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EARL F. PRENTICE AND JOHN E. RENSEL

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Tag Retention of the Spot Prawn, *Pandalus platyceros*, Injected With Coded Wire Tags

EARL F. PRENTICE AND JOHN E. RENSEL

National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, Wash. 98112, USA

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Juvenile spot prawns, *Pandalus platyceros* (initial carapace length 15.0–22.5 mm), were successfully tagged with Bergman–Jefferts coded wire tags in the thoracic sinus. Tagged prawns, prawns subject to tagging needle insertion but without tags, and a control group were tested. No significant differences in growth and survival within or between test groups occurred and no behavioral changes were observed among tagged animals. All tagged prawns molted at least twice during the 6-mo experiment. Average tag retention was 95%.

Key words: *Pandalus platyceros*, tagging, tag retention, molting, survival

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Nous avons marqué avec succès de jeunes crevettes, *Pandalus platyceros* (d'une longueur de caparace initiale de 15.0 à 22.5 mm), à l'aide du fil codé de Bergman-Jefferts inséré dans le sinus thoracique. Nous avons fait des essais avec des crevettes marquées, des crevettes soumises à l'insertion de l'aiguille de marquage sans les marques, et un groupe témoin. Il ne se produisit pas de différences significatives dans la croissance et la survie parmi ou entre les groupes d'essais, et nous n'avons observé aucun changement de comportement chez les animaux marqués. Toutes

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les crevettes marquées muèrent au moins deux fois durant l'expérience de 6 mois. La moyenne de rétention des marques fut de 95%.

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VARIOUS methods have been developed for identifying individuals or groups of Crustacea (Neal 1969); however, none have been entirely satisfactory. Tagging and marking can be divided into two classes: external and internal. External tags and markers are not acceptable for they often alter animal behavior, increase mortality, and are shed when the animal molts. Furthermore, small animals cannot be externally tagged. Internal stains are short-term (6 mo maximum) and are often not readily detectable because of animal coloration.

The internal tagging method using the Bergman–Jefferts coded wire tag described by West and Chew (1968) for prawns meets most of the criteria for an acceptable tag. The tag is retained through repeated molts, has numerous code combinations (8×10^4), is relatively easy to apply and detect, and does not alter growth, survival, or behavior of the animal. A major objection to the technique was that the tag was placed in the edible portion (abdomen) of the prawns. We modified the tagging technique by inserting the tag through the anterior portion of the cephalothorax into the thoracic sinus, thus overcoming this objection. This report describes the modified technique and reports the growth, survival, and tag retention of the test prawns.

Materials and methods — Test animals — Juvenile spot prawns, *Pandalus platyceros*, were used in a tagging experiment that lasted from January to July 1976. All test animals were measured from the base of the eyestalk to the posterior middorsal edge of the carapace using calipers at days 0, 104, and 174 of the experiment.

Treatments — Three treatments were evaluated: tagged prawns; wounded prawns — subjected to insertion of a tagging needle but without tags; and a control group — neither tagged nor wounded. Each of the three treatments had five replicates of 30 prawns for a total of 450 animals. Animals were randomly assigned to experimental groups.

Holding containers and animal maintenance — The prawns were held in 15 fiberglass tanks (107 × 27 × 26 cm; volume, 75.1 ℓ). Salt water was continuously supplied to each tank at flow rates varying from 2 to 3 ℓ/min. The water had an average pH of 7.28, a salinity of 28‰, and a temperature range of 7.0–12.0°C. All groups were held under natural photoperiod. The prawns were fed all they would eat once every other day on a diet of salmon, *Oncorhynchus* spp., and mussel, *Mytilus edulis*. Each tank was examined daily and exuviae and dead prawns were immediately removed. To ensure uniformity of exuviae count data, only the carapaces were counted, because this was found to be the last portion of the exuviae to be consumed by the prawns after molting.

