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Impact of small boats on the haulout activity of harbour seals (*Phoca vitulina*) in Métis Bay, Saint Lawrence Estuary, Québec, Canada

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Abstract

The impact of small boats on harbour seal haulout behaviour was studied from May to August 1997 in Métis Beach, Canada. The number of seals hauled-out increased throughout the summer and was affected by air temperature, tide, and wind direction. Disturbances most often were caused by kayaks and canoes (33.3%), motor boats (27.8%), and sailboats (18%). Numbers of seals hauled-out decreased after a disturbance, except during the molting period when seals seemed more reluctant to enter the water. The most severe reaction was seen with the approach of kayaks-canoes with a flushing response of 86% compared to 74% by motor boats and 0% by sailboats. While animals were hauled-out, they spent over 70% of their time resting and comfort behaviour and 11–34% of their time in alert behaviour. Increases in alert behaviour by seals occurred during a disturbance, but changes were quite subtle.

Key words: disturbance, harbour seal, behaviour, ecotourism, *Phoca vitulina*

Introduction

Marine mammals generate considerable respect and curiosity from humans owing to their large size, relative scarcity and aquatic abilities. This led to the development of ecotourism, where people pay to observe seals and whales in the wild. The whale observation industry is considered to be non-invasive. However, owing to its rapid growth and expansion, there are concerns about the impact of boat traffic on marine mammal populations (Bonner, 1982). Within the Tadoussac region of the St.Lawrence Estuary, Canada, the whale watching industry is estimated to generate 40 million dollars annually (Foley & Michaud, 1998). Although, most of the growth in ecotourism is in whale watching, seal watching excursions are also available and expected to increase.

Haulout sites used by seals are accessible to human visits by a boat. Harbour seals (*Phoca vitulina*) could be particularly vulnerable to human disturbance, because of their coastal nature (Waters, 1992). Renouf *et al.* (1981) showed that after a disturbance by humans, harbour seals and grey seals increased their movements between the sea and their haulout site at Miquelon. Allen *et al.* (1984) observed that the normal haulout pattern of harbour seals was interrupted by disturbance from boats, pedestrians, dogs, and aircraft.

Harbour seals move ashore to give birth and suckle their young during late May to early July (Boulva & McLaren, 1979). Mating occurs in the water around the time of weaning (Bigg, 1969; Boulva & McLaren, 1979). Moulting (Brown & Mate, 1983) begins in late July (juveniles) and continues until September (adults).

The development of seal watching and an increase in summer leisure activities near haulout sites in the St Lawrence Estuary could impact haulout activities, lactation or moult. Herein, we examine the impact of small boats (motor boats, kayaks, canoes, sailboats) on the haulout activity of harbour seals in a small bay.

Materials and Methods

This study was conducted from 23 May to 31 August 1997 in Métis Bay, Québec, Canada (Fig. 1). It is a shallow bay (<8 m) encompassing an area of 2.5 km^2 protected from prevailing winds from the south and west. The area is characterized by a semi-diurnal tidal cycle with a maximum tidal amplitude of 4.7 m (Canadian Tide and Current Tables, 1997). Rocks and small reefs exposed at low tide are used as haulout sites. Some of the haulout sites are situated just outside of the bay, 500 m to the southwest of the bay entrance (Zone 3) (Fig. 1).

