

**SOCIAL ORGANIZATION OF HARBOUR SEALS (*Phoca vitulina concolor*) IN SPRING AND EARLY
SUMMER AT INDIAN POINT, MT. DESERT ISLAND, MAINE**

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Harbour seals at the 'nursery site', Indian Point, Mt Desert Island, Maine, 1976.

Abstract

A colony of harbour seals, *Phoca vitulina concolor*, was observed between April 25 and July 11 1976 at Indian Point, Mt Desert Island, Maine. During this period about 85 adults and juveniles and 45 pups were recorded at the site. Observations at high tide and ebbing tide revealed that seals at this haul-out site were organised into sub-groups consisting mainly of peers, i.e. all adults, juveniles, mother-pup pairs, or weaned pups. Mean group size was 10.3 (range 2–36, n=35). Groups of adults, juveniles or newly-weaned pups arrived from the sea at high tide and remained in the water in their discrete groupings until the first ledges were exposed. While in the water group members surfaced and submerged at intervals of about one minute. As the tidal ledges were exposed, the seal groups hauled out, retaining their group identity. Pup groups tended to haul out beneath juvenile groups. Haul-out was often preceded by one or more seals porpoising and splashing alongside the haul-out ledge or between ledges. Seals hauling out sometimes made naso-naso or naso-body contact with their nearest neighbours, or rubbed their hind-flipper together. Such interactions were usually amicable, resulting in flippering, growling or lunging on only 11/69 occasions. It is suggested that the groups seen in the water functioned as foraging groups, and the haul-out site functions as an 'information centre' for at least 3–4 foraging groups hauling out here. This haul-out colony provided groups of weaned pups with the opportunity to follow older juveniles to foraging grounds. The observations made during this study contra-indicated the idea that harbour seal colonies are anonymous aggregations of animals.

Introduction

The purpose of this study, carried out in the spring of 1976, was to describe the composition of a harbour seal colony at a haul-out site in Maine, and to estimate the impact of different features of the haul-out site on the structure of the colony.

Where harbour seal haul-out sites are in the littoral zone, seals tend to haul out on the ebbing tide (Scheffer and Slipp, 1944; Venables and Venables, 1955; Wipper, 1975), although where land above the high water level is used, the tidal cycle may be less important than the diurnal cycle or other factors in governing the seals' movements toward and away from the shore, and hence their daily activity of activity and rest (Bishop, 1967; Wilson & Kleiman, 1974; Bonner, 1976). Wipper (1975), studying *P.v. vitulina* in the North Sea, observed that few seals hauled out at night. This author considered that the tendency for harbour seals to congregate during the spring and summer at inshore ledges or sandbanks surrounded by shallow water is due to their requiring land for successful parturition and also for 'sunbathing', since (a) newborn pups have poor temperature regulation and therefore need to spend much time hauled out, and (b) the annual growth spurt of juveniles and the seals' annual moult, which also takes place during these months, require high levels of vitamin D, which necessitates continued exposure to UV rays. In the past, the shallows must also have provided a refuge from large marine predators, although now the nursery congregations are easy prey for man. Wipper pointed out that these seals' ability to swim powerfully with relatively economical movements of the hind flippers renders even the youngest seals capable of swimming into the shallows against the receding tide, and vice versa.

Before and as they hauled out to rest, juvenile seals have been observed engaging in complex social interactions, mainly of a playful nature (Wilson, 1974b, Wilson & Kleiman, 1974). Since mammalian social play is widely believed to be instrumental in establishing and maintaining social relationships between young conspecifics (e.g. Bekoff, 1972), these seal groups were thought to be composed of individuals among whom a network of social relationships, probably of a long-term nature, existed. The long period of immaturity (about 4-5 years in harbour seals) is consistent with this view. However, an opposing view has been suggested, i.e. that *P.v. richardii* is 'loosely gregarious on land but as a rule solitary when foraging' (Scheffer and Slipp, 1944) and forms 'almost casual associations which dissolve with each flood tide and reform, seemingly without plan, on each ebb, being a 'society of strangers' (Knutson, 1974). However this 'anonymous herd' view was not supported by any descriptions of haul-out behaviour.

