

# Stakeholders' perceptions of ecosystem services and *Pangasius* catfish farming development along the Hau River in the Mekong Delta, Vietnam



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## ABSTRACT

This study identifies stakeholders' perceptions of ecosystem services (ESS) along the Mekong River in Vietnam. It evaluates trade-offs made between ESS under different *Pangasius* catfish development scenarios, and stakeholders' preferences to these scenarios. The study was conducted through interviews, focus group discussions and a questionnaire survey with 150 households. Rice cultivation and *Pangasius* catfish farming were identified as the most important economic activities. Provisioning services were scored as the most important ESS, followed by supporting, regulating and cultural services. Most stakeholders perceived that an intensification of *Pangasius* catfish farming would increase the production of catfish, but decrease nine other ESS, while integrated *Pangasius* catfish farming would decrease the *Pangasius* catfish production but increase nine other ESS. An integrated system was preferred by the majority of the respondents, mainly because it was perceived to enhance several ESS and provide benefits to local communities. In conclusion, a sustainable development of *Pangasius* catfish farming in the Mekong Delta must include local stakeholders' participation and apply farming strategies that make use of the natural environment without severely or irreversibly degrading it.

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## 1. Introduction

*Pangasius* catfish farming in Vietnam has emerged as one of the most impressive aquaculture developments in the world, with a very quick increase in production and export volumes, contributing significantly to Vietnam's economy and role in the global fish and seafood markets (Khiem et al., 2010; FAO, 2013). This aquaculture sector is rapidly intensifying and expanding in terms of both production volume and culture area in the Mekong Delta, Vietnam (Bosma et al. 2011; De Silva and Phuong, 2011; Halls and Johns, 2013). In order to satisfy the future demand for income, food security and increased gross domestic product (GDP), intensive small-scale *Pangasius* farming systems are increasingly being replaced by large-scale *Pangasius* catfish farming systems in the Mekong Delta (De Silva and Phuong, 2011). There is currently an estimated production of more than 1.2 million tonnes of fish per year, which are exported to some 140 countries (VASEP, 2013). This production

is expected to grow by approximately 5% per annum by the end of this decade, with the value approaching \$2 billion (VASEP, 2013; Halls and Johns, 2013).

Although the aquaculture industry generally is regarded as an efficient mean for increased income and food security, it also bears risks of negative environmental impacts, such as pollution and biodiversity change. In some cases it has even led to environmental disasters (Tovar et al., 2000; Folke et al., 1998; Pullin, 1993). Intensified fish production is often associated with increased fish stocking densities, high inputs of feed and antibiotics, followed by releases of uneaten feed, untreated wastewater, chemicals and disease outbreaks (Da et al., 2011; Anh et al., 2010). This increases the pressure on ecosystem functions and impacts on ESS, which in turn affects people's livelihood and the development of the aquaculture industry itself. This has happened many times before and is often due to a general lack of ecological understanding about the strong complementarity between the supporting environment and the aquaculture operations (Hambrey et al., 2008). This study emphasizes that aquaculture is an integrated part of the social-ecological system in which it is embedded, and need to be adjusted to the context and carrying capacity of that system (Soto et al., 2008). The high production of *Pangasius* catfish in the Mekong

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Delta is produced in a small area of approximately 5500 ha (Vietnam Directorate of Fisheries, 2015), and when the scale of the production increases, there is an increasing risk that the carrying capacity of the supporting ecosystem is crossed. When this happens, *Pangasius* catfish farming will be the main factor impacting on its own activities. In fact this already happened some ten years ago, when cage farmers were forced to shift to pond farming, because of low water quality due to a high density of *Pangasius* catfish cages on the river (Phuong and Oanh, 2010). Thus, if this aquaculture sector's development is to be sustainable, efforts must be directed towards methods that make use of the natural environment without severely or irreversibly degrading it. It should also be designed to be more resilient to increasingly unpredictable conditions, following from climate change and upstream dams (Smajgl et al., 2015).

This study aims to identify and assess the status and trends in key ESS including supporting, provisioning, regulating and cultural services produced and delivered by the Hau River ecosystem, which are of key importance to both *Pangasius* catfish farmers and other stakeholders' livelihoods and wellbeing in the northern parts of the Mekong Delta in Vietnam.

