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IUCN OTTER SPECIALIST GROUP BULLETIN

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NOTE FROM THE EDITOR

I apologise that this issue once again has been delayed, although this seems to be becoming a habit. I accepted a new position at the National School of Veterinary Science in Oslo, Norway and this moving to another country made it very difficult for some time to work on the otter Bulletin. Please find the new contact address on the inner side of the title page.

One of the first e-mails that I received after arriving here was the one from Hans-Heinrich informing us that Claus had died. While writing this it is still a fact that somehow seems to be very unreal for me. I knew Claus for about 15 years. All the years since we first met on a Mustelid-Colloquium in Bielefeld, Germany, - my first international conference attended ever, we had regular contact. I still remember the moment when he said in South Africa to all of us, that we may have more scientists dealing with otters in Austria than we have otters, followed by his big smile. Only a few minutes later he argued that the big interest for otters in Austria should be reflected by the fact that an Austrian takes over the responsibility for the Otter Bulletin, while looking into my eyes as if he knew (probably he did) that I tend to accept these offers. As a result of this choice Claus and I had to deal a lot with each other and we had continuous contact throughout the years about all aspects of the Bulletin. I take it as a big honour that he sometimes called me to discuss aspects of the group and asked about my opinion. Claus and I did not only talk about otters but also a lot about private things, - about life and this made him to a very special person for me. Claus death showed me how relative things in life can be. Not only will I remind his inset for otters but I will also remind him as a good friend.

I was often asked during the last weeks about whether and when we are going to have a new chairperson and whom it is going to be. Currently there is a lot of constructive discussion going on within the continental coordinators and probably at the time the next Bulletin will be published more details can be presented. In case of any question please contact your continental coordinator, as they should have the most recent information.

In addition, I really want to thank Kevin Roche, Rachel Kuhn, Daniel Scognamillo, Hans van den Berg, Els Hoogsteede-Veens, Erwin Hellegering, and all the reviewers for their continuing contributions to the IUCN OSG Bulletin.

I U C N / S S C O S G G R O U P

The Section from the chairman’s desk is empty this time! While Claus had agreed to send me his contribution around New Year I was shocked like many of you when I heard about Claus death! After some considerations I asked Addy to write about Claus.

IN MEMORIAM CLAUS REUTHER

Like all of you, I was deeply shocked about Claus Reuther's death. Most of you know that Claus and I had a peculiar relationship. I have not been easy for him, neither has he been for me. Nevertheless, behind the scenes we have always had a lot of respect for each other! Because of this deep respect for all he accomplished and to give our support for the people he left behind, my wife and I attended his funeral.

During the funeral the president of Aktion Fischotterschutz, prof dr. Willfried Janssen, memorized Claus' remarkable achievements and being in a very touching way. Still, at that very moment, it was hard to believe that his death is reality.

I have known Claus already a long time. I met him for the first time in Oderhaus (Harz) as a biology student (1983). We discussed research about the locomotion of otters. Soon after this I started to work as a student for Hans Kruuk. In the years after, Claus, his wife Biggi and I met each over and over again in many corners of this beautiful planet. During an Italian meeting Claus, Biggi and I went to several restaurants together, having a nice time. In Chili, while we as husbands were busy with the otter work, Biggi and my wife Lena became friends and enjoyed the Chilean surroundings of Valdivia.

When Claus opened his wonderful Otterzentrum in Hankensbüttel I was there to congratulate him and his staff. When we opened our Otterpark in Leeuwarden Claus was there to return the favour. He also helped us preparing the wonderful combined IUCN OSG and Council of Europe Otter meeting we hosted a few months after we opened our park (1994). Later on we strongly disagreed about the oncoming reintroduction of the otter in the Netherlands. About that we have written down our views in the Otter Specialist Bulletin. There were some more strong clashes between us, but the respect remained.

Striking examples of the achievements of Claus and his staff are the Ise and OHNE project. The Ise is a small river near the Otterzentrum in Hankensbüttel. Decades ago it was like a sterile canal without otters, but because of the work of Claus and his companions, it is now a beautiful little river with an abundance of natural values and nowadays otters too!

OHNE is the project, which has a practical approach to realise a (wet) ecological infrastructure throughout Europe. In the German State of Niedersachsen Claus has accomplished a lot within this project. Modern tools like GIS and spatial planning have been utilised for this project. His staff will continue this project.

I should not forget the good job Claus and his former colleague Bärbel Rogoschik have done with respect to keeping otters in captivity. Before they started only Philip Wayre was capable to keep Eurasian otters in a proper way. Claus and Bärbel provided a lot of good information over the years, which made it possible for others too to keep and breed *Lutra lutra* in a sound way. The information they provided is an important basis for the present EEP Husbandry Guidelines for *Lutra lutra*.

In the last years of his life Claus did a lot of work for the Otter Specialist Group on his own expenses. He flew everywhere around the globe. He wanted to see all of the otter species inhabiting this planet. He almost succeeded. He helped where he could, but was sometimes too fast in his actions. When IOSF heard there could be a new otter species in the west of Africa, he got to know this, went there without deliberation and tried to find it. This issue and others too led to some serious problems between him and other OSG members.

I want to thank you, Claus Reuther, for all you did for the otters of the world, for wetland protection and for the many people you have helped and guided.

Addy de Jongh, director Dutch Otterstation Foundation

A R T I C L E

ASSESSING THE DISTRIBUTION OF REINTRODUCED POPULATIONS OF RIVER OTTERS IN PENNSYLVANIA (USA) DEVELOPMENT OF A LANDSCAPE- LEVEL APPROACH

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(received 18th February 2005, accepted 24th February 2005)

Abstract: Since 1982, 153 river otters have been reintroduced into central and western Pennsylvania. The reintroduction project is now in its final phase, but has largely seen the long-term survival of the reintroduced population. This research used indicators of otter presence (spraints and footprints), which have on the whole been successful in studying the distribution of the otter. A protocol based on an SIG has been developed to enable the changes in otter population to be followed, and this will continue to be used to monitor future population changes. This was achieved through collaboration with wildlife conservation officers (WCOs).

During the 1970s, improvements in furbearer management techniques and water quality coincided with increased concern about river otter (*Lontra canadensis)* declines in North America (ENDANGERED SPECIES SCIENTIFIC AUTHORITY, 1978). Consequently, many wildlife management agencies conducted surveys to determine the status of river otters. Results of these surveys demonstrated that, in many cases, there was a need to implement conservation measures to restore or enhance river otter populations. Many of the conservation actions implemented were in the form of re-introduction projects (RALLS, 1990). The first river otter re-introduction project was initiated in Colorado during 1976 (TISCHBEIN, 1976). From 1976 to present, 21 states and 1 Canadian province (Alberta) have released >4,100 river otters through re-introduction projects.

Monitoring initial fates of translocated wildlife and subsequent long-term studies to determine if self-sustaining populations become established should be an important aspect of re-introduction projects (SERFASS, 1994; IUCN, 1998). Unfortunately, there have been few formal studies, accompanied by published reports or other external documentation, evaluating short or long-term status of re-introduced river otter populations. ERICKSON and MCCULLOUGH (1987), SERFASS et al. (1993a), and JOHNSON and BERKLEY (1999) reported favorable survival rates and persistence of river otters based on radio-telemetry studies conducted at re-introduction sites in Missouri, Pennsylvania, and Indiana, respectively. Pennsylvania developed survey strategies to enhance procedures to detect presence of river otter latrine sites for monitoring persistence of re-introduced river otter populations (SWIMLEY et al. 1998). However, there have been no other published informations regarding long-term monitoring of river otter populations in North America.

Since 1982, the Pennsylvania River Otter Reintroduction Project (PRORP) has applied an integrated, adaptive management approach to reintroduce 153 river otters successfully to seven water systems in central and western Pennsylvania. The project was comprised of five developmental and implemental stages: 1) site selection, 2) identification and selection of appropriate sources and numbers of animals, 3) veterinary care, captive management, and translocation, 4) public relations and education, and 5) post-translocation monitoring and evaluation, which resulted in a successful, ecologically based, and publicly supported reintroduction project.

PRORP is in the final phase of the reintroduction process and is focusing on the development and evaluation of long-term approaches for monitoring the reintroduced populations, as recommended by IUCN 1998 guidelines. Surveys to detect river otter sign (e.g., scats and tracks) have been demonstrated effective in determining the presence of river otters and will form the basis for the establishment and refinement of monitoring protocols. As part of the process of refining surveys, we have been considering four specific questions regarding the use of scats for monitoring river otter populations:

- Are river otter latrines (areas along the shoreline where river otters defecate; locating these areas have been the focus of many studies to determine the presence or absence of river otters) associated with certain riparian habitat features?

Outcome: Certain habitat features (e.g. evidence of beaver activity, vertical banks, large rock formations, and backwaters) were more frequently associated with latrine than random sites and were therefore useful in predicting the location of river otter latrines (SWIMLEY et al., 1998; CARPENTER, 2001; MILLS, 2004).

- Does river otter marking intensity vary among seasons?

Outcome: These investigations demonstrated that river otters marked much more frequently during the spring and fall (CARPENTER, 2001; MILLS, 2004). From this information, we now conduct surveys almost exclusively during these seasons of peak marking activity.

- Can DNA be extracted from river otter scats and applied for determining the density of river otters in various wetland habitats?

Outcome: Initial research has resulted in the development of microsatellites markers specific for assessing genetic variability in river otters (BEHELER et al., 2004), was successful in extracting DNA can be extracted from scats collected from captive river otters, and demonstrated that river otters possess enough genetic variability to identify individuals. This approach is now being applied to river otter scats collected from reintroduction sites.

- Can cost effective landscape-level monitoring approaches be implemented to better represent and predict, respectively, the current and future distribution of river otter populations?

Outcome: This portion of the evaluation has been the focus of the senior author's (B. Hubbard) M.S. research in Wildlife and Fisheries Biology. The remainder of this articles focuses on what has been accomplished with the development of landscape monitoring protocols for river otters in Pennsylvania.

