HAUL OUT AND ASSOCIATED BEHAVIOR OF THE HARBOUR SEAL (PHOCA VITULINA L.) IN BARKLAY SOUND, B.C.

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August 27, 1986

ABSTRACT

Based on observations of the Harbour Seal (Phoca vitulina L.) at Baeria Rocks and the Geer Islands, British Columbia, a model outlining aspects of haul-out behavior is proposed. Seal haul-out and activity levels peak at low tides. A second peak of activity is observed at high tide. Interactions during haul-out are limited, with little spacing or aggressive behavior. Animals are alert and responsive to intrusion. Surveillance frequency is inversely proportional to group size; increasing with decreasing group size. Diving patterns are recovery,rather than preparation, limited.

INTRODUCTION

The Harbour Seal (Phoca vitulina Linnaeus 1758) ranges in the Pacific from the central Bering Sea (69 35'N, 139 W) to Baja California (28 12'N) (Newby, 1973). In British Columbia, it is dispersed evenly along the coast in favored areas including tidal-mudflats, sand bars, estuaries, and reefs (Bigg, 1969;1981). It forms small loose groups; 30 typically, but up to 100 to 150 animals have been noted.

Studies of the Harbour Seal have mostly been concerned with reproduction and development (Newby, 1973; Bigg, 1965;1969; Boulva and McLaren, 1979; and Bigg, 1981 for a review). Other studies have concentrated on collected specimens, such as that by Stutz(1967) on pelt variation.

Behavioral studies on the Harbour Seal have been carried out on mother-young interactions and on seasonal distribution patterns (Brown and Mate, 1982; Newby, 1973; Bigg, 1981). Other behavior studies have included haul-out patterns. This involves the small herds of seals coming out of the water to rest in sheltered areas (Bigg, 1969). Haul-out probably serves as a thermal conservation tactic and allows the animal to subsist on one large meal per day (Boulva and McLaren, 1979). When hauled out, animals spread themselves out, keeping several feet between individuals, through aggressive gestures that include head butting, snotting, growling, biting, and fore-flipper waving (Bigg, 1981). Aggressive vocalizations are considered to be the only vocalizations made past weaning (Bigg, 1981). The seals sleep lightly, waking up periodically to survey their surroundings (Bigg, 1981). The effectiveness of their continues surveillance is relected in their rapid dispersal in the water with minimal disturbance (Allen et al., 1984; Bigg 1969;1981). Passing aircraft, ar any human activity within 100m results in this disturbance reaction (Allen et al. 1984). They also report a correlation between number of seals and low tide, with an additional peak in mid-afternoon.

Intensive studies on detailed behavior during haul out are lacking, Grayhill (1981) providing an exception, but which was, unfortunately, unavailable for review. This current study attempts to provide a basis for a working model of haul out patterns, associated behavior for Harbour Seals in Barklay Sound, British Columbia.

MATERIALS AND METHODS

Data collection was carried out at three sites in two areas of Barklay Sound, British Columbia: Baeria Rocks (48 57'3"N; 25 9'2"W) and Geer Islets (48 55'8"N; 125 6'6"W). Observations at Baeria Rocks were taken from a small (5m) boat anchored 100-150m off shore. Two shore based observation sites were used in the Geer Islets, with two seal haul out sites observed (Fig. 1). Observation was through binoculars or a 60mm telescope. Dates and times of observation showing correlation with tides are summarized in Table 1. At all sites, observation was restricted by several factors. Disturbances by passing boats, high winds, rough water conditions, and thick morning fog all influenced observation time. At Geer Islets, counts were undertaken every 15 minutes while conditions permitted. Position of animals included observations on geometric relation to the shoreand position in relation to the intertidal zone. Movements wererecorded where animals changed location on the haul-out site. Aggressive behavior included any interaction (Bigg, 1981) forcing movements of animals on site. Any vocalizations were noted and corresponding behaviors observed. Survey behavior of animals included lifting the head from resting position and observing the surroundings. Frequency of surveillance was also recorded. Disturbances and their overall affect on behavior were noted whenever they took place. An all-occurence sample of diving patterns was recorded for a single animal on August 10 for a period of one hour at Geer Islands. Surface intervals and dive durations were recorded.

