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CAPTURE AND RADIO TELEMETRY OF MOUNTAIN GOATS IN ALASKA

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ABSTRACT

Between August 1979 and June 1981, 41 mountain goats (Oreamnos americanus) were captured and radiocollared in the Kenai Mountains, Alaska. Capture was by drugged darts fired from a helicopter, using the drug M-99 (etorphine hydrochloride). The method was efficient and selective. No goats were killed or seriously injured during capture. Drug effects appeared more consistent and predictable in early summer than in late summer when goats were fat. Goats were equipped with color-coded radiocollars and subsequently relocated periodically by means of a Piper Supercub fixed-wing aircraft equipped with directional antennas and scanning receiver. Except for 1 collar that failed initially and 8 goats that subsequently died, all collars were still functioning in January, 1982.

INTRODUCTION

Several methods have been used with varying degrees of success to capture, mark, and relocate Rocky Mountain goats. In the early 1950's, goats were captured in Alaska for a transplant while swimming or by commercial trappers. Attempts to catch them by foot traps, baited corral-tarps, lassoing, and running down newborn kids met with poor success (Burris and McKnight 1973). Rideout (1974a) successfully captured goats in Montana with baited Clover traps; he tried drop nets and darts drugged with phencyclidine hydrochloride (Sernylan, Parke-Davis Co.), but had limited success.

Hebert et al (1980) captured goats in Canada with Clover and corral traps. These methods were slow, inflexible, required considerable manpower and time, and resulted in losses from capture myopathy. Cannon-netting was used by Thompson and McCarthy (1980), but, while successful, was cumbersome, slow, and also required a fixed, baited site.

Quaedvlieg et al. (1973) utilized Clover traps in Alberta, but then immobilized the captured goats with the drug etorphine hydrochloride (M-99, D-M Pharmaceuticals) for ease in handling. Free-ranging goats were captured by Kuck (1977) utilizing M-99 and darts fired from the ground and from a helicopter.

This technique and/or drug has been used on numerous wildlife species in Africa (Young 1975) and in America on moose (Alces alces) (Ballard and Gardner 1980, Gasaway et al 1978, Lynch 1981, Roussel and Patenaude 1975), bighorn sheep (Ovis canadensis) (Thorne 1971), pronghorn antelope (Antilocapra americana) (Autenrieth et al 1981), woodland caribou (Rangifer tarandus) (Fuller et al. 1981), black bears (Ursus americanus) (Beeman et al. 1974), Sitka blacktailed deer (Odocoileus hemionus) (Schoen et al. 1981), and others.

Schoen (1978) tried snares and helicopter-dropped nets, but finally settled on the drugged dart fired from a helicopter as the best method to date for capturing free-ranging goats in Alaska. He used 2.5 - 3 mg of M-99 per goat injected intramuscularly with a Cap-chur gun (Nasco-west, Modesto, CA) from a Hiller 12E helicopter. Of 8 goats hit, 5 were captured; no losses occurred. He captured these goats in winter in deep snow to avoid losses caused by falling from precipitous terrain.

Installation of radio-collars has proven one of the best methods by which captured animals can be identified and relocated as needed. Relocating collared goats was initally accomplished by use of fixed directional antennas and triangulation or by hand-held directional antennas (Rideout 1974b). More commonly, free-ranging animals have been relocated by utilizing directional antennas mounted on aircraft, either fixed-wing or helicopter (Ballard et al. 1979, Hoskinson 1976, Inglis 1981, Mech 1974). Schoen (1979) used double, 3-element Yagi antennas mounted on a Helio Courier for locating collared goats with excellent success in southeastern Alaska.

This paper presents updated and detailed methodology and results utilizing these highly successful techniques on mountain goats in Alaska. The capturing, collaring, and radio-tracking work was part of a larger study on goat movements.

METHODS

CAPTURING AND COLLARING

Twenty goats were captured in the Kenai Mountains, Alaska, in August 1979; 3 in August 1980; and 18 in June 1981. The same technique was used in all 3 sessions with but minor variations. Habitat was generally goat summer range consisting of very rugged, heavily glaciated mountains. All goats were captured in the alpine between elevations of about 762 m (2500 ft) and 1372 m (4500 ft); some on open tundra or fellfields, some on snowbanks, glaciers, or icefields, and some on precipitous slopes or cliffs. No serious injuries or fatalities occurred.

