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WILDLIFE CAPTURE
AND CHEMICAL IMMOBILIZATION

MAIELLA NATIONAL PARK | WILDLIFE RESEARCH CENTER
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ABSTRACT BOOK

WILDLIFE RESEARCH CENTER

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ORAL COMMUNICATIONS

1.Caeley Thacker

Comparison of carfentanil-xylazine and butorphanol-azaperone-medetomidine combinations for immobilization of free-ranging bison (*Bison bison*)

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Background

Several drug combinations have been evaluated as potential alternatives to carfentanil-based mixtures for chemical immobilization of ungulates; however, there are few direct comparisons of their efficacy. We compared the performance of a customized butorphanol-azaperone-medetomidine (BAM) combination to that of carfentanil-xylazine (CX) for reversible immobilization of free-ranging bison (*Bison bison*).

Methods

We immobilized 12 adult female bison by ground-darting from a vehicle in Northeast British Columbia in the fall of 2021. We compared a customized mixture of BAM comprised of 4.5 mL of compounded BAM with an additional 10 mg of 40 mg/mL medetomidine to a CX mixture comprised of 1.3 mL of carfentanil and 0.5 mL of xylazine at concentrations of 3 mg/mL and 100 mg/mL, respectively.

Results

Regardless of drug combination, all animals were adequately induced for handling and minor invasive procedures (e.g., skin biopsy and blood sampling). All animals recovered smoothly and timely, with most bison (10 of 12) becoming ambulatory in ≤10 min. Mean quality scores for induction and immobilization were similar for both drug combinations, while those for recovery were slightly better for CX. None of the mean induction or recovery times evaluated differed significantly between animals immobilized between our two drug combinations. Mean pulse rate and SpO 2 levels were lower for bison immobilized with BAM than those immobilized with CX; however, only that for SpO 2 was statistically significant. Considering vital rates and relaxation scores at 4–8 min (T1) and 14–20 min (T2) after recumbency, a general linear model revealed that 1) a deeper plane of anesthesia was reached at T2 , regardless of drug combination, and 2) respiration rates were significantly greater for animals immobilized with our BAM combination than those with CX, regardless of the time period.

Conclusion

BAM is a viable alternative to CX for immobilization of free-ranging female bison from the ground at the dosages we used.

Keywords: Bison, carfentanil, alpha 2, butorphanol-azaperone-medetomidine

2. Jacopo Morelli

Capture and chemical immobilization of the grey wolf (Canis lupus) in Scandinavia: a review of 16 years of experience with tiletamine-zolazepam-medetomidine.

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Background

Grey wolves (Canis lupus) are captured and chemically immobilized across the globe by means of several methods and drug combinations. Darting free-ranging individuals from a helicopter with a combination of tiletamine-zolazepam, with or without administering medetomidine on the ground, has been the protocol of choice in Scandinavia since 2008 for a total of 174 captures. Here we provide an overview of methods, benefits, risks and best practice guidelines associated with this drug combination.

Methods

The records of all wolves chemically immobilized in Scandinavia between 2008 and 2023 were reviewed and information on sex, weight, age, drug doses, duration of helicopter chase (i.e., from the first observation of the wolf until its recumbency as result of the immobilization), induction and recovery were analyzed. Physiological adverse effects related to either the capture method or the administered drugs were recorded, and appropriate strategies of intervention were adopted.

Results

All wolves were darted from a helicopter with tiletamine-zolazepam (mean dose 7 mg/kg) and captured for monitoring and research purposes in Norway and Sweden between December and March. The intensive helicopter chase was kept to less than 3 minutes to minimize stress and physiological adverse effects. No musculoskeletal injuries were reported during the chase. Inductions were overall quick, while recoveries were prolonged and often characterized by paddling, ataxia, and emesis. The potent antiemetic maropitant has been recently added to the capture protocol, with satisfactory results to date. Both hypothermia and hyperthermia occasionally occurred and were treated with active warming (e.g. insulated blankets, warm water bags) and cooling (e.g. snow, intravenous fluids), respectively. While mild transient hypertension was reported in some individuals, other cardiopulmonary variables were within physiological range. Two mortalities were directly linked to the capture event, both due to drowning in open water within the 24 hours after the recovery.

Conclusion

Free-ranging grey wolves have been successfully captured by darting from a helicopter with tiletamine-zolazepam, with or without administering medetomidine on the ground, for 16 years in Scandinavia. The association of this drug combination proved to be reliable and relatively safe when associated with this capture method. Adverse effects were rare and treatable.

Keywords: Canis lupus; tiletamine-zolazepam; medetomidine; chemical immobilization; hyperthermia; maropitant.

Figure 1.

WOLF CAPTURE DATA 2008-2023

Number of captures	
Males	96
Females	78
Total:	174
Adults	108
Pups (<1 year old)	59
Mean body mass (kg)	
All	40.3
Pups (M+F)	36.4
Adult M	46.3
Adult F	38.2
Darts and drugs	
Mean N darts spent per wolf:	1.8
% wolves down with 1 dart:	89.1
Mean ZT dose (mg):	275.9
Mean ZT dose (mg/kg):	7.0
% receiving M:	65.5
Mean M dose (mg):	0.6
Mean M dose (ug/kg):	15.6

Helicopter chase (from 1st observation until recumbency)

Median (min):	Range (min):
15	3-250

Induction (from darting until recumbency)

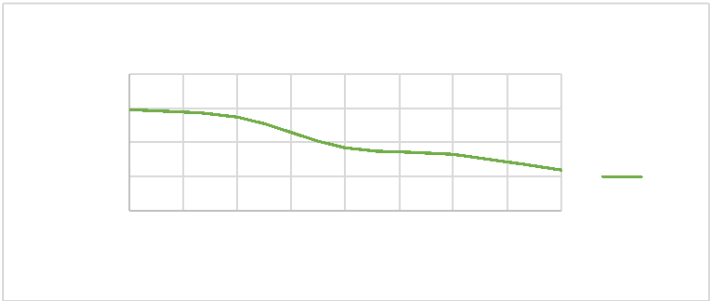
Median (min):	Range (min):
4	1-51

Recovery (from end of the procedures until coordinated walking)

Median (min):	Range (min):
133	10-551
% recoveries >2 hours:	51.6

Body temperature

% hyperthermia (>40.0°C):	32.2
% hypothermia (<37.0°C):	9.2



3. Ladislav Molnar

Immobilization of brown bears and use of cage trap in problem bear management in Slovakia.

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Population size and range of brown bear in Slovakia reached the historical maximum . Even large forested territories in Slovakia do not prevent human-bear conflicts. Authors presenting their experience with capture field anesthesia and veterinary interventions of problem nuisance bears,. From 2013 to 2019 total 25 bear captures and translocations were carried on. The most preferd way of capture was found a specially designed metal cage trap (1,5m x 1,7m x 2,5m). Trapping was performed in remote areas as well as in urban heavily inhabited areas with regular presents of bears. The main benefit of Trap cage was the public safety factor.. Almost fully cowered metal box trap allowed consequent immobilization of captured individuals also a safe injury-free temporary housing and further translocation. Authors used 3 anesthetic protocols to handle captured bears. For that reason uniform protocols were designed separately for free ranging and cage trapped bears. For anesthesia was used only registered and easily available anesthetics. Ketamin-xylasin mixture (Ketased-Xylariem) at dose rate 3-4 mg/kg (K) and 1-1,5 mg/kg (X) for young and subadults (14-70 kg) injected by blow pipe. Adult bears trapped in cage traps were anesthetized by 3-5 ml PneuDart darts. Preferred mixture was combination of Zoletil/Xylasin 3,5-5(Z) mg/kg and 1-2 mg/kg (X). Distant immobilization of free ranging bears-ussualy visiting communal trash bin areas or gardens in villages was performed by 2-3ml Pneu dart darts emitand by Dan-Inject rifle. Preferred drug combination due to long distance shooting by 2-3 ml PneuDart darts was, tiletamine-zolazepam (Zoletil 100) /detomidine (Domosedan)mixture at dose rate 3,5-5 mg/kg(Z) and 1-2 mg/kg (D). Recovery lasted from 40 to 150min. Anesthesia in all cases was antagonized by Atipamesol at dose rate 1,3 mg/kg min 30min post induction.. All immobilized bears were monitored and oxygenated by O2 at flow rate 3-5 l/min. The cowered cage trap was found as very safe way of capturing brown bears in densely inhabited areas. Tiletami-zolazepam-detomidine (TZD) mixture showed as excelen long distance darting anesthetic protocol with partial reversal ability and with minimum negative effect on physiological parameters. Presented result can be used for population managment of brown bears.

