

Informational Leaflet 6

KING CRAB MIGRATIONS FROM AN OFFSHORE RELEASE LOCATION, KODIAK ISLAND, OCTOBER 1960

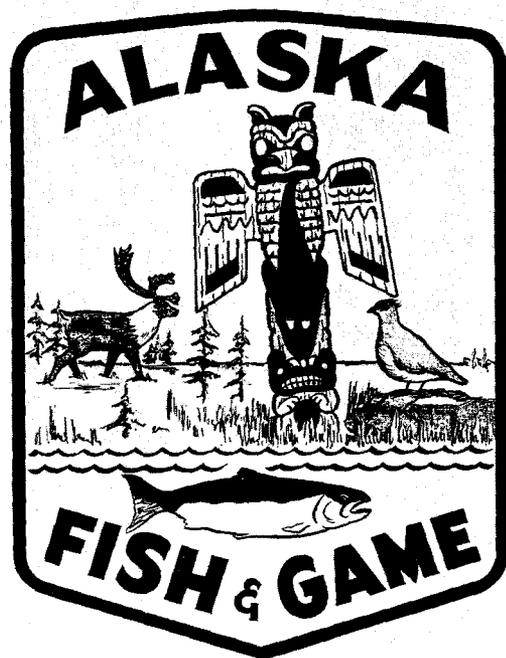
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December 30, 1961

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INFORMATIONAL LEAFLET NO. 6

King Crab Migrations from an Offshore Release

Location, Kodiak Island, October, 1960

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INTRODUCTION

The relatively young Kodiak Island king crab fishery is rapidly expanding from a small bay operation to a large offshore fishery. Migratory relationships between offshore and inshore stocks are of primary concern. In fact, it is paramount to determine whether or not discrete offshore populations exist.

Successful management of the king crab fishery demands either complete regulatory control or international agreements regulating exploitation, especially since these stocks are subject to harvest in state as well as international waters. Considerable migration data have been collected from numerous within-bay tagging operations substantiating inshore-offshore movements.

Discrete populations are not believed to exist offshore in any appreciable quantity. Shallow offshore areas at present indicate crab abundance only during the summer and fall seasons prior to the inshore spring migration.

Initial tagging in offshore waters in the Kodiak area began in October 1960 when 800 large male king crabs were released in 107 fathoms 12 miles from Two-Headed Island. The crabs averaged 11 pounds and consisted of 45% shells of the year and 55% one year or older.

This report presents migrations resulting during the first seven months and nine days following initial release, including the relationship between movements and commercial harvest.

METHODS

All crabs were marked with a newly designed plastic dart tag applied to the dorsal brachial region of the carapace. An ice pick was used to jab the initial hole in the shell after which the tag was pushed through with the thumb. The double barbed dart was 20 mm in length with a round 19 mm diameter yellow disc attached. The legend was printed on the disc.

No measurements were collected since it is believed that tags will not be retained through ecdysis. In fact, tags may cause death during the molt by preventing the crab from withdrawing from his old exoskeleton.

Two groups of crabs receiving differential treatment were released the same day in the same area. On October 19, 1960, a group of 300 crabs were tagged aboard the floating ship DEEP SEA and placed in a live tank. On October 22, 1960, they were removed from the live tank, loaded dry aboard a fishing boat, and taken to the area of initial capture for liberation. Soon after releasing these crabs, 500 more were caught with pots, tagged and returned immediately to the water. None of the second group of 500 crabs were out of the water more than 10 minutes. These crabs were tagged and released as they were removed from the pots.

Printed tag-recovery instruction forms were distributed to the fishermen by field biologists. Their presence insure maximum recording of biological data on tag returns. Rewards of one dollar were paid for each tag recovered. Fishermen were encouraged to return all tagged crabs to the water as soon as tag numbers and re-release capture area were recorded.

RECOVERY

Two hundred sixty-three tagged crabs were captured during the seven months and nine days following initial release. Total recovery was actually greater because of few fishermen believed early recaptures were not useful and released them without recording data. Of the 263 recoveries, 110 were re-released after recording necessary data. Of these, 25 were caught a second time.

The commercial crab fishery harvested 32.8% of the tagged crabs, excluding recaptures. This percentage is minimal because tag loss, unreported tag recoveries, and mortality are not considered.

There is a significant difference in the rates of recovery of tagged crabs between the two differently-treated release groups, which probably indicates a mortality due to handling among the small release group (Table 1)¹. The possibility that the smaller group migrated to an area of low fishing pressure, resulting in low returns, was studied; however, it was found that captures of the smaller group occurred from all fishing areas, disproving a separate migration.

