

Population Biology of Pearl Oysters in Kenya

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Thesis submitted to the University of Nairobi in fulfillment of the
requirements for a Doctor of Philosophy degree in Zoology of the University
of Nairobi

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ABSTRACT

During the last century, the culture of oysters for pearl production has been expanding worldwide. A pearl oyster shell fishery has existed in West Indian Ocean region for many decades and pearl culture was first introduced during the last decade. However, no information on the stocks and population characteristics exist, and no regulations of the fishery are in place in Kenya. The aim of this study was to examine the status of the populations and determine the influence of the environment, in particular the monsoon seasons and tidal currents, on growth, reproduction and settlement of pearl oysters. The objectives of the study were to determine the density; rates of settlement on artificial collectors; gonadosomatic cycle; growth rates of pearl oysters. To achieve these objectives, field surveys to determine the distribution, occurrence and population density of pearl oysters were conducted in study areas between Malindi and Vanga. In addition, artificial collectors were set in Malindi, Mombasa and Shimoni to monitor juvenile settlement, and growth patterns and reproductive activity were studied in Gazi Bay.

Five pearl oyster species *Pinctada imbricata*, *Pinctada margaritifera*, *Pinctada nigra*, *Pteria penguin* and *Pteria chinensis* were recorded during the field surveys. Among these, *P. imbricata* was the most abundant and widely distributed species. The *P. margaritifera* occurred in relatively low densities within sheltered areas in Kanamai, Mombasa, Gazi Bay and Shimoni. The species was most abundant in Gazi Bay (0.3 ± 0.15 per 100 m²) and in Shimoni (0.25 ± 0.18 per 100 m²). The *P. penguin* occurred in deep channels in Shimoni and Mombasa, while moderate densities of *P. chinensis* occurred in lagoons and channels in Malindi, Mombasa and Shimoni. The length frequency distributions of *P. imbricata*, *P. nigra* and *P. chinensis* were normal, an indication of stable populations with relatively constant recruitment and mortality. In contrast, the length frequency distributions of *P. margaritifera* and *P. penguin* were discontinuous, an indication of discontinuous recruitment patterns.

The settlement of commercial pearl oyster seed on collectors was low. One *P. margaritifera* and three *P. penguin* (0.05 and 0.15% of macrofauna, respectively) were removed from the collectors in Tudor channel over a one year period. Settlement of *P. imbricata* occurred throughout the year and was higher during the northeast monsoon season. The gonad activity and spawning of the species in Gazi Bay occurred throughout the year. Spawning intensified during the northeast monsoon season (main peak) when water temperature was rising, and at the beginning of the southeast monsoon season when temperature was declining (minor peak). Male sex expression was higher than female sex expression. The m:f ratio in the current swept area was 1:0.72, compared to 1:0.81 in the sheltered site. The shell free dry flesh weight, gonadosomatic index and gamete output of the species were higher in the current swept area.

Growth rates of *P. imbricata* and *P. margaritifera* in Gazi Bay were higher in the current swept site than the sheltered site. Growth rate of *P. margaritifera* in Gazi Bay ranged from 0.09 ± 0.016 per day in 60-65 mm size class to 0.02 ± 0.004 mm per day in 95-100 mm size class, and was approximately double during the northeast monsoon season compared to the southeast monsoon season. Von Bertalanffy growth constants, K for the species in the sheltered site and the current swept site, with L_{∞} fixed at 127.2 mm, were 0.30 and 0.38, respectively. The Von Bertalanffy growth parameters for *P. margaritifera* and *P. penguin* in above ground culture were $K = 0.6$, $L_{\infty} = 127.2$ mm and $K = 0.24$, $L_{\infty} = 230$ mm, respectively. The rate of nacre deposition for *P. margaritifera* was 3.4 ± 0.95 μm per day, was related to the shell growth rate, and marginally higher in the current swept site. These results add to the understanding of bivalve resources in Kenya, in particular, the abundance of pearl oysters and the influence of the environment within tropical inshore habitats. The information is also applicable in aquaculture, stock management and enhancement of pearl oyster resources.

Key words: Pearl oysters, *Pinctada imbricata*, *Pinctada margaritifera*, *Pinctada nigra*, *Pteria penguin*, *Pteria chinensis*, densities, settlement, artificial collectors, gonadosomatic cycle, growth patterns, southeast monsoon, northeast monsoon, currents, Kenya.