

ON THE DISTRIBUTION OF SALINITY AND FISH SPECIES IN A CHANNEL NETWORK IN THE MEKONG DELTA, VIETNAM

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ABSTRACT

Considering the impact of human activities with a specific focus on irrigation development, we conducted a series of surveys on the distribution of salinity and fish species in rivers, main canals and agricultural channels in Ben Tre, Vietnam. Salinity (pss) was measured using different salinity sensors according to sampling sites. Fish sampling was conducted by a hand net, a cast net and a fyke net considering the local condition of a sampling site. We observed totaled 79 species including freshwater, brackish water and marine species, whereas some specimens could not be identified due to insufficient information on the species. Different species showed different ranges of its distribution along salinity. Further studies are needed to assess the impact of development activities for urbanization and irrigation based on hydrodynamic simulations considering water flow and salinity dynamics both affected by irrigation management.

Keywords: Fish fauna, Saltwater intrusion, Hydrodynamics, Tidal effect, Ecosystem management

1. INTRODUCTION

The Mekong Delta is a large flat low-lying area with complex channel networks for irrigation and transportation by ship. Whereas the area is well-known as a major food production region in Vietnam, the farmers and irrigation managers concern saline water intrusion as a big threat to agricultural production such as rice and fruit. Specifically, Ben Tre province is considered vulnerable under the threat of sea level rise which can affect major agricultural production such as rice and fruit in the region. In addition, dam construction planned and implemented in the upper Mekong River (Kano *et al.*, 2016) increases the risks of saltwater intrusion in the delta. To cope with the problems, many gates have been and are being built to prevent or minimize the impact of saline water intrusion into agricultural areas. In addition, rapid economic growth accelerate urbanization and modernization of irrigation infrastructures. However, the importance of ecosystems and ecosystem services gained less attention irrespective of their capacity to provide necessary goods and services for human well-being. We therefore conducted a series of surveys on the distribution of salinity (pss) and fish species in Ben Tre, Vietnam.

2. METHODS

Ben Tre province is located about 70 km from the Ho Chi Minh City, Vietnam, whose land-uses are diverse such as residential areas with home gardens, fruit farms of pomelo and coconuts, rice paddies, and shrimp farming areas near the coast. Rice paddies spread in the beneficially area of Balai Barrage on the Balai river, which prevent saltwater intrusion in the river. Major shrimp farming area is located downstream of the beneficially area as well as in the Binh Dai area.

We conducted a series of surveys on salinity and fish fauna at 81 points from October 2017 to October 2019 (Figure 1). Salinity (pss) was measured using different salinity and conductivity sensors according to sampling sites. Missing data on salinity was filled using the salinity-conductivity relationship ($SAL = 0.0006 COND$; $R^2 = 0.996$) obtained in the target region. Fish sampling was conducted for 30 min per site using a hand net, a cast net and a fyke net considering local condition. Fish individual was identified to species level based on Tran *et al.* (2013) and released around the sampled location. Relationship between salinity and fish abundance was analyzed and mapped over Ben Tre province in order to understand the spatial distributions of salinity and fish species.

3. RESULTS & DISCUSSION

Salinity in the surveyed sites ranged between 0.04 and 23.33 (pss) with mean salinity being 2.6 (pss) (Figure 1a), which can be categorized into fresh- and brackish water. We observed 79 species including freshwater,

brackish water and marine species (Figure 1b-1e). Some specimens could not be identified due to their small body size and insufficient information on the small-bodied species.

Some freshwater fish such as *Rasbora aurotaenia* were found in various salinity conditions (up to 14 pss)(Figure 1b), while other species such as *Dermogenys siamensis* and *Trichopsis vittata* occurred in narrower salinity range (up to 3.99 and 5.4 pss, respectively). *Oryzias* sp. occurred widely but close to main channels. This may partly because of its low swimming ability against fast flows. In contrast, *Ambassis vachellii* was found mainly in the coastal area with salinity over 10 pss. These results reflect the eco-physiological characteristics (e.g., salinity tolerance) of the target species. Such biological parameters should be studied for a deeper understanding of species' response to anthropogenic impacts such as gate construction.