Landscape-level population monitoring: Europe had developed and implemented The Standard Method, a grid-based format for surveying otters at a landscape level (see REUTHER et al., 2000 for a detailed review of The Standard Method). This manner and place of its implementation across the continent is detailed in REUTHER et al., 2000. Unfortunately, no standardized methodologies have been developed for monitoring long-term trends in river otter distributions in Pennsylvania or elsewhere in North America. Consequently, we developed a GIS-based approach for application in monitoring the current and future distribution of river otters. Our initial efforts have focused on developing this landscape-level monitoring approach within the Allegheny River drainage, which comprises approximately the western third of Pennsylvania (Figure 1).

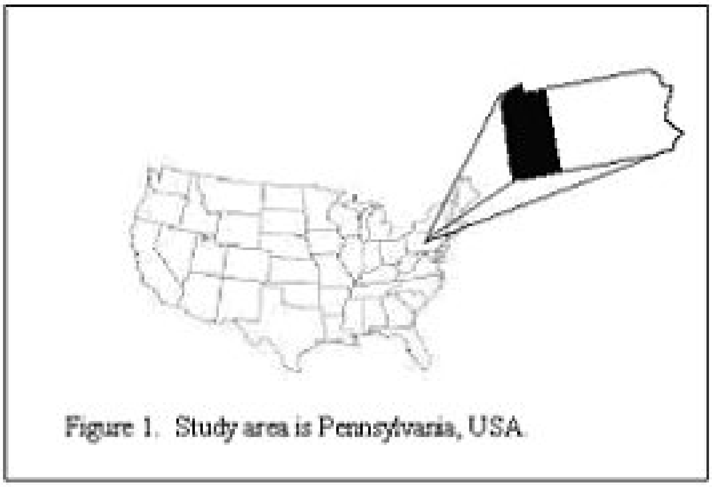

Figure 1. The state of Pennsylvania (expanded area of map) is located in the eastern United States. The study area for our landscape-level assessment of the distribution of river otters occupies the western portion of the state (in black).

Initially, interviews were conducted with Wildlife Conservation Officers (WCOs) of the Pennsylvania Game Commission (the agency responsible for the management of all avian and mammalian species in the Commonwealth) to determine the general distribution of river otters in the drainage. WCOs enforce wildlife laws in the state, are assigned to a specific district (usually 1-3 WCO districts for each county in the state; Figure 2) and generally are well informed about the occurrence of most large or unique mammalian species in their districts. The opinions of WCOs traditionally have been used to monitor the occurrence of river otters at their district and county levels (SERFASS et al., 1999). However, this coarse-level approach considerably overestimates the actual distribution of a habitat specialist, such as the river otter. Consequently, we modified a GIS-based grid system developed in conjunction with the Pennsylvania GAP Project (PAGAP, 2004), resulting in the creation of a statewide electronic grid comprised of 1 km^2 cells. WCOs subsequently were interviewed and asked to evaluate the presence or absence of river otters within each grid cell occurring in their respective districts. This level of evaluation provides a more realistic assessment of the distribution of river otters and provides a standardized approach for assessing expansion or contractions associated with river otter populations over time. The ease in which the grid can be filled in with information provided by WCOs about presence or absence of river otters (assuming the information they provide is reliable) offers potential to reduce the time and costs associated with intensive field studies. Also, each grid cell represents a sample unit and, therefore, facilitates quantification of landscape-level habitat features associated with the presence or absence of river otters.

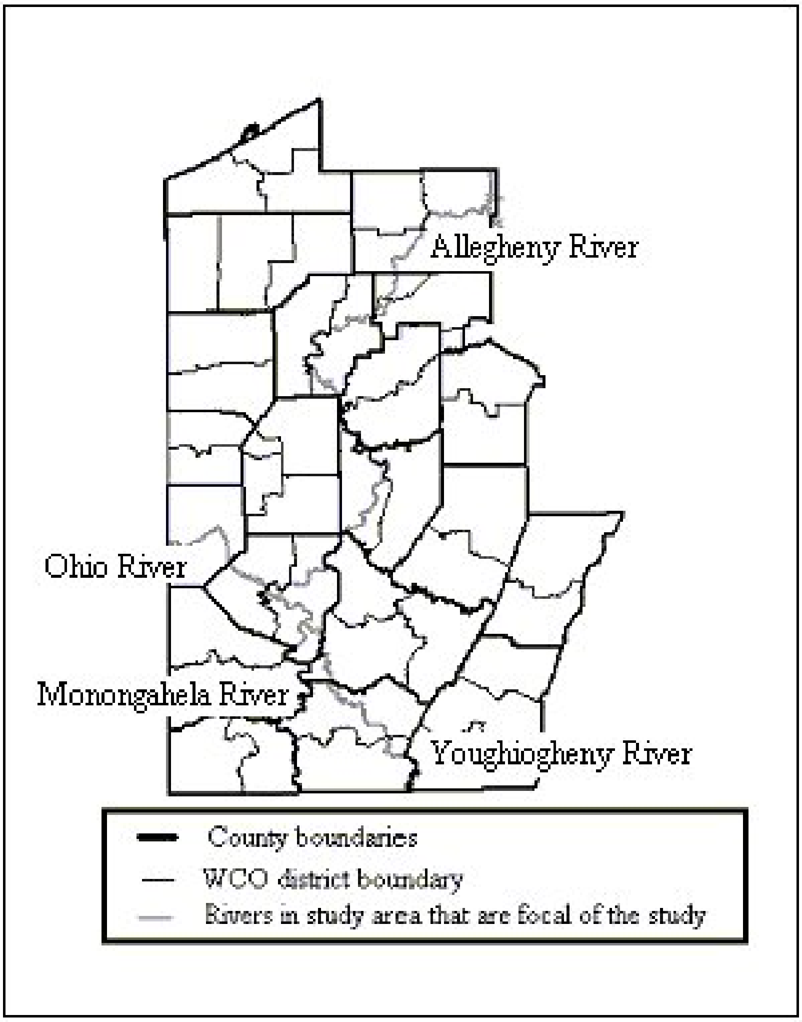

Figure 2. County boundaries (primary geopolitical units), Wildlife Conservation Officer districts, and location of major rivers in western Pennsylvania study area. River otters have been traditionally monitored at the county or WCO district levels in Pennsylvania.

We are in the final stages of assessing the validity of responses by WCOs for the presence or absence of river otters within each grid cell. The validation process involves searching riparian habitats for the presence of river otter sign (primarily scats) during periods of peak scat marking (spring and fall). For selecting grid cells for inclusion in the validation process, we took a stratified random sample of all cells identified by WCOs as positive cells (considered occupied or likely occupied) and negative cells (considered unoccupied) in the southern portion of the study area (which included 10% of the positive cells and about 2% of the negative cells occurring within 10 km of a positive cell). When completed, we will have assessed 130 grid cells for the presence or absence of river otters. The validation process will provide considerable insight about the ability of WCOs to reliably predict the presence or absence of river otters at the scale established by the grid (1 km^2 cells). The results will therefore indicate if a relatively quick and efficient approach for assessing the distribution of river otters (WCO surveys) can supplant or supplement more time and labor intensive approaches (riparian surveys). Regardless of the technique used to assess the distribution of river otters, representing presence or absence data at the scale of our grid-based approach provides a much more realistic appraisal of the distribution of an organism, especially in the case of a habitat specialist such as the river otter (Figure 3,4).

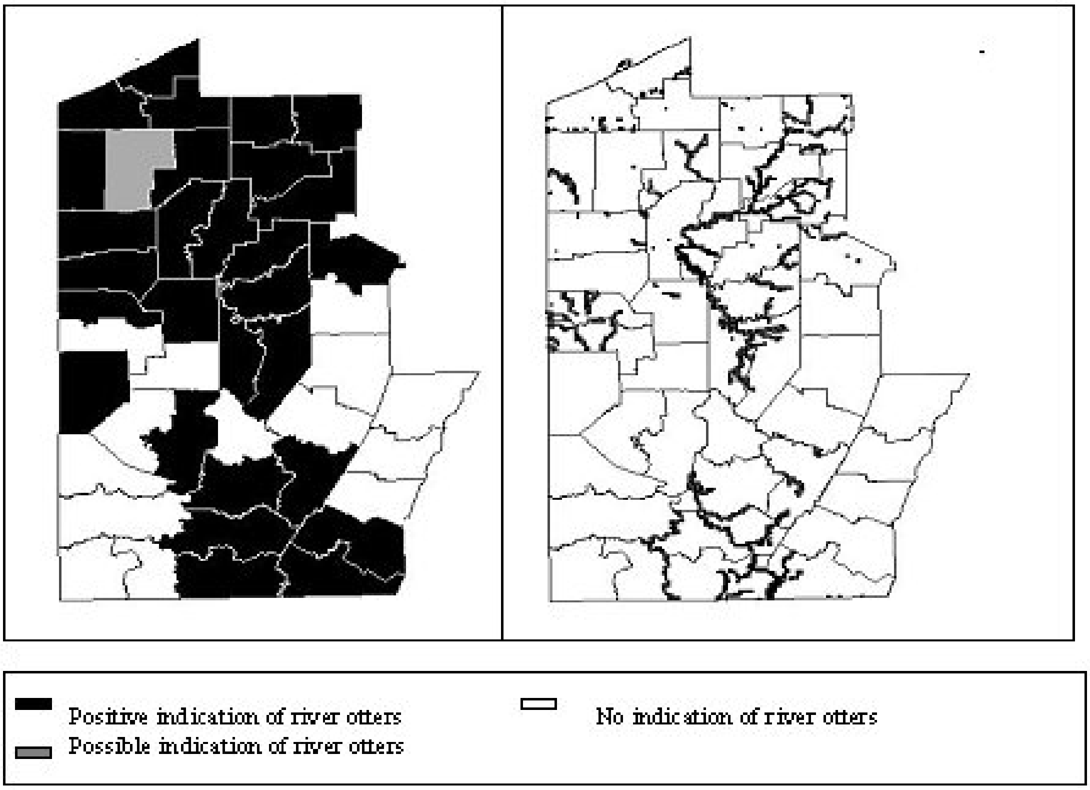

Figure 3. Distribution of river otters in western Pennsylvania based written surveys and interviews with Wildlife Conservations Officers (WCO) conducted during 2001-2004. The areas represented as being occupied by river otters differs dramatically when the information is portrayed at the WCO district-level (A) versus the 1-km^2 grid-level (B). The respective distributions are based on the opinions of WCOs and not actual field surveys.

