

Major Research Paper

Climate Change Adaptation in Vietnamese Fisheries; A Look at Adaptive Capacity Using the National Adaptive Capacity Framework

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Table of Contents

List of Abbreviations	Page 3
Introduction	Page 4
Research Questions	Page 5
National Adaptive Capacity Framework (NAC)	Page 6
The Problem; Explained	Page 10
Literature Review	Page 13
a. The Vietnamese Context	Page 13
b. Climate Change and Fisheries	Page 16
c. Adaptation to Climate Change	Page 19
Policy	Page 24
a. Fisheries Development Strategy Through 2020	Page 25
b. National Target Program to Respond to Climate Change	Page 29
c. National Strategy on Climate Change	Page 34
Discussion	Page 37
Conclusion	Page 42
References	Page 44
Appendix	Page 48

List of Abbreviations

EMW - East Meets West Foundation

FDI - Foreign Direct Investment

FDS - Fisheries Development Strategy through 2020

GDP - Gross Domestic Product

IPCC - Intergovernmental Panel on Climate Change

LDC - Least Developed Countries

MARD - Ministry of Agriculture and Rural Development

MONRE - Ministry of Natural Resources and the Environment

MPI - Ministry of Planning and Investment

MRP - Major Research Paper

NAC - National Adaptive Capacity Framework

NGO - Non Government Organization

NTP RCC - National Target Program to Respond to Climate Change

NSCC - National Strategy on Climate Change

OECD - Organization for Economic Cooperation and Development

SRV - Socialist Republic of Vietnam

UNDP - United Nations Development Programme

UNFCCC - United Nations Framework Convention on Climate Change

WRI - World Resources Institute

Introduction

Climate change is a process that will inevitably occur in the coming years despite the global attempts to mitigate the causes and effects (World Bank, 2010a). With the entire natural environment expected to be affected in some form, nations need to make a more concerted effort to prepare themselves against the impacts. Developing nations, specifically those in South-East Asia, are likely to disproportionately bear the anticipated effects (IPCC, 2012). According to the World Bank (2010b), Vietnam in particular is expected to be one of the countries hit the hardest by climate change as a sea level rise of only 1m would cause 10% of the Vietnamese population to be directly affected (MONRE, 2008). Other scholars and publications, including Shaw et al. (2010) and the IPCC (2012), have shown that the incidence and intensity of typhoons has increased, temperature has increased (and conversely the number of cold fronts has decreased), and droughts are more prevalent (MONRE, 2008).

The fisheries sector in Vietnam is especially at risk to environmental change. Water quality is a source of concern, with ocean warming, acidification, and deoxygenation becoming a consistent problem due to seawater chemistry changes with the increased absorption of greenhouse gases (Frost et al., 2012). Regional differences in water salinity and stratification are also anticipated. Agriculture, which includes fisheries, is an integral economic activity in Vietnam and contributes approximately 20% to GDP (World dataBank, 2014). The agricultural sector also employs a vast proportion of the nearly 93.5 million people who live there, as shown in Table 1 below (Todaro and Smith, 2012). Thus, it can be concluded that this nation needs to implement processes to combat the financial and social pressures, and losses that may accompany a decreased fish catch. Under normal environmental conditions, Vietnam, which borders the South China Sea in the east and the Gulf of Thailand in the south, has a climate that

provides excellent conditions for fish species to thrive due to ideal water temperatures and accordingly, availability of food. Vietnamese fisheries profit from the country’s extensive coastline which provides substantial access to marine resources and allows for a large area to implement aquaculture (World Bank, 2010b). In addition to being a popular region for the commercial wild fishing industry, aquaculture is a quickly growing industry at small and large scales. The exportation of both wild catch and aquaculture amounts to a significant portion of the Vietnamese economy, and employs millions of people (FAO, 2014). The majority of fisheries in Vietnam are classified as small-scale in that 72% of mechanized boats operate in near shore areas (4-5 nautical miles from the coast, and in waters less than 50m deep) and therefore any change in marine or freshwater ecosystems will have serious ramifications for those operations (Pomeroy, 2011).

Table 1: Share of the Population (%) Employed in Various Sectors 2004-2008

Source: World dataBank, 2010 in Todaro and Smith, 2012

	Male	Female	Share of GDP
Agriculture	56	60	22
Industry	21	14	40
Services	23	26	38

Research Questions

This paper examines the preparedness of Vietnam to deal with the effects of climate change, particularly in the fisheries sector (herein including both fishing and fish farming, unless stated otherwise). To do this, the analysis will be guided by a set of related research questions: is climate change adaptation addressed in the fisheries and climate change policies of Vietnam, and

if so, how and where? Is there an adaptive capacity framework associated with these policies (adaptation to be defined below)? Three Vietnamese strategies have been chosen for evaluation (and will be systematically explored later in this paper): the Vietnam Fisheries Development Strategy (FDS) through 2020 released by the Ministry of Agriculture and Rural Development (MARD), the National Target Program to Respond to Climate Change (NTP RCC) created by the Ministry of Natural Resources and the Environment (MONRE) (2008) and the National Strategy on Climate Change (2011-2020) (NSCC) with the governing body also being MONRE. The FDS policy was chosen as it provides the Vietnamese government's plans for short term development in their fisheries sector. The NTP RCC and the NSCC were chosen to provide insight as to how the Vietnamese government expects to implement climate change adaptation activities. Furthermore, these two policies will highlight how the fisheries sector will be treated under the scope of anticipated climate change effects within the near future.

The National Adaptive Capacity Framework (NAC)

To help dissect the Vietnamese policies from an adaptive capacity lens, the National Adaptive Capacity Framework (NAC) put forth by the World Resource Institute (WRI) was chosen to determine if the selected Vietnamese policies are holistic and realistic. Thus, a supplementary research question will be considered: do Vietnamese policies embody the values and key steps listed in the NAC framework (named below)? The WRI's NAC was chosen based on its cutting edge approach - the theory was released in 2009 and is based on information provided by the UNFCCC, along with other leading scientists and adaptation specialists (WRI, 2009). The NAC is a practical tool to better comprehend the institutional aspects of adaptive capacity. It stands apart from other frameworks as it is not intended to conduct comparisons

among countries but rather, it provides a set of domestic capacity-building processes tailored to individual country needs. The framework is primarily for the creation of a snapshot at a given time so that adaptation over a period of months or years can be improved according to changing circumstances.

The NAC has five indicators which are used to assess a country's overall adaptive capacity. The indicators are: assessment, prioritization, coordination, information management, and climate risk management, explained in Table 2 below. Each indicator has a series of questions associated with it to help guide NAC implementors to a conclusion as to whether or not the conditions for the indicators are met. The guiding questions per indicator can be found in Appendix A, and will be utilized in the policy section below to help assess the three selected Vietnamese policies. All five indicators will be used to analyze the chosen policies, but it is important to bear in mind that though these indicators are practical across all sectors and industries, the reader must consider the scope of this paper. These indicators will only be used in the context of fisheries. The nature of the NAC exposes the adaptive capacity of a country as a whole, and provides a comprehensive overview of the institutional capacity altogether. This framework normally requires input from stakeholders and involves considerable monitoring of current practices in the country of interest over an elongated time period. In this analysis however, the indicators will be used as part of a preliminary process to determine if the requisite conditions of this framework are present in the aforementioned policies. The purpose of assessing the three policies in this manner is to highlight the areas in the fisheries sector where Vietnam is succeeding and where direction is lacking with respect to implementation of climate change awareness and acknowledgment. To be clear, the NAC in its entirety involves a thorough process and requires an extensive period of time to fully examine the state of a country's climate

change preparedness. The aim of this paper is to set the foundation for what a full scale application of the framework in Vietnam would look like, but does not endeavor to completely actualize all aspects of it.

The pilot applications of the NAC were used in three very different country contexts: Nepal, Ireland, and Bolivia. These three nations vary in multiple aspects such as global economic performance, geographical features and locale, as well as governmental and institutional structures. Considering that the framework was successfully implemented into these three

Table 2: NAC Indicators for Adaptive Capacity

Source: Dixit et al., 2012, pg 42-45

	Assessment	Prioritization	Coordination	Information Management	Climate Risk Management
Definition	Examining available information to aid in decision making	Assigning importance to particular issues, populations, sectors, or areas	Coordination among disparate actors at various levels, both within and outside the government	Collection, analysis, and dissemination of information in support of adaptive activities	Opportunity to examine institutional aspect of capacities needed to address risks of climate change
Elements to consider	<ul style="list-style-type: none"> • A broad set of stakeholders are/were engaged • Assessments cover all sectors and regions • Assessments include exposure to climate impacts • Key documents explicitly address climate change 	<ul style="list-style-type: none"> • Prioritization processes take into account input from local institutions • Prioritization involves a range of stakeholders including vulnerable and marginalized groups • A time period and process have been set for revisiting priorities 	<ul style="list-style-type: none"> • Vertical coordination needs have been considered • Coordination needs are clearly articulated • A process and time period have been set for activities • There is a system for monitoring and review of the coordination mechanism 	<ul style="list-style-type: none"> • Monitoring and data gathering are focused upon • Appropriate systems from information analysis (e.g. sufficient budget etc.) • Network for information sharing on adaptation available • Information reaching key stakeholders 	<ul style="list-style-type: none"> • Risk assessment takes into account biophysical, socioeconomic and policy factors • Assessment methodology is transparent and available to the public
Analyzed in this paper with a focus on fisheries	Yes	Yes	Yes	Yes	Yes

divergent country contexts, it portrays that the NAC can be tailored to distinct environments. These previous evaluations along with the five indicators will help guide and shape the analysis of Vietnam's policies. The WRI details their evaluation of the three countries within their document entitled "Ready or Not" by Dixit et al. (2012) and provides a practical pathway to help uncover the roles which national institutions will play in adaptation, and what existing capacities they can draw from. The "Ready or Not" document also makes suggestions as to what type of institutional strengthening is necessary for a country to be adequately prepared for potentially adverse climate change effects. The way in which the NAC would be useful to Vietnamese policy is that it could be a catalyst for action and fill key capacity gaps. It is a tool that will be used in this particular application to identify strengths and weaknesses in Vietnam's adaptation system and related policies.

However, there are several limitations in this study that must be stated as these impediments may impact the outcome. Primarily, the policies used for analysis have been translated into English from Vietnamese and therefore the language used in the English translation might not adequately express the policies in their entirety. Furthermore, this was a desk study and was constrained by the resources that were accessible by internet and library research at the time. No field research, including both qualitative and quantitative methods, was conducted. Lastly, as was explained above, the NAC is a framework that ideally is applied to a country as a whole, and outcomes are monitored over time to ensure that adequate amounts of information are gathered. This study is merely a microcosm of a full assessment and will only provide a snapshot of the state of adaptive capacity in the fisheries sector in Vietnam. Taking into account the complexity, overlap, and the sheer number of stratagems, policies, and other

legislative documents that govern marine resources, a much larger study in terms of time and analysis would be required to give a more thorough illustration of Vietnam's adaptive capacity.

