	Bac Lieu	0.34	0.51	0.00	0.62	High
IV	**Southwest region**	**0.29**	**0.21**	**0.54**	**0.32**	**Low**
27	Ca Mau	0.41	0.73	0.39	0.58	High
28	Kien Giang	0.34	0.46	0.40	0.47	Medium
Nationwide		**0.45**	**0.48**	**0.52**	**0.47**	**Medium**

Source: VIFEP

Tuna fisheries are among the region's most economically essential industries. While there are no detailed studies specifically addressing how climate change impacts tuna species in Vietnam's waters, research from the Pacific Ocean offers some insights. This broader research can serve as a foundation for understanding potential impacts in the Vietnamese context. A 2021 study found that climate change has observed impact on ocean temperature changes, and influence on atmospheric and hydrological cycles that have a significant impact on tuna distribution and abundance. This scenario approximates the El Niño-Southern Oscillation (ENSO) phenomenon.

ENSO involves warming and cooling patterns in the Pacific Ocean that have been observed to affect the location and population sizes of tuna, particularly skipjack, which are more sensitive to changes in water temperature. During warmer El Niño phases, skipjack populations increase and shift eastward, while cooler La Niña conditions drive them westward. Studies project that climate warming will push tuna species northward from Vietnam's Exclusive Economic Zone, with skipjack habitat deteriorating in tropical waters, but improving in higher latitudes.

This northward shift of tuna due to rising sea temperatures is poised to present significant challenges for Vietnamese fishers by limiting their access to traditional tuna stocks. It will likely disrupt local water circulation patterns, which refer to the movement of water within specific areas influenced by tides, winds, temperature differences, levels of salinity, and geographical features. These circulation patterns are crucial for distributing nutrients and maintaining the availability of prey species. Changes in water temperature and circulation can alter salinity levels that, in turn, can hit the reproductive rates of prey species around river deltas. These combined effects may further complicate the ecological balance and the sustainability of local fisheries.

Operational costs for fishing vessels, such as fuel, are expected to increase in proportion to the tracking distance of fish stocks. Given the global criticism of harmful incentives like fuel subsidies, this type of support for fishers is expected to decrease. Combined with restrictive access to fishing licenses in international or foreign waters, Vietnam's fishing industry is likely to face significant economic challenges. Vietnam's current status as a non-cooperating member of the Western and Central Pacific Fisheries Commission (WCPFC) restricts its fishing activities in the international waters managed by the commission. The likelihood of increased frequency and severity of typhoons could further complicate fishing activities.

In summary, Vietnam's management of marine capture fisheries is grappling with several significant challenges. The 2017 Law on Fisheries (Law No. 18/2017/QH14) mandates periodic assessments that are crucial for developing predictive models under various hypothetical scenarios. However, because of the absence of a detailed implementation plan, there are considerable gaps in time-series data. The national fisheries database (VNFishbase) is incomplete and requires extensive updates and calibration to function properly. Marine stock assessments are also limited to a depth of 182 metres, which restricts the ability to obtain a comprehensive understanding of stock status or their responses to climate change. While VIFEP conducted economic analyses on climate impacts, these are not all-encompassing. The Research Institute for Marine Fisheries (RIMF) expanded its comprehensive assessments to marine living resources in coastal and offshore areas from 2011-2020. Its primary focus on the changes in fish stock composition and distribution, however, neglects the effects of climate change. To enhance fisheries management

and adapt to evolving environmental conditions, a more detailed and comprehensive approach is necessary in future assessments.

1.3 Impacts on aquaculture

Climate change is markedly affecting aquaculture in Vietnam, particularly within the MRD, a key region for shrimps and iridescent shark catfish. The sector faces challenges from sea level rise, saltwater intrusion and frequent extreme weather events that disrupt production and inflict economic losses. As sea levels rise, saltwater encroaches into freshwater systems and coastal lands, altering the salinity of water bodies where fish and shellfish are farmed. This salinity change can stress aquatic species that are not tolerant to such shifts and potentially reduce their survival and growth rates. For Vietnam, if the sea level rises by 1 metre, about 40 per cent of the MRD area, 11 per cent of the Red River Delta area, and 3 per cent of the area of other coastal provinces will be flooded. Considering that the MRD contributes 50 per cent of the country's rice production and 95 per cent of rice exports, 65 per cent of aquaculture production and 60 per cent of exported fish, 70 per cent of fruit production, and one-third of Vietnam's agricultural GDP, this will result in a huge loss. Without adaptation measures, around 45 per cent of the MRD area will be affected by changes in salinity—resulting in an economic cost of about US $17 billion by 2030.

Aquaculture also faces enhanced risks from stronger storm surges and ocean acidification, affecting species health and productivity. Saltwater intrusion from 2015-2016 damaged 5 per cent (20,000 hectares) of total aquaculture area in the MRD. Similarly, from 2019-2020, it damaged 1 per cent (8,716 hectares) of the delta's total aquaculture area. The most affected provinces were Ca Mau, Tien Giang, Ben Tre, Kien Giang, and Bac Lieu. Species with high losses included shrimp, molluscs, freshwater carps, and catfish. The expansion of mariculture could present an opportunity to extend coastal farming areas. In Ca Mau province, damages were reported across 2,161 hectares of aquaculture area, with the majority in black tiger shrimp farms. The estimated total damage in this province alone amounted to VND 61.79 billion. In Bac Lieu province, a total of 6,203 hectares of shrimp farms were affected, with varying degrees of damage. Kien Giang province suffered losses over 6,949.6 hectares of shrimp farms. In Ben Tre province, the impact was reported over 1,890 hectares, including giant freshwater prawn (*Macrobrachium rosenbergii*) farms and shark catfish culture.

Another effect of climate change on aquaculture is temperature rise. Research from MoNRE shows that if the number of hot days above 35°C in a year increases by one day, there will be a 0.4 per cent reduction in farmed shrimp production the following year—decreasing to 0.6 per cent two years later, and again by 0.6 per cent three years later. The study also reported that climate change impacts, especially temperature rise, on the aquaculture fisheries sector in 10 northern and north-central provinces would result in an economic loss of VND 445 billion by 2050 (based on 2012 comparative prices discounted at 3 per cent per year) for the aquaculture sector.

1.4 Impacts on aquatic ecosystems

Research indicates that Vietnam, along with the Philippines, China, Taiwan, and Indonesia, is among the territories with the highest proportion of threatened coral reefs. Climate change, characterized by warming seawaters, alterations in salinity, and pollution,

Small scale fisheries in Tam Tien commune, Quang Nam province by Vo Hong Ron

has significantly impacted the habitat of coral species. Vietnam's coral reefs are known for their high biodiversity, hosting around 350 reef-building species and approximately 3,000 other marine organisms that depend on these reefs. Many of these species, such as lobsters, abalone, pearl clams, and sea cucumbers, hold substantial economic value. The ongoing effects of climate change threaten to further disrupt the biodiversity of these reefs and jeopardize the species that rely on them for survival, potentially impacting their economic contributions.

Vietnam's marine ecosystems, including its coastal wetlands like the mangrove forests in Ca Mau, Ho Chi Minh City, Vung Tau, and Nam Dinh, are experiencing significant changes attributed to climate change. These changes are evident in the reduction of coastal biodiversity and the degradation of marine habitats, leading to a decrease in available aquatic resources. In particular, there is a significant reduction in the area of these ecosystems, with up to 60 per cent of natural habitats being lost. Rising sea levels, increased saltwater intrusion, increased salinity in coastal estuaries, and other natural disasters such as storms and floods have negatively impacted marine and coastal ecosystems. In a 100-cm sea level rise scenario, 78 out of 286 'critical habitats' (27 per cent), 46 protected areas (33 per cent), 9 biodiversity areas of national and international value (23 per cent), and 23 other biodiversity areas in Vietnam would be severely affected.

According to national statistics from 2014, the coverage of Vietnam's seagrass ecosystems had already decreased by 40-70 per cent from previous benchmarks. Specifically, the seagrass area in Cua Dai (Quang Nam province) had declined by nearly 70 per cent as of 2009. In the south of Da Chong Cape (Dong Nai province), seagrass coverage had reduced from 45-60 per cent to lower than 19 per cent over the same period. In Ham Ninh (Quang Binh province), it had fallen from 30 per cent in 2004 to 15 per cent by 2009.

Climate change continues to alter hydrological regimes, oceanographic conditions, wave patterns, and sea level rise, all of which threaten to significantly reduce the extent of Vietnam's mangrove ecosystems. According to projections, a 1.0 metre rise in sea level could affect around 300 sq km of mangrove forests, representing roughly 15.8 per cent of the nation's total mangrove forest coverage. The resilience of mangrove species varies, with some unable to withstand changes in environmental factors like tides, salinity and temperature, resulting in the contraction of mangrove areas. The unique and fragile mangrove ecosystems are particularly susceptible to the effects of climate change, including the destruction from more intense and frequent storms.

Compounding the loss of mangrove forest cover, rising sea levels also cause serious indirect impacts on biodiversity and growth of mangrove forests. Degradation and reduction of mangrove forests may lead to:

i. Increased risk of coastal erosion
ii. Reduction in the livelihoods of coastal communities affecting fishing, aquaculture and ecotourism activities
iii. Reduction in the carbon storage capacity of mangrove forests.