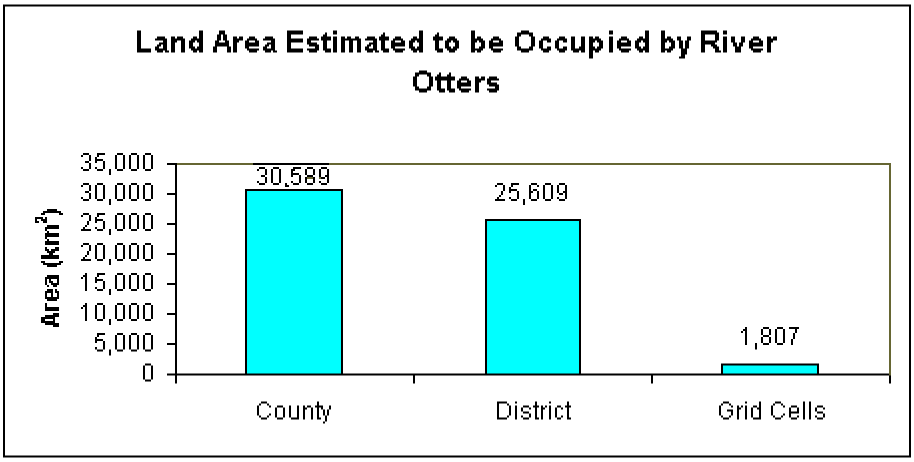

Figure 4. Land area estimated to be occupied by river otters based on Wildlife Conservation Officer's opinions when presented at the county, WCO district, and grid-cell-levels of assessment.

Results of our interviews with WCOs and associated riparian surveys demonstrate that river otters persist at all reintroduction sites in western Pennsylvania and that populations are expanding. Our goal is for the state natural resource management authorities (The Pennsylvania Game Commission and Pennsylvania Department of Conservation and Natural Resources) to adopt use of the grid-based approach described in this article for long-term monitoring of the reintroduced populations.

Acknowledgements *- We would like to thank the Pennsylvania Wild Resource Conservation Fund, a State Wildlife Grant Administered by the Pennsylvania Game Commission, and the U.S.D.A. Allegheny National Forest for funding support and our families for moral support.*

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RÉSUMÉ: Evaluation de la distribution de populations de loutres du Canada réintroduites en Pennsylvanie (USA): Développement d'une approche au niveau du paysage

Depuis 1982, 153 loutres de rivière ont été réintroduites dans le centre et l'ouest de la Pennsylvanie. Le projet de réintroduction est actuellement dans sa phase finale, soit principalement la mise au point d'un suivi à long terme des populations réintroduites. Celui-ci se fera à partir de la recherche d'indices de présence (épreintes et empreintes de pas), qui s'est avérée être un moyen efficace pour étudier la distribution de la loutre. Un protocole, basé sur un SIG, a été développé, afin de suivre l'évolution de la répartition de la loutre de rivière. Ce suivi est réalisé en collaboration avec les officiers de conservation de la faune sauvage (WCOs).

RESUMEN:

Desde 1976, 21 estados en los Estados Unidos y 1 provincia canadiense (Alberta) han liberado >4100 nutrias de río a través de proyectos de reintroducción. Desafortunadamente, pocos estudios se han realizado para monitorear el destino inicial de las nutrias de río translocadas y si las poblaciones pudieron establecerse. Como parte de la fase final del proceso de reintroducción, el Proyecto de Reintroducción de Nutrias de Río en Pennsylvania (PRORP) está enfocado en el desarrollo y evaluación de una encuesta para el monitoreo de poblaciones reintroducidas en el estado. Resultados de las entrevistas con Oficiales de Conservación de Fauna Silvestre (WCO) y reconocimientos de campo en áreas ribereñas demuestra que nutrias de río persisten en todos los sitios de reintroducción en el oeste de Pennsylvania y que las poblaciones se están expandiendo. Nuestro objetivo es que las autoridades estatales de manejo de recursos naturales adopten la metodología de grilla propuesta en este artículo para el monitoreo a largo plazo de poblaciones reintroducidas.

ARTICLE

FIRST PHYSICAL EVIDENCE OF THE NEARCTIC RIVER OTTER (*LONTRA CANADENSIS*) COLLECTED IN NEW MEXICO, USA, SINCE 1953

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(reveived 2nd March 2005, accepted 4th March 2005)

Abstract: On November 3rd, 2004, we collected what seems to be 3 North American River Otter (*Lontra canadensis*) spraints on the San Juan river, Navajo Reservoir, Navajo State Park, San Juan County, New Mexico, USA. Given that the samples were collected on a hard substrate, not good for tracks, we then had them analyzed in the laboratory. DNA was extracted from the samples and the cytochrome *b* gene was amplified and sequences for 2 of the samples. The sequences were identified as being *L. canadensis*, after comparison with the NCBI Genebank. These spraints constitute the second data and the first concrete indicator of presence in this state for more than 50 years. Otter releases have been carried out in the past in the basin, without taking account of subspecies, and the presence of indigenous otters prior to these introductions from other areas means that the identification of subspecies is premature and additional analyses are necessary. More field surveys would indicate the distribution of the otter in the state and help to evaluate the quality of the wetlands.

On 3 November 2004 between the mouths of Grassy and Albino Canyons of Navajo Reservoir and on the east bank of the Los Pinos arm, 16.2 Km N. and 1.3 Km E. of the village of Navajo Dam, San Juan County, New Mexico, three presumptive river otter (*Lontra canadensis*) scats (or spraints in British English) were found; two new and one old scat. Scats ranged from 12 to 20 mm in diameter and varied in hue from white to tan. Scats were compared to drawings and photos of MURIE (1974) and HALFPENNY (1986). No river otter tracks (or seals in British English) were observed at this location. The scats were found on a small spit of dried and cold mud, a substrate not conducive to receiving fresh tracks. The spit was positioned across the arm from a small point. Sandstone rim rock formed the sides of the box canyon about 305.8 m wide and approximately 182.9 m deep. Water depth and width was about 3.7 m and 9.1 m, respectively. Early successional vegetation in the area consisted of plants such as: red willow (*Salix exigua*), salt cedar (*Tamarisk pentandra*), cocklebur (*Xanthium* sp.), low grass (Poaceae), and a lone cottonwood (*Populus deltoide*s).

The scats contained remnants of crayfish exoskeleton and fish bones and scales. Skeletons of old flathead catfish (*Pylodictis olivaris*) were observed at the scat site and those of fresh kokanee salmon (*Oncorhynchus nerka*) (discarded by fisherman after cleaning their fish) were found and at a nearby marina at Pine Site, Navajo Lake State Park. Live common carp (*Cyprinus carpio*) and gambusia (*Gambusia affinis*) were observed as well.

Tracks of other commensal animals such as beaver (*Castor canadensis*), ringtail (*Bassariscus astutus*), mountain lion (*Puma concolor*), black bear (*Ursus americanus*), gray fox (*Urocyon cinereoargenteus*), and mule deer (*Odocoileus hemionus*) were observed on the east bank in the vicinity (< 40 m) of the presumptive otter scat. Tracks of cattle (*Bos taurus*) were found on the opposite bank. Birds observed on site and on the outgoing and return trips included: the American coot (*Fulica americana*), great blue heron (*Ardea herodias*), common merganser (*Mergus merganser*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhyncho*s), white pelican (*Peliecanus erythrorhynchos*), and gulls (*Larus* spp.). All these species are considered piscivorous and/or aquatic bird species indicating good quality otter habitat (POLECHLA, 2002b).

Without corroborating sign or evidence, separation of river otter scat from raccoon (*Procyon lotor*) is difficult if raccoons abstain from plant material (e.g., fruits) and switch to/or subsist on crayfish and fish. The later two food items are the preferred and almost exclusive prey of river otters (MELQUIST

et al., 2003). Because tracks were not found associated with the presumptive otter scat due to frozen/hard substrate, a DNA analysis was performed to confirm or refute field identification.
Extraction of DNA from the three scats and one negative control (no DNA source) was performed following manufacturers protocol for the QIAamp DNA Stool Mini Kit (Qiagen, Inc., Valencia, California), with modifications described by HARRISON et al. (2002). Polymerase Chain Reaction (PCR) was used to amplify the cytochrome *b* region of mitochondrial DNA using primers L14724 or L15513 and H15915 (IRWIN et al., 1991). Reaction conditions and cleanup procedures followed those of Harrison et al. (2002). Cleaned PCR products were sequenced using BigDyeTM Terminator Cycle Sequencing Ready Reaction mix (Applied Biosystems, Inc., Foster City, CA) and either of the forward primers (L14724 or L15513), and the reverse primer (H15915). Sequences were determined by running samples on an ABI 3100 Automated DNA Sequencer, and then submitted to an NCBI Nucleotide-nucleotide BLAST search (http://www.ncbi.nlm.nih.gov/BLAST/) for sequence identification.

Two of the three scats provided enough quantity and quality DNA for cytochrome *b* amplification and sequencing and were identified based on 412 and 236 nucleotides. BLAST search results showed both samples to be most similar (99%) to *L. canadensis* sequence provided by KOEPFLI and WAYNE (1998). Additionally, the first scat sample was 89% similar to the Neotropical otter (*L. longicaudis)* and the marine otter or chungungo (*L. felina*) and 87% similar to the sea otter (*Enhydra lutris*). The second sample was 90% similar to *L. longicaudis* and *L. felina* and 85% similar to the Eurasian otter (*Lutra lutra*).

The river otter is a native member of the New Mexican fauna (Polechla et al. 2000). However, the first and heretofore only voucher specimen (*Lontra c. sonora*) from the state was collected in 1953 by T. J. Lyon (McCLELLAN, 1954). In addition to this single museum skin specimen, housed at the Museum of Southwestern Biology (MSB), numerous sightings and reports of otters in New Mexico have been recorded (BAILEY, 1931, POLECHLA et al., 2000). More recently, Mr. Lyon reported seeing signs of otter years after collection of the 1953 specimen (Lyon fide J. Hubbard pers. comm.). A Dr. A. Daggett (personal communication) reported observing an otter in the summer (late August-early September) of 2001 in Canyon Bancos, 7.4 straight-line Km S. (= 10.2 Km by waterway) of the Colorado/New Mexico State Line, Rio Arriba County, New Mexico. The description of the animal’s appearance and swimming behavior were typically river otter in nature. It was described as “long, sleek, slender and very maneuverable,” with a head and body length as about “2 feet” with a “tail about 1/3 of the head and body length”. The animal “[circled the] boat twice before it swam off down the shoreline,” while its tail circumscribed a “snakelike or sigmoid pattern” in the water. These characteristics rule out other of the state’s mammalian species including the semi-aquatic beaver, coypu (*Myocastor coypu*), muskrat (*Ondatra zibethicus*), and mink (*Mustela vison*).