Tagging method — Tagging was done with a Technical Research Company wire tag injector, model No. 3 and a Northwest Marine Technology hand-operated tagger. Tag detection was accomplished using a Jefferts electronic closed head tag detector. The mechanics and operation of the tagger and detector were similar to those described by West and Chew (1968). The tags were injected into the thoracic sinus (hemocoel) by penetrating the right-hand frontal region of the cephalothorax approximately at the intersection of lines drawn from the suborbital spine and the 3rd or 4th posterior rostral spine (tooth) (Fig. 1). Care was taken to avoid penetrating vital organs during the injection procedure. Immediately after tagging, the prawns were passed over a magnet to magnetize the tag and then through the tag detector to verify tag insertion; if the tag was not detected (i.e., the detector was not activated) the animals were rejected and not used in the experiment.

Analysis of data — Growth and survival data were analyzed using the *F*-statistic. For each test group and each selected time interval, molt frequency was estimated by ratio E_i/N_i, where i = the selected time interval (1 day or several days) used; the time intervals are monotonic and nonoverlapping; E_i = the number of molts in time interval i; N_i = the number of animals available to molt in time interval i. For example, if a 5-day time interval were used, the above ratio would be calculated as the quotient of the number of molts in the interval divided by the number of prawn alive and available to molt in that interval.

These interval ratios are used to calculate

$$M_t = \sum_{i=1}^{t} (E_i/N_i)$$

where t = the total number of time intervals and M_t = the estimated molt occurrence at the termination of t time intervals.

Results and Discussion — The mean length and standard deviation of prawns for each treatment and growth period are given in Table 1. The initial carapace length ranged from 15.0 to

FIG. 1. Coded wire tag within the thoracic sinus of a spot prawn (tagged for 157 days). A portion of the cephalothorax has been removed to expose the tag.

TABLE 1. Size of prawns in experimental groups at start of study and after 104 and 174 days. CL = carapace length (mm) expressed as mean with SD in parentheses.

	Start of study 0 days		104 days		174 days	
Treatment	Total no.	CL	Total no.	CL	Total no.	CL
Control	150	19.4(1.55)	126	21.3(1.68)	109	22.1(1.52)
Wound	150	19.6(1.45)	128	21.3(1.59)	110	22.4(1.47)
Tag	150	19.7(1.46)	130	21.2(1.39)	85	22.2(1.40)

[a]One replicate ($n = 27$) deleted for histological examination of prawns after 157 elapsed days.

22.5 mm. No significant differences in growth or survival within or between test groups (Table 2) were shown at any time ($F = 0.959$, df = (2,327), $P > 0.25$). Likewise, no behavioral differences were seen between test groups.

Tags were removed from the prawns after either 157 or 180 days and examined microscopically. No alteration to the tags was noted. The tags were found either free floating within the thoracic sinus or within the musculature in the immediate area of tag insertion (Fig. 1). No tags were found in organs. Histological examination of tissue and organs in the area near the tag showed no inflammatory response. The only perceptible damage from tagging was at the point of needle entry. A black spot (melanin-like

TABLE 2. Total elapsed days, survival, and tag retention (values expressed as means with SD in parentheses) for three experimental populations of spot prawns after 1, 2, and 2+ molts.

Treatment	Start of study		1 molt			2 molts			2+ molts			
	No. prawns	No. reps.	Total elapsed days	% Survival	% Tag retention	Total elapsed days	% Survival	% Tag retention	Total elapsed days	% Survival	% Tag retention	Estimated no. of molts after 180 days
Control	150	5	93(12.16)	88(11.51)	—(—)	147 (7.03)	77 (6.47)	—(—)	180(0)	71 (5.43)	—(—)	2.71 (4.51)
Wound	150	5	93 (8.24)	90 (4.72)	—(—)	146 (5.60)	80 (4.21)	—(—)	180(0)	66(12.39)	—(—)	2.76(28.30)
Tag	150	5[a]	95(12.75)	90 (2.09)	96(4.19)	157(10.57)	77(10.34)	95(4.79)	180(0)	69(11.41)	95(9.01)	2.63(25.65)

[a]One replicate (n = 27) deleted for histological examination of prawns after 157 elapsed days.

