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Short term movements of snow crabs (Chionoecetes opilio) in Bay of Islands, Newfoundland, as monitored by ultrasonic tracking

by

Donald R. Maynard and David A. Robichaud*
Department of Fisheries and Oceans
Invertebrates Research Section
Marine Biology Research Centre
Université de Moncton
Moncton, N.B. E1A 3E9

*Department of Fisheries and Oceans
Invertebrates and Marine Plants Division
Biological Station
St. Andrews, N.B. E0G 2X0

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ABSTRACT

Ultrasonic transmitters were attached to five snow crabs, Chionoecetes opilio, (Three males and two females) in the Bay of Islands, Newfoundland. These crabs were tracked up to 17 days. There was no clear pattern of diurnal movement that emerged over the tracking period. The activity indexes and vectors of movement differed between male and female crabs.

Thirty experimental crabs, with transmitters attached and thirty control snow crabs were held in an aquarium over a five week period. No effect of the attachment and presence of transmitters on mortality was found.

RÉSUMÉ

Les transmetteurs ultrasoniques ont été attachés à cinq crabes des neiges, Chionoecetes opilio, (trois mâles et deux femelles), dans la Bay of Islands, Terre-Neuve. Les crabes ont été suivis pour une durée maximale de 17 jours. Pendant la période de dépistage, aucun cycle de mouvement journalier n'a été décelé. Les indices d'activités et les vecteurs de mouvements ont été différents entre les mâles et les femelles.

Pendant cinq semaines, trente crabes des neiges expérimentaux ont été groupés dans un aquarium avec des transmetteurs ainsi que trente crabes des neiges contrôlés. Aucune influence des attachements et de la présence des transmetteurs sur la mortalité des crabes n'a été décelée.

INTRODUCTION

The movement pattern of snow crab is a subject which several researchers have posed concepts. Brunel (1960, 1961 and 1962) and Powles (1968) conducted trawling experiments and from the results postulated a diurnal activity pattern at snow crabs. Watson and Wells (1972) conducted tagging studies with the results suggesting random and limited long term movements.

A day to day crab tracking experiment could provide the basic information required to better understand specific crab movement. Biotelemetry has been conducted by Mohan and Thorne (1973) on Alaska king crab (Paralithodes camtschatica) and was considered a feasible research technique to obtain information on short term movement of crabs. This paper describes a technique of ultrasonic tracking of snow crab Chionecetes opilio and interprets the results of the crab movement and activity observed.

MATERIAL AND METHODS

The cylindric transmitters, were 46 mm long and 16 mm in diameter, and weighted 18 g in air and 9 g in water. The transmitters had a pulse rate of 858 ms to 1126 ms at 50.00, 65.54 and 69.00 khz with an acoustic output of 152 dB re lu PASCAK at 1 meter and approximately an 18 day battery life depending on frequency and pulse rate. Transmitters were attached to the dorsal gastric area of the crab carapace by using a "TY-RAP" cable tie (Figure 1).

Snow crabs were caught in the Baie des Chaleurs and held in covered tanks at the Shippagan Marine Centre for a period of two weeks acclimation. Dummy ultrasonic transmitters were attached to the test crabs, (15 males and 15 ovigerous females and held in a tank with 34 control crabs. The test crabs had a minimum and maximum carapace width and weight of 61-88 mm, 90-244g and 61-129 mm, 90-940g for the females and males respectively. These crabs were fed and checked weekly over a five week test period.

The field tracking experiment was carried out in Middle and Goose Arm of the Bay of Islands, Newfoundland. On August 27 and 28, transmitters were attached to snow crabs caught by trapping, and are as follows:

Transmitter #	Size	Sex	Depth caught and released
5520	110 mm	male	183 m
5521	77 mm	fem.	183 → 91.5 m
5522	79 mm	fem.	183 m
5532	81 mm	male	91.5 m
5534	106 mm	male	91.5 m

Except for the crab that was moved (5521), the transmitter attachment and release was completed in approximately two minutes in a shaded area of the boat.

The crabs were tracked with an ultrasonic signal receiver in a small outboard launch twice a day. The location of the crab was marked with a buoy directly over the site. The depth range of the depth sounder used was limited to a 183 meters, therefore it was impossible to determine any variation of depths of the two crabs in water over 183 meters. Location of the experimental area was beyond the range of electronic navigational aids such as Loran-C, therefore the geographic location was taken by using triangulation. The tracking team would travel to a minimum of two shore reference points and measure the distance to the buoy with a Wild TM2 coincidence range finder.

The sighting points were calculated and positioned on a map by triangulation. Distances between sites were measured on a map with a precision hand divider and map scale. A compass rose was used to determine direction of movement on the map. As an index of activity, the linear speed of crab movement from sighting point to point was calculated, and plotted against the midpoint of the time of the sightings. On these figures day, night and weather are represented.