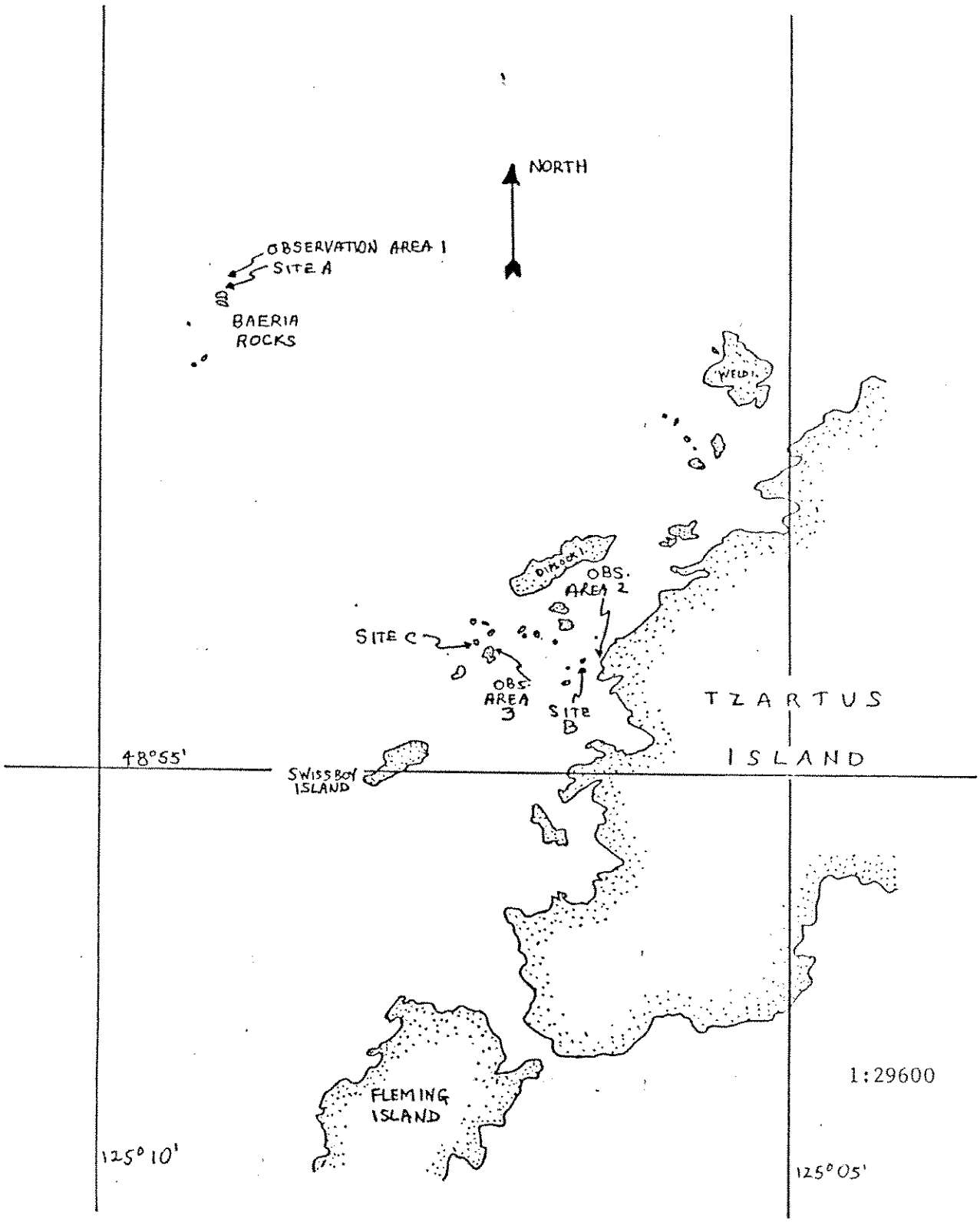

Fig. 1: Observation sites in Barklay Sound;