The Problem; Explained

The ecological importance of fisheries in Vietnam is substantial. There are complex interlinkages between organisms within a given ecosystem - the loss of any one species negatively affects the balance, while a simultaneous influx of species (due to changes in weather patterns and temperature etc.) results in the same problem (NPWRC, 2013). Therefore, with climatic shifts likely to induce the migration or extinction of species in Vietnam, fish in particular, these changes could push multiple ecosystems over the precipice into complete degradation. Furthermore, fish is of cultural significance to Vietnam and other South Asian countries. It is eaten daily in some cases, and the extinction or severe decrease in catch would certainly be a detriment to those who rely on it as a staple food (Ha & van Dijk, 2013). A decline in fish production would similarly be an impediment to those who rely on fishing as a source of income, either directly or indirectly (Ha & van Dijk, 2013). With the global population expected to reach nine billion people by 2050, and climate change forecasted to be an increasingly important driver of climate systems, the fishing industry will need to adjust to a lifestyle with less wild fish (IPCC, 2012).

Fisheries worldwide are being overexploited due to increased technological capacity to capture fish and increased seafood demand. Despite these factors, the stressor on fisheries that will be the focal point of my research is that of climate change. Climate change was brought to the forefront of international discourse by the UNFCCC, the United Nations Framework Convention on Climate Change, in 1992 at the Earth Summit in Rio de Janeiro. This global

process is, at its simplest, a prolonged distributional change in climate and weather patterns which will be accompanied by a host of unknown changes in ecosystems worldwide. One of the predictions made by the World Bank Group is that significant losses in the fisheries sector will occur in Vietnam (2010b) in both wild catch and aquaculture. Aquaculture production in the country, with shrimp and catfish dominating the industry, is expected to grow and thrive in the coming years according to Marschke and Wilkings (2014), and is a growing contributor to GDP. However, small fish farmers may experience an exacerbated level of farming difficulty as climate change will make these types of operations more challenging and ineffective to maintain through fish stock death from acidification, water temperature variations, or alternatively, due to increased monetary investment required. Coastal fish farmers are expected to have an especially difficult time in comparison to freshwater fish farmers as coastal regions will lose mangrove cover, which shelter ecosystems from extreme weather events, turbidity, nutrient loading, and sedimentation (Bell et al., 2013). These changes could cause or aggravate poverty that already exists in the farming lifestyle. Marschke and Wilkings (2014) note that small fish farmers are above the rural poverty line in Vietnam, but cannot afford certain key necessities (e.g. paying employees minimum wage). Climate change is not merely a passing problem, but an issue that governments will need to consider during decision making. Thus, adaptation to climate change is no longer solely an acceptable response to the threat this process poses but, instead, has become a policy imperative.

Adaptive strategies vary depending on what impact of climate change one is intending to slow or repel. Adaptation can be defined as the “adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts” (UNFCCC, 2013). Furthermore, it “refers to changes in processes, practices, and structures to

moderate potential damages or to benefit from opportunities associated with climate change” (UNFCCC, 2013). Adaptation can be broken down into two categories: hard and soft. Hard adaptation refers to measures that involve specific technologies and capital goods, such as dykes, or seawalls. Soft adaptation measures include capacity building, policy and strategy development, and information sharing (World Bank, 2013). The types of adaptation activities, policies, and strategies that will be adopted by countries, states, regions, and municipalities worldwide will be dependent on the ecological surroundings, geographical location, social and economic situations, among various other factors. In the case of Vietnam, adaptation strategies need to acknowledge not only the variants in topography and ecology throughout the country, but also the vast inequality that exists socioeconomically so as to assure that at risk populations are not inordinately affected. Instituting adaptive capacity into policies and stratagems has been shown to reduce the likelihood and magnitude of the expected harmful outcomes of climate change (IPCC, 2012). Adaptive capacity can be defined as “the ability or potential of a system to respond successfully to climate variability and change and includes adjustments in both behaviour and in resources and technologies” but also incorporates elements of disaster risk (IPCC, 2012). Furthermore, it is a term that encapsulates the idea of guaranteeing survival and sustainability of communities whilst adapting to uncertain environmental changes. Adaptive capacity has transitioned to the forefront of academia regarding the ‘how to’ of responding to climate change, and the IPCC has recognized this idea as a *necessary* condition for the design, implementation, and ultimate success of effective adaptation strategies (2012). The IPCC notes that adaptive capacity is influenced by governance structures and policies, which is a key piece of the puzzle when assessing Vietnam’s fisheries.

Literature Review

The relevant literature for this project is broad, but can be divided into three categories: the Vietnamese context, climate change and fisheries, and adaptation to climate change. These categories are not exclusive, and in many cases overlap.

a .The Vietnamese Context

The UNDP (United Nations Development Programme) published a Human Development Report in 2007/2008 which focuses on climate change in Vietnam and frames the expected trends and predictions for environmental change, along with adaptation activities implemented in the country as of 2008. Despite not focusing on fisheries, this document stresses the need for local knowledge to be incorporated into all policy decision making. The UNDP ties climate change to poverty and notes that vulnerable populations require long-term adaptation measures, particularly where existing livelihood practices will be disrupted. The World Bank has also produced several publications on the Vietnamese context, some of which include analysis using a climate change lens. One in particular entitled “The Social Dimensions of Adaptation to Climate Change in Vietnam” provides an excellent cross-cutting analysis of how this phenomenon will impact various sectors, and vulnerable populations. This publication examines social vulnerability and adaptive capacity in certain climate sensitive regions of the country, and identifies socioeconomic and biophysical zones of vulnerability, addresses shortcomings in the current institutional framework, and suggests cost-effective participatory scenarios of adaptation pathways that could be employed in the future.

The vulnerable populations in Vietnam, namely farmers and those in primary production industries, who arguably require adaptation solutions the most, are finding solutions hard to

come by. Both Dang et al. (2014) and Bosma et al. (2012) studied farmers in Vietnam, one of the poorer groups of individuals in the country. In conjunction, their articles uncover struggles of adaptation activity adoption in fisheries due to policy or program barriers. Dang et al. found that although farmers were conscious of climate variability in their region, their access to adaptation information, knowledge of who to contact, and understanding of the importance of adaptation was limited. Bosma et al. discuss the use of rice-fish systems as a means of climate change adaptation in certain physical and socio-economic contexts. Integrated rice-fish systems could provide higher incomes to farmers and improve farm productivity.

The literature on fishery overexploitation, a problem that is exacerbated by climate change, in Vietnam, is widespread. In 2009, Pomeroy et al. outlined policy changes for small scale fishermen in Vietnam over the last ten years, after near shore fisheries were determined to be overexploited. Pomeroy et al. suggest paths forward in legislation to help alleviate pressure faced by these issues such as improving fisheries statistics, and incorporating a more integrated approach to resource management and restoration. Marconi et al. (2010) carried out work on the long term sustainability of traditional fisheries in one of the northern Vietnamese lagoons, Cau Hai. The conclusion by Marconi et al. echoes Pomeroy et al.'s article and notes that fishing thresholds are fragile, and if exceeded, could cause fishery collapse. Furthermore, their study recommends the use of legal frameworks to ensure that fisheries are regulated, and concrete measures are implemented to assess this (e.g. quotas, limited by-catch). Ha and van Dijk (2013) published an article on fisherfolk in the southern portion of the Mekong Delta in Vietnam. They touch upon the need for further policy regulation and compliance. Their research highlights that enforcement is a policy imperative for Vietnam, and that in its absence, fishery stock overexploitation and noncompliance to laws will continue to occur in near shore areas. The

suggestion is made that fishery diversification is also required going forward (e.g. varying types of species catch, seasons in which fishing occurs, and gear used to fish).

Proper and ongoing management of Vietnamese fisheries is a recurring theme throughout the literature. Van Tuyen et al. (2010) pinpointed the Tam Giang lagoon in central Vietnam as their area to focus upon for co-management issues. The research completed by Van Tuyen et al. explains fishery based livelihood challenges and discusses that there are natural and anthropogenic changes occurring which will increase obstacles for management. They note that there was a positive outcome in engaging fishers and fish farmers in a participatory process as fishery planning and management was strengthened. They put forth the idea that there is no “end-point” in management as continual adjustments and capacity building efforts will be necessary going forward. More recently, Boonstra and Nhung (2012) asserted that fisheries management in Vietnam has been affected by state regulation, market exchange, and community-based management. The authors contend that the interplay between these institutional orthodoxies is static and adversely affects the current and future development of fisheries management. Boonstra and Nhung proclaim that natural resource management is extremely dependent on stakeholder interactions which are particularly relevant to Vietnam due to an increase in private and multilateral interest.

Adaptation to climate change in Vietnam already exists in some form, which Shaw et al. (2010) address in their book on adaptation in South-East Asia. Vietnam will be one of the five countries most affected by climate change due to large quantities of its population, infrastructure, and economic production being located in low lying deltas. The authors note that Vietnam already has a large system of first-order, or hard, adaptation measures (e.g. dykes and seawalls), but is lacking an overarching national strategy of climate change adaptation (soft measures)

which will hinder progress towards addressing the needs of industries and vulnerable populations. In 2013, Bruun and Casse's conclusion was consistent with that of Shaw et al. in that they suggest an overall integrated approach is required in Vietnam to properly treat livelihood stresses and social justice issues that will arise from environmental change. They further remark that a three-dimensional resolution would function best, consisting of social, state, and environmental elements to include local communities, economic and political development, as well as the protection of the environment and resources.

b. Climate Change and Fisheries

There is consensus that climate change will have an adverse effect on fisheries globally and that institutions must preempt the effects by implementing legislation to conserve and manage stocks. Allison et al. (2009) compared the vulnerabilities of 132 developing nations' economies using an indicator-based approach. Their research showed that many developing national economies have vulnerable capture fisheries to climate change which is consistent with many other academic works. Vulnerability is comprised of three elements according to this 2009 study: exposure to the physical effects of climate change; the degree of intrinsic sensitivity of the natural resource system of dependence of the national economy upon social and economic returns from that sector; and the extent to which adaptive capacity enables impacts to be offset. Vietnam was ranked as the 27th most vulnerable nation, within the top quartile of the dataset. Appendix B and C visually depict fisheries sensitivity of national economies to climate change as well as adaptive capacity of national economies through this group of authors' research. It is argued that little attention has been given to the repercussions of changing fisheries ecosystems on people, and that policies created at national levels will have severe implications for decision

making capabilities of those at the local level, which is relatively consistent with the research conducted on Vietnam by other scholars.

Payne (2013) provides the most overarching review of the expected state of catch fisheries with respect to climate change and indicates that spatial distributions of fish species will shift dramatically. This author predicts that the change in make-up of catch in tropical countries will be the most startling as compared with non-tropical nations. He reiterates that tropical countries are globally the most reliant on the fishing industry for revenue and compositional changes in fishery productivity will negatively affect food security and development. Ficke et al. (2007) wrote a comprehensive article with respect to the impacts of climate change on freshwater fisheries. This piece highlights the need for proactive management and how adaptive strategies might cope with the uncertainty that this process brings. Ficke et al. stress that the management of fisheries will need to be made a priority in developing nations where fish stocks are of extreme socioeconomic importance. Coulthard added to Ficke et al.'s conclusion by studying adaptation to environmental change within artisanal fisheries; research which was conducted in a South Indian lagoon. Coulthard's findings suggest and reiterate that tactics to adjust to climate change will vary from region to region and that adaptation approaches will need to be derived on a case by case basis. Marschke et al. (2014) emphasize that policy response scenarios for coastal environmental change at various levels are required, and suggest that diversification may be a necessary tool to adapt to environmental change.