Additionally, two otter specimens have been collected and prepared from the San Juan drainage system just on the other side of the border in Colorado (Polechla 2002b, 2003). These specimens were provided by S. Wait of the Colorado Division of Wildlife (CDOW) for deposition at MSB. These specimens consisted of a male, collected on 17 March 2003 on the Los Pinos River about 2.1 Km E. and 3.2 Km S. Columbus, La Plata County, Colorado at an elevation of 2,195 m, and a female, collected on 16 September 1996 on Vallecito Creek, 0.8 Km N. of Vallecito Reservoir, La Plata County, Colorado at an elevation of 2,347 m.

A study was completed in the San Juan drainage of Colorado, in which river otters were documented in a place where native otters had been previously reported and where they had been translocated from Wisconsin, an unidentified state in the U.S., and Nova Scotia (H. Browning personal communication 2002, POLECHLA, 2002b). BICH (1988) reported otters in the San Juan and Colorado drainages of Utah prior to translocations. Since one of four subspecies of river otters (HALL, 1981, POLECHLA, 2002b) may be suspected (*L. c. canadensis, L. c. lataxina, L. c. pacifica, L. c. sonora*), the subspecific designation of our specimens will require further analysis.

FINDLEY et al. (1975) stated that otters “may well be extinct in the state.” In 1985, the NMGFD declared the river otter apparently extirpated in New Mexico (JONES and SCHMITT, 1997) although no field surveys were conducted for otters. This opinion has been was repeated in the literature (FREY, 2004; BISON-M, 2004; SAVAGE, 2004, FRIENDS OF THE RIVER OTTER, 2005). Our record of a river otter scat in New Mexico constitutes the first time that physical evidence of otters has been documented in over 50 years. In addition, this constitutes the second collection of physical evidence of otter in the state to date.

Other species of otters and carnivores were once thought to extirpated or extinct. By 1911, scientists regarded the southern sea otter (*Enhydra lutris nereis*) as extinct (FISHER et al., 1969) until 300 sea otters were "discovered" along Big Sur coast, California (MATTISON, 1971; KENYON, 1969). However, undocumented observations of southern sea otters were reported during this intervening 27 years (KENYON, 1969). In similar fashion, the hairy nosed otter (*Lutra sumatrana*) was summarily regarded as extinct (ECOLOGICAL RESEARCH DEPARTMENT, 1991; KANCHANASAKA, 2002; Otter Net 6 February 2005 **http://www.otter.org/news/news29.html**,) until they were "rediscovered" in Thailand from 1998 to 2000 (KANCHANASAKA, 2002). In 1904, the jaguar (*Panthera onca*), a large diurnal charismatic mega-mammal, was thought to be extirpated from New Mexico, until GLENN (1996) using hounds bayed one in the Peloncillo Mountains on the Arizona/New Mexico border. These species were thought to be extirpated or extinct until actual field surveys were conducted in earnest.

With less than 5% of the river miles properly surveyed in New Mexico and very little surveyed in the Rio Grande, Colorado, and Arkansas River drainages in neighboring Texas, Mexico, Arizona, Utah, Wyoming, California, Nevada, and Colorado (POLECHLA, 2002a,b; 2004, DEPUE and SCHNURR, 2004), plans for translocating otters may be premature. Until the majority of the river miles (and shoreline) of habitat is surveyed, by biologists experienced with tracking otters and other New Mexican fauna, for river otters during the seasonal peak of otter sign abundance, then a river drainage should be regarded as potentially possessing otters. Simultaneous to these river otter surveys, the majority of potential habitat should be surveyed as well (POLECHLA et al., 2000). RALLS (1990) recommends that an effective otter restoration program in a particular watershed involve an assessment of current suitability of habitat and the removal of the factor(s), which contributed to the decline of the population.

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RESUME: Premiers indices de présence de la loutre du Canada (*Lontra canadensis*) collectés au Nouveau Mexique, USA, depuis 1953

Le 3 Novembre 2004, nous avons collectés ce qui semble être 3 épreintes de loutre du Canada (*Lontra canadensis*) sur la rivière de San Juan, Navajo Reservoir, Navajo State Park, San Juan County, New Mexico, USA. Etant donné que les échantillons ont été collectés sur un substrat dur, dépourvu de traces, nous les avons fait analyser en laboratoire. L'ADN a été extrait des échantillons et le gène cytochrome b a été amplifié et sequencé pour 2 des échantillons. Les séquences ont été identifiées comme étant de *L. canadensis*, après comparaison avec la NCBI Genbank. Ces épreintes constituent la deuxième donnée et le premier indice de présence concret pour cet état, depuis plus de 50 ans. Des lâchés d'individus ayant été effectués par le passé dans le bassin, sans tenir compte des sous-espèces, et la présence de loutres autochtones, antérieure à l'introduction d'individus issus d'autres régions, ayant été signalée, l'identification de sous-espèces est prématurée et des analyses supplémentaires sont nécessaires. Davantage de prospections sur le terrain permettraient de connaître la distribution de la loutre dans l'état et d'évaluer la qualité des zones humides.

RESUMEN:
El día 3 de noviembre del año 2004 se colectaron tres heces que parecían ser de nutria de río (*Lontra canadensis*) en el río San Juan en la Reserva Navajo, Parque Estatal Navajo, condado de San Juan en el estado de Nueva Mexico, Estados Unidos. Las muestras fueron analizadas para extraer ADN. El gen citocromo *b* fue amplificado y secuenciado a partir de 2 de las muestras. Las secuencias fueron comparadas con el banco genético NCBI y fueron asignadas a *L. canadensis*. Estas heces son el segundo registro para el estado y es la primera vez en 50 años que se colectan evidencias físicas. La identificación de subespecies es necesaria debido a previas translocaciones de individuos sin considerar subespecie y a reportes de la presencia de individuos nativos previa a la translocación. Reconocimientos de campo son necesarios para determinar otras áreas donde la especie pudiera existir y determinar la condición de los humedales.

A R T I C L E

HIGH MORTALITY OF NEARCTIC RIVER OTTERS ON A FLORIDA, USA INTERSTATE HIGHWAY DURING AN EXTREME DROUGHT

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Abstract: From 28 December 1999 until 15 July 2000, I recorded 15 river otters killed on a 16 km segment of Interstate highway in Polk County, Florida, USA. This included 9 during a 37 day period, the highest road mortality rate reported for North American otters. This compares to 22 otters killed on a south Florida road during a 2 year period. My sample of 15 killed on I-4 is a negatively biased count of the true number killed, due to the minimal sampling period and sampling method. Possible reasons for such a high number counted during such a short period are discussed, including the impact of a major drought, high traffic density, and possible dieldrin bioaccumulation.

INTRODUCTION

The Nearctic river otter (*Lontra canadensis lataxina*) occurs throughout Florida (HALL 1981, BROWN 1997) and is currently classified as a protected furbearer that can only be taken, according to Florida Administrative Code 68A-24.002 (2) (C), “from December 1 through March 1 by live traps, guns, dogs or snares.” Historically, Florida’s wetlands have been very productive in output of otters. In 1960-61, this state was third in the United States for otter harvest, with a total of 1435 animals in the hide dealers’ reports. This figure was probably an underestimate, since hide dealers’ reports do not indicate the true fur catches. One hide dealer indicated in an interview with MCDANIEL (1963) that he bought 4,500 hides in 1961-62 when 2,779 were reported in the hide dealer reports.

Abundance of this semi-aquatic mammal in Florida was reported to be lowest in freshwater marshes, intermediate in salt marshes, and highest in swamp forest (HUMPHREY and ZINN 1982). However, the tremendous loss of wetlands (56 percent between l936 and l987) in Florida (KAUTZ 1993) has undoubtedly decreased populations. No statewide surveys have ever been conducted, thus there is little reliable information regarding the distribution, density, or mortality factors of otter in Florida. The only data available is the number of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) tags issued each trapping season which shows a dramatic decline (pers. comm. KURT HODGES, Florida Fish and Wildlife Commission, Fig.1); however these data may reflect marketplace trends rather than population trends of river otters.

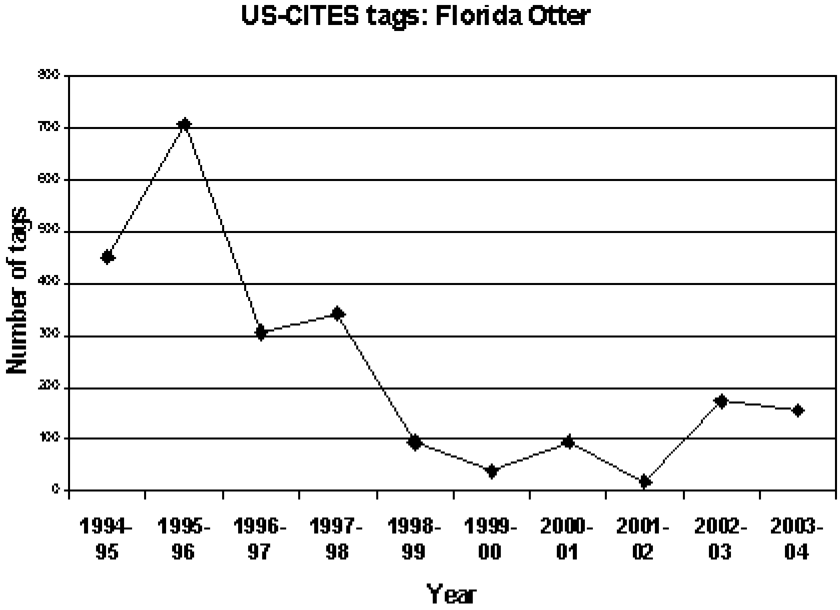

Figure 1. Yearly number of CITES tags issued for otters originating in Florida from 1994-2004.

