

- Black-footed Cat Working Group -

Report on surveying, catching and monitoring Black-footed cats (*Felis nigripes*) on Benfontein Nature Reserve, South Africa and on Grünau Farms, Namibia in 2020

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Introduction:



The Black-footed Cat Working Group (BFCWG) aims to conserve this rare cat species by furthering awareness and conducting multidisciplinary research on the species' biology. The BFCWG owns a research vehicle (Ford Ranger 2.6 l) which is insured and its running and maintenance costs are covered through a dedicated Non-Profit Company since 2019. The specialised equipment required for our research is stored at the McGregor Museum, Kimberley, Northern Cape Province.

This year we made a joint trip to assist in establishing a new study in southern Namibia, on farmland in Grünau (GR) from 24 February – 2 March 2020 and then to exchange and capture new individual black-footed cats (BFC) in the current long-term study area, Benfontein Nature Reserve (BFN), near Kimberley from 2 - 8 March 2020. We also report here, in abbreviated form, on the Black-Footed Cat Research Project Namibia which is managed locally by Martina Küsters (wildlife specialist) and Morgan Hauptfleisch (NUST). This project uses a vehicle (an Isuzu D-Max 4x4) loaned to the project and the Namibia University of Science and Technology (NUST) by Auas Motors, Windhoek. The vehicle is administered through the NUST Biodiversity Research Centre.

Background and Study Areas

Background: This project is part of a multidisciplinary effort to study the distribution, ecology, health, and reproduction of *F. nigripes* over an extended period. The aims are repeated captures of BFCs for biological sampling and radio-collaring for subsequent observation. Several methods like camera trapping, den monitoring, focal animal surveys, were employed to survey areas previously known to hold BFCs. From November 2005 until the present, annual capture operations are conducted on BFN. From 2009 to 2018, annual captures were also conducted on two additional properties in the Upper Karoo, Northern Cape, close to the town of De Aar, before research ended on these properties in November 2018. In 2020 we started with a new study area in southern Namibia. Seventeen reports are available detailing previous fieldwork for download as PDF on the website www.black-footed-cat.wild-cat.org.

1 – New study area in Namibia:

Grünau (GR): Private farmland comprising an extensive area of 51 000 ha with Dwarf Shrub Savannah vegetation in typical Nama Karoo habitat. The area receives a low rainfall of 125 mm annually and is lightly stocked with sheep (*Ovis aries*). Part of the property of Kobus and Margaret van der Merwe had been surveyed for two nights in January 2019 by Martina Küsters, Morgan Hauptfleisch and Alexander Sliwa resulting in three sightings of BFCs. This area was identified as a potential study site and surveyed as the landowners had reported several sightings of BFCs in the area since 2012 (Küsters 2020a). A well-maintained grid of sand and gravel roads traverses the property allowing good survey coverage. The steep and emergent koppie “Kirchberg” provides ideal conditions to acquire an initial radio signal of radio-collared BFCs caught in the area.

2 - Benfontein Nature Reserve (BFN):

A private nature reserve owned by De Beers Consolidated Mines, located 10 km southeast of Kimberley on the border of the Northern Cape and Free State Provinces in central South Africa. The majority of the 11 400 ha consists of arid plant communities receiving an average annual precipitation of 450 mm. BFN has been the subject of the first field study on the species by A. Sliwa in the 1990s (1992-1998) (Sliwa 2004, 2006, Sliwa *et al.* 2010) and continues to be an important site for long-term monitoring.

Methods:

- (A) Spot-lamp searching:** For a total of 13 nights (seven on GR, six on BFN) a 4x4 vehicle (Ford Ranger 2.6 l) drove a route of 20–80 km in length along dirt roads at a speed of 20–30 km/h whilst looking for the characteristic bright eye-shine of cats. A minimum of three people (5 this trip) stood on the open back of the vehicle operating two spotlights (1 million candle power / Lightforce® SL240 mm) nets.
- (B) Catching via searching and pursuit:** Once BFCs were located by their eye-shine in the spotlights, their species identity was swiftly confirmed, when necessary, using 10x42 binoculars. If positively identified, they were pursued quickly by vehicle for a short distance of between 100–600 m until the cat squatted low on the ground in front of the stopped vehicle ($n=6$). Two people with fish landing nets then netted the cats. On other occasions the cats found a den system (dug by aardvarks, ground squirrels or springhares) and were either captured by exposing them after digging ($n=5$) or were lost when escaping deeper into the den system ($n=4$).

All captured cats were subsequently anaesthetised with an intramuscular injection of medetomidine, midazolam and butorphanol and covered with a blanket to shield them from lights and sounds. The males were also given ketamine to ensure prolonged anaesthesia for semen collection. During this trip we processed seven of the 12 captured cats in the field. All animals were given complete physical examinations, had biological samples collected for disease and genetic studies, morphometric measurements obtained and radio-collars fitted. During this year's captures, additional vital body parameters were collected while the cats were under anaesthesia. We attempted to collect and preserve sperm in five males, succeeding in all. The anaesthetic drugs were reversed with an intramuscular injection of atipamezole, flumazenil and naltrexone. The cats were then placed in a small plastic crate for awaiting full recovery.

All BFCs were released back into a den close to their capture locations. A blanket was used to cover the den entrance, keeping them inside until they were fit to leave on their own accord. One or two digital camera traps were set close to the den entrance to record the cat leaving the den. There were no complications associated with these procedures and all radio-collared cats ($n=11$) were confirmed alive and well on subsequent nights using telemetry and visual verification. One young female, not radio-collared due to low body weight, was confirmed leaving the den via the camera trap set.

- (C) "Digging" of previously radio-collared cats:** This method was employed once this year. The entrance of den system, in which the radio-collared BFC was resting during daytime, was draped with a net and the cat ran into the net. The still-functioning radio-collar of the male *Phusa* was exchanged with no digging or modification on the den being necessary. We caught the two other still radio-collared cats at night by respectively pursuing and catching them, like *Hamba* directly in the net and *Kazi* by digging for an extended period (1.5 hrs).

- (D) Live-trapping:** no trapping was performed on this field trip.