Badjeck et al. (2010) published an article on the consequences of climate variability on fishery based livelihoods. Previous literature was synthesized by Badjeck et al. to show how climate change will impact livelihoods at the household and community level. This 2010 article identifies certain general adaptation strategies, but the research is not pointed to a specific

aquatic ecosystem, but rather is an overview of the state of things globally. Badjeck et al. briefly discuss multiple countries and note the need for a diverse portfolio of responses, particularly when differentiating between aquaculture and wild catch. In a similar vein, McIlgorm et al. published a study in 2010 which looked at what sorts of alterations should be made in fishery legislation to deal with climate change. This study had seven international cases from developed nations and provides insight into how these countries are adapting laws regarding their fishery resources and whether or not these adjustments should and could be considered by Vietnam. Charles (2012) discussed that sustainable interactions between communities and oceans require a social-ecological systems perspective along various scales (e.g. local to national). He notes that one of the key things to consider for marine environmental and resource challenges is that a technological approach to adaptation (e.g. sea wall construction) could undermine the importance of institutions and should be used in conjunction with institutional change, not as a substitute.

The management approaches required for freshwater fisheries will differ from those of coastal fisheries. Similarly, wild fishing and aquaculture also require differentiation in policy as the legislation that governs these activities must account for various subtleties and nuances. Fish farming requires detailed legislation in the face of environmental change. Merino et al. (2010) proposed that fishmeal, an important aspect of aquaculture and used in both freshwater and salt water aquaculture systems, could suffer global market perturbations from regional environmental drivers. According to this 2010 article, sub-optimal management schemes will severely alter the resiliency and sustainability of fisheries in the face of climatic disturbances. Armitage and Marschke (2013) complement this research in that their findings from the Tam Giang Lagoon in central Vietnam show that small-scale fish farmers in this area have an uncertain future due to

ecological decline (resource exploitation). Armitage and Marschke suggest that climate change will likely accentuate the trend of livelihood shifts from fish farming to other, more fruitful employment options.

There are a host of articles which have been published regarding commercial marine sectors and their adaptation strategies and preparedness. One piece which summarizes the tone on the subject is Grafton's 2010 article in which research was performed on how climate change is impacting marine capture fisheries. His piece portrays the state of adaptation strategies at the moment for larger commercial fisheries, and explains the policy background necessary to implement these changes. Grafton discusses the importance of adaptive capacity and vulnerability determination, and suggests that precautionary fisheries management should be implemented now, as opposed to later, through vulnerability management frameworks. Ruddle and Davis (2009) assert through case studies that local ecological knowledge (LEK) might not accurately describe ecosystem processes such as seasonality and thus cannot be considered as 'stand-alone' knowledge for wild fishers. Ruddle and Davis hypothesize that LEK cannot be the only knowledge recognized when dealing with issues such as climate change and adaptive processes, and that a scientific element is necessary to create policy. They do emphasize however, that both types of knowledge have merits and should work in conjunction.

c. Adaptation to Climate Change

Adaptation to climate change seems to have become a normalized activity in vulnerable ecosystems. Sorell Negro (2012) writes that faced with rising sea levels, coastal protection against erosion and other detrimental processes is paramount and that adaptation operations must be derived locally. His suggestion that regional governments need to shape adaptation strategies

reflects the conclusion established by several other academics, notably Ruddle and Davis. Harsem and Hoel studied marine fisheries in Norway in 2013 and determined that fisheries management required the ability to adjust responses as needed to react to variable environmental changes. They deduce that three factors need to be present: scientifically supported decision-making, appropriate regulatory frameworks (which includes restrictions on access to resources, quotas, when and where exploitation can occur), and enforcement to ensure compliance with regulations. For these three stipulations to be effective, the national government must support those actions both financially and ideologically.

As fisheries are seen as an economically important resource, legislation is generally geared towards protecting fisheries at a macro level as opposed to targeting micro level activities of subsistence fishermen. However, the monetary value of fisheries at all levels (subsistence to commercial) associated with adaptation to climate change (or lack thereof) cannot be overlooked. The OECD released a publication in 2010 which outlined possible policy approaches to adaptive capacity and the monetary implications. The organization notes that the uncertainty of the climate change phenomenon poses a unique problem, and calls for greater local level involvement to better comprehend changes in fish stocks regionally. The document indicates that fisheries governance must be practical and have a long term focus, and thus fisheries adaptation is constrained by “value-based decisions and trade-offs” suggesting that there will be political, social, and economic implications. The World Bank released three documents in 2010 (2010a, 2010b, 2010c) which were detailed reviews of the impact of climate change on Vietnam and possibilities for action. The third document, 2010c, enlightens the reader as to the cost of adaptation in fisheries. These releases, coupled with the Mekong River Commissions paper (2010) on adaptation and climate change tools, supply the necessary

governmental background information as to their view of the appropriate action to climate change that the Vietnamese government should undertake. Frameworks for adaptation toolkits are explored, and specific examples of adaptation measures are suggested for Vietnam's future response to climate change. The Mekong River Commissions paper highlights a contrasting piece of information to Dang et al.'s research however – the Commission asserts that access and availability of methods and tools for adaptation is not a limitation.

Beckman argues through his 2011 work that adaptation activities do not exist in a vacuum and thus any activity to increase resilience in one area can have unforeseen implications, such as increased vulnerability, on other scales. He examines central Vietnamese provinces and determines that current policies in the forestry sector reduce the capability of mountainous populations of building adaptive capacity and managing risk by disallowing these populations from having access to land and forest resources. Vietnam needs to ensure that flexibility and versatility are foundational characteristics of future policies to allow for unplanned obstacles. Booth et. al's work in 2012 mirror Beckman's in that they too suggest that the interrelatedness of ecosystems (the dynamics between agro-ecological and socio-economic change) must be taken into account when developing adaptation methods. Both papers aim to convince target audiences that the avoidance of individual solutions is not ideal, but instead the encouragement of synergistic collaboration between and within regions is necessary. In 2012, Boateng reiterated these ideas in his article which focused on coastal development needs. He suggests a framework for coastal adaptation planning which reflects many of the aspects of the NAC and can be found in Appendix D.

Francois Fortier wrote an article in 2010 on how Vietnamese climate change policy is being designed. Fortier has a negative view in that he believes the strategies are partial and do

not allow for a pluralist representation of interests due to technocratic processes. Fortier suggests that Vietnam has adopted a business as usual approach, and fails to implement mid and long-term adaptation strategies to cope with structural and environmental changes. There has been work carried out on the greater Mekong basin and the various adaptation strategies that exist, such as the research published by Kranz et al. in 2010. Using two case studies, the authors compare adaptation strategies within the Mekong River basin and Orange-Senqu basin in Africa and evaluate the nature of the stressors and adaptive capacity by way of the MTF – Management and Transition Framework. The MTF was developed as an “analytical tool for describing actor configurations and policy processes in river basins” (Kranz et al., 2010, pg 651) and conceptualizes policy making into four stages: problem identification, agenda setting, policy formulation, and decision-making. Similarly in 2013, Heikkila et al. published an article on river basin adaptation in the Mekong river basin. Heikkila et al. used four case studies to determine how stressors impact adaptation responses, and discovered that organizational action is intricately linked with the nature of the stressor. Both studies do not apply their findings to fisheries but the papers do provide information as to what other adaptation activities are occurring in South East Asia and potential appropriate institutional responses.

Johnson and Welch (2010) examined future options for marine fisheries which revolve around adaptation. These researchers took a more general approach to this topic and evaluated fisheries using a vulnerability assessment framework and adaptive capacity. Suggestions are made for broad adaptive strategies as well as strategies for countries with different levels of ability to adapt. Similarly, Leith et al. (2014) published an article which puts forth ideas on how to use a framework to characterize the challenges and opportunities of adaptation options and pathways in fisheries. The authors examine marine fishery systems and suggest that there are

certain conditions which need to be present in order for an adaptive capacity to thrive. Those conditions include: clear goals for adaptation, the removal of barriers for participation and collaboration, adequate monitoring, and proper decision making when facing uncertainty. Furthermore, they suggest accounting for the numerous variables that can and will affect adaptation and can potentially allow for “millions of adaptation combinations” (pg. 62). Many of the facets of their framework mirror that of the NAC which strengthen the notion that the NAC is a fitting framework to be applied to evaluate Vietnam’s climate change preparedness.

Overall, many scholars, multilateral organizations, and civil society groups, have studied and written on diverse aspects of Vietnam, climate change, and fisheries. The underlying tone of the literature on Vietnam indicates that the country is indeed in need of forward thinking in order to face the challenge that climate change presents head on. The literature points to the unanimous desire for a more concrete and inclusive approach to climate change policy responses from the Vietnamese government at all levels (municipal, provincial, federal). Multiple scholars suggest that perspectives from stakeholders, along with local knowledge, should hold more weight in discussions and policy creation. Future studies could potentially further explore relationships between technological and institutional adaptation as Charles’ work in 2012 identifies some tension between the two. Additionally, gaps in literature exist on the differences in adaptation approaches required in Vietnamese aquaculture fisheries versus commercial and wild catch fisheries; a topic which would yield important analyses and results to help shape and guide fishery sector policy in the years to come.

Policy

Known officially as the Socialist Republic of Vietnam, the country is ruled by a single party, the Communist Party of Vietnam, with other political parties proscribed (CIA, 2013). The governmental structure of the country has implications for how policies are created and actualized, especially for adaptive capacity which depends heavily on local dynamics (Bruun and Casse, 2013). The National Assembly is a group of 500 members that vote on and create both domestic and foreign legislation. In the 1980's, Vietnam adopted a political and economic reform, entitled "Doi Moi", to spur economic liberalization and modernization as well as a shift to export industries which drastically changed the way in which the country was viewed (CIA, 2013). This reformation allowed for immense poverty reduction and a better global reputation to elicit foreign investment. With greater interest in Vietnam from private companies however, lies an inherent problem – that of conflicting ideals between environmentally friendly laws and economic growth. Despite the dichotomous values between these two ideas, Vietnam has made some strides in attempting to rectify their laws involving natural resources in the direction of implementing a climate change lens onto policy. Yet, Vietnam still has many obstacles to surmount and policy alterations to make should the country truly want to make a concerted effort to adequately prepare their population and economy for environmental change.

MONRE has been designated the leading agency for climate change coordination in the country while MARD holds responsibility for natural disaster mitigation and response (Shaw et al., 2010). MONRE published their official scenario for climate change in Vietnam in 2009. The department suggests that projections will fall within what the World Bank deems as the 'middle range' (World Bank, 2010b) and therefore anticipates a reasonably significant impact on all sectors and industries, including fisheries, from climate change. The Vietnamese government

recognizes that certain regions and communities are more vulnerable to this climatic shift than others. They have noted that the water resources and agriculture sector will be the most adversely affected, and have concluded that fisherfolk (especially those living in vulnerable regions) will bear the brunt of the effects and are the least capable of doing so. Yet, after conducting in-depth research into Vietnamese fishery policy and related climate change policies, it appears that there are few directives within these policies to adequately protect and strengthen the resilience of the fishery sector. References to adaptation do exist, albeit somewhat vaguely and without prudent planning which goes against what many of academics, explored above, suggest. Targets are set by the coordinating body of each policy individually, but comprehensive goals are absent, along with the identification of responsible parties for implementation and monitoring. Ensuring that there is an appropriate adaptive capacity system in place furthers the resilience and capability of a locale (region, country or otherwise) and industries to minimize vulnerabilities for predicted or unforeseen climatic changes (IPCC, 2012). It is not clear within the chosen Vietnamese policies that an adaptive capacity framework is present.