Table 1: Observation times showing corresponding tidal cycles

DATE	TIME (BEGINING)	TIME (END)	TIDE		
6 AUG.	11:45	13:35	LO	07:30	1.4'
			HI	14:20	9.3'
9 AUG.	10:11	11:07	LO	09:24	2.0'
			HI	15:51	10.2'
10 AUG.	12:27	13:16	LO	09:58	2.6'
			HI	16:26	10.3'
13 AUG.	19:45	20:30	HI	18:50	10.4'
			LO	02:05 (14 AUG)	2.5'
14 AUG.	06:30	16:30	LO	02:05	2.5'
			HI	08:37	7.4'
			LO	13:25	5.3'
			HI	19:37	10.6'
15 AUG.	10:00	15:57	HI	10:04	7.6'
			LO	14:47	5.5'
			HI	21:07	10.6'
23 AUG.	11:30	12:30	LO	09:28	2.4'
			HI	15:48	10.5'
24 AUG.	14:30	15:30	LO	10:01	3.3'
			HI	16:20	10.3'

RESULTS

Haul-out Cycles

Results of counts of hauled out animals with tidal correlations are seen in Table 2. Counts from Geer Islands spanning two tidal intervals (low to high and high to low) are depicted graphically in Fig. 2 and 3. These figures indicate that the number of hauled out animals is greatest at low tides. Instantaneous counts at various times at Baeria Rocks confirms this trend. The numbers of hauled out animals also fluctuates the most at low tide. This is a function of the fact that near low tide many animals are seen returning to the water and also hauling out. Due to the large population at Geer Islands and the great distances involved, it was not determined if this represented many animals returning to the water and hauling out sometime later, or a few animals doing so more frequently. All other instances of observations of haul-out patterns were interrupted by disturbance resulting in dispersion of animals and were consequently not used in the graphical analysis.

Haul-out Positions

Seals were found in small groups of animals or scattered more randomly on the leeward side of the rocks. For example, on Baeria, a cluster of 6 to 8 animals in close proximity, often touching, were surrounded by the remainder of the population, which were scattered randomly over 75m of shore. This same trend was seen at Geer Islands, except that 2 to 3 groups of similar size were seen. Again, the remainder of the population were scattered randomly over the rocks.

The typical alignment of scattered animals was parallel to the shoreline in the intertidal zone (as indicted by a band of Fucus). Similarly the clustered groups only occupied the intertidal, but were positioned randomly relative to shoreline.

Movements

Animals were only infrequently seen to change position on the haul-out sites. This was most commonly accomplished by returning to the water and hauling out in a new position, often on the opposite side of a cluster. Incidents where this occurred includes:

1) August 9 10:39 Baeria
2) August 14 15:18 Geer
3) August 15 14:40 Geer

Table 2A: Haul out counts for Baeria Rocks (Area A).

DATE	TIME	TIDE			NO. HAULED OUT
6 AUG.	12:00	LO ↓ HI	07:53 ↓ 14:20	1.4' ↑ 9.3'	2
9 AUG.	10:11	LO	09:24	2.0'	11
	10:25				8
	10:32				9
	10:39				8
	10:40				9
	10:50				9
	11:07	HI	15:51	10.2'	4
10 AUG.	12:27	LO	09:58	2.6'	0
	12:33				0
	12:57				8
	13:00				0
	13:07				0
	13:16	HI	16:26	10.3'	0

Table 2B: Haul out counts for Geer Island (Area B)

DATE	TIME	TIDE			NO. HAULED OUT
6 AUG.	11:45	LO ↓ HI	07:53 ↓ 14:20	1.4' ↓ 9.3'	0
10 AUG.	13:41	LO	09:58	2.6'	0
	14:11				0
	14:44	HI	16:26	10.3'	1
14 AUG.	06:30	LO	02:05	2.5'	FOG
	09:30	↓ HI	↓ 08:37	↓ 7.4'	FOG
	12:30	↓ LO	↓ 13:25	↓ 5.3'	FOG
	13:36	↓ HI	↓ 19:57	↓ 10.4'	1