This study was therefore designed to gather detailed records of the haul-out patterns of a colony of harbour seals in order to give a firmer basis to the author's theory that the herd is structured and owes its overall structure to the way in which individuals of similar age tend to associate in the water and haul out together.

The study site

The seal haul-out site observed in this study was an archipelago of tidal ledges situated in a channel between two islands (Green Island and Black Island) in Blue Hill Bay, at Indian Point, West Mount Desert Island, Maine. The archipelago comprises two clusters of ledges which are about 300m apart at their nearest point.

The *mid-channel ledges* consist of a line of five ledges (sites I–V) on two separate shelves (I–III and IV–V) surrounded by water of c 6m depth. As the tide recedes, site I is exposed first, then sites II and III, and lastly sites IV and V. The *nursery site* lies closer to Green Island. The ledges arise from two shelves (VI and VII) lying almost parallel and separated by relatively shallow water (the *lagoon*) of c. 3m depth.

Ledges I–III and VI–VII dropped steeply into the water on the Black Island side, while IV and V sloped gently on both sides. The underwater shelves supporting the ledges extend between 3–8m from the visible ledges.

The *nursery ledges* are partly exposed at high tide, whereas the *mid-channel ledges* are completely covered at high tide, and the surrounding water tended to be rougher than around the nursery ledges. The *mid-channel ledges* had a rough, irregular surface. Site VI of the nursery ledges had a very smooth surface sloping gently into the water at about 30°. Site VII had a rougher surface and a slightly steeper angle of 35–40°.

The seal haul-out site was observed daily from high tide until half-tide. This period included the seals' return to the tidal ledges as the tide receded until the haul-out was complete and there were virtually no seals in the water. This 3-hr period after high water was considered to be the time when the behaviour and the social organisation of the seals could best be studied.

Methods

The study period was April 25 to July 11, 1976. The seals were observed from the Green island shore through binoculars and photographed using an 800mm lens. Notes were taken either on paper or with a cassette tape recorder. Behaviour was timed using a stop-watch.

Records of haul-out behaviour were graphed to display minute-by-minute changes in the number of seals hauled out on each ledge and the number active in the water. Sub-groups of seals were identified as the number of seals hauling out after one another on to a particular ledge until there was an interval in the haul-out record.

Each seal was assigned to an estimated age class according to its relative size and appearance. Pups were easily distinguished by their small size and grey colour, which contrasted with the brown colour of the other seals. Juvenile seals (estimated approximately 1–4 years) were brown colour (until the July moult) and ranged from only slightly longer in the body than weaned pups to only slightly smaller than adults. The head is more rounded, larger in relation to body size than in adults, and the

fur appears to be less spotted than in adults. Adult seals were relatively larger, more spotted pelage, more angularly-shaped head, and thickened neck in some animals (thought to be mature males).

Distance between seals was visually estimated in 'adult body lengths'. The sexes were not distinguished (with the exception of a mother tending her pup, or occasions where the belly was clearly visible).

Results

Number of seals at observation site

The maximum number of seals in each age class observed at the site (Table 1) indicates that this site is both an important pupping site with at least 45 pups being born here during the 1976 season, and a maximum of 84 adults and juveniles recorded during the pre-pupping and pupping periods. Numbers decreased after the pupping period (Table 1)

Table 1. Maximum number of seals counted at the Indian Point haul-out site, spring-summer 1976.

Dates	Maximum seal counts
<i>Pre-pupping</i> April 25–May 10	81 juveniles and adults
<i>Pupping</i> May 11–June 17	45 mother-pup pairs (May 28) 84 adults and juveniles (May 11)
<i>Post-weaning</i> June 14–June 28	18 juveniles and 17 pups (June 28)
<i>Post-weaning (contd)</i> July 01–July 11	21 juveniles (July 08) 12 pups (July 02) 10 adults (July 06)

Occupancy of the different ledges.

During the pre-pupping period (April 25–May 10) juveniles were most often recorded on the *mid-channel ledges* I–III and VI, while adults were mostly recorded on sites III and IV–V. Juveniles were never recorded on sites IV–V. Thus juveniles generally hauled out sooner on the ebbing tide than did adults.

During the period of pupping and lactation (May 11–June 17) the *mid-channel ledges* continued to be used, mainly by juveniles. Mothers with pups mainly occupied the *nursery site* (VI–VII), although they sometimes transferred to sites I–III around half-tide. Some juveniles and other adults also used the *nursery site* during this period. Pregnant females most often used VII, while mothers with pups mostly used VI.