1.5 Impacts on gender

In Vietnam, the impact of climate change on gender dynamics within the fisheries sector is under-researched. Men typically engage in offshore and large-scale fishing operations using vessels longer than 15 metres. These roles are becoming increasingly challenging due to shifting marine conditions and fish migration in response to warming waters. Women are generally absent on these larger vessels, often perceived as bringing 'bad luck' and due to the demanding nature of the work, which includes long hours and heavy labour at sea.

In contrast, women are more involved in artisanal or subsistence fishing, utilizing smaller craft over shorter trips, usually lasting between four to six hours. These operations often see women working alongside close male family members, such as husbands or brothers, where the physical demands are less than those on larger vessels. As climate change reshapes coastal fisheries and diminishes nearshore fish stocks, women's direct involvement in these smaller-scale operations is decreasing. Women's roles in relation to both small and large fishing operations often involve logistics and financial management, such as preparing provisions for trips. With the ongoing changes in fish stocks forcing vessels to travel farther and for longer periods, the burden on women in these supportive roles continues to intensify, highlighting the gender-specific impacts of climate change in the fisheries sector.

In aquaculture, women's presence is more visible. A study revealed that women's participation in inland or pond aquaculture is 15-45 per cent. Often living with their families in floating houses connected to marine cage culture, women typically assist with housework, logistics, and sometimes feeding tasks. On the other hand, men are charged with the more physically demanding jobs such as maintaining the cages, cleaning or replacing nets, and supervising the cultured species. The broader impacts of climate change, such as the increased migration of men from rural areas to urban centres in search of employment, frequently leave women to shoulder greater responsibilities within these aqua-

culture operations. This shift often results in heightened gender disparities, with women managing increased burdens with fewer resources.

In Vietnam, traditional gender roles that restrict women to specific tasks hinder their ability to adapt to changing conditions, thereby reducing their resilience. This limitation underscores the need for further research to better understand these challenges and develop effective solutions via targeted interventions.

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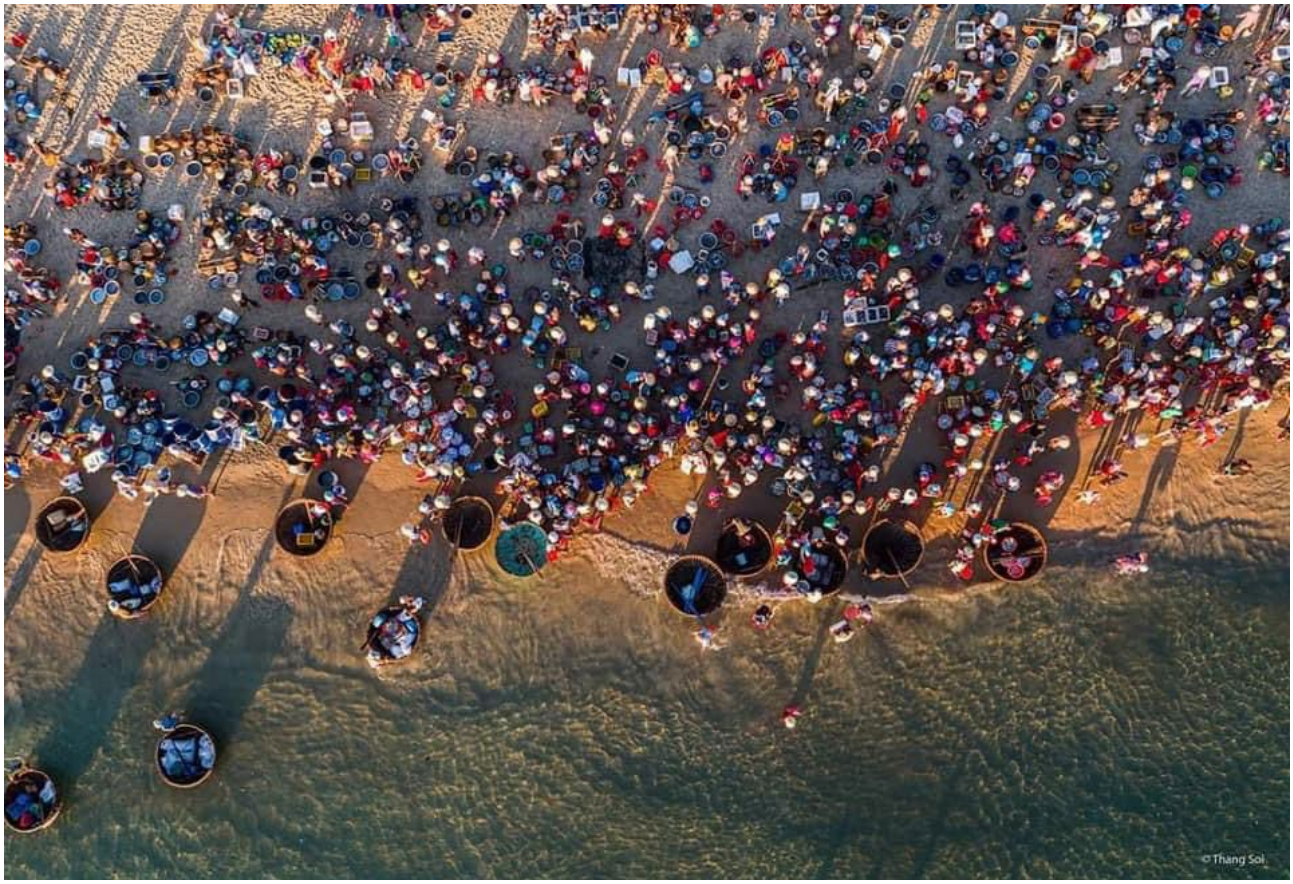

A fishing market in Tam Tien commune, Quang Nam province by Vo Hong Ron

2. Policies and Programmes

2.1. National and local policies

Vietnam has demonstrated commitment to climate change response through several key policies and strategic plans. The Central Executive Committee's Resolution No. 24-NQ/TW focuses on proactive climate change responses and environmental protection. The National Strategy on Climate Change, established by the Prime Minister's Decision No. 2139/QD-TTg, outlines objectives to enhance national resilience and reduce greenhouse gas emissions while ensuring sustainable development. It also aims to develop a low-carbon economy and improve the quality of life in the face of global climate shifts. The 2012-2020 National Action Plan on Climate Change (NAPCC), developed to execute this strategy, has been instrumental in advancing Vietnam's climate change initiatives.

The Prime Minister's Decision No. 1474/QD-TTg, issued on October 5, 2012, along with NAPCC, aims to enhance climate monitoring and natural disaster warnings, ensure food and water security, and improve flood defences. The plan emphasizes reduction in greenhouse gas emissions, fostering a low-carbon economy, and strengthening policy and management capabilities. It also encourages participation from various sectors and focuses on raising awareness, developing human resources, advancing science and technology, and bolstering international cooperation. The plan included 65 specific projects and tasks slated for 2012-2020, prioritizing programmes due for completion by 2015 to ensure the necessary funding and resources. Of these, 25 projects (38 per cent) have been approved and are currently being implemented, while the remaining 40 projects (62 per cent) have been integrated into the existing programmes and tasks of the responsible agencies (as of 2020).

After the expiry of the 2012 decision, the government issued, on July 20, 2020, Decision 1055/QD-TTg, promoting the National Plan for Adaptation to Climate Change (NPACC) for the period 2021-2030, along with a vision to 2050. This aims to reduce vulnerability and risk to the impacts of climate change by strengthening the resilience and adaptive capacity of communities, economic sectors, and ecological systems. It also promotes the integration of climate change adaptation into national strategies and planning systems. The decision outlines 43 missions in the agricultural sector, including fisheries.

The organizational management structure for handling the impacts of climate change is shown in Figure 2. MoNRE oversees the monitoring and evaluation system, coordinating with various ministries and provincial-level People's Committees. It is responsible for implementing and assessing climate change adaptation activities, guiding other min-

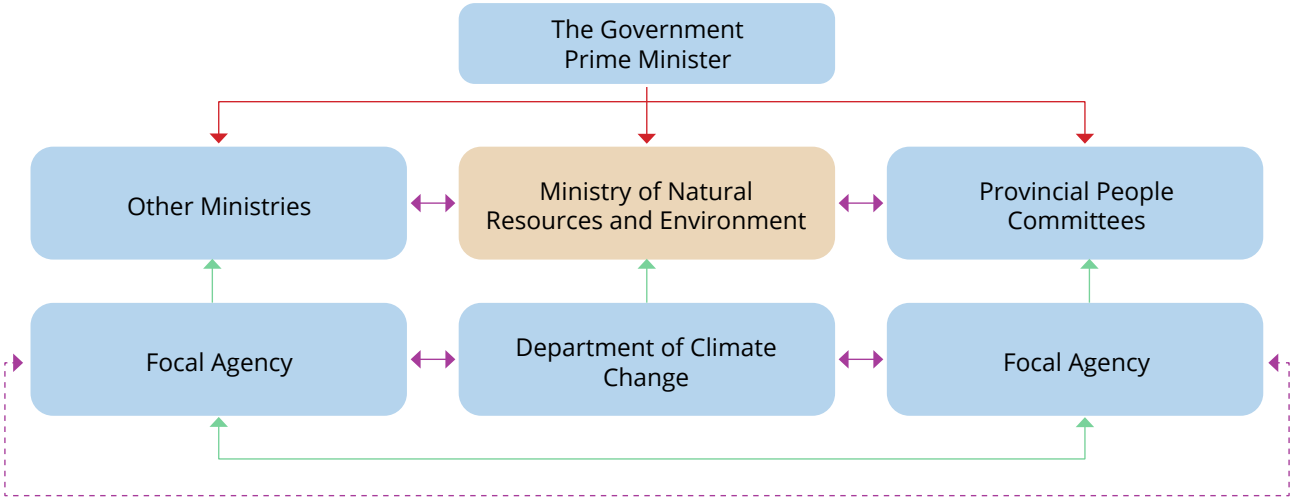

Figure 2. Organizational chart depicting the management structure in response to climate change. Red arrows indicate command channels, double purple dashed arrows represent cooperative interactions, and green arrows denote reporting lines.

istries and committees in these tasks, conducting periodic comprehensive evaluations, and synthesizing reports for state management and for the requirements of the United Nations Framework Convention on Climate Change (UNFCCC). Other ministries and agencies are tasked with managing their respective monitoring activities and reporting their findings annually to MoNRE.