Considering the impact of tidal gates and its operation, ecohydraulic conditions (*i.e.*, water flow and salinity) around an irrigation facility needs to be considered in future research. For this to achieve, numerical simulations of water flow and salinity in small- to large-scale channels and rivers are essential, for which longitudinal and cross-sectional profiles of the rivers and channels are required.

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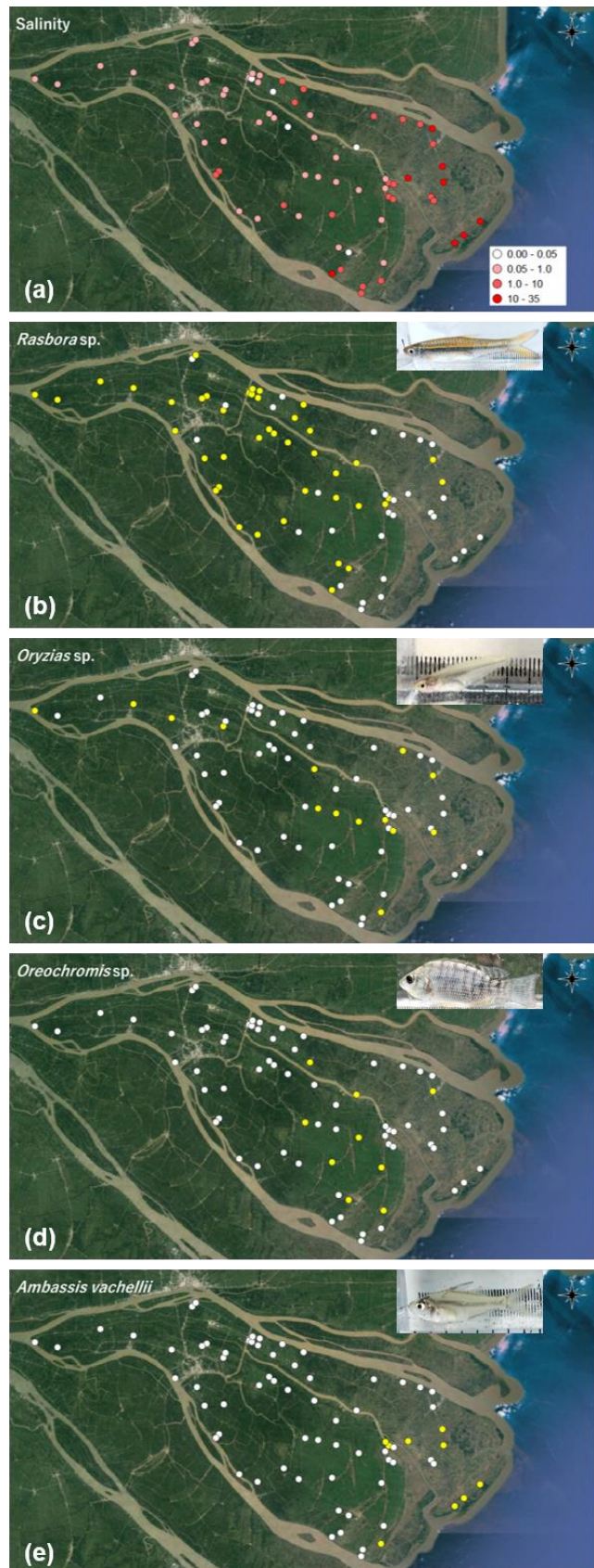


Figure 1. Distribution of salinity and selected fish species in the sampling locations: (a) salinity, (b) *Rasbora* sp., (c) *Oryzias* sp., (d) *Oreochromis* sp., and (e) *Ambassis vachellii*. Yellow marks indicate species' presences, while white marks indicate its absences