RESULTS

Both female crabs were ovigerous and number 5521 was moved from the trapping site and released inshore. The life of the transmitters attached to the crabs varied from 10 to 17 days. The "TY-RAP" attachment method proved quick and secure. Close observation of the test crabs showed no displacement of the leg joints or chaffing through of the cuticle. Of the 34 control and 30 test crabs three crabs of the control group died over the test period.

The positions of each tracking site are indicated in (Figures 2 and 3). The results of each crab tracking are presented in (Tables 1 to 5). At the bottom of each table is the plus or minus range of accuracy of the rangefinder for that particular set of measurements.

Component vector directions were calculated for each crab and illustrated on (Figure 4 and 5). Activity indexes for the males and females is presented in (Figure 6 and 7).

DISCUSSION

The effect of trapping and attaching the transmitters does not cause mortality, but could have a temporary disturbing affect. The temporary disturbance of the animal has been observed in other biotelemetry experiments on crustacean, Maynard and Conan (1984). The crabs in (Figure 6 and 7) exhibit an accelerated or depressed activity after transmitter attachment and return to the substrate. After the first two days the crabs appear to settle into a diurnal pattern as suggested by Brunel (1960, 1961, 1962) and Powles (1968). Interpreting the sunny and overcast weather conditions during the daylight as increased or reduced light on the bottom there appears to be activity according to light condition, as suggested by Powles (1968). At certain points during the tracking period the crab activity did not change according to the variation in light conditions. This phenomenon was noted by Powles during trawling surveys, and it was suggested that it may be a lag in the crabs control reaction to the light stimuli.

The activity indexes and component vectors of movement suggest that during the period of the tracking study the males and females did not have the same movement strategy. This would concour with Adam's review Adams (1979) of Kon (1969), where it was stated that adult male crabs go through seasonal migration from deeper water to shallow waters with no mention of female migration.

Over the short period of this experiment the three crabs for which we have accurate depth records did not display great changes in depth. The female that was displaced into shallower water moved back down the slope to occupy the same depth from which she was trapped. The two males for which we have accurate depth record, show an average gradual descent of 0.9 meters per day. This may be a pattern of movement at that particular time of season.

With a longer period of tracking and refinement of field techniques, the use of biotelemetry on snow crab (Chionoecetes opilio) will provide valuable information on movement and behavior of the species.

ACKNOWLEDGMENTS

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Table 1 - Table of the snow crab movements over the tracking period. Transmitter # 5520.

Site #	Date	Time	Distance in meters moved from previous site	Depth in meters
1	27/7	1600		30.5 +
2	28/7	1030	323	
3	29/7	1200	832	
4	30/7	1200	740	
5	30/7	1750	138	
6	31/7	0935	370	
7	31/7	1915	*	
8	01/8	1030	20	
9	01/8	1830	*	
10	02/8	1000	138	
11	02/8	1830	92	
12	03/8	1050	231	
13	03/8	2000	*	
14	04/8	1100	231	
15	05/8	1040	508	
16	05/8	1930	*	
17	06/8	1100	323	
18	06/8	1830	*	
19	07/8	1130	138	
20	07/8	1830	*	
21	08/8	1030	185	

Accuracy of distance + - 75 m

Table 2 - Table of snow crab movements over the tracking period. Transmitter # 5521

Site #	Date	Time	Distance in meters moved from previous site	Depth in meters
1	27/7	1940		15.2
2	28/7	1215	*	15.2
3	29/7	1030	190	15.2
4	30/7	1100	231	27.1
5	30/7	1750	*	27.1
6	31/7	0935	*	27.1
7	31/7	1930	*	27.1
8	01/8	1030	46	27.1
9	01/8	1830	25	27.1
10	02/8	1000	185	30.5
11	02/8	1830	*	30.5
12	03/8	1050	138	30.5
13	03/8	2000	*	30.5
14	04/8	1100	46	30.5
15	05/8	1040	55	30.5

Accuracy of distance + - 20 m

* = no change from previous site

Table 3 - Table of the snow crab movements over the tracking period. Transmitter # 5522

Site #	Date	Time	Distance in meters moved from previous site	Depth in meters
1	27/7	1600		30.5 +
2	27/7	1930		
3	28/7	1200	185	
4	29/7	1030	185	
5	30/7	1100	*	
6	30/7	1800	*	
7	31/7	0935	462	
8	31/8	1915	*	
9	01/8	1030	*	
10	01/8	1830	*	
11	02/8	1000	323	
12	02/8	1830	138	
13	03/8	1050	138	
14	03/8	2000	*	
15	04/8	1100	46	
16	05/8	1040	231	
17	05/8	1930	*	
18	06/8	1100	138	
19	06/8	1830	*	

Accuracy of distance + - 30 m

Table 4 - Table of snow crab movements over the tracking period. Transmitter # 5532