The relative importance of road-kill compared to natural mortality factors of otter is not clear due to the obvious sampling bias involved, since road-killed carcasses are often available for examination but carcasses of animals that die in the wild are rarely discovered. In Europe, road mortality has been reported in a number of studies to be the predominant cause of non-natural mortality for the Eurasian otter *Lutra lutra* (see references in PHILCOX et al., 1999). Fifty-five out of a sample of 113 otters in Shetland, England, were killed on roads (KRUUK and CONROY 1991), with animals of all ages affected randomly. PHILCOX et al. (1999) reported a rapid increase in the number of otters killed on English roads since 1983, and that the busier "Trunk" or A roads (comparable to Interstate highways in the US) accounted for 57% of the incidents, but only comprised 13% of the road network. Likewise, MADSEN (1996) reviewed data from European otters killed by cars and concluded that the most dangerous kinds of roads for otters are highways or primary roads that are wider than 6 m with a relatively high traffic density and speed. KÖRBEL (1994) showed that regional roads with a higher volume of traffic made up only 9.5% of the road system in Germany but accounted for 60.7% of the otter roadkills. In the United States, the impact of roadkill on otters has only been reported as supplemental data. MELQUIST (1981) reported roadkill as the single most important mortality factor in his study, accounting for 3 out of 9 fatalities. LARIVIERE and WALTON (1998) asserted in their review that most *Lutra* mortality is human-related, listing roadkill along with trapping, illegal shooting, and captures in fishery nets.

In Florida, the evidence is clear that vehicle collisions have negatively impacted many species in a density independent fashion, including the highly endangered Florida panther (*Puma concolor coryi*), Florida key deer (*Odocoileus virginianus clavium*), and the American crocodile (*Crocodylus acutus*) (SMITH 2003). An important variable often cited in road-kill studies is traffic volume (CRISTOFFER 1991) and Florida has the 3rd highest traffic volume in the United States (FHWA 1996). In 2002, people traveled 787,832,000 km on public roads each day in the state (FDOT 2003). Vehicle kilometers driven on Florida state roads increased 90% between 1980 and 1997, from 194.8 million km to 372.1 million km (FDOT 1998). Roadkills of the Florida black bear (*Ursus americanus floridanus*) have grown over 45-fold, from 2-7 from 1976-79 to 105-133 during 2000-2004 (FLORIDA FISH AND WILDLIFE COMMISSION 2005). Roads criss-cross through most of the significant conservation areas in Florida. SMITH (2003) suggested that the state "looks like a jigsaw puzzle divided into various-sized pieces of land separated by an extensive road network, which jeopardizes the ability of wide-ranging wildlife, such as the Florida panther, Florida black bear, and river otter to successfully disperse and colonize adjacent habitat areas". This observational report documents a high number of otters killed during a short period of time by highway traffic on a short section of Interstate highway.

METHODS

Starting 28 December, l999, I recorded road-killed otter carcasses along a 16 km. section of Interstate 4, between Orlando and Tampa in Polk County, in central Florida. A round trip was made on each of 2 days per week. This section of Interstate extends from mile marker 53, beginning on I-4 about 2.4 km west of Florida state road 27 to mile marker 48, west of the intersection of state road 559 and I-4. Both sides of this section of I-4 are bordered by forested wetlands with occasional pasture and forested uplands. The forested wetlands include swamp forest, dominated by bay trees (*Persea palustris, Magnolia virginiana*) and sweetgum (*Liquidambar styraciflua)*; cypress forests (dominated by *Taxodium sp*.); and mesic/hydric pine forest (dominated by *Pinus elliotti*) (FLORIDA GAP ANALYSIS PROJECT 2001). I also include road killed otters I observed on other Florida highways during 2000. Yearly rainfall data for Polk County and average annual daily traffic (AADT) data for this section of Interstate were collected from the Southwest Florida Water Management District (SWFWMD) website and the Florida Department of Transportation (FDOT), respectively. I compared my data with unpublished data provided by M. MAIN, collected during a 2 year study of landscape influences on road-kill of wildlife in south Florida (MAIN and ALLEN 2002). Rainfall for Lee County, Fl, which encompasses much of the south Florida study, was obtained from the South Florida Water Management District (SFWMD).

RESULTS

I recorded 9 road-killed otters for the 37 day period between 18 December 1999 through 2 February 2000, and tallied a total of 15 otters along Interstate 4 for the 7 month period ending 15 July 2000 (Table 1). This compares with 22 otters collected over a 2 year period with normal precipitation in the south Florida study (Figure 2). The majority of the otters were killed between mile markers 53 and 43. Only 1 otter was found in the center strip between the lanes; 8 were found on the north side of the west bound lane, and 6 on the south side of the east bound lane. Four additional otters were found dead along other Florida roads during 2000 (Table 1). Photographs were taken at most sites and nine carcasses in good condition were collected, frozen, and sent to a taxidermist for preservation as voucher specimens.

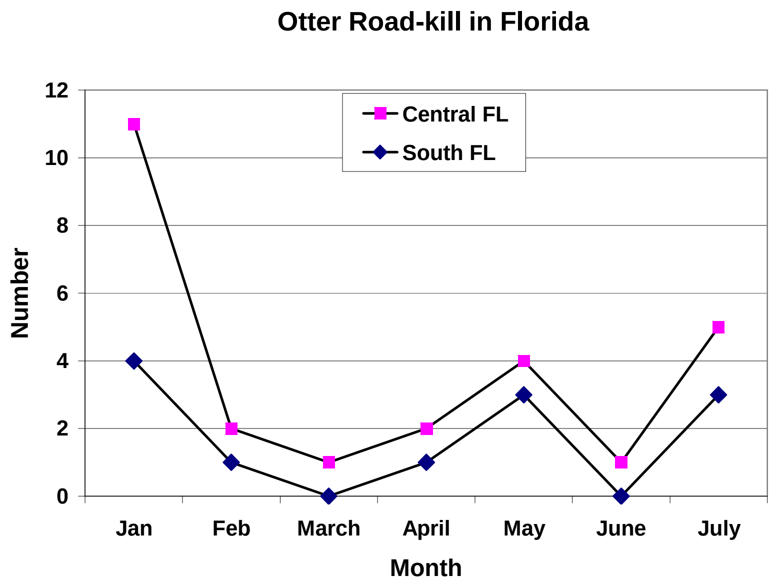

Figure 2. Road kill of Nearctic river otter in 2 studies in Florida, USA. Top stippled area represents data collected during Jan.-July during 7 months of one year (2000) in Central Florida, solid area at bottom summarizes data for 7 months of 2 years (1996-98) in south Florida.

Table 1. Dates and locations of road-killed river otters found along Interstate 4, Polk County, Florida, USA, December, 1999-July, 2000, and found dead on other Florida roads during 2000.

Otter No	Date	Location			Comment
		Nearest Mile Marker	Lane	Shoulder	
1	12/18/99	53	west-bound	middle	2.41 km W. Hwy 27; collected; killed within last 24 hours; collected
2	01/03/00	43	east-bound	south	67 m. W. MM43; S. of SR 559; photograph
3	01/03/00	48	east-bound	south	0.72 km E. SR 557;photograph;
4	01/11/00	48	east-bound	south	91 m E. SR 557
5	01/14/00	48	east-bound	south	found beside otter 3, 11 days later; photograph
6	01/26/00	53	west-bound	north	3 km. W. SR 27;photograph
7	01/28/00	52	west bound	north	1.1 km E. SR 557;largest otter; photograph
8	01/30/00	48	west-bound	north	0.4 km E SR557; photograph
9	02/02/00	52	west-bound	north	0.8 km E. MM 52; beside wetland pool; collected
10	03/26/00	48	east-bound	south	1.3 km W. MM48; found still alive, lived 2 days; collected; photograph
11	04/22/00	52	west-bound	north	9 m W. MM 52;killed within last 48 hrs; photograph; collected
12	05/29/00	53	west-bound	north	0.7 km W. MM 53; killed within previous 24 hrs
13	06/13/00	45	west-bound	north	
14	07/03/00	48	west-bound	north	0.8 km E. SR 557
15	07/15/00	44	east-bound	south	old exit 21 (now Exit 44), collected
16	05/29/00	Polk	SR 27		1.3 km S. 192 Intersection, center median;collected
17	10/02/00	Alachua	Interstate 75		0.8 km S. Micanopy Exit, west side
18	10/24/00	Alachua	Interstate 75		ca. 13 m SE of above location, east side of southbound lane
19	11/05/00	Brevard	SR 46		9 km W. of I-95 Intersection south shoulder; collected

The 12 month period from September 1999 to August 2000 was the driest period across the Southeastern United States since national records began in 1895 (NOAA NATIONAL CLIMATIC DATA CENTER, 2002). Polk County suffered the worse drought in 89 years, with the minimum annual rainfall (73.6 cm) for the 1915-2004 period occurring in 2000 (Southwest Florida Water Management District 2004; Fig. 2). Although the rainfall for Polk County during the wet (June-September) season of 1999 (before the otter data was collected) was normal (68 cm compared to the mean of 71.5), the rainfall during the dry (October-May, 1999-2000) season, when the otters started showing up on roads, was 38.2 cm. This represented the sharpest winter-to-winter drop (62.9 cm) during the 17 year period from 1987-2003. The number of otters/month was found at a rate of 3.5 times greater in central Florida during the drought than in south Florida with no drought (SFWMD 2005; Fig. 3).