Keywords: bear, cage trap, Zoletil100, Detomidine

4. Simone Angelucci

Physiologic evaluation of capture and anesthesia with Fremont® Humane Foot Snare and Medetomidine–Ketamine–Acepromazine in free ranging Apennine wolf (Canis lupus italicus) and implications on animal welfare.

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The Maiella National Park (MNP) has been one of the parks that has worked most on the research and management of the Apennine wolf (Canis lupus italicus) in recent years. As coordinating beneficiary of the Life Wolfnet project (LIFE08 NAT/IT/000325) in the years 2010-2014, and currently of the Wolfnext project, financed by the Italian Ministry of the Environment, the Park's staff has been working since 2010 on various capture activities for research and to acquire information to prevent illegal mortality and promote coexistence with human activities. 20 wolves were captured from 2010 to 2017: 12 of these, with the same mixed technique (Fremont® snare, a spring-activated foot snares equipped with a GSM-based alarm and chemical immobilization with a mixture of 0.05 mg/Kg of medetomidine -Domitor®-, 4.30 mg/Kg of ketamine -Imalgene®- and 0.15 mg/Kg of acepromazine -Prequillan®-) and under similar operating conditions (we have excluded wolves previously injured, recovered, captured in occasional or opportunistic situations or anesthetized with different mixture) were evaluated on the physiological response to the capture technique and animal welfare.

Induction, handling and recovery time were monitored, total capture time was registered and physiologic parameters checked. The wolves were equipped with global positioning system (GPS) radio-collar (Followit® GPS collars or Vectronic Aerospace®) and were left to recover close to the trap site. As reverse drug, 0.04mg/Kg of atipamezole (Antisedan®) was administered.

Clinical parameters (Heart rate, Respiratory rate, Temperature, SpO2, Noninvasive Blood Pressure and Electrocardiogram) were monitored instrumentally with a multiparameter portable monitor (Comen - Monitor Star 8000 VET®) during anesthesia on field conditions and by means of haematologic and biochemical test. We also evaluated injury scores due to the snare action on legs and mouth. Intensive post release GPS monitoring allowed us to verify that none of the captured wolves died after capture events nor showed abnormal social behavior.

Keywords: wolf, Humane Foot Snare, Medetomidine, Ketamine, Acepromazine, clinical parameters

5. Richard Delahay

A novel physical restraint cage for blood sampling conscious European badgers (Meles meles) in the field.

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Background

In the UK and Republic of Ireland, the European badger is considered the most significant wildlife reservoir of the bacterium Mycobacterium bovis, the cause of bovine tuberculosis (bTB) in cattle. To expand options for bTB surveillance and disease control, the Animal and Plant Health Agency developed a physical restraint cage to facilitate safe field collection of a small blood sample from the metatarsal pad of a restrained conscious badger.

Methods

The restraint cage has bespoke features including a cushioned movable internal wall, a solid floor and two sliding panels through which the hindfoot of a restrained badger can be accessed. Pronged metal inserts can be inserted horizontally to restrict internal cage height, which together with the movable internal wall, provide restraint. An initial field trial was conducted on badgers routinely trapped as part of a wider study. However, because their responses to restraint may not be generalisable, a subsequent field trial was performed on badgers that had not previously been trapped.

Results

For the routinely trapped badgers, the target blood sample volume of 10 ul was successfully obtained on 22 of 33 occasions (67%). Same day examination of restrained animals detected no injuries other than the blood sampling incision site, and there was no evidence of a negative effect of restraint on subsequent recapture probability. For the naive to trapping badgers, the target blood sample volume was successfully obtained on 19 of 26 occasions (73%). All 26 badgers were assessed as fit for release back into the wild. Failure to obtain an adequate blood sample was more likely in cubs.

Conclusion

The restraint cage removes the need for general anaesthesia to obtain a diagnostic blood sample, thus eliminating the risks of associated adverse effects, reducing costs and time before release back into the wild. These advantages could expand current options for surveillance and disease control in badgers by allowing more efficient trap-side blood sampling.

Keywords: badgers; blood sampling; conscious; physical restraint

6. Naima Jutha

A multimodal approach to the immobilization of free-ranging grey wolves (Canis lupus) using netgun capture and reversible butorphanol/azaperone/medetomidine anesthesia.

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The capture and restraint of grey wolves (*Canis lupus*) must consider various challenges, including animal and human safety, access to capture terrain, and animal welfare. In northern Canada, capture of wolves occurs on some landscapes where a combination of net gun capture and chemical immobilization can enhance the safety and efficiency of capture and handling. Given the documented success of alpha-2 agonist-opioid combinations in canids in zoological and domestic animal settings, we used a compounded injectable anesthetic alongside a physical capture technique in free-ranging wolves. Twelve adult grey wolves were immobilized using a two-step multimodal approach: aerial net-gun capture with manual restraint using a Y-pole, followed by intramuscular injectable anesthesia. Captures occurred in November 2021 and January 2022 (n=2, Yukon, Canada), and in March 2023 and June 2023 (n=10, Northwest Territories, Canada). During physical restraint, a face mask was placed over the animal's eyes to reduce visual stimulation and 0.5 mL of a commercially-available reversible combination of butorphanol (27.3 mg/ml), azaperone (9.1 mg/ml), and medetomidine (10.9 mg/ml) was administered intramuscularly (BAM II, Chiron Compounding Inc.). Mean induction time was 5.3 ± 3.25 minutes. Anesthetic assessment showed all wolves to be in adequate, stable plane of anesthesia during handling, and majority animals did not require additional drug (n=11/12). In one case, a wolf experienced transient arousal, followed by re-sedation within 2 minutes. Vital signs were monitored throughout handling and were within expected limits throughout the procedure. Radio-collars were fitted, and biological samples and data were collected during anesthesia for health and population monitoring purposes. Six animals had minor capture-related injuries, including a cutaneous laceration, laceration to the tongue/lip, broken nail, and fractured tooth. Anesthesia was reversed with 1.1 mL atipamezole (25mg/ml) and 0.5mL naltrexone (50 mg/ml) administered intramuscularly. Time to ambulation following reversal administration was 5.50 ± 2.82 minutes. A smooth emergence from field anesthesia was observed with consciousness and ambulatory ability occurring simultaneously in all wolves. Our experience with this approach offered a safe, rapidly-effective, and reversible option for the capture, field anesthesia, and handling of wolves for the fitting radio-collars and collection of samples.

Keywords: northern Canada; butorphenol; azaperone; medetomidine; grey wolf; net-gun capture

7. Liliana Costanzi

Impacts of capture on wild animals. Assessing short term effects on behaviour in free-ranging wolves (Canis lupus): a case study.

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Background

Monitoring wild animals often require invasive procedures, such as chemical or physical restraint, as in the case of GPS radiocollars deployment. These devices are crucial tools to understand ecological functions, interactions, and spatial behaviour of individual. However, since their application involves capturing and often anesthetizing the animals, the post-capture behaviour can be affected by these procedures. Therefore, in order to avoid bias in the data collection it is crucial to assess the post-capture impacts, moreover, this may help to measure and mitigate any unnecessary discomfort experienced by the animals.

Methods

Between 2019 and 2023, we captured 11 wolves using foothold traps and subsequently immobilized them with a mixture of anesthetic drugs using a syringe blowpipe. Seven wolves were captured in the North-Eastern Italian Pre-Alps, while two wolves were from the Foreste Casentinesi National Park in the Apennines between Tuscany and Romagna, and two were from Migliarino San Rossore Massaciuccoli Regional Park along the Tuscany coast. We used GPS positions during the first 100 days after capture to examine the effect of time after release (hours) on the wolves' movement rate (km/h). Additionally, we analysed the activity pattern of two wolves for which it was possible to recover the collars after data recording. All wolves were monitored for almost one year using a multiple-method approach which also incorporated camera traps.

Results

All captured wolves displayed low levels of mobility during the initial 20 days post-capture followed by a gradual restoration of normal activities (Fig.1). This general trend was further supported by the analysis of activity using two recovered collars. However reproductive females in three cases returned to their pups on the same day of capture and every wolf returned in the pack resuming all the functions they held prior to capture.