All tag recoveries were made by the commercial fishing fleet. Dependence upon commercial boats for tag returns limits value of migration data somewhat, but no more than in similar studies conducted in a like manner. Locations where increased fishing would have been desirable include: (1) offshore waters over 5 miles from shore, especially during the winter and spring seasons, and (2) in areas 1 and 2, which appear in Figure 2. Increased fishing in these areas probably would indicate that few tagged crabs are present. The limited exploratory or search-type commercial fishing that did occur indicated low density. Fishermen are capable of locating and following schools of commercial crabs; consequently, the gradual migration of crabs inshore could be traced by watching the commercial fleet. Fishermen moved their pots inshore gradually as the main body of crabs migrated shoreward. Commercial catch by date for each of six major areas is presented in Table 2.

¹ Means for the smaller and larger group, respectively, were 19 and 41.2. Variance in the same order was 1.0 and 40.7. A "t" test of these data gives $t = 5.8$, $p < 0.01$, a significant figure; hence, we must reject hypothesis $M_1 = M_2$ (Figure 1).

Table 1. Commercial fishery returns of tagged crabs by month and release unit (100 crabs/unit) for two separate release groups.

	Unit	October	November	December	January	February	March	April	May	Totals
Small Group	1	1	2	4	3	6	4	0	0	20
	2	2	3	4	6	4	0	0	0	19
	3	1	2	3	5	4	1	2	0	18
Large Group	4	4	5	8	15	15	3	0	2	52
	5	2	4	4	10	13	4	1	2	40
	6	1	3	7	7	15	0	1	1	35
	7	4	5	5	9	15	0	0	2	40
	8	3	2	7	8	16	1	0	2	39
TOTALS		18	26	42	63	88	13	4	9	263