In addition, a number of laws, programmes, projects and other related documents have also been issued. They include:

- the Law on Environmental Protection (2014 and then again in 2020)
- the Hydrometeorological Law
- the plan to implement the Paris Agreement
- the project to protect and develop coastal forests to respond to climate change in the period 2015–2020
- the target programme to respond to climate change and green growth for the period 2016-2020
- SPR-CC programme document for the period 2016-2020
- the adaptation programme for the sustainable development of the MRD
- Vietnam's Nationally Determined Contribution (NDC), updated in 2020
- the Prime Minister's Resolution No. 06/NQ-CP, dated January 21, 2021, promulgating the action programme to continue implementing Resolution No. 24-NQ/TW of the 11th Party Central Committee on proactive response to climate change
- the drive to strengthen resource management and environmental protection according to Politburo's Conclusion No. 56-KL/TW, dated August 23, 2019
- the Prime Minister's Decision No. 896/QD-TTg, issued on July 26, 2022, approving the National Strategy on Climate Change up to 2050
- the Prime Minister's Decision No. 118/2007/QD-TTg, issued on July 25, 2007, outlining policies to assist organizations and individuals involved in marine and coastal fisheries, aquaculture, and related logistics services in managing risks associated with natural disasters
- the Decree No. 67/2014/ND-CP, providing further support for managing natural disaster risks, including accident insurance for crew members, ship hulls, and fishing gear as described in Clause 2, Article 4, and Article 5, enhancing protections for fishermen facing risks and disasters

- the Prime Minister's Decision No. 339/QD-TTg, dated March 11, 2021, outlining Vietnam's fisheries development strategy until 2030, with a vision to 2045
- the Decision No. 1090/QD-TTg, dated September 19, 2022, approving the national programme to develop effective and sustainable fisheries exploitation for the period 2022-2025, with an orientation to 2030

In its recent Resolution 48/NQ-CP, issued on April 3, 2023, the government has delineated strategies for sustainable fishing practices and use of sea and island natural resources up to 2030, with a vision that extends to 2050. This focuses on improving climate monitoring, forecasting and early warning systems, with a goal to have a modernized and integrated system by 2030. It emphasizes strengthening the resilience of natural and social systems to climate impacts, developing community disaster response models, and implementing ecosystem-based solutions to minimize environmental damage like sea level rise and saltwater intrusion. The resolution advocates for proactive planning to mitigate natural disasters and climate change impacts, tailored to specific marine economic sectors and promotes technological innovations to reduce greenhouse gas emissions in alignment with Vietnam's commitment to achieve net zero emissions by 2050.

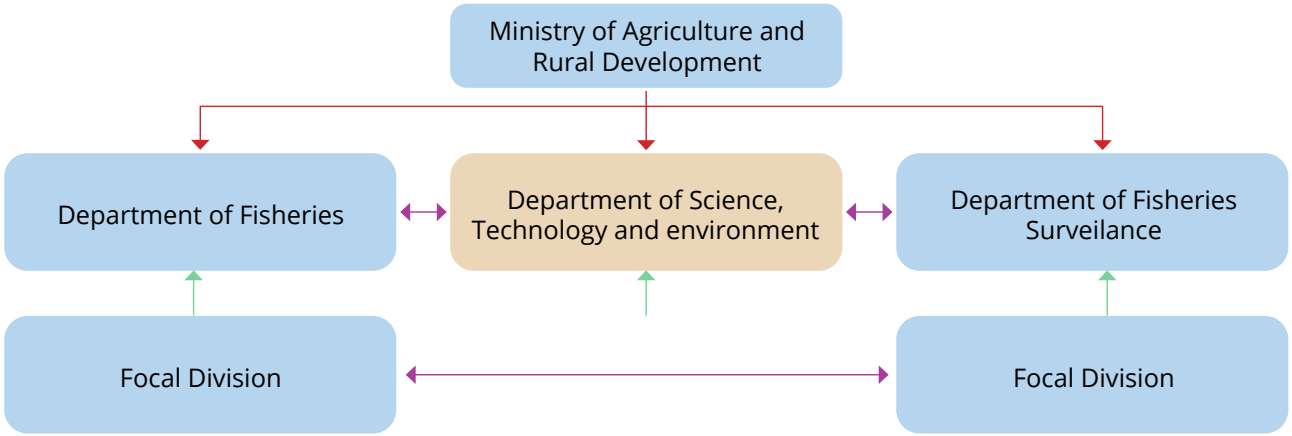

Figure 3. Organizational chart depicting the MARD's management structure in response to climate change. Red arrows indicate command channels, double purple dashed arrows represent cooperative interactions, and green arrows denote reporting lines.

The MARD has established a management structure (shown in Figure 3) for responding to climate change. The Department of Science, Technology, and Environment is designated as the primary entity in this framework. Under the Department of Fisheries, the Division of Capture Fisheries and the Division of Aquaculture are responsible for gathering and providing information on capture fisheries and aquaculture, respectively. The Department of Fisheries Surveillance oversees the Division of Aquatic Resources Protection and Development, which is tasked with collating information pertaining to the conservation status of aquatic resources.

The MARD issued and implemented a number of policies to support fisheries development, as well as strengthen capacities and propose solutions for climate change adaptation through national programmes and action. These include:

- Decision 158/2008/QD, issued on December 2, 2008, approving the national target Programme to respond to climate change; the Prime Minister's Decision No. 1670/

QD-TTg issued on October 31, 2017, approving the target programme to respond to climate change and green growth in 2016-2020

- Action plans to respond to climate change for the agriculture and rural development sector for 2011-2015 and vision to 2050 were outlined in Decision No. 543/QD-BNN-KHCN, dated March 23, 2011. The vision was extended to 2016-2020 under Decision No. 819/QD-BNN-KHCN dated March 14, 2016

- On March 17, 2020, the ministry issued the implementation plan for the Paris Agreement for 2021-2030 in Decision 891/QD-BNN-KHCN. The plan emphasizes several key areas: developing fisheries, aquaculture, and seafood trade to respond to climate change; creating a sustainable fisheries development project in the MRD; and investigating and evaluating the effects of saltwater intrusion on aquaculture in the delta. It includes activities related to sustainable fishing practices and aquaculture. Although these missions are not mandatory, they are prioritized and encouraged tasks

The MoNRE's Department of Climate Change (DCC) has launched a website (adaptation.dcc.gov.vn) that offers a comprehensive database. It consolidates information on legal documents, science and technology programmes, covering more than 100 topics and including research results, and the adaptation activities of various ministries, sectors, and localities. It also features maps displaying such data as baseline temperatures, rainfall, sea level rise, and climate change scenarios and their impacts.

Significant challenges remain due to notable differences between Vietnam's policies and international standards; this complicates the development, updating and implementation of these documents. There is a lack of detailed operational guidance and difficulties in integrating scientific tools for prediction and planning. Many legal documents fail to provide adequate guidance on mechanisms for sharing climate change data, prioritizing adaptation activities, and integrating gender equality into climate adaptation strategies. In addition, technical guidelines and management documents for adaptation activities require more detail to be practically applied across various fields. There is a scarcity of expertise in utilizing scientific tools for climate prediction. Research on using climate scenario data in infrastructure planning is also insufficient to form the basis for setting standards and regulations.

The NAPCC includes 43 tasks and solutions for the agricultural sector, with several tasks specifically targeting fisheries. The most significant challenge is financial capital, as current domestic funding covers less than 50 per cent of the plan's requirements, necessitating support from international bodies and the private sector. Another major limitation is the limited availability and sharing of data. Accurate forecasting demands a substantial volume of data that Vietnam currently lacks. Although the MoNRE has issued the 2020 Climate Change Scenario, it has not been updated. The ministry is awaiting the IPCC's announcement of the Global Climate Change Scenario, which will then be downscaled for Vietnam. Based on this, specific assessments for each industry will be made. The slow institutionalization of policies, coupled with inadequate guidance, further complicates effective implementation across localities and ministries not specialized in climate change. These factors necessitate a re-evaluation and potential restructuring of institutional roles to streamline efforts and enhance the effectiveness of Vietnam's climate change policies.

Small-scale fisheries in Tam Tien commune, Quang Nam province, by Vo Hong Ron

2.2. Monitoring and early warning

According to MoNRE's 2022 national report on adaptation plan, the Hydro-Meteorological Station Network comprised 1,640 stations and measuring points as of April 2020. This included 202 meteorological stations, 14 automatic radiation measuring stations, 29 agricultural meteorological stations, and one global climate monitoring station in Pha Din. There were 782 independent automatic rain measuring points and 404 hydrological stations, of which 162 were not part of the network's development plan, but were invested in for automatic hydrological monitoring of inland areas in the MRD. The network also included 27 oceanographic stations, 179 air and water environmental monitoring stations (including 91 salinity measurement stations), 27 overhead meteorological stations, weather radar, and 18 lightning detection and monitoring stations.