Conclusion

Despite the small sample size, these findings suggest that capture events induce a significant and lasting behavioral modification in wolves, indicating a high level of stress. To gain a deeper understanding, future research should investigate how factors such as sex, social status, weight and the drug combination used during captures may influence post-capture movement patterns.

Keywords: chemical immobilisation, spatial behaviour, movement rate, Canis lupus

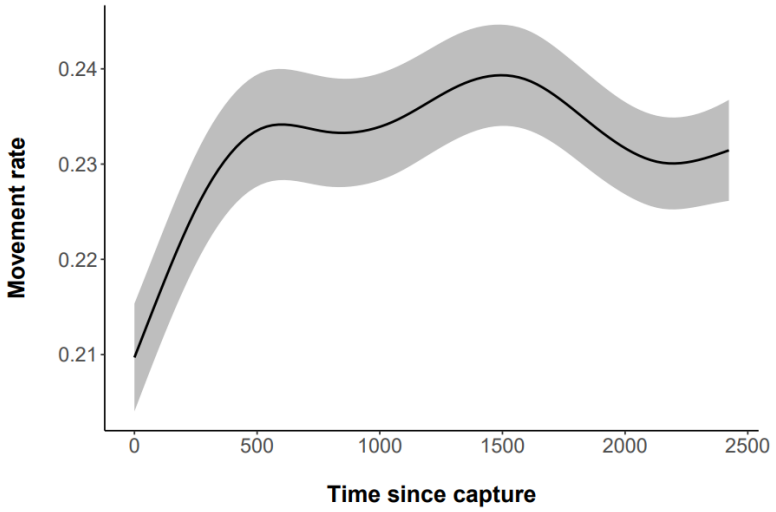

Fig.1 Effect of the time since capture (hours) on wolves movement rate (km/h)

8. Andrew R. Di Salvo

Investigating the efficacy of butorphanol-dexmedetomidine-midazolam versus tiletamine-zolazepam for field immobilizations of free-ranging wild fishers (Pekania pennanti)

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From 2009-2011, the California Department of Fish and Wildlife, United States Fish and Wildlife Service, Sierra Pacific Industries, and North Carolina State University reintroduced 40 adult fishers (24 females, 16 males) into a portion of their historical range in northern California. Annual captures and chemical immobilizations were conducted each fall from 2012 through 2017 to evaluate fisher health, affix monitoring collars, and determine species survival, reproduction, dispersal, home range, and energy dynamics. We compared butorphanol-dexmedetomidine-midazolam (BDM), a fully reversible immobilization combination, to tiletamine zolazepam (TZ). Fishers were captured in a baited and modified Tomahawk trap, transported to a central location, and weighed prior to their initial anesthetic injection. After processing, BDM fishers were reversed with naltrexone, flumazenil, and atipamezole while TZ fishers naturally recovered. The mean ± SD dose of BDM was 0.20 ± 0.02 mg/kg butorphanol, 0.03 ± 0.01 mg/kg dexmedetomidine, and 0.15 ± 0.01 mg/kg midazolam with a mean ± SD dose of reversal of 0.68 ± 0.18 mg/kg naltrexone, 0.21 ± 0.04 mg/kg atipamezole, and 0.10 ± 0.01 mg/kg flumazenil. The mean ± SD dose of TZ was 7.20 ± 0.43 mg/kg tiletamine zolazepam. Seven fishers (3 BDM, 4 TZ) required supplemental isoflurane to achieve deeper anesthesia during processing. A successful outcome – no significant anesthetic complications, no manual restraint post-induction, and an unremarkable recovery – was achieved in 15/16 BDM fishers and 30/30 TZ fishers; the solitary unsuccessfully immobilized BDM fisher experienced a spontaneous arousal near the end of processing and had to be manually recaptured, restrained, and reinduced with isoflurane before completing processing. Mean ± SD induction time for BDM was 8.8 ± 5.1 minutes and TZ was 2.6 ± 0.7 minutes. Mean ± SD recovery time for BDM was 44.6 ± 8.0 minutes and for TZ was 87.7 ± 24.2 minutes. While TZ offered quicker induction, the advantages of complete reversal and faster recovery in free-ranging landscapes with BDM remain attractive. However, we recommend further investigation of BDM at a higher dexmedetomidine dose or supplementing BDM with a less potent dissociative agent to avoid spontaneous arousals in a field setting.

Keywords: butorphanol; dexmedetomidine; fisher; midazolam; tiletamine; zolazepam

9. Slaven Reljić

Chemical immobilization of brown bears – a Croatian experience

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Background

Capture of brown bears for scientific purposes in Croatia dates back to 1981 when the first bear was equipped with a VHF radio collar. In 2003, the first GPS/GSM collar was employed on bears as a novel technique. In addition to collecting location data of the collared bears, we used the capture events to collect data on body morphometry, blood parameters (cellular composition and biochemistry), DNA (blood), age (premolar tooth) and various other values such as stress level, heavy metals, fatty acids (hair, blood).

Methods

The first bear in 1981 was chemically immobilized with ketamine (K, Ketalar) and xylazine (X, Rompun) in combination with only ketamine to prolong immobilization. Since 2015, we have used the combination of tiletamine and zolazepam (TZ, Zoletil) with medetomidine (M, Domitor, Sedastart) and adding only medetomidine for prolongation of immobilization. During sleep, the bears' heart and respiratory rates, body temperature were monitored and later blood oxygen levels with an oximeter.

Results

The absolute range of doses administered to a total of 53 bears for the ketamine + xylazine combination was between 4.0 and 30.3 mg/kg ketamine and between 0.42 and 12.5 mg/kg xylazine. The ranges of doses given to 21 bears immobilized with the tiletamine and zolazepam + medetomidine combination were 1.78 to 6.40 mg/kg and 0.011 to 0.050 mg/kg, respectively. The KX combination resulted in a slower onset of sleep with a shorter duration and sometimes a rapid recovery with full movements of the animal. with TZM induced faster onset but with slow and gradual recovery, sometimes for hours, when doses were higher. In cases where higher doses of TZM were administered, respiratory depression with lower values of blood oxygenation was also noted.

Conclusion

The wide range of dosages administered, for both the KX and TZM combinations, was related to various field conditions (e.g., stress level, thickness of subcutaneous fat), but suggests that the use of these chemical agents for immobilization is relatively safe in cases where it is difficult to estimate the actual body mass of captured animals. Because oxygenation of the blood is lower when the TZM combination is used, oxygen flow devices should be used throughout the procedure.

Keywords: immobilization; brown bear; Ursus arctos; free-ranging wildlife; Croatia

10. Adrian Colloff

The welfare impacts of two methods for blood sampling European badgers (Meles meles) in the field

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Background

In the UK and Republic of Ireland, the European badger is considered the most significant wildlife reservoir of the bacterium Mycobacterium bovis, the cause of bovine tuberculosis (bTB) in cattle. To expand options for bTB surveillance and disease control, the Animal and Plant Health Agency developed a bespoke physical restraint cage to facilitate safe field collection of a small capillary blood sample from the metatarsal pad of a restrained conscious badger. A key step, prior to pursuing operational deployment of any new wildlife management method such as this, is an assessment of the relative welfare impacts of the approach.

Methods

We used an established welfare assessment model (the Sharp and Saunders model based on the Five Domains model) during two stakeholder workshops to compare the welfare impacts of the restraint cage approach with the only current alternative for obtaining blood samples from badgers in the field, which involves administration of a general anaesthetic. Stakeholders with appropriate academic and practitioner expertise participated in the workshops and comprised experts in the fields of wildlife biology, animal welfare science, badger capture and sampling, and veterinary science.

Results

Both blood sampling approaches were assessed to have negative animal welfare impacts but based on our assessments, the restraint cage approach is no worse for badger welfare compared to using general anaesthesia and possibly has a lower overall negative impact.

Conclusion

Our study suggests that, when applied by a panel of stakeholders with suitable expertise, the model developed by Sharp and Saunders provides a versatile and practical tool for assessment of the welfare impacts of wildlife management methods and can be applied more broadly than its originally intended purpose of assessing the relative humaneness of pest animal control methods. Our results can be used to integrate consideration of badger welfare alongside other relevant factors, including financial cost and efficiency, when selecting an approach for blood sampling wild badgers in the field.