A Bell 206 B Jet Ranger helicopter was used in all operations. The crew consisted of 3 men: pilot, shooter, and assistant, except that only the pilot and shooter were present in 1980. Crew size, which was adequate, was limited to 3 to reduce weight and allow more maneuverability of the helicopter in dangerous terrain. Communication between crew members was enchanced by use of a three-way, portable intercom system (Genie Electronics Engineering, Inc., Red Lion, PA) which allowed continuous conversation and direction.

Etorphine (M-99) was used for all capturing. It was fired in darts from a standard Cap-chur gun using green (intermediate-range) propellant charges. Dart needles were modified by cutting off most of the barb and shortening needles to just ahead of the barb attachment. Less tissue damage resulted from the shorter darts which were then easier to remove with the smaller barbs. A dosage of 4 mg (4 cc) of M-99 was used on all but the largest adult males, some of which were given 5 mg. However, 4 mg was used on all goats from yearlings to adult males in the June 1981 operation.

In practice, goats were located in terrain where it appeared we had a good chance to effect a capture before darted animals could reach extremely precipitous areas where they might become injured by falling when narcosis occurred. An animal or group was selected and the helicopter maneuvered in a slow hover behind the target until a favorable shot was presented. Goats usually reacted to close pursuit in one of three ways: if in sloping terrain, they would frequently climb; when rock outcrops were present, they often would flatten against the downhill side; on relatively level ground, they would run straight away. If they reached dangerous terrain, the chase was abandoned. Their deliberate and relatively predictable flight pattern allowed close approach from the rear or side in most cases, and with patience, easy shots of under 15 m (49 ft) could be obtained. Continuing voice communication between shooter and pilot via the intercom contributed substantially to efficiency and success.

When dart placement was confirmed, the helicopter would back off to avoid unnecessary harassment, and the goat would be observed from a distance until it went down. Only if it began running for dangerous cliffs would attempts to herd it be made. Usually, goats would respond to herding until the drug began taking effect, after which, they would go their own way regardless of helicopter approach.

When the goat became and remained prostrate the helicopter would land nearby and the crew could proceed with their equipment to the goat. However, in steep terrain where the helicopter could not land, it was often necessary for the shooter and assistant to jump from the hovering machine to be picked up later.

The anesthetized goat was sexed, aged from horn annuli, weighed and measured, and biological samples taken. Weight was obtained from slinging the goat beneath a portable 300 lb (136 kg) capacity spring scale suspended from a stout pole which was then lifted by 2 men. We found it impossible for 2 men to lift full-grown males high enough for weighing by this method.

A numbered eartag (Rototag, Nasco-West, Modesto, CA) was installed, and finally a color-coded radiocollar was fastened to the drugged goat. Radiocollars (Model MKVM, configuration 5 B with mortality-sensing option, Telonics, Inc. Mesa, AZ) were individually color-coded for visual identification by wrapping with various colors of plastic electrical tape in different patterns. The collars used were in the frequency range 150.000 to 152.000 MHz.

When work with the goat was completed, an injection of the antagonist diprenorphine hydrochloride (M-50-50, D-M Pharmaceuticals) was given intravenously in an amount equaling the original injection of M-99. Injection site was commonly the radial vein which was raised for easy access by using a lightweight, surgical-rubber-tubing tourniquet proximal to the site.

RADIO LOCATING

A Piper PA-18-150 Supercub has been the vehicle used in this project for all relocating of radio-collared goats. It has been used on wheels in spring and fall, floats in summer, and skis in winter with equal success. A pair of Hy-gain model RA-3 (Telonics, Inc.) 3-element Yagi antennas are mounted, 1 on each side of the airplane, on the lift struts. Mounting is similar to that described by Inglis (1981) except that the antennas point outward at 90 degrees to the axis of the fuselage rather than forward as in his description. Thus, the loudest signals are heard directly off either wing. The antennas lead via coaxial cables down the wing lift struts and through the control cable openings into the interior of the cockpit. They are connected to a Telonics TAC II right-left-both toggle switch, which in turn is connected to a Telonics mated TR-2 receiver and TS-1 scanner. Earphones can be plugged into the receiver. However, since I both fly the plane and operate the receiving electronics, I have found it more convenient to connect the telemetry receiver to an intercom system (Telonics model TADS-2) which integrates this system with the aircraft's avionics through 1 headset, as well as allowing a passenger with a second headset to hear all incoming signals and to communicate with me vocally.

