

RESPONSES OF BROWN BEARS TO HUMAN ACTIVITIES AT O'MALLEY RIVER, KODIAK ISLAND, ALASKA

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Abstract: We classified levels of direct response of brown bears (*Ursus arctos middendorffi*) to aircraft, watercraft, and groups of people on the O'Malley River area of Kodiak Island, Alaska. General public use occurred on the area in 1991 and 1993, whereas structured bear viewing programs used the area in 1992 and 1994. Brown bears displayed high (running) or moderate (walking away) response on 18 (48%) occasions when fixed-wing aircraft flew over the animals <100 m above ground. Three of 4 helicopter flights <200 m overhead and 9 interactions with watercraft at ≤200 m distance also elicited strong response. Encounters between people and bears resulted in strong responses from bears more frequently (37%, $n = 134$) during years of general public use than in years of structured bear viewing (6%, $n = 72$, $P < 0.0001$). We suggest that higher levels of low or neutral response by bears to encounters with guided bear viewing groups was the result of consistent and predictable patterns of human activity.

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Key words: aircraft, bear–human interaction, brown bear, Kodiak Island, public use, *Ursus arctos middendorffi*, watercraft.

There is an increasing demand for brown bear viewing and photographic opportunities in Alaska. Areas often targeted by bear viewers are feeding sites that concentrate and hold bears. As human presence in these areas increases, the potential for negative impacts on bears using the feeding sites also increases (Mattson et al. 1987, Olson et al. In Press). To provide bear viewing opportunities for the public and minimize effects on bears, structured bear viewing programs have been established in Alaska. Popular bear viewing programs currently exist at the McNeil River State Game Sanctuary (Alaska Dep. of Fish and Game [ADF&G], Aumiller and Matt 1994), Brooks Camp (Katmai National Park and Preserve, Olson and Gilbert 1994), and Pack Creek (U.S. Dep. Agric. For. Serv., Fagen and Fagen 1994a).

The Kodiak National Wildlife Refuge (NWR) initiated a program in 1991 to enhance bear viewing opportunities on Kodiak Island. A part of that project was a 4-year (1991–94) study to determine response of brown bears to 2 forms of human activity: unrestricted public use and structured bear viewing. We report on specific bear–human interactions and resultant effects on bear behavior.

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STUDY AREA

The O'Malley River study area (OMR) was located on Kodiak Island in the Gulf of Alaska (56–58°N, 152–155°W). OMR was part of the Karluk River watershed and included O'Malley River, the lower portions of Canyon Creek, Falls Creek, Cascade Creek, and portions of the O'Malley Lake and Karluk Lake shores (Fig. 1). Vegetation of the area included grass–forb openings interspersed with patches of tall (>1.5 m) shrub and balsam poplar (*Populus balsamifera*). Representative vegetation included bluejoint grass (*Calamagrostis canadensis*), sedge (*Carex* spp.), fireweed (*Epilobium augustifolium*), Sitka alder (*Alnus crispa*), salmonberry (*Rubus spectabilis*), and European red elder (*Sambucus racemosa*).

The Karluk River watershed supported the largest run of sockeye salmon (*Oncorhynchus nerka*) on the Kodiak Archipelago (Brennan et al. 1996). Annual escapement of sockeye salmon into the Karluk River ranged from 657,455 to 1,134,086 during 1991–94 (ADF&G files, Kodiak), and an estimated 20–25% of those fish spawned in O'Malley River and tributaries, Cascade Creek, and along the beaches of Karluk and O'Malley Lakes. These salmon attracted 58–62 identifiable bear groups (single animals or family groups) to OMR each year during 1991–94 (V.G. Barnes, Jr., unpubl. data).

Two general types of public use occurred on OMR during the study. In 1991 public use included guided and unguided day use, overnight camping, and cabin rental along Cascade Creek. Similar public use occurred in 1993, except people were not allowed to camp on the area or rent the cabin. The most common activities were wildlife viewing and photography, fishing, and hiking.