The accuracy of Vietnam's storm forecasts has gradually approached the level of advanced countries in the region and elsewhere in the world. Currently, Vietnam provides early storm warnings five days in advance, while forecasts and warnings of tropical depressions are issued three days in advance. As well, the number and frequency of warning messages and forecasts for storms and tropical depressions have increased to four to eight bulletins per day. Frost forecasts and warnings are issued two or three days in advance with about 75 per cent reliability—with warnings of severe cold and harmful cold are provided two to three days in advance with 80-90 per cent reliability. Flood warnings are issued one or two days in advance for rivers in the central region and the central highlands, and three to five days ahead for rivers in the northern and southern regions, with 70-80 per cent reliability. Warnings of widespread heat waves are issued two to three days in advance with 70 per cent reliability.

The earthquake and tsunami warning system has begun to take shape. At the central level, the Institute of Geophysics is responsible for broadcasting tsunami warning bulletins to relevant agencies and activating the system of watch stations to warn the public when a tsunami is likely to occur. Locally, the Steering Committee for Natural Disaster Prevention and Search and Rescue of provinces and cities from Ha Tinh to Ba Ria-Vung Tau activates the system of local watch stations. These stations guide people in responding to earthquakes, tropical depressions, storms, and other types of natural disasters according to the actual situation in their locality.

2.3. Ensuring food security

Agricultural insurance policies in farming, livestock, and aquaculture have guaranteed the rights of insurance participants and shared risks in agriculture. These policies have been implemented in 20 provinces. A total of 304,017 farming households and production organizations were participating in agricultural insurance as of 2022. The total insured value of the whole programme was VND 7,747.9 billion, of which seafood (aquaculture) accounted for VND 2,883.7 billion. The insurance claim rate (as reported in 2022) was 178.1 per cent—with a total compensation settlement payout of VND 701.8 billion, of which compensation for seafood amounted to VND 669.5 billion. The government has also signed Decision No. 13/2022/QD-TTg to implement a support policy for agricultural insurance. Targets eligible for agricultural insurance premium support include: crops of

Fisheries products processing by women in Tam Tien commune, Quang Nam province, by Hoang Thi Ngoc Ha

rice, rubber, pepper, cashew and coffee; livestock, including buffalos, cows and pigs; and aquaculture, covering black tiger shrimp, white shrimp, and shark catfish.

2.4. Community participation

The 2013 Law on Natural Disaster Prevention and Control, along with its implementing Decree 66/2014/ND-CP, mandates community involvement in natural disaster prevention and management, supported by state-led training and public awareness initiatives. The 2014 Law on Environmental Protection further assigns communities a role in climate change response activities. Meanwhile, Decision No. 172/2007/QD-TTg, issued on November 16, 2007, had outlined the National Strategy for Natural Disaster Prevention and Mitigation until 2020, advocating for a participatory approach and the integration of disaster management into local development plans.

In 2015, climate-smart aquaculture (CSA) trials were conducted in the Hoang Phong commune of Thanh Hoa province. This was a collaboration of WorldFish, VIFEP and the Thanh Hoa Agriculture Extension Centre (TEC), under the aegis of the MARD and the CGIAR research programme on Climate Change, Agriculture and Food Security (CCAFS). These trials involved raising tilapia in rotation with tiger shrimp, mud crab, and seaweed using traditional extensive aquaculture methods. Initial results indicated that the CSA approach offers a 'triple win' for local farmers by sustainably enhancing productivity and efficiency, increasing resilience to climate change, and contributing to climate change mitigation. However, challenges such as the availability of high-quality fish seed and feeds, low market demand for tilapia, and risks associated with extreme climate events need to be addressed to expand this practice across regions.

Small scale fisheries in Tam Tien Commune, Quang Nam province, by Hoang Thi Ngoc Ha

The 2017 Law on Fisheries in Vietnam mentions 'co-management' and 'community-based fisheries co-management' in Article 10. Although the law does not directly address the use of these management strategies to mitigate the impact of climate change, it implies a framework that could be leveraged to enhance resilience. This approach suggests a shift towards a more localized participatory management of fisheries resources, which could be crucial for adapting to and mitigating the effects of environmental variability. This is also supported by the Fisheries Development Strategy to 2030, with a vision that extends to 2045. Between 2021-2023, a project titled 'Enhancing Implementation of the 2017 Fisheries Law in Vietnam: Initiatives from Central to Local Levels', led by the Centre for Marinelife Conservation and Community Development (MCD), focused on promoting co-management practices in aquatic resource protection across Binh Dinh, Quang Nam, and Khanh Hoa provinces. The initiative aimed to provide practical lessons and strengthened the capabilities of stakeholders engaged in the implementation process.

Over the course of three years, the project enabled two communities to be recognized and granted the authority to co-manage aquatic resources in line with the 2017 Fisheries Law. It also supported five community organizations to develop and implement co-management plans. As a result, 180 hectares of coral reef areas are now under protection through concerted efforts in patrolling, monitoring, and public education conducted by these organizations. This project exemplifies effective community involvement in resource management, which is crucial for the sustainable protection of marine environments.

The project, initiated under Decision No. 1002/QD-Ttg (July 13, 2009), advanced community-based natural disaster risk management nationwide. By the end of 2018, surpassing project targets, awareness programmes had reached 1,900 of 6,000 high-risk communes, with 1,320 communes developing risk maps and over 1,475 provincial lecturers trained. Numerous technical documents and guides for community-level implementation have been distributed by the MARD. Following the 'four on the spot' strategy in disaster management, significant progress has been made in natural disaster response, with 44 of 63 provinces developing prevention plans and 39 crafting response strategies by 2018.

Training for local authorities and response teams is conducted regularly to enhance readiness across all levels of government. Grassroots organizations and government bodies at all levels are crucial in implementing climate change response and disaster risk reduction measures, with established Steering Committees for Flood Prevention, a Search-and-Rescue apparatus that is active from the provincial level down to the village level. Localities are now focused on developing and diversifying livelihoods through activities such as restructuring crops and livestock, changing the scope and scale of production, and applying technology transfer. About 200,000 hectares of ineffective rice cultivation have been converted to more effective aquaculture, corn, cash crops and animal feed crops in the deltas of the Mekong and the Red River.

The Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods (MD-ICRSL) Project, funded by the World Bank and implemented by the MARD in coordination with relevant ministries and localities, comprised five components and 16 sub-projects aimed at enhancing monitoring, forecasting, and database analysis capabilities, as well as investing in infrastructure and developing livelihoods for targeted regions. The project directly contributed to the development of about 1.183 million hectares and benefited about 3.95 million people across 26 districts. It also indirectly impacted the three regions of Dong Thap Muoi, Long Xuyen, and the Ca Mau peninsula and coastal estuary, covering over 1.5 million hectares and involving around 4.97 million people.

Key infrastructure improvements included the upgrading of 470 km of embankments, construction of 192 culverts, protection of 27 km of coastline, and enhancement of a 50-km coastal mangrove forest belt. The project also developed flood drainage corridors, upgraded fragile dikes, and constructed viaducts to mitigate flood impacts and enhance production stability during flood seasons. Furthermore, the project supported the conversion of over 47,900 hectares to sustainable production practices and provided training to 40,830 individuals on sustainable techniques. This support fostered diverse, sustainable livelihood models tailored to regional conditions, encouraging local populations to adapt their practices to better cope with climate change and potential sea level rise.

Launched in 2023, a project, titled 'Smart Coastal Communities Adapting to Climate Change in Vietnam', spearheaded by UNDP and funded by the Canadian government is another effort that focuses on enhancing the resilience of vulnerable coastal communities. The project, which places an emphasis on women, aims to bolster marine and coastal ecosystem services and promote climate adaptation and biodiversity conservation. Running for four years until March 2027, it is active in three coastal provinces of Binh Dinh and Thua Thien Hue, both in the central region, and Soc Trang in the MRD. The initiative features three main components: (i) climate change response; (ii) biodiversity conservation; and (iii) gender equality. Initial efforts in Binh Dinh province have involved mangrove reforestation, establishment of a marine protected area in the Quy Nhon Bay, coral reef restoration, installation of early warning stations, and support for community-based livelihood models.

Although there have been continuous efforts, the development and diversification of livelihoods to adapt to climate change in Vietnam faces financial constraints and a lack of comprehensive and scalable solutions. While certain models for livelihood transformation have shown success, there is still a need for consistent and thorough evaluation. Local knowledge on responding to climate change has not been fully harnessed, assessed, or utilized in formulating guidelines for its preservation and enhancement. Although many projects and initiatives focus on aquaculture, there remains a significant gap in assessing the impact of climate change on marine capture fisheries. This sector is crucial and has the potential to affect millions of people in coastal communities, underscoring the need for an integrated approach to climate adaptation across all facets of the fisheries sector.