Table2C: Haul out counts for Deer Island (Area C). Rock 'i' and 'ii' refer to the principle and a secondary site (see "Movements"

DATE	TIME	ROCK	TIDE			No. HAULED OUT
14 AUG.	13:43	i	LO	13:25	5.3'	35
	13:48	i				37
	13:52	i				37
	14:07	i				37
	14:22	i				37
	14:37	i				38
	14:53	i				42
	15:08	i				31
	15:23	i				28
	15:40	i				29
		ii				7
	15:56	i				27
		ii				8
	16:10	i				21
		ii				0
	16:17	i				18
		ii				0
	16:38	i				15
		ii				0
	16:50	i				12
		ii				0
	18:30	i, ii	HI	19:57	10.4'	0
15 AUG.	10:00	i	HI	10:04	7.6'	3
	11:00					3
	12:00					4
	12:30					5
	13:00					8
	13:30					15
	14:00					13
	14:15					15
	14:30					13
	14:43		LO	14:47	5.5	14
	15:00					17
	15:19					22
	15:33					22
	15:45					28
	15:57		HI	21:07	10.6	20

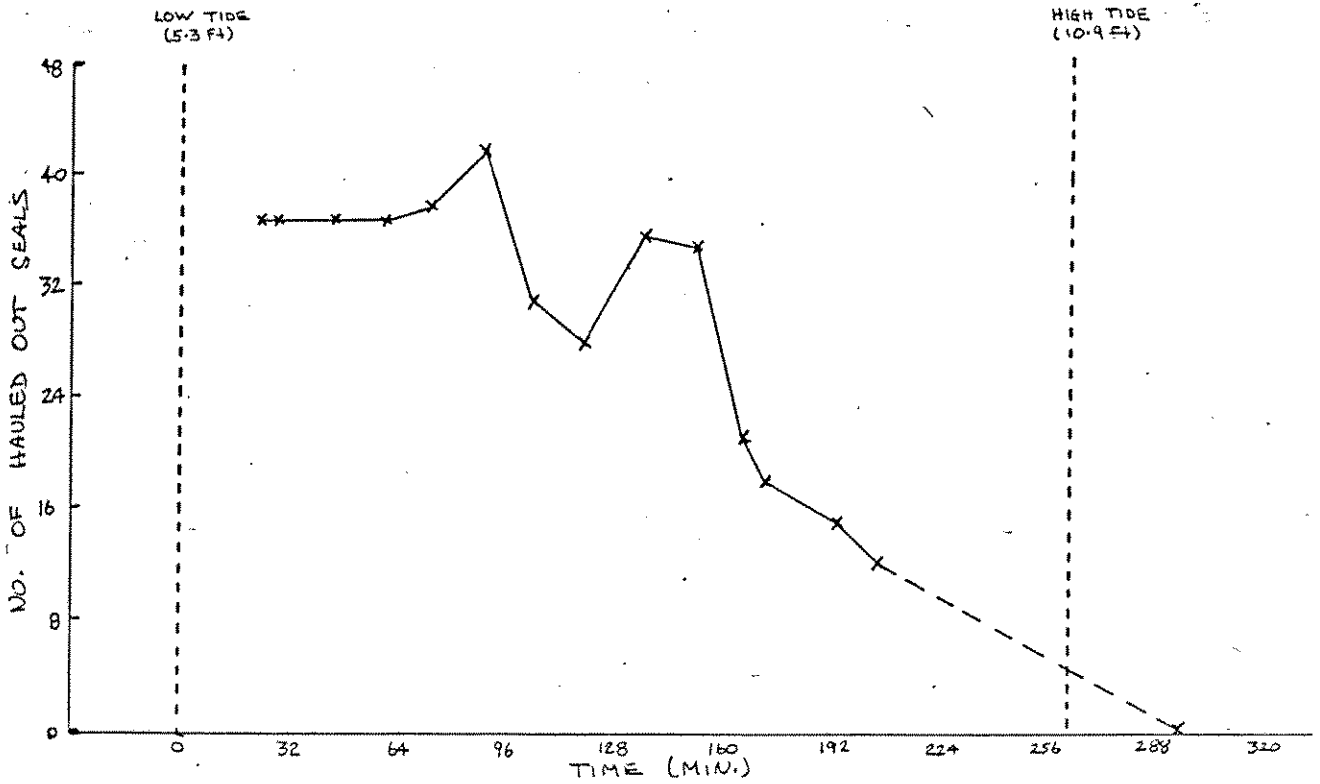

Fig. 2: Haul out over a complete (Low to High) tide cycle (From Aug. 4, 13:43 to 18:30) for Geer Island, area C.