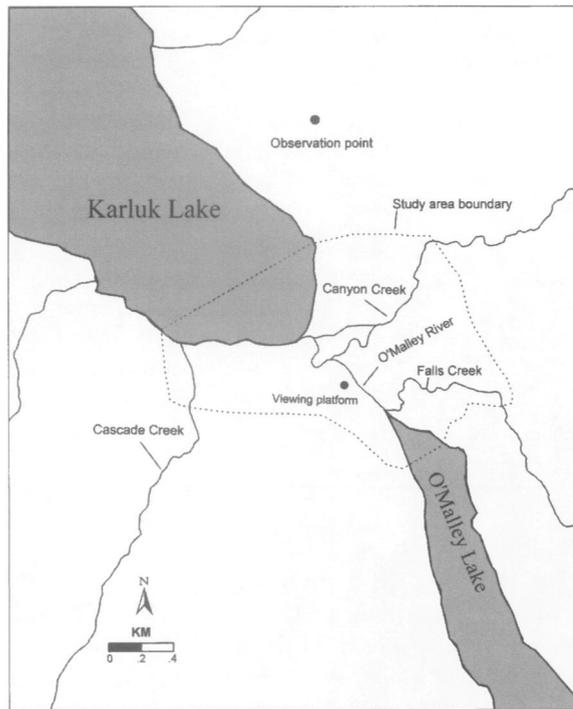


Fig. 1. The O'Malley River study area on Kodiak Island, Alaska, 1991.

Public use on OMR in 1992 and 1994 was limited to participants of a structured bear viewing program. A 16-km² area surrounding O'Malley River was closed to general public access during 25 June to 30 September. The bear viewing program was operated by Kodiak NWR employees in 1992 and by a private operator under a special-use permit in 1994. During both years program participants stayed overnight at a campsite on the Karluk Lake shore about 2.5 km from O'Malley River. Each day a maximum of 6 visitors and 1 or 2 guides hiked to a wooden viewing platform located about 3 m above and 5 m from the near bank of the O'Malley River. Travel to the viewing platform occurred during 0800–1000 hour in the morning, and departure from the platform usually occurred during 1500–1800 hour. Bears were actively deterred from entering the immediate campsite area but were not intentionally disturbed elsewhere.

METHODS

Study periods were late June to late September in 1991 and 1992, July to late September in 1993, and July to late August in 1994. Data were collected by 2–3 observers based at a field camp located at 325 m elevation on a

slope overlooking OMR (Fig. 1). Observations were recorded from an open knob about 100 m from camp and 1.4 km straight-line distance from O'Malley River. Observers used binoculars (10X) and spotting scopes (20–60X) to locate and classify activities of bears and people. We used scan and focal sampling procedures (Altmann 1974, Warner 1987, Gunther 1990, Olson and Gilbert 1994) to record observations; 12–15 minute scans (12/day) and 1 hour focal samples (4/day) were scheduled at randomly assigned times between 0600 and 2200 hours for 5 days/week. Additional bear–human interactions were recorded when we were observing bears to develop identification profiles or when we anticipated an interaction (e.g., an approaching aircraft). Data reported here were acquired from 1,668 hours of observation (1991 = 480, 1992 = 433, 1993 = 490, 1994 = 265).

Brown bear response to aircraft, watercraft, or encounters with people on the ground were classified as follows: Neutral—no apparent change in behavior; Low—bear intently watched subject, walked <50 m and resumed normal behavior, or offspring displayed alarm but mother was unaffected; Moderate—bear walked away from subject (out of OMR or into cover) and did not reappear in ≤30 minutes; High—bear ran from subject and out of OMR.

When an aircraft approached OMR we selected a bear group judged to be within 100 m of the anticipated flight path for observation. Overflight elevation was based on trial flights by Kodiak NWR aircraft at known elevations and benchmarks on terrain surrounding OMR. Overflight elevation at the point nearest the bear groups was classed at <100 m, 100–200 m, or 201–400 m above ground. Aircraft were grouped into size categories of small (PA-18 Super Cub), medium (Cessna 180, 185 or 206 and DeHavilland Beaver), large (Widgeon, Goose, Caravan), and helicopter.

We only recorded interactions between bears and groups of people or watercraft when the distance between subjects was estimated at ≤200 m. Distances between subjects were estimated by comparison with known lengths between landmarks and were classed as <50 m, 50–100 m, and 101–200 m.