Keywords: badgers; animal welfare; blood sampling; Five Domains model

11. Giovanna Miani

Capture–induced changes in brown bear (Ursus arctos) activity patterns

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Background

Evaluating capture impact on brown bears (*Ursus arctos*) is essential to understand invasive monitoring effects, pinpoint crucial aspects, and refine capture protocols. To ascertain bears activity, motion sensors on radio–collars can be used to detect movements like walking or foraging. This study aimed to describe how capture alters the activity patterns in bears.

Methods

We retrospectively analyzed data from motion sensors applied on the GPS-collars placed during 7 bear captures in north–eastern Italy. We examined the activity data on the x–axis for 7 days following captures, with activity fixes recorded at 5-minute intervals. To assess timing of increased activity, we analysed the trend displayed by the cumulative moving average (CMA). By pinpointing the initial three peaks (P1, P2, P3) of activity, we could describe the activity trends after captures.

Results

On average, 1975 (range=1913–2017) x-axis activity values were analyzed per bear. Values ranged 0-255, where 255 depicts maximum acceleration. On average, the first CMA peak (P1) occurred 10 hours (range=7–14) after drug administration, showing an average value of 22.5 (range=2.5–78.2). P2 appeared after 36 hours (range=19–55) while P3 after 61 (range=49–77). Average values of P2 and P3 were 30.4 (range=17.9–48.8) and 32.5 (range=20.7–45.6), respectively. The highest peaks within the first seven days occurred 96 hours (range=12–147) after sedation, with an average value of 42.6 (range=24.3–78.2).

Conclusion

The CMA showed an oscillatory pattern linked to bear circadian rhythms, with a more prominent excursion in the first days after capture. In the first 10 hours post–sedation, activity slightly rises as bears move from capture sites. Consequently, P1 values tended to be lower than P2 and P3, with variability possibly influenced by varying effective drug doses. Subsequently, there was a decline until 1.5 days (P2), and a second drop followed by a third rise (P3) in less than 3 days. On average, P2 and P3 had similar, less variable values, indicating an emerging consistent pattern.

This pilot study describes activity of bears after capture. Further studies will aim to understand which specific aspects (drug type/dosage, capture method, ….) have a prominent influence on animals' behavior.

Keywords: Ursus arctos; x-axis activity; capture implications; activity pattern; post-capture activity; GPS collars

12. Alexandra Thiel

The cost of research: Lasting effects of capture, surgery and muscle biopsy on brown bear movement and physiology.

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Background

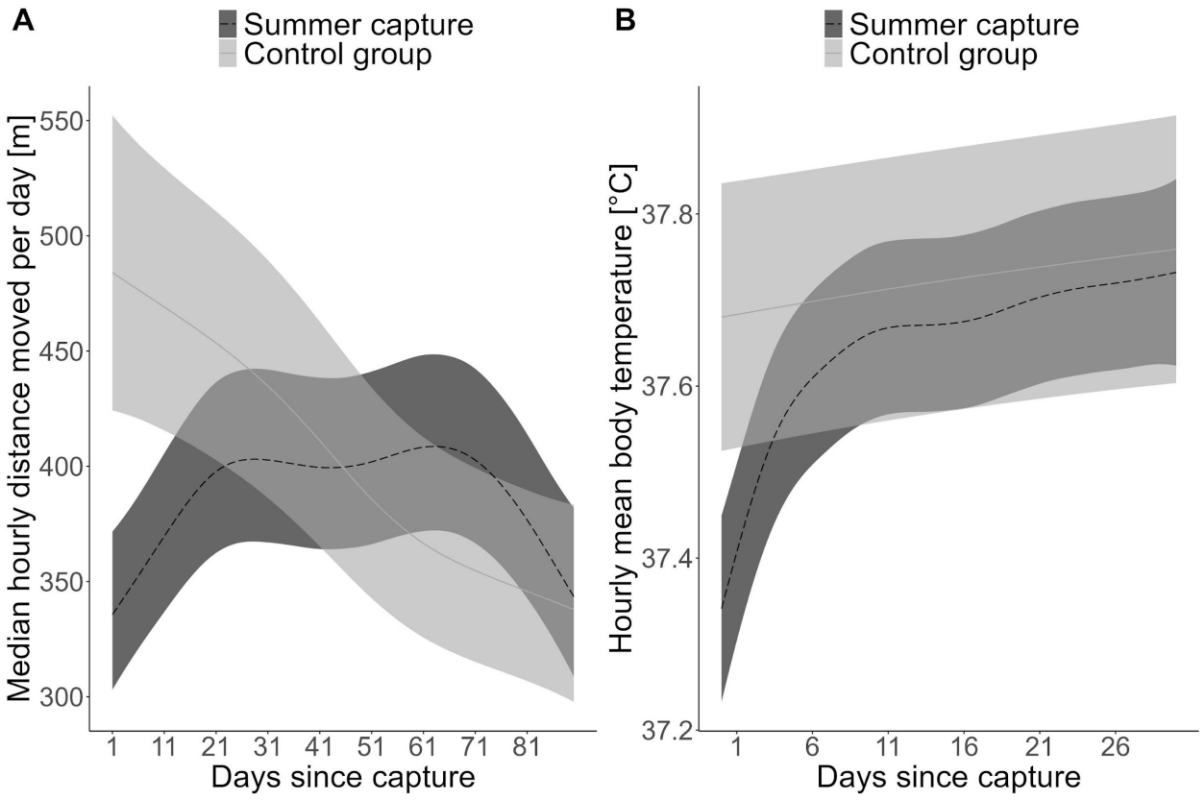
The use of animal models is a key component in the field of translational medicine to transfer scientific findings into practical applications for human health. A fundamental principle of research ethics involves weighing the benefits of the research to society against the burden imposed on the animals used for scientific purposes. The utilization of wild animals for research requires evaluation of the effects of capture and invasive sampling procedures on the study organism. Determining the character, severity and duration of these interventions on the animal's physiology and behavior allows for the refinement of study methodology and for the exclusion of biased data from scientific publications.

Methods

In this study, we compared movement, body temperature patterns and timing of hibernation onset of 39 Scandinavian brown bears (Ursus arctos) that were captured via helicopter in summer and underwent surgery and muscle biopsies as part of a human health project to 14 bears, which were not captured during the same time period (control group). We used generalized additive mixed models with median hourly distance moved per day and hourly mean body temperature as response variables and related these to time since capture to estimate when captured bears would return to control group levels.

Results

Captured bears in summer showed reduced movement for at least 22 days with a decrease in hourly distance moved of up to 30%, compared to the control group, but did not differ in the timing of hibernation onset. Furthermore, captured bears had 0.4°C reduction in body temperature immediately after the capture and returned to control group levels after 3 days.



Conclusion

We revealed that behavior and physiology of brown bears can be altered by capture and surgery for several days to weeks post capture. The overall aim of this interdisciplinary study to translate findings from the brown bear into human medical research may justify the invasiveness of the applied sampling procedures, nonetheless, the documented detrimental effects on behavior and physiology can be regarded as significant costs for the animals and should be carefully taken into consideration when formulating future capture and handling protocols for free-ranging brown bears.

Keywords: Behaviour, body temperature, brown bear, helicopter capture, surgery, translational medicine

13. Antonio Antonucci

Apennine Chamois (Rupicapra pyrenaica ornata) wild captures by associated mechanical and chemical immobilization in conservation translocations activities: clinical analysis and source population monitoring as tools to evaluate the efficacy and safeness of the method.

