

Study of water quality changes and growth of cultured edible oysters (*Crassostrea madrasensis*), culture sites at Gagewadiya and Kandakuliya in Puttlam district

H.I. Wijayananda, R.M.G.N. Rajapaksha and N.P.P. Liyanage
Faculty of Animal Science and Export Agriculture, Uva Wellassa University of Sri Lanka

and

H.M.P. Kithsiri, S. Corea, G.R.H. Rupika and U. Fernando
National Aquatic Resources Research and Development Agency

and

T. Dejager
International Development Research Center

Introduction

Global bivalve production from aquaculture has consistently increased over the years. Sri Lanka is a country which has vast natural resources and suitable environmental conditions for aquaculture. Therefore it has a great potential for develop and contribute to national fish and shellfish production. Although the bivalve industry is highly developed industry in East Asian region finfish and shellfish, specially mollusk and sea cucumbers cultures are at very initial stage in Sri Lanka (Samarasundera, 2010). Sustainable utilization of unexploited high demand finfish and shellfish species are a good alternative to develop the industry. Oysters are nutritious, still unexploited fishery resources in Sri Lanka. Which has good export demand worldwide. Although Sri Lanka have required resources naturally to uplift the industry in large scale, lack of information, limited supply of seeds and lack of trained personals are act as major constraints (FAO, 2006). The success of bivalve culture greatly depends on suitable environmental factors that ensure both optimal growth and quality as well as ensure food safety (FAO, 2006). Kandakuliya and Gagewadiya areas are blessed with natural oyster resources but which are not used commercial scale at present. Therefore the two locations have significant possibility to conduct oyster culture in large scale which providing self-employment opportunities for fisher communities. The study of water quality changes and growth of edible oysters (*Crassostrea madrasensis*) culture, sites at Gagewadiya and Kandakuliya in Puttlam district was carried out to investigate the possibility of establish these culture in commercial scale.

Methodology

The research project was conducted in two experimental sites (Gagewadiya and Kandakuliya), locates in Puttlam district, Sri Lanka. Field data were collected during October 2013 to July 2014 from pre-establish two experimental culture sites. There were four sampling points in each site separately K1, K2, K3, K4 in Kandakuliya and G1, G2, G3, G4 in Gagewadiya. Water quality data, growth data and phytoplankton data were collected each site separately. Water quality and phytoplankton data were collected twice a month, and growth data were collected once a month during the studied period. Temperature, pH, salinity, transparency were recorded as onsite measurements. Further analysis were conducted for nitrite, nitrate, phosphate and ammonia using DR-4000U spectrophotometer according to standard procedures of Parsons *et al.*, 1984. Unionized ammonia levels were calculated using total

ammonia levels. Phytoplankton samples were collected using phytoplankton net (50 µm mesh size). The samples were examined under light microscope and identified to genus level using identification keys (Newell and Newell, 1963; Rebert, 2003; Swadling, 2008; Verlencar and Somshekar, 2004). Length (distance between the end of umbo and the ventral shell margin) and width (length at the widest axis of the body) were taken as growth parameters. Twenty five *C. madrasensis* organisms were used to take measurements from each site separately, for the growth study.

Both primary and secondary data were used to analysis. Secondary data were taken from IDRC oyster research and culture programme. Minitab 16 statistical package was used to data analysis. All data were analyzed statistically using one way ANOVA (Turkey test) for all selected locations. Person product movement correlation coefficient analysis was done between water quality parameters and growth of oysters to find whether there were significant relationship between those variables.

Results and Discussion

According to the water quality study there were no significant difference ($P \geq 0.05$) in nitrite, nitrate, phosphate, unionized ammonia, temperature, pH, depth and transparency at Kandakuliya and Gagewadiya except salinity during the studied period. All water quality parameters were in acceptable range for oyster culture. Gagewadiya (2-29 ppt) showed lower salinity and wide salinity variation than Kandakuliya (25-43 ppt), as this site receives fresh water from “kalaoya”. Rapid decline of salinity which make unfavorable for cultured oysters were observed in November 2013 and April 2014 at Gagewadiya. It was 2 ppt and 4 ppt respectively. This lower salinity was resulted from increased fresh water discharge from “kalaoya” catchment area. According to Sasikumar *et al.* (2007) *Crassostrea madarasensis* species can tolerate salinity changes from 0-40 ppt. However if these unfavorable salinities were exist longer period oyster spats can be transferred to other sites with optimum salinity. Finally it will help to increase the growth rate of *C. madrasensis* in that site.

According to growth study, there was no significant difference ($P \leq 0.05$) in growth rates (length and width) of *Crassostrea madarasensis* at Kandakuliya and Gagewadiya. Since the water quality parameters in both sites were nearly equal to each other, growth in both sites were similar. Even though there were no significant difference ($P \leq 0.05$) in growth, organisms in Gagewadiya site shown slightly higher growth than Kandakuliya. This is because of favorable aquatic environment for oysters in Gagewadiya than Kandakuliya. That creates by nutrition rich fresh water comes from “kalaoya”. Finally it cause to higher growth rate of the oysters in Gagewadiya than Kandakuliya.

Correlation analysis revealed that, there was no significant relationship ($P \geq 0.05$) between growth of *C. madrasensis* with nitrite, phosphate, unionized ammonia, pH and salinity levels. Nitrate, temperature and transparency have significant relationship ($P \leq 0.05$) with growth (length and width) of *C. madrasensis*. Nitrate cause to growth of phytoplankton in the surrounding water, which is primary food source for oysters. Therefore it directly affect to the growth of oysters. No harmful algal species were recorded during the studied period.

Conclusion

Salinity levels in both Gagewadiya and Kandakuliya were in tolerable level for *C. madrasensis* during the studied period. The absence of toxic algae (dianoflagellates) at both sites and suitable ranges of temperature, pH, transparency, nitrite, nitrate, phosphate, and unionized ammonia levels suggest that Kandakuliya and Gagewadiya areas are suitable for commercial oyster culture practices. According to growth study, *C. madrasensis* growth in Gagewadiya site shows slightly higher growth rate than Kandakuliya site. Therefore Gagewadiya site can be recommended as best site among those two sites.

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