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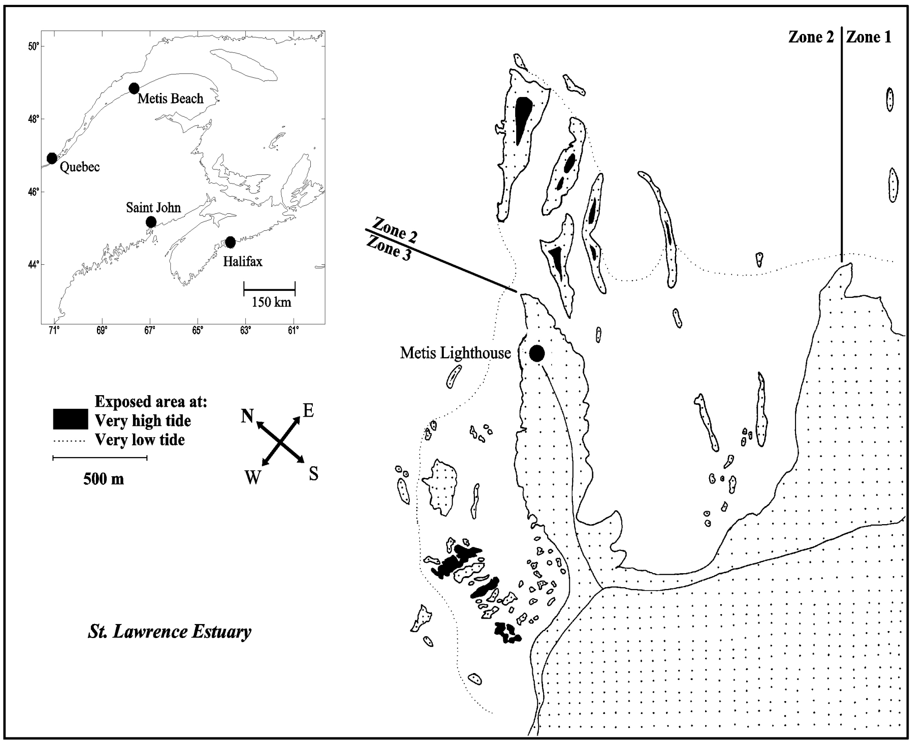

Figure 1. Map of Métis Bay showing harbour seal haulout sites. Zone 1 encompassed haulout sites 12; Zone 3 encompassed haulout sites 17 to 19, located outside of the bay. Zone 2 includes all remaining haulout sites within the bay.

During winter, the bay is normally covered by solid fast-ice, while drifting pack-ice covers the estuary to varying degrees.

Observations were made from the Métis lighthouse, 16.5 m above sea level using a telescope (Bausch and Lomb zoom 60 ×). Seals were observed from 0845 to 1645 hrs, 3 to 4 times a week, especially on weekends when disturbances were most likely to occur. Information recorded hourly included: air temperature (°C), wind velocity (Knots), % cloud cover, % of sunny sites, location and total number of hauled-out seals. Seals were classified as newborn, juvenile, adult, or unknown. Small seals were identified as newborns if they were directly associated with an adult or if they were observed to suckle; otherwise they were considered to be juveniles. Unknown seals were animals hidden by rocks or for which only a part of the body was visible.

Behavioural data were gathered by instantaneous scan sampling (Altmann, 1974). Scan blocks sampled 8 seals for a period of 10 min. Seals were scanned at 20-sec intervals (Kovacs, 1987). The behaviour of each seal was classified as rest, alert, locomotion, comfort movement, or agonistic (Kovacs, 1987). The different types of human disturbance and their distance to the seals were noted. During each disturbance, 5 seals were scanned at 10-sec intervals, while noting the distances of the approaching disturbance. These distances were classed into 3 categories (0–100 m, 101–200 m, and >200 m).

For the analyses, the study area (Fig. 1) was divided into three zones (1,2 and 3) and the study period was divided into 3 seasons: Season 1 encompassed the period prior to pupping (23–29 May), Season 2 the ‘whelping-suckling period’ (2 June to 17 July), and Season 3 ‘weaning-molt period’ (18 July to 26 August). Factors affecting the number of seals hauled-out (season, haulout zone, age class) were examined. Since the data were not normally distributed, the data were ranked and then analyzed by performing an ANOVA on the ranked data to test the effect of three crossed fixed factors (season, haulout zone, age class) without replication and their interactions on the ranked data. A multiple non-parametric comparison test (Tukey on ranked data) was applied to the significant interactions (Vincent, 1997). The relationship between number of seals hauled-out and environmental factors, such

Table 1. Mean daily number of harbour seals hauled (±SE) in each zone by season. Significant differences (Tukey test) are indicated with signs < or >.