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The Apennine chamois (Rupicapra pyrenaica ornata) is a sub-species endemic of the Central Apennines. It is a priority species in the Habitats Directive (92/43/EEC), listed in the Appendix II of the Washington Convention(CITES) and re-classified from Endangered to "Vulnerable " in the IUCN 2008 Red List, thanks to the success of the first reintroduction actions. The Maiella National Park (MNP) thanks to a positive trend of his reintroduced (1992) chamois population, has been considered as a good source population for the realization of reintroductions in other protected areas. Captures of wild Apennine chamois in the MNP had never been attempted and therefore it was necessary to scrupulously plan the activities with, in a "preliminary phase", the individuation of the herds to be trapped, the capture areas and the best trapping method, in an "operational phase", the realization of the captures and the application of a standardized health monitoring protocol that was used to record the clinical findings and, in a "post-capture monitoring phase", the check for any possible negative consequences in regards to the captured chamois and the herds to which they have belonged. The aim of this study was to evaluate the efficacy and safety of a new capture method that includes mechanical immobilization, handling methods and chemical immobilization on free-ranging Apennine chamois, to allow the contemporary captures of groups of animals, that are considered the most suitable for reintroduction activities. This capture method foresees the associated use of the "Up-net" and/or box-trap and an acepromazine-medetomidine-ketamine administration. The effects of this protocol on the captured animals was evaluated by means of hematological and chemical analysis. In addition, for the first time on this species was applied the venous blood gas analysis during the field activities, in order to assess the animal welfare during the capture sessions and prevent critical situations. In order to verify the absence of a possible negative effect of captures on the increasing potential of the source population, we conducted a post-capture monitoring on the herds from which individuals were captured and released ex situ. Our objective was to verify that the herd remained integer and vital and that the capture event did not represent a considerable disturbance. We thus conducted a short and long term monitoring evaluating the possible fragmentation of the herd, the possible abandonment of the area, the possible decrease of herd reproductive capability and the possible decrease of kid survival.

The method and the chemical immobilization protocol applied in this study represent an innovative and useful approach for the free-ranging chamois captures, especially in conservation and management contexts, in which groups of animals should be captured and moved for reintroduction purposes.

Captures of wild chamois in the PNM were performed for the first time during the Life Coornata Project, when thepopulation was still growing and expanding at a spatial level and at the same time to evaluate the possible negative effect of captures on the released animal and on the source population.

Out of 37 translocated chamois, 21 individuals were evaluated clinically and by comprehensive investigation (18 female - 1 yearling, 4 subadults and 13 adults - and 3 male -1 yearling and 2 adults) with the aim to constitute new populations.

Keywords: Apennine chamois, animal welfare, acepromazine, translocation

14. Lorenzo Frangini

Take a deep breath, and try it again: brown bear (Ursus arctos) spatial behaviour in relation to the techniques and capturing site

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Background

Brown bears (*Ursus arctos*) captures represent a highly stressful event with potential behavioural consequences. Hence, assessing capture impacts is crucial and requires tools like GPS telemetry tracking to study post-release behavioural shifts as abnormal mobility, changes in habitat use and reactions to human-induced disturbances. We aim to preliminarily assess collared bears spatial behaviour in relation to the capture sites and techniques, hypothesizing that bears might avoid these areas due to perceived recapture risk.

Methods

We captured seven male bears (plus 1 recaptured) between 2007 and 2018 in north-eastern Italy, through remote drug delivery (RDD) from stand (n=2) or box traps (BT) (n=5+1, 160x160x280 cm). Bears were fitted with GPS collars collecting relocations every 15 minutes up to 6 hours. We calculated the Euclidean distance of each GPS relocation from the capturing site, starting two days post-capture, and categorized as: 'visit' (< 50m; VI), 'approach' (50m-100m; AP), and 'proximity' (100m-500m, PR). Furthermore, we assessed the time between capture and first visit. Capturing sites were baited with corn and fruits before and after capture.

Results

Overall we obtained 24,763 (mean = 3095.38, SD = 2208.23) locations with variable monitoring periods (125-521 days). Genetic analysis identified six Dinaric-origin bears that displayed vagrant (n=5) and resident (n=1) spatial behaviour and one dispersed from the Central Italian Alps population with resident behaviour. Four individuals returned to the capturing site (VI), while five approached (AP) it. Bears captured by RDD did not revisit the capturing site (VI=0 during 125 and 207 days monitoring). The first VI occurred within the same month (5-23 days after capture) for 3 bears or after almost one year (328-350 days) for 2 bears; different bears show different number of VI relocations (mean=3,4 min-max=0-13), AP (mean=1,4 min-max=0-4) and PR (mean=5,9 min-max=0-20) . Finally, the mean distance of all bear locations from capturing sites was 28.54 km (SD = 19.57 km), with the lowest values depicted by the resident bear.

Conclusion

Our preliminary results show a great variability among individuals, likely influenced by inter-individual differences, capturing technique, and ecological role of the area surrounding the capturing site. Moreover, BT seem to induce a lower avoidance risk perception.

Keywords: Ursus arctos; capture site; spatial behaviour; risk avoidance; GPS telemetry; capture technique

15. Jane Harms

Using BAM (butorphenol/azaperone/medetomidine) combination protocols for capture of free-ranging and captive wildlife in the Yukon, Canada

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Capture of large mammals provides important information for management and conservation of wildlife populations. Ideal immobilization protocols for both aerial- and ground-based remote wildlife capture should include drugs that are: effective in a wide range of species, require small volumes, are consistantly obtainable, result in short induction times, and provide reliable, safe and reversible anaesthesia. In the Yukon, Canada, wildlife species are routinely captured for health assessments and radio-collaring. Further, the Yukon Wildlife Preserve, home to a range of native Yukon wildlife species, uses chemical immobilization for routine and emergency procedures. Since 2016, Yukon Government and Yukon Wildlife Preserve staff have used the pre-mixed combination BAM (butorphenol, azaperone and medetomidine) for more than 500 immobilization events, including in free-ranging or captive wood bison, elk, moose, northern mountain caribou, and muskoxen, as well as free-ranging grey wolves and captive thinhorn sheep, mule deer, mountain goats, canada lynx, and red and arctic fox. Because established BAM protocols were lacking for many of the species we immobilized, initial field applications involved comparison of multiple doses, and development of doses for each species that decreased induction times and ensured stable anesthetic depth, while minimizing side effects. In some species such as bison, moose, muskox and wolves, additional medetomidine was added to decrease induction times and increase sedation efficacy. For free-ranging captures, animals were located using a helicopter and immobilized by remote drug delivery using a Daninject rifle and Pneudart or Daninject darts. All captive animals were immobilized from the ground using similar remote drug delivery systems. Once a reliable level of anaesthesia was achieved, animals were provided with supplemental oxygen and monitored for anaesthetic depth, heart rate, respiratory rate, body temperature and oxygen saturation. Duration of induction, handling, and recovery were recorded, and the animals were monitored post capture via radio-collar data (free-ranging) or visual assessment (captive). In all species, BAM was reversed by intramuscular or intramuscular/intravenous administration of naltrexone and atipamezole. Despite some differences in the sedation quality and capture efficacy, BAM is an accessible drug combination that results in a reliable and safe immobilization for many wildlife species in northern Canada.

Keywords: wildlife immobilization; butorphenol; azaperone; medetomidine; reversible anesthesia; Yukon

16. Giulia Maria De Benedictis

Qualitative assessment of immobilization with detomidine, ketamine and azaperone in fallow deer (Dama dama): a pilot study

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Background

The quality of induction, immobilization, and recovery during wild ungulates capture is crucial to reduce perianaesthetic morbidity and mortality, and operator risks. Literature regarding the clinical effects and quality of immobilization protocols in fallow deer (Dama dama) is sparse. This pilot study aims to evaluate the quality, timing, and clinical effects of a novel immobilization protocol in fallow deer.

Methods

Fourteen adult fallow deer (6 females, 8 males) weighing 57.28±13.47 Kg were darted in a deer park with a combination of detomidine 0.23±0.06 mg/kg, ketamine 2.28±0.64 mg/kg and azaperone 0.34±0.09 mg/kg for translocation and blood collection. Atipamezole 0.25±0.09 mg/kg was administered intramuscularly 47.8±6.0 minutes after first approach. During immobilization, the physiological parameters monitored included oxygen saturation, pulse rate, respiratory rate, arterial blood pressure, end tidal carbon dioxide, rectal temperature, reflexes, and muscle tone. Qualitative assessment of immobilization was performed for each animal by 5 operators (2 veterinary anaesthetists, 2 wildlife veterinarians and a veterinary student), who agreed on 3 scores, on induction quality, anaesthesia depth and recovery quality. Induction quality was assessed using a descriptive score ranging from 0 (poor) to 3 (excellent). Anaesthesia depth was scored from 0 (no sign of sedation/anaesthesia) to 7 (too deep anaesthesia). Quality of recovery was scored from 0 (poor) to 5 (excellent).