The capture vehicle in Namibia was staffed in February 2020 by:

Ms. Beryl Wilson, zoologist, McGregor Museum, Kimberley, South Africa (berylwa@museumsnc.co.za)

Ms. Martina Küsters, field researcher BFCWG, Black-footed Cat Research Project Namibia, Swakopmund, Namibia (kusters.m@hotmail.com).

Dr. Alex Sliwa, behavioural ecologist and zoo curator, Cologne (Kölner) Zoo, Germany (sliwa@koelnerzoo.de)

Dr. Morgan Hauptfleisch, Ass. Prof. Namibian University of Technology (NUST), Windhoek, Namibia (mhauptfleisch@nust.na)

Dr. Jason Herrick, director of reproductive sciences, Omaha's Henry Doorly Zoo, USA (jason.herrick@omahazoo.com)

Dr. Nadine Lamberski, Chief Conservation and Wildlife Health Officer San Diego Zoo Wildlife Alliance, Escondido, USA (nlamberski@sdzw.org)

Dr. Axel Hartmann, veterinarian, Ministry of Environment, Forestry and Tourism, Etosha Ecological Institute, Okaukuejo, Namibia (axel.hartmann@meft.gov.na)

Mr. Ndele Shipala, student, NUST, Windhoek, Namibia

The capture vehicles on BFN (South Africa) were staffed in March 2020 at various times by:

Ms. Beryl Wilson, zoologist, McGregor Museum, Kimberley, South Africa (berylwa@museumsnc.co.za)

Ms. Martina Küsters, field researcher BFCWG, Black-footed Cat Research Project Namibia, Swakopmund, Namibia (kusters.m@hotmail.com)

Dr. Alex Sliwa, behavioural ecologist and zoo curator, Cologne (Kölner) Zoo, Germany (sliwa@koelnerzoo.de)

Dr. Jason Herrick, director reproductive sciences, Omaha's Henry Doorly Zoo, USA (jason.herrick@omahazoo.com)

Dr. Arne Lawrenz, director Wuppertal Zoo (lawrenz@zoo-wuppertal.de)

Dr. Murray Hyslop, veterinarian, Kimberley Veterinary Clinic, South Africa

Ms. Anmari Coetzee, veterinarian nurse, Kimberley Veterinary Clinic, South Africa

Dr. Amie MacIntyre, veterinarian, Kimberley Veterinary Clinic, South Africa

Mrs Heidi Fölscher, zoology collections manager, McGregor Museum, Kimberley, South Africa

Dr. Sandra Lai, post-doc, Montreal, Canada

Mr. Vito Lawrenz, vet student, Ludwig Maximilian University, Munich, Germany

Ms. Michelle Schroeder, field technician, BFCWG, Kimberley, South Africa (MustelaMichellea@gmail.com)

Mr. Javed Anver, field technician, BFCWG, Kimberley, South Africa

Results:

Trapping: no trapping with cage traps was performed on this field trip.

Spot-lamp searching and catching/exchanging radio-collars:

GR, Namibia: we saw seven BFCs during seven nights of searching (100% chance of sighting a BFC/night) and caught five of them (71% capture success; one of them was a re-capture, collared the previous night) – all of them female. During these night drives we observed other carnivore species such as aardwolves (*Proteles cristatus*), bat-eared foxes (*Otocyon megalotis*), several Cape foxes (*Vulpes cana*), common (small-spotted) genets (*Genetta genetta*) and striped polecat (*Ictonyx striatus*). We also observed armadillo (*Oryzomys afer*), porcupines (*Hystrix africae australis*) and spotted eagle-owls (*Bubo africanus*). We didn't see any black-backed jackals (*Canis mesomelas*) or caracals (*Caracal caracal*) in the area of GR.

BFN: During six nights of searching we saw BFCs 15 times unaided by telemetry. Thus, we saw 2.5 BFC on average on any of the six nights (250% chance of BFC sightings/night). We managed to capture eight of the 11 cats we attempted (73% capture success) for via the pursuit and later including the digging method. We decided to not collar two juvenile females (one of which we didn't even anaesthetise after assessing it visually in a den at close range), due to their small sizes. All, except the one juvenile female left in the den, were microchipped, and sperm samples were collected from the males.

Three un-collared BFCs ran into deep dens and we gave up the digging process after about an hour on each occasion. In total, we dug on six separate occasions attempting to reach a BFC, resulting in three successful captures. We also saw three radio-collared BFCs (*Phusa* and *Hamba* and later *Cal*, unaided by telemetry and captured the first two to exchange collars or didn't pursue them after checking their radio-signals) this way. The entire area was part of the previous ecological study of A. Sliwa from 1992–1998, and the same area we have covered during previous annual capture trips (2005–2018). During these night drives we observed many springhares (*Pedetes capensis*), but also other carnivores like black-backed jackals (sightings every night, particularly in east-central BFN), several groups of bat-eared foxes, and many aardwolves. We sighted no caracal.

We exchanged the still-functioning radio-collar of the male *Phusa* with a new collar, by locating him in his den. Also the functioning collars of male *Hamba* through a short pursuit and capture by net. We did likewise for female *Kazi* by pursuing her for a short distance at night, to not compromise her in her den together with her young kitten, but had to dig for her when she found another den for escape. Thus, we had seven radio-collared BFCs on BFN when the BFCWG left on 9 March 2020.

Monitoring radio-collared cats on BFN and GR:

BFN: The field technicians, Javed Anver and Michelle Schroeder, acquired location fixes (waypoints) of the seven radio-collared cats in their dens during daylight and at night. We achieved sufficient numbers of waypoints to determine home ranges for 2020, although three males that died in winter from predation (Table 1), likely did not yet roam the full size of their ranges. The BFCWG was able to finance the tracking of all the cats by Javed Anver and Michelle Schroeder on BFN, with assistance from the McGregor Museum using a Toyota Hilux Legend driven by Heidi Fölscher on occasions during the day when the project vehicle was undergoing repairs. Overall 3 125 waypoints were collected up until 31 December 2020. Home range size estimates incorporating all collected waypoints for all the individual cats tracked in 2020 are provided in Table 1 and Minimum Convex Polygon (MCP100%) outlines are shown in Map 1.

