EDITORIAL: IMPROVING THE HEALTH OF SETIU WETLANDS ECOSYSTEMS AND PRODUCTIVITY OF CRUSTACEAN RESOURCES FOR LIVELIHOOD ENHANCEMENT

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Abstract: The Niche Research Grant Scheme (NRGS) program which was awarded to Universiti Malaysia Terengganu (UMT) in 2013 is generally aimed to develop more focus social innovation activities in Setiu Wetlands, Terengganu, Malaysia, involving every UMT academia. In this NRGS Special Issue, a total of 15 papers is presented with all these papers are part of the six main project components of the NRGS research program. The six main project components of NRGS research program are; i) An integrated assessment of physical and chemical parameters and their effect on the biological resources on Setiu Wetlands, ii) Assessment of Wetland forest health and its socio-ecological functions, iii) Assessment of the population and genetics of crustacean species in Setiu Wetlands, iv) Enhancement of the productivity of crustacean resources through application of feed technology, v) Development of product mangrove, gelam and mud crab for aquaculture, nutraceutical and cosmeceutical application and vi) Improving the livelihood of local communities using Setiu Wetlands resources. This Special Issue presents the biological and socioeconomic information of Setiu Wetlands ecosystems and crustacean resources which is significant for sustaining the livelihood of their local communities. It is foreseen that this first special issue of NRGS publication will be useful to researchers, academicians and related stakeholders interested in the biological and socioeconomic information about Setiu Wetlands ecosystems and their crustacean resources.

Keywords: Crustacean resources, ecosystem, livelihood, Niche Research Grant Scheme, Setiu Wetlands.

Introduction

The Niche Research Grant Scheme (NRGS) has been awarded to UMT at the end of 2013 by the Ministry of Higher Education, Malaysia. The NRGS program is generally aiming to develop more focus social innovation activities, involving every Universiti Malaysia Terengganu (UMT) academia who can benefit the local community especially and global community generally. This Special Issue is based on the NRGS Program Seminar entitle 'Improving the Health of Setiu Wetlands Ecosystems and Productivity of Crustacean Resources for Livelihood Enhancement' presents the biological and socioeconomic information on Setiu Wetlands ecosystems and crustacean resources which is significant for sustaining the livelihood of the local communities inhabiting the coastal zone of Terengganu and the South China Sea. In the latest development, this research program has initiated the implementation of the Setiu Wetlands Research Corridor and further development of the UMT niche area, 'Marine Sciences and Aquatic Resources' so that it is more visible and sustainable.

Setiu Wetland

Setiu Wetlands are located in Terengganu, north-eastern peninsular Malaysia. It is the largest natural Wetlands in the East Coast region of Peninsular Malaysia with the size of 23,000 hectares, combining various ecosystems, including freshwater, seawater, brackish water and a 14 km lagoon (Suratman *et al.,* 2005; WWF, 2008; Suratman *et al.,* 2016). The Wetlands is an area of high biodiversity. Through various research conducted previously, 29 species of mammals, 161 species of birds, and 36 species of reptiles and amphibians are found (WWF, 2013).

Besides that, various marine animal including invertebrate species, gastropod species, and bivalve species, crustaceans are also available. Setiu Wetlands is a major aquaculture spot. The local residents are involved in brackish water cage culture, pond culture, pen culture and oyster farming. Other than that, the lagoon is also a natural harbour for fishing boats of the fishermen surrounding the area. Local industries at the local villages also produced seafood-based delicacies such as 'budu' (fermented fish sauce), fish crackers, dried anchovies and 'belacan' (shrimp paste) (Suratman *et al.,* 2014). Small fishing boat-making industry is also carried out by the villagers.

Health of Wetland Ecosystems

The ecosystem health of wetland is a newly emerged concept, which refers to the state of a wetland having no impairment to the processes of material cycling and energy flow inside the studied ecosystem. When wetland is identified a healthy ecosystem, this wetland ecosystem remains resistant or resilient to the long-term unexpected disturbance caused by natural human activities and shows diversity, and robustness, because the critical components of the ecosystem are preserved and exhibit no symptoms. The evaluation of Setiu's ecosystem in this program is aimed to determine the magnitude of the jeopardise to or deterioration of the ecosystem. The evaluation will also provide an early warning or offer information to the decision-making process on maintaining the sustainability of Setiu Wetlands.

Crustacean Resources

Setiu Wetlands support (or have supported) some of the most commercially significant crustacean stocks in Malaysia. Major crustacean resources include species of mud crab (*Scylla olivacea, S. tranquebarica* and *S. paramamosain*), blue swimming crab (*Portunus pelagicus*), giant freshwater prawn (*Macrobrachium rosenbergii*) and marine shrimp (*Penaeus monodon* and *P. merguensis* (Ikhwanuddin *et al.,* 2010; Taufik *et al.,* 2014; WWF, 2014). Under this NRGS research program, the trends in catch, recruitment and abundance (when possible) and discuss existing evidence of overfishing and management options will be examined. The research program will also emphasize the importance of recognizing the multi-scale spatial structure and suggest the need to consider spatially explicit strategies of crustacean stocks from Setiu Wetlands.

Livelihood Enhancement

The issue of livelihood enhancement and diversification amongst Setiu Wetlands fishing communities gained prominence since lately. This is when doubts began to crop up about the capacity of the fisheries sector to contribute sustainable to the livelihoods, especially of the poor. This NRGS research program is based on the premise that fishing communities themselves harbour a wealth of knowledge, experience and understanding on livelihood enhancement and diversification.