Results

After injection, sternal and lateral recumbency were achieved within 5.7±1.9 and 14±7.1 minutes, respectively. Physiological parameters were stable during immobilization. Induction quality was rated excellent (score 3) in all deer except for three where it was rated good (score 2). Anaesthesia depth was moderate (score 4) in 9 and deep (score 5) in 5 animals. Recovery quality was scored in 10 animals, and was 5 (excellent), 4 (good) and 3 (fair), in 2, 7, and 1 fallow deer, respectively. All animals were standing within 8.1±3.5 minutes after administration of atipamezole. No complications were observed in the perianaesthetic period.

Conclusion

The combination of detomidine, ketamine and azaperone provided effective and stable immobilization in fallow deer, with a good quality of induction, anaesthesia depth, and recovery.

Keywords: immobilization, fallow deer, qualitative assessment, azaperone, detomidine, ketamine.

17.Ladislav Molnar

Field Immobilization of european bison a translocation.

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After succesful reintroduction projects a sustainable population of european bison is present free in of east Slovakia,as well as in few captive breeding centers, This require regular management interventions .A safe immobilization protocol was immportant to introduce with focus on easily accesible drug mixture. In period of 2020 and 2022 a 3 large translocation and transports were performed from Slovakia to Rumania and Hungary of total 23 animals. Animals of different weight and age were captured by darting and transported by standard catle transport tract.Translocation was on 1500 km distance,lasted over 20hours with stops. In the paper, the authors point out the practical aspects of the immobilization and relocation of 23 European bison (Bos bonasus). It involved the transport of 11 individuals, i.e. j. three pregnant females with cubs, two bulls and three subadult individuals. In the history of captive bison breeding, this was the largest transport of bison to date. The transfer was carried out in two separate transports. The capture, handling, and release into the acclimatization enclosure itself required a consistent and logistical workflow from the point of view of the staff involved. Immobilization was performed with disposable Pneudart shots in a volume of 5 ml. The chosen anesthetic was a combination of Zoletil and Domosedan /zolazepam-tiletamine-detomidine/. For an adult individual with an estimated weight of 500 kg, a dose of 5 ml was used, which was obtained by dissolving 750 mg of Zoletil in 4 ml of Domosedan. This dose was sufficient to handle an individual for 40 minutes. The entire transport in two stages took place without complications and the individuals successfully acclimatized in the new environment. Combination of Zoletil and Domosedan was faund as effective and safe drug combination. Recommended dose was calculated Zoletil 50 and +1ml Domosedan / 100kg bw.as effective drug combination for european bison

Keywords european bison, Zoletil, Domosedan

18. Rudi Cassini

Integrating capture-based and environmental samplings to investigate endoparasite community in a population of Alpine marmots (Marmota marmota)

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Background

Alpine marmots are semifossorial, highly social rodents, with a key role within Alpine ecosystems. Scant information is available on endoparasite community of this species, whose faecal samples are not easily retrievable in the environment. Since 2019 the Paneveggio Pale di San Martino Natural Park (PPSMNP) has been running a project to study marmot's ecology, using a Capture-Mark-Recapture approach. A survey on gastrointestinal parasites was combined with this study, taking advantage of the more informative data acquirable during captures, aiming at a better knowledge of health status to the marmot population.

Methods

Faeces were collected in three areas of the PPSMNP, identified as A1, A2 and A3. Samplings were conducted from 2021 to present, using two strategies. During Spring (only in A1), samples were collected from the capture cage, recording data related to single individuals. Environmental samples from the burrow's entrance and from neighbouring latrines were collected monthly from June to August in all areas, only recording the time-space data. Samples were analysed through qualitative (Sedimentation and Flotation) and quantitative (MiniFLOTAC) techniques, to detect gastrointestinal parasites' oocysts and eggs. Differences in prevalence among areas and sampling months were investigated through a χ^2 test. Differences in abundance were assessed using non-parametric tests, also considering the individual factors when available (sex and age).

Results

Thirty animals were sampled during the capture activity, while 89 samples were collected from the environment (overall, 119 samples). Coccidia were the most prevalent parasite (94/119; 79.0%), followed by *Ctenotaenia marmotae* (23/119; 19.3%), with significant differences in prevalence and abundance among areas and months (Table 1). Other parasites were sporadically present: *Capillaria* sp. (n=11), *Ascaris laevis* (n=4), *Citellina alpina* (n=2), *Strongyloides* sp. (n=2). No significant difference was detected between sex nor among age classes.

Conclusion

The study represents the first description of Alpine marmot endoparasite community in Italian eastern Alps. Environmental factors were demonstrated to influence the distribution of the two most prevalent parasites. The use of samples from capture cages allowed a first analysis of the influence of individual factors on parasites' distribution. Although no significant influence was found, an increment in samples number (e.g., including summer captures), may provide sounder results.

Keywords: Gastrointestinal parasites; Coccidia; *Ctenotaenia marmotae*; Capture; *Marmota marmota*; Italy.

Table 1 – Prevalence and abundance of Coccidia and *C. marmotae*, according to sampling area and month. Significant differences in values among subgroups are evidenced.

			Coccidia				*Ctenotaenia marmotae*			
Factor	Variable	N	Prevalence (%)		Mean output	S.E.	Prevalence (%)		Mean output	S.E.
Area	A1	54	79.6%		4026.2	1097.0	3.7%		72.6	72.6
	A2	31	61.3%	**	8500.8	5935.2 **	29.0%	**	234.6	126.0 **
	A3	34	94.1%		1790.3	369.4	35.3%		184.1	128.7
Month	May	30	96.7%		6615.2	1845.5	0.0%		0.0	0.0
	June	27	51.9%	**	8498.0	6707.4 **	3.7%	**	51.4	51.3 **
	July	11	72.7%		205.5	111.5	18.2%		10.0	10.0
	August	51	84.3%		2189.2	77.1	39.2%		312.8	132.3

** p-value <0.01

19. Iris A. Marti

Immobilization of Free-ranging Eurasian lynx – Complications, Challenges and Lessons learned

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The Eurasian lynx (*Lynx lynx*) is a keystone predator and an important component in the ecosystems throughout its distribution range. As conservation efforts intensify, capturing free-ranging lynx for research or translocation projects is gaining importance. Physical restraint followed by chemical immobilization and translocation of free-ranging carnivores are associated with various risks for both the captured animal and the capture team.

During the last five years (2019-2023) veterinarians of the Institute for Fish and Wildlife Health Bern together with field biologists of the Foundation KORA, conducted 105 lynx captures in Switzerland. The captures were carried out within the framework of two international translocation projects and one research project within the Swiss Alps and Jura Mountains. Applied methods included box traps and foot snares.

While no mortalities occurred during this period, we encountered several capture-related incidents. These consisted of drug related cardiovascular and respiratory complications such as pulmonary oedemas and hypoxemia, injuries acquired during physical restraint or transport and complications associated with the harsh environmental conditions during wintertime.

To comply with 4R principles (reduction, replacement, refinement and responsibility) balancing both animal welfare and capture success, we established different adaptations in the anaesthesia protocol, anaesthesia monitoring, transportation and the available equipment. One of the most beneficial and easy measures, fully compatible with remote field work in small teams, proved to be the supplementation of oxygen as a standard treatment under anaesthesia. Additionally, procedures for the capture of non-target species were established.

The immobilization of free-ranging lynx does and will continue to come with inherent challenges. However, addressing the difficulties associated with capturing these elusive felids by continuous adaptations in capture protocols is essential to ensure animal welfare, human safety, successful research outcomes and conservation.

Keywords: Eurasian lynx, field anaesthesia, transportation, complications, oxygen.

20. Michał Figura

Rescue, rehabilitation, and post-release monitoring of grey wolves and Eurasian lynx in Poland

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Background

Free-ranging grey wolves and Eurasian lynx injured in human-related accidents, captured in snares, or orphaned are often rescued, rehabilitated, and released into the wild, but the outcomes of such actions are rarely evaluated.

Methods

We studied the fate of 23 wolves (18 adults and 5 pups) and 6 Eurasian lynx (1 adult and 5 kittens) in Poland that were rescued due to various reasons (snaring, car accidents, drowning, diseases, orphanhood). We estimated the differences in the success of rehabilitation of orphaned young wolves and lynx. We also applied GPS-GSM telemetry to perform post-release monitoring of 18 wolves and 6 lynx to asses their survival and behaviour in the wild.