During the post-weaning period (June 14–July 11) weaned pups hauled out on the *mid-channel ledges* alongside the juveniles. There was no difference between pups and juveniles in ledge use, but both used site I more than II and II more than III. Adults were not observed at the site during the latter half of June, but reappeared in early July, mostly using site V.

Use of the shallow water surrounding the nursery ledges

Beyond the *nursery site* shallows, mother-pup pairs sighted were usually travelling towards or away from the site, the mother almost always leading the pup. Within the *lagoon* area mother and pup often swam around in a leisurely manner, with the mother guiding her pup less strictly, allowing the pup to take the lead or swim off in a different direction. Mother-pup pairs sometimes engaged in energetic locomotor play. The only two prolonged bouts of locomotor play took place in very shallow water (c. 1m depth) close to VI–VII. Brief bursts of locomotor play also occurred slightly further from the rocks, in water c. 3m depth.

‘Lone’ pups (either weaned pups or pups in late lactation whose mothers had temporarily left them alone at the site) were usually close to sites VI–VII. Here they approached one another and other seals and sometimes engaged in solo locomotor play while orienting towards a hauled-out seal.

Aquatic behaviour of seals arriving at high tide

Over the high water period, a group of seals would often appear in the vicinity of the submerged haul-out ledges. Such a group would contain up to about 12 members, all of similar body size. Groups of juveniles or pups were most often observed.

Seals in these groups would show very little movement at the water surface. They would repeatedly submerge and surface again simultaneously (time underwater was not recorded accurately, but was of the order of one submergence and resurface per minute). Seals of a group at the surface were approximately equally spaced, although with each resurfacing the spacing usually changed. For example, a group of three post-weaning pups submerged and surfaced three times, surfacing first at about 8m apart, then at 14m and finally 2m apart. Over all observations, the mean spacing between individuals in post-weaning pup groups was about 5m ($n = 63$; $SD = 4.5$) and about 6m for juveniles ($n=83$; $SD = 3.9$), with a range of distances at surfacing from near body contact to about 15m apart. A pup in these groups would sometimes surface or submerge with a splash (apparently signalling to its neighbours), but this was rarely seen in juvenile groups.

These groups sometimes drifted around the haul-out site area, though juvenile groups appeared to more static than pup groups (82% of juvenile groups surfacing were off site I; $n=50$, while only 32% of pup groups were off site I, $n=29$).

On May 17 a group of about 9 pups arrived at the still-submerged sites I–III. Sub groups of 3–6 pups spent an hour surfacing and submerging, during which time they moved up and down the I–III ledge area 6 times. They then disappeared before the juveniles began to haul out, reappeared 30 min later, and hauled out after the juveniles.

The group diving (described above) would end abruptly before the haul-out began, the latter involving much more rapid movement.

Mother-pup pairs occasionally showed similar simultaneous movement in the *nursery site lagoon* over the high water period on days when spring tides covered much of site VI. On June 8, surfacing and submerging by a group of four mother-pup pairs was recorded in the lagoon for about 15 min, and on June 9 a group of 5 pairs behaving similarly was observed for about 25 min. These mother-

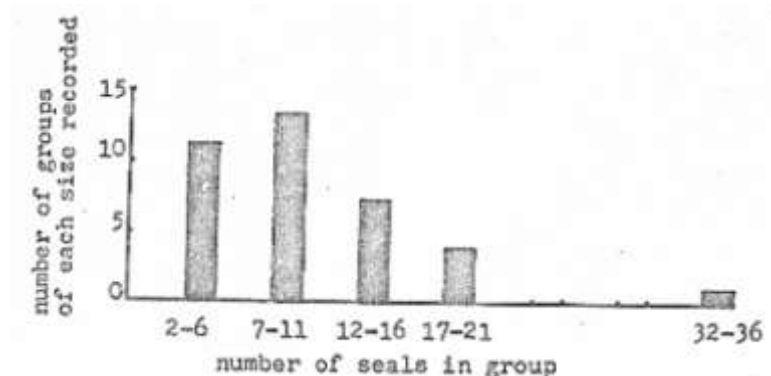
pup groups were slightly more widely spaced than pup or juvenile groups (mean c. 8–9m apart, SD =5m; range 3–20m, n=33).