Vietnam's Fisheries Development Strategy Through to 2020 (FDS)

The FDS was created in 2010 and is under the direction of MARD. The strategy outlines fairly lofty targets and development opportunities within the country's fisheries sector and is primarily focused on sector growth, naming industrialization and modernization as the main focal points leading up to 2020. As MARD is responsible for natural disaster mitigation and response (Shaw et al., 2010), one would assume that policies under MARD's direction would reflect those responsibilities. This is not the case in the FDS. The FDS assumes poverty reduction will be an associated outcome with the creation of jobs in the sector from

industrialization, but effectively excludes the concept of environmental change – a process which will be an important driver of forced employment modification and/or loss. With respect to the NAC’s requirements for adaptation, the absence of true climate change considerations does not meet the conditions for implementing adaptive capacity.

Table 3 below applies the NAC indicators to the FDS which paints a clearer picture as to how the fishery strategy measures up to framework requirements. The analysis of the FDS was undertaken by comparing the NAC definitions of the indicators and capacity questions (along with the subsequent “elements to look for” as shown in Appendix A) to the document as a whole to determine whether or not the strategy complies with the requirements. Out of the five indicators, the FDS performs poorly on all fronts as there is not reference to climate risk or adaptation within the document (this will be dissected further in the discussion section below). There is a silver lining, with certain indicator fundamentals being met, such as the monitoring of environmental impacts over time, and the indication that increased vertical communication between governments will occur.

The capacity questions that guide indicator performance are not wholly applicable to the FDS because adaptation and climate change are both neglected at large in this document. The capacity questions are based upon the expectation that adaptation is explicitly referred to in policy documents, and if the concept of adaptation is absent, the capacity questions cannot be applied. Overall, the FDS is a policy that is poorly equipped to handle environmental change as the policy is fixated on growth and industry development as opposed to proactive management as Ficke et al. (2007) suggest. The largest hindrance this policy has with respect to adaptive capacity is the deficiency in recognition that adaptation should be a centerpiece in fisheries development. However, this policy does recognize the need for regional development to allow

Table 3: NAC Indicators within the FDS

Source: MARD, 2010

FISHERY DEVELOPMENT STRATEGY THROUGH TO 2020				
Assessment	Prioritization	Coordination	Information Management	Climate Risk Management
<ul style="list-style-type: none"> - climate impacts not mentioned; pinpoints climate change only once throughout the entire document - environmental protection noted as a focal point, though ambiguous - does not specify what aspect of it - acknowledges importance of community-based management in marine security - considers regional issues, but does not treat them on climate terms 	<ul style="list-style-type: none"> - adaptation not prioritized, and therefore processes such as 5-year plans for adaptation are not discussed - no input from local-level institutions with respect to adaptation in this policy - priorities to be revisited in 2020 no other timelines are present 	<ul style="list-style-type: none"> - as adaptation is not mentioned within the fisheries document, coordination on this topic between municipal, provincial, and federal government is severely limited if not absent - document refers to some vertical coordination between localities, regions, and federal government with respect to development of fisheries - specifies involvement required by MONRE and MARD to direct localities, but does not allude to <i>how</i> this will happen - coordinating body is mentioned: MARD - absence of clear adaptation mandate for coordination body 	<ul style="list-style-type: none"> - reference to monitoring the environmental impacts in all regions - plans of monitoring assays and experiments during importations and exportations of aquatic species in Vietnam - allocated budget is noted (\$2.5 billion USD) but breakdown is not provided, nor referenced - no allusion to data gathering; no quotas mentioned, or current levels of fish stocks - indicates that MARD will coordinate with other ministries and branches named in the document to share data and implement the strategy 	<ul style="list-style-type: none"> - climate risk has only very minimally been considered in this document - does not consider future infrastructure requirements - resource management is briefly mentioned: document indicates that improvement of the capacity of state and community-based management of fisheries is necessary - adaptation options not considered - no cost analysis - no short, medium, long term evaluations set

for the continued survival of traditional fisheries and to incorporate more knowledge from local experts. Regional development may encourage adaptation to occur at a smaller scale – the document clearly identifies specific regions (e.g. Red River Delta in the northern part of the country) and highlights aspects of the sector which need attention in those locales. Yet, without articulating increased adaptation as an outcome within the document, one cannot assume that adaptation will be a byproduct of the incorporation of local knowledge.

McIlgorm et al. (2010) emphasize the importance of acknowledging potentially reduced harvests within governance approaches to climate change alongside various other responses such as habitat restoration, continuous monitoring of fish species, and the review of access allocations. However, the FDS does not discuss at length any of these topics and is focused instead on the economic benefits of the exploitation of fish species within Vietnamese waters. Although environmental protection, along with the regeneration of aquatic resources, is mentioned in the FDS document as one of the major solutions that is required, the most blatant issue with respect to adaptive capacity is that climate change is acknowledged only once throughout the entire policy and not associated with environmental protection. Apart from article 1.4 of the FDS which identifies that the government has a development viewpoint for adaptation to climate change, nothing else in the entire document refers to climate. Even then, article 1.4 is rather topical, and only grazes the issue of climate change. Article 1.4 states the following:

“To develop fisheries toward quality and sustainability, through harmonizing the increase of added value with assurance of quality, food hygiene and safety, environmental protection, protection and development of resources and social security; to proactively adapt to the impacts of climate change; and closely combine fisheries development with the protection of national sovereignty and marine security”
(MARD 2010, pg 64)

MARD and MONRE are two departments of the Vietnamese government which have important national natural resource responsibilities and need to be working hand in hand in order to

properly address the problem that climate change poses to these resources. Without detailing the necessary adaptation to future environmental change that must occur, this document does not meet any adaptive capacity requirements as put forth by the NAC.

Under the section entitled “Targets to 2020”, neither adaptation nor integrated management is mentioned – instead seafood export and job creation are discussed. Though extremely important issues, these subjects cannot be treated without considering them under a climate lens as a changing climate will inevitably affect both quantity and quality of export and subsequently the number and types of jobs available. The government aspires to create a further five million jobs in the fisheries sector, but does not state where these employment opportunities will manifest. It is possible that these employment opportunities could materialize in the realm of adaptation, but without articulating this, the policy can be interpreted in any number of ways. After delving further into the FDS, it appears that sustainability and preparation for environmental change are not priorities in the policy piece, and that the components of the NAC are in their infancy, if at all present. Out of all five NAC indicators, not a single one is even moderately addressed.

National Target Program to Respond to Climate Change (NTP RCC)

The NTP RCC of Vietnam was written in 2008 as part of the country’s ratification of the UNFCCC’s Kyoto Protocol and acts as the foundation for the prevention and mitigation of environmental change. Least developed countries (LDC) who chose to partake in the UNFCCC were required to create a National Adaptation Plan (NAP) and a National Adaptation Programme of Action (NAPA) to identify priority areas (UNFCCC, 2013). Developing countries not part of the LDC group were invited to partake in this as well, and Vietnam created the NTP RCC

initially tasked to the Hydro-meteorological Service, but overtaken by MONRE. Overall, it is the most detailed and thorough of the chosen policies in this paper for analysis. This policy document acknowledges that fisheries are an extremely vulnerable sector and need to be focused upon for adaptation activities, however the document as a whole mainly focusses upon the enhancement of understanding of climate impacts as well as legislating the assessment of costs for various adaptation measures. Below, Table 4 applies the NTP RCC to the indicators of the NAC framework. Table 4 clearly represents that when assessing the NTP against the capacity questions, that it is a suitable foundational policy document to set Vietnam on the path towards environmental resilience due to the detail it has compared to the other two documents. However, the document requires certain modifications and updates in order to remain a relevant and effective policy tool, such as the implementation of greater lateral policy awareness so that the provisions found within the document could easily be applied to other natural resource documents, such as the FDS. The NTP does in fact note that one of the goals of the policy is to integrate it into sectoral and local development strategies and plans, and it names the FDS explicitly (pg. 34). Regardless of naming the FDS as one of the policies for integrated climate change awareness, this never came to pass in the FDS as climate is not mentioned, and thus reduces the validity of the NTP as a whole.

The NTP RCC recognizes the need for multiple aspects of the NAC, such as vulnerability assessment, and notes that individuals and companies associated in the fishery sector are at a great risk. Most of the NAC indicators are thoroughly met within this policy document as is evidenced by Table 4. The NTP RCC performs highly, particularly under assessment, as it answers the capacity questions under this indicator rigorously. Coordination is also

Table 4: NAC Indicators within the NTP RCC

Source: MONRE, 2008

NATIONAL TARGET PROGRAM TO RESPOND TO CLIMATE CHANGE				
Assessment	Prioritization	Coordination	Information Management	Climate Risk Management
<ul style="list-style-type: none"> - explicit recognition of climate change and assessment of climate change impacts clearly outlined within specific sectors and localities - clear link between fisheries and climate impacts - vulnerability assessment for fishers to be undertaken - various regions and locales taken into account - budget under control of the Program Executing Board who will propose and allocate money for NTP RCC activities and work in conjunction with Ministry of Finance and Ministry of Planning and Investment 	<ul style="list-style-type: none"> - temporal scope identified (2009-2010 start up, 2011-2015 implementation, post 2015 development) - Notification of mainstreaming climate change into national development policies - Proclaims plan to integrate NTP into local development strategies and that stakeholder consultations will draw on knowledge from local communities from specific areas of vulnerability and urgent adaptation needs - identifies vulnerable groups as requiring special attention going forward 	<ul style="list-style-type: none"> - coordination body named: MONRE - Puts forth plans to develop a "Task Force" to deal with multilateral actors - identifies need for coordination across the country/territorial regions/localities/sectors in almost every part of the document - Highlights need to transparent mediation mechanism between ministries, localities, other stakeholders etc. - vertical interests and various stakeholders considered - no reference to frequency of coordinating body meetings - Does not specifically refer to bodies involved in Task Force 	<ul style="list-style-type: none"> - illustrates desire to create a climate change database for information storage and sharing - delegates responsibility at the district and provincial levels for the consolidation, gathering, and maintenance of climate data - Provides a very clear budget allocation table in VND from 2009-2015 - puts forth organizational structure to oversee monitoring of vulnerable ecosystems, including fisheries 	<ul style="list-style-type: none"> - fisheries are mentioned in this document as a priority area - establishes connection between fishery policy documents - lacking allusion to risk assessments of fisheries (none of historical, current, and ongoing) but this can be implied through the identification of fishery policy documents - focus on 'hard' adaptation options (e.g. dykes and seawalls), but does note certain 'soft' options (e.g. institutional strengthening, collaboration between departments for adequate information sharing)

NATIONAL TARGET PROGRAM TO RESPOND TO CLIMATE CHANGE				
Assessment	Prioritization	Coordination	Information Management	Climate Risk Management
<ul style="list-style-type: none"> - methodology of assessment made relatively transparent - notes that budget for the International Consultation Board will be donated by international donors - Combination of internationally sourced funding along with national sources 	<ul style="list-style-type: none"> - notes that adjustments to laws and policies are necessary as climate change requirements unfold over time 	<ul style="list-style-type: none"> - does not mention specific conflict resolution mechanisms 		

evidently a high performing indicator within the NTP as the policy document asserts that the whole political system must take responsibility for climate change adaptation, and that actions must be locally derived and implemented. The document very clearly outlines who must take responsibility for certain projects, and even goes so far as to designate parts of the budget to specific departments. Still, a recurring problem throughout the piece is that it does not specifically articulate the basis for how this will be accomplished, particularly relating to fisheries. Of course, it is imperative to remember that this document was created in 2008, and significant progress has been made in the past six years, but more so at the local and community level.