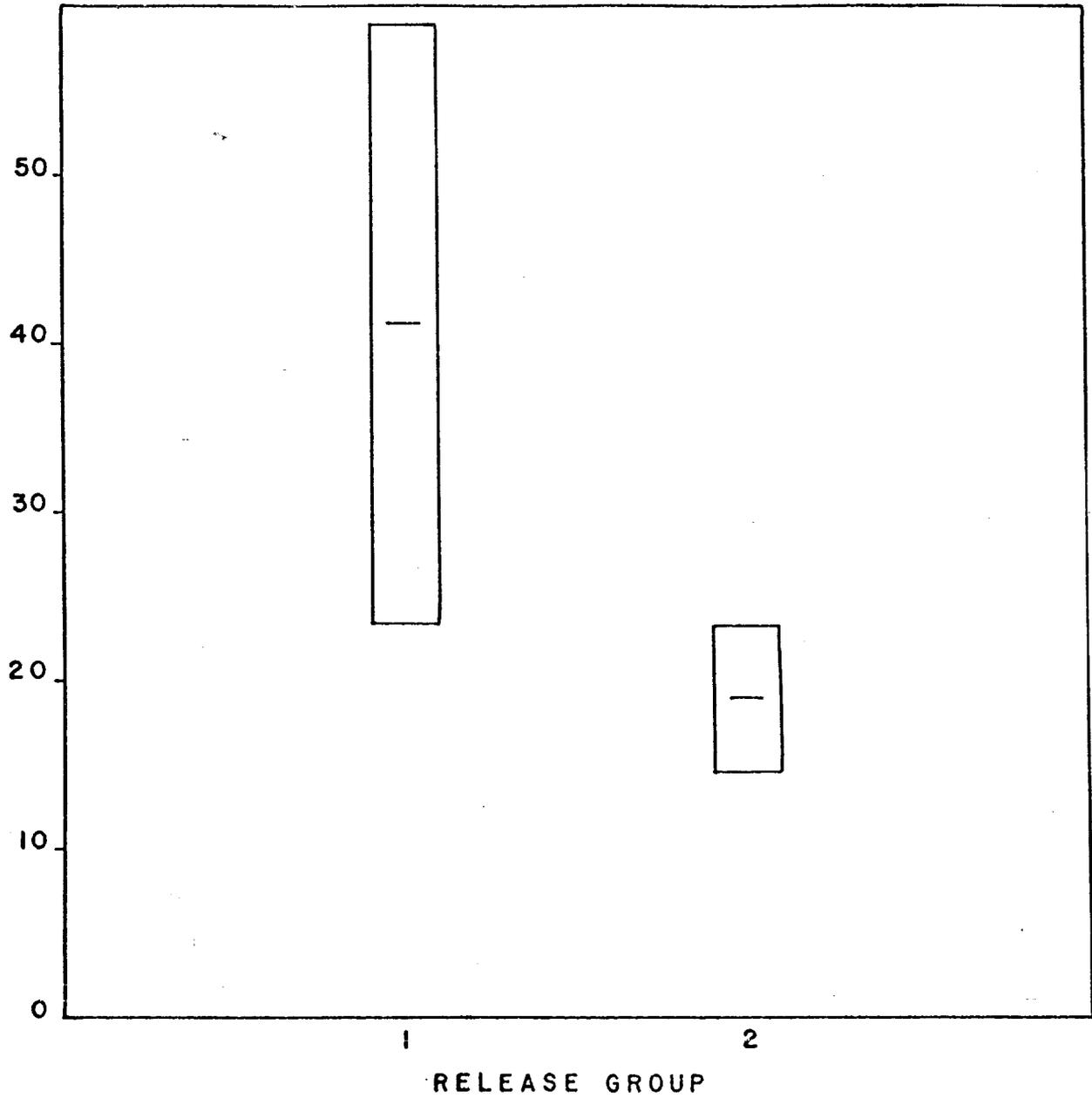


Figure 1. Confidence limits (.95) for sample means of tagged crab returns resulting from two differently treated release groups.

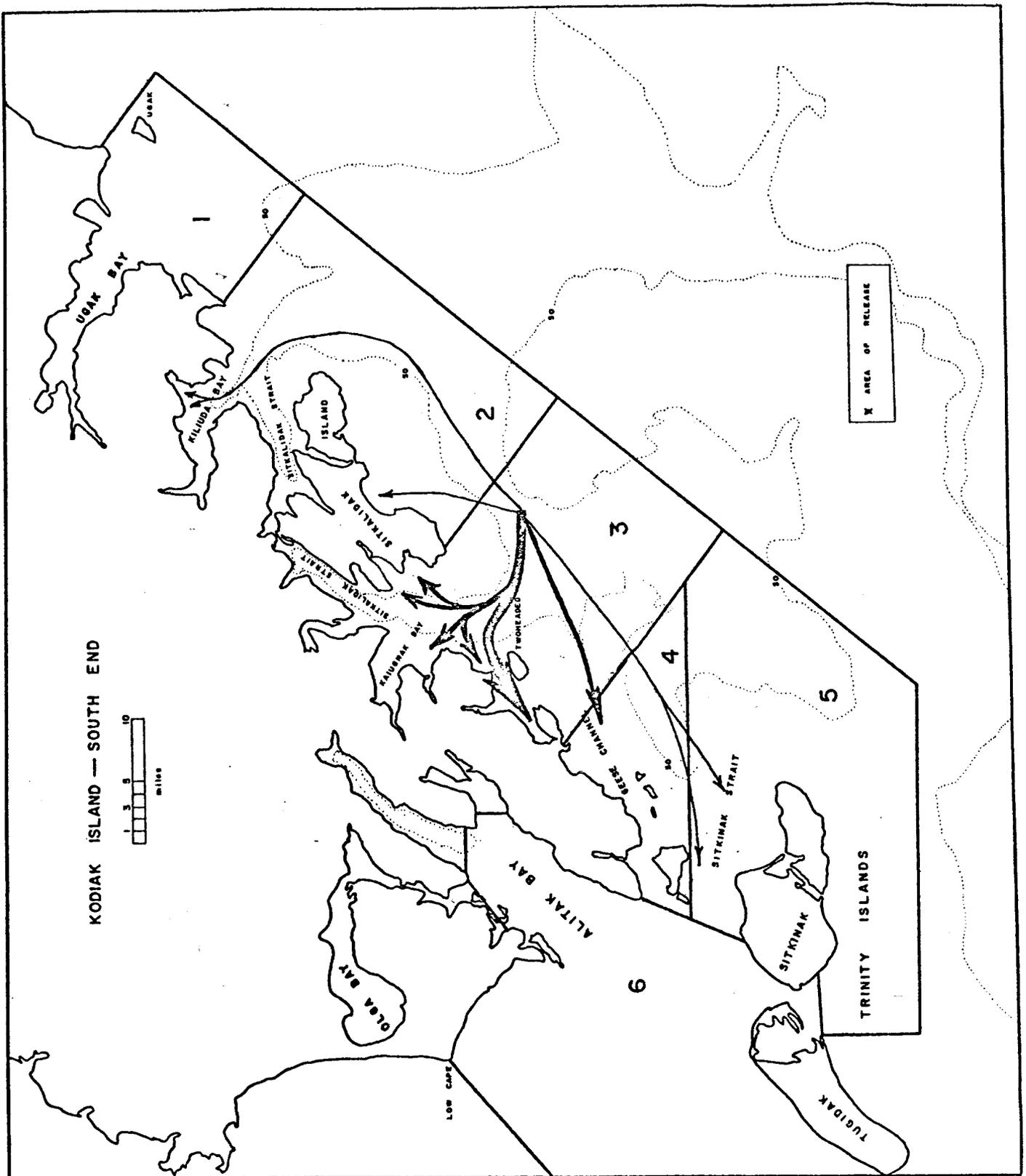


Figure 2. Migration pattern as determined from 263 tagged crabs recaptured during the period October 1960 - May 1961, showing the six major fishing areas.