Discreteness of groups of seals arriving at the site and hauling out

The haul-out records indicated that there was usually an interval between periods when several seals would haul out one after the other in quick succession. Thus it appeared that seals arrived and hauled out mostly in groups.

The first group to arrive usually hauled out on site I (the first ledge to emerge on the falling tide). During the pupping period this haul-out (usually of juveniles) was most often completed, or nearly so, before a new ledge (II or III) was occupied. When seals did haul out on a second ledge simultaneously with the site I haul-out, the latter nevertheless continued to about the same number of seals (mean 10.5 seals, n= 6, SD = 4.6) as when no second haul-out was occurring (mean 8.7, n=13; SD = 2.6; no significant difference by Median test and Fisher Exact Probability test). This implies at least some discreteness of groups as they hauled out on adjacent ledges. During the pre-pupping period the mean group size overall was 10.3 (n=35; SD = 6.7; range 2–36; Fig. 1). The large groups (32–36) recorded twice (Fig. 1) may, of course, having been two or more smaller groups coalescing.

Fig. 1. Size of seal groups recorded at Indian Point, pre-pupping period (April 25–May 10), 1976



During the pre-pupping period the mean number of groups observed per day was 3.5 (n = 10 days). On 7 of 10 days there were either 3 or 4 groups; in bad weather on the other days, fewer seals and hence fewer groups were recorded). The mean time interval between group arrivals was about 20 min (Table 2).

Table 2. Time interval between arrival of successive groups of seals after the start of the haul-out (pre-pupping period).

Time interval (min)	1 st and 2 nd group	2 nd and 3 rd group	3 rd and 4 th group
Mean	22	19	27
SD	5	7	24
Range	15–30	7–28	5–29
(n)	(7)	(6)	(4)

During the pre-pupping season, groups were predominantly either juvenile or adult (Table 3).

Table 3. Degree of exclusivity of adult and juvenile per groups forming haul-out clusters during the pre-pupping period.

	Adult	Juvenile
Mean % predominant peer group in cluster	77.9%	91.8%
SD	15.7%	9.4%
(n) clusters of 7 or more seals	(13)	(14)

Mother-pup pairs seemed usually to approach and haul out at the *nursery site* singly or in associations of only 2–3 pairs and there was usually a relatively long interval between successive pairs hauling out when compared to adults and juveniles mean number hauling out per min. = 0.1 mother pup pairs; n=16, compared with 0.4 adults and juveniles; n=26; $P < 0.001$, Median test). On June 8–9 (the spring tides), however, a group of 5 mother-pup pairs surfaced and submerged in synchrony until the ledge was exposed and then hauled out one after the other in a cluster.

The pattern of clustering on the ledges was different during the post-weaning period than in the pre-pupping period. The total number of seals (juveniles and pups) forming the final cluster on site I in the post-weaning period (mean = 14.7; n= 7) was greater than the total number of seals (juveniles and/or adults) forming the final cluster on I during the pre-pupping period (mean = 10.5; n=8; $P < 0.05$, Median test and Fisher Exact Probability test). Furthermore, the first and largest combined cluster of juveniles and pups on each day was about twice the size of the second cluster to be formed, which was in turn more than twice the size of the third cluster (Table 4).

Table 4. Number of pups and juveniles on the mid-channel ledges (post-weaning period)

(a) June 14–28

	1 st cluster (n=9)		2 nd cluster (n=7)		3 rd cluster (n=3)	
	Pups	Juveniles	Pups	Juveniles	Pups	Juveniles
Mean	8.4	7.5	4.7	3.3	1.7	1.7
Range	4–13	5–11	3–8	1–7	0–3	1–2
SD	3.3	2.3	2.2	2.3	2.0	1.4

(b) July 01–11

	1 st cluster (n=7)		2 nd cluster (n=7)		3 rd cluster (n=0)	
	Pups	Juveniles	Pups	Juveniles	Pups	Juveniles
Mean	6.0	7.3	2.4	4.4		
Range	3–10	2–14	1–4	2–7		
SD	2.7	3.9	1.2	2.0		

There were fewer pups in both the 1st and 2nd clusters in July than in late June ($P \leq 0.05$, Mann-Whitney U test), but no significant difference in the number of juveniles.