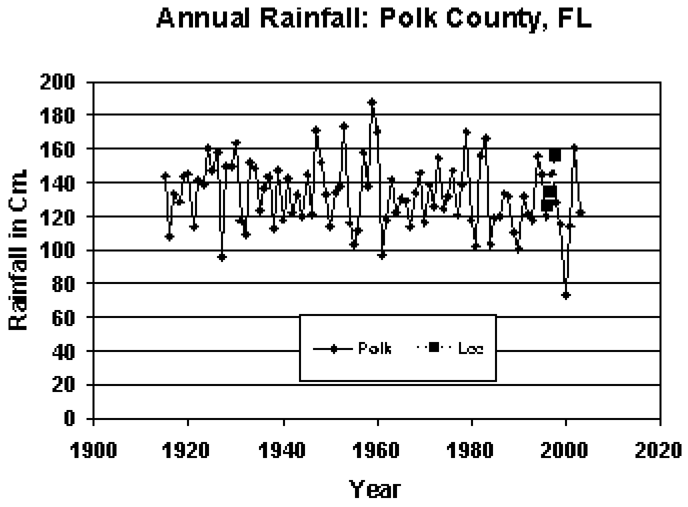

Figure 3. Total rainfall/year for Polk County, FL from 1915-2004; note the minimum in 2000 during drought. Three squares in 1996-98 represent average rainfall in Lee County, FL, main part of study area for the south Florida study cited in text, with average or above-average rainfall

AADT counts on Interstate 4 near where this data was collected were 56,500 and 61,500 in 1999 and 2000, respectively, for this 4 lane highway (Fig.4). This equates to a mean of 43 cars per minute (61,500 cars/day/24 hr/day/60 min/hr), or 0.71 cars/second, or equivalently, 1.41 seconds/car. Traffic volume varied greatly in the south Florida study, but averaged ca. 5800 cars per day (MAIN and ALLEN 2002).

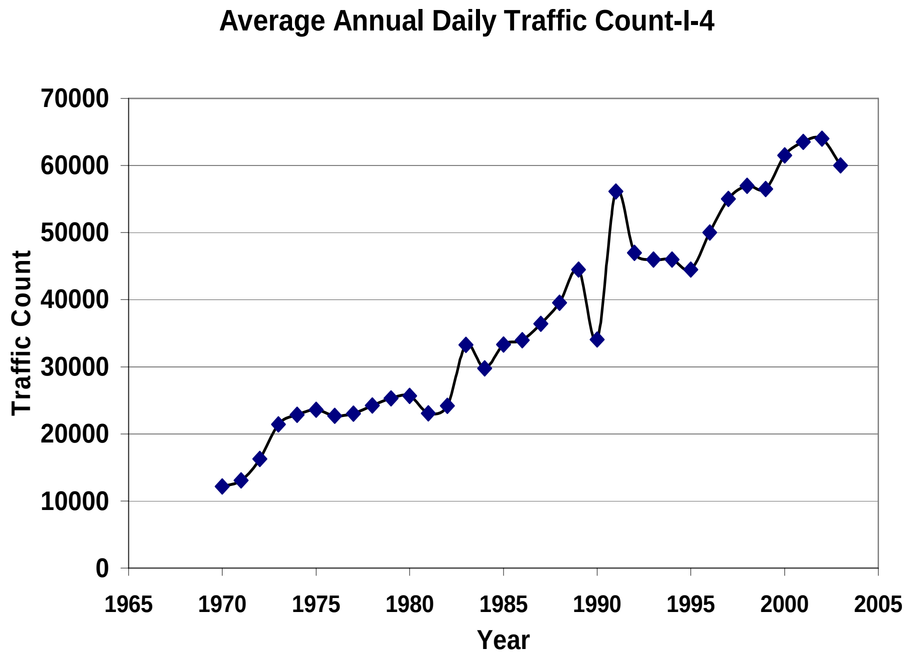

Figure 4. Average annual daily traffic density on Interstate highway 4, in northeastern Polk County, FL, at monitoring station 0108, located just west of the intersection of I-4 and State Road 27, from 1970-2003. Data from Florida Department of Transportation (2003).

DISCUSSION

Otters are vulnerable towards being killed by highway traffic due to reasons related to kinesthetics, ecology and vision; pollution and disease might be contributory factors. Because they are primarily aquatic animals, the normal gait on land is a “loping” movement, so they may not have the agility or speed of a feline or canine to quickly avoid a vehicle. They often move in family groups, increasing the probability that at least one in the group could be hit. They move along traditional routes, and these routes may cross roads. Otters will use whatever waterways are available, and deep roadside canals and ditches are prominent features of the Florida landscape, especially in south Florida. During dry periods, there is a high probability that otters will use these roadside waterways as travel routes, which brings them into direct contact with traffic should they attempt to cross the highway. Otters will move long distances over land and sometimes will forage on land (WHITAKER and HAMILTON 1998), two activities which increase the chances they will cross highways and be killed. Forty-seven per cent of the otter road kills in Germany from 1985-1993 occurred on roads crossing no water sources (KÖRBEL 1994). On land otters' vision is naturally impaired, since they are nearsighted (TOWEILL and TABOR 1982). Additionally, dieldrin accumulation has been shown to adversely affect vitamin A metabolism in European otters, which in turn causes permanent damage to otters' vision (WILLIAMS 2004). Obviously, any impaired vision could cause an otter to simply not notice a fast moving approaching vehicle. Like most mustelids, otters are susceptible to canine distemper. The later stages of this disease can cause permanent damage to vision and hearing, both of which would decrease an otter's ability to perceive oncoming traffic.

Florida has an annual cycle of wet (June-September) and dry (October-May) seasons. During the dry season in Florida, it is a normal yearly event for otters to retreat from marshland during the winter dry season and move to permanent ponds where water is available and food is more concentrated (HUMPHREY and ZINN 1982). During these movements, one would expect occasional road mortality from otters attempting to cross a busy highway. However, nine otters killed within a 37 day period seem excessive, and I could not find a road mortality rate this high reported in the literature for North American otters. Moreover, the data presented in Table 1 are absolutely minimum numbers for several reasons. Sampling was minimal: I only drove along the Interstate 4 of the 37 days, and there were gaps of 5 days between most trips. Secondly, detection visibility was problematic: some of the trips were early in the morning when either visibility was poor due to low light or fog, or I was unable to closely observe the roadside critically due to busy traffic conditions. Finally, there was one occasion when an otter carcass observed but not collected at a specific site on the morning trip was not there on the return trip the evening of the same day, perhaps having been dragged away by scavengers or taken by people.
The two major reported food items taken by otters in Florida are crayfish and fish (Cooley 1983). An Arkansas study (TUMLISON and KARNES 1987) involving fluctuating water levels in a mesic forest, found that when water levels receded, crayfish sought refuge in their burrows and were unavailable to otters. The otter responded by increasing the quantity of fish in their diet. In Florida, KUSHLAN (1976) found that fish move into deeper depressions with the drying up of adjacent swamps. These concentrated fish pools represent an easy source of prey for otters. KILHAM (1982) watched otters hunting such a pool during a 1981 drought in Highlands County, Florida. The meter-deep water hole was dug for cattle, and was all that remained of a body of water 2 ha in extent that covered a woodland swamp and adjacent marsh before the drought. He observed otters on 4 occasions catching a progressively decreasing number of catfish, and along with other predators, exhausting the source in about 18 days. My speculation is that the complete drying up of these pools combined with possible over-harvest by otters during this extreme drought probably depleted local food resources. Otters then began to move longer distances, by an order of magnitude, in search for extant wetlands with prey. These magnified movement distances resulted in more opportunities for collisions with vehicles on the busy I-4 interstate highway, which apparently intersected the path of some of the emigrating otters.

Otters 3 and 5 (table 1) were found at the same spot 11 days apart. MASON and MACDONALD (1986) speculated that Eurasian otters follow traditional routes in their movements, and discussed "black spots" on some English roads where otters are frequently killed at the same place, including one site in south-west England where 5 otters were killed at the same place within 6 years. North American river otters hunt and travel in groups (BECKEL 1990; REID et al. 1994). Six of the otters in this report were killed near mile marker 48, and 6 more were killed at the adjacent mile markers 52 and 53, so it appears that these otters were using movement corridors that intersected these mile markers. One interpretation of this data is that it simply reflects high mortality where traditional otter movement paths intersect a busy highway, e.g., they would have been killed regardless of the drought. However, I have driven the same route 2 days per week (occasionally more) for the last 4 years and not observed road-killed otters on this segment of highway. The data clearly show that most of the 15 otters (Table 1) were killed at only several locations, but I maintain that there was intensified ecological pressure to move along these paths due to the unavailability of aquatic prey, since many of the wetland pools had dried up due to the drought.

Two factors that affect road mortality of many vertebrates are traffic volume and speed (FORMAN and ALEXANDER 1998). Traffic volume is increasing linearly on Interstate 4 (Figure 4), and was approximately ten times that of the south Florida study. Average speed for the 16 km. segment of I-4 in Polk County was not available from FDOT, but the average speed for all Interstate highways in Florida in 2000 was 107 km/hr. This is probably representative of average speed on I-4, and is 1.3 times the average speed reported in the south Florida study. The fact that almost all the otters were found along each side of the road bordering the wetlands, rather than in between the lanes, indicates that they had little chance to safely cross the highway. The single otter found on the shoulder of the road between the lanes had apparently crossed from one side of the road through a culvert that then opened up in the median between the lanes, and was killed when it then attempted to cross the westbound lanes. I have observed during the evening hours that the density and speed of vehicles on the section of I-4 between Tampa and Orlando is so great as to resemble a “moving wall”, with minimal time gaps between vehicles in which an animal could safely cross the highway, and the FDOT data support my mental construct. Since the AADT data is a combined sum for traffic moving in both directions, this means a vehicle is moving either east or west on I-4 an average of every 1.41 seconds, clearly not a sufficient time interval for any quadruped vertebrate with a normal gait and speed to safely cross between cars. It is likely that a threshold level of traffic density has probably been reached, at least during certain times of the day, in which no quadruped vertebrate animal can successfully cross the highway.

Besides traffic volume, the type of wetland a Florida road intersects may be important. Otters are known to occupy a variety of wetlands. However, SMITH and DODD (2003) reported no otters among the immense road kill data set they collected along Payne’s Prairie, an “open” 56 kilometer^2 basin composed primarily of freshwater marsh, wet prairie, and open water in Alachua County (central Florida), with a tree canopy existing only in some upland areas. The majority of the observations in this paper come from roads adjacent to forested swamps, and thus could be interpreted as weak support for HUMPHREY and ZINN’s (1982) claim that higher densities of Florida otters occur in forested swamps. However, 3 of my observations were adjacent or not far from lakes, and one was near open marsh near the St Johns River.