Seasons	Zone 1	Zone 2	Zone 3	Zone differences
1	13.7 ± 2.6	8.0 ± 1.7	2.5 ± 0.6	Z1=Z2=Z3
2	2.9 ± 0.3	11.4 ± 1.2	15.5 ± 2.0	Z1<Z2=Z3
3	12.8 ± 2.4	11.9 ± 1.7	14.2 ± 2.3	Z1=Z2<Z3
Seasonal differences	S2<S1=S3	S1<S2<S3	S1<S2=S3	

Table 2. Mean daily number of harbour seals hauled (±SE) in each season by age class. Significant differences (Tukey test) are indicated with signs < or >.

Age class	Season 1	Season 2	Season 3	Seasons differences
Newborns	0	1.9 ± 0.3	0	S1=S3<S2
Juveniles	2.6 ± 0.3	6.1 ± 1.0	7.9 ± 0.6	S1<S2<S3
Adults	17.7 ± 2.2	17.4 ± 2.3	25.6 ± 0.6	S1=S2<S3

as tidal height (m), amplitude (m), wind velocity (knots), temperature (°C), % of cloud and % of sunny sites was examined using a Spearman rank correlation. The recovery pattern of haulout after a disturbance was examined by the length of time that passed until half the initial number of seals hauled-out returned to pre-disturbance levels, by the mean number of seals hauled-out for 6 couplets of days (first day with disturbance, second day without disturbance) and by the number of days that passed before haulout numbers returned to their pre-disturbance levels using a Kruskal–Wallis test or a Mann–Whitney test. SYSTAT version 7 was used for all analyses. The probability of error was set at $\alpha=0.05$ for all tests.

Results

A total of 320 hrs of observations were conducted over 43 days: 16 days without disturbance; 27 days with at least one disturbance during the day. Disturbances were caused by private vessels, or research boats (motorboats). Seals were present in the study area on all days that observations took place. During the observation period, the average number of seals seen per day without disturbances increased from 32.9 (SE=5.6) during Season 1, to 39.1 (SE=2.8) during Season 2, to 47.9 (SE=3.5) in Season 3.

An ANOVA with three fixed factors (season, zone and age class) on the ranked haulout data was significant for all three factors (season: $F_{2,2649}=26.2$; zone: $F_{2,2649}=35.0$; age class: $F_{3,2649}=171.9$, $P<0.05$). As the summer progressed, there was a significant shift in the distribution of animals among the three zones (Table 1). Early in the summer (Season 1), the majority of animals hauled-out in Zones 1 and 2. During Season 2, fewer seals hauled-out in Zone 1, while numbers increased in Zones 2 and 3. Zone 3 was particularly important for females and pups, while Zone 1 was rarely used. During Season 3, more animals were observed to haul out in Zone 1 compared to Season 2, while the number of animals hauled-out in Zones 2 and 3 changed little (Table 1). Newborns could only be identified reliably during the whelping season. After weaning, they were indistinguishable from yearlings. Few juveniles were observed to haul out early in the summer (Season 1), but numbers increased during the summer. The mean number of adults hauled-out remained constant during Seasons 1 and 2, but were observed to increase in Season 3 (Table 2).

The number of seals hauled-out increased throughout the morning until about 1100 hr, remained near the maximum until 1200 hr and then declined in the afternoon (Fig. 2a). However, some differences in the shape of the haulout pattern occurred among seasons. In Season 2, haulout began before observations started. Also, the numbers of seals hauled-out remained stable until 1400 hr and then decreased, giving the pattern a more flattened look. During Season 3, the numbers of seals hauled-out when observations started were even higher than those observed in Season 2. Seals continued to haulout until 1100 hr then numbers declined throughout the remainder of the day.