The pups seemed to arrive at the ledges at high tide in groups composed exclusively of pups and did not begin to haul out until the juveniles had already formed a cluster. Then they would add on to the end of a juvenile cluster.

Following their total absence from the study site during the immediate post-weaning period, a few adults, seemingly newly moulted and very active, returned to the *mid-channel ledges* on 5/7 days during July. They arrived at the *mid-channel ledges* about 30 min after the start of the juvenile haul-out on site I (mean 36.5min, SD=10.7, range 24–49min).

Individual behaviour in the water prior to haul-out

Seals sometimes circumnavigated the ledges before finally hauling out. They would swim to and fro alongside the ledge, sometimes looking up at seals already hauled out, who would watch if still awake. Sometimes one or more seals would haul out in one place, then return to the water and haul out further along a few moments later. Sometimes only one seal would haul out, then return to its companions gathering beneath it.

Adults, juveniles and weaned pups often porpoised (leaped) and splashed nearby seals already hauled out. Porpoising often occurred in the 50m stretch of water between sites III and V, which was covered by a series of 3–4 leaps, a second seal sometimes following the porpoising one. On one occasion an adult splashed repeatedly, jerking its head at another seal, who then re-entered the water. On another occasion 4 of a group of 14 adults hauled out on site III. One of the 10 remaining in the water swam rapidly alongside the ledge, splashing continually, and then soaked the 4 seals on the ledge with an enormous splash of its hind flippers. It continued this display for about 6 mins, at the end of which the four seals re-entered the water. From June 2–8 adults (presumably males) were observed to splash and slap the water with both fore and hind flippers while rearing out of the water before diving; they would then submerge leaving only their hind flippers above the surface. Most of this behaviour took place near the nursery ledges, and was apparently directed towards mothers with pups.

Haul-out behaviour

When a seal hauls out to join an existing cluster, it may choose either end of, or a position within, the cluster. Most juveniles and pups hauling out on sites I–III added on to the ends of the forming cluster (Table 5(a)). By contrast, mother-pup pairs and other adults at the nursery site more often selected a position within the cluster (Table 5(b)). This difference was significant (chi-squared = 47.6; df=1; $P < 0.001$).

Table 5. Position in cluster where seals hauled out

(a) Juveniles and pups at the mid-channel ledges

	Within cluster	End of cluster
Juveniles	10	53
Pups	8	50

(b) Mother-pup pairs and other adults at the nursery site

	Within cluster	End of cluster
Mother-pup	14	4
Adult	7	1

It was sometimes clear that seals swimming together would split up and haul out at opposite ends of the cluster. Successive pups or juveniles approaching site I would haul out at the opposite end of the ledge from the preceding seal about as often as immediately behind it. For example, on June 26, 4 pups from a group in the water hauled out within 2 min of one another so that the 1st and 3rd pups were at one end of the cluster and the 2nd and 4th pups went to the opposite end. Nevertheless, swimming companions often showed a strong tendency to haul out together. For example, on June 17, 11 pups appeared together beside the ledge. Six of these pups hauled out one after the other at one end of the ledge and then the remaining five hauled out together at the opposite end.

Interactions between neighbouring seals on the ledge

A newcomer to the ledge often hauled out nearby another seal and settled down beside it without any overt interaction. However sometimes a newcomer approached one of its neighbours, looked at it closely, sometimes initiated a naso-naso contact, sniffed its hind flippers, rubbed its own hind flippers together (sometimes close to its neighbour's nose), or occasionally lay on its back and ribbed its back or nape on the rock. The neighbour's reaction would range from remaining asleep to watching, moving over slightly, approaching the newcomer, initiating or accepting a naso-naso contact, rubbing its hind flippers together, or wave its fore flipper and occasionally rear up, lunge or growl at the newcomer.

When one juvenile hauled out beside another, the approached seal made no overt response (9/69 occasions), watched it (30/69 occasions), responded with some form of amicable contact or olfactory exchange (19/69 occasions), or flippered, lunged or growled at it (11/69 occasions). When a newcomer went right up to its neighbour, initiating an interaction, it almost always met with an amicable response (11/13 occasions).