GR: The field technician, Ndele Shipala, was able to complete several tracking periods. He continued tracking all four females directly after their capture in late February up until 4 May 2020, then returned to the study site on 28 May 2020 after a 3-week break for servicing the vehicle in Windhoek. The first captured female “Prima” went missing after a month of tracking, after 27 March, and was subsequently only found through intensive assistance by Martina Küsters with the help of aerial tracking on 28 May. She had relocated a total of 27 km northeast of her last location (Küsters *et al.* 2020b). Unfortunately Covid-19 lockdown restrictions also affected field work and no tracking and monitoring took place from 1 July – 13 October 2020. In this period one more female “Lace” shifted her range but was found through intensive ground to ground tracking with renewed help by Martina Küsters (Küsters *et al.* 2020c). Altogether, close to 1 000 waypoints were collected for the four females, a very solid foundation for defining their large home ranges and providing novel information on the species from a different country and much drier habitat than in the other study areas. Home range size estimates incorporating all collected waypoints for all the individual cats tracked in 2020 are provided in Table 1 and Minimum Convex Polygon (MCP100%) outlines are shown Map 2. Alex Sliwa visited GR for five nights in late November and helped tracking and took photographic material of the four females there (Figures 8 to 11).

Fate of three black-footed cats in 2020 on BFN (radio-collared in March 2020):

Male Terio: An older adult male, captured and collared only on 6 March 2020. He maintained a smallish home range of 6.6 km² (115 waypoints). While he was last seen alive on 31 May 2020, his carcass was found on 4 June 2020, probably killed by a caracal (Map 1; Tab1). This was inferred from his injuries when examined during a necropsy by Beryl Wilson. He was the largest of the captured BFCs, but still succumbed to predation.

Male Cal: A young adult male; collared on 2 March 2020; stayed mostly in the southern central part of BFN and had an average home range for an adult male (19.0 km², 150 waypoints). He was found in his resting den during daylight on 27 June 2020 and later that night killed by a canid (black-backed jackal) (Map 1; Table 1). His body was torn in pieces leading to this conclusion.

Male Phusa: An adult male, with small size and lower body weight for his age (Table 1). We tracked him since his capture in November 2018. In 2020, he used a smaller than average 12.0 km² home range (330 waypoints). In general, he was behaviourally an unusual cat often choosing resting sites (dens) in reeds associated with water sources and often alternating between these few resting sites. He was last seen alive on 5 August 2020 and his mangled carcass was found only three days later. He was likely killed by a caracal due to the carcass condition when examined during a necropsy by Beryl Wilson.

Cats currently alive on BFN:

Male Hamba: By now an adult male with a good sized home range in west-central BFN, where we first captured him in November 2018. He is very well habituated. While close to attaining full adult male size, he is still lacking the >2 kg body mass of a dominant male with broad head and shoulders, whilst already observed mating and frequently spray marking his range, a sign of residency. He had the largest recorded home range of all cats on BFN (23.1 km², 735 waypoints) in 2020.

Male Putter: An adult male in good condition. Whilst caught SW of “white rock gate” on 7 March 2020, and showing some courage he was named for lashing out at the golf putter used to tease him out of a muddy hole he had ran into (Fig. 21). In 2020, he maintained a home range of 13.1 km² (468 waypoints) and often crossed to the southern neighbouring farm Melrose.

Female Kazi: A large adult female, always on the move, restless and often shy. She maintains a small home range of 7.2 km² (800 waypoints) for a female, however in prey rich “panveld” habitat. She had kittens on two occasions in 2020. She was seen in early January 2020 in proximity of male “Phusa” and an un-collared larger male, maybe a sign of starting her oestrus.

Female Durga: An adult female captured on 5 March 2020 when she was caring for two kittens. In 2020 she maintained a smallish home range (6.6 km²; 557 waypoints) and bred a second time in October.

Cats currently alive on GR:

Female Prima: The first-captured young adult female BFC in Namibia has given the monitors a runabout. Only a few days after capture she “vanished” behind a large hill to the south of the property, which blocked the signal of her collar. After staying in the general area of her capture for a full month (until 27 March), with a home range size of 40.5 km² (51 waypoints), she re-located north-east of her capture site out of signal range and was only found two months later through aerial tracking (Map 2). In this area, she only covers a smallish range (10 km², 126 waypoints), where she gave birth, and seems to have established a new home range (data until January 2021).

Female Lace: Adult female in good body condition. After staying in a home range around her capture site for 4 months until 30 June (18.4 km², 159 points) she shifted her range across the B1 tarmac road during the enforced lockdown observation break. From 14 October until the end of year she used a smallish home range of 6.7 km² (92 points). She is still the shiest of the Namibian females.

Female Kara: Adult female in good body condition, that we caught close to “Lace”. She is the best habituated female with the most stable home range of 40.8 km² (304 points). If we exclude a few outlying points where was recorded during her excursions, her overall home range would only be 29 km².

Female Auas: Older adult female; very thin when caught with worn foot pads. She stayed initially on the eastern side of the B1 road where she was caught, then after the rains on 1 March she moved north across the Gamkab River until June. When post-lockdown tracking resumed she had moved further east from there again. Her condition has improved after the rains and she has habituated well to being tracked. Her total range in 2020, with the constant range shifts and expansions was 125 km² (266 waypoints), which is phenomenal for a female BFC.

Behavioural Observations of Black-footed Cats: A total of 11 cats were monitored via telemetry in 2020, with varying intensity also due to Covid-19 lockdown restrictions. All were well-habituated through the field technicians and provided valuable insights into the killing of various prey. A new prey species was recorded for Namibia and the BFC as a species, the giant ground gecko (*Chondrodactylus angulifer*). Additional information on spray-marking, courting during the mating seasons and the birth of kittens, and sadly also death of three study animals was recorded. These excellent data sets will allow meaningful comparison of annual home range sizes between years and between study areas in future analyses.

Reproduction BFN: Of the two females tracked in 2020, we have two confirmed reproduction events by each.