Site #	Date	Time	Distance in meters moved from previous site	Depth in meters
1	28/7	1600		15.2
2	28/7	2000	138	13.7
3	29/7	1305	277	15.9
4	30/7	1300	323	15.9
5	30/7	1900	277	15.2
6	31/7	1120	370	15.6
7	31/7	1930	*	15.6
8	01/8	1120	138	15.6
9	01/8	2000	90	15.2
10	02/8	1200	255	15.9
11	02/8	2000	85	15.2
12	03/8	0920	180	16.2
13	03/8	2100	*	16.2
14	04/8	1010	*	16.2
15	04/8	2030	24	16.2
16	05/8	1200	92	16.2
17	05/8	2000	*	16.2
18	06/8	1200	195	16.2
19	06/8	1800	30	16.2
20	07/8	1230	277	16.8
21	07/8	1900	23	16.8
22	08/8	1100	54	16.8
23	09/8	1100	185	16.8
24	09/8	2000	231	16.8
25	10/8	1100	154	17.1
26	10/8	1930	123	17.1

Accuracy of distance + - 30 m

* = no change from previous site

Table 5 - Table of the snow crab movements over the tracking period.
Transmitter # 5534

Site #	Date	Time	Distance in meters moved from previous site	Depth in meters
1	28/7	1600		15.2
2	28/7	2000	110	15.2
3	29/7	1305	185	15.6
4	30/7	1300	512	15.6
5	30/7	1900	*	14.6
6	31/7	1120	585	14.6
7	31/7	1915	*	14.6
8	01/8	1100	*	15.2
9	01/8	2000	*	15.2
10	02/8	1200	185	15.2
11	02/8	2000	180	14.6
12	03/8	0920	175	15.2
13	03/8	2100	*	15.2
14	04/8	1010	257	15.2
15	04/8	2030	*	15.2
16	05/8	1200	240	16.5
17	05/8	2000	30	16.5
18	06/8	1200	277	16.5
19	06/8	1800	107	16.5
20	07/8	1230	1018	17.4
21	07/8	1900	61	17.4
22	08/8	1100	47	17.4
23	09/8	1100	185	17.4
24	09/8	2000	40	17.4
25	10/8	1100	122	18
26	10/8	1930	*	18
27	11/8	1030	231	18
28	11/8	1730	92	18
29	12/8	1030	50	18
30	12/8	1900	*	18
31	13/8	1100	185	18
32	13/8	1900	*	18