Results

We recorded a substantial difference in the outcome of rescue actions towards wolf pups and lynx kittens. While the majority of the wolf pups had to stay in the wildlife sanctuaries due to strong habituation the lynx kittens were successfully rehabilitated and released into the wild. After release, the monitored lynx had no problem with hunting, and prey mainly on roe deer (*Capreolus capreolus*) and occasionally on the European hare (*Lepus europaeus*) and red deer (*Cervus elaphus*). The fate of the adult wolves, which were successfully rehabilitated and released, depends on their social status. Breeding individuals joined their mates, reproduced, and reared pups. Subadults came back to their family groups, and dispersed after a few months. We found no differences in home-range size, dispersal patterns or prey preferences between released wolves and individuals captured and tracked for research purposes

Conclusion

Our findings suggest that rescued and rehabilitated adult wolves and lynx recover and return to their regular activity and habits even after suffering serious injuries and spending three months in wildlife rehabilitation centres. In the case of orphaned young individuals, there is a massive difference between wolf pups and lynx kittens. The wolf pups rarely can be released due to habituation to humans. At the same time, the lynx kittens showed no sign of habituation, even after several months in captivity, and after releasing into the wild quickly started to hunt wild prey.

Keywords: Canis lupus; *Lynx lynx*; large carnivore conservation.

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21. Ève Lamontagne

Point of view: What if we got rid of chase time limits?

A qualitative approach to decision-making in complex situations

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Methods

Researchers often use quantitative techniques to gather complex information on animal welfare, usually summarized as numerical indexes for statistical analysis. However, attempting to quantify, on a linear scale, concepts as multifaceted and transient as well-fare is difficult. Quantitative methods are meaningful only when compared in a replicable environment. Qualitative methods are recognized as valuable tools for interpreting complex situations requiring specific experience and knowledge.

Results

Wildlife capture takes place in the real world, where scenarios always differ, yet measures related to animal welfare do not adapt. Standard operating procedures limit chase time as a rigid threshold that does not integrate contextual variables which poses a series of problems:

1. Hazing versus chase start is subjective
2. Chase time limits are often too short for the reality of fieldwork
3. Encourages recorders to minimize chase time on the data sheets
4. The data collected is unusable

Rigid chase time limits are not well suited to wildlife capture. Standard operating procedures should use an integrated qualitative approach to let biologists determine the acceptable length of chase time for each animal based on their signs of well-being.

Conclusion

Chase times should start when the animal is aware of human presence, when its stress level drastically increases, and should be recorded as an observation rather than a time limit. Qualitative criteria should be used to determine when the chase should stop, and failed capture attempts should also be recorded.

Criteria to consider but not limited to:

- Environment: snow depth, quality of target capture area, proximity to the next best capture area
- Weather: outside temperature, wind speed, time of day, month of year
- Animal: sex, overall look (fur, fat, demeanour), observing for signs of fatigue (heavy breathing, panting, stumbling)

Rectal temperature should be used as an immediate control measure and to adapt handling times and samples taken.

Keywords: Net-gunning; chase time; qualitative approach; point of view; animal welfare; methodology

Human and wildlife conflict, Amputation of the forelimb of Persian Leopard (*Panthera pardus tulliana*) being caught in a metal gin trap in Bashagard County

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Background

As the human population increases, anthropogenic Intensive Pressure on wildlife populations increases as well. Weakness in education, pervasive poverty in local societies, traditional animal husbandry and … are among the intensifying factors for human-carnivores conflict. Humans may directly kill wildlife as an act of revenge for livestock or crop depredation. Unfortunately illegal using different types of traps like metal gin trap are quite common in Middle East.

Methods

On December/2020 We tried to rescue a six-year female Persian Leopard (Panthera pardus tulliana) being caught in a metal gin trap that was set by local people in one county in the southeast of Iran. After 3 days leopard being trapped, rangers and rescue team were informed by local people and due to being an impassable location, it took 24 hours to get to the location and rescue the leopard. A combination of Ketamine (2.5 mg/kg) + Medetomidine (0.08 mg/kg) was injected remote delivery by using Co2 Injection Pistol DanInject in the left hindquarters.
The animal was transferred to the county town, radiographic examination and supportive treatments including rehydration, primary wound management and washing were carried out.

Results

Clinical examinations disclosed a deep incision located on the metacarpus of the left forelimb, with necrotic soft tissues and greyish mottled skin.
Due to the unavailability of Doppler ultrasound and to ensure the lack of blood supply to the extremities and digits before making any decision, the leopard was transferred to Tehran (capital of IRAN). Doppler ultrasound and other complementary neurological examinations confirmed the necessity for amputation. To prevent impaired wound healing and forming pressure lesions as a result of unnecessary weight that the animal must carry without any purpose or benefit to the animal, full limb amputation by Disarticulation at the Scapulohumeral Joint was performed.

Conclusion

After full limb amputation had been performed, Persian Leopard was transferred to Qazvin Zoo for lifelong keeping.

Keywords: Persian Leopard; Metal Gin Trap; Chemical Immobilization; Amputation

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Challenges and strategies capturing wolves in a human-dominated landscape in Switzerland

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Background

After eradication of wolves (Canis lupus) in Switzerland in the late 19th century, the first individuals returned and settled in the 1990ies. In the last ten years they have strongly increased in numbers. Together with the simultaneously growing numbers of ungulates, the cultural landscape strongly influenced by local human population is confronted with new challenges. Our research investigates required adaptions and management solutions in order to support coexistence with wolves.
Part of our questions require the GPS collaring of wolves. Up to now, experience in capturing wolves is scarce in Switzerland. Also, the human-dominated landscape with a very high density of people using the forest for work and recreational activities, as well as strong political opinions towards wolves, we field biologists are confronted with high socio-cultural challenges. The different stakeholders involved in capture planning and execution, as well as used capture methods will be illustrated on this poster.

Methods

In a first approach we set the goal of the region where and number of wolves to be captured, in order to address the research questions and meet our financial possibilities. Secondly, we chose possible capturing methods, to learn, test and evaluate. Thirdly, all stakeholders are listed, described after relevance, political position and grade of involvement respectively information.

Results

In this first project year, the capture attempts have started in September 2023. Two capture methods have been used:
a) Opportunistic direct narcotization by rifle after reports of fresh wolf kills. A specific decision tree was created to evaluate risk factors.
b) Systematic setting of LPC foothold traps.
On the workshop, hopefully first results of success can be shown.
The diagram of stakeholders is complex and will be shown on the poster. Communication towards the different organizations is time consuming. However, the high communication effort enabled our capturing attempts.

Conclusion

Capturing wolves is very time consuming, communication intensive and expensive. But we gained experience and efficiency and can show advantages and disadvantages of the different capture methods. Also, the necessity, value and manner of communication will be shown.

Keywords: Wolf ; Canis lupus ; capture methods ; distance immobilisation ; human-dominated landscape ; stakeholder communication.

Chemical immobilization of free-ranging Fallow deer in Northers Italy: a retrospective observational study

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Induction time is the most important factor when considering wildlife immobilization, and it can widely depend on breed, sex, age class, anaesthesiologic protocol and needle length. The goal of every conservation-veterinary intervention, with a remote drug-delivery system, is to balance the depth and quickness of the anaesthetic protocol, to allow a concise and immediate recovery of the animal to minimize stress, risk of injury and to ensure clinical monitoring as soon as possible. A retrospective observational study was conducted in order to describe the relationship between the upon cited parameters and induction time in 64 free-ranging fallow deer (*Dama dama*; 32 males and 32 females) in Northern Italy, while captured for management purposes from 30 hectares fenced area, from December 2021 to May 2022. Two Daninject 11 mm dart guns were used with 3ml dart syringes and 2.0 mm x 40 mm or 2.0 mm x 30 mm needles, depending on animals and seasonality. A Wiener Mischung protocol was administered based on an estimation of the animals' weight (3 mg/kg tiletamine-zolazepam and 3 mg/kg xylazine). The dosage used for adult males was 1.5 ml, for subadult males 1 ml, for adult females 1.1 ml and for subadult females 0.9 ml. Induction time varied between age classes and sex, averaging (minutes) for adult males as 7.6±3.2, subadults males 11.1±3.2, adult females 9.5±1.4 and subadult females 12.3±0.3. No issues with induction, transport and awakening are to be reported. Although the small number of animals per group does not allow us to statistically evaluate the relationship between induction time and sex or age group, we can hypothesize their influence. Moreover, an appropriate experimental design is needed to investigate the relationship between induction time and sex or age group, in order to permit for a better use of the anaesthetic protocol itself and a smoother and safe immobilization procedure.