During Season 1, when no disturbances were observed, the number of seals hauled-out was negatively correlated to tidal height (Table 3). In Season 2, the number of seals hauled-out was positively correlated to air temperature and negatively corre-

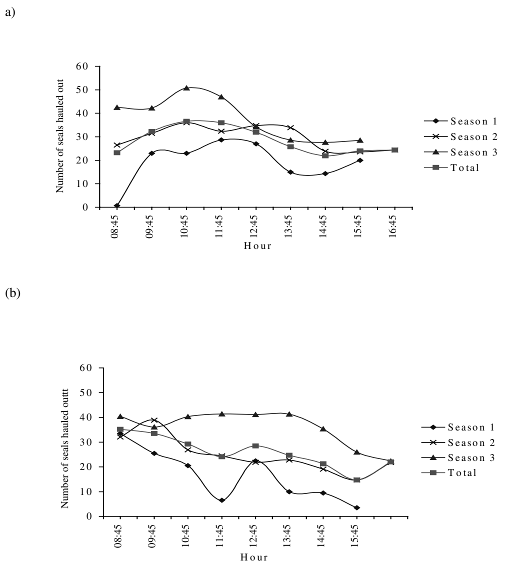

Figure 2. Number of harbour seals hauled-out in Métis Bay on days with no disturbance (a) and with disturbance (b).

lated with tidal height. In Season 3, the number of seals hauled-out was positively correlated with air temperature, % sun and wind velocity and negatively correlated to % cloud cover (Table 3).

Disturbances were documented throughout the study. The most frequent disturbances (n=73) were caused by kayaks and canoes (33.3%), motor boats (27.8%), sailboats (18%), research captures (7.3%), tourists on foot (5.6%), fishermen (4.2%), aircraft (1.4%), and seadoo (1.4%). Few disturbances were noted early in the observation period (Season 1), but they increased in frequency throughout the summer from an average of about 1 per day in Season 1, 2.4 per day in Season 2, and 3.4 per day in Season 3. Few disturbances occurred during the morning, but they increased throughout the day reaching a maximum by 1400-1500 hr and then declining. Disturbances occurred primarily in Zone 2 (n=37 disturbances) followed by Zone 3 (n=30 disturbances) and Zone 1 (n=6 disturbances). Zone 1 was disturbed more frequently during Season 1 and Season 3 while Zone 3, which was located outside of Métis Bay (Fig. 1), was disturbed more frequently during Season 3. Some differences were observed in environmental conditions between days when animals were disturbed and days when no disturbances occurred during the three seasons (Table 4). During Season 1, many more sunny days with no disturbances were observed than sunny days with disturbances, while the proportion of sunny sites in Seasons 2 and 3 were similar with disturbances and periods without disturbance. During all three seasons days without disturbance tended to be colder than days with disturbances. (Table 4).

The effects of disturbance on the ranked numbers of seals hauled-out were examined using an ANOVA with three factors (disturbance, zone and age class). Hauled-out numbers were affected by disturbances ($F_{1,3783}=67.5$, $P<0.05$), zone ($F_{2,3783}=86.2$, $P<0.05$), and age of the hauled-out seals ($F_{3,3783}=215.7$, $P<0.05$). Significantly more seals were hauled-out in Zones 2 and 3 when there were no disturbances than when animals were disturbed, but no differences were observed in Zone 1 (Table 5). Disturbances had little effect on the number of newborns hauled-out, but significantly more juvenile and adult seals hauled-out when no disturbances were noted (Table 5).

Disturbance had an effect on the daily haulout pattern. Overall, on days when seals were disturbed, the largest number of animals were hauled-out in the morning but declined throughout the day (Fig. 2). In Season 1, the maximum number of hauled-out animals were observed early in the morning but their number declined until about noon. A second peak in haulout abundance occurred around 1300 hr but the number of animals hauling out

Table 3. Spearman rank-correlation coefficients between environmental variables and number of harbour seals hauled-out, with and without disturbance. Significant coefficients are bold.