Accuracy of distance + - 30 m

* = no change from previous site

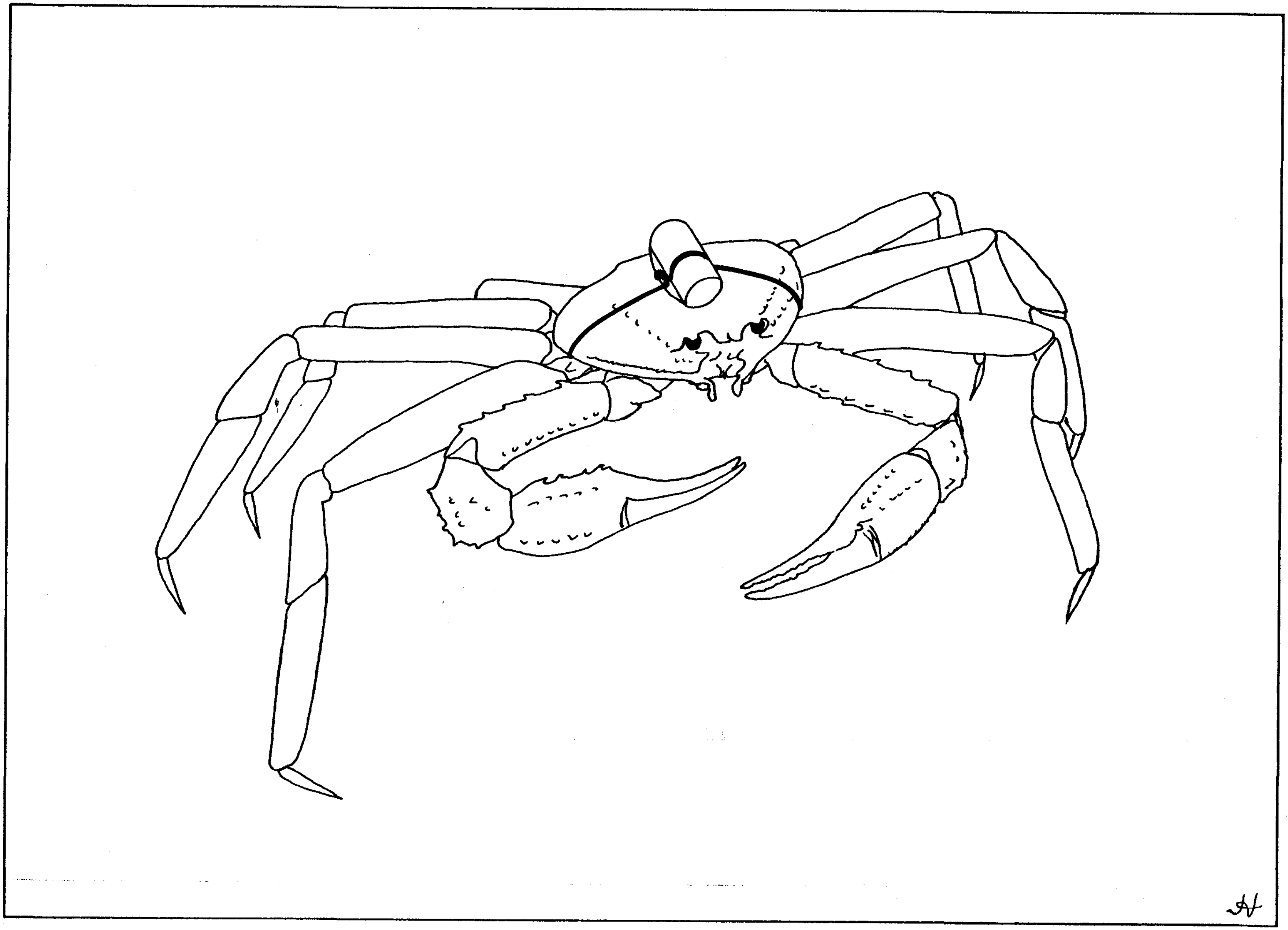

Figure 1 Transmitter attached to snow crab with "TY-RAP" cable tie.

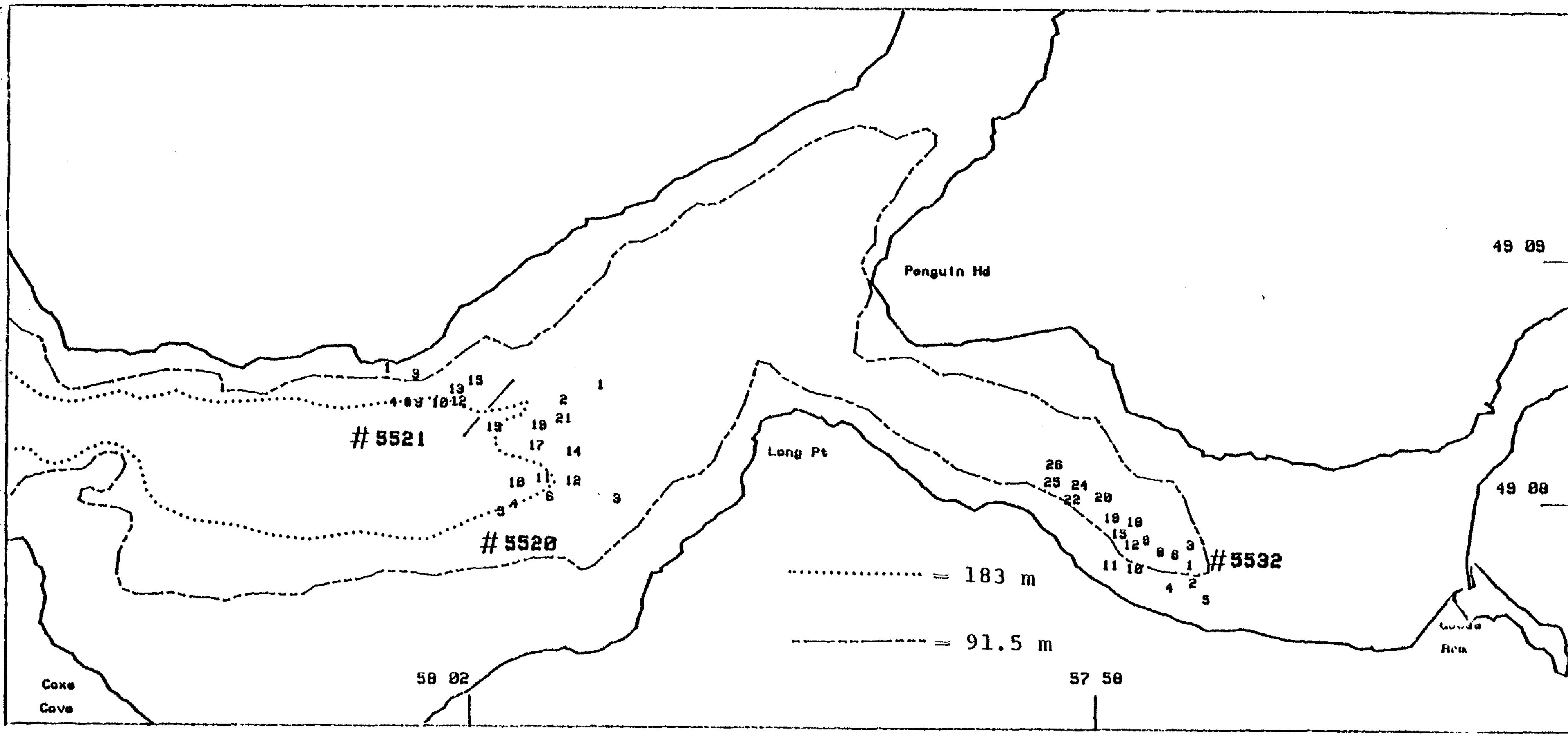

Figure 2. Tracking sites for snow crabs 5521, 5520 and 5532.