As aforementioned, the one aspect that recurs throughout the NTP is that the document makes a lot of assertions, but does not reiterate how these ideas will be actualized. Using the

NAC lens to analyze these ideas, they lose purpose without an explanation of details, or an allusion to a secondary strategy which could act as the enforcement arm of the policy. This policy, the lack of concrete timelines would be an inherent flaw in the policy as setting anticipated durations for targets to be reached is a crucial element of all indicators. Vague deadlines are set for certain targets (e.g. a framework for a database on climate change was to be completed by 2010), but more details are needed to determine who the responsible actors are for the creation or implementation of these targets. The World Bank echoes this sentiment regarding the NTP and indicates that there is a lack of “identification of the nature of adaptation measures available for key sectors of economic activities and regions of the country, and the assessment of the possible costs and benefits of these measures” which limits governments at all levels to plan and implement cost-effective adaptation options (World Bank 2010b, pg 23). The World Bank (2010d) also argues that the NTP overlooks “soft” adaptation measures (e.g. social vulnerability) in favour of “hard” measures (e.g. more durable buildings, reinforced infrastructure etc.) which omits the role of increased institutional capacity alongside the building of social capital to enhance resilience. This has significant implications in the fisheries sector as a focus on soft adaptation measures is needed to curtail economic losses and livelihood shifts that many fishers will have to endure.

The NTP RCC acknowledges that there are improvements required within the document. It recognizes that without improvement, the implementation of the policies and procedures it denotes could be problematic. It cites four main hurdles: poor awareness in scope and measures to respond to climate change, a lack of coordination to respond to climate change especially in highly sensitive sectors and regions, a lack of methodologies or tools to bestow upon decision makers at the sectoral and local level, and an implicit lack of knowledge of climate change as a

long-term issue. Deficiencies in the policy and supporting mechanisms are identified, but no suggestions are established which will aim combat this.

National Strategy on Climate Change (2011-2020) (NSCC)

The NSCC, a document created in 2011, acts as an addition to the NTP RCC in that the same subject matter is covered but the NSCC focusses on a specific time period. The goals and targets listed in this strategy not only work in conjunction with the ideas presented within its sister document the NTP, but set the stage for future planning. There are some marked contrasts between the two, however. Principally, this document is not at all as thorough and comprehensive a document as the NTP and offers scarce details on methodologies for implementation. This document seems to be merely an overview of what is already known regarding climate change in Vietnam and there appears to be an absence of depth, substance, and direction for any industry, let alone fisheries. MONRE has already compiled and undertaken extensive background research with respect to climate scenarios, and thus simply publishing basic strategies to combat these changes is no longer helpful; concrete plans and procedures that pinpoint sectors and regions which require extra attention, and *how* these regions will be approached, are necessary. The NSCC does not acknowledge the fisheries of Vietnam directly and therefore many of the NAC capacity question for this specific sector and the associated adaptation activities are not particularly relevant. Though the policy incorporates adaptive capacity as this paper has defined above, an adaptive capacity *framework* is not mentioned within the document which is in direct contrast as to what many scholars, such as Leith et al. (2014) and Boateng (2012), believe to be the correct path forward to building resilience and countering vulnerability. Yet, the policy is still an important piece of the overall puzzle of the

Table 5: NAC Indicators within the NSCC

Source: Socialist Republic of Vietnam, 2011

NATIONAL STRATEGY ON CLIMATE CHANGE 2011-2020				
Assessment	Prioritization	Coordination	Information Management	Climate Risk Management
<ul style="list-style-type: none"> - references to full scale assessments carried out by respected scientific bodies - indicates desire to build the notion of climate change into other policy documents - considers a vast range of stakeholders - brief reference to budget - that of increasing it 	<ul style="list-style-type: none"> - notes adaptation is crucial as a strategic viewpoint - time periods are set, but very little detail is given in terms of goals or targets to be met, and only implied reference to fisheries - water management adaptation in the Mekong and Red River Deltas prioritized between 2011-2015 - reports that decision making will occur with input from communities, scientists and non-governmental organizations 	<ul style="list-style-type: none"> - designates several coordinative bodies: MONRE, MPI, and local bodies - recognizes need of collaboration with other ministries and sectors, including NGO's and private enterprises - notes need to work in conjunction with international actors 	<ul style="list-style-type: none"> - discussion of consolidating remote measuring systems (of weather, water resources etc.) - expresses plan to build a database to log changes in water resources with respect to climate change both qualitatively and quantitatively - plans to improve awareness, education and training on climate change 	<ul style="list-style-type: none"> - provides background information on climate change impacts and effects - priority area of fisheries not mentioned; water resources mentioned for strategic areas (Mekong River Delta, Red River Delta) and degradation of water resources acknowledged - adaptation indicated as a solution, but mentioned generally rather than in specific contexts - emphasizes mitigation on equal footing with adaptation - focus on 'soft' adaptation options

state of Vietnam's plans for prospective development across various sectors. It provides an overview of larger topics that imply fisheries protection such as water security and management.

Table 5 above outlines how the NSCC measures up to the NAC indicators. Similarly to the FDS, which avoids mention of climate change and adaptation throughout the majority of the document, the NSCC skirts around the topic of fisheries. Upon analysis of the indicators within this document, several of the capacity questions are not able to be answered unless we were to look at this document more topically, without a focus on fisheries, or if we assume that fisheries are encapsulated under more broad terms, such as water resources. The superficial and cursory information that it provides does not satisfy many of the capacity question requirements. Generally speaking, however, with relation to the NAC indicators, the NSCC exhibits some of the desirable qualities such as broad stakeholder consultation, desire to increase public awareness, and references data gathering and monitoring. Unfortunately, having neglected fisheries as a whole, the NSCC loses credibility in terms of its overall goal of seeing climate change as a “challenge and a chance” – the headline which is used at the beginning of the document to describe the objectives contained within. It does not broach the subject of challenges within any of Vietnam's most profitable sectors, and leaves a lot to be desired when exploring the topic of ‘chances’. With the FDS articulating the aspirations of having fisheries contribute extensively to the economy, job creation, and poverty reduction, the NSCC should have, at the least, touched upon the challenges and chances fisheries, one of the most productive areas of the Vietnamese economy, will elicit.

Discussion

As stated previously, one of the goals of the NAC is to isolate strengths and weaknesses in the adaptive capacity of the country at hand. In the case of Vietnam, it appears that there are more policy shortcomings than there are advancements with respect to fisheries sector preparedness for climate change. Climate change adaptation is addressed in the climate change policies of Vietnam, but not within the FDS. There is no overarching adaptive capacity framework associated with any of these policies. There are some parallels between the documents, but more prevalent are the differences that can be drawn from the three policies described and analyzed above vis-à-vis fisheries and adaptive capacity according to the NAC. Correlations between these policies revolve around the indicator of assessment as they all utilize available information to aid in decision making. Above that, each policy possesses certain characteristics of the remainder of the indicators. Namely, all of the policy documents identify a responsible institution with the means, skills, and knowledge for implementation and no policy seems to work in isolation under one department or governing body. All three documents take into account input from local sources, and have undertaken some sort of environmental and vulnerability assessment. Each policy extends itself to be implemented and interpreted by several bodies at various vertical levels of governance, which signifies that the most amount of information possible will be considered, and that coordination between disparate actors is present.

The main difference that is apparent when comparing the three policies is that they all govern different aspects of the natural environment in Vietnam and thus cannot have complete subject overlap regarding climate change. It is clear that the NSCC and the NTP RCC both dictate actions which need to be taken around climate change and adaptation is an inherent

aspect of this realm which cannot be ignored or omitted. As for fisheries, both climate change policies vary in terms of acknowledging that the sector requires attention. The NSCC neglects to mention fisheries at all, whereas the NTP RCC refers to fisheries extensively throughout the document and identifies them as an area for special attention. The FDS, on the other hand, lacks a climate change angle and bypasses the subject of adaptive capacity, vulnerability, and climate risk assessment. In terms of NAC indicators, all three are rather distinct. Table 6 below provides a visual representation and concise comparison of the three documents. As the NTP RCC was the most well rounded and thorough document, it met many of the minimum indicator requirements and answered a fair number of the capacity questions asked within the NAC framework despite being the most dated policy. The other two policies fared rather poorly which emphasizes the need to either revamp the policies individually to ensure that they are resilient enough to handle environmental change, or interconnect the policies so that they can draw from each other's strengths. It must be mentioned that although the NSCC does not mention fisheries outright, it does discuss the idea of the preservation of biodiversity and the fact that water resources in Vietnam are vulnerable to climate change, which can be extended to include the idea of fisheries. These factors were taken into consideration when awarding the policy with rating of "poor" instead of "non-existent" for all indicators. However, if this policy were to be more streamlined and more specific, categorically including the fisheries sector would be beneficial in short and long term planning.

Table 7 further dissects the state of awareness by the government of the vast spectrum of fisheries that exist in Vietnam. It is clear that none of the policies differentiate between marine and freshwater ecosystems – this is in direct opposition to what Bell et al. (2012) argue for parts of the Pacific. Through the use of water temperature mapping, these authors deduce that

Table 6: A Comparison of the FDS, NTP RCC, and NSCC by NAC Indicators

	Fishery Development Strategy Through to 2020	National Target Program to Respond to Climate Change	National Strategy on Climate Change
Assessment	Non-existent	Satisfactory	Poor
Prioritization	Non-existent	Satisfactory	Poor
Coordination	Poor	Satisfactory	Poor
Information Management	Poor	Satisfactory	Poor
Climate Risk Assessment	Non-existent	Satisfactory	Poor

^a The descriptive word found in corresponding boxes summarizes how well the policy complies with NAC capacity questions for each indicator, summarizing whether or not the policies address both fisheries and climate change adaptation. The rating scale is comprised of four possible classifications: non-existent, poor, satisfactory, detailed. A rating of ‘non-existent’ indicates that the indicator is not met in the corresponding policy. A rating of ‘poor’ indicates very few of the capacity questions are answered in the policy for that indicator. A rating of ‘satisfactory’ indicates that at least half of the capacity questions are explained in the policy for that indicator. A rating of ‘detailed’ indicates that the majority, if not all capacity questions are addressed in the corresponding policy.