In use, frequencies of collars to be located are programmed into the scanner and the antenna switch is set on "both". When a signal is heard, the scanner is locked on and the antenna switch moved to "right" or "left" for the loudest signal and to determine which direction to fly. If the goat appears to be at some distance away, the airplane can be turned slowly until a signal of equal strength from each antenna is heard. It is then pointing toward the collared animal. Because of the topography inhabited by mountain goats, this usually entails flying directly toward a mountain and is the main reason for not using Inglis' (1981) forward-pointing antennas and search method for final transmitter location.

Although the search method used is roughly similar to that described by Mech (1974) and others, the mountainous terrain necessitates some special techniques. Upon reaching the general area of the collared goat (indicated by an increasingly loud signal), the plane is flown close to and parallel with the mountain slope with the receiver volume turned low and tuned to the antenna facing the mountain. A rapid build-up and peak in sound level indicates the vertical plane occupied by the goat, but not the elevation. When the plane is flown close to the slope and the volume is loudest from the antenna facing the mountain, the target transmitter is either just off the wing tip or above the flight level. If it is of equal strength from both antennas at peak level, the transmitter is directly below; if stronger from the antenna facing away from the mountain, the goat is downslope.

Once the goat has been located, or its location approximated with appropriate precision, its position may be plotted on a map. I use clipboard-sized segments of U.S.G.S. 1:63,360 topographical maps with mylar plastic overlays. Four clipboards cover my study area. Further data on companions, habitat, etc. may be recorded on other forms or recorded in a small cassette recorder slung from my neck for that purpose.

RESULTS AND DISCUSSION

CAPTURING AND COLLARING

Because of their behavior when closely pursued by helicopter and their favorable response to etorphine, mountain goats are well suited to this method of capture. Efficiency of capture was high in all 3 collaring sessions to date. In the first, with no previous crew experience in capturing goats, and despite inclement weather, 19 goats were successfully captured with 22 hits. One more adult male was captured, but, because of an initial underdose, took 4 more darts before he could be caught. Thus, 20 were captured in a 5-day period. Three others were hit but not captured. One of these, a yearling, climbed into the clouds before narcosis occurred. It was seen the next day, apparently fully recovered. Another yearling vanished into a jumble of rocks after being hit, but apparently recovered; no carcass could be found later. An adult female, hit in the flank with injection directly into the rumen probable, showed no effect of the drug and escaped beneath a glacier.

During the second attempt in August 1980, 3 goats were captured with 3 hits in 1 afternoon. Eighteen goats were captured in the final operation in June 1981, with 19 darts (every shot hit) in 4 days. One adult male received a partial injection, only, and escaped into unsuitable terrain without complete narcosis. No mortalities occurred out of the 45 goats darted. Althrough several animals fell or slid considerable distances, no serious injuries resulted.

Recovery of anesthetized goats occasionally was hazardous due to terrain. Ice axes were used to good advantage on steep slopes and snowbanks. Rock climbing equipment, although always carried, was required only once when it was found necessary to rappel down to an animal on a cliff ledge. A major contribution to success was the skill and interest displayed by the helicopter pilot, as well as the ability of the machine to perform as required.

Mean weights of goats captured and dosage levels of etorphine are listed in Table 1 by month of capture (August 1979 and August 1980 are combined). sex, and age class. Because most adult males could not be weighed, listed dosage levels for that class are biased on the high side. Dosage levels and animal weights were compared between month and class by standard t-tests. In almost all cases, dosages used resulted in deep anesthesia and ease of handling with no struggling or obvious awareness.

Statistically significant differences between mean weights and dosages in mg/kg of M-99 were found between June and August in "adult" females (those older than 1 year). Animals were lighter in early summer and, consequently, dosage rates were higher. Suggestive differences ($P < 0.10$) were found in weights and dosage levels between June and August in yearlings, while no significant difference ($P > 0.10$) could be detected for these parameters in "adult" males. The latter 2 anomalies were probably results of small sample size. Had more yearlings and adult males been captured, and more of the latter weighed, significant differences probably would have been found.

When all sexes and ages were combined, significant differences ($P < 0.05$) between June and August weights and dosage levels were noted, as they were between adult males and adult females when months were combined. Thus, goats generally received higher per kg dosages of M-99 in early summer when they were lighter in weight, and adult males received lighter dosages than adult females. The range overall in dosage levels was between 0.0304 mg/kg for a large adult male (and possibly lower for larger, unweighed males), and 0.1176 mg/kg for a small yearling. The overall mean dosage level for all animals and both seasons was 0.0680 mg/kg (SD=0.0185,N=32).