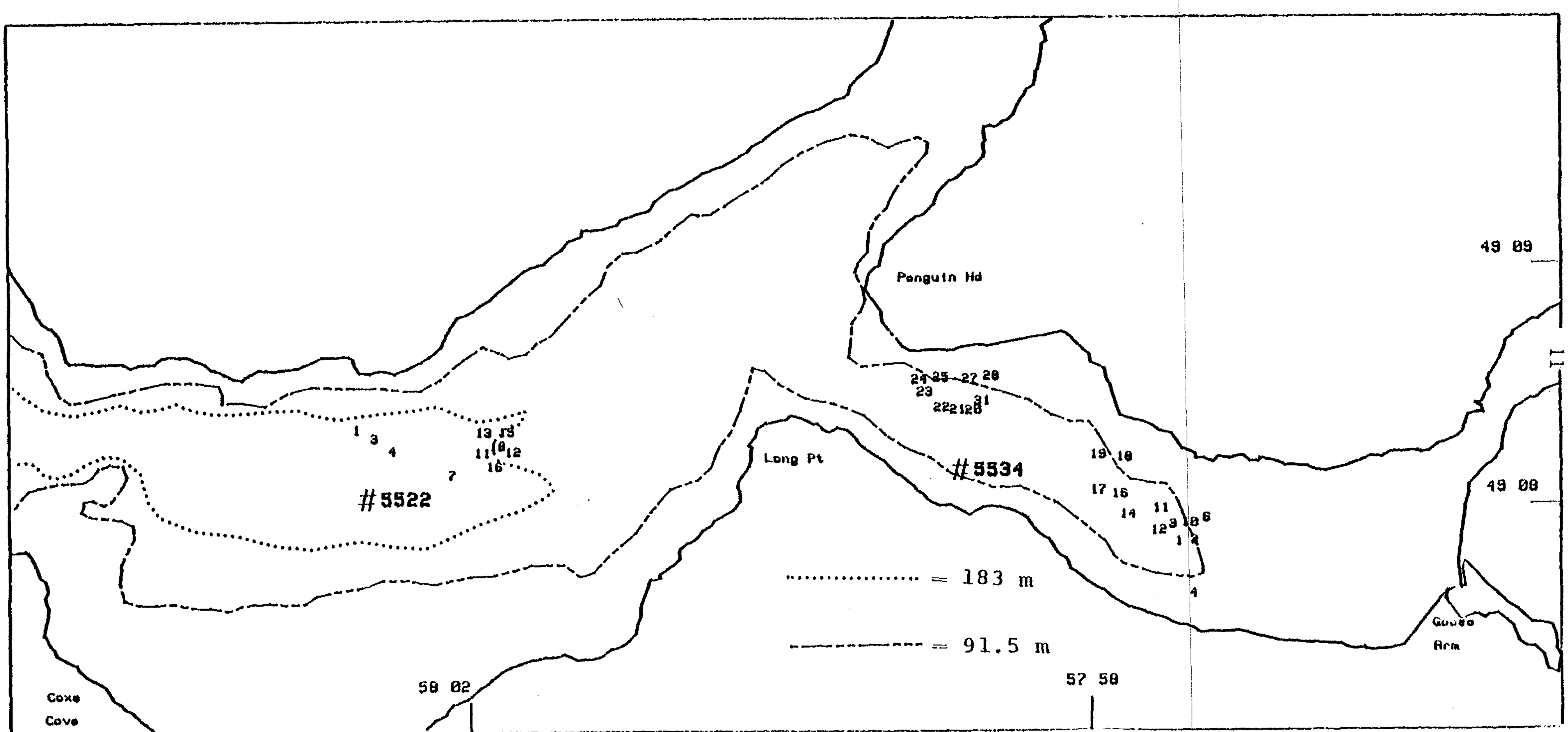

Figure 3. Tracking sites for snow crabs 5522 and 5534.