Kazi: Prior to her capture to exchange her radio-collar on 4 March 2020, one kitten was observed on 25 February. This must have resulted from her mating in late November 2019. The kitten was last seen in early May 2020, so only survived for three months. In late July, she was watched mating and one kitten was observed on 19 November 2020. Michelle Schroeder last saw the male kitten on 13 January 2021 after which it was never seen again, thus disappearing at about 2.5 months of age, too young to have become independent.

Durga: The day after being captured on 5 March 2020 we confirmed two kittens of about 2 weeks of age in *Durga's* daytime den. They were last seen on 23 April 2020, thus within two months of age and were thus also probably lost. After she mated again in mid-August, a single kitten of less than a week was observed on 3 November 2020. The female kitten was last seen on 30 January 2021, thus within three months.

Two Sub-adults caught: On 3 March 2020 we caught a roughly five month old sub-adult female (Cat 7 20, Table 1), which was certainly born on BFN. The second cat we saw in a den that we decided not to capture was about the same age or even a bit younger than the first subadult.

Reproduction GR: Of the four females tracked in 2020, we have confirmed reproduction in the female *Prima*. In mid-October, Ndele Shipala saw a single, very young kitten (<7 days) in the entrance of the resting den (Küsters *et al.* 2020c). He confirmed the survival of the kitten in early December, so the kitten survived to at least two months of age. Unfortunately, there were no confirmed kittens for the other three females, despite rounded (maybe gravid) appearances being observed on various occasions.

Camera Trapping: The field technicians deployed digital camera traps (Bushnell Trophy Cam HD Nature View with close focus lens, Browning Strike Force Pro XD, Secacam Pro) to acquire regular pictorial material of all the monitored cats and to check for the presence of kittens (Sliwa *et al.* 2018) at their subterranean dens (Figs.12, 25, 26 & 28).

Scat Dog work: We implemented a pilot study on BFN to evaluate the effectiveness of using of scat detection dogs and fecal DNA for BFC research. A dog's superior olfactory abilities have been used effectively to survey other rare carnivore species and suspected this could improve detectability of BFC. From July through October 2020, Michelle Schroeder trained *Dougal* (a male Border-collie/Pointer cross) to find and indicate on BFC scat (feces). Together they completed 70 kms of systematic transect surveys on foot across known BFC home-ranges. The dog found 64 samples suspected to belong to the target species. Further DNA analysis will confirm donor species and individual identity to derive population

estimates using a 'Mark-recapture' framework. Preliminary genetic results from microsatellites indicate that amplification success is high, and most scats belong to BFCs. This study signifies that combined with genetic analysis, detection dogs can be a useful research tool, particularly in data deficient BFC populations.

Outreach and social media coverage of BFCs and the BFCWG: Throughout 2020 several members of the BFCWG have spread information on the species, through interviews and presentations about our joint research. Scientific tourists and interested laypersons were provided the opportunity to join on tracking sessions of the radio-collared BFCs. We continue to have our almost annual field capture trip followed on social media by ISEC Canada (International Society for Endangered Cats) as part of their long-term crowd sourcing project for the smaller wild cats. Alex Sliwa gave an interview on "Cats of the Wild podcasts" <https://www.catsofthewild.com/episodes/on-the-trail-of-the-black-footed-cat>

Also, from November 2018, Beryl Wilson and Alex Sliwa regularly update the Facebook Page, formerly "Save the Black-footed Cat!" now "Black-footed Cat Working Group" <https://www.facebook.com/groups/black.footed.cat/> with publicly visible posts. These are shared from the public Instagram page "blackfootedcat.life" <https://www.instagram.com/blackfootedcat.life/> administered by Alex Sliwa with posts about every 4 days using pictures of black-footed cats and other parts of the species biology and the research endeavours taken over the past decades with a few sentences of informative text. The field technicians provided regular updates on the monitored cats and wrote several ($n=4$) field reports for sponsors, leading to excellent support even in these difficult Covid-19 times.

Non-Profit Company (NPC): The Working Group continues to be solvent and funding for field work is still possible for the next financial year. There are no outstanding debits or stipends owed.

Publications, conference papers, presentations by BFCWG group members on *Felis nigripes*:

Eggers, B., Tordiffe, A., Lamberski, N., Lawrenz, A., Sliwa, A., Wilson, B. & L. C. R. Meyer (2020). Evaluation of two doses of butorphanol-medetomidine-midazolam for the immobilization of wild versus captive black-footed cats (*Felis nigripes*). *Journal of Zoo and Wildlife Medicine* 51(3):497-506.

Sliwa, A., Wilson, B., Rodgers, M., Anver, J., Schroeder, M., Küsters, M. & Hauptfleisch, M. (2020): Black-footed Cat Working Group - Report on surveying and monitoring Black-footed cats (*Felis nigripes*) on Benfontein Nature Reserve and in Namibia in 2019. 15 pp. DOI: 10.13140/RG.2.2.28768.64005.

Küsters, M. (2020) Black-footed cat research Project Namibia. Unpublished progress report. Namibian Commission on Research, Science and Technology, Windhoek. Permit renewal application September 2020.

Küsters, M., Hauptfleisch, M., Shipala, N. & Sliwa A. (in prep). Black-footed cat research Project Namibia. Research project update. *Namibian Journal of the Environment*, Windhoek, Namibia.

Küsters, M., Hauptfleisch, M., Sliwa A. & Shipala, N. (2020). Black-footed cat research Project Namibia. Project update May 2020. Unpublished report.

Küsters, M., Hauptfleisch, M., Sliwa A. & Shipala, N. (2020). Black-footed cat research Project Namibia. Project update October 2020. Unpublished report.

Discussion and Conclusions:

Valuable data on censusing and monitoring of black-footed cats has been collected again by the BFCWG in 2020. We saw one BFC per night on GR (100% chance of sighting a BFC/night) and caught 5 (one was

a re-capture) of them in seven nights (71% capture success) while on BFN we saw 2.5 BFCs on average on any of the six nights (250% chance of sightings a BFC/night). We managed to capture eight of the 11 cats we attempted (73% capture success) for via the pursuit and later including the digging method. We didn't attempt to capture one juvenile cat (too small for collaring), which was already cornered in a dead end section of a den that would have increased our capture percentage. So although the BFC sighting frequency between the two study sites was highly different (by factor 2.5), both were actually good and even exceptional in comparison to previous years (Sliwa *et al.* 2018; 2019). The capture success was similar and also comparable to that of previous capture periods in previous years. On BFN we managed to exchange all three still functional radio-collars of cats monitored since November 2018.