Improving the resilience and adaptation of SSF to climate change in Vietnam involves several strategic approaches, including:

- Enhancing the capacity for climate monitoring and forecasting to enable fishers to better prepare for adverse weather conditions. This includes the development of localized early warning systems and training programmes to help fishers interpret and act on relevant information
- Promoting sustainable fishing practices. This can be achieved by supporting the adoption of gear and methods that reduce environmental impacts and establishing protected spawning areas to help replenish fish stocks. Education and training programmes will also raise awareness about sustainable practices and their long-term benefits for both the environment and the fishing communities
- Diversifying income sources for fishing communities to reduce their vulnerability to climate-related shocks. This involves developing aquaculture as an alternative or

complementary activity to capture fisheries. It includes supporting alternative livelihoods through skill development in other sectors such as tourism or crafts

- Continue enhancing the resilience of coastal infrastructure to withstand extreme weather events. This includes building more robust harbour facilities, improving flood defences, and restoring mangrove forests, which provide natural coastal protection and breeding grounds for fish

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A fisherman preparing his fishing net in Tam Tien commune, Quang Nam province, by Hoang Thi Ngoc Ha

3. Adaptive Capacity of SSF Communities

A Case Study in Tam Tien Commune, Nui Thanh district, Quang Nam province

3.1 Background

The terrain of Quang Nam province is divided into three regions: the mountainous region to the west, the midlands, and the coastal plains to the east. The province has a coastline stretching 125 km across six districts and cities. Coastal localities have rich marine ecosystems that offer many economic activities, including fishing and aquaculture, agriculture, forestry, business and tourism services. Nui Thanh, a typical district in terms of its fisheries economy with traditional offshore and nearshore fishing as well as river fishing, has a coastline of 37 km. The area is also known for its beautiful landscapes, mangrove forests, and coastal salt marshes. With a total area of 53,396.07 hectares, the district has a population of 160,414 (as of 2020) residing in one town and 16 communes, including six coastal communes. Over 60 per cent of the district's population live in rural areas and are primarily engaged in agriculture, fisheries, forestry, tourism, and services.

Nui Thanh has two sea entrances, An Hoa and Cua Lo, which form the abundant fishing grounds that are rich in seafood resources and are conducive to the development of fisheries. The production from 2016 to 2020 increased rapidly—production volume in 2016 was 51,230 tonnes, rising to 54,344 tonnes in 2020. Its economic value increased from VND 1,795.260 trillion in 2016 to VND 2,254.529 trillion in 2020, averaging a 5.86 per cent increase per year. This is attributed to the contribution of the fishing community in the Tam Tien commune, one of the coastal communes engaged in traditional fishing that has recently taken up aquaculture development.

Covering a total area of 19.6 sq km, Tam Tien commune's population of 11,432 people is composed of 41.1 per cent women—with roughly 66.6 per cent of its population in the working age, that is, around 7,612 workers. The commune has 240 hectares of forests, mostly coastal. As of 2023, the commune had a total of 292 fishing craft operating at sea and on rivers, of which 59 per cent were engaged in offshore fishing with 172 fishing vessels and about 430 regular seafaring workers (all male). The coastal location near major river mouths affords a significant advantage for the Tam Tien commune and neighbouring communes in developing community livelihoods linked to coastal and marine ecosystem services.

A co-management practice is being implemented by the local government and community groups to protect 64 hectares of coral reef, contributing to the reduction of over-fishing in the coastal areas of Tam Tien. The community organization, which consists of 42 members engaged in co-management and protection of aquatic resources, was officially recognized and designated as the delegated authority according to Decision No. 8314/QD-UBND of the People's Committee of Nui Thanh district on October 27, 2022. However, over the past two decades, these areas have frequently suffered from adverse impacts of worsening extreme weather events, including storms, drought during the dry season, and floods during the rainy season, accompanied by riverbank and coastal erosion.

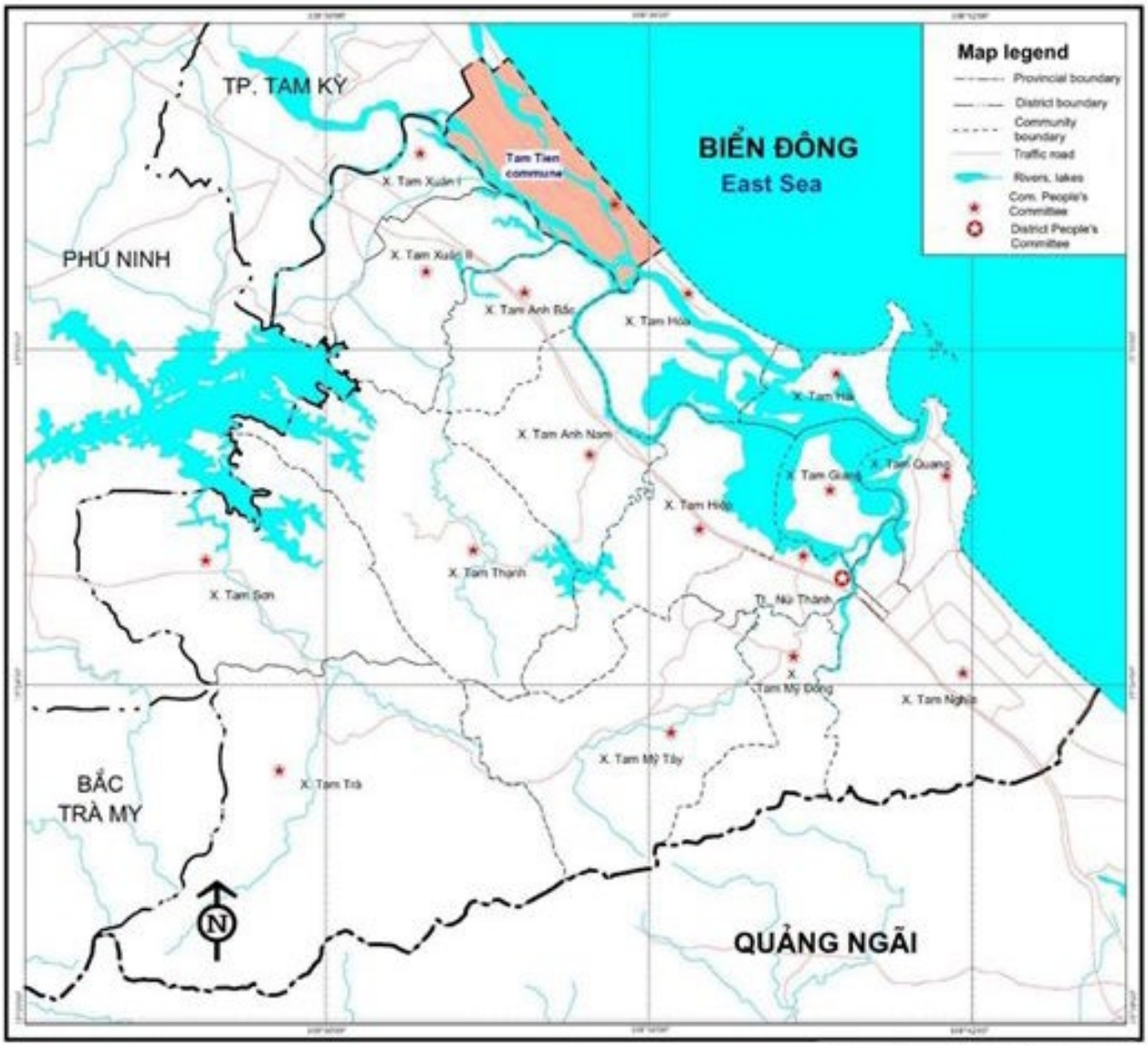


Figure 4. Administrative map of Nui Thanh District, Quang Nam Province

3.2 Impact on Vulnerable Community Groups in Quang Nam Coastal Area and Tam Tien Commune

Quang Nam, a mountainous and primarily coastal plain area, is one of the central provinces highly vulnerable to climate risks. According to the Provincial Climate Change Assessment Report of Quang Nam in 2020, the period from 1970 to 2018 witnessed significant fluctuations in climate factors such as rainfall, temperature and sea level, along with abnormal extreme weather events across the province and specifically in the coastal district of Nui Thanh. Typical natural disasters include storms, tropical depressions, floods, drought, erosion, and saltwater intrusion.

Between 1976 and 2018, the average annual temperature of Quang Nam province increased by an average of 0.16°C per decade, with the latter period recording higher increases than the former, accompanied by an increase in prolonged sunny days. During this period, rainfall slightly increased in mountainous areas, but increased significantly in coastal areas, while sea levels were recorded to be higher. According to climate change scenarios, if sea levels rise by 100 cm, about 13.2 per cent of the area of Nui Thanh district will be submerged. Over the past four decades (1976-2018), a total of 35 storms hit Quang Nam province, and two-thirds of them have directly impacted coastal fishers and small-scale fisheries, including Nui Thanh district and the Tam Tien commune.

Secondary scientific data and recent field surveys conducted by a local research group showed that the fisheries economy, in particular, and key production sectors such as agriculture, forestry, and services in the Tam Tien commune, are suffering significant losses due to the effects of climate change alongside challenges from the development process itself (such as environmental degradation and overexploitation of fisheries). It is especially concerning that the number of major storms and super typhoons has been trending upward in recent decades. Table 2 illustrates some of the major storms that have caused significant human and property losses, as well as environmental damages, to Quang Nam province and neighbouring coastal provinces.

Table 2. Statistics of the damages caused by several major storms to Quang Nam province and neighbouring coastal provinces.

Name of Storm	Year	No. of Fatalities & Missing Persons	No. of Houses collapsed and swept away	Economic Loss (in billion VND)	Production Loss
Xangsane	2006	67	16,000	10,000	Thousands of people were injured, hundreds of thousands of hectares of flower fields and aquaculture ponds were flooded; hundreds of fishing craft were swept away, sunk, and damaged.
Ketsana	2009	174	2,000	14,014	
Nari	2013	4	11,000		
Molave	2020	67	88,591	10,000	

Source: compiled from the Climate Assessment Report and Disaster Damage Report of Quang Nam province in 2020 and 2022 (People's Committee of Quang Nam province, 2022; UNDP, 2022).