	No disturbances			With disturbances		
	Season 1	Season 2	Season 3	Season 1	Season 2	Season 3
Sample size	26	104	83	10	89	179
r_{critic}	0.390	0.197	0.216	0.648	0.209	0.197
Tidal height	**− 0.572**	**− 0.380**	0.010	− 0.268	0.033	**− 0.395**
Wind velocity	0.155	− 0.032	**0.238**	− 0.647	− 0.114	0.032
% of cloud	0.143	− 0.037	**− 0.328**	**0.717**	**0.353**	**0.213**
% of sun	0.124	0.185	**0.306**	**− 0.877**	**− 0.3401**	− 0.022
Temperature	0.301	**0.301**	**0.317**	− 0.381	0.160	**0.289**

Table 4. Mean daily number of harbour seals hauled (± SE) with and without disturbance for each zone and for each age class. Significant differences (Tukey test) in the numbers between presence or absence of disturbance are indicated with signs < or >.

Zones	Without disturbances	With disturbances	Differences
1	9.8 ± 1.5	5.4 ± 0.7	without=with
2	10.4 ± 1.4	5.0 ± 0.7	without>with
3	10.7 ± 1.5	10.4 ± 1.6	without>with
Age class	**Without disturbances**	**With disturbances**	**Differences**
Newborns	0.6 ± 0.1	0.30 ± 0.05	without=with
Juveniles	5.5 ± 0.5	3.9 ± 0.5	without>with
Adults	20.3 ± 0.1	13.4 ± 1.4	without>with

Table 5. Daily mean percent of sunny sites per season with and without disturbance. Significant differences between presence and absence of disturbance are indicated with signs < or >.

Seasons	Without disturbances	With disturbances	Differences
		Percent Sunny sites	
1	91.0 ± 0.4	39.1 ± 14.2	without>with
2	84.9 ± 3.2	87.2 ± 3.1	without=with
3	63.2 ± 5.0	66.8 ± 3.0	without=with
		Temperature	
1	11.7°C ± 0.5	15.5°C ± 0.3	without<with
2	17.8°C ± 0.4	21.4°C ± 0.9	without<with
3	17.9°C ± 0.4	20.9°C ± 0.3	without<with

declined throughout the remainder of the day. In Season 2, abundance was greatest in the morning and declined throughout the day. A much different pattern was observed in Season 3 with the number of animals hauling out remaining constant throughout the day until about 1500 hr.

On days when disturbances occurred, the number of seals hauled-out was positively correlated with percent cloud cover during all three seasons (Table 4), and negatively correlated with the proportion of sun (Seasons 1 and 2). In Season 3, numbers of seals hauled-out was negatively correlated with tidal height and positively correlated with temperature, which is similar to what was observed during periods when seals were not disturbed (Table 4).

No difference was observed in the time required for animals to begin hauling out again between motor boat disturbance (15.4 min, SE=3.2, n=15) and kayak disturbance (18.7 min, SE=5.7, n=6). However, unrelated research activities, involving the pursuit and capture of seals during Season 1 and 2, had a major impact on haulout behaviour since seals did not haulout again while the boats were present. Numbers of seals hauling out (Fig. 3) appeared to increase two days after a disturbance occurred, but the changes were not significant (P=0.319).

The distance at which at ≥50% of seals first detected boats (alert distance) occurred when they were up to 800 m away from the animals. However, on average seals became more alert when vessels

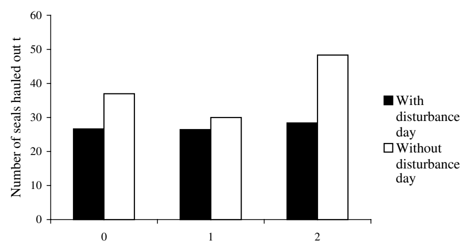

Figure 3. Number of harbour seals hauling out on days following a disturbance.