Over the years, the detection rates of BFCs had been similar for BFN. BFN and the new site at GR have both open habitats with good visibility. During this trip, we encountered rain on GR and had to stop working earlier on two nights restricting our work slightly, thus also possibly influencing our detection and capture success.

Whilst no jackals and caracals were sighted during any of the seven nights of spotting on GR, the jackal density on BFN seemed continuously high with an average of at least one sighting per night when spotting. With these larger predators having killed with certainty three of our male BFCs on BFN, the sighting frequencies of un-collared cats confirms that there is still a good population of BFCs of both sexes, probably both resident and transient, on BFN. Likewise, on GR there were repeated sightings of un-collared cats ($n=3$).

It is promising that we had two records of reproduction in each of the two adult female cats *Kazi* and *Durga* on BFN both in March and in October/November 2020, although don't know whether any of these kittens survived to independence. Likewise, on GR the female *Prima* had a confirmed kitten.

On BFN, we currently have only four out of seven cats radio-collared in March 2020 that are alive and actively being monitored in March 2021. This is 38% mortality, due to predation. Despite this high percentage, it is still less than in 2019 (50%) and 2018 (50%) respectively, although it must be stated that similarities and differences in percentages shift quickly with such relatively small numbers of cats being monitored via telemetry. Necropsies of timely found bodies of our study cats will remain crucial to give a measure of the frequency and prevalence of AA-Amyloidosis, provided a body is found reasonably fresh in the current and future study areas, and not only on BFN where it had been reported before (Terio *et al.* 2008; Zimmermann *et al.* 2011). In 2020 we could not relate AA amyloidosis as a cause of death for the three cats, although the older male *Terio* may have been affected by the condition, due to his unusually small home range (6.6. km² in 2.5 months) for his body size of a fully adult male, which may be indicative of such a diseased condition, although his blood chemistry looked good in March 2020 (A. Lawrenz, pers. comm.). In general, the year 2020 has been an average one in terms of BFC mortality.

Home range sizes of cats on BFN were mostly lower than previously recorded (Table 1, Fig. 1) with only the adult male *Hamba* roaming an average annual of 23.1 km², similar to previously recorded resident male home ranges on BFN (average 21 km², range 16-24 km², $n=5$, Sliwa, 2004). Male *Phusa* only roamed 12 km² in seven months of intensive monitoring. His comparatively low body weight during capture, despite his age, may have indicated some underlying social or physically compromising condition. Likewise, adult male *Terio*, as discussed above, and male *Putter* (13.1. km²) were below this average in home range size. Young adult male *Cal* may have still have made movements to secure a resident's home range, but was killed in June, after 3.5 months of monitoring. The two females also maintained below average home ranges in 2020 with respectively 7.2 and 6.6. km² (100% MCP) in comparison (average 10 km² range 6.2- 14.5 km², $n=7$, Sliwa, 2004). This smaller than average size of home ranges could have been due to higher prey density, due to good summer rainfalls, much of it later in the year than usual. This would also be supported by the frequent breeding attempts.

When looking at the data of the four females from GR in Namibia with a much drier habitat than other study areas their home ranges, regardless of home range shifts, are massive (Tab. 1; Fig 2.). While home range shifts inflated the sizes immensely, as in the case of *Prima* with 213 km², the two females that had a moderate home range shift *Lace* and *Auas* with 53 km² and 125 km² respectively are impressive. Even the only female *Kara* that didn't perform an obvious home range shift covered a home range of 41 km², far larger home ranges than the BFN females in the past and in 2020, likely due to a significantly lower prey density.

With two active field sites, BFN with initially seven radio-collared cats and GR with all of the four radio-collared cats surviving for a whole year, the BFCWG was happy to enlist the work the three field technicians in 2020, collecting 3 125 waypoints on BFN and 999 waypoints on GR (Maps 1 & 2; Table 1), which is far more than in preceding years. This was possible despite the difficulties in schedules, some vehicle issues on BFN and lockdown in GR. From the start of 2021, we have two field technicians, one for each site, both with their own future research plans.

The BFCWG will return to BFN and GR for capturing and sampling of wild black-footed cats in 2021, because the batteries of the currently fitted radio-collars should be operational for a minimum of 18 months, thus at least until August 2021.