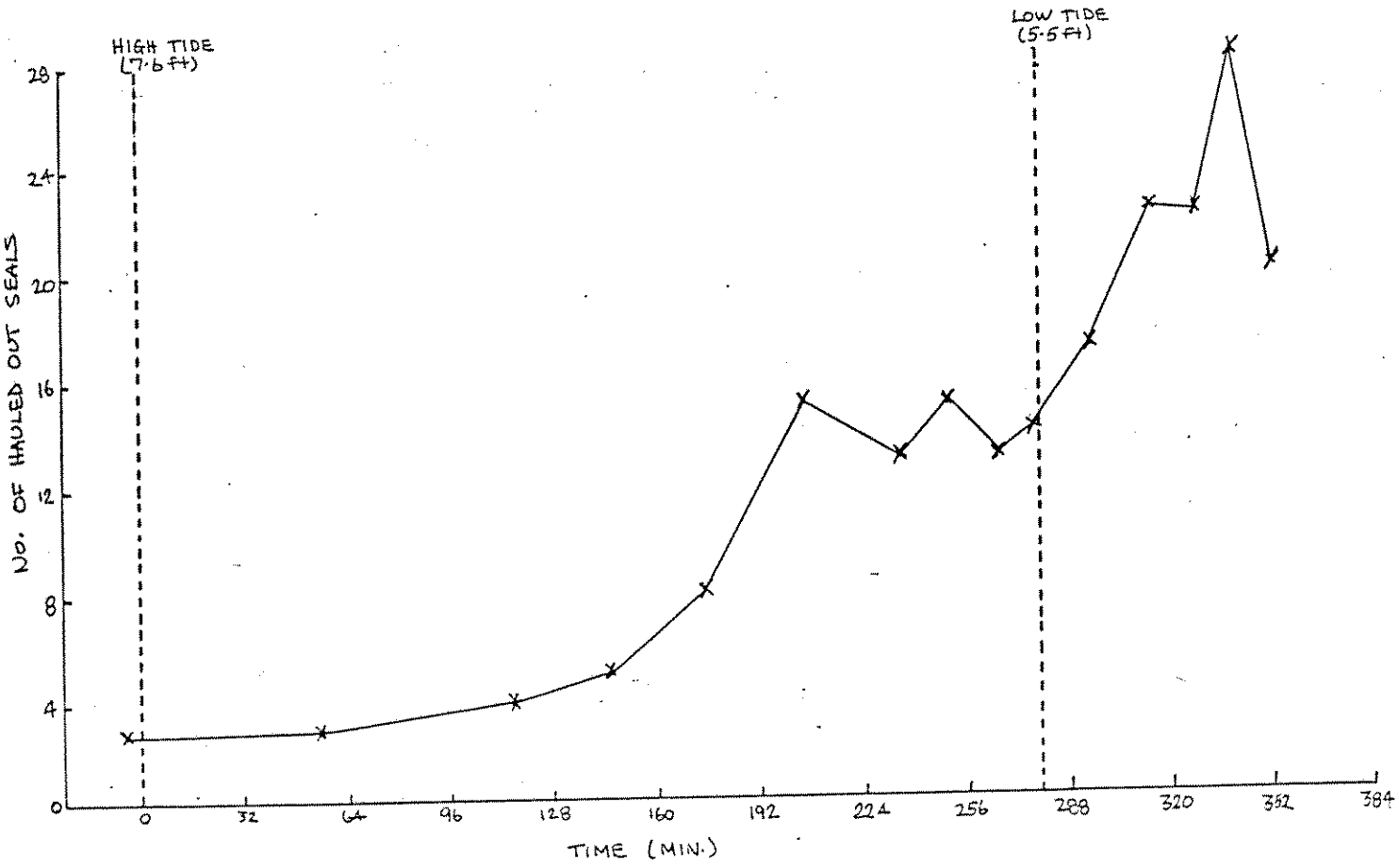

Fig. 3: Haul out over a complete (High to low) tide cycle (From 15Aug. , 10:00 to 15:57) for Geer Island, Area C. Note vertical scale differs from that of Fig. 2.

Other movements includes a single animal at Baeria on August 9 at 10:50, which was observed climbing approximately 3 m above the high tide mark where it remained for 6 minutes and then returned to its original position in the intertidal. No subsequent movements of this animal were seen.

At Geer Island on August 14 from 14:53 to 15:20, animals were seen to leave the main rock, swim across to a smaller rock, and rehaul-out. Only small numbers of animals (Table 2) hauled out at this site, however, as the shoreline was steep and many attempts at hauling out resulted in the seal falling back into the water or being washed back in.

Aggressive Encounters

Only two instances of aggression were observed. At 14:00 on August 14 at Geer, one seal approached a second one that was hauled out. The established animal rapidly waved its fore-flippers towards the approaching animal causing it to withdraw. The second instance of aggreesion occurred on August 15 at 14:51 on Geer Islands. This encounter involved an instance of head-butting where two animals, lying in close proximity, hit each other with the sides of their heads. This behavior was repeated 2 to 3 times with no apparent subsequent change in behavior.

Vocalizations

On August 9 at Baeria Rocks, two series of vocalizations were heard; one at 10:11 and another at 10:32. Each series lasted for 3 to 5 minutes with vocalizations spaced approximately one minute apart. The sound was characterized by a gradually ascending tone with a short, rapid upsweep at the end. The source of the vocalizations could not be determined precisely. The first series occurred when 11 seals were hauled out with none visible in the water. One seal was seen hauling out during the second series, but it was impossible to ascertain whether or not the vocalizations were directed at it.