After newcomers had ceased to arrive on the falling tide, it was rare for neighbours (other than a mother and pup) to touch one another. However, olfactory exchange without physical contact was occasionally observed, as in the following illustration (June 28, one site VIB).

Juvenile 1 rubs hid flipper. Adjacent juvenile 2 rubs hind flippers. Pup 3 beside juvenile 23 raises head, wipes face, rubs own hind flippers. Juvenile 2 rubs hind flippers and pup 3 rubs hind flippers, looking around. Three mins later Juvenile 4 rubs hind flippers. Juvenile 2 and pup 3 rubs hind flippers, Juvenile 4 looks at juvenile 2.....all settle down to sleep again.

Overt threats (flippering, lunging, growling) by adults and juveniles occurred most often by mothers (67/113 incidents), next often by other adults (29/113) and least often by juveniles (17/113). Most threats (90%) were directed towards seals less than 1.5 adult body lengths apart. 58% of all records of conflict on the ledges were of a seal sparring with another attempting to haul out beside it, and 6% were of a newcomer lunging or growling at its neighbour.

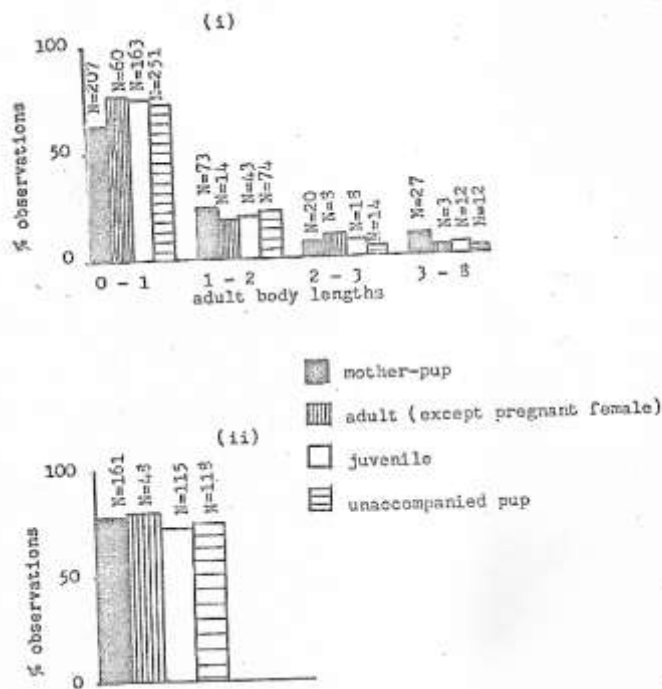
The mildest form of threat was fore-flipper waving. More intense threat involved growling snorting and lunging, sometimes accompanied by fore-flipper waving or slapping. Sparring mothers sometimes reared up into the chest-to-chest position while lunging and growling. However, no biting or physical injury was seen.

Threat most often resulted in the target seal withdrawing (48/113 incidents), and less often in either the initiator (18/113) or both protagonists (11/113) moving away. Neither seal moved away on 36/113 occasions. Of newcomers hauling out who were threatened, 70% (28/40) left that spot, whereas the threatening seal did not move. A threatened seal often returned to the water.

Personal space in the haul-out

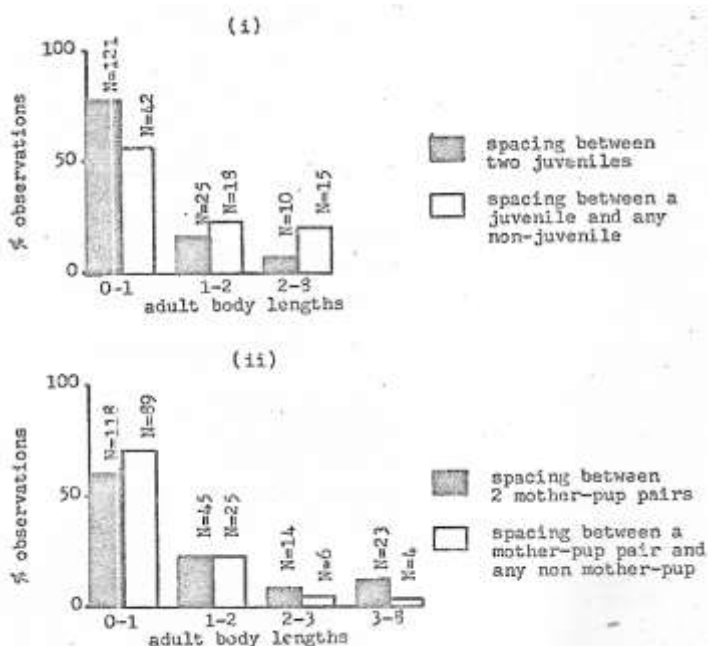
60–70% of all seals in a haul-out cluster settled less than 1 adult body length from their nearest neighbour, and 70–80% of these (i.e. c. 50% of the total) settled allowing themselves and their nearest neighbours a personal space of less than half a body length (Fig. 2).