Keywords: wildlife chemical capture; fallow deer; Wiener Mischung protocol

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Development of an effective, versatile humane wild hog trap

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Background

Wild pigs (*Sus scrofa*) have become a pervasive and highly destructive invasive species, causing substantial ecological and economic damage worldwide. Monitoring and control are critical in areas where pigs are invasive or there is disease risk. Trapping is a critical tool used worldwide to handle wild pigs. Traditional trapping strategies often involve traps that require substantial investment to acquire, set up and manage. These devices can educate pigs and potentially require cellular service (e.g., "smart" traps). Given the devastating worldwide impact of wild suids, including African Swine Fever risks, a new trapping strategy that is adaptable, efficient, effective, and humane is needed.

Methods

We aimed to design and evaluate a trap that: 1) improved capacity by increasing the number of traps on the landscape, specifically in areas where current traps are limited by technology or road access; 2) decreased the costs, labor, equipment, and technology required; 3) offered the ability to catch multiple groups, and 4) reduced the impacts on trapped animals. The development process involved iterative design improvements, incorporating feedback from stakeholders with expertise in wild hog management. The trap design featured a double-walled net with an internal skirt, internal anchors, and external supports. This trap was commercialized in 2020 and is used successfully in more than 30 countries across five continents to address disease, research, and damage management objectives. In addition, we examined the effectiveness and ethical considerations concerning the overall well-being of trapped wild pigs.

Results and Conclusion

Results have demonstrated that the trap successfully captured wild pigs while minimizing the risk of injury to captured animals. Our trap's low-cost construction and adaptable design represents a significant advancement in invasive species management and ensures it is accessible to wildlife agencies, landowners, and conservation organizations seeking an effective and humane wild hog population management approach. Widespread adoption of this innovative trap has the potential to mitigate the environmental and economic impacts caused by wild pig proliferation.

Keywords: net-trap; trapping; Sus srofa; animal welfare; capture; ASF.

Figure 1. Net trap set up to capture wild pigs in Italy.

Efficacy and Recovery Quality of Concentrated Alfaxalone Anesthesia in Spotted Hyena (*Crocuta Crocuta*) – A Pilot Study

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Background

When anesthetized with various protocols, spotted hyenas can experience respiratory depression, bradycardia, muscle tremors, and vomiting; recoveries can be rough, with ataxia and agitation. Anesthetic protocols that minimize adverse effects, providing smooth induction and recovery, are needed. Alfaxalone (10mg/mL) has been used in domestic carnivores with smooth inductions and recoveries. Intra-muscular use in non-domestic carnivores has been challenging because of the large volume requirements. Availability of a concentrated formulation makes alfaxalone use more feasible in large species. This pilot study endeavored to determine a useful dose of an experimental concentrated alfaxalone formulation as part of an anesthetic combination for spotted hyenas.

Methods

Five spotted hyenas (Table 1) were anesthetized for examinations. Alfaxalone (1-4mg/kg; 40 mg/mL) was administered IM concurrently with butorphanol (0.25mg/kg; 50mg/mL) and medetomidine (0.025mg/kg; 20mg/mL). As a pilot study, adjustments to alfaxalone dosages were made as the study progressed. Physiologic measurements were recorded every five minutes. Supplemental oxygen was administered after initial measurements. Isoflurane (1%) was administered if anesthetic depth became insufficient. For recovery, hyenas received atipamezole (0.25 mg/kg; 25mg/mL) $\pm$ naltrexone (0.2mg/kg; 50mg/mL) IM. Quality and duration of induction and recovery from anesthesia were assessed.

Results

Four of five hyenas (54-57 kg) were recumbent within 10 minutes. Hyena #5 (Table 1) received 1.1 mg/kg alfaxalone but was not adequately induced and needed a second dose. Physiologic parameters were highly variable over time and between individuals, but values were considered acceptable. Low SpO_2% values (60-82%) improved rapidly with oxygen supplementation (89-100%).

Hyenas receiving 2.2-3.5mg/kg alfaxalone had smooth inductions, but were excited during recovery, with tremoring, bumping into walls, leaping into the air, and ataxia that subsided over time. Hyenas #3-5 were not administered naltrexone, in case it may have contributed to excitement. Recovery was smoother for animals that received 1mg/kg alfaxalone, but some ataxia was still observed for one hour.

Table 1 Anesthetic and antagonist drug dosages (mg/kg) administered to spotted hyenas and resulting induction and recovery times (min)

Hyena ID	Sex	Age (yr)	Alfaxalone (mg/kg)	Induction Time	Time to Antagonist*	Time to Head Move**	Time to Stand**	Time to Full Recovery**
1	F	4.5	3.5	2	107	17	18	198
2+	M	4.5	2.1	8	117	15	22	120
3	M	4.5	1.0	1	135	8	14	60
4	M	20.5	1.1	4	124	9	11	60
5	F	20.5	1.1	23	137	5	21	90

*Minutes since anesthetic administration
**Minutes since antagonist administration
+Animal was administered midazolam (0.05 mg/kg) IM as part of the induction protocol

Conclusion

Alfaxalone (1-2mg/kg), combined with other drugs, may be useful for hyena anesthesia. Given the post-recovery trembling and agitation observed, use of alfaxalone dosages > 2mg/kg should be used with caution in this species. Further refinements to alfaxalone-based protocols may improve recovery quality.

Keywords: Hyena; *Crocuta crocuta;* alfaxalone; anesthesia.

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A journey through time: comparison of three anesthetic protocols in free ranging Marsican brown bears

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Background

The Marsican brown bear (Mbb) (*Ursus arctos marsicanus,* Altobello 1921), an endemic brown bear subspecies of Central Apennine (Italy), has his core area in the National Park of Abruzzo; Lazio e Molise (PNALM). Protecting and studying the Mbbs is a pillar activity of the PNALM. The capture is a crucial tool to study the Mbbs, therefore the anesthetic protocol is always under review.

Methods

This study compares three anesthetic protocols in terms of efficacy, feasibility and safety. Data were collected during the capturing of wild specimens in wildlife management practice and research. Most were captured with an Aldritch's snare, some with a tubetrap. Captures for clinical or surgical purposes were excluded. The protocols are xylazine/ketamine (XK) used from 1990 to 1992 in 4 bears; medetomidine (10mg/ml)/ketamine (M10K) from 2000 to 2021 in 71 bears and medetomidine (20mg/ml)/ketamine (M20K) used from 2021 to 2023 in 6 bears. The investigated variables are: total anesthesia time (V1); awakening's time (V2); mixture's total mg of ketamine to total weight ratio (V3); rectal temperature (RT); respiratory rate (RR) and heart rate (HR). Variable means were compared with a one-way ANOVA.

Results

	V1 (min)	V2 (min)	V3 (mg/kg)	RT (°C)	RR (rpm)	HR (bpm)
XK (n= 4)	381± 82.56	107.5 ± 31.71	0.112	39.26 ± 0.3	29.25± 6.9	79.5± 13.4
M10K (n=71)	103.3 ± 36.02	10.31 ± 5.97	0.052	37.98 ± 5	17.87±12.53	56.08 ±14.9
M20K (n=6)	83.83 ± 28.22	8.5 ± 6.53	0.052	38.23 ± 1.99	16 ±1.63	58.50 ± 13

Conclusion

The results show a significant enhancement in V1 and V2 in M10K and M20K protocols ($p < 0.0001$). The switch from xylazine (Rompun) to medetomidine (Zalopine) was a positive change, because the latter was more effective and more manageable. The change from medetomidine 10 mg/ml to 20 mg/ml (Medised 20x) showed a small, but meaningful improvement. Another game changer, starting from the second protocol, was the introduction of the synthetic α2 adrenergic receptor antagonist (atipamezole), which led to the remarkable reduction of the awakening time. Moreover, medetomidine allowed to halve the quantity of ketamine. The development in pharmaceutical and in handling protocol improved both quality and timing of captures. The investigated physiological parameters improved as well, although not significantly: with M20K protocol, RT, RR and HR values were close to normal for Mbbs'. In thirty years, a lot of enhancements have occurred in wildlife's capture: it's important to take a step back and look from where we started to see where we are going.

Keywords: Marsican brown bear; anesthetic protocols; physiological parameters; wildlife capture.