One adult male, estimated to weigh well over 136 kg (300 lb) was insufficiently dosed with the first 4 cc dart at a dosage level of about 0.0294 mg/kg or less. He subsequently took 4 more darts (one did not inject) for a total of 15.5 mg of M-99 (approximately 0.1140 mg/kg) before capture. Although this required considerable harassment during pursuit, he recovered with no apparent ill effects.

No differences in mean induction time could be detected between months or sex/age classes. The mean induction time was 7.5 minutes, with a range of 2 to 15 minutes. Not all induction times were recorded; however, it appeared that these were more uniform and capture more certain in June when the animals were lighter and dosage rates in mg/kg higher at 4 mg/dart.

Quaedvlieg at al. (1973) reported a mean dosage level of 0.0375 mg/kg and induction time of 3.3 minutes for trapped goats, but lost one, presumably from underdosing and consequent excitement. Schoen (1978, 1979) first used 2.5 - 3 mg/goat in capturing free-ranging animals for a mean induction time of 15 minutes. Increasing dosage to 3.5 mg/goat decreased his mean induction time to 12 minutes. In this study, the average dosage of 4 mg/goat further reduced mean induction time to 7.5 minutes. Reduced induction time, obviously, is advantageous in preventing escape and reducing exertion in darted animals. Autenrieth et al. (1981), working with pronghorns, and Lynch (1981), working with moose, both felt underdosing with M-99 was more dangerous than overdosing due to the prolonged pre-induction excitement and exertion. I agree, and believe that a safe and workable dosage for mountain goats is 4 mg/goat in early summer (3 mg/yearling probably would be adequate, but 4 mg appears safe), and 4 to 4.5 mg/goat in fall except that adult males should be given at least 5 mg in fall.

Kuck (1977) and Quaedvlieg et al. (1973) gave the antagonist M-50-50 at double the rate of M-99 in the capture dose. Schoen (1978) gave it at equal dosage intramuscularly and reported a mean recovery time of 8 minutes. In this study, M-50-50 was givin at the same dosage as M-99 but intravenously. Mean recovery time was 1.5 minutes, with a range 0.5 minutes to 4 minutes. The 1 male given 15.5 mg of M-99 was given 10 mg of M-50-50 and recovered in 2.3 minutes. No differences in mean recovery time could be found between sex/age class or month of capture. Recovery typically was sudden with the animal up and walking off within seconds of first opening its eyes. Although most appeared disoriented at first, their sense of balance returned rapidly and no falls occurred during recovery. Two animals which inadvertantly received their antagonist intramuscularly took over 15 minutes each to recover. Thus, intravenous is the preferred route for the antagonist where rapid recovery is desirable.

The cost of capturing 18 mountain goats in June 1981 (exclusive of manpower) included the following:

Helicopter	20 hours @ $381.00/hr	$ 7620.00
Darts	19 @ $9.24 (many were recovered)	175.56
Drugs (M-99 and M-50-50)		484.50
Collars	18 @ $262.20	4719.60
	Total	$ 12,999.66

The cost per goat captured was $722.20. Ballard and Spraker (1979) estimated the cost of capturing wolves (Canis lupus) by helicopter and dartgun at $578 per wolf, exclusive of collar and manpower. Including a radiocollar would have brought their cost up to about $840 per wolf. In 1953, the State of Alaska paid trappers $100 per male goat and $400 per female for a transplant (Burris and McKnight 1973), and had difficulty obtaining enough animals. The present method is cheaper (allowing for inflation), more selective, and much more efficient.

RADIO LOCATING

Locating radiocollared mountain goats by the method described has proven relatively simple and certain. On nearly every search, all goats have been located, although not always visually. During summer, it has been easier actually to see the animals than during winter when they blend in with the numerous snowbanks or are under tree canopies. Even when the collared goat could not be spotted, it has been possible to narrow its location to a circle of about 100 m (300 ft) in diameter or less by careful flying and search. During hot summer days, goats have been found by persistent search even when under snowbanks or in shallow caves.

One problem encountered occasionally has been signal echos in certain valleys. These indicate false positions and sometimes require considerable searching to overcome. They appear more prevalent in narrow canyons in winter.