A single seal was heard producing grunting and snorting sounds while hauling out at Geer on August 24 at 11:30. The sounds proudced were not conclusively directed towards another seal, although one was observed in the immediate vicinity. The sounds were initiated while the seal was in the water and continued until the animal was settled on the haul-out site approximately 3 minutes later.

Surveillance Behavior

A solitary hauled out seal was observed on August 14 at 13:16 at site B of the Geer Islands. Approximately every 10 seconds the animal looked up and took a general survey of the area, taking about 2 seconds for each survey. At 15:12 that day at site C of the Geer Islands, observations of a single animal and a group of 8 revealed that the single animal surveyed once every 30 to 40 seconds, while the group surveyed less frequently (approximately every 3 to 5 minutes). It would appear that solitary animals survey more frequently than those in larger groups.

Disturbances

The most easily disturbed animals were a mother and her pup which were scared into the water by a passing cormorant on August 6 at Baeria. They appeared very nervous prior to the encounter, although possibly due to our presence, and dove in immediately after the first noise was heard. The seals remained in the water for half an hour before hauling out again.

At Baeria Rocks on August 9 at 10:32, several animals appeared disturbed by a passing boat. The animals , which are normally motionless, stirred for a few minutes until the boat was well out of the vicinity.

At 11:07 another boat passed by, but produced no visible agitation within the seal group. The boat, however, moved to within 10m causing all except for four seals to clear the haul-out site. The weather grew progressively worse, forcing the eventual evacuation of the observers and thus making rehaul-out timing impossible.