Prompted by numerous road kills of black bear and panther, Florida transportation officials are now installing underpasses at many locations throughout the state. However, with Florida's flat topography, installing an underpass often means elevating a section of road, which adds great expense to road projects. Such wildlife crossings may work well at sites where roads intersect with linear streams, but it is not clear how beneficial they would be in preventing otter deaths in Florida where roads often traverse long distances through wetlands, with many places where otters could cross.

An individual otter’s ability to avoid oncoming traffic could be decreased due to lack of cognitive function, hearing, or sight, brought about by elevated environmental pollutants in their bodily tissues. It is not known if this issue played a role in these traffic accidents, but an emerging body of environmental toxicology studies worldwide have shown links between exposure to these compounds and behavioral deterioration. Studies have linked hearing loss in humans (RYLANDER and HAGMAR, 2000) and rats (GOLDEY, 1995) due to polychlorinated biphenyls (PCBs) accumulation. Auditory impairment has been shown in children through increased exposure to methylmercury from their fish-eating mothers (MURATA et al., 1999). North American river otters bio-accumulate PCB’s (WREN et al., 1986; WREN, 1991; GUTLEB, 2000) and mercury (WREN, 1986; YATES et al., 2004; FRANCES and BENNETT, 1994; GUTLEB, 2000). If we hypothesize that a similar auditory impairment occurs in *Lontra*, it could lessen an individual’s ability to hear a fast approaching oncoming vehicle with enough time to avoid it. A more definitive link between elevated pesticide levels and traffic accidents relates to the otters’ eyesight. WILLIAMS (2004) reported that of 88 otters killed on roads in England, the majority of otters had abnormalities of the retina similar to those that occur in animals that receive insufficient amounts of vitamin A during development. Dieldrin is known to affect vitamin A metabolism by blocking its transport around the body and increasing the rate at which it is excreted. Analyses of liver samples from these English otters showed that they had abnormally low levels of vitamin A and their dieldrin concentrations were more than three times higher than in healthy animals. In central Florida, organochlorine pesticides, including dieldrin, were widely used from the l940’s to 1980’s for crop pest control. Dieldrin is bioaccumulative and has been reported in waterbirds from Palm Beach County (RUMBOLD et al., 1996). Fish represent the most important food by volume of Florida river otters (COOLEY, 1983) and high levels of dieldrin were found both in fish and soils from a wetland restoration area in central Florida that was once used to grow vegetables (MARBURGER et al., 2002). In Georgia, dieldrin was found in 59% of river otters collected in 1979-

1981 and analyzed for pesticides (CLARK, 1981). It is likely that lower water levels from the drought would have concentrated any pesticide residues already occurring in the Polk County wetlands. The situation regarding elevated environmental pollutants in the tissues of otters and impacts on behavior is likely very complex, and the comments in this paragraph are speculative.

Prompted by numerous road kills of black bear and panther, Florida transportation officials are now installing underpasses at many locations throughout the state. However, with Florida's flat topography, installing an underpass often means elevating a section of road, which adds great expense to road projects. Such wildlife crossings may work well at sites where roads intersect with linear streams, but it is not clear how beneficial they would be in preventing otter deaths in Florida where roads often traverse long distances through wetlands, with many places where otters could cross. In view of Florida’s increasing network of highways which are intertwined with the state’s wetlands, road-kill of otter and other aquatic animals will likely increase. Future study of the use of the newly placed network of underpasses by this riparian species is recommended.

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RÉSUMÉ: Important taux de mortalité de la loutre du Canada (*Lontra canadensis lataxina*) sur une autoroute en Floride (USA), durant une très forte sécheresse
Du 28 décembre 1999 au 15 juillet 2000, j'ai relevé la présence de 15 cadavres de loutres sur une portion de 16 km de l'autoroute Interstate Highway du Conté de Polk en Floride, USA. 9 de ces cadavres ont été trouvés durant une période de 37 jours, ce qui représente le plus haut taux de mortalité routière connu pour les loutres d'Amérique du Nord. Ce chiffre se compare avec celui de 22 loutres tuées sur une route du sud de la Floride, sur une période de deux ans. Mon échantillon de 15 loutres tuées sur la I-4 est négativement biaisé par rapport au nombre réel de loutres tuées, en raison de la courte période d'échantillonnage et de la méthode employée. Des hypothèses, expliquant ce taux de mortalité si élevé durant une si courte période, sont discutées ici, incluant l'impact d'une sécheresse majeure, un trafic routier important et une possible bioaccumulation de dieldrine.

RESUMEN:
Desde el 28 de diciembre de 1999 hasta el 15 de Julio del 2000 se registraron 15 nutrias de río atropelladas en un segmento de 16 km de la autopista interestatal en el condado Polk, Florida, Estados Unidos. Nueve de estos registros fueron colectados en un período de 37 días, la tasa de mortalidad por atropellamiento en autopistas más alta reportada en Norte América. Estos registros se comparan con 22 nutrias atropelladas en caminos del sur de Florida en un período de 2 años. La muestra de 15 muertes en la autopista I-4 es una subestimación del verdadero número de nutrias atropelladas, consecuencia del corto período y de la metodología de muestreo. Razones posibles para la alta tasa de mortalidad incluyen el impacto de sequías, la alta densidad de tránsito y la posible bioacumulación de dieldrina.

R E P O R T

INTRASPECIFIC AGONISM BETWEEN GIANT OTTER GROUPS

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Abstract: In August 2002, we studied Giant Otters in the region of the Vermelho river, in the Brazilian Pantanal. During our research, we observed and filmed a particularly aggressive interaction between two groups of Giant Otters at the junctions of the rivers Vermelho and Miranda. This article reports the event and presents a sonogram of the very stereotypic vocalisations of the aggressor group.

INTRODUCTION

Intraspecific aggression is common in mammals (EBENSPERGER, 1998), especially in carnivores for which it has been widely documented (e.g. KRUUK, 1989, McLEOD, 1990; FRANK et al., 1995). However, reports of intraspecific aggression involving otters are so rare in the literature that SIMPSON (2000) believed himself to be the first author to provide information on it. In fact, we have found only three other records of intraspecific agonistic interactions in otters (ESTES, 1989, SCHWEIZER, 1992, ROSAS and MATTOS, 2003).

Giant Otters (*Pteronura brasiliensis*) are territorial social mammals. Groups mark their territory with the scent from their latrines and perianal glands, as well as through a variety of vocalizations. Apparently, they use these mechanisms to prevent agonistics encounters with neighboring groups (DUPLAIX, 1980; SCHWEIZER, 1992; CARTER and ROSAS, 1997). As far as we know, the occurrence of aggressive disputes between adults of different groups has been reported only once before (SCHWEIZER, 1992), and a case of infanticide has been recently published (MOURÃO and CARVALHO, 2001).

Since August 2002, we have been studying the ecology and natural history of giant otters occurring in the Vermelho River region (56^{o} 58'52" W, 19^{o} 36' 38" S), of the Brazilian Pantanal. On one occasion, we recorded by digital video an extremely aggressive interaction between two giant otter groups at the junction of the Vermelho and Miranda rivers. In this note, we report this event and present a sonogram of the highly stereotyped vocalization displayed by the aggressor group.

On the morning of 23 October 2003 at 10:15 AM, we heard a loud noise and movement of giant otters near the confluence of Vermelho and Miranda Rivers. A group of four giant otters were persecuting a single individual, which eventually escaped by leaving the Miranda river and going up the Vermelho River. The aggressor group had been studied previously, and its range comprised one stretch of about 12.1 km of the Miranda River, downstream of the mouth of the Vermelho River. At the beginning of the dispute, we observed two other individuals in peripheral positions in relation to the five active participants of the fight. We could not identify those otters or the persecuted individual based on their throat spots. However, the site of the dispute was the lower limit of the range of a group resident in the Vermelho River. That group was composed of three individuals, and it is probable that they were the animals involved in the dispute.

The aggressors moved extremely fast, presenting a behavior, which we never observed before in giant otters. Instead of alternating diving and emersion, as is characteristic in the species, they swam continuously on the surface (Figure 1). The animals appeared to be "surfing" on the surface of the water for periods of about 15 seconds at a time their head, neck and forearms were exposed. While surfing at the water surface in pursuit of the otter, the aggressors produced a loud roar in a chorus interspersed with acute whistles, which we had never heard before (Figure 2). After about 60 seconds of chasing, the group managed to surround the single otter. The group stopped and first one and then two other otters attacked the surrounded animal. The remaining individual of the aggressor group did not join the fight, but stayed close and vigilant. A few moments later, the persecuted individual escaped and swam up the Miranda river.

Figure 1. Four giant otters swimming continuously at the water surface while persecuting an individual of another group. Pantanal of Brazil, October, 2003.

The aggressors chased the fugitive for about 1 km. We followed the fugitive upstream for an additional stretch 1.4 km of the Miranda river. This individual had no apparent injuries.

Sociability is not characteristic of the Mustelidae (JOHNSON et al., 2000). Giant otter distinguish themselves among the Lutrinae by their large body size, as well as by the size and cohesion of their social groups. Perhaps it is not a coincidence that the two other otter species for which intraspecific aggression is known, the sea otter (*Enhydra lutris*) (ESTES, 1989) and Eurasian otter (*Lutra lutra*) (SIMPSON, 2000), also present some degree of sociability (JOHNSON et al., 2000). Therefore, it is possible that intraspecific aggressiveness and sociability are associated in the Lutrinae.