I do not know the maximum range of these collars. Sharp signals have been received from as far away as 25 km (15 mi). However, most searching is done in valley systems where ranges are much less and unwanted signals from adjacent valleys are blocked out by high ridges. Valley-by-valley searching acquires signals only from those animals within the valley and assures the operator that any signals heard emanate from nearby animals.

Another minor problem encountered has been signal drift, particularly in cold weather. However, this drift has been less than 1.0 KHz and only by a few transmitters. Since no collar frequencies have been spaced closer than 10.0 KHz, there has been no confusion created in identificaton, but merely a requirement to program the scanner 1.0 KHz to one side or the other of the listed frequency on a few collars.

Transmitter longevity has been very satisfactory. Except for 1 possible complete failure initially, all collars have functioned as advertised. Expected life upon installation was 2 years. All collars put on in August, 1979 and on still-living goats (13) were functioning in January, 1982--29 months later. One collar on a goat killed by an avalanche in early winter 1979, and buried under tons of packed snow all that winter, all the next, and part of the third, finally ceased to function in December, 1981. All this time it had been operating on "mortality mode" at twice the normal pulse rate, resulting in a higher battery drain. Other collars continued to operate under avalanches and after the goat carcasses had been eaten later by scavengers and the collars much chewed, even by grizzly bears (Ursus arctos). This speaks well for their construction. In fact, all the electro ic equipment purchased from Telonics, Inc., has performed remarkably well under adverse conditions.

Time required to radio locate 34 collared goats--the maximum number operating at any time--on a study area of approximately 609 km^2 (235 mi^2), was about 7 to 8 flying hours, including about 1 hour of ferry time to and from the area. This required 2 flights in a Supercub and could be accomplished in 1 day during summer, but took 2 in winter when days are short. More goats could be located visually in summer than in winter.

Color-coding collars makes it possible to identify individuals visually, an advantage when several collared animals are in the same group. Individual identification is necessary, for example, to determine which collared females are accompanied by kids in a group with several radiocollars. Bright collars also make it easier to sight a collared goat. Color-coding by plastic electrical tape has worked well, although sometimes it has been necessary to fly rather close to identify certain patterns. Collars so marked in 1979 were still recognizable in January, 1982.

Flight performance of the airplane use in radio tracking mountain goats is of great importance to both efficiency and safety. I have found the Piper Supercub to be an excellent vehicle, especially when flying and tracking alone. It is simple, may be flown slowly with safety, and has the tight turning radius necessary to search small valleys. Schoen (1979) used the Helio Courier, an aircraft of similar performance, with good success. Kuck (1977) used a Cessna 182 for radio locating mountain goats in Idaho; I believe such a fast, heavy aircraft would be both inefficient and dangerous for this work in the rugged mountainous terrain of Alaska's goat habitat.

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LITERATURE CITED

Autenrieth, R. E., G. L. Copeland and T. D. Reynolds. 1981. Capturing pronghorn using a helicopter and etorphine hydrochloride. Wildl. Soc. Bull. 9(4):314-319.

Ballard, W. B., A. W. Franzmann, K. P. Taylor, T. Spraker, C. C. Schwartz and R. O. Peterson. 1979. Comparison of techniques utilized to determine moose calf mortality in Alaska. Pages 362-367 in Proc. 15th N. Am. Moose Conf. and Workshop. Soldotna-Kenai, AK.

__________ and C. L. Gardner. 1980. Nelchina yearling moose mortality study. Alaska Fed. Aid in Wildl. Rest. Prog. Rept. Proj. W-17-11 and W-21-1. 22 pp.

__________ and T. Spraker. 1979. Unit 13 wolf studies. Alaska Fed. Aid in Wildl. Rest. Prog. Rept. Proj. W-17-9 and W-17-10. 90 pp.

Beeman, L. E., M. R. Pelton and L. C. Marcum. 1974. Use of M-99 etorphine for immobilizing black bears. J. Wildl. Manage. 38(3):568-569.

Burris, O. E. and D. E. McKnight. 1973. Game transplants in Alaska. Alaska Dept. Fish and Game, Wildl. Tech. Bull. 4. 57 pp.

Fuller, T. K. and L. B. Keith: 1981. Immobilization of woodland caribou with etorphine. J. Wildl. Manage. 45(3):745-748.

Gassaway, W. C., A. W. Franzmann and J. B. Faro. 1978. Immobilizing moose with a mixture of etorphine and xylazine hydrochloride. J. Wildl. Manage. 42(3):686-690.