Eight hauled out seals dove into the water at 12:59 as our boat came around a corner and approached to within 70m. The seals were very nervous while we remained in the area, and they were still in the water after we circled the rock and returned to the site 17 minutes later. All the individuals had formed a large aggregation by the time we returned, but they still appeared agitated. The group scattered somewhat upon our return and one individual performed a "spy-hop" (coming vertically out of the water exposing one third of its body).

A group of 35-40 seals dove into the water on August 23 at11:30 at Geer Islands, apparently as a result of a helicopter overhead. They were previously relaxed and appeared unstressed, but became more agitated after entering the water and noticing our presence. A few individuals followed us along the shore of the island as we returned to our camp. Two members of the group continued watching us from 75m offshore for about 20 minutes after the incident.

Diving

On August 13 from 19:45 to 20:30 at site B at Geer, a solitary seal was observed diving. This individual would surface for a variable time and dive with a splash. Large numbers of salmonids were observed jumping during this time, and thus it is assumed that the seal was feeding. Times of dives and surface intervals are seen in Fig. 4. The average surface interval was 14.4s (SD=10.99) and the average dive time was 62.6s (SD=57.4). At the same site onAugust 14 another solitary animal was observed diving. This was during the late evening, however, when light was bad and thus no timings could be recorded.

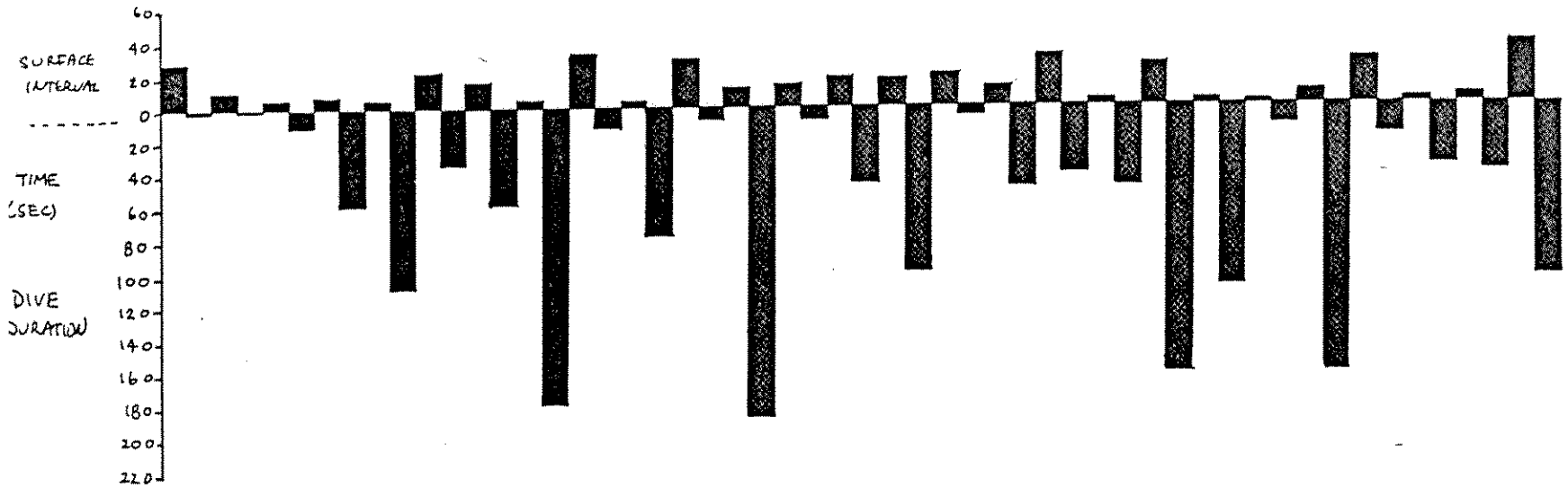

Fig. 4: Diving and surface intervals for a solitary seal at Geer Island, Area B.