RESULTS

We recorded 86 responses of a brown bears to aircraft, with the majority (69%) occurring in 1991 (Table 1). The Kodiak NWR asked air charter companies to avoid flights below 244 m after the 1991 season, and compliance with that request reduced bear–aircraft interactions in subsequent years. Eighteen (48%) of 37 overflights at <100 m

elicited moderate or high response from bears compared to just 3 (9%) of 36 flights at 100–200 m ($\chi^2 = 14.47$, 1 df, $P = 0.0001$). At overflight elevations of <100 m, strong reaction by bears (moderate or high) did not differ between small and medium-size aircraft ($\chi^2 = 0.80$, 1 df, $P = 0.37$). A single instance of a large aircraft at <100 m resulted in a low response by a bear. Although sample size was small, bears were largely unaffected by aircraft flights >200 m above ground (Table 1).

We observed bear response to 4 helicopter flights, and 3 of these events (1 at <100 m, 2 at 100–200 m) caused bears to flee OMR. One flight at >200 m elicited no response from the bear under observation.

Brown bear response to human groups was recorded for 134 encounters during years of general public use (1991, 1993) and for 72 encounters in alternate years (1992, 1994) when bear viewing programs were in operation (Table 2). Groups of people in bear viewing programs usually were larger ($\bar{x} = 6.4$) than those during general public use ($\bar{x} = 3.2$; $t = 13.45$, 2 df, $P < 0.0001$). Under both types of management brown bears usually reacted strongly or not at all. There were few encounters ($n = 5$, 2%) where bears intently watched humans without walking or running away. High and moderate responses occurred more frequently ($n = 49$, 37%) with general public use than under conditions of structured bear viewing ($n = 4$, 6%; $\chi^2 = 23.57$, 1 df, $P < 0.0001$). Most of the interactions we documented were at distances <50 m (40%) or from 50 to 100 m (37%). The lower incidence of moderate or high response at 101–200 m (26%) compared to <100 m (40%) was not significant

($\chi^2 = 2.75$, 2 df, $P = 0.25$). One bear–human encounter in 1991 caused a female to abandon a 0.5 year-old cub that was subsequently killed by another bear. We did not observe bears charging people, although agonistic behavior without bluff charges might have gone undetected.

The primary activities of most people involved in bear–human encounters in 1991 and 1993 were photography ($n = 69$, 51%), bear viewing ($n = 27$, 20%), walking ($n = 9$, 7%), and bear deterrence (shouting, waving arms; $n = 8$, 6%). Bears ran or walked away from photographers more often ($n = 21$, 30%) than from people who were just watching ($n = 4$, 15%). Bears reacted strongly in all encounters where people were walking or using deterrence methods.

We documented interactions between bears and approaching (outboard powered) small skiffs or rafts at <100 m ($n = 3$) and 100–200 m ($n = 6$). The subject bears fled from OMR in all 9 events.

DISCUSSION

Aircraft flights over areas where bears seasonally concentrate on Kodiak Island are usually of 2 types. Certain areas, including OMR, are along standard travel routes that follow drainages and passes to villages and seasonally-occupied cabins or camps. Most traffic to and from these villages and camps is by medium-size or large fixed-wing aircraft and, except as dictated by weather, at elevations >450 m. The second type of air traffic typically occurs <200 m above ground and in-

Table 1. Responses of brown bears to 86 overflights of fixed-wing aircraft on the O'Malley River study area, 1991–94, Kodiak Island, Alaska.

Aircraft elevation above ground	Aircraft type	Level of brown bear response ^a				Total N
		High	Moderate	Low	Neutral	
<100 m	Small	2	2	1	1	37
	Medium	7	7	15	1	
	Large	0	0	1	0	
		9 (24%)	9 (24%)	17 (46%)	2 (5%)	
100–200 m	Small	1	2	0	13	36
	Medium	0	0	10	8	
	Large	0	0	0	2	
		1 (3%)	2 (6%)	10 (28%)	23 (64%)	
201–400 m	Small	0	0	0	3	13
	Medium	0	1	2	7	
	Large	0	0	0	0	
		0	1 (8%)	2 (15%)	10 (77%)	

^a High = run, moderate = walk away or to cover, low = watch, walk <50 m, or both, neutral = no change in behavior.

Table 2. Responses of brown bear to 206 encounters with human groups on the O'Malley River study area, 1991–94, Kodiak Island, Alaska.