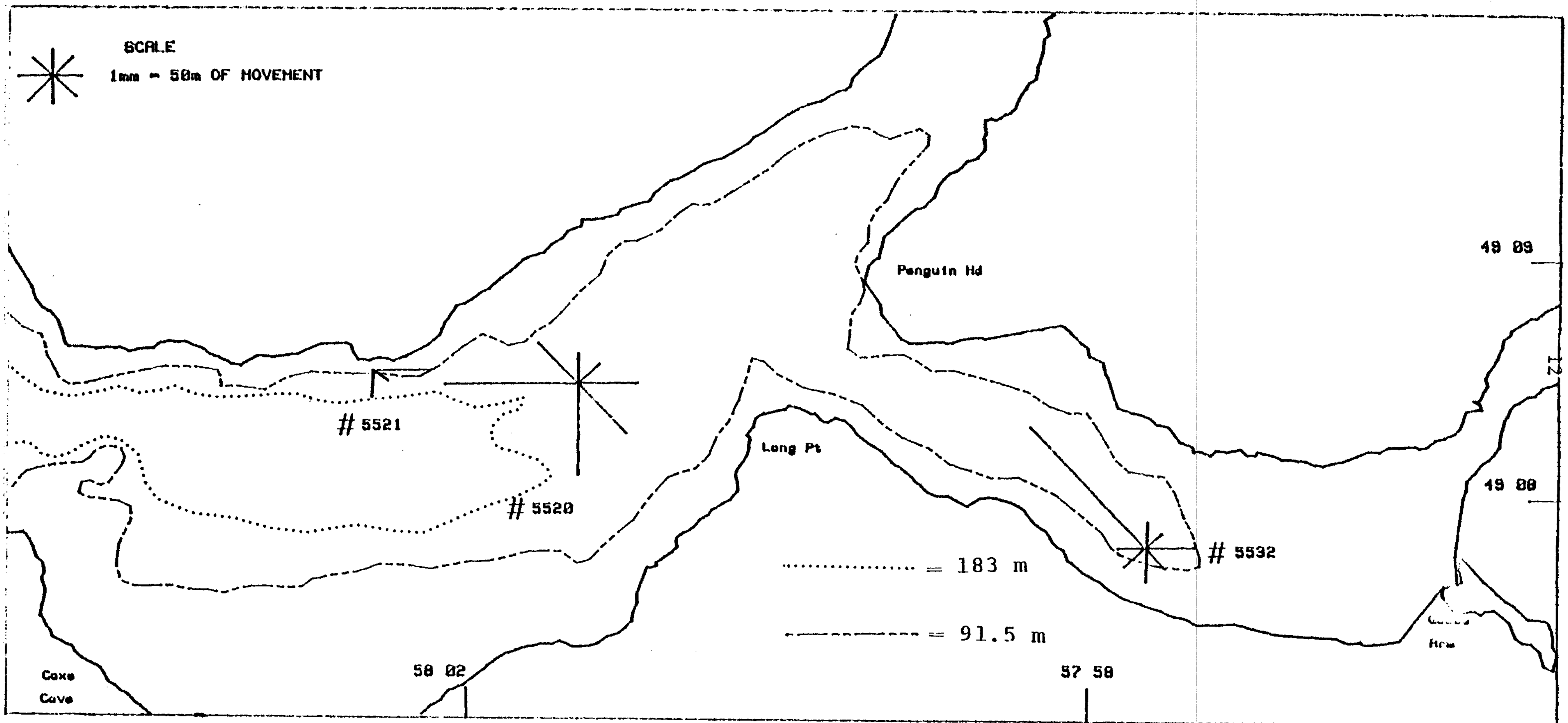

Figure 4. Component vectors of the directional movement of snow crabs 5520, 5521 and 5532.