DISCUSSION

General trends in tidal correlations with haul-out behavior are seen in Fig. 2and 3. Numbers of hauled out seals are at a peak at or near low tide. This finding is in agreement with Allen et al. (1975). Instantaneous counts of hauled out animals confirms this trend for maximum haul-out at low tide. Correlation of haul-out with time of day, however, were not carried out. Fig.2 and 3 indicate a high degree of instability of numbers hauled out at low tide and is likely a function of increased activity level at this time. For approximately one hour before and after low tide many seals were observed hauling out and returning to the water. This trend was seen more definately at Geer Island. Due to the distance factor and the large number of seals at this site, however, it was impossible to ascertain cycle times for any one animal. The increase in activity level is hypothesized to be correlated with peak efficiency of foraging at low tide, possibly due to increased availability of prey.

Observations of aggressive behavior and general haul-out positions were not in total agreement with Bigg(1981). Seals did not maintain spacing of several feet between them, in fact, clusters of seals were seen in close proximity and even touching at both Baeria and Geer. Perhaps this lack of spacing is related to the few instances of aggressive encounters. Only two instances of aggression (one fore-flipper waving and one head-butting) were observed during the entire study period. Other times of the year , such as during reproduction, may show more aggression among individuals.

Animals were always hauled out in the intertidal zone. One animal

[illegible] areas, the seals perferred to return to the water. An alternate explanation could be that fishing success is higher at tidal extremes in general and that the abandonment of haul-out sites is fishing rather than substrate related.

Movements in the haul-out sites were minimal. Animals appeared to prefer to return to the sea and swim around to another area rather than disturb other animals or walk over the rocky intertidal. This observation likely reflects their increased mobility in water making location changes quicker and easier. The lack of vocalizations was a reflection of the sparsity of other aggressive or hierarchal behaviors. The paucity of data, however, precludes elaborate elucidation of generalities concerning their significance.

Minimal surveillance was observed during haul-out of large groups of animals contradicting the frequency reported by Bigg (1981). It is assumed that periodicity of surveillance was controlled by group size. Solitary animals surveyed the area fairly constantly, whereas, large groups surveyed infrequently. This is reflected in the fact that large groups individuals were only required to look about occaisonally to ensure safety. In small groups, however, animals are required to survey continuallyfor signs of threat or intrusion.

Disturbance patterns followed those of Allen et al. (1984). Intrusion within 100m caused hauled out individuals to return to the water. Once in the water, however, seals showed a high degree of curiosity, following the observers when they were on land or in a boat. This arousal indicates that seals are more secure in the water and that they are more vulnerable when hauled out.

Diving cycles, such as that represented in Fig.4 may represent periods of fishing. The repetitive nature of the dives, with minimal surface times coupled with the appearanceof fish jumping at the surface of the water, provides a basis for such an assumption. It appears significant that the apparent strategy is for recovery rather than preparation for dives. Recovery includes minimizing the length of subsequent dives and extending the surface interval immediately after a long dive. Preparation would include an extended surface interval prior to the dive, which was not observed. Due to the nature of their prey, seals probably adapted to diving in succession with minimal surface time. This would allow seals to be able to have short dives for locating prey and then longer dives for prey capture.

SUMMARY

Based on the overall observations the following model of seal behavior is proposed.

Animals haul-out in increasing numbers towards low tide, when activity is at a maximum. Activity and perhaps fishing is also high at high tides, when haul -out is minimal. Animals generally are unaggressive; hauled out individuals occassionally lying in close proximity to each other, often touching, with no apparent conflict. During haul-out, surveillance is proportional to group size; larger groups showing less frequent surveys per individual than for small groups. Observation of disturbances, often in the form of an intrusion within 100m, results in the return of the animals to the water. Dives, presumedly for fish, are limited by recovery from long dives, rather than in preparation for them.

ACKNOWLEGEMENTS

The authors would like to express their appreciation to Beth Mathews and Jim Darling for their assiastance in initiation of the project. Gratitude is also extended to Mike Bigg for his suggestions and comments throughout the study.

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