Fig. 2. Personal space of hauled-out seals



Juveniles settled closer to their peers than to other seals (Fig. 3 (i); chi-squared = 14.1; df = 2; $P < 0.001$), but mother-pup pairs showed a tendency to ensure more space between one another than between themselves and any other seals (Fig. 3 (ii); chi-squared = 8.9; df = 3; $P < 0.05$). The few records of pregnant females suggest there were always at least 1–2 body lengths between adjacent pregnant females.

Fig. 3. Difference in personal space between similar and non-similar neighbours in a haul-out cluster



Personal space in the water

Member of a juvenile or pup group often followed each other very closely in the water. Overt threat (splashing, growling or lunging) in the water was usually only seen between mothers attending pups. Such behaviour was once seen between two adults (thought to be males) and once by an adult when an unaccompanied pup swam up to it. Such behaviour resulted in increasing the distance between the protagonists. Few instances of such conflict were seen at distances greater than c. 3 body lengths, and none at distances of more than 4 body lengths.

Discussion

The results of this study are consistent with previous observations of *P.v.vitulina* in the UK and *P.v.concolor* on Sable Island, Nova Scotia during the spring and early summer, in that harbour seals tend to swim and haul out in groups which consist mainly of peers (Wilson, 1974; Wilson & Kleiman, 1974). In the pre-pupping period 3–4 such groups, averaging about 10 individuals of either juveniles or adults, seemed to return from the sea to the haul-out site and maintain their group cohesion to a considerable extent as they hauled out on adjacent ledges. In the post-weaning period, groups of pups entered the haul-out area separately from older juveniles, but mingled with juveniles as they hauled out. I conclude that the Indian point seal colony was structured socially into sub-groups consisting of peers, and that close social cohesion rather than casual association characterises the social structure of the herd. Wipper (1975) reached a similar conclusion for *P.v.vitulina* in the North Sea. He noted that when a haul-out group was disturbed, two or more adults who had fled to the water would often encourage a naive juvenile to follow them into the water by repeated splashing and diving.

Since the groups of seals observed returning to the haul-out ledges on the ebbing tide are presumed to have been foraging, it seems probable that these groups were actually foraging groups, and the simultaneous surfacing and submerging by group members may be a form of cooperative foraging. This interpretation is supported by similar behaviour definitely involving foraging by a group of *P. largha* which I observed from a cliff at Notoro Point, Abashiri, Hokkaido in 1971. Since I have not been able to find any published documentation of group foraging by harbour seals, I will reproduce this record here:

On October 16 1971 we spotted 7 adult *P. largha* floating in a group close to the haul-out ledges. Periodically they would all submerge, shortly to surface again more or less at the same time. Then sometimes one would open its mouth several times as if swallowing.....soon a group of newcomers arriving together increased the number in the group to 20. A little later we saw a smaller seal on the periphery of the group tossing a half-eaten fish, submerging and reappearing several times still with the same fish.....sometimes letting it float before picking it up and tossing it again.....meanwhile the group dwindled to about 10 seals.....the same small seal surfaced with another, smaller fish, which it ate quickly and then dived, reappearing with another small fish, which it also ate at the surface, then dived and surfaced with another very long fish, continuing to dive and surface while eating it. Meanwhile the other seals continued to surface and submerge, apparently eating underwater, remaining in more or less the same position with respect to one another, swimming lazily on their backs, flippers stretched high in the air, sometimes opening their mouths. Individuals sometimes swam away from the group and returned, and sometimes one seal was seen to follow another.

