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主論文の要約

博士の専攻分野の名称：博士（水産科学）　　氏名：Emmanuel Andrew Sweke

学 位 論 文 題 目

Social–Ecological Studies to Sustain Local Fisheries at Akkeshi and Erimo, Eastern Hokkaido, Japan

(北海道東部えりも町と厚岸町における持続可能な漁業のための社会生態学的研究)

The key rationale behind sustainability science is to understand the relationships between nature and human society to foster solutions to problems in the two components. Fisheries social–ecological systems comprise a social (human) system and marine ecosystem that are interconnected and interact. Both natural and human drivers, and their interactions are known to cause pressures on marine ecosystems. The present study was done in Akkeshi and Erimo in eastern Hokkaido, Japan. Fishers in these areas engage in a variety of fisheries and catch wide ranges of marine living species; about 40 and 20 species are landed in Akkeshi and Erimo, respectively. In Japan, Akkeshi is well known for oyster (*Crassostrea gigas*) farming, whereas Erimo is renowned for producing an expensive kelp species (*Laminaria angustata*) and chum salmon (*Oncorhynchus keta*). This work endeavored to fill in the knowledge gap on social–ecological systems, and foster future research directions, and facilitate formulation of sustainable fisheries management strategies in the areas.

To attain these goals, three main sources of data were used. The first was fisheries data from Fisheries Cooperative Associations (FCAs) and town halls. The second was surveys on fisheries history and sustainable fisheries perspectives from local adults and high school students. A total of 443 people (192 adults and 250 students) were surveyed on various aspects of fisheries. Third was research institutions and websites, and environmental and economic indices, particularly, consumer price index (CPI). The data were analyzed using models including linear multiple regressions, and a bio–economic integrative mathematical model.

In **Chapter 3**, it was found that catch rates, i.e., catch per unit effort (CPUE) of species, for instance, chum salmon and whelk (*Buccinum isaotakii*) declined and were partially linked to increased seawater surface temperature over the past two decades, and variations in chlorophyll-a, nitrate and phosphate. Similar findings have been reported in other studies in different areas. However, because of limited information in the study areas, further investigations are needed to expand our understanding and facilitate sound adaptive management to cope with the situation in the future.

Multispecies fisheries as practiced in Akkeshi and Erimo are known to cause complication in fisheries management, consequently depletion of the resources. Therefore, understanding the behavior of fishers pertaining change in fishing effort among different target species is a key in sustainable management of resources. **Chapter 4** employed a bio–economic integrative mathematical model to study effort allocation in the areas during 1967–2010. There was slow change in effort fractions allocated between species: effort was highly allocated to kelp (*L. angustata*) followed by chum salmon (*O. keta*) and oyster (*C. gigas*) in Akkeshi, and to chum salmon followed by whelk (*B. isaotakii*) and kelp in Erimo. This slow switch in effort might have been caused by high initial investment cost in fisheries and complication to obtain fishing licenses for new target species. To sustain the fisheries resources and the communities, it is urged that effort should be timely regulated.

In **Chapter 5**, leadership was identified as an important factor to develop successful sustainable management of the marine resources. I urge that FCA leaders should be equipped with the necessary creative knowledge and skills in leadership to enable them carry out their responsibilities more efficiently. However, it should be noted that this will not be a panacea for most fisheries challenges unless stakeholders including fishers are aware of the necessity of conserving resources for the current and future generations use. It was also apparent that young people's willingness to become fishers highly depended on the occupation of their parents, ambition to study fisheries at higher education, experience with fishery activities, and recommendation from parents. To recruit young people into fisheries and reduce dwindling manpower, the communities, in particular, fishers, should pass over to their children the local suitable knowledge and good fishing practices.

Chapter 6 examined the factors that influence job satisfaction of fishers. Fishers in Erimo were more satisfied than fishers in Akkeshi caused by disparities in socio–economic factors and fishery types. Fishers' satisfaction on their occupations was linked to household size in both areas, and was high for fishers doing oyster aquaculture in Akkeshi. To maximize job satisfaction and social services in the study areas, it is recommended to enhance community participation in management of fishery resources and train young people in modern oyster farming techniques that will ensure good quality of products and increase net gain from production.

In conclusion, to ensure sustainability of the local societies and ecosystem integrity, adaptive co–management of fisheries resources is especially required. Thus, fishers should be thoroughly trained in sustainable fisheries including timely identification of any threatening problem such as increase in bycatch, and encouraged them to take appropriate adaptive solutions rather than relying on enforcement of management policies from local and national institutions, which take long time.