

Mangrove crab (*Scylla serrata*) populations may sometimes be best managed locally

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Abstract

Mangrove crabs (*Scylla serrata*) were trapped in summer and fall 2004 at four sites, each in a separate municipality on the Pacific island of Kosrae, Federated States of Micronesia. Carapace width (CW) of the 219 crabs averaged 15.1 ± 0.13 cm (SE), slightly larger than the mean size of 221 crabs trapped from the same sites 4 y earlier. Mean CW of the 56 crabs in the upper quartile was 17.5 ± 0.17 cm (SE). In the current study, both sizes of crabs as well as degree and direction of change in size from summer to winter varied among the municipalities. The average CW of crabs from one municipality was significantly larger than from any of the other municipalities. Average CW of crabs from another municipality decreased from summer to fall. These results suggest that although the island-wide crab population appears to be stable, some municipalities may wish to enact site-specific management policies to obtain a harvest regimen that will meet local needs.

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1. Introduction

Mangrove crabs (*Scylla* spp., also called mud crabs) are large, tasty, and relatively easy to capture, making them an increasingly scarce resource throughout the Indo-Pacific region (Brown, 1993; Marichamy and Rajapackiam, 2001). In spite of continued harvest pressure, these crabs are managed in only a few parts of their range, most notably in northern Australia (e.g., Pillans et al., 2005). Consequently, they have become smaller and harder to catch in many places, especially in

developing countries. Appropriate harvest policies for these large crabs (carapace width, or CW, of males can reach 25–28 cm: Carpenter and Niemi, 1998, reported by Williams and Primavera, 2001) might sustain a source of protein and cash for many communities. The purpose of this study was to analyse local differences in crab populations both spatially and temporally in order to suggest simple but meaningful management practices.

Although four species of mangrove crab are now recognised (Keenan et al., 1998), only one species (*Scylla serrata*, the most widespread) is found on the island of Kosrae, Federated States of Micronesia, where it is one of the most valuable products harvested from the island's mangrove forests (Naylor and Drew, 1998). On Kosrae, mangrove crabs are prized for family feasts, sold to local tourist hotels, and exported primarily as gifts to

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family members in Guam, Hawaii, and elsewhere in the Pacific islands. The crabs may be either trapped in small estuaries and tidal creeks or collected by hand in mangrove forests. Household surveys suggest that catch per unit effort (CPUE) declined from 1990 to 2000, the number of households participating in crab harvesting also decreased, and fewer harvesting trips were made each month (Naylor et al., 2002). Nevertheless, the number of crabs exported from Kosrae for sale and for gifts increased from 1997 to 2000.

A sample of 368 crabs caught from 1999–2001 primarily by traps set along interior and fringe mangrove channels and by hand along randomly selected transects in Kosrae averaged 15.2 ± 2.4 cm (SD) in CW (Bonine et al., 2008); the largest was 21.0 cm. In April 2000, in response to the growing sense documented above that crabs were getting smaller and harder to catch, a new law passed by the Kosrae State Legislature established a minimum harvestable size limit of 6 in (15.2 cm) “measured along the largest diameter across the outside of the shell” (Kosrae State Legislature, 2006). The law also prohibited export of mangrove crabs and declared a closed season from 1 August through 31 December. This law was unpopular, and the portions prohibiting export and declaring a closed season were repealed the following year. During the time the law was in effect, people may have continued to harvest crabs for family consumption, but none were sold to hotels on the island or exported during the 5-mo ban.

The objectives of this study were to determine how the mean CW of crabs and CPUE in Kosrae might have changed since the earlier study, as well as how variable they might be both around the island and over shorter periods of time. I also wanted to determine whether different locations on the island might benefit from different regulations.

2. Materials and methods

2.1. Study sites

Kosrae ($5^{\circ}19'N$, $163^{\circ}E$) is a high volcanic island in the eastern Caroline Islands in the Pacific Ocean and is one of four island-states in the Federated States of Micronesia. It is ~ 104 km² in area with a narrow coastal plain and a mountainous interior. With rainfall of ~ 4 – 5 m y⁻¹ and no distinct dry season, several small rivers traverse the coastal plain and flow through mangrove forests that vary from narrow strips to belts as wide as 800 m.

Most of Kosrae’s ~ 7800 people live on the coastal plain. The island is divided into four municipalities:

Lelu, Malem, Utwe, and Tafunsak (Fig. 1), each with at least one village as a population centre. In spite of Kosrae’s small size, these municipalities differ socio-economically (Table 1).

Lelu contains the government offices for the State of Kosrae. It has a number of wealthy and influential families, an active harbour, and many small businesses, and in most households at least one member has a salary. The Pukusrik Tidal Channel, the trapping location for Lelu, is lined by narrow strips of mangrove forest and terminates in a large stand of mangroves. Many Lelu households are located along the landward edge of the mangroves; many of these residents own boats, and they harvest crabs and fish.

At the other socioeconomic extreme, the municipality of Utwe contains many subsistence-level households, especially in the underpopulated southwestern part of the island. Trapping was conducted in the Utwe-Walung Tidal Channel, which provides boat access during high tide to some of the most remote, extensive, uninterrupted mangrove forests on the island. In Utwe, several women earn money by catching crabs by hand. Crabs were exported commercially from Utwe before 2000, but those were harvested on the other side of the municipality, distant from the Utwe-Walung Tidal Channel and closer to the remote village of Walung (which is part of Tafunsak municipality).

Malem, with a moderate income level, is located on a high-energy coastline where boat access is difficult. Few people in Malem have fishing boats, and the only place where they can harvest crabs is along the Inya River, which is actually part of Utwe.

The fourth municipality, Tafunsak, is the location of another major harbour and the airport, so it has several small businesses and a moderately high standard of living. The trapping location for Tafunsak was the Okat River, which is beyond the harbour and the main concentration of households. Most of the mangroves in this municipality are found in a belt several hundred metres wide and stretching from north of the Okat River south to Walung. Before 2000, crabs were harvested from the Okat River for commercial export to other Micronesian islands, especially Guam, but this enterprise did not resume after the law was repealed.

Little is known about the life history of the mangrove crabs from spawning through the larval stages. However, once the crabs have matured enough to migrate from the reef into a mangrove forest, their long-shore movements are known to be limited (Hill, 1975; Perrine, 1978; Hyland et al., 1984; Bonine et al., 2008). The area of mangrove forest within 0.5 km around each channel where traps were set was measured on a vegetation map

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