On October 18 we observed a group of about 7 seals. A second group appeared and promptly disappeared again. We had the impression this time that within the group of 7 seals, they were diving and surfacing in pairs.

Some further support for this interpretation comes from the report by Hofman (1975) of 'up to six crabeater seals (*Lobodon carcinophagus*) synchronously diving and surfacing' Hofman also cites D. Parmelee as having witnessed two groups of about 30 crabeater seals behaving similarly. Hofman interprets this behaviour as feeding, but commented that 'we do not know at what depth or if they were collectively attacking a school of krill'. Jackass penguins (*Spheniscus demersus*) also forage at sea in groups which afterwards congregate on shore. At sea, groups of 2–10 penguins fish by diving and surfacing simultaneously about once a minute. Fishing groups of penguins returning to the shore averaged 4.8 individuals (Siegfried et al., 1975).

The observations of harbour seals at the Indian Point site suggested the haul-out colony consisted of at least 3–4 such groups of adults, juveniles or weaned pups. One possible reason why it could be beneficial for these groups to haul out in combination as a colony, is that the colony then acts as an 'information centre'. Krebs (1974) has reviewed the information centre concept as it applies to birds nesting in colonies and foraging in flocks, i.e. if prey occurs in large transient clumps, individuals may benefit from colony membership by following successful colony members on the next foraging trip. Such a concept might apply to harbour seals, if one group which had been unsuccessful on the previous tide were able to follow a more successful group from the colony to better feeding grounds. This study observed that groups of weaned pups tended to assemble at the haul-out beside older juveniles; possibly they were using these juveniles as guides to potential foraging grounds and learning from them. One benefit to pups of the social assembly of nursing mother-pup pairs is that pups at weaning are immediately in the proximity of other weaned pups, with which they can form a group. Social facilitation amongst weaned pups in a foraging group may accelerate the rapid learning process essential to the survival of weaned pups.

Conclusion (appended by the author, 2010)

The results of this study showed that this colony of harbour seals at Indian Point, Maine was far from being a casual 'society of strangers' forming and dissolving on each tide, as suggested by Knudtson (1974). This colony clearly consisted of social groups, the members of which appeared to have been at sea together and probably foraging together. These observations were not consistent with the comment by Scheffer and Slipp (1944), that '*P.v. richardii* is 'loosely gregarious on land but as a rule solitary when foraging'. It is undoubtedly the case that harbour seals do not always forage in groups. Possibly they do so when targeting shoaling prey, but not when targeting sparsely distributed prey. The clear sub-group structure of the colony of *P.v. concolor* observed at Indian Point may therefore not be replicated in other colonies; however, the existence or not of such groups is likely to be a product of the local feeding ecology, and not a sub-species difference between *P.v. richardii*, *concolor* or *vitulina*.

The prevalent misapprehension, persisting to the present day, that a harbour seal haul-out group is a casual aggregation of strangers seems to arise from casual observations of hauled-out seals, noting that they tend to maintain a personal space on the haul-out rocks and that they sometimes flipper or

lunge at their nearest neighbours. However, both this 1976 study and previous studies (Wilson, 1974b, Wilson & Kleiman, 1974) have described how harbour seal juveniles may be highly contact-prone while socialising and playing in the water (or at the water's edge at beach haul-out sites), but the same individuals maintain a small personal space (usually less than 1 body length) when resting on the rock or beach (Fig. 3). The personal space maintained on land does not contra-indicate social cohesion any more than when two human beings sit together on adjacent chairs! Observations of naso-body contacts between mother and pup and between playing juveniles and documentation of areas of sebaceous cells on the body (Wilson & Kleiman, 1974) indicate that olfactory exchange is important in social bonding between individual harbour seals. On shore, the hind-flipper rubbing observed at Indian Point probably releases odour from the anal gland (Ortmann, 1960), which is probably individually distinct.

Fig. 3. Harbour seals in close body contact while playing in the water or at the water's edge, but maintaining a small personal space when hauled out and resting

(a) Playing in close body contact (top: *P.v. vitulina*; middle: *P.v.vitulina*; bottom: *P.v. concolor*)



(b) Hauled out (*P.v.vitulina*) with individual personal space



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