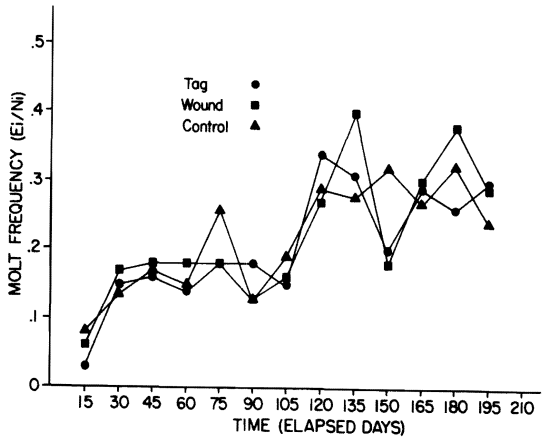

FIG. 2. Molt occurrence for combined replicates of wound, tag, and control groups based on 15-day periods.

deposit) formed at the wound site within a day or two after tagging, but was lost at first molt. The absence of the black spot was used to confirm the first molt after tagging. Penn (1975) described a similar scar formation and used it as a molt indicator.

After 180 days tag retention was 95% and the average molt occurrence was 2.63% for the five tag replicates (Table 2). Tag loss is thought to have occurred primarily through the puncture in the carapace prior to the first molt. Due to surface tension, the tag had a tendency to follow the hypodermic needle as it was retracted from the wound, and tags were seen partially protruding into the puncture. This problem was subsequently overcome in other tests by tapering the tip of the push-rod within the hypodermic needle (for a detailed description of the tagging apparatus see West and Chew (1968)). As a result of this modification, the push-rod inserts the tag at an angle from the needle, and consequently the tag does not follow the needle upon its retraction. This minor change improves tag retention.

No mortality could be attributed to the tagging of the prawns (Table 2). Mortality that did occur (31.3%) for all treatments combined was due to cannibalism at the time of molt or poor water quality during water system failures.

Exuviae were removed daily from all containers and the percent molt occurrence calculated with the aforementioned formula. The substantial decrease in time between molt periods (0 to 1 and 1 to 2) (Table 2) was probably due to the rise in water temperature from 7 to 12°C and/or extended photoperiod. No definite molt cycle could be determined for any treatment group during the study (Fig. 2). There was a trend, however, toward a 60-day cycle on an individual

replicate basis irrespective of treatment. The absolute time of molt peaking would vary between replicates, but the basic 60-day cycle persisted. The variable lighting conditions within the laboratory may account for the variability between replicates.

The Bergman–Jefferts wire tag and the tagging technique described above appear to have considerable merit. First, the tag and tagging technique is applicable to animals of a small size. For example, the minimum carapace length of prawn in our study was 15 mm; however, animals as small as 10 mm have been successfully tagged in subsequent tests. Also, this method of tagging can be applied to several types of crustaceans, such as shrimp, crab, and lobsters. Since the tag is inserted in nonedible portions of the animals, there is no concern over accidental ingestion by consumers.

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NEAL, R. A. 1969. Methods of marking shrimp. FAO Fish. Rep. 3: 1149–1165.

PENN, J. W. 1975. Tagging experiments with western king prawn, *Panaeus latisculatus* Kishinouye. I. Survival, growth, and reproduction of tagged prawns. Aus. J. Mar. Freshwater Res. 26: 197–211.

WEST, W. Q. B., AND K. K. CHEW. 1968. Application of the Bergman-Jefferts tag on the spot shrimp, *Pandalus platyceros* Brandt. Proc. Natl. Shellfish Assoc. 58: 93–100.