Hebert, D. M., W. K. Hall and B. McLellan. 1980. Rocky Mountain goat trapping and transplanting in British Columbia and Alberta. Pages 388-401 in W. O. Hickey (ed.) Proc. Bienn. Symp. North. Wild Sheep and Goat Counc. Salmon, ID, April 23-25.

Hoskinson, R. L. 1976. The effect of different pilots on aerial telemetry error. J. Wildl. Manage. 40(1):137-139.

Inglis, J. M. 1981. The forward-null twin-Yagi antenna array for aerial radiotracking. Wildl. Soc. Bull. 9(3):222-225

Kuck, L. 1977. The impacts of hunting on Idaho's Pahsimeroi mountain goat herd. Pages 114-125 in W. Samuel and W. G. MacGregor (eds.) Proc. 1st Int. Mountain Goat Symp. Kalispell, MT. Feb. 19.

Lynch, G. M. 1981. Use of etorphine to immobilize moose. J. Wildl. Manage. 45(4):981-985.

Mech, L. D. 1974. Current techniques in the study of elusive wilderness carnivores. Pages 315-322 in Proc. 11th Int. Cong. Game Biol.

Quaedvlieg, M. T., G. Gunderson and A. Cook. 1973. Goat transplant 1972. Alberta Fish and Wildl. Div., Wildlife Inventory. Job Compl. Rep. VII Proj. W 472.

Rideout, C. B. 1974a. A comparison of techniques for capturing mountain goats. J. Wildl. Manage. 38(3):573-575.

_____ 1974 b. Radio tracking the Rocky Mountain goat in western Montana. Pages 139-144 in Proc. 11th Ann. Rocky Mountain Bio-engineering Symp. and 11th Int. ISA Biomedical Sci. Instrumentation Symp.

Roussel, Y. E. and R. Patenaude. 1975. Some physiological effects of M-99 etorphine on immobilized free-ranging moose. J. Wildl. Manage. 39(3):634-636.

Schoen, J. W. 1978. Winter habitat use by mountain goats. Alaska Fed. Aid in Wildl. Rest. Prog. Rept. Proj. W-17-10. 21 pp.

______. 1979. Winter habitat use by mountain goats. Alaska Fed. Aid in Wildl. Rest. Prog. Rept. Proj. W-17-11. 52 pp.

______, M. D. Kirchoff and O. C. Walmo. 1981. Seasonal distribution and habitat use by Sitka black-tailed deer in southeastern Alaska. Alaska Fed. Aid in Wildl. Rest. Prog. Rept. Proj. W-21-1. 59 pp.

Thompson, M. J. and J. J. McCarthy. 1980. Cannon-netting mountain goats. Pages 384-386 in W. O. Hickey (ed.) Proc. Bienn. Symp. North. Wild Sheep and Goat Counc. Salmon, ID, April 23-25.

Thorne, T. 1971. The use of M-99 etorphine and acetylpromazine in the Rocky Mountain bighorn sheep. Pages 127-134 in E. Decker (ed.) Trans. 1st N. Amer. Wild Sheep Conf. Ft. Collins, CO, April 14-15.

Young, E. (ed.). 1975. The capture and care of wild animals. 1st U. S. ed., Ralph Curtis Books, Hollywood, FL. 234 pp.

Table 1. Mountain goat weights and dosages of M-99 by month of capture, sex, and age class.[1]

Month	Sex	Age class	N	Mean weight in kg	Difference significant?	Mean dosage mg/kg	Difference significant?
June	both	yrl.	3	38.4	no; $P > 0.10$	0.1042	no; $P > 0.10$
August	both	yrl.	2	50.4		0.0794	
June	F	2+	10	52.9	yes; $P < 0.001$	0.0759	yes; $P < 0.001$
August	F	2+	12	73.1		0.0577	
June	M	2+	2	70.3	no; $P > 0.10$	0.0600	no; $P > 0.10$
August	M	2+	3	97.8		0.0417	
Both	F	2+	22	63.9	yes; $P < 0.01$	0.0660	yes; $P < 0.025$
Both	M	2+	5	86.8		0.0500	
June	Both	1+	15	52.3	yes; $P < 0.001$	0.0796	yes; $P < 0.001$
August	Both	1+	18	74.8		0.0566	

[1] Exclusive of all animals which were not weighed.