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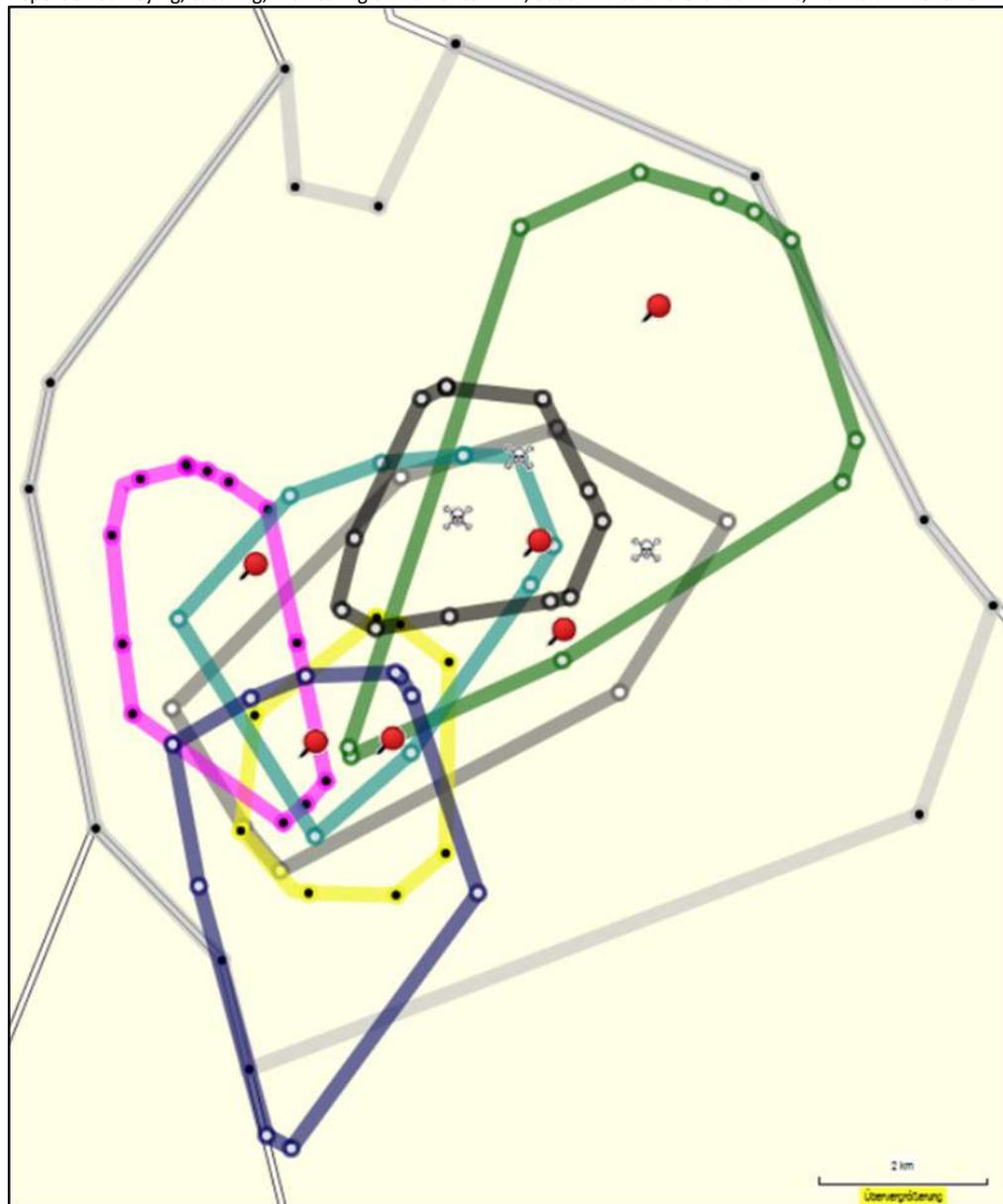
In Namibia, we sincerely thank the van der Merwe family, in particular Kobus and Margaret for their continued support and permission to conduct the research on their farm near Grünau in southern Namibia. All the farmers in the Grünau area are thanked for supporting, helping and allowing access to their properties in order to monitor the radio-collared BFCs: Johandre & Anri van der Merwe; Marisa & Phillipus Fourie; Alwyn Smith; Dolf & Kinna de Wet; Rean Steenkamp & Barend Matheus Swartz.

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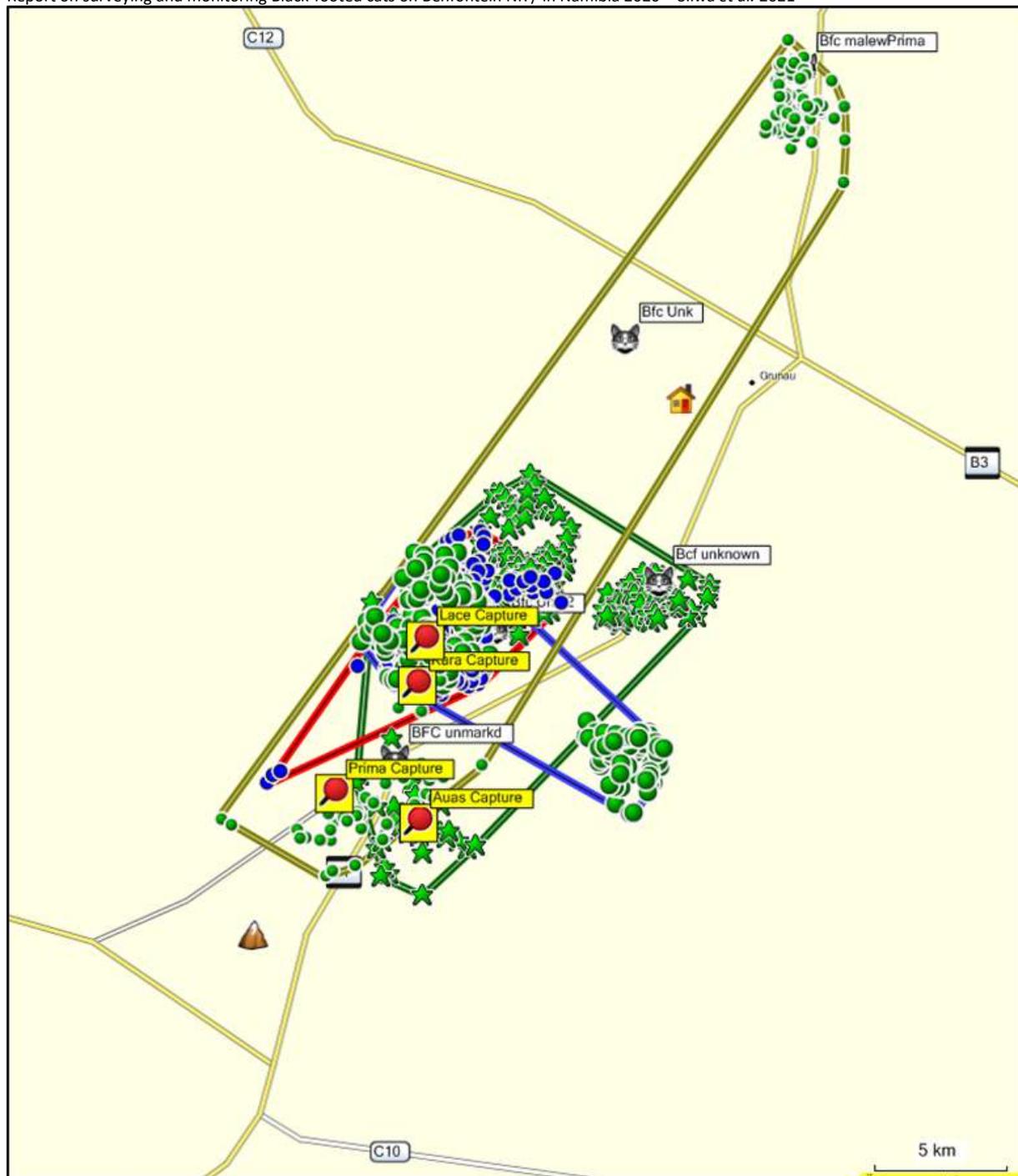
Map 1: Map of Benfontein (BFN; boundary = light grey polygon) with ranges of all BFCs in 2020, minimum convex polygons (100% MCP) encompassing the locations ($n = 3\ 125$) of 7 radio-collared black-footed cats monitored between January – December 2020. Red beacons are capture locations for 6 cats and skull signs show locations where 3 males were found dead.