Table 6. Mean values of harbour seal flushing distances, alert distances, and flushing rate (± SE) for different classes of distance.

Distances (m)	Season 2		Season 3		Average	
	Kayaks	Motor boats	Kayaks	Motor boats	Kayaks	Motor boats
Alert distance	220 ± 80, n=6	800, n=1	250 ± 20, n=6	280 ± 40, n=6	240 ± 40, n=12	340 ± 70, n=7
Flushing distance	130 ± 30, n=9	600, n=1	220 ± 30, n=10	160 ± 30, n=14	180 ± 20, n=19	190 ± 40, n=15
Flushing rate (%)						
>200 m	70.0 ± 30.0, n=3	20, n=1	39.4 ± 12.6, n=6	51.5 ± 38.5, n=2	49.6 ± 12.9, n=9	45.2 ± 16.2, n=3
101–200 m	56.2 ± 26.9, n=3	—	49.4 ± 17.2, n=6	40.0 ± 17.3, n=8	51.7 ± 13.6, n=9	49.4 ± 17.2, n=8
0–100 m	97.1 ± 1.8, n=6	—	63.1 ± 22.1, n=4	67.8 ± 14.5, n=9	83.5 ± 9.9, n=10	67.8 ± 22.1, n=9

approached to ≤300 m. No differences in alert distance (Table 6) were observed between seasons (P=0.192) or between motor boats and kayaks-canoes (P=0.303).

Seals were observed to enter the water (flushing distance) when boats were at distances of >200 m. The type of boat did not affect the flushing distance (P=0.740), but there was a slight effect of season on flushing distance (Table 6) which was not quite significant (Mann–Whitney, P=0.083). The percentage of animals entering the water (flushing rate) was similar between classes of distance (>200 m and 100–200 m, but increased when vessels approached to less <100 m (Table 6). When a kayak or canoe approached, more seals entered the water in Season 2 than in Season 3 (ANOVA, $F_{1,43}$=5.4, P=0.025), but no significant differences were found between classes of distance (ANOVA, $F_{2,43}$=2.47, P=0.096).

When disturbed by kayaks-canoes, seals cleared the site at a mean distance of 140 m (SE=30) in Season 2 and 100 m (SE=20) in Season 3 (P>0.05). When disturbed by motor boats during Season 3, they cleared the site at a mean distance of 100 m (SE=30) in Season 3.

Seals hauled-out spent over 70% of their time in rest and comfort behaviour and 11–34% of their time in alert behaviour. Changes in behaviour were observed when animals were disturbed but these changes were quite subtle. Motorboats had a greater impact on the amount of time animals spent in rest than did kayaks-canoes ($F_{1,98}$=6.47, P=0.013). When disturbed by motor boats, rest behaviour decreased from 66.7% (SE=4.7) to 51.7% (SE=8.5) during the disturbance. Time spent in rest behaviour when disturbed by kayaks or canoes decreased from 75.6% (SE=2.8) to 63.7% (SE=5.1).

The type of vessel did not affect time spent in comfort behaviour ($F_{1,98}$=1.43, P=0.234), but significant changes were observed between the pre-disturbance and disturbance periods ($F_{1,98}$=6.82, P=0.002). Time spent in comfort behaviour decreased from 4.7% (SE=1.0) to 1.4% (SE=0.5), when disturbed by motorboats, while for kayaks or canoes comfort behaviour decreased from 3.1% (SE=0.4) to 2.0 % (SE=0.5).