Management type	Distance between bears and humans	Level of brown bear response ^a				Total N
		High	Moderate	Low	Neutral	
General public use (1991, 1993)	<50 m	8	11	3	31	53
	50–100 m	7	15	0	28	50
	101–200 m	2	6	1	22	31
		17 (13%)	32 (24%)	4 (3%)	81 (60%)	134
Bear viewing program (1992, 1994)	<50 m	1	0	1	33	35
	50–100 m	1	2	0	28	31
	101–200 m	0	0	0	6	6
		2 (3%)	2 (3%)	1 (1%)	67 (93%)	72

^a High = run, moderate = walk away or to cover, low = watch, walk <50 m, or both, neutral = no change in behavior.

volves small or medium-size aircraft on fish and wildlife surveys or medium-size aircraft on “flight seeing” tours to show tourists as many bears as possible.

Standard point to point air traffic clearly is not disruptive to bears at OMR, although it may habituate some bears to aircraft (McLellan and Shackleton 1989). Thus, bears on OMR may be less affected by aircraft than on areas where air traffic is uncommon.

Fixed-wing aircraft flying at <100 m were often disruptive to bears, but the incidence of strong response (running or walking away) declined sharply at 100–200 m and was negligible at >200 m. Disturbance to brown bears might be greater on areas with less cover and infrequent or sporadic air traffic (Harding and Nagy 1980, McLellan and Shackleton 1989). Surprisingly, we were unable to distinguish a difference in response of bears to different sizes of fixed-wing aircraft. This result could be a consequence of bear habituation to aircraft or our limited sample for small aircraft interactions. Regardless, efforts to keep both fixed-wing and helicopter flights >200 m above ground should minimize adverse effects to bears at streams with spawning salmon.

Our sample of interactions between bears and watercraft was small but nonetheless convincing that outboard-powered boats and rafts on OMR were particularly disruptive to bears. Travel by watercraft was the most infrequent type of human activity on Karluk Lake, thus the activity least familiar to bears. That unfamiliarity, combined with the high levels of noise that are typical of boats, probably explains why bears ran from approaching watercraft.

Brown bears on OMR ran or walked away from encounters with people more frequently during years of

general public use than in years with bear viewing programs. This contrast was evident even though the largest groups usually were associated with the viewing programs. We believe people in bear viewing programs were less disruptive to bears than non-guided use because the patterns of human activity were consistent and predictable. Program participants traveled to and from the viewing platform at approximately the same time each day, used a trail that did not interfere with bears using O'Malley River, and stayed at the platform during the time they were at the river. Similar conditions contributed to minimal disruption of bear behavior at the McNeil River State Game Sanctuary (Faro and Eide 1974, Aumiller and Schoen 1991, Aumiller and Matt 1994). At the Stan Price State Wildlife Sanctuary (Pack Creek), restrictions on human movements also resulted in less disturbance to brown bears (Fagen and Fagen 1994b).

In years when general public use occurred on OMR, visitors moved about the area freely and often used the O'Malley River as a travel route. The shore of Karluk Lake was a common place for planes and boats to offload people and also was a popular area for people who fished or stalked bears for photographs. Human activity patterns were unpredictable and were focused on areas where bears preferred to fish. This type of activity not only increased the chances of encountering and surprising bears, but also might have caused some bears to avoid OMR (Olson et al. In Press).

Substantial movement of people during years of general public use, compared to the primarily stationary mode of people in viewing programs, appeared to be an important element in disturbance of bears. Activities such as walking, aggressive behavior to alert or scare bears, and stalking with cameras were particularly disruptive to bears.

Effects of these activities extended to 200 m and, for some bears, probably much further (McLellan and Shackleton 1989).

Brown bear viewing programs conducted by private enterprises are common on Kodiak NWR, Katmai National Park and Preserve, and many other areas in private or government ownership. The affect of these programs on bear use of habitat will undoubtedly vary. Nevertheless, management of these programs can be enhanced by knowledge of how bears react to different human activities. Guidance to improve bear viewing opportunities and facilitate bear access to important habitat should consider (1) altitude limits for aircraft, (2) control of extensive movement by people, (3) identification of travel routes that minimize encounters with bear, and (4) limits on the number of travel routes and observation points used by people. To accommodate a growing demand for bear viewing opportunities (Titus et al. 1994), we encourage investigation of management options that are more restrictive than general public use but less restrictive than highly structured programs that are very successful but in short supply.

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