Based on 3125 waypoints.

Individuals:

- Female *Kasi* magenta polygon, (7.2 km²; $n = 800$) in “Pan Veld”-habitat type. She is alive and well and had kittens on two occasions in 2020.
- Female *Durga* yellow polygon, (6.6 km²; $n = 557$), remarkably small range.
- Male *Hamba* green polygon (23.1 km², $n = 735$).
- Male *Putter* dark blue polygon (13.1 km², $n = 468$). Often crossed to southern adjacent farm Melrose.
- Male *Terio* black polygon (6.6 km², $n = 115$), last seen alive 31.5.20. **DEAD** on 4.6.20
- Male *Cal* dark grey polygon (19.0 km², $n = 150$). Was last seen alive on 27.6.20, **DEAD**
- Male *Phusa* bluegreen polygon (12.0 km², $n = 330$). Last seen on 5.8.20, **DEAD**

It is fascinating that in the southwest of Benfontein NR there is an area where 6 out of the 7 monitored cats overlapped within the course of 2020.



Map 2: Map of Grünau (GR) with ranges of all BFCs in 2020, minimum convex polygons (100% MCP) encompassing the locations ($n = 999$) of 4 radio-collared black-footed cats monitored between February – December 2020.

Legend:

- Red beacons are capture locations for 4 cats.
- Cat face icons: un-collared BFCs seen
- House icon: Namgate Guest House
- Mountain icon: Kirchberg Koppie

Based on 999 waypoints.

Individuals:

- Female *Prima* light polygon, (213 km^2 ; $n = 177$ – small green dots). She had a kitten - in the area she re-located to in October 2020.
- Female *Lace* blue polygon, (53.5 km^2 ; $n = 252$ – larger green dots). She made a distinct range shift to the south-east.
- Female *Kara* red polygon (40.8 km^2 , $n = 304$ – blue dots).
- Female *Auas* dark green polygon (125 km^2 , $n = 266$ – green stars). She made several range shifts.



Fig. 1: Martina Küsters and Ndele Shipala with netted female *Lace* (A.Sliwa).



Fig. 2: Beryl Wilson with female *Prima* and mascot *Gru* (A.Sliwa).

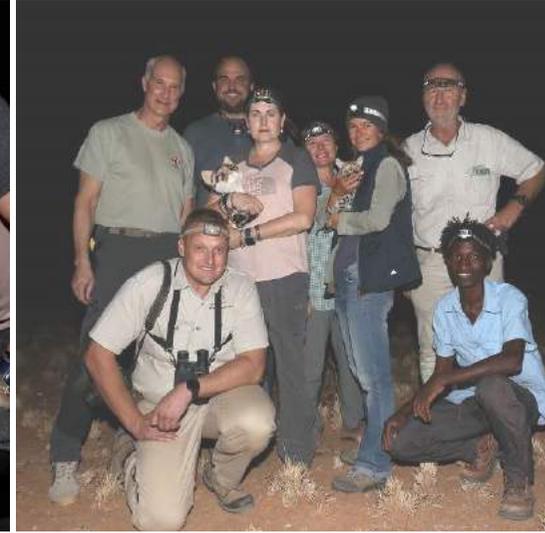


Fig. 3: Team with female *Kara* (self-release).



Fig. 4: Ground to ground tracking in Namibia. (A. Sliwa).



Fig. 5: Tracking from the field vehicle (A. Sliwa).



Fig. 6: Nadine Lamberski and Axel Hartmann working on *Prima* (A. Sliwa)



Fig. 7: Farewell Photo with our hosts, the van der Merwe family (M. Hauptfleisch).

February and November 2020 – Namibian cats



Fig. 8. Female *Prima* in November 2020 (A.Sliwa)



Fig. 9: Female *Lace* in November 2020 (A.Sliwa)



Fig. 10. Female *Kara* in November 2020 (A.Sliwa)



Fig. 11: Female *Auas* in November 2020 (A. Sliwa).



Fig. 12: *Lace* at sunset on 10.3.2020 (Camera Trap set by N. Shipala)



Fig. 13: Thundershowers on 1.3.2020, Grünau Farm (A. Sliwa).



Fig. 14: Thundershowers made the Gamkab River flow on March 1st 2020 (A. Sliwa).

Fieldwork on Benfontein (BFN), South Africa, March 2020



Fig. 15: The Benfontein capture team (self-release).



Fig. 16: Martina Küsters with netted juvenile female we didn't collar (A. Sliwa).



Fig. 17: Dr Murray Hyslop attending to *Durga* (A. Sliwa).



Fig. 18: Capturing *Phusa* in daylight (A. Sliwa).



Fig. 19: Michelle Schroeder listening for the cats' signals (A. Sliwa).



Fig.20: Michelle Schroeder and Alex Sliwa are setting camera traps at *Kazi's* den to check for kittens (J. Anver).



Fig.21: *Putter* with his very muddy paws and feet (A. Sliwa).

Black-footed Cats on Benfontein (BFN) in 2020



Fig. 22: *Hamba* in February 2020 (A.Sliwa).



Fig. 23: *Kazi* in hunting mode, February 2020 (A. Sliwa).



Fig. 24: *Phusa* rushing forward in February 2020 (A. Sliwa).