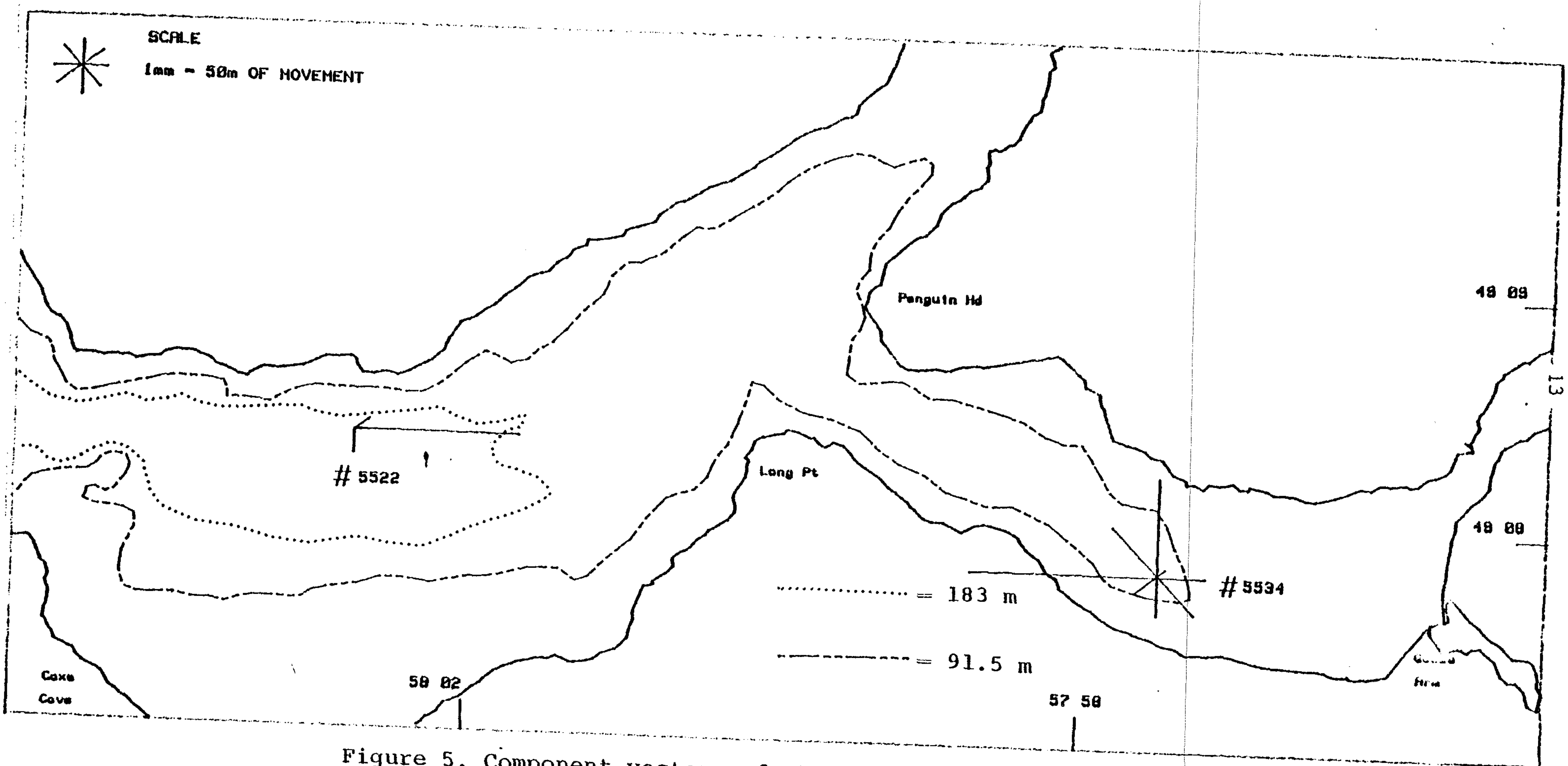

Figure 5. Component vectors of the directional movement of snow crabs 5522 and 5534.