Discussion

The pinniped life cycle is characterized by marine foraging and an obligate requirement to haulout on land or ice for whelping and raising of their young (Thompson & Miller, 1990). Adaptations to a marine lifestyle have led to a reduction in mobility on land. Consequently, pinnipeds prefer isolated beaches, remote offshore islands, isolated reefs or rocks to minimize threats from terrestrial predators (Terhune, 1985). Harbour seal pups enter the water soon after birth and follow the female as she travels between haulout sites (Thompson *et al.*, 1994). However, harbour seals also haulout to rest and during the moult (Ashwell-Erickson *et al.*, 1986). Factors affecting haulout behaviour include suitability of haulout sites, environmental conditions and motivation or biological need (Sullivan, 1980; Brown & Mate, 1983; Thompson *et al.*, 1989).

Haulout sites are usually located in areas that combine : access to deep water permitting an easy escape (Terhune & Almon, 1983; Hoover, 1988), a gentle slope and a plane surface (Pauli & Terhune, 1987) and protection from wave action (Sullivan, 1980; Renouf & Lawson, 1986; Johnson *et al.*, 1989). Sites where disturbance is constant are rarely used or may be abandoned (Newby, 1971). Tidal height often determines the availability of haulout sites, the number of seals hauling out being more important at low tide (Terhune & Almon, 1983; Stewart, 1984; Roen and Bjorge, 1995). Watts (1992) found that solar radiation, wind speed and air temperature were associated with the number of seals hauled-out. At Métis Bay, more animals hauled-out in warmer temperatures and when the wind was from the southwest. This apparent conflict (higher winds, increase in hauled-out seals) results from the orientation of the bay, which provides shelter to seals from the predominant southwest winds, while higher winds from this direction (across land vs across the water) would be associated with higher temperatures. Numbers also changed seasonally. An increase in numbers of animals hauled-out was observed during Season 2 owing to the onset of pupping, and the need for females to haulout to suckle their pups (Kovacs *et al.*, 1990). Numbers of animals continued to increase during Season 3 owing to the onset of the moult (Brown & Mate, 1983). On days when seals were disturbed, more seals hauled-out under cloudy conditions. These differences may reflect a reduction in the number of disturbances on cloudy days, or the increase may reflect a response to a deprivation effect where animals tend to haulout more, to compensate for time lost hauling out during previous disturbances (Brasseur *et al.*, 1996).

Few disturbances were observed at the beginning of the study. However, the number of disturbances increased markedly beginning about mid-July which coincides with the main summer vacation period in the area. Métis Bay is a popular summer area with many local cottages. The orientation and shape of the Bay provides protection from prevailing winds resulting in a favourite microclimate to humans in addition to the seals. At low tides, people were more likely to be present on the beach, but boats coming from the bay could not pass. Disturbances by sailboats occurred primarily on windy days while disturbance by kayaks was more common on calm days.

Zone 1 was located deep inside Métis Bay, it was the least disturbed by boats, but was situated near a beach where people often walked and was close to a highway. The increase in summer traffic may have contributed to the shift in haulout sites from Zone 1 to Zone 3, especially when the vacation period began. Zone 2 was used the least and was also the most disturbed because of its location. Being inside the bay and close to the shore, it was very accessible to tourists. Any boat traffic from a neighbouring motel inside the bay could pass very close to this site when moving out into the bay. Zone 3 being outside of the bay was less disturbed than Zone 2 but was still close to the shore and was accessible to tourists by boat.

Harbour seal pups need to suckle on land (Renouf & Diemand, 1984). In addition, very young pups are limited in their ability to regulate body temperature increasing the need to spend time hauled-out (Wilson, 1978). Zone 2 and Zone 3 were the most accessible to pups because of their gentle slope and plane surface. Reefs in Zone 2 and 3 were also exposed for a longer time at low tide than the reefs in Zone 1. However, Zone 3 was the area used most often by mother-pup pairs for suckling and resting, probably owing to security and relative remoteness of this area. Moss (1992) observed that mother-pup pairs hauling out nearshore could be the most sensitive segment of the population to be affected by disturbances. Disturbance a few hours after birth may result in the separation of the mother from the pup leading to the death of the young (Reijnders, 1980). Repeated disturbance may affect pup growth by reducing the time allowed to suckle and resting of the pup (Reijnders, 1980). In the Métis Beach area, pupping and lactation lasts from mid-May until mid-July (Dube, Henry and Hammill, personal observations), just prior to the main vacation period.