Table 2. Comparison by area and date between commercial catch and tag returns.

Area*			10/23 - 12/ 3	12/ 4 - 12/31	1/ 1 - 1/28	1/29 - 2/25	2/26 - 4/ 1	4/ 2 - 4/29	4/30 - 5/27	Totals
1	Ugak	Catch	0	0	0	0	0	36	0	36
	Bay	Tags	0	0	0	0	0	0	0	0
2	Sitkalidak	Catch	9,276	3,194	194	2,134	4,473	1,085	1,057	21,413
	Island	Tags	7	0	1	0	0	2	0	10
3	Kaiugnak and	Catch	85,106	46,544	34,043	120,710	20,636	1,597	4,290	312,926
	Kaguyak Area	Tags	37	42	58	46	12	2	7	204
4	Geese	Catch	0	1,455	1,354	104,803	23,130	0	8,260	139,002
	Channel	Tags	0	0	1	34	1	0	2	38
5	Sitkinak	Catch	0	0	3,250	65,923	31,491	0	0	100,664
	Strait	Tags	0	0	0	1	0	0	0	1
Number of Crabs			94,382	51,193	38,841	293,570	79,730	2,718	13,607	574,041
Number of tags			44	42	60	81	13	4	9	253**
6	Alitak	Catch	2,193	22,530	235,900	204,561	138,736	4,913	23,068	631,901
	Bay Area	Tags	0	0	0	0	0	0	0	0

* See Figure 2

** Area of capture was lacking for ten recoveries.

MIGRATION

Arrows on the migration charts were drawn purposely to show that crabs seem to use troughs as natural migratory routes. Close contact with the fishermen showed an unproductive area on the flats just south and east from Two-Headed Island while good catches were realized just north of the island in the trough.

Initial movement of crabs following release indicate disruption from their natural environment possibly caused by the cumulative effect of lifting them to the surface and subsequent release. Additional disturbance of holding 300 crabs for three days may cause more disruption. Early tagging studies by Powell², 1961, describe initial movements as wheel-like with the hub as the location of release and spokes as direction of travel for individual crabs.

Figure 3 illustrates initial movements as determined by the 18 tagged crabs recaptured during October. Possibly the four crabs moving out the trench were disturbed and not displaying true migration. The steep banks close to the release area are believed to have funneled the crabs primarily in two directions preventing a wheel pattern from developing.

It is believed that most crabs re-establish themselves resuming their normal movements within their respective schools in approximately a month, depending upon the amount of disruption.

Early tagging studies showed an inshore move to occur every year with an annual disappearance of tagged crabs from the bays each summer. Lack of an offshore fishery limited determining the extent of the summer migration. Tag return data from the present offshore release complements data from earlier studies and increases knowledge as to extent of offshore movements. Crabs move at least ten miles from shore during the summer and probably even further. Migration Figures 4-10 show the migration pattern developing from November through May. Large scale inshore movements begin in November and end sometime in January when most of the crabs are in shallow water. The turnabout spring move to offshore waters probably begins in late March and continues through May.

Lack of fishing during this period because crabs are soft makes it impossible to study the gradual move back to deep water. However, in September, 1961, 12 tagged crabs that had not molted were recaptured in the general area of release. This may indicate that these crabs had moved inshore and returned to deep water within the year since initial release.

² Powell, Guy C. 1961. Migration of male king crabs (*Paralithodes camtschatica*) in Chiniak Bay, Alaska, 1959-1960. Unpublished MS, on file, Alaska Department of Fish and Game, Juneau, Alaska.

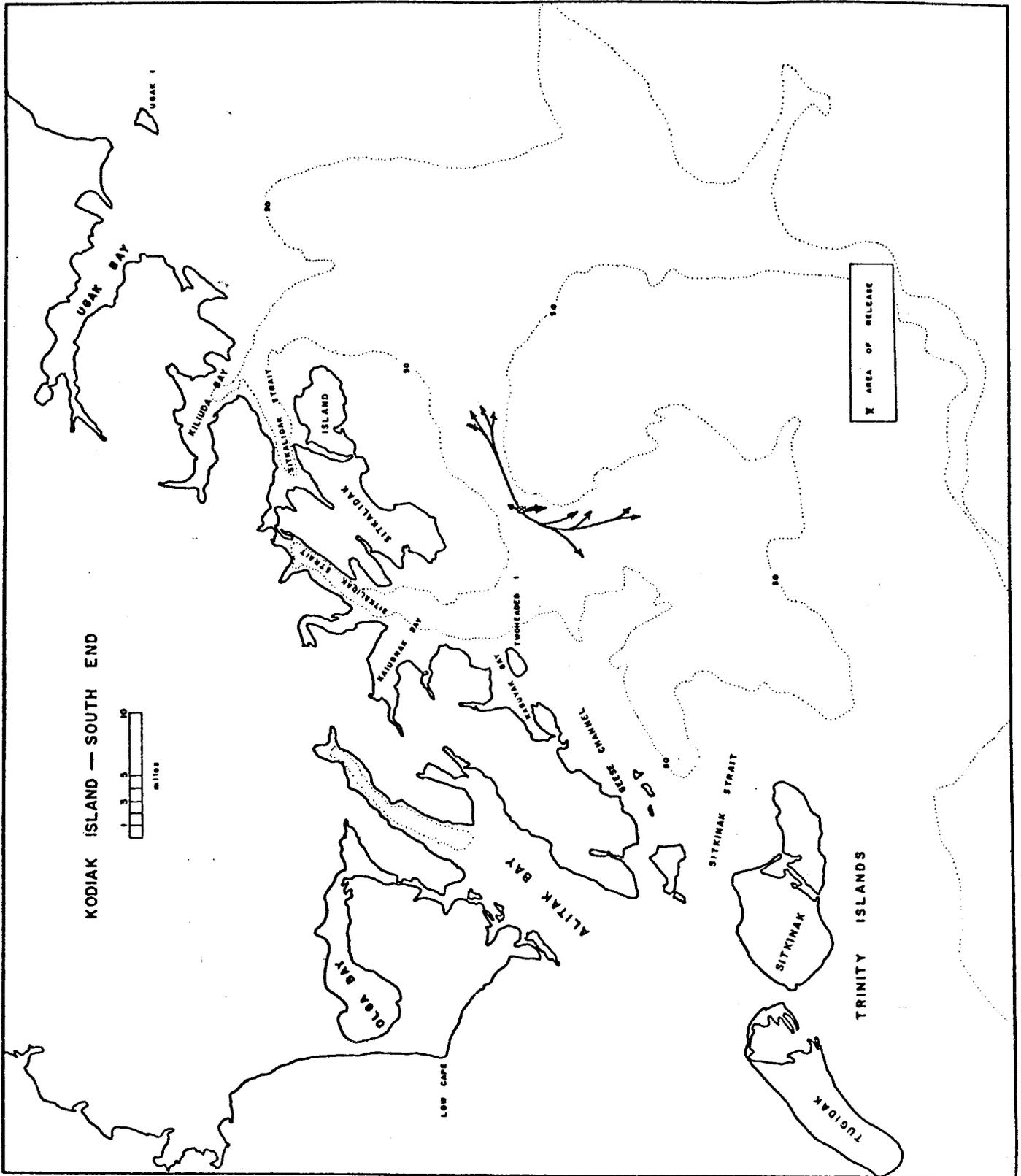


Figure 3. Wheel-like migration that resulted soon after initial release as determined by 18 recaptured tagged crabs caught during late October, 1960.

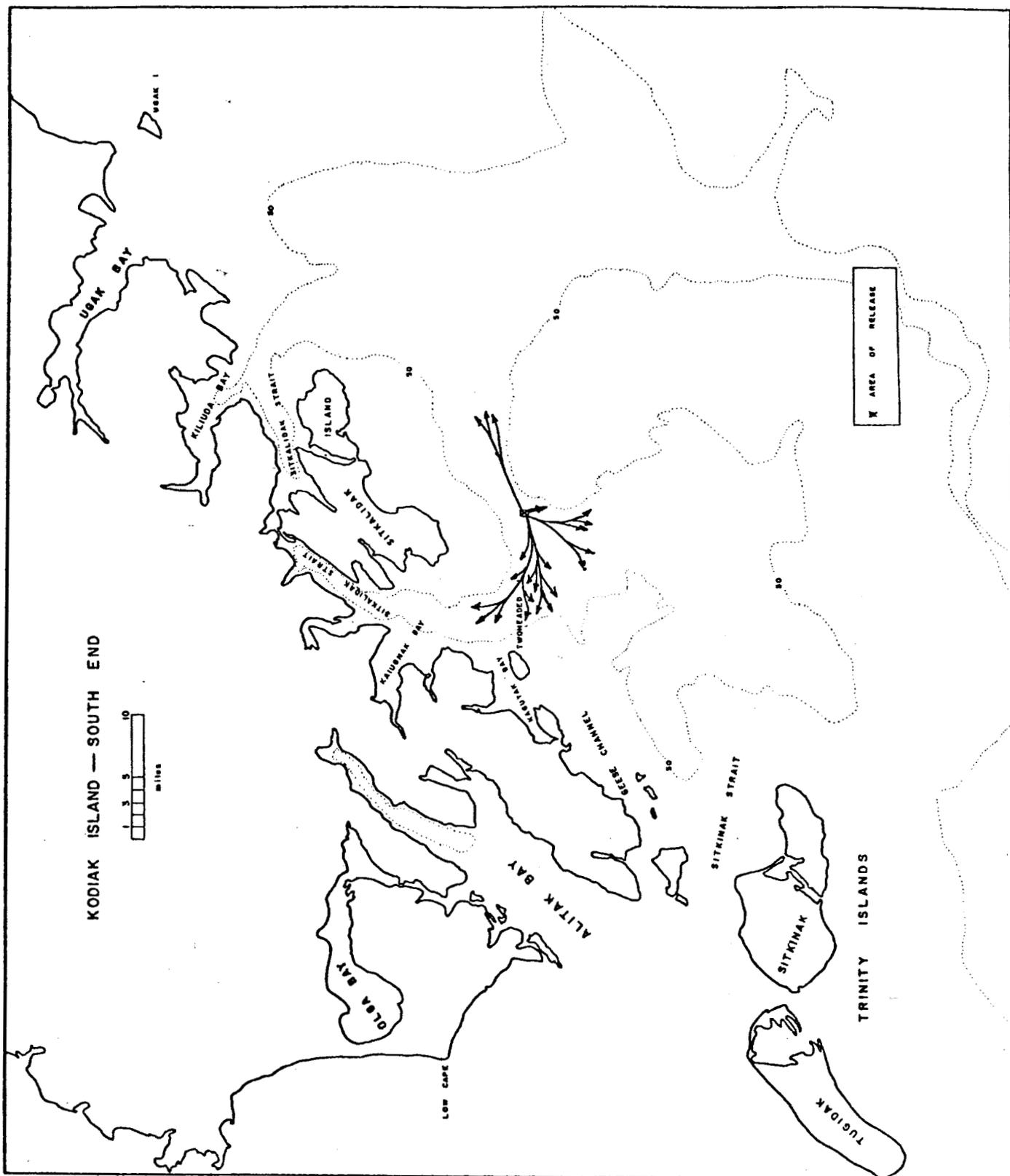


Figure 4. Migration pattern as determined from 26 tagged crabs captured by commercial boats during November, 1960.

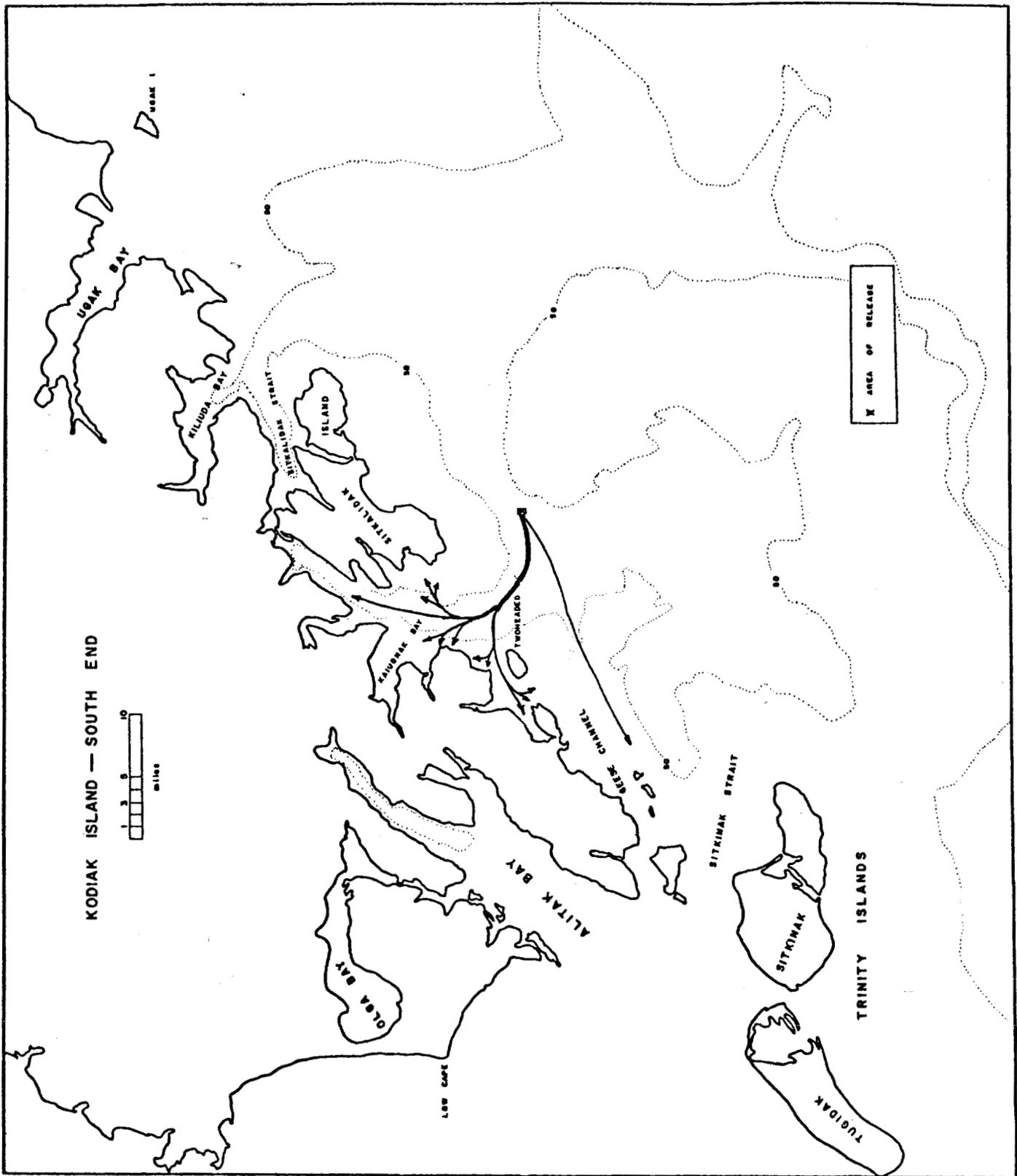


Figure 8. Migration pattern as determined from 13 tagged crabs captured by commercial boats during March, 1961.

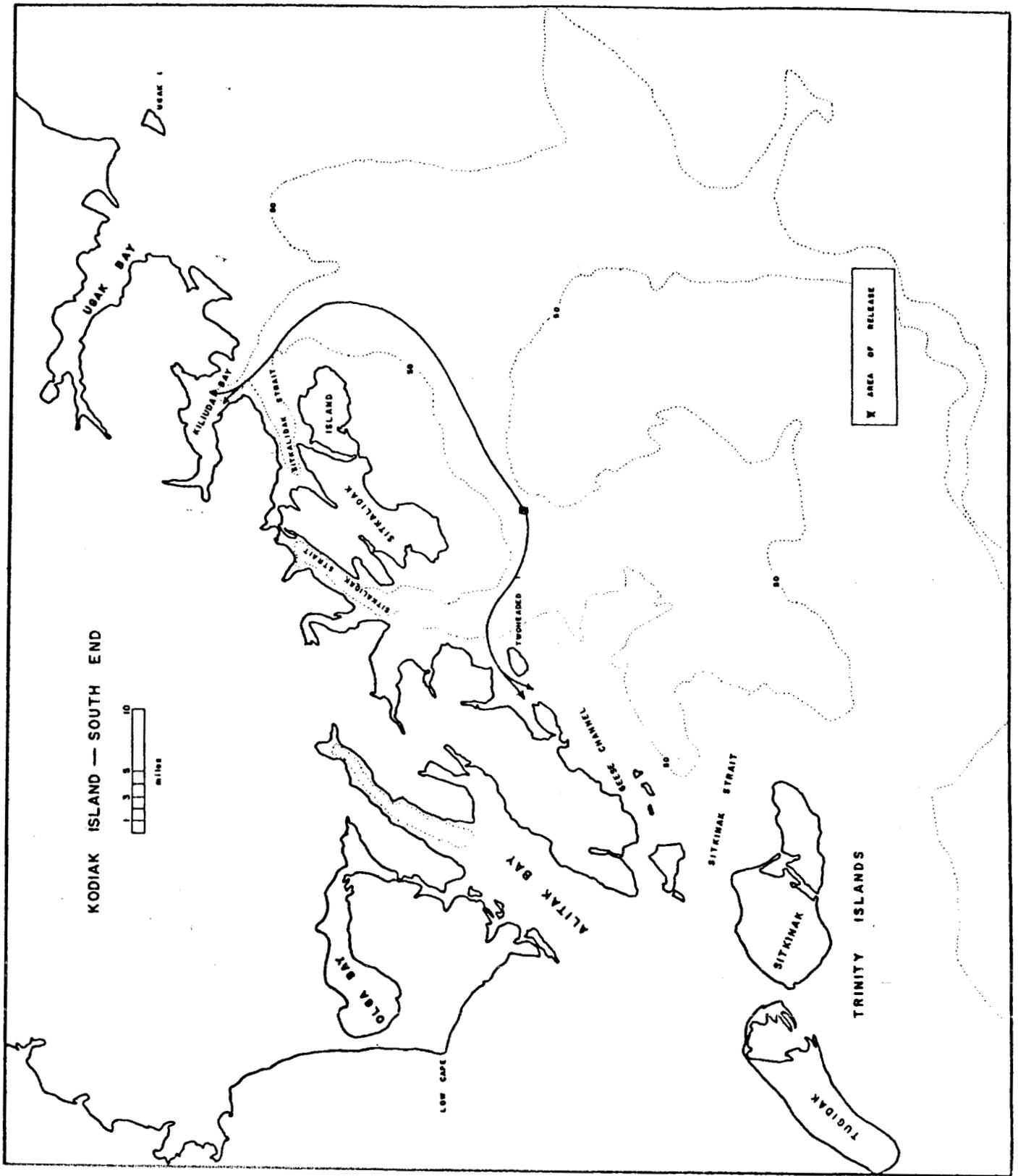


Figure 9. Migration pattern as determined from 4 tagged crabs captured by commercial boats during April, 1961.

Most of the crabs moved directly toward shore to Areas 3 and 4. Increased distance from the release location shows fewer returns. This "in-out" movement rather than along-shore movement is further substantiated by the fact that no tagged crabs were recovered from a heavy harvest of 631,901 crabs in Area 6 of Alitak Bay. Long term studies may provide additional knowledge of along-shore migrations; however, to date no crab has ever been released in one bay and captured in another. This holds true for crabs captured as long as six years after release.

DISCUSSION

Migration

Migratory data show that crab stocks which are harvested in inshore areas by the Kodiak area fishing fleet during the winter are the same crabs that graze offshore in international waters during the summer. Indications are that these crabs are reared in the same area of capture and that each bay has a discrete population. Recoveries of crabs that were released more than once after initial capture also showed inward movements with lingering in one bay rather than intra-bay travel. Migratory patterns suggest that crabs are dependent upon inshore (including Island groups) shallow areas for reproduction and molting.

The question asked now is, do discrete offshore populations exist. With present knowledge, it appears that they do not. The narrow shelf on the southeast side of Kodiak Island, which extends a maximum of 60 miles from shore before dropping rapidly to depths exceeding 300 fathoms is believed to be used only as range for grazing summer crabs. Since these summer crabs are inshore during winter and spring, it is doubtful that offshore areas are populated at this time. If they are populated, increased exploratory fishing and expanded commercial operations will be necessary before stocks will be utilized.

Mortality

The "pot" is the common unit of gear being used to harvest king crabs. Indices of fishing intensity found by tagging and recapture show the pot to be efficient and capable of levying an annual fishing mortality of 30%.

Natural mortality rates require further study. Tag returns indicate slight mortality among the larger actively growing individuals. Predators acting upon these larger crabs seem to be few except for large fishes, which utilize soft king crabs following ecdysis. Before accurate natural mortality estimates can be determined, we must first evaluate tagging mortality and tag loss. In the present study, mortality due to improper handling caused lower returns from the small release group. Limited experiments concerning loss of loop tags (Powell, 1960³) indicate gradual loss increasing significantly during the spring period.

³ Powell, Guy C. 1960. Alaska Department of Fish and Game. Unpublished MS, on file, Juneau, Alaska.

The dart tags used during this study either cause death at molting or are lost during ecdysis. Because of this, we realize that mortality increased during April and May among the tagged crabs as they were molting.

SUMMARY

- (1) Eight hundred large male king crabs were tagged and released twelve miles offshore Two-Headed Island on October 22, 1960.
- (2) Tagged crabs were released in two groups each receiving different handling. One group suffered significant mortality as determined by tag returns.
- (3) A total of 263 crabs were captured by commercial boats the first 218 days following release. Percent harvest of tagged crabs was 38.84 after calculating for known mortality.
- (4) A large scale movement occurred from the point of release toward shore and into the bays. By January, the body of crabs, which were offshore during October had moved into the shallows. Movements were primarily inshore rather than along-shore. There were no indications of discrete offshore populations.

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