Understanding the strategies adopted by different stakeholders could be the starting point for more appropriate responses to the issue. The NRGS research program presently attempts to develop a detailed, case study based, typology of different livelihood enhancement and

diversification strategies adopted by the Setiu Wetlands fisheries (Nakisah & Fauziah, 2003). The strategies for livelihood enhancement and diversification sought to safeguard the existing scheme of things than to seek options for improving conditions. An important strand that runs through the systems of organisation (social, economic, political) in this research program was the emphasis on stability (economic and social) over profit maximisation.

Content of this issue

In this Special Issue of NRGS publication, a total of 15 papers is presented. All these papers are part of the six main project components of the NRGS research program. One paper under the first NRGS research program for the integrated assessment of physical and chemical parameters and their effect on the biological resources on Setiu Wetlands were presented. This paper aim to study the combination of titanium dioxide nano particles with polystyrene sulfonate as composite for further explores its potential in anticorrosion coatings. Two papers under the second NRGS research program on the assessment of wetland forest health and its socio-ecological functions are included in this issue. These papers basically related to bats as an important pollinator agent for mangrove tree species, *Sonneratia alba* and anti-oxidative activities and flavonoids contents in leaves of selected mangrove species of Setiu Wetlands.

Next, three more papers were also published in this issue which fall under the third NRGS research program on the assessment of the population and genetics of crustacean species in Setiu Wetlands. These three papers are on; preliminary genetic baseline data of chacunda gizzard shad, *Anodontostoma chacunda* in Setiu Wetlands, aspects of population biology of orange mud crab, *Scylla olivacea* in Setiu Wetlands and changes of histamine levels and bacterial growth in longtail tuna, *Thunnus tonggol* stored at different temperature levels. The forth NRGS research program for enhancement of the productivity of crustacean resources through application of feed technology presents a paper on the effects of phospholipid supplements to fishmeal replacements on growth performance, feed utilization and fatty acid composition of mud crab, *Scylla paramamosain*. Subsequently, another three more papers were also presented in this issue under the fifth NRGS research program on the development of a product from mangrove, gelam and mud crab for aquaculture, nutraceutical and cosmeceutical application. These three papers include; *in vitro* evaluation of probiotic properties of *Bacillus licheniformis* from orange mud crab, *Scylla olivacea*, biomaterials derived from *Sardinella fimbriata* bones as anodyne sunscreen and infestation of *Probopyrus* sp. on *Macrobrachium lanchesteri*. Lastly, a total of five papers were presented under the sixth NRGS research program on improving the livelihood of local communities using Setiu Wetlands resources. These five papers included; gender differences in the effects of honey and black seed mixture supplementation, preliminary study of chemical and physical properties of ball clay and its sintered ceramic pieces, quality analysis of anchovies, *Stelophorus commersonii* dried in drying racks, a case study of coastal community on the application of fuzzy analytic network process for determining weights of quality of life and a sustainable e-business model for rural women.

Conclusion

After almost three years of its implementation, this NRGS research program has achieved half of its human development (target 13 PhD and 18 MSc. students graduated), about 90% in publication (41 published papers out of 45 papers targeted), at least one Intellectual Property is in progress for filing, two international networking (with Veterinary Medical Research Institute, Budapest, Hungary and World Wide Fund for Nature-WWF) and one national seminar on Setiu Wetlands related to policy implication.

Wetland ecosystems provide a range of services which benefit people, society and

economy at large (Millennium Ecosystem Assessment, 2005). Wetlands ecosystems play vital roles in relation to climate change (local climate regulation, climate mitigation and adaptation), food security (provision of food and provision of habitats and nurseries for fisheries), job security (maintenance of fisheries, soil quality for agriculture) and a range of cultural benefits, including knowledge (scientific and traditional), recreation and tourism, and the formation of cultural values, including identity and spiritual values (Russi *et al.,* 2013). Lesser known, but no less important, wetlands, especially help in erosion control and sediment transport, subsequently adding to land formation and increasing resilience to storms in deltas and coastal areas. Values of wetlands are typically higher than for other ecosystem characters. The literature on the values of wetlands and other ecosystems underlines that wetlands ecosystems can have some of the highest values compared to other ecosystems due to the importance of clean water provision, natural hazard mitigation and carbon storage (de Groot *et al.,* 2012).

An additional advantage of maintaining them is that wetlands also deliver multiple co-benefits of significant social and economic values, and hence can help address a wide grasp of needs and objectives. Wetlands contribute to local climate regulation and act as carbon sinks, helping reduce climate change, and for this reason their degradation can lead to very significant gas emissions. Wetlands also regulate sediment transport, thereby contributing to land formation and coastal zone stability. Mangroves, for instance, can provide important fish nursery functions and provide basis for local food security and livelihoods (fisheries), as well as sources of materials and fuel (Russi *et al.,* 2013). Wetlands are some the most important bio-diverse areas in the world and provide essential habitats for many

Examples of major wetlands include the Danube Delta in Romania and the Ukraine; the Waddensea across the Netherlands, Germany and Denmark; the Everglades in the USA; the Pantanal wetlands across Brazil, Bolivia and Paraguay; the Okavanga Delta in Botswana; the Sundarbans in Bangladesh; the Camargue in France; the Arctic Tundra of Queen Maud Gulf in Canada; the Volga Delta and southern Lake Baikal in the Russian Federation; Wasur National Park in Indonesia and Kakadu National Park in Australia.

Final remarks

The editors hope that the information presented here will be useful to researchers, academicians and related stakeholders interested in the biological and socioeconomic information about Setiu Wetlands ecosystems and their crustacean resources. This should lead to the development of more effective methods for improving the health of Setiu Wetlands ecosystems and productivity of crustacean resources for livelihood enhancement.

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