Similarly, the Tam Tien commune is a coastal area that regularly bears the adverse impacts of extreme weather conditions and natural disasters. The synthesis of reports, scientific data combined with surveys and interviews with local officials and community consultations, showed that Tam Tien and several nearby communes situated in coastal, riverbank, and estuarine areas, are frequently exposed to major natural disasters such as storms, heavy rains, and combined rainfall and storm surges causing flooding, thunderstorms, lightning, hailstorms, drought, and the potential risk of landslides.

Agriculture and fisheries activities in these areas mainly follow traditional methods, relying heavily on nature. The seasonal production and harvesting from fishing, aquaculture, and seafood processing typically occur from March to September each year. This coincides with periods prone to storms, tropical low pressures causing heavy rain, flooding, and inundation as well as prolonged heatwaves. Consequently, the SSF in the Tam Tien commune (including fishing and aquaculture along the riverbanks), farming, water management projects, and coastal forest areas are vulnerable and suffer significant damage. Coastal fishing and aquaculture along the coast and riverbanks, mainly brackish shrimp farming as a major source of income for the local people, continue to be the most affected livelihoods.

Fishermen group in Tam Tien commune, Quang Nam

Table 3. Seasonal calendar of livelihoods and disaster in Tam Tien Commune (based on April 2024 field survey)

No.	Livelihoods, disaster and climate risks	Production Season											
		1	2	3	4	5	6	7	8	9	10	11	12
I.	**HOUSEHOLD LIVELIHOODS**												
1	Capture Fisheries			Capture fisheries									
2	Aquaculture (shrimp and fish) - Fish aquaculture: from March to September - Shrimp aquaculture: Intensive aquaculture, mainly white-legged shrimp; peak season in June and September.			Aquaculture									
3	Purchase, transportation, and processing of aquatic products: purchased at Tam Tien fish market (processing and storing fish at processing households, traders visit the locale to buy on-site).			Collection, transportation and processing of fisheries products									
4	Ecotourism and services (newly developed)												
5	Cultivation: rice, vegetables, cereal crops (potato, peanuts, cassava); peak harvest is March, April, August, and September (mainly for home use and sale to users in the district), insignificant income.					Cultivation							
7	Husbandry	Husbandry											
II.	**DISASTER AND CLIMATE RISKS**												
1	Typhoons: peak is in October and November, affecting both fishing activities and brackish water shrimp farming in the area along both banks of the Truong Giang River.										Typhoons		
2	Thunderstorms: occur annually and are very dangerous for offshore and nearshore fishing, as well as for boat anchorage areas.				Thunder storms								
3	Heavy rain and flooding: significantly impacts fish and shrimp ponds and cages along both banks of the Truong Giang River, as well as rice fields.	Heavy Rain, Flood									Heavy Rain. Flood		
5	Landslide: Dangerous, coastal embankment area of Ha Loc village (Tam Tien commune).												
4	Drought: water shortage for production (rice and plants cultivation).												

The results of the field surveys, community consultations, and interviews with key commune officials in April 2024 indicated that the impact of various types of natural disasters varies. Storms, followed by floods causing inundation and landslides, droughts leading to water shortages during the dry season, and thunderstorms were cited as the major threats. Increasing temperatures and heavy rainfall causing flooding pose the greatest threat to aquaculture ponds. Thunderstorms, lightning, and storms are significant dangers to the capture fishing industry. Thunderstorms and lightning often occur at sea and in coastal areas during the summer, happening at night and manifest very quickly, making early prediction difficult. This poses grave health hazards and often results in casualties or accidents, the destruction of fishers' property, shipwrecks, and collapse of houses.

In 2023, due to unusual weather, both the catch and aquaculture production, particularly in the aquaculture area of the Tam Tien commune, decreased compared to the 2022 level. This requires monitoring—particularly in light of frequent disease outbreaks, unstable prices, and increased costs of feed and supplies for shrimp farming. In September 2022, Typhoon No. 4 (Noru) caused seven vessels to sink and inflicted significant property damage. Over the past decade, more than 140 households living in coastal and riverbank areas at high risk of landslides have been relocated to the Resettlement Project for People Affected by Landslides in Quang Nam province.

Table 4. Summarizing the impacts of natural disasters and climate change on fishing, aquaculture, and seafood processing (ranking of impacts from 1-5)

No.	Community livelihoods	Disaster and climate risks that affect the livelihoods	Affected sites	Impacts and effects (specific description)	Levels of impacts and effects (from 1-5)	Ranking of levels of impacts on male and female labourers (from 1-5)	
						Female	Male
1	Capture fisheries	Thunderstorms and typhoons	Anchoring areas and bridges	- Sunken or lost vessels - Fatalities or disappearances - Damaged equipment - Loss of fisheries products, fishing cessation (no income)	**4**	**3**	**5**
2	Aquaculture	Typhoons, heavy rains, landslides, high temperatures and sudden increases	Along both banks of the Truong Giang River, 0.7-1.5 km away from the coastline	- Storms cause pond embankments to break and damage aquaculture properties and equipment; drifting cages result in lost shrimp and fish, leading to a sharp decrease in productivity - Freshwater intrusion leads to decreased seafood quality - Aquatic species grow slowly (such as flounder and white-legged shrimp) and suffer from diseases, resulting in high mortality rates - Decreased income, increased debts, and bankruptcy - Reduced employment opportunities, job losses for labourers	**4.5**	**3.5**	**2.5 – 3**
3	Fisheries products collection and processing	Affected indirectly by the typhoons and storms, heavy rain	Four communes along the coastline of Tam Tien Commune	No fisheries products (seafood) mean no jobs and no income; impacting women the most as they constitute the primary workforce	**3**	**3.5-4**	**2**

The Tam Ky and the Truong Giang rivers run along the length of the Tam Tien commune. This is a natural advantage for rice and flower cultivation and brackish aquaculture. But storms and heavy rains increase the risk of flooding and landslides. Many households suffer significant losses in crops, shrimp, and pond properties due to high water levels. In addition to direct and visible impacts, extreme climatic change possesses the potential for larger and longer-lasting effects that are harder to observe directly. Some scientific studies have demonstrated that climate change affects fish stocks and aquaculture production, while also negatively impacting coral reefs and altering species composition and diversity. Rising sea levels and increasing average temperatures lead to habitat loss. Changes in temperature and ocean currents have a significant effect on fish migration. Ocean acidification impacts the health of marine ecosystems, thereby potentially reducing fish abundance. Most survey participants and interviewees were unaware of these phenomena or do not understand them.

In short, the primary climate risks faced by the coastal community in the Tam Tien commune include storms, floods, drought and hurricanes, with the most impacted livelihoods being capture fisheries and aquaculture farms. Men and women have to endure varying impacts due to the increased human safety and health risks. The loss of, and damage to, infrastructure and equipment (craft, houses and others), reduction of opportunities for employment and income as well as increased social tensions are other issues of concern.

3.3 The capacity to reduce risk and adapt

In the current context of climate change, people are facing risks across the world. But those living in rural and coastal areas in tropical ecosystems associated with agricultural and fisheries livelihoods, like the Tam Tien commune, have to contend with greater, more immediate, threats and danger. The risks are exacerbated if the community possesses characteristics that increase its vulnerability, while also having a low coping capacity due to limited resources. The inverse can also be true: a high community coping capacity corresponds to reduced risk.

For the overall economic development of the Tam Tien commune—and specifically the fisheries livelihoods—capacity will have to be demonstrated by the ability to mobilize several types of human, natural, financial, physical and policy resources. In fact, these are also the resources to key a number of efforts that will enhance the community's resilience in the context of climate change, such as disaster risk reduction, adaptation to climate change, and sustainable livelihood development. Some of the key advantages and opportunities for the development of SSF and disaster response in the analysed localities are:

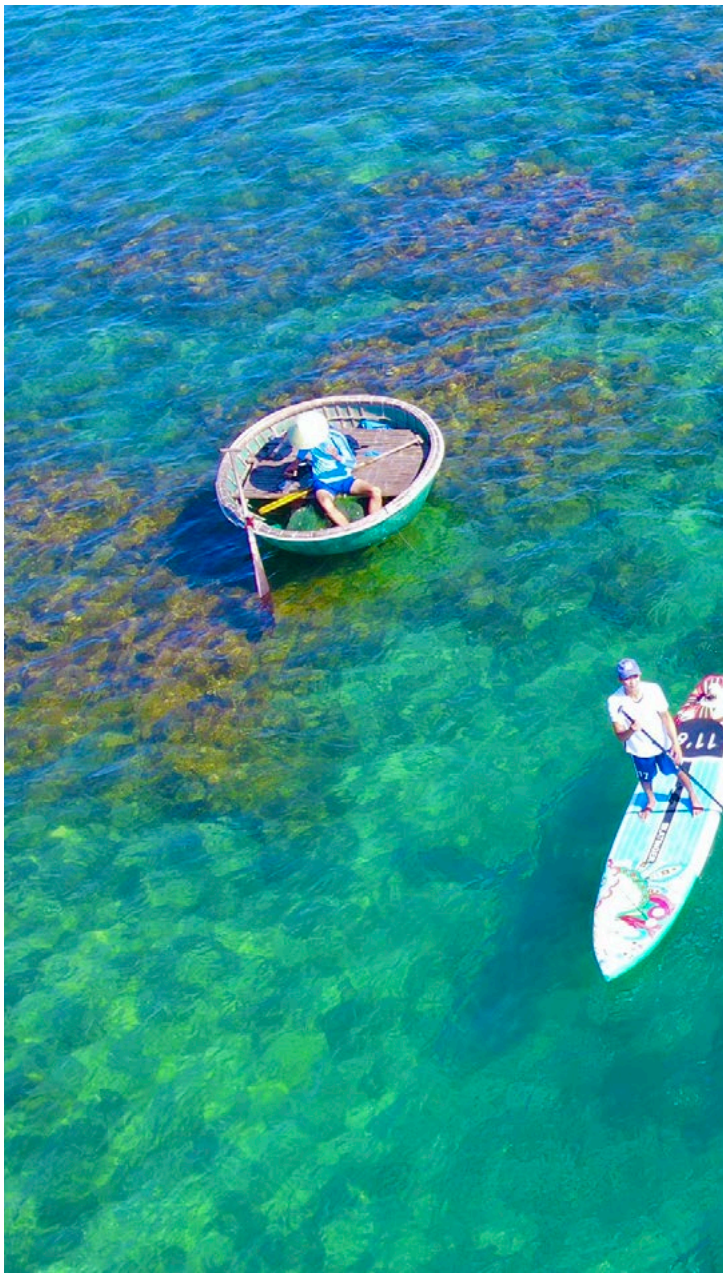
- Advantageous location, coastal terrain, numerous rivers, and aquatic resources
- The presence of, at the provincial level, economic and social development planning and a Climate Change Adaptation Action Plan for the 2021-2030 period, including directions for fisheries development
- Local authorities and residents that are more proactive in disaster prevention and control efforts

- The presence of NGOs in the Tam Tien commune, providing technical support and awareness-raising

- Great potential and direction for the development of SSF linked with community-based ecotourism

However, there are still many difficulties and challenges for the community and the Tam Tien authorities. Although the commune has significant advantages in terms of aquatic resources and its coastal location for developing SSF and community tourism, this is also a characteristic that reflects the high exposure and vulnerability of the locality to natural hazards like extreme weather events and rising sea levels.

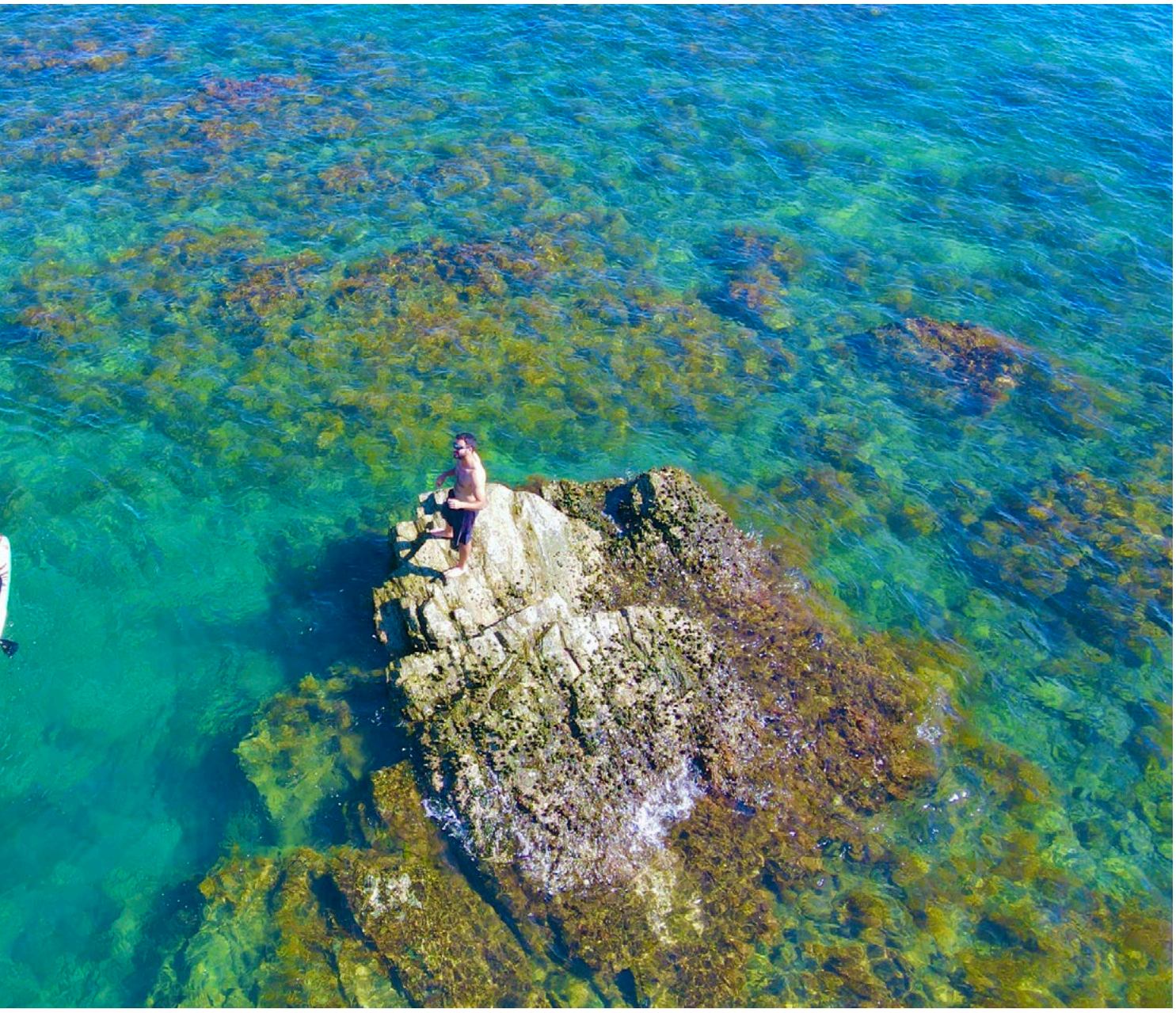
In terms of general population health, knowledge, skills, experience, and attitudes of the local workforce as well as traditional cultural practices and community cohesion, the Tam Tien commune has many strengths. The majority of fishery and aquaculture workers are aged between 20 and 50, possessing good health and extensive experience with a strong sense of solidarity and mutual support. However, most of them have low levels of education and lack scientific knowledge, relying solely on their traditional experiences regarding weather and fishing, which may not always be effective in cases of extreme and unpredictable weather events. Many households still use destructive fishing gear near the shore; for example, small mesh nets and bottom trawls. Although access to information is easier and faster now, people's awareness, understanding, and compliance with laws regarding sustainable fisheries exploitation remain very limited.



Even with the existing infrastructure and equipment, the Tam Tien commune is still limited in terms of disaster response and underutilized for fisheries. In 2023, the commune had 30 offshore fishing vessels and 241 nearshore and river fishing craft. Although the locality has been supported by many fishing vessels for nearshore and offshore fisheries, there has not been significant utilization of these advantages. Both in fishing and aquaculture, with 385 hectares of aquaculture ponds, there is a lack of early warning equipment against disasters. In aquaculture ponds, technical equipment, including wastewater treatment systems, are outdated. Post-harvest infrastructure like fish markets and seafood processing facilities are mostly self-established, manually operated

by traditional methods, with little investment in workshops, equipment, or technical processes. The entire Tam Tien commune currently has eight seafood processing facilities operated by private households. But, as of March 2024, only four households were equipped with basic technical equipment and registered for business.

Despite the availability and the ability to mobilize capital for fisheries development and disaster response, financing remains a weak component for the local residents and authorities. Although the government provided support through banking policies for preferential loans with low interest rates and long repayment periods, many households have not been able to leverage this advantage. This may be due to either difficulty in understanding complex loan application procedures or having low repayment capabilities and limited credibility with banks. This is partly due to the unstable income of households, owing to the greater levels of risk posed by annual disasters and environmental pollution. Both the local population and the authorities do not have



Ecotourism development in Ba Dau Reef co-management area, Tam Tien Commune, Quang Nam province

regular and reliable sources of funding to invest in disaster risk reduction equipment through reinforcement of craft, investing in early warning systems, and improving technical equipment in aquaculture ponds. They also do not have a reserve fund for disaster prevention and environmental remediation.

An important advantage for Nui Thanh district and the coastal communes is that Quang Nam province is a priority area in the national development strategy and benefits from specific policies relating to fisheries development, investment and aquaculture. Many households and fisheries businesses have received support with initial investments in craft and favourable loan mechanisms, but the actual implementation has not been sufficiently effective. A major challenge for Tam Tien and neighbouring communes is that Nui Thanh district is undergoing significant changes in urban development planning, such as the establishment of new industrial centres and the construction of seaports. There is no evidence yet of integrating potential risks from both natural and human factors; or of building risk reduction solutions into economic and social development planning at both the commune and district levels. Meanwhile, the effectiveness of enforcement mechanisms and monitoring of compliance with fisheries laws and resource management at the local level remains limited.

In addition to the specific strengths and limitations outlined above, gender equality and the roles of men and women in local fisheries and agriculture require further study. In the Tam Tien commune, nearly 100 per cent of the male workforce is engaged in the fishing activities. Over 90 per cent of the female workforce is engaged in fisheries support activities, including trading, purchasing, and processing seafood. Men often face the risk of natural disasters at sea and are directly vulnerable to the associated health risks, whereas women are more affected in terms of employment and income stability. Women also experience severe psychological trauma if their husbands or sons encounter risks at sea.