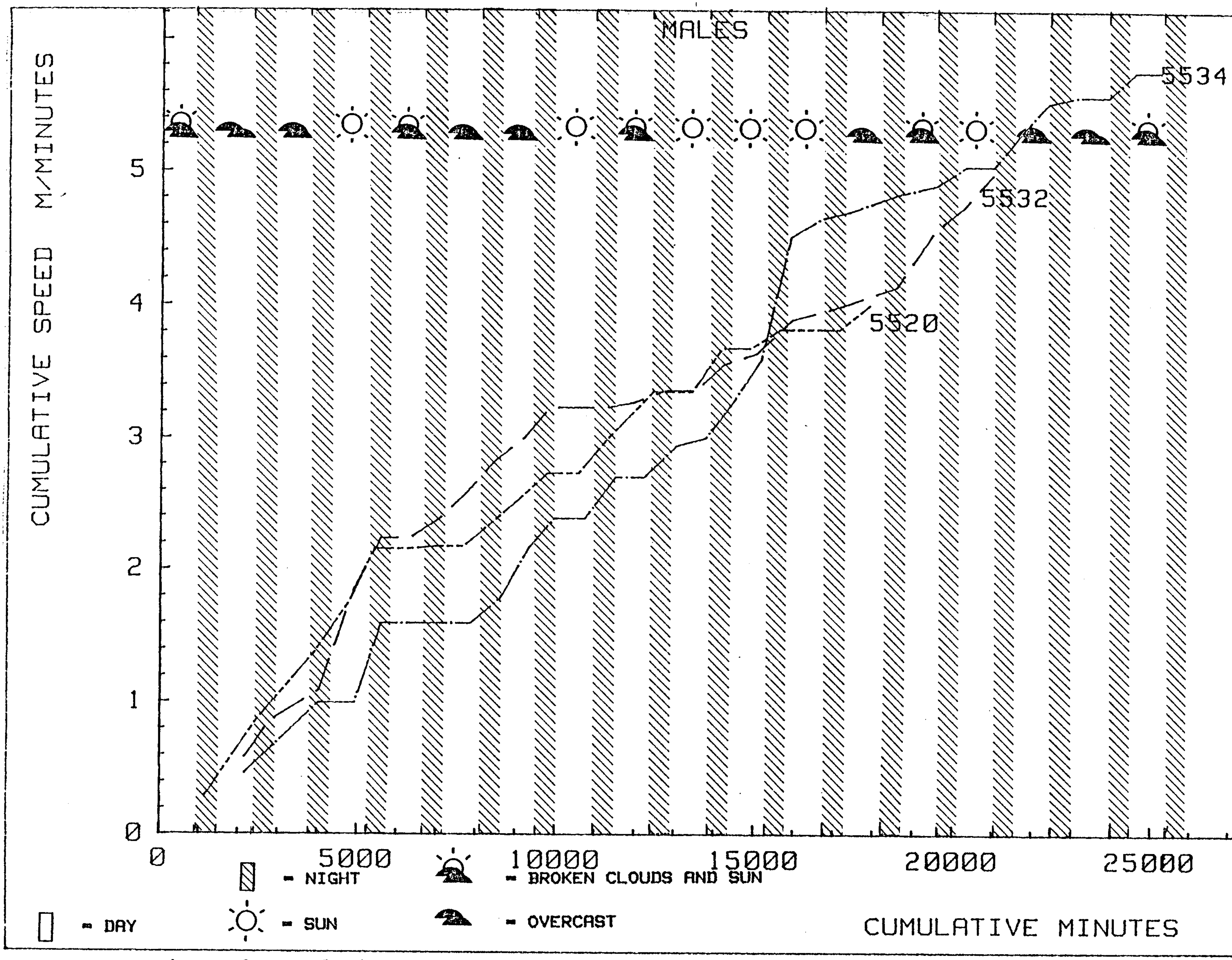

Figure 6. Cumulative speed vs cumulative minutes of male snow crabs 5520, 5532 and 5534.

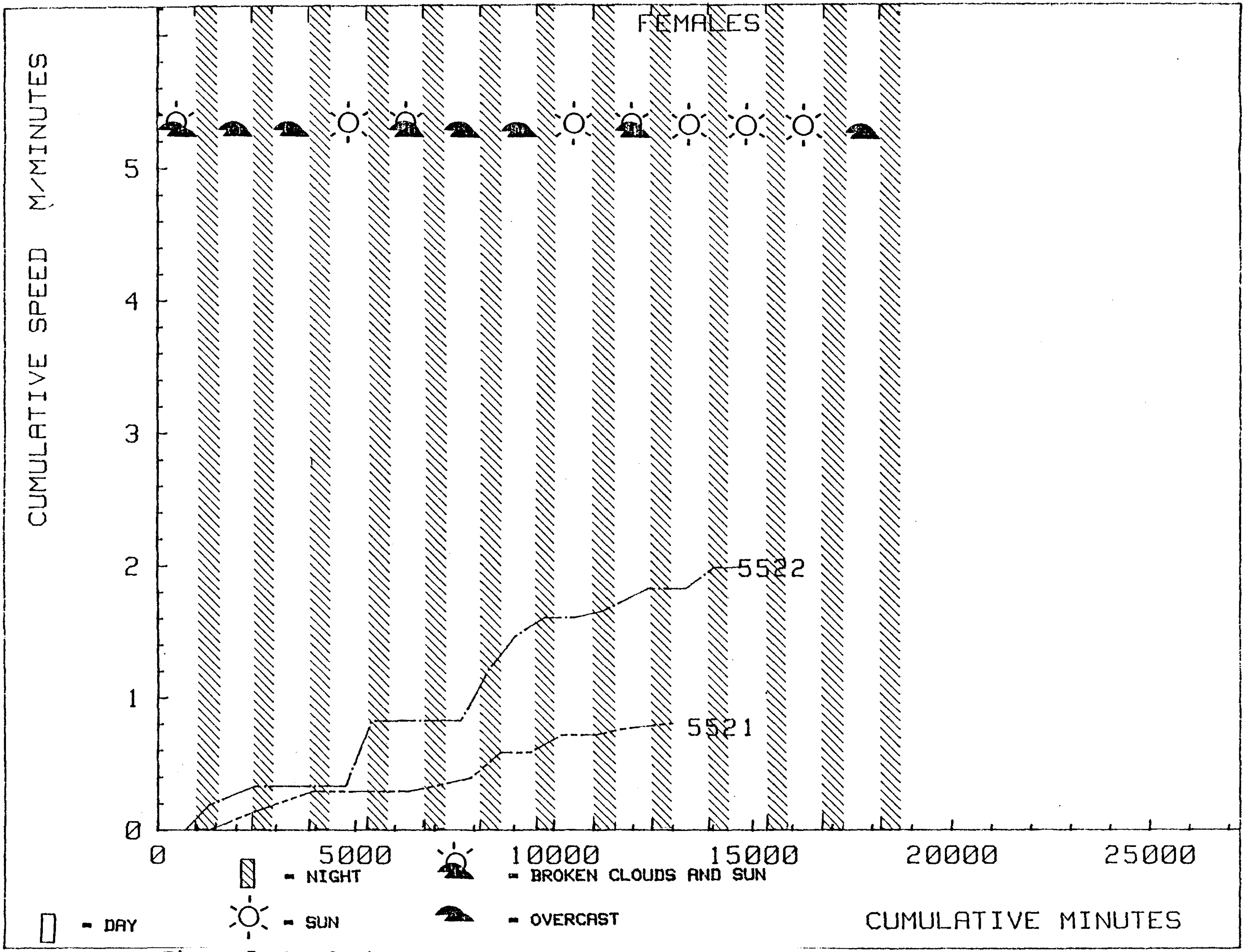

Figure 7. Cumulative speed vs cumulative minutes of female snow crabs 5522 and 5521.