Seasonal differences were observed in the seal's response to disturbance. During Season 2, a higher proportion of animals entered the water when boats were (>200 m away compared to Season 3). This is likely related to the presence of females with pups during Season 2 who would be more sensitive to the approach of a vessel, entering the water to protect their pup. During Season 3, when animals were moulting, fewer animals flushed into the water as vessels approached. These differences compared to Season 2, reflect a greater motivation to remain hauled-out, benefiting from warm temperatures, which facilitate cell and hair growth during the moulting process (Ashwell-Erickson *et al.*, 1986). This reluctance to enter the water at this time also makes the animals more approachable by tourists.

Seals were reluctant to haulout again after being disturbed. This was more evident when the disturbance was caused by kayaks-canoes. This is likely due to kayaks-canoes remaining close to the haulout site to observe animals in the water. On the other hand, people in motor boats had a tendency to move away more quickly from the haulout site. Once animals were disturbed, there did not appear to be any significant lingering effect on the recovery of numbers to their pre-disturbance levels. This surprising finding may be due to the fact that only 25 to 70% of the local population may be hauled-out at any one time (Harkonen *et al.*, 1999; Hubert *et al.*, 2001). Consequently, while some animals, once disturbed, may leave the immediate area for a few days to look for alternative haulout sites, or to forage (Murphy & Hoover, 1981; Thompson & Miller, 1990), others that had not been exposed to the disturbance would be returning to the site to haulout. This would give the impression that disturbance had no impact on haulout numbers because different seals would have hauled-out at the site. However, observations of marked animals would be needed to confirm the effects of disturbance on individual animals.

Terhune & Brillant (1996) observed that newly hauled-out seals spent more time scanning than seals hauled-out over 30 min and that seals on the periphery scanned longer than those in the centre. Seals were alert a longer time when approached by motor boats than kayaks-canoes. Motor boats are audible to the seals before visual contact is made, providing a warning of approach; boat speed also seems to be important (Osborn, 1985). Seals had more flight reactions when the disturbance was passing at a low speed (kayaks-canoes), staying longer around seals than when high speed passes occurred. This could be linked to a surprise factor by kayaks-canoes which approach slowly, quietly and low on water making them look like predators. Osborn (1985) observed that harbour seals are very sensitive to the movements of their neighbours and one seal entering the water when surprised resulted in other seals entering the water also. Too few visits were made by sailboats to test their effects on seal haulout behaviour. The approach of sailboats appeared to cause a marked change in alert behaviour but did not result in animals entering the water. Owing to their large profile, sailboats would be easier to detect than the low profile kayak. The mean flushing distance was 190 m for motor boats and 178 m for kayaks-canoes compared to 150 m for seals approached by a powerboat in the northern San Juan Islands, Washington (Suryan & Harvey, 1998). This contrasts sharply with conditions observed in Elkhorn Slough (Monterey Bay, California) where 74% of flushing happened when the disturbance was less than 30 m away from the animals (Osborn, 1985). However, the area studied by Osborn (1985) was located close to a harbour. It is likely that animals had habituated to high traffic levels.

This study showed that boat traffic at current levels has only a temporary effect on the haulout behaviour of harbour seals in the Métis Bay area. Current tourist activity occurs from mid-July to the end of August. This has little impact on females with young pups which are normally weaned by this time. Seals were less concerned about the approach of boats during August. This increased tolerance may result from hormonal and physiological changes linked to the moult (Ashwell-Erickson *et al.*, 1986).

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