

### Population Fluctuations of the Prawn, *Palaemonetes paludosus*, in the Everglades

**ABSTRACT:** The prawn, *Palaemonetes paludosus*, is abundant in the southern Florida Everglades. The population levels and ecologic role of the prawn are influenced by hydrologic conditions. Populations changed markedly during 1966-1972, being relatively high in years when water levels fluctuated in a typical seasonal pattern but decreasing by about half during 2 years when the typical dry season did not occur. The prawn is apparently well-adapted for surviving dry periods and achieves reproductive activity following high water periods.

#### INTRODUCTION

The prawn, *Palaemonetes paludosus* (Gibbes), occurs in freshwater habitats along the Atlantic and Gulf coasts of North America (Holthuis, 1952). It is common in the extensive marshes and swamps of southern Florida, being especially abundant in areas of heavy plant cover in the Everglades. Such high densities suggest that the prawn is of considerable ecological importance in the Everglades ecosystem. As little is known about its biology, this paper reports on changes in prawn populations in the Everglades associated with year-to-year differences in hydrologic conditions.

#### METHODS

Data were collected for 7 years (1966-1972) in the marshes of Everglades National Park, Florida. Samples were collected at 10 permanent trap sites, generally on each of 2 consecutive nights per month. The trap was a 1.5- x 3-m rectangular sheet of netting supported along its edges by pipe. The trap was brought rapidly from the bottom to the surface trapping aquatic animals on the net or in the water column above it (Kushlan, 1974a). Biological years used in calculations start at the beginning of the typical wet season in June and run through the end of the following dry season in May.

#### RESULTS

The prawn typically experiences substantial fluctuations of water level caused by seasonal and yearly differences in rainfall and overland discharge in the Everglades. Water is generally high during the summer and autumn, June through December, but declines from January through May. By the end of the dry season, standing water is usually confined to ponds and other relatively deep pools, where aquatic organisms become densely concentrated. When water levels rise with the onset of the rains in June, marshes relood and aquatic organisms disperse. During the 1966-1972 study period, water levels fluctuated normally in most years, but during the 1968-1969 and 1969-1970 dry seasons, water levels in the marshes failed to fall below ground level (Fig. 1). More typical fluctuating conditions were restored in 1970-1971. The

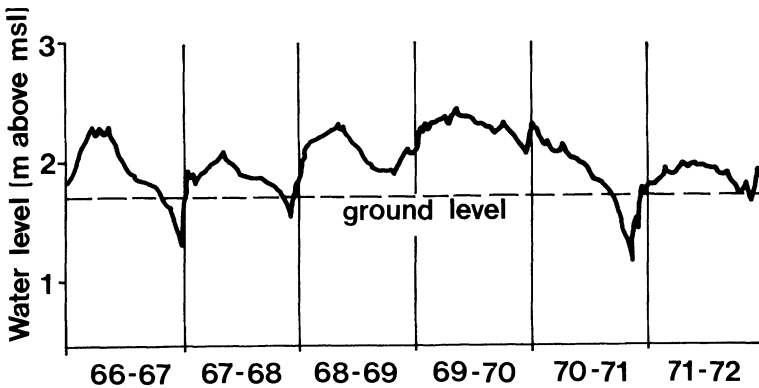


Fig. 1.—Fluctuations of water level in the southern Everglades 1966-1972

overall pattern can be seen by comparing mean water levels for each year (Table 1). The 2 middle years of the study had higher water levels, on the average, than other years.

Prawns were relatively abundant during the years when water fluctuated typically; however, in the 2 years when dry seasons did not occur, the population fell to about half its typical levels (Table 1). The impact of extended high water is shown particularly in data for 1970-1971, the year normal water fluctuation returned to the Everglades (Fig. 1). Prawn populations remained low in 1970-1971 and did not recover until the following year (Table 1). This demonstrates that the low populations of 1968-1969 and 1969-1970 were real and not merely a sampling bias because of failure to sample during a drying period.

Prawns in the Everglades are reproductively active throughout the year (Fig. 2). However, the percentage of ovigerous females peaks when water levels rise in summer (June) and in autumn (September), when water levels are usually highest. Thus, reproductive activity appears to be greatest in the wet season.

#### DISCUSSION

Population changes of prawns in the Everglades appear to be associated with two interacting factors: fluctuating water conditions and predation. During drying periods, prawns migrate into ponds and other dry season refugia in great numbers along with other aquatic organisms, especially fish. Because of the high animal densities, oxygen depletion can occur, causing massive mortality unless alleviated by compensatory predation (Kushlan, 1976a). The prawn is one of the species best adapted to low oxygen levels and survives such conditions longer than most of the fish (Kushlan, 1974b). It does this by swimming at the surface using the oxygen diffusing across the surface layer. Such adaptations for survival at low oxygen tensions also occur in other species of *Palaemonetes* (Welsh, 1975). As a result of its adaptations, the prawn can survive drying conditions. When water levels rise, survivors are able to begin reproductive activity, much of which appears to occur in the summer wet season (Fig. 2).

The period of extended high water that occurred during this study was associated with changes in the fish community. Primary among the changes were the decreasing number and importance of the small fishes that dominate the fish fauna under normal conditions and the concurrent appearance in numbers in the marsh, of larger, mostly carnivorous fishes (Kushlan, 1976b). If fluctuating conditions militate against larger predators, prawn populations may

TABLE 1.—Mean annual water level (m above mean sea level) and mean annual prawns per trap 1966-1972

	66-67	67-68	68-69	69-70	70-71	71-72
Water level (m)	1.90	1.78	2.01	2.15	1.79	1.70
Prawn/trap	48	35	19	23	24	56

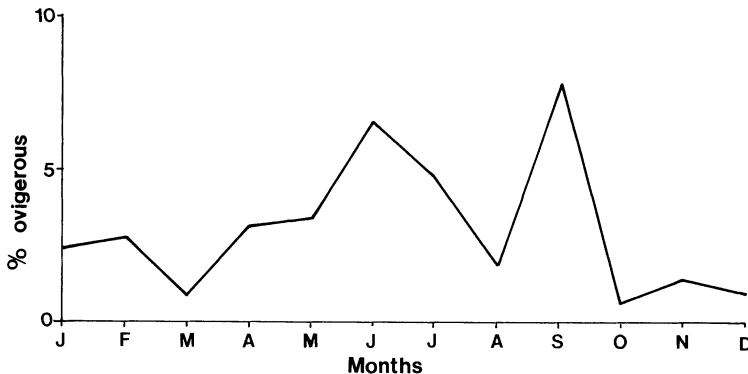


Fig. 2.—Breeding season of the prawn in the southern Everglades

become larger than under more constantly high water conditions.

*Palaemonetes* is omnivorous and probably primarily a detritivore (Meehan, 1935). It undoubtedly serves as important a function in energy flow in the Everglades marsh as has been demonstrated for *P. pugio* in salt marshes (Welsh, 1975). This role is enhanced by recurring dry seasons that allow populations to build up and is disrupted by periods of extended high water. Other Everglades detritivores are also affected by extended high water. As in the prawn, crayfish (*Procambarus alleni*) populations are reduced by lack of dry seasons (Kushlan and Kushlan, 1979). Apple snail (*Pomacea paludosa*) populations, on the other hand, are enhanced by extended high water (Kushlan, 1975).

Seasonal drying is apparently an extremely critical factor in the functioning of the Everglades ecosystem, and year-to-year changes in drying patterns have substantial impacts on important trophic compartments such as the typically abundant prawn. At any time, therefore, prawn population levels and their ecological role in the Everglades depend in large part on past and present hydrologic conditions.

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