

Impact of climate change on mangrove crab (*Scylla serrata*) fattening and its implication on the livelihoods of coastal communities of Tanzania

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Abstract

This research project is aimed at evaluating the impact of climate change on the growing mud crab (*Scylla serrata*) fisheries industry in Tanzania. The specific objectives are: to assess the contribution of mud crab fattening to the livelihoods of peoples; to assess local perceptions on climate change and associated impacts on mud crab fattening and fishery; to determine the abundance and distribution of mud crab stocks in the wild under current climate change; to determine the climate change factors such as salinity, water temperature, dissolved oxygen and meteorological data such as precipitation, water discharge and air temperature and to conduct training of two graduate students. The study will be conducted in Pangani and Rufiji districts along the Tanzanian coast. The abundance of mud crab wild stock will be estimated using Catch per Unit Effort (CPUE). Environmental variables and meteorological data will be collected in both sites. Socio-economic survey will be conducted using well structured questionnaires. The findings will help: to give an insight on economic benefit of mud crab farming to the coastal communities, to know the effect of climate change on the abundance and distribution of mud crab wild stock, and to suggest whether mud crab farming is best option adaptation strategy for impact of climate change to coastal communities.

Key words: Abundance and distribution, climate change, livelihood, mud crab

Résumé

Ce projet de recherche vise à évaluer l'impact du changement climatique sur l'industrie de pêche du crabe de palétuvier (*Scylla serrata*), en croissance en Tanzanie. Les objectifs spécifiques sont les suivants: évaluer la contribution de l'engraissement des crabes de palétuvier pour les moyens de subsistance des populations ; évaluer les perceptions locales sur le changement climatique et les impacts associés sur l'engraissement et la pêche de crabes de palétuvier ; déterminer l'abondance et la distribution des stocks des crabes de palétuvier en milieu sauvage sous le changement climatique actuel ; déterminer les

facteurs de changement climatique tels que la salinité, la température de l'eau, l'oxygène dissous et les données météorologiques telles que la précipitation, la décharge des eaux et la température de l'air, ainsi que dispenser une formation de deux étudiants de maîtrise. L'étude sera menée dans les districts de Pangani et Rufiji le long de la côte tanzanienne. L'abondance du stock de crabes de palétuvier sauvage sera estimée à l'aide des prises par unité d'effort (PUE). Les variables environnementales et les données météorologiques seront recueillies dans les deux sites. L'enquête socio-économique sera menée au moyen de questionnaires bien structurés. Les résultats permettront: de donner un aperçu sur les avantages économiques de l'élevage des crabes de palétuvier pour les communautés côtières, de connaître l'effet du changement climatique sur l'abondance et la distribution des stocks de crabes de palétuvier sauvage, et de suggérer que l'élevage de crabes de palétuvier est une meilleure option de stratégie d'adaptation face à l'impact du changement climatique sur les communautés côtières.

Mots clés: Abondance et distribution, changement climatique, moyen de subsistance, crabe de palétuvier

Background

Climate change is projected to increase pressure on livelihoods and food supplies, including those in the fisheries. Climate change is a statistically significant variation of the mean state of the climate or of its variability, typically persisting for decades or longer (IPCC, 2001). Livelihood comprises the capabilities, assets including both material and social resources and activities required for a means of living. Fisheries as one of the livelihoods along the coast differ from mainstream agriculture and have distinct interactions and needs with respect to climate change. Capture fisheries have unique features of natural resource harvesting linked with global ecosystem processes. Not only overexploitation has been contributing to the decline of the fish stock but also climate change has an effect on the abundance of fish and shellfish stocks (Hiddink *et al.*, 2008). The relationships between mud crab (*Scylla serrata*) population and climate change have not yet been described along the Tanzanian coast. In Tanzania, all efforts to develop an aquaculture industry along the coast is focused on mud crab. Mud crab farmers have been collecting juvenile crabs from the mangrove ecosystem as seed. Lack of accurate and precise information on mud crab abundance and distribution signifies the need for further research. The socio-economic benefit from crab fattening is also

not well known along the Tanzanian coastal communities. Therefore, this proposed research will provide information on the knowledge gap regarding the crab farming and fishery.

Literature Summary

The potential impact of climate change on marine fishery is expected to occur in marine waters. Climate change indicators such as water temperature, salinity, precipitation, oceanographic parameters like wind speed and currents are correlated with fish population (Tolan and Fisher, 2009). It has been claimed that climate shifts. For example, 1°C increase in sea temperature may produce major changes in dominant fish stock. Understanding the impact of climate change on the abundance of fish and shellfish stocks is necessary for the development of cost-effective management of fisheries resources. Among the most effective strategies to mitigate the impacts of climate change on fishery resources may be to ensure that wild stocks and the habitats in which they depend on are preserved and protected. Sustainable mariculture such as crab fattening in cages/pens along the mangrove forest can also be regarded as an adaptation of the fisheries sector to climate change. Availability of mud crab seed from the wild would be likely affected by climate change. The key variables expected to drive climate change impacts on fisheries and aquaculture are changes in temperature, ocean currents, winds, nutrient supply, rainfall, ocean chemistry and extreme weather conditions. It is very likely that changes in any of these would also significantly change the marine ecosystems (Sarmiento *et al.*, 2004) and consequently the distribution, growth, recruitment, and catch of exploited marine species including mud crabs.

Study Description

This research project will be conducted in Pangani and Rufiji districts in Tanzania. Structured questionnaire with both closed and open ended questions will be used concurrently with a checklist of climate change and variability issue. The questionnaires will include information such as initial and harvest weight of the stocked crab, feeding regime, cleaning of pens, benefits and constraints of mud crab farming. Other information required will be on the local perception on climate change. Information of input such as variable cost as well as fixed cost and output (yield per cage) will be recorded. Variable cost will include cost for seed and feed collection and labour (family and hired). Fixed costs will include cage construction cost. Output and costs for cages will be used in cost-benefit analysis so as to identify the costs, income and benefit overtime.

For a study on abundance and distribution of mud crabs in the wild, seine nets and basket traps will be used to collect crabs in both shallow and deep waters. The traps measure 70cm in length, 60cm in width and 15cm in height and have a mesh size of 2.5 cm. The traps will be baited with fish offal and laid prior to tidal inundation and recovered at low tide. The traps will be deployed for a period of 5 days, defined here as sampling period. External carapace width of *Scylla serrata* will be measured to the nearest 0.5cm. and used to establish recruitment pattern. Climatic variables such as temperature, dissolved oxygen, pH and salinity will be measured *in situ* using a portable measuring system. Meteorological data will be collected from nearby meteorological station. Historical data on mud crab fishery and meteorological data will be collected from relevant authorities.

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