To enhance the community's resilience and the sustainability of local SSF, it is necessary to strengthen the community's capacity in disaster risk reduction and climate change adaptation, and develop climate-resilient aquatic livelihoods. This involves enhancing households and communities' resources, including mobilizing and optimizing natural resources, human resources, financing, physical resources, and promoting the role of policies in the local context to cope with disasters and enhance production.

3.4 Impact and influence of stakeholders

Stakeholders at various levels significantly impact SSF. This includes key groups such as fisheries management authorities at the provincial and central levels, local governance bodies, fishers and their local community, businesses, tourists, social organizations and NGOs and scientists, among others. Foreign and local tourists play a crucial role in developing tourism activities linked to traditional fishing and on-site recreational services like coral reef diving, rowing and photography. The government has recently issued a National Programme on Aquatic Resources Protection and Development (until 2030 with a vision plan till 2045), which applies a co-management approach and highly recommends tourism as an avenue to support community livelihood development. This has been linked to the protection of aquatic resources and reduction of over-fishing efforts in the nearshore areas.

Tourism activities are expected to create jobs and increase access to resources for local communities, while ensuring their participation in management processes and providing financing to protect and restore marine biodiversity. In addition, the government recently approved a national programme on job transformation to convert a number of fisheries that affect resources and the environment—including bottom trawlers operating in coastal waters and open areas—from fisheries exploitation into aquaculture, services, recreational fishing and tourism in conservation areas. This is intended to ensure both the protection of aquatic resources and compliance with legal regulations. The specific roles and impacts of each stakeholder are further analysed in Table 5.

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Table 5. Key Stakeholders and their influences in SSF adaptation

Name of key stakeholders	Roles and influence in climate change adaptation
National level: Management agencies (MARD, Department of Fisheries, Department of Fisheries Surveillance	Propose, guide, and oversee the implementation of policies and measures for the management, protection of aquatic resources, and sustainable development of SSF linked with environmental protection and marine ecosystem conservation
Provincial level: Department of Agriculture and Rural Development; Sub-Department of Fisheries; Fisheries Associations	Disseminate information, and monitor and supervise the activities of vessels, enterprises, and fishers in fishing and aquaculture Support community networking, collaborate with NGOs to minimize climate risks and develop fisheries while protecting the environment
District level: People's Committee, Agriculture Division; Environment and Natural Resources Division	Provide technical guidance and raise awareness within the community Support policies for preferential capital for fishers and mobilize other material resources
Commune Level: People's Committee	Support the implementation of preferential capital policies; disseminate warnings about natural disasters and disaster prevention and response, integrated with marine environmental protection
Household: fishers, farmers, seasonal hired labourers	Play a central role in production, business, and logistics in SSF Vulnerable to natural and socio-economic crises while also playing a key role in protecting fisheries resources and addressing climate change
Enterprises (local and non-local): processing and trading.	Support the link of fishers to the market, create more employment opportunities for female workers, and contribute to the development of local tourism and services
Mass organizations: Women's Union, Farmers' Union, Youth Union, Red Cross Society	Promote information, support for policy beneficiaries, on-site small loan support; linkage to promote opportunities, employment for female workers, and vulnerable groups in fisheries (the poor, people with disabilities, single-parent households)
Border Guard, Fisheries Inspection: relevant authorities related to the protection of marine areas, fisheries resources, and community safety	Monitoring, accident rescue, and disaster response; timely information and forecasting of disasters and extreme weather; coordination in handling violations in fisheries exploitation and environmental infringements
NGOs	Facilitate connections and promote cooperation among the key actors, technical support, scientific and participatory research, and other resources for environmental protection, ecosystem services; support communication to raise awareness, provide training on skills on disaster risk reduction and climate change adaptation, and suggest small financial innovation and recommendations for the investment decision

4. Recommendations to enhance SSF adaptation and resilience

To strengthen the SSF subsector's resilience and sustainability, it is necessary to address the community's capacity to minimize natural disaster risks and develop aquatic livelihoods. This involves developing solutions that enhance their ability to adequately utilize human, financial and physical resources; respond to policy constraints; and leverage the effectiveness of natural advantages in local conditions.

4.1 Proposed solutions to enhance adaptation and resilience

The current situation demands improvements in the awareness, habits, and actions of the community, in particular, guidance about (and promotion of) the roles played by official policies, and development planning that considers the risk factors of local managers. Based on discussions with the community group, key informant interviews, and input from research experts, some key solutions to be considered for the next three-to-five years include:

- An approach to integrated management, inter-sectoral cooperation, and ecosystem-based adaptation (EbA) with nature-based solutions (NbS) involving multiple stakeholders should be leveraged, expanded, and improved for the locality—and not just for the fisheries sector. Regulations under the co-management plan of aquatic resources protection should be further monitored and enforced by the local government and community groups for enhancing the resilience of marine ecosystems like coral reefs and community livelihoods.

- Comprehensive and scientific assessments to evaluate the opportunities and risks faced by the community, the ecosystem and coastal resources, and SSF amidst significant policy changes, land use, and environmental degradation. The results of these studies will provide guidance or suggestions for decision-makers at all levels to develop long-term adaptive strategies and solutions that enable residents, businesses, and managers to be more proactive and aware of risk-informed development planning and investment decisions. This approach aims to balance economic benefits with sustainable resource management, enhance ecosystem health, and minimize climate risks. It is emphasized that local managers should integrate disaster resilience and resource management goals into annual and periodical socio-economic development plans.

- Consideration should be given to developing a community-based ecotourism model that leverages the community's internal material resources, state budget, and en-

hanced private sector participation, including tourism-related businesses. Tourism products should be linked to, and built upon, the foundation of sustainable use of fisheries resources and production, with an emphasis on protecting and restoring the marine resources and reducing the fishing efforts in the nearshore areas.

- The fisheries economy in general, including SSF at the local level, should be built upon a sustainable seafood value chain at an appropriate scale, where the various links from the supplier, production, harvesting, procurement, processing, market distribution, and technical practices are closely interconnected. It is recommended to use information and communications technology (ICT) to improve post-harvest care and increase the value of products. This can be achieved by creating a strong brand, such as 'clean food', which reflects community conservation efforts and initiatives to protect and manage fisheries resources and coral reef ecosystems.

- A core team of village-level educators/promoters should be formed through Training of Trainer (ToT) programmes. This workforce will help communicate to stakeholders the current priority issues on sustainable fisheries, responsible tourism, natural resource conservation, or disaster risk reduction and climate change adaptation.

- Optimizing the roles of key stakeholders at all levels and fostering interdisciplinary collaboration will drive sustainable development of SSF and enhance the resilience of the fishing community. These stakeholders include various groups such as provincial and central fisheries management agencies; local governments; fishers and the community; businesses; local grassroots organizations and unions; tourists; NGOs; and scientists.

- In addition to strengthening the government's management capacity at all levels, leveraging the role and potentials of the community as both resource users and managers will reinforce their responsibility on protecting and enriching fisheries resources—the very resources they depend on.

- Farmers and fishers engaged in aquaculture and fishing livelihood activities and community members involved in tourism-related businesses should be empowered as the backbone of the community. Therefore, enhancing awareness and capacity of this group and other relevant stakeholders regarding environmental risks, climate change adaptation, and local development orientation, as well as promoting gender equality, are essential. Strengthening communication through diverse, modern, and engaging channels will attract young people and businesses to contribute in these efforts. Timely provision of quality information will positively support community practices and decision-making, fostering collaboration.

- In their roles as fisheries managers and as regulatory agencies, local government entities like fisheries sub-departments should enhance monitoring, supervision, and support for fishers in complying with legal regulations for sustainable aquaculture development and fishing activities. Close collaboration and sharing of benefits among stakeholders at all levels based on the common goal of local sustainable development are key factors in enhancing resilience and adaptation of SSF communities.

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The Tam Tien commune coastline, Quang Nam province, by Hoang Thi Ngoc Ha

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Climate change is significantly impacting **Vietnam's** small-scale fisheries, threatening marine capture, aquaculture, and aquatic ecosystems, while exacerbating gender inequality within the sector. This case study provides a comprehensive analysis of these challenges and offered practical solutions. It reviews national and local policies, highlighting proactive measures and strategic plans designed to enhance resilience and adaptation for the small-scale fisheries in Vietnam. Emphasizing community participation and co-management practices, the case study presents a pathway to sustainable fisheries in the face of these climate change impacts.

Through a detailed case study in Tam Tien commune, Nui Thanh District, Quang Nam Province, the report shows the specific challenges faced by local fishing communities due to extreme weather events and potential climate risks. It assesses their adaptive capacities, socio-economic conditions, and the roles of various stakeholders, showcasing community-driven initiatives to protect marine resources and sustain community livelihoods.

By implementing the strategies outlined in this case study, small-scale fishing communities can potentially restore and protect their ecosystems, improve resource management, and strengthen policy support for resilient and sustainable fisheries, ensuring secure livelihoods for fishers and promoting gender equality within the sector.

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Than Thi Hien is a fisheries management expert at the Centre for Marinelife Conservation and Community Development (MCD) in Hanoi, Vietnam.

Hoang Ngoc Son is a marine biologist at the Vietnam Institute of Fisheries Economics and Planning (VIFEP) in Hanoi, Vietnam.

Hoang Thi Ngoc Ha is a climate change expert at the Centre for Eco-community Development (ECODE) in Hanoi, Vietnam

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