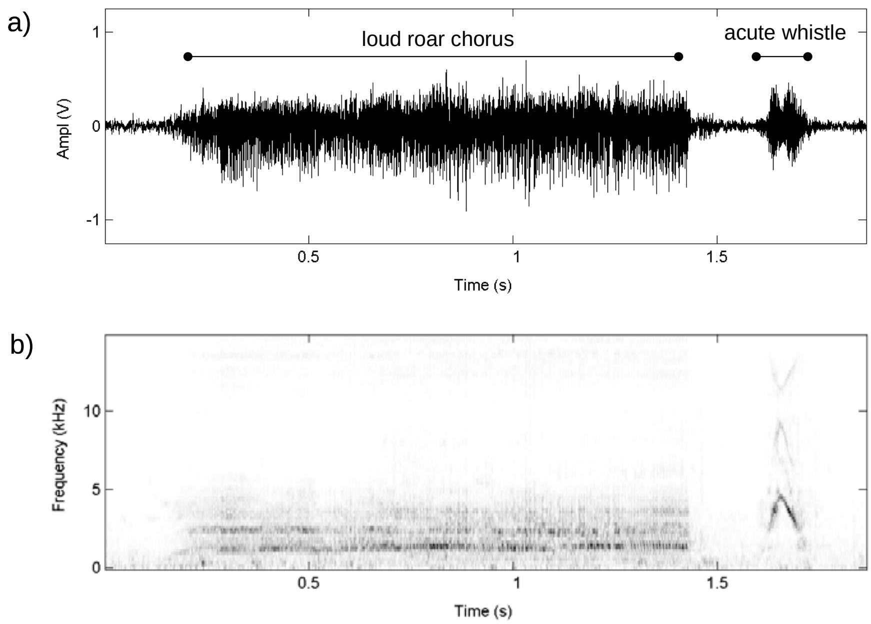

Figure 2. Oscillogram (a) and spectrogram (b) of the highly stereotyped vocalization displayed by the aggressor group while persecuting the otter. Note the loud roar in a continuous chorus interspersed with acute whistles.

Figure 3. Foto showing the moment of the persecuted giant otter was attacked by one individual of the other group. Pantanal of Brazil, October, 2003.

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RESUME:Agonisme intraspécifique entre des groupes de loutres géantes
Nous étudions les loutres géantes de la région de la rivière Vermelho, dans le Pantanal au Brésil, depuis août 2002. Au cours de nos recherches, nous avons observé et filmé une interaction particulièrement agressive entre deux groupes de loutres géantes à la jonction des rivières Vermelho et Miranda. Cet article reporte cet événement et présente un sonogramme des vocalisations très stéréotypées émises par le groupe agresseur.

RESUMEN: Aunque el comportamiento social no es característico de los mustélidos, la nutria gigante (*Pteronura brasiliensis*) es una especies social y territorial. En un estudio sobre la ecología e historia natural de la nutria gigante en la región del río Vérmelo en el Pantanal brasileño, se registraron eventos de comportamiento social y agresivo entre grupos. Considerando que otras dos especies de nutria también muestran estos comportamientos, la nutria marina (*Enhydra lutris*) y la nutria europea (*Lutra lutra*), estos eventos podrían sugerir que la agresividad intraespecífica y el comportamiento social están asociados en Lutrinae.

R E P O R T

PRELIMINARY STUDY OF THE TRACKS OF CAPTIVE OTTERS (*Lutra lutra*) AS A TOOL FOR FIELD RESEARCH

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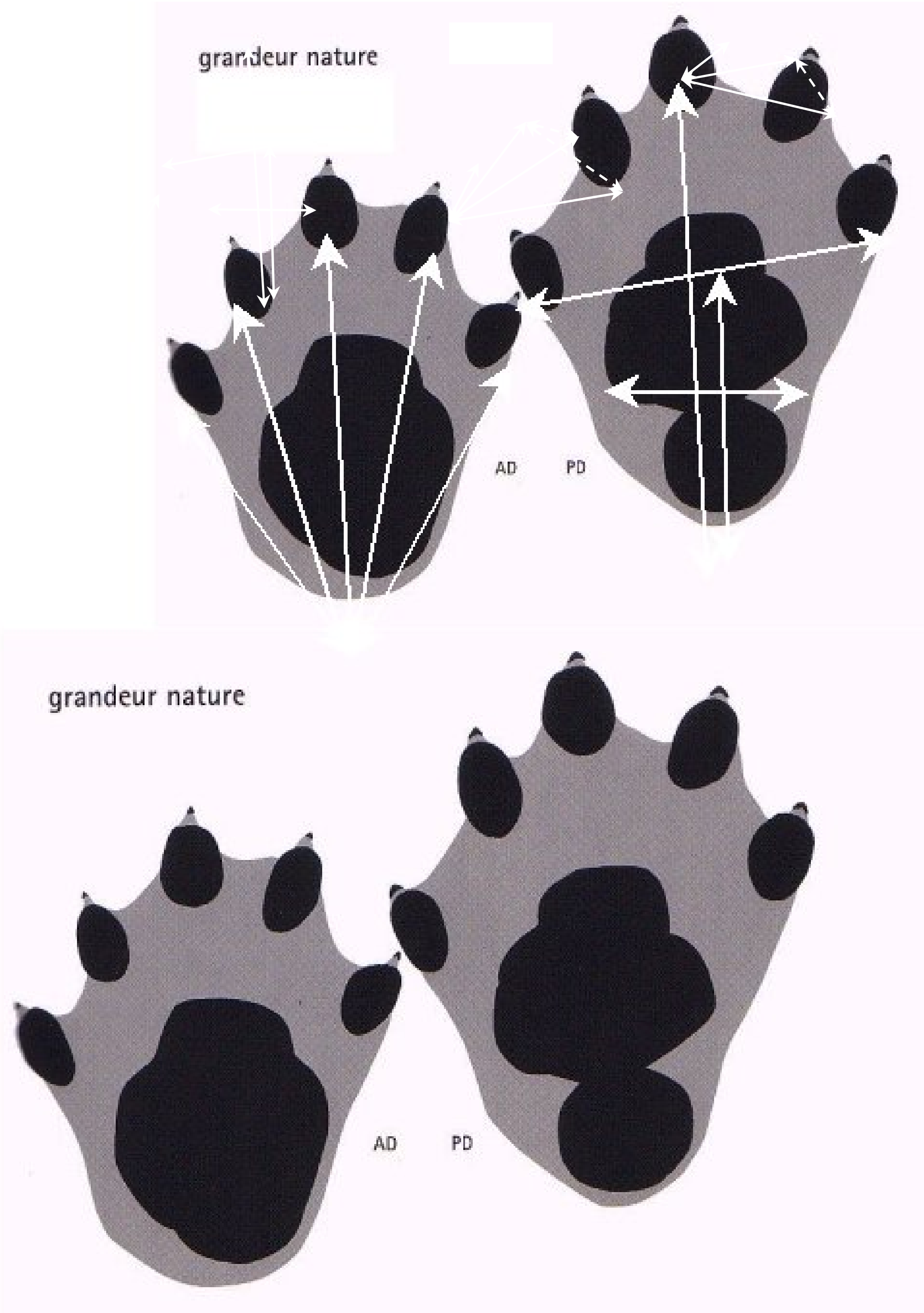
Abstract: For several years, spraints and prints have allowed the presence of Eurasian Otters, Lutra lutra, to be established in a non-invasive way. Prints are very variable, even from the same individual, depending on the substrate: snow, sand, silt etc. This preliminary study defines a statistical formula to allow estimation of whether a hind paw print on clay or mud belongs to a male or female, using seven biometric parameters. A database of measurements from animals in various zoos could be created, which could then be used in situ to allow the field researcher to know a little more on the otters creating the prints - sex, possible age and so on.

INTRODUCTION

Eurasian otter *Lutra lutra* tracks are relatively easy to identify for population surveys, but aspects of the tracks could also be used to identify characteristics of individual otters. Also, individual otter identity would help to determine population statistics such as numbers of individuals, sex, age ratios or size of territories. The major problem with tracking is the variation in print size depending on the degree of compression of the substratum, which is also function of the age and sex of otters. Moreover, weight of the otter, nature of the substratum, and moisture conditions affect the degree of compression whilst a young male may have similar sized tracks to an adult female. The objective of this preliminary study in captivity was to test the influence of three substratums on otter print size and try to develop a non-invasive field tracking technique to identify the sex, age and why not individual identity of otters.

MATERIALS AND METHOD

A study measuring 19 parameters of otter tracks on three substratums (snow, sand and limono-argileous mud) was conducted in summer 2003 at the Otter Reintroduction Centre, Hunawihr, France. The eight breeding enclosures at the centre allowed precise measurement of the tracks of nine individuals (five males and four females). Tubs containing the substratum material were dug into strategic sites used by the otters, such as along a fence or near a holt. The tubs were kept moist. One hundred and twenty-eight tracks were measured.



A **B** **C** **D**

Figure 1 : Diagrams A, B, C, D representing the 19 parameters measured.

- length of digits	diagram A
- total width and length	diagram B
- length and width of the plantar ball	diagram B
- interdigit distances	diagrams C and D

Due to the significant differences observed, therefore, only datas for back feet, measured on mud, were used in the present analysis as these data represented over half (69.2 %) of all back tracks monitored (Table 1).

To check for differences between sexes and individuals, we used a discriminant analysis as described by BACKHAUS et al. (1996) and using STATISTICA software. For each individual analysis we obtained a classification function based on the formula:

$$Y = bo + b1X1 + b2X2 + \ldots + biXi$$

where "X1, X2, …, Xi" correspond to measurements of the print in the field and "b1, b2, …, bi" are the discriminating coefficients. "b0" is a constant delivered by the software.

Table 1. Numbers of otter tracks (front and back) noted for each of nine otters in three different substratums

Age	Date of birth	Sex	Number of prints							
			snow		mud		sand		TOTAL	
Frontfeet (F) or Backfeet H)			*F*	*B*	*F*	*B*	*F*	*B*	***F***	***B***
11 years	01.06.92	M	0	0	0	4	0	0	**0**	**4**
10 years	10.14.92	F	0	0	3	14	0	0	**3**	**14**
8 years	10.23.95	F	0	1	0	12	0	0	**0**	**13**
3 years	08.22.99	F	0	3	6	15	0	8	**6**	**26**
5 years	09.07.97	M	0	6	13	16	0	2	**13**	**24**
4 years	12.16.98	M	0	0	2	6	0	0	**2**	**6**
4 years	12.16.98	F	0	5	0	4	0	0	**0**	**9**
14 years	09.10.88	M	0	7	0	0	0	0	**0**	**7**
1 year	04.14.02	M	0	0	0	1	0	0	**0**	**1**
TOTAL			**0**	**22**	**24**	**72**	**0**	**10**	**24**	**104**
Percent (front and back separated)			**0**	**21.2**	**100**	**69.2**	**0**	**9.6**		
Percent (front and back combined)			**17.2**		**75.0**		**7.8**			

RESULTS AND DISCUSSION

Influence of substratum on track dimensions

The discriminant analysis showed that dimensions were significantly different between substratums, particularly for 2 individuals (*3