The study was done in close collaboration with local stakeholders and the analysis builds on their perceptions of ESS and how these contribute to their livelihoods. These participatory processes were expected to capture, from the bottom-up, stakeholders' perceptions of ESS and foster the incorporation of different types of knowledge in decision making processes (Lopez and Videira, 2016). As highlighted by several recent reports and global processes such as IPBES (2010), IPCC and CBD (1990), local participation and knowledge must play a critical role in identification of ESS and scenario development (Kok et al., 2016; Lopes and Videira, 2016; Peterson et al., 2016; Vogt et al., 2016). Local implementation of ESS assessments has been seen as a major challenge especially in developing countries, and examples of participatory approaches for ESS identification, where stakeholder groups are jointly engaged in scoping tasks are still scarce (Casado-Arzuaga et al., 2013; Lopes and Videira, 2016). However, with the aim to establish successful environmental policies for sustainable agriculture, the farmers must be involved, and their opinions and preferences, as well as their attitudes towards ESS must be understood (Berg et al., 2016; Casado-Arzuaga et al., 2013; Quinn et al., 2015). In this paper we show how place-based research on the conceptualization and articulation of ESS can help to identify the demand and prioritization of ESS among local stakeholders in the Mekong Delta of Vietnam. The concept of ESS is quite new in Vietnam but has recently been used to provide guidance for sustainable aquaculture/agriculture development in Southern Vietnam (Berg et al., 2016; Loc et al., 2016; McDonough et al., 2014), and gained increased interest by the Ministry of Natural Resources and the Environment (MONRE) through the ProEcoServ project.

In this study the "Toolkit for Ecosystem Service Site-based Assessment (TESSA)" (Peh et al., 2013) and "Integrating ESS in Strategic Environmental Assessment: A guide for practitioners" (UNEP 2014) were used to guide the work. The close consultation with local stakeholders provided opportunities for non-specialists to participate in the analysis, and provided capacity building through "learning by doing", which is an important step for adaptive co-management of social-ecological linked systems.

The specific objectives of the study were to: (1) identify and assess key economic activities of stakeholders relying on ESS from the Hau River; (2) assess stakeholder's perceptions of key ESS provided by the Hau River and their importance to the stakeholders' livelihoods and well-being; (3) evaluate the current status of key river ESS based on stakeholder's awareness and perceptions; (4) evaluate the potential changes of key ESS under different *Pangasius* catfish farming scenarios; and (5) analyse stakeholders' prefer-

ences to different *Pangasius* catfish farming development scenarios and their perceptions of who would gain and lose from these different scenarios.

The study illustrates and evaluates semi-quantitatively the trade-offs made between ESS under different *Pangasius* catfish farming development scenarios, and analyses the different stakeholders' preferences to the different scenarios and issues of concern. The analysis should be seen as a first attempt to provide a basis for deciding how *Pangasius* catfish farming could be developed to improve the chances for sustainable resource use, and optimized fish and food production in the Mekong Delta. The study is also an attempt to apply an ecosystem approach to aquaculture development, emphasizing that aquaculture is an integrated part of social-ecological linked systems (Soto et al., 2008). It is expected that the study will provide some guidance and technical support to local policy makers and managers in the Mekong Delta on how future aquaculture systems could be planned and designed to optimize the net benefits that society receives from aquaculture production.

## 2. Material and methods

### 2.1. Study area

An Giang is one of 13 provinces in the Mekong Delta of Vietnam (Fig. 1). It has a total area of 353,700 ha and a population of 2,273,150 people. In 2012, the total cultivated area in An Giang was approximately 290,000 ha and provided nearly 1.9 million tonnes of food (An Giang Bureau of Statistics, 2012). MARD (2016) reported that *Pangasius* aquaculture activities covered 5370 ha in 2015 and are expected to reach 7720 ha in 2020. *Pangasius* catfish constitutes more than 90% of the annual production of 260,000 tons of farmed fish (An Giang Department of Fisheries, 2012). Long Xuyen City is considered the center of aquaculture, with *Pangasius* catfish being cultured mainly in ponds along the river banks. The field work of this study was conducted in the My Hoa Hung commune, which is surrounded by Hau River, and where a large number of *Pangasius* catfish household clusters are found (Fig. 1).

### 2.2. Research design

A number of different methodologies were applied to engage with local stakeholders and to learn about local conditions in the

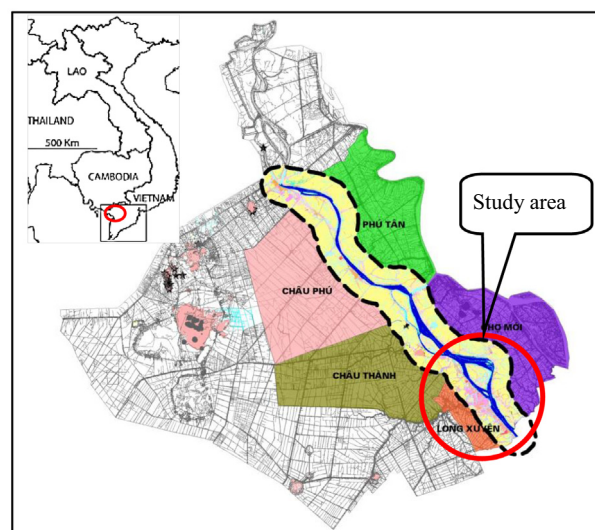


Fig. 1. Map of An Giang province and Long Xuyen city with the selected study area.

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