Table 7: Distinction Between Production Systems

	Fishery Development Strategy Through to 2020	National Target Program to Respond to Climate Change	National Strategy on Climate Change
Differentiation between freshwater and marine fisheries	Non-existent	Non-existent	Non-existent
Differentiation between wild catch and aquaculture	Vague	Vague	Non-existent

^a The descriptive word found in corresponding boxes summarizes how well each policy addresses the different types of fishing that exists in Vietnam, in addition to the different types of aquaculture that are also present. The rating scale is comprised of three possible classifications: non-existent, vague, detailed. A rating of ‘non-existent’ indicates that no differentiation exists. A rating of ‘vague’ indicates that there has been some sort of acknowledgement of difference, but there is a lack of clear boundaries or explanation. Additionally, it could mean that only one of the two types of indicators is addressed. A rating of ‘detailed’ indicates that the terms are clearly defined and distinct.

freshwater fisheries in certain areas might in fact become more productive and therefore these types of fisheries would require a different set of rules and regulations than marine ecosystems. Vietnam would benefit from undertaking scientifically-based projections for environmental change and apply these findings to legislation so that distinct ecosystems are addressed. Of further note is that none of the aforementioned policies differentiate between wild catch and aquaculture. The FDS, an economically focused document, only refers to aquaculture - one of the stated development viewpoints is “converting traditional fishing into modern fishing” (MARD, 2010, pg 64) or put simply, converting traditional wild catch fishing into aquaculture. The policy mentions fish farmers in certain areas, and notes that farmers in mangrove forests surrounding Ho Chi Minh City and the Ba Ria-Vung Tau province (both in the southern portion of the country) should maintain ecologically organic models of farming. Mirroring the FDS, the NTP RCC refers to aquaculture, but not conventional types of fishing (though this activity could be incorporated into the agriculture sections of the document). Additionally, the policy does not clearly dictate a difference between marine and freshwater ecosystems, effectively lumping the two together. In the case of the NSCC, as there is no explicit reference to fish or the fishing sector in Vietnam, the rating of non-existent is the only rating that can apply to both indicators. Detailing the policies further with respect to fish farming vs. fishing and marine vs. freshwater ecosystems would greatly enhance their applicability and usefulness. Considering how viable aquaculture is to the economy of Vietnam and the desires to grow this industry as is shown in the FDS, protecting the environmental conditions that surround the sector would be of great benefit to the government.

It appears through this analysis that the three policies are diverse and divergent pieces of legislation. The difficulty lies in having the policies work synergistically and harmoniously in

order to elicit relevant, specific, and timely actions in the future when necessary, and this fact will likely act as a hurdle for the Vietnamese government and other civil society actors. Both financial and human resources should be imbued into not only ensuring that these policies are complementary and mutually congruent, but also into adequately equipping these strategies with the means to monitor and enforce the policies and procedures they prescribe. There should be a concerted effort going forward to streamline all policies centered on natural resource protection under an adaptive capacity lens. Further research could concentrate on applying the NAC framework in a full scale capacity to facilitate more awareness of the strengths and weaknesses in the adaptive capacity of Vietnam.

Co-management is certainly an area that Vietnam will want to heavily consider in the coming years. This type of management style will address gaps that policies may not cover outright, and allows for flexibility in decision making so that solutions can be tailored to the needs of individual regions and ecosystems. Using the Tam Giang Lagoon in central Vietnam as an example, Armitage et al. (2011) discovered that the historically used top-down system for solving resource issues was met with limited success. They argued that more vertical (villages-communes-districts-province) and lateral (among stakeholder or user groups of a particular resource) discussions would be beneficial. Armitage and Marschke (2013) suggest the adoption of an integrated fishery system perspective where national policies can learn from the mandate of local fishing associations. Furthermore, the suggestion to strengthen institutional networks for collaborative decision making is put forth to empower fishing associations and would aid in capacity building. Discussion surrounding co-management and resource management (the limitation of natural resource access and the use of strict property rights) has to dominate the conversations Vietnam has with third parties to ensure that adequate attention is being given to

the sectors and activities that require it; climate change adaptation in fisheries cannot be overlooked.

Conclusion

Prominent economist magazines and forecasters hypothesize by that Vietnam is on its way to becoming the next emerging Asian market (Harjani 2013). The country has become a hotspot for multilateral activity (e.g. World Bank activities, Asian Development Bank projects), research in various fields, and diverse inputs of FDI (Foreign Direct Investment) due to private interest in real estate and infrastructure. Coordination between governments of various sizes and the implementation of numerous stakeholder opinions (NGOs and private interests) as well as scientific information is a challenge, but there is no lack of interest in capacity building. Gaps in the literature on climate change exist in terms of applying adaptive capacity theories to country case studies, specifically for the fisheries sector. Gaps regarding how the limited specificity of policies (e.g. clearly separating freshwater and marine ecosystems) will hinder future action by government are also prevalent. This paper has endeavored to highlight areas for policy improvement in Vietnam as their preparedness for climate change within their fisheries will require vast amounts of attention in the coming years, and associated policies will require serious modifications. With proper management of FDI, multilateral aid, and Vietnam's own resources, vulnerable communities and at-risk ecosystems will likely be better equipped to surmount the challenge that is present with climate change. The NAC provides the groundwork for identifying the institutional necessities to advance policies aimed at promoting vertical coordination between levels of government, as well as emphasizing the need for climate-centric planning. A crucial aspect going forward, however, that cannot be overlooked is that of policy complementarity and

reciprocity - if policies continue to function in a vacuum, the risk of limited individual policy efficacy could occur.

Climate change outcomes are at this point somewhat vague - drastic environmental changes are expected to happen, but the timeframe and magnitude of these effects is contested. Much of the research is speculative as long-term monitoring and data is not yet available. Due to this fact, the certainty of the effects of climate change are difficult to pinpoint and thus adaptation might not comprehensively address all problems. Yet, the literature available on this topic discusses climate change and its outcomes thoroughly, as many scientists and organizations have put forth their own estimates as to what may happen. Adaptation strategies have been explored, especially through UN organizations in order to aid those in developing nations prepare adequately for the challenge ahead. It is imperative that nations heed the warnings put forth by reputable, scientifically-based organizations in order to be sufficiently prepared for the turmoil that no doubt will accompany environmental change.

References

- Allison, E.H., Perry, A.L., Badjeck, M-C., Adger, W. N., Brown, K., Conway, D., Halls, A.S., Pilling, G.M., Reynolds, J.D., Andrew, N.L., Dulvy, N.K. (2009). "Vulnerability of National Economies to the Impacts of Climate Change on Fisheries." *Fish and Fisheries*, 10, 173-196.
- Armitage, D., Marschke, M. (2013). "Assessing the Future of Small-Scale Fishery Systems in Coastal Vietnam and the Implications for Policy." *Environmental Science and Policy*, 27, 184-194.
- Armitage, D., Marschke, M., Van Tuyen, T. (2011). "Early-Stage Transformation of Coastal Marine Governance in Vietnam?" *Marine Policy*, 35, 703-711.
- Badjeck, M-C., Allison, E.H., Halls, A.S., Dulvy, N. (2010). "Impacts of Climate Variability and Change on Fishery-Based Livelihoods." *Marine Policy*, 34(1), 375-383.
- Beckman, M. (2011). "Converging and Conflicting Interests in Adaptation to Environmental Change in Central Vietnam." *Climate and Development*, 3(1), 32-41.
- Bell, J.D., Ganachaud, A., Gehrke, P.C., Griffiths, S.P., Hobday, A.J., Hoegh-Guldberg, O., Johnson J.E., Le Borgne, R., Lehodey, P., Lough, J.M., Matear, R.J., Pickering, T.D., Pratchett, M.S., Gupta, A.S., Senina, I., Waycott, M. (2013). "Mixed Responses of Tropical Pacific Fisheries and Aquaculture to Climate Change." *Nature Climate Change*, 3, 591-599.
- Boateng, I. (2012). "GIS Assessment of Coastal Vulnerability to Climate Change and Coastal Adaption Planning in Vietnam." *J Coast Conserv*, 16, 25-36.
- Boonstra, W.J., and P. T. Hong Nhung. (2012). "The Ghosts of Fisheries Management." *Journal of Natural Resources Policy Research*, 4(1), 1-25.
- Booth, T. H., Jovanovic, T., Ho, N. S., and C. Miller. (2012). "A Systematic Regional Approach for Climate Change Adaptation to Protect Biodiversity." *Climatic Change*, 117, 757-768.
- Bosma, R.H., Nhan, D.K., Udo, H.M.J., and U. Kaymak. (2012). "Factors Affecting Farmers' Adoption of Integrated Rice-Fish Farming Systems in the Mekong Delta, Vietnam." *Reviews in Aquaculture*, 4(3), 178-190.
- Bruun, O., and T. Casse. 2013. *On the Frontiers of Climate and Environmental Change; Vulnerabilities and Adaptations in Central Vietnam*. Springer: Berlin Heidelberg
- Charles, A. (2012). "People, Oceans, and Scale: Governance, Livelihoods, and Climate Change Adaptation in Marine Social-Ecological Systems." *Current Opinion in Environmental Sustainability*, 4, 351-357.
- CIA (Central Intelligence Agency). 2013. *The World Factbook: Vietnam*. Retrieved from: <https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html>
- Climate Change Working Group. (2011). Activities and Thematic Groups. Retrieved 1 March 2013 from: <http://www.ngocentre.org.vn/ccwg>
- Coulthard, S. (2008). "Adapting to Environmental Change in Artisanal Fisheries - Insights from a South Indian Lagoon." *Global Environmental Change*, 18(1), 479-489.
- Dang, H.L., Li, E., Bruwer, J., and I. Nuberg. (2014). "Farmers' Perceptions of Climate Variability and Barriers to Adaptation: Lessons Learned from an Exploratory Study in Vietnam." *Mitigation and Adaptation Strategies for Global Change*, 19(5), 531-548.
- Dixit, A., McGray H., Gonzales, J., and M. Desmond. (2012). "Ready or Not: Assessing Institutional Aspects of National Capacity for Climate Change Adaptation." World Resources Institute. Retrieved 25 August 2014 from <http://www.wri.org/publication/ready-or-not>

- East Meets West Foundation (EMW). (2009). Climate Change Adaptation Survey. Retrieved 23 August 2014 from: downloads.eastmeetswest.org/pubs/emw_climatechangeadapt_survey.pdf
- FAO (Food and Agriculture Organization of the United Nations). (2014). Fishery and Aquaculture Country Profiles: Vietnam. Retrieved 23 August 2014 from: http://www.fao.org/fishery/countrysector/FI-CP_VN/en
- Few, R., and P. Gia Tran. (2010). "Climatic Hazards, Health Risk and Response in Vietnam: Case Studies on Dimensions of Vulnerability." *Global Environmental Change*, 20, 529-538.
- Ficke, A., Myrick, C., Hansen, L. (2007). "Potential Impacts of Global Climate Change on Freshwater Fisheries." *Reviews in Fish Biology and Fisheries*, 17(4), 581-613.
- Fortier, F. (2010). "Taking a Climate Chance: A Procedural Critique of Vietnam's Climate Change Strategy." *Asia Pacific Viewpoint*, 51(3), 229-247.
- Frost, M., Baxter, J.M., Buckley, P.J., Cox, M., Dye, S.R., Harvey, N.W. (2012). "Impacts of Climate Change on Fish, Fisheries and Aquaculture." *Aquatic Conservation: Marine and Freshwater Ecosystems*, 22, 331-336.
- Grafton, R. Q. (2010). "Adaptation to Climate Change in Marine Capture Fisheries." *Marine Policy*, 34(2), 606-615.
- Ha, T. T. P., van Dijk, H. (2013). "Fishery Livelihoods and (non)-compliance With Fishery Regulations - A Study in Ca Mau Province, Mekong Delta, Vietnam." *Marine Policy*, 38(1), 417-427.
- Harjani, Ansuya. "The Emerging Market to Watch in 2014." *CNBC*. 23 December 2013. Retrieved 10 October 2014 from: <http://www.cnbc.com/id/101294392#>
- Harsem, O., and Hoel, A. H. (2013). "Climate Change and Adaptive Capacity in Fisheries Management: The Case of Norway." *Int Environ Agreements*, 13, 49-63.
- Heikkila, T., Gerlak, A., Bell, A., Schmeier, S. (2013). "Adaptation in a Transboundary River Basin: Linking Stressors and Adaptive Capacity Within the Mekong River Commission." *Environmental Science and Policy*, 25(1), 73-82.
- Intergovernmental Panel on Climate Change (IPCC). (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Reports of the Intergovernmental Panel on Climate Change*. New York, NY: Cambridge University Press.
- Johnson, J., and D. Welch (2010). "Marine Fisheries Management in a Changing Climate: A Review of Vulnerability and Future Options." *Reviews in Fisheries Science*, 18(1), 106-124.
- Kranz, N., Menniken, T., Hinkel J. (2010). "Climate Change Adaptation Strategies in the Mekong and Orange-Senque Basins: What Determines the State-of-Play?" *Environmental Science and Policy*, 13(1), 648-659.
- Leith, P., Ogier, E., Pecl, G., Hoshino, E., Davidson, J., Haward, M. (2014). "Towards a Diagnostic Approach to Climate Adaptation for Fisheries." *Climatic Change*, 122, 55-66.
- Marconi, M., Sarti, M., Marincioni, F. (2010) "Sustainability Assessment of Traditional Fisheries in Cau Hai Lagoon (South China Sea)." *Marine Environmental Research*, 70(1), 253-263.
- MARD (Ministry of Agriculture and Development). (2010). *Vietnam Fisheries Development Strategy Through 2020*. Retrieved 19 August 2014 from: <http://www.ecolex.org/ecolex/>

- ledge/view/RecordDetails;DIDPFDSIjsessionid=E81CBCEAAF9138E893BA02790
BDD5BEF?id=LEX-FAOC099785&index=documents
- Marschke, M., Lykhim, O., and N. Kim. (2014). "Can Local Institutions Help Sustain Livelihoods in an Era of Fish Declines and Persistent Environmental Change? A Cambodian Case Study." *Sustainability*, 6, 2490-2505.
- Marschke, M., Wilkings, A. (2014). "Is Certification a Viable Option for Small producer Fish Farmers in the Global South? Insights from Vietnam." *Marine Policy*, 50, 197-206.
- McIlgorm, A., Hanna, S., Knapp, G., Le Floc'H, P., Millerd, F., Pan, M. (2010). "How Will Climate Change Alter Fishery Governance? Insights from Seven International Case Studies." *Marine Policy*, 34(1), 170-177.
- Mekong River Commission. (2010). *Review of Climate Change Adaptation Methods and Tools*. Retrieved 8 February 2013 from: www.mrcmekong.org/.../Tech-No34-Review-of-climate-change.pdf
- Merino, G., Barange, M., Mullon, C., Rodwell, L. (2010). "Impacts of Global Environmental Change in Aquaculture Expansion on Marine Ecosystems." *Global Environmental Change*, 20, 586-596.
- MONRE (Ministry of Natural Resources and Environment). (2008). *National Target Program to Respond to Climate Change*. Socialist Republic of Vietnam. Retrieved from: http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.isgmard.org.vn%2FVHDocs%2FNationalPrograms%2FNTP%2520RespondtoClimateChange.pdf&ei=ZS8PVMLAFIPLggSnx4KYBg&usq=AFQjCNFq1mEUuuMfo4yIB7JwsuiRCRbOCA&sig2=PzRxhy9R7h2kxQsGAc5d_w&bvm=bv.74649129,d.eXY
- Negro, S. E. (2013). "Recent Developments in Coastal Adaptation to Climate Change." *Urban Lawyer*, 45(4), 991-1005.
- NPWRC (Northern Prairie Wildlife Research Centre). (2013). Effects of Biodiversity on Ecosystem Functioning: A Consensus of Current Knowledge. Retrieved 12 April 2013 from: <http://www.npwrc.usgs.gov/resource/habitat/econsens/index.htm>
- Payne, M.R. (2013). "Climate Change at the Dinner Table: An Innovative Use of Catch Statistics Shows that Climate Change has Already Influenced the Composition of Species in Fisheries Around the World, and Thereby the Fish that We Eat." *Nature*, 497, 320.
- Pomeroy, R. (2010). *Addressing Overcapacity in the Small-Scale Marine Fisheries of Vietnam*. World Fish Centre. Retrieved 10 October 2014 from: www.oecd.org/greengrowth/fisheries/43018729.pdf
- Pomeroy, R., Nguyen, K. A. T., Thong, H. X. (2009). "Small-Scale Marine Fisheries Policy in Vietnam." *Marine Policy*, 33(2), 419-428.
- Prime Minister of the Socialist Republic of Vietnam. (2010). *Decision on Approval on Vietnam Fisheries Development Strategy Through 2020*. Socialist Republic of Vietnam. Retrieved 5 September 2014 from: faolex.fao.org/docs/pdf/vie99785.pdf
- Organization for Economic Cooperation and Development (OECD) (2010). The Economics of Adapting Fisheries to Climate Change. Retrieved 21 January 2013 from: http://www.oecd-ilibrary.org/agriculture-and-food/the-economics-of-adapting-fisheries-to-climate-change_9789264090415-en
- Ruddle, K., and A. Davis. (2009). "What is "Ecological" in Local Ecological Knowledge? Lessons From Canada and Vietnam." *Society and Natural Resources*, 24(1), 887-901.

- Shaw, Rajib, Pulhin, Juan M., and Joy Jacqueline Pereira. 2010. *Climate Change Adaptation and Disaster Risk Reduction: An Asian Perspective*. Bingley: Emerald Group.
- Smith, T.F., Thomsen, D.C., Gould, S., Schmit, K., and B. Sclegel. (2013). "Cumulative Pressures on Sustainable Livelihoods: Coastal Adaptation in the Mekong Delta". *Sustainability*, 5, 228-241.
- Socialist Republic of Vietnam. (2011). *National Strategy on Climate Change Period 2011-2020*. Retrieved 1 August 2014 from: <http://www.chinhphu.vn/portal/page/portal/English/strategies/strategiesdetails?categoryId=30&articleId=10051283>
- Todaro, M. and Smith, S. *Economic Development* (11th Edition). Boston, MA: Addison-Wesley.
- United Nations Development Programme (UNDP). *Climate Change and Human Development in Vietnam*. Retrieved 23 August 2014 from: <http://hdr.undp.org/en/content/climate-change-and-human-development-viet-nam>
- United National Framework Convention on Climate Change (UNFCCC). (2013). FOCUS: Adaptation. Retrieved 1 March 2013 from <http://unfccc.int/focus/adaptation/items/6999.php>.
- Van Tuyen, T., Armitage, D., Marschke, M. (2010). Livelihoods and Co-Management in the Tam Giang Lagoon, Vietnam. *Ocean and Coastal Management*, 53(1), 327-335.
- World Bank Group. (2010a). *Development and Climate Change: The Social Dimensions of Adaptation to Climate Change in Vietnam*. Retrieved 12 February 2013 from: <http://climatechange.worldbank.org/content/country-case-studies-economics-adaptation-climate-change>
- World Bank Group. (2010b). *Vietnam: Economics of Adaptation to Climate Change*. Retrieved 19 January 2013 from: <http://climatechange.worldbank.org/content/country-case-studies-economics-adaptation-climate-change>
- World Bank Group. (2010c). *The Cost of Adapting Fisheries to Climate Change*. Retrieved 28 August 2014 from: <http://documents.worldbank.org/curated/en/2010/08/12779737/cost-adapting-fisheries-climate-change>
- World Bank Group. (2010d). *The Social Dimensions of Adaptation to Climate Change in Vietnam*. Retrieved 30 August 2014 from: <http://documents.worldbank.org/curated/en/2010/12/13431938/social-dimensions-adaptation-climate-change-vietnam>
- World Bank Group. 2013. *Key Words and Definitions*. Retrieved 30 October 2014 from: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTTOOLKIT/3/0,,contentMDK:22284629~pagePK:64168445~piPK:64168309~theSitePK:3646251,00.html>
- World dataBank. 2014. *World Development Indicators*. Retrieved 31 October 2014 <http://databank.worldbank.org/data/views/reports/tableview.aspx>
- World Resources Institute (WRI). (2009). *The National Adaptive Capacity Framework, Key Institutional Functions for a Changing Climate*. Retrieved 2 April 2013 from www.wri.org/project/vulnerability-and-adaptation/nac-framework

Appendix - Figures and Tables

Appendix A: Key Elements of NAC Indicators - Assessment, Prioritization, Coordination, Information Management, Climate Risk Management

Source: Dixit et al., 2012

NAC Function 1: Assessment

CAPACITY QUESTIONS	ELEMENTS TO LOOK FOR
To what extent has a national vulnerability and impacts assessment been conducted?	<ul style="list-style-type: none"> ■ Assessment(s) include(s) exposure to climate impacts. ■ Assessment(s) include(s) socioeconomic drivers of vulnerability. ■ Assessment(s) take(s) into account community-level assessments. ■ The methodology of the assessment(s) is made transparent. ■ A broad set of stakeholders were engaged in the development of assessment(s). ■ Assessment(s) cover(s) all sectors and regions.
To what extent have existing adaptation efforts been systematically inventoried?	<ul style="list-style-type: none"> ■ Community-based activities have been inventoried. ■ Academic studies have been reviewed. ■ Activities in a large number of sectors have been reviewed.
Is there an assessment of climate risks to priorities in major existing national planning documents?	<ul style="list-style-type: none"> ■ Key documents explicitly address climate change. ■ Key documents have been reviewed for climate sensitivity and resilience. ■ Assessment(s) is (are) available freely in the public domain.
Is there a system in place for regularly updating the above assessments in the future?	<ul style="list-style-type: none"> ■ An institution (or institutions) has (or institutions have) a mandate to produce the above assessments iteratively over time. ■ Sufficient budget is provided for ongoing assessment(s). ■ The mandated institution coordinates appropriately with other institutions.

NAC Function 2: Prioritization

CAPACITY QUESTIONS	ELEMENTS TO LOOK FOR
To what extent have national priorities for adaptation been identified?	<ul style="list-style-type: none"> ■ Prioritization processes take into account key documents (e.g., 5-year plans, PRSPs, key sector policies, etc.) that reflect existing national development priorities. ■ Prioritization processes take into account input from local-level institutions. ■ Prioritization processes are transparent and publicly documented. ■ Prioritization involves a range of stakeholders, including vulnerable and marginalized groups, in order to assure that priorities are informed by a broad range of perspectives.
To what extent is there a system in place for reviewing and adjusting priorities over time?	<ul style="list-style-type: none"> ■ A time period and process have been set for revisiting priorities. ■ The institution that leads prioritization reports to an appropriate authority. ■ Prioritization decisions can be enforced by officials and members of the public. ■ Resources have been allocated to support convening and other prioritization costs.

NAC Function 3: Coordination

CAPACITY QUESTIONS	ELEMENTS TO LOOK FOR
Have key services, sectors, or activities been identified where coordination may be needed for successful adaptation?	<ul style="list-style-type: none">■ Vertical coordination needs have been considered.■ Needs for coordination across sectors and ministries have been considered.■ Coordination needs are clearly articulated in a public document.
Has an authoritative body been tasked with adaptation coordination?	<ul style="list-style-type: none">■ A coordination body has been established.■ The coordination body has a clear mandate.■ The coordination body has appropriate membership.■ Staff serving the coordination body have appropriate skills and knowledge.■ The coordination body regularly reports to an appropriate authority.■ Sufficient resources have been provided for coordination activities.
To what extent have clear coordination processes been established?	<ul style="list-style-type: none">■ A description of the coordination process is available in a public document.■ There is a system for monitoring and review of the coordination mechanism.■ There is a process for managing conflicts that may arise during coordination.■ Participants in coordination have sufficient flexibility to participate constructively.
To what extent do conditions allow coordination to improve over time?	<ul style="list-style-type: none">■ A process and time period have been set for reviewing coordination activities.■ A process and time period have been set for revisiting coordination needs and priorities.■ Resources have been provided for the review of coordination activities.
To what extent is the coordination mechanism functioning effectively?	<ul style="list-style-type: none">■ The coordinating body meets regularly.■ Participants in coordination report regularly to the organizations they represent.■ Coordination participants and their stakeholders report positively on the body's activities.■ Findings from coordination reviews are taken on board.

NAC Function 4: Information Management

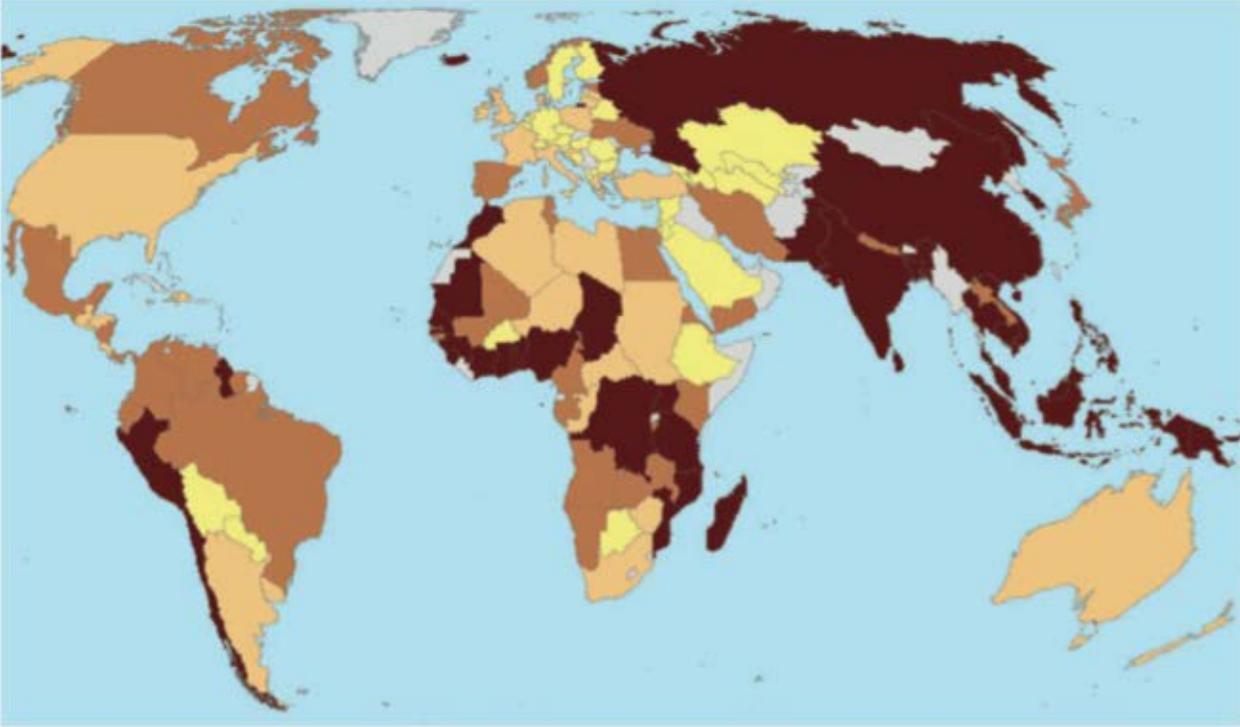
CAPACITY QUESTIONS	ELEMENTS TO LOOK FOR
To what extent are there appropriate systems for data gathering?	<ul style="list-style-type: none">■ The country has climate observation/monitoring systems that are regularly maintained and updated.■ The country has demographic information systems that are regularly maintained and updated.■ Environmental monitoring/observation systems are regularly maintained and updated.■ Methods for data gathering are transparent and publicly available.■ Raw data is readily available publicly and undergoes regular review.■ Sufficient budget is provided for ongoing data gathering.
To what extent are there appropriate systems for information analysis?	<ul style="list-style-type: none">■ There is a process for updating key climate-related definitions, such as (but not limited to) 'normal precipitation levels', 'drought', and important system 'thresholds'.■ Consolidation and analysis of historical climate information occurs.■ The status of vulnerable ecosystems is periodically analyzed.■ The status of vulnerable human systems is periodically analyzed.■ Climate scenarios are developed using all available projections and their uncertainty estimates.■ Analysis is made publicly available and undergoes regular review.■ Sufficient budget is provided for ongoing information analysis and for improving skills and knowledge.■ The analysis produced is easily available to the public.
Has an appropriate national platform (or network) for public information sharing on adaptation been identified (or created)?	<ul style="list-style-type: none">■ An institution(s) has a mandate to disseminate information broadly.■ The mandated institution(s) coordinate(s) appropriately with other institutions.■ A diversity of information users has access to the platform.■ There is a system for monitoring and evaluation of information dissemination.■ Monitoring and evaluation findings are taken on board.■ Sufficient budget is provided for ongoing information dissemination.
To what extent is relevant information reaching key stakeholders who need it?	<ul style="list-style-type: none">■ Representatives of key government agencies say they have the information they need.■ Representatives of lower levels of government say they have the information they need.■ Representatives of the public (including vulnerable populations) report that they have access to this information.■ Key stakeholders are using information in decision making and project implementation.■ Key information is publicly available via a variety of channels.

NAC Function 5: Climate Risk Management

CAPACITY QUESTIONS	ELEMENTS TO LOOK FOR
To what extent has climate risk been assessed for the priority area?	<ul style="list-style-type: none">■ A systematic risk assessment has been conducted.■ Risk assessment takes into account biophysical, socioeconomic, and policy factors.■ Risk assessment considers infrastructure, natural resources management, and social protection programs, as appropriate.■ Assessment methodology is made transparent and readily available to public and other agencies.■ An institution has a mandate to conduct risk assessment iteratively over time.
Have adaptation options for the given priority area been thoroughly considered?	<ul style="list-style-type: none">■ Consideration of options included an appropriate breadth of possible solutions: "Soft" and "hard" options.■ Infrastructure-based, ecologically-based, and social protection-based options.■ Existing adaptation and/or risk reduction projects were reviewed for appropriate replicable options.■ Cost analysis, including total costs and cost effectiveness, was conducted.■ Environmental implications of options were considered.■ Social implications of options were considered, including implications for women and marginalized groups.■ Options were evaluated for their short-, medium-, and long-term efficacy.■ A broad set of stakeholders was engaged in consideration and selection of options.■ Processes exist for reviewing options selected based on new risk assessments over time.■ Authorities make publicly available a process description and justification of options selection.
To what extent are selected adaptation options implemented on the ground?	<ul style="list-style-type: none">■ Projects/programs/policies are developed to implement selection option(s), as appropriate.■ Appropriate authority is tasked with implementation.■ Sufficient budget is provided in support of implementation.■ A system exists for reviewing effectiveness of implementation.■ Projects/programs/policies are achieving stated objectives and timelines.■ Mechanisms exist for adjusting nonperforming projects/programs/policies.■ Mechanisms exist for integrating new risk assessment information into projects/programs/policies over time.

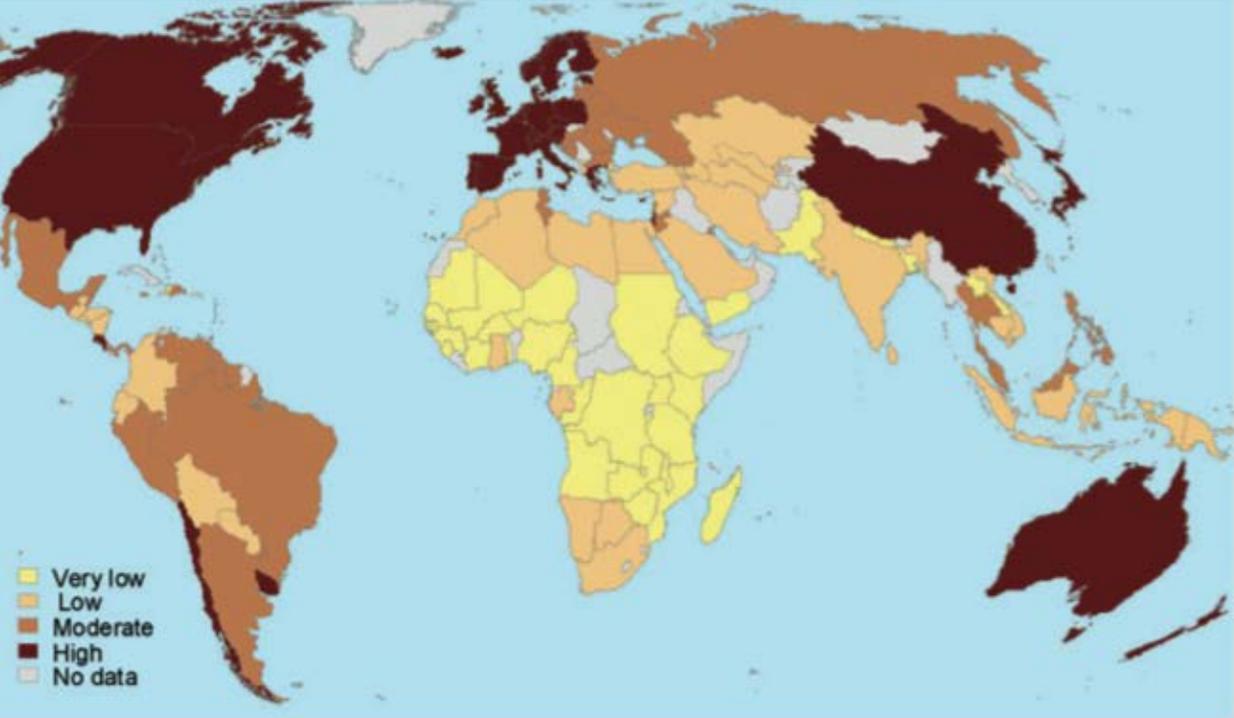
Appendix B: Fisheries Sensitivity to Climate Change of National Economies

Source: Allison et al., 2009



Appendix C: Adaptive Capacity of National Economies to the Impacts of Climate Change

Source: Allison et al., 2009.



Appendix D: Framework for Coastal Adaptation Planning
 Source: Boateng, 2012.