Fig. 25: *Durga* with kitten at den site 11.12.2020 (M. Schroeder- BFCWG).



Fig.26: *Durga's* kitten holding his mother back on 13.12.2020 (M. Schroeder- BFCWG).



Fig.27: *Kazi's* kitten feeding (M. Schroeder- BFCWG).



Fig. 28: *Putter* leaving his den, 26.4.2020 (M. Schroeder- BFCWG).

Table. 1: Body measurements (cm), range size and remarks on 12 black-footed cats on Grünau Farms (GR), Namibia and Benfontein Nature Reserve (BFN), South Africa, 2020. Shaded animal columns indicate individuals that died in 2020.

Capture Date	24.02.20	27.02.20	27.02.20	29.02.20		2.3.20	3.3.20	3.3.20	4.3.20	5.3.20	6.3.20	6.3.20	7.3.20
Name (also on Map)	<i>Prima</i>	<i>Lace</i>	<i>Kara</i>	<i>Auas</i>		<i>Cal</i>	<i>Hamba</i>	-	<i>Kazi</i>	<i>Durga</i>	<i>Phusa</i>	<i>Terio</i>	<i>Putter</i>
No. captured	Cat 1 20	Cat 2 20	Cat 3 20	Cat 4 20		Cat 5 20	Cat 6 20	Cat 7 20	Cat 8 20	Cat 9 20	Cat 10 20	Cat 11 20	Cat 12 20
Sex	F	F	F	F		M	M	F	F	F	M	M	M
Age (judged by teeth)	Adult	Adult	Adult	Adult		Y Adult	Adult	Juvenile	Adult	Adult	Adult	Adult	Adult
Microchip #.	953010004073 751	953010004073 73717	953010004073 718	953010004073 771		945000001950 911	276095610401 684	945000001951 986	9450000018 08148	945000001951 981	276095610404 684	9450000019 51990	9450000019 51984
Mass (kg)	0.97	1.11	1.10	1.02		1.72	1.82	0.86	1.38	1.33	1.52	1.95	1.90
Ear (cm)	5.0	4.7	4.7	4.7		4.8	5.1	4.5	5.0	4.9	4.9	4.9	5.1
Shoulder (cm)	23	23	22	23		26	27	22	24	25	26	27	27
Total Length (cm)	52	52	52	56		61	57	51.5	57	57	59	62	61
Hind foot (cm)	7.85	8.55	8.20	8.83		9.2	9.4	7.9	9.2	8.8	9.3	9.9	9.4
Front foot (cm) (L x W)	2.05 x 1.73	1.87 x 1.56	1.8 x 1.6	1.9 x 1.5		2.1 x 2.0	2.4 x 2.0	1.7 x 1.4	1.9 x 1.8	2.0 x 1.6	2.0 x 1.7	2.2 x 2.1	2.2 x 2.0
Tail (cm)	16	15	16	17		19	17	15	18	16	17	18	16
Neck (cm)	10	11	11	10		13	13	9	11	11	11.5	14	13
Canine UR (cm)	0.72	0.818	0.70	0.84		0.95	1.07	0.22	0.99	0.92	0.97	1.00	1.00
Canine LR (cm)	0.68	0.63	0.60	0.73		0.83	0.99	Milk	0.80	0.70	0.81	0.82	0.85
Canine UL (cm)	0.74	0.76	0.73	0.80		0.92	1.11	0.14	0.91	0.88	0.94	0.97	0.96
Canine LL (cm)	0.68	0.66	0.61	0.72		0.80	0.89	Milk	0.79	0.72	0.84	0.88	0.84
Testes (cm)/nipples	Never used	Not ob. gravid	Poss. gravid	Nipples used				juvenile	Nipples recently used	Nipples recently used	1.5 x 1.0 1.5 x 1.0	1.8 x 1.0 1.7 x 1.0	1.4 x 1.0 1.4 x 1.0
No. fixes collected in 2020	177	252	304	266		150	735	-	800	557	330	115	438
Range (100MCP) 2020 (km ²)	213.0	53.5	40.8	125.0		19.0	23.1	-	7.2	6.6	12.0	6.6	13.1

Remarks: Total fixes collected in 2020 for Namibian Cats, n = 999 ; Fixes for BFN cats = 3125; Total= 4124

- Prima* (Cat 1 20): GA – young adult female in lean but good condition; pale background colour. Used an area further south on GA, then shifted her range 35 km north, where she has bred.
- Lace* (Cat 2 20): GA - adult female – good body condition. Shifted her range across the B1 tarmac road. Still the shiest Namibian female
- Kara* (Cat 3 20): GA - adult female; good condition. Has remained in her range for a whole year. She is the best habituated female
- Auas* (Cat 4 20): GA - older adult female; very thin, worn pads, initial on eastern side of B1 road, after rains moved across Gamkab River then moved back to east. Has calmed well.
- Cal* (Cat 5 20): BFN – young adult male – in good condition. Killed on 27.6.20 – same day in a den alive. **DEAD**
- Hamba* (Cat 6 20): BFN - adult male; in good condition, has grown since November 2018; exchanged collar.
- Cat 7 20: BFN – juvenile female, recently independent, ~5 months, too small for collaring, just replacing her lower canines from milk to permanent dentition.
- Kazi* (Cat 8 20): BFN – adult female; very good condition and big for a female, nipples recently used, but no more milk. Excellent teeth. Gave birth in October again. Maintained territory in W, 1 excursion 5km to East.
- Durga* (Cat 9 20): BFN - adult female; caught close to white-rock gate, good and lean condition, bit team member, has 56 week old kitten seen during day tracking on 8.3.20.
- Phusa* (Cat 10 20): BFN - adult male, small for his age, had eaten something. Found dead on 8.8.20, last seen alive 5.8.20. Likely killed by caracal. **DEAD**
- Terio* (Cat 11 20): BFN - adult male, fully adult in good lean condition; mostly in SW BFN and moving south to Melrose farm; last seen 31.5. and found dead on 4.6.20, **DEAD**
- Putter* (Cat 8 20): BFN - adult male; good condition, caught SW of white rock gate, dug out and had muddy feet, pulled at the putter.