

# Movements and Haulout Behavior of Radio-tagged Harbor Seals, *Phoca vitulina*

KENNETH W. PITCHER and DENNIS C. McALLISTER

Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, Alaska 99502

Pitcher, Kenneth W., and Dennis C. McAllister. 1981. Movements and haulout behavior of radio-tagged Harbor Seals, *Phoca vitulina*. Canadian Field-Naturalist 95(3): 292-297.

Movements, haulout area fidelity, and haulout frequency of Harbor Seals (*Phoca vitulina*) were studied in the Kodiak Island area, Alaska, by relocating radio-tagged animals captured on a large hauling area. Eight of 35 radio-tagged seals were found on hauling areas other than the capture site. The longest movement was 194 km and one seal crossed 74 km of open ocean. Movement rates up to 27 km/d were recorded. There appeared to be considerable fidelity to one or two specific haulout locations by individual radio-tagged animals. Resident, radio-tagged seals of a large hauling area were hauled out during 50% of the daily radio checks in June and 41% from 1 August to 5 September. On an individual basis, frequency of haulout ranged from 16 to 80% of the days.

Key Words: Harbor Seals, *Phoca vitulina*; Gulf of Alaska, radio-tagged, movements, haulout behavior.

In common with other pinnipeds, Harbor Seals (*Phoca vitulina*) spend much of their lives in the ocean. At times they haul out of the water onto reefs, beaches, ice, or other suitable substrata where they rest, give birth, and suckle their young. At this time they can be most easily and accurately counted. Several workers have attempted to census Harbor Seal populations by counting hauled-out animals (Rosenthal 1968; Pearson and Verts 1970; Calambokidis et al. 1979). However, because of insufficient information regarding haulout area fidelity and the proportions of populations visible, such counts served only as minimum estimates. A recent study suggests that on the average Harbor Seals spend about 44% of their daily activity budget hauled out (Sullivan 1979). Most published information, based primarily on repetitive observations of recognizable individuals, suggests that at least some animals return repeatedly to the same hauling area (Boulva and McLaren 1979; Calambokidis et al. 1978; Reijnders 1976; Knudtson 1974).

Harbor Seals are considered to be relatively sedentary animals with local movements associated with tides, food, reproduction, and season (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969). These impressions were the results of general observations rather than records of individual movements. The only scientific information of which we are aware on movements of individual seals is from recoveries of animals tagged as pups (Divinyi 1973; Bonner and Whitthames 1974; Boulva and McLaren 1979).

In this study we used radio-tracking techniques to monitor movements and haulout behavior of individual Harbor Seals thereby collecting new and more

comprehensive information on the range of movements, movement rates, haulout area fidelity, and frequency of haulout of Harbor Seals.

## Methods

This study was conducted in the Kodiak Island area of the Gulf of Alaska (Figure 1). The primary study site was the southwestern hauling area on Tugidak Island (56° 27' N, 154° 47' W) where up to 9000 Harbor Seals have been counted on a 3.2-km stretch of gravel beach. Field work was conducted between 8 May and 9 September 1978. Thirty-five seals (including 24 mature females, 5 immature females, 5 mature males, and 1 immature male) were captured on the southwestern hauling area, immobilized with Ketamine hydrochloride (Ketalar; Parke, Davis and Company), and fitted with radio transmitters attached with a bracelet around the base of a hind flipper. The first 21 seals were captured between 8 May and 2 June. Capture operations were then suspended to avoid disturbance during pupping. Fourteen more seals were fitted with transmitters from 3 to 9 July. The transmitters, fabricated by Cedar Creek Bioelectronics Laboratory of the University of Minnesota, operated on separate frequencies in the 164 to 165-MHz range. Signals could be received only when the seals were hauled out. Maximum range of the transmitters was about 8 km. Radio-tagged seals were also marked with individually recognizable color combinations of cattle ear tags placed in hind flippers and vinyl flagging attached to the transmitters to serve as backup identifiers to detect transmitter failure or loss.

Both numbers of radio-tagged seals and total numbers of seals hauled out on the southwestern haul-

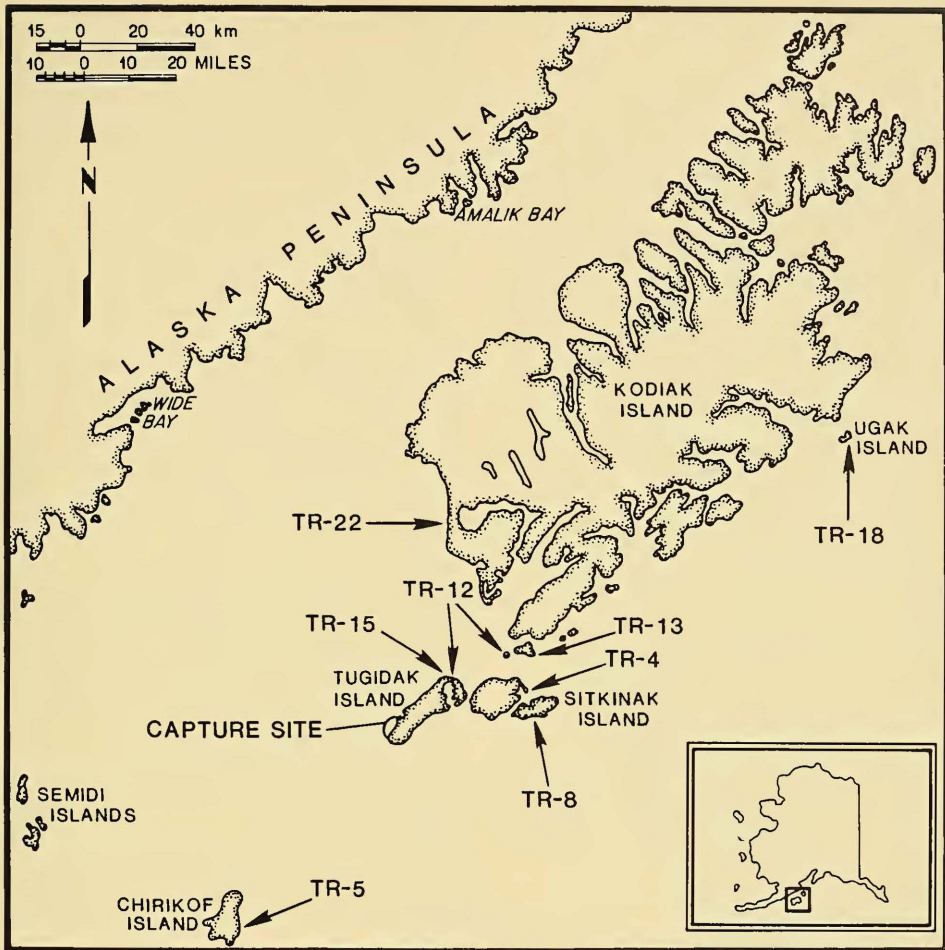


FIGURE 1. Gulf of Alaska study area showing locations of radio-tagged (TR) Harbor Seals found at haulouts other than the capture site on southwestern Tugidak Island.

ing area were monitored on a near daily basis during June and from 1 August to 5 September. Additional observations of radio-tagged seals were made from 9–31 May, but behavior of the animals may have been affected by the disturbance of ongoing capture operations. Radio checks and counts of seals on the southwestern hauling area were made from the top of 30-m bluffs abutting the beach. A portable radio-tracking receiver with hand-held Yagi antenna was used for the onsite radio checks. Seals were directly counted from the bluffs or from polaroid prints taken from the bluffs. Hauled-out seals were examined with 10× binoculars to locate radio-tagged individuals and the results compared with radio checks to detect radio

failures or losses. Radio checks and counts were timed to coincide with daytime low tides when maximum numbers were usually hauled out.

Aerial, radio-tracking surveys, using a scanning receiver, were flown in a Bellanca Scout fixed-wing aircraft or a Bell 206 helicopter. Twenty-seven surveys, totaling 53.6 h, were flown to locate radio-tagged seals that moved from southwestern Tugidak to other hauling areas. Coverage of the surveys included most of the shoreline and all of the known, major haulouts in the Kodiak Island group. Chirikof Island and the Semidi Islands were surveyed twice. The coast between Wide Bay and Amalik Bay on the Alaska Peninsula was surveyed once. Surveys were



flown during lower stages of the tide when the most seals were usually hauled out.

## Results and Discussion

### *Movements*

Eight radio-tagged seals (six females and two males) were relocated 17 times at hauling areas other than the capture site. The longest movement was a minimum of 194 km to Ugak Island (Figure 1). Another animal crossed 74 km of open ocean to Chirikof Island and then returned to southwestern Tugidak. The other movements ranged between 26 and 74 km. The general pattern for these animals seemed to be for them to remain at the new site for some period of time rather than using many locations. Twelve of 17 relocations of radio-tagged seals on haulouts other than southwestern Tugidak were clustered in the northern Tugidak, Sitkinak, southern Kodiak area (Figure 1), which are the nearest hauling areas to southwestern Tugidak. Several different "types" of movements occurred. One seal (TR-18) made a long move to another hauling area which it appeared to use for the remainder of the study period. Another (TR-5) made a long move to a hauling area, then returned to southwestern Tugidak where it appeared to stay for the remainder of the summer. Two radio-tagged seals (TR-4, 13) alternated between two haulouts. Three seals (TR-8, 15, 22) were found at hauling areas other than southwestern Tugidak only once. No correlation between sex and age of the radio-tagged seals and extent or type of movement was apparent; however, sample sizes of all groups except adult females were very small.

It was probable that additional movements of radio-tagged seals occurred. Many of the other transmitter-equipped seals were absent from southwestern Tugidak for extended periods (Figure 2). Only occasional radio-tracking surveys were flown and radio-tagged animals which were not hauled out at the time or in the area of the survey would not have been found.

Information on average movement rates was derived by dividing minimum distances between consecutive sighting by elapsed time. Rates for four animals were 24, 19, 27, and 26 km/d. These rates were minimums because actual routes traveled were unknown and actual travel times were no doubt less than observed in most cases.

Information previously available on movements of individual Harbor Seals was from the recoveries of animals which had been tagged within several weeks of their birth (Bonner and Witthames 1974; Boulva and McLaren 1979; Alaska Department of Fish and Game, unpublished data). They documented dispersal of juveniles up to 250 km from large pupping areas.

Mansfield (1967) remarked on the wandering or dispersal of young Harbor Seals, referring to them as "rangers." Additional insight into the range of Harbor Seal movements comes from offshore sightings. Spalding (1964) reported observations of Harbor Seals 50–65 km offshore in the Gulf of Alaska, and Wahl (1977) saw a seal 80 km off the coast of Washington State.

### *Haulout Area Fidelity*

There appeared to be considerable fidelity to specific haulout areas by individual radio-tagged seals. Twenty-three of 31 (74%) seals that were relocated after capture were found only at the capture site. Of the eight animals that were found on haulouts other than southwestern Tugidak, three were found on the same haulout more than once. Only one seal was found on more than two sites and it was found on only three. Additional use of haulouts other than southwestern Tugidak may have gone undetected, but the consistency of these data leads to the conclusion that few sites are generally used.

Other investigators have also presented evidence suggesting considerable site fidelity. Calambokidis et al. (1978) suggested that both year-round site loyalty and long-distance movements occurred in Harbor Seal populations in Puget Sound. They based this on repetitive observations of uniquely marked individuals and fluctuations of counts of seals on hauling areas. Knudtson (1974) and Reijnders (1976) reported observations of the same animals returning repeatedly to the same hauling area. Divinyi (1973) collected a tagged Harbor Seal on the southwestern Tugidak haulout where it had been tagged as a pup three years earlier. Boulva and McLaren (1979) saw recognizable individuals hauled out in the same area day after day during summer.

### *Frequency of Haulout and Proportion Hauled Out*

Insight into what proportion of the population was represented by counts of hauled-out seals was gained by examining haulout histories of radio-tagged seals (Figure 2). Since more than one hauling area was sometimes used and since only southwestern Tugidak was regularly monitored, it was impossible to quantify precisely the haulout frequency of all radio-tagged seals. To alleviate this problem we subsequently classified certain radio-tagged seals as southwestern Tugidak residents by excluding those found hauled out at other locations and those which were absent from southwestern Tugidak for extended periods. We then examined the haulout data from these animals during two periods with frequent monitoring and minimal disturbance (1–30 June and 1 August–5 September).

In June, resident radio-tagged seals were found hauled out during daily radio checks on an average of

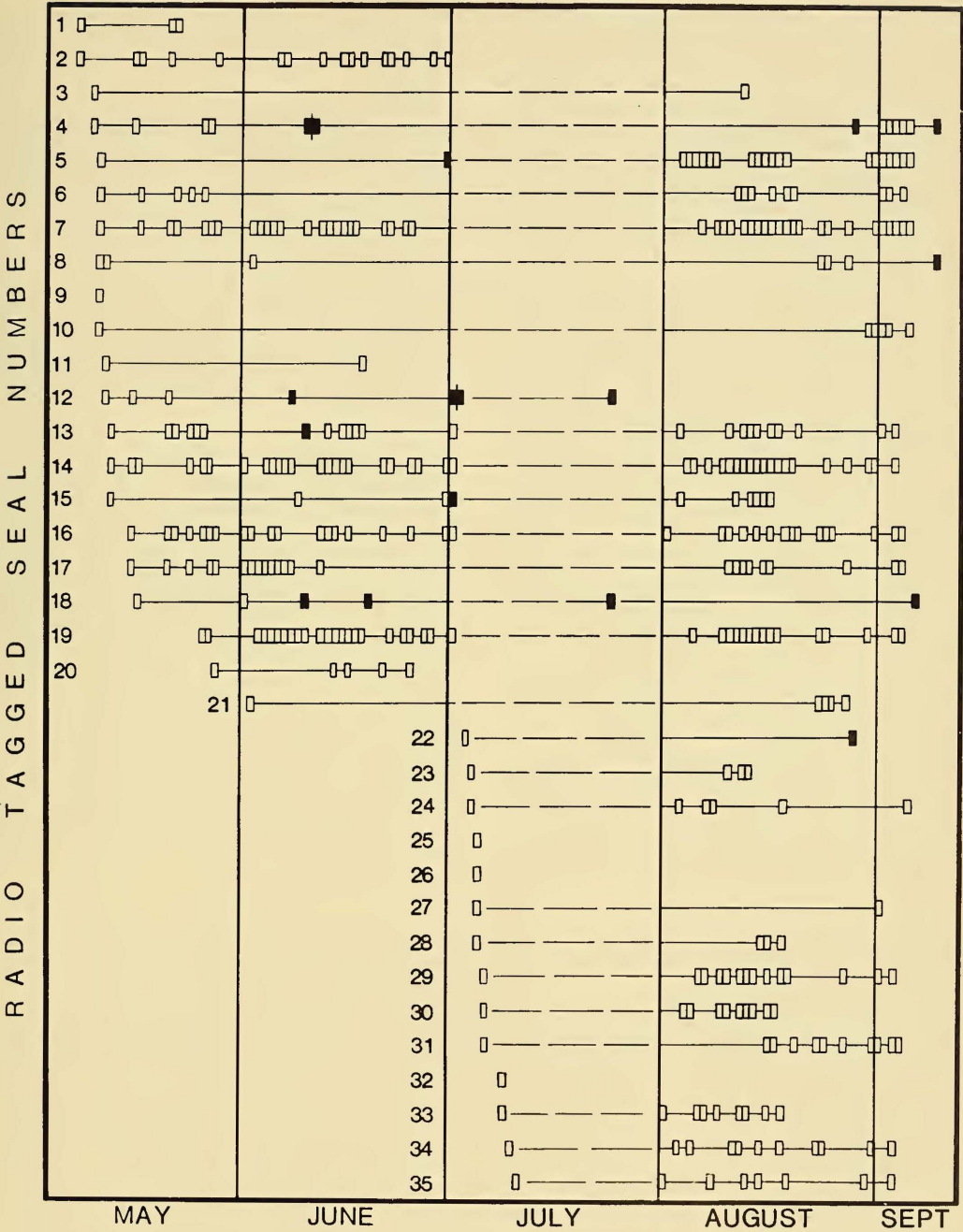


FIGURE 2. Haulout patterns of radio-tagged Harbor Seals on southwestern Tugidak Island showing the presence or absence of each individual during daily radio checks. Open box, present; dark box, found on other haulout; capture operation caused some disturbance between 8 May and 2 June; 25 valid radio checks between 1 and 30 June; no onsite radio checks 2-31 July; 31 valid radio checks between 1 August and 5 September.



50 ± 7% (95% confidence interval) of the days, and between 1 August and 5 September they were found hauled out on 41 ± 5% (95% confidence interval) of the days (Table 1). On an individual basis, frequency of haulout ranged from 16% (TR-20 during June and TR-24 during August–September) to 80% (TR-19 during June) of the days. If the resident radio-tagged animals were representative of the population, the average number of seals hauled out during the daily radio checks probably represented between about 35 and 60% of the total population.

Our findings agree quite well with the results of certain other studies. Sullivan (1979) found that Harbor Seals spent an average of 44% of their daily activity budgets hauled out. Summers and Mountford's (1975) estimate of Harbor Seals in the Wash, Great Britain, based on mark–recapture studies, was considerably higher than numbers seen hauled out. Finley (1979) speculated that midday counts of Ringed Seals (*Phoca hispida*) represented about 70% of the population based on a recognizable individual that was observed 71% of the time.

The effects of capture, handling, and attachment of the transmitter package on the behavior of radio-tagged seals was largely unknown but cannot be entirely ignored. Haulout behavior of radio-tagged seals observed on southwestern Tugidak appeared to be normal. However, some seals developed abrasions where the bracelet encircled the ankle, apparently because of excess rigidity of the bracelet. In one instance, both the health and choice of haulout location of a radio-tagged seal appeared to be influenced by the abrasion resulting from the transmitter attachment. TR-22 was relocated 56 d after capture on a beach not normally used as a haulout by Harbor

Seals. She appeared thin and weak. Her hind flipper at the point of transmitter attachment was badly chafed and infected. We recaptured her and removed the transmitter.

Four radio-tagged seals were never relocated after release. They may have moved beyond the range of the aerial surveys or not have been hauled out during any of the surveys. If the transmitters failed or were lost they would not have been relocated during aerial surveys, but would have been seen on southwestern Tugidak where visual searches were routinely made. Mortality, either related or unrelated to capture and transmitter attachment, could explain lack of contacts. Hammond and Elsner (1977) reported delayed deaths of seals several hours after they appeared to be recovered from immobilization with Ketamine hydrochloride.

Acknowledgments

This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) office. Field assistance was provided by G. Browning, P. Smith, and D. Stevens. Pilots during aerial radio-tracking surveys were P. Buker, R. Wright, and Lts. (NOAA) Christman and Layden. Drafts of the manuscript were critically reviewed by J. Burns, D. McKnight, K. Schneider, and D. Siniff. Thanks are due to R. Reicle and D. Siniff of the University of Minnesota for their assistance and advice on radio-tracking procedures.

TABLE 1—Haulout frequency of resident radio-tagged Harbor Seals on southwestern Tugidak Island

Resident seal number	1–30 June			Resident seal no.	1 August – 5 September		
	Days checked	Days hauled out	Proportion days hauled out		Days checked	Days hauled out	Proportion days hauled out
2	25	11	0.44	5	31	19	0.61
7	25	16	0.64	6	31	9	0.29
14	25	16	0.64	7	31	22	0.71
16	25	11	0.44	13	31	10	0.32
17	25	9	0.36	14	31	19	0.61
19	25	20	0.80	16	31	15	0.48
20	25	4	0.16	17	31	9	0.29
				19	31	15	0.48
				24	31	5	0.16
				29	31	13	0.42
				34	31	10	0.32
				35	31	7	0.23
Overall	175	87	0.50	Overall	372	153	0.41

### Literature Cited

- Bigg, M. A.** 1969. The Harbour Seal in British Columbia. Bulletin of the Fisheries Research Board of Canada 172: 33 pp.
- Bonner, W. N., and S. R. Witthames.** 1974. Dispersal of Common Seals (*Phoca vitulina*), tagged in the Wash, East Anglia. Journal of Zoology, London 174: 528-531.
- Calambokidis, J. A., R. D. Everitt, J. C. Cabbage, and S. D. Carter.** 1979. Harbor Seal census for the inland waters of Washington, 1977-1978. Murrelet 60: 110-112.
- Divinyi, C. A.** 1973. Growth and movements of a known-age Harbor Seal. Journal of Mammalogy 53: 824.
- Finley, K. J.** 1979. Haul-out behavior and densities of Ringed Seals (*Phoca hispida*) in the Barrow Strait area, NWT. Canadian Journal of Zoology 57: 1985-1997.
- Fisher, H. D.** 1952. The status of the Harbour Seal in British Columbia with particular reference to the Skeena River. Bulletin of the Fisheries Research Board of Canada 93: 58 pp.
- Hammond, D., and R. Elsner.** 1977. Anesthesia in phocid seals. Journal Zoo Animal Medicine 8: 7-13.
- Knudtson, P. M.** 1974. Mother-pup behavior within a pupping colony of Harbor Seals (*Phoca vitulina richardi*) in Humboldt Bay, California. M.Sc. thesis, California State University, Humboldt, California. 42 pp.
- Mansfield, A. W.** 1967. Distribution of the Harbor Seal, *Phoca vitulina* Linnaeus, in Canadian Arctic waters. Journal of Mammalogy 48: 249-257.
- Pearson, J. P., and B. J. Verts.** 1970. Abundance and distribution and Harbor Seals and Northern Sea Lions in Oregon. Murrelet 51: 304-305.
- Reijnders, P. J. H.** 1976. The Harbour Seal (*Phoca vitulina*) population in the Dutch Wadden Sea: size and composition. Netherlands Journal of Sea Research 10: 223-235.
- Rostental, R. J.** 1968. Harbor Seal censuses in Humboldt Bay during 1966 and 1967. California Fish and Game 54: 304-305.
- Scheffer, V. B., and J. W. Slipp.** 1944. The Harbor Seal in Washington State. American Midland Naturalist 32: 373-416.
- Spalding, D. J.** 1964. Comparative feeding habits of the Fur Seal, Sea Lion, and Harbour Seal on the British Columbia coast. Bulletin of the Fisheries Research Board of Canada 146: 52 pp.
- Sullivan, R. M.** 1979. Behavior and ecology of Harbor Seals, *Phoca vitulina*, along the open coast of northern California. M.Sc. thesis, California State University, Humboldt, California. 115 pp.
- Summers, C. F., and M. D. Mountford.** 1975. Counting the Common Seal. Nature 253: 670-671.
- Wahl, T. R.** 1977. Sight records of some marine mammals offshore from Westport, Washington. Murrelet 58: 21-23.

Received 8 November 1980

Accepted 5 March 1981