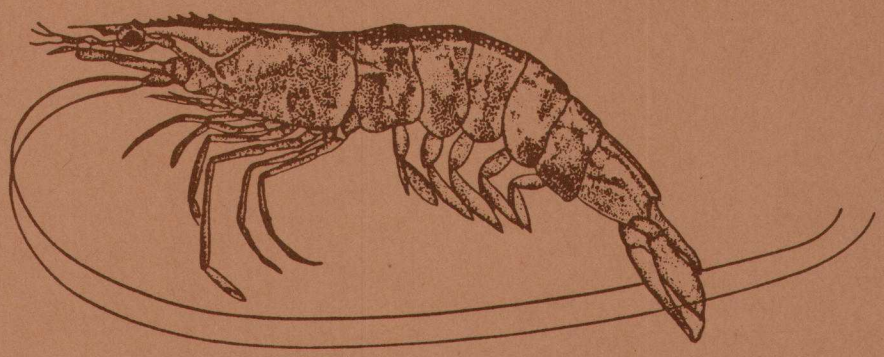
NOAA Technical Memorandum NMFS-SEFC-97

Short-term Mortality of Tagged Shrimp During Field Tagging Experiments



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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Center
Galveston Laboratory
Galveston, Texas 77550

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Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
John V. Byrne, Administrator

National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

1/ Present Address: University of Texas Medical Branch, Galveston, Texas 77550

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Brian Holt[1/]

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Introduction

Mark-recapture experiments on penaeid shrimp in the Gulf of Mexico have provided data on the growth, movement and life history of these important commercial species. Various tag and marking techniques have been used to study shrimp over the past twenty years with varying degrees of success.

Neal (1969) reviewed several methods of marking shrimp, including staining and external and internal tags. He concluded no method was ideal and that the marking method needed to be matched to the needs of each study. For long term growth, migration, and mortality studies an external tag was found to be superior.

Marullo et al. (1976) described initial studies utilizing a vinyl streamer tag. The tag proved to be superior to other external tags in that the tag and tagging procedure did not increase mortality above untagged shrimp in laboratory studies. Present mark-recapture studies conducted by the National Marine Fisheries Service, Galveston Laboratory utilize a polyethylene Mini-Ribbon tag, a modification of the vinyl streamer tag.

Mortality caused by the tagging procedure is a primary concern in mark-recapture studies. If significant, this mortality will bias estimates of population size and fishing mortality (Ricker, 1975). In field experiments, condition of the shrimp to be tagged may be an important factor, determining whether tagging affects mortality. Shrimp in poor condition show signs of visible necrosis (tissue degeneration) and/or recent ecdysis (soft exoskeletons) that make them more susceptible to damage from handling or other

forms of stress. Direct mortality from the tagging procedure should occur during a short period of time after tagging. This paper describes three short term (< 120 hour) tagging mortality experiments done with brown shrimp (Penaeus aztecus) under field conditions.

Methods

Brown shrimp for the experiments were collected in conjunction with normal shrimp tagging operations on the Texas Parks and Wildlife vessel WESTERN GULF off Port Aransas, Texas in July, 1980 and the NMFS, FRS OREGON II off Pascagoula, Mississippi, in September, 1980. They were taken with standard 13.7 m (45 ft) shrimp trawls in 9 to 31 m of water and held for 8 to 12 hours before tagging.

The fiberglass tagging and holding tanks were set up as open, constant flow systems, similar to that described by Emiliani (1971), except that no cooling system was used. Equal numbers of shrimp tagged with polyethylene Mini-Ribbon tags inserted between the first and second abdominal somites (Marullo, et al 1976) and controls were placed in one tank and held for at least 72 hours. The number of mortalities and temperature and salinity were recorded every 2 to 4 hours. Pieces of peeled shrimp or squid were fed daily and an aluminum or rubber mesh substrate provided for a resting site.

Two experiments were conducted in July 1980 at the University of Texas boat basin in Port Aransas, Texas. The shrimp were brought onshore from the WESTERN GULF and later released offshore as a part of a mark-recapture study underway in the area. The tanks were set up under a covered porch near the boat basin.

In the first experiment 97 tagged shrimp and 99 controls were observed for 96 hours. Unequal numbers resulted from broken or missing tags. The shrimp were in good condition, showing no signs of necrosis or recent ecdysis. The tagged shrimp were 56% female and 44% male, while the controls were 43% female and 57% male (Table 1).

The second experiment used identical numbers of tagged and control shrimp, but the shrimp were stressed, showing evidence of slight necrosis and recent ecdysis. This experiment lasted 72 hours. Forty percent of the tagged shrimp were female and 60% were male. The controls were 46% female and 54% male (Table 1).

The third experiment was conducted on the FRS OREGON II off the coast of Mississippi in September, 1980. The shrimp used for the experiment showed no visible signs of necrosis or recent ecdysis. There were 71 tagged and 72 control shrimp because of an accidental tagged mortality at the beginning of the experiment. The experiment lasted a total of 105 hours. Females comprised 84% and males 16% of the tagged shrimp. The controls were 82% female and 18% male. The shrimp were much larger in this experiment due to the time of capture (Table 1).

Results

Mortality was fairly low in both the tagged and control groups in the first July and September experiments. Chi Square tests revealed no significant difference between the tagged and control group mortality which was 5.2% and 4.0% respectively in the first July experiment ($\chi^2 = 0.14$, d.f.=1) and 15.5% and 12.5% in the September study ($\chi^2 = 0.28$, d.f.=1). Water temperature ranged from 26.8 to 30.3°C and salinity 34 - 38 ppt in the first July experiment while the temperature was 27.3 to 30.0°C and the salinity was 26 to 32 ppt. in the September experiment. Very few exoskeletons, indicating active ecdysis, were found in the first July experiment, however, several were removed during the September experiment.

Mortality was much higher in the second July experiment. Control mortality was 21.2% and tagged shrimp mortality increased to 47.4%. This

difference was significant in Chi Square testing (χ^2 = 14.96**, P < .005, d.f.=1). The water temperature ranged from 26.8 to 30.6°C and the salinity ranged from 35 to 37 ppt. High numbers of exoskeletons were found in the tank during this experiment.

Mortality progressed steadily over time throughout the experiments with no sudden "die-offs" of shrimp (Figure 1). Regressions run on both control and tagged groups reflect this good linearity (r^2 = .79 - .99).

Discussion

The experiments clearly reveal that the condition of the shrimp prior to tagging dictates the survival of the tagged animals. The difference between mortality rates of tagged and untagged, seemingly healthy shrimp was neglibible, while tagging more than doubled the mortality with the stressed shrimp.

There is no apparent relationship between mortality and shrimp size or sex in these experiments. Also, no conclusion can be made between the apparent relationship of higher rates of mortality in tanks with higher rates of ecdysis as seen in these experiments. Further experimentation is needed to clarify these points.

Although "condition" is a vague term the quality of shrimp released seems to be as important or more so than the quantity released. The slope of some of the mortality curves show that much of the mortality may occur after the short holding times used in most mark-recapture studies. This short term mortality may not reflect the actual survival after release and the eventual percent of returns. However, if shrimp that show no signs of necrosis or ecdysis are tagged by competent personnel, length of holding

time may not be important, since mortality will not increase due to the tagging process.

Literature Cited

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Neal, R. A. 1969. Methods of marking shrimp. FAO Fish. Rep. 57:1149-1165.

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Table 1. Numbers and tail length of tagged and control Brown shrimp (Penaeus aztecus) used in three field mortality experiments.

Experiment	Number			Tail Length (mm)			
				Male		Female	
	Total	Male	Female	$\bar{X}$	Range	$\bar{X}$	Range
July, 1980 #1							
Tagged	97	43	54	57.5	48-68	59.4	45-77
Control	99	56	43	58.1	49-71	60.9	46-81
July, 1980 #2							
Tagged	97	58	39	57.5	47-70	62.4	51-83
Control	99	53	46	57.0	48-67	60.6	46-85
September, 1980							
Tagged	71	11	60	68.2	55-100	86.0	66-100
Control	72	24	48	72.9	64-83	86.1	71-100

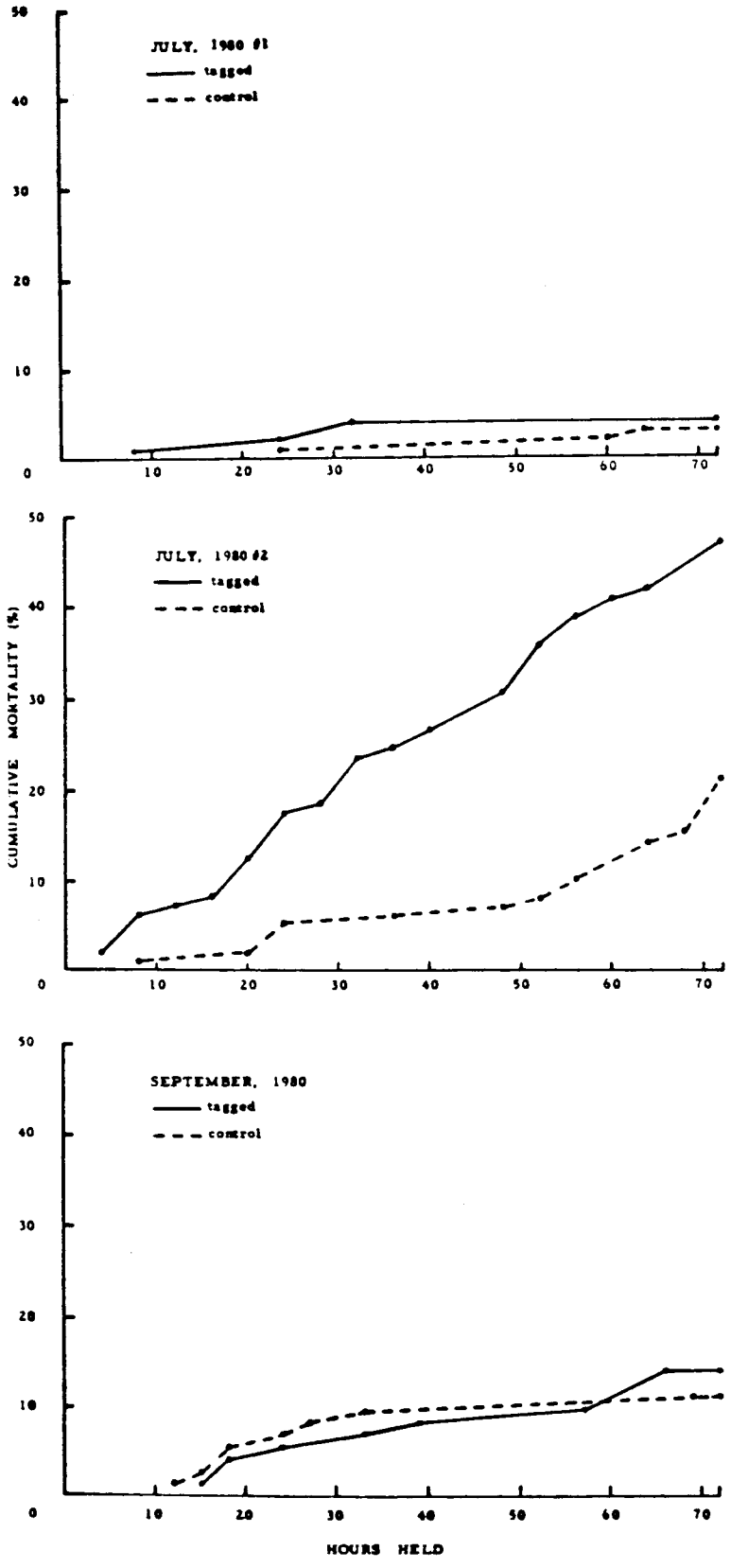

Figure 1. Cumulative mortality of Brown Shrimp (Penaeus aztecus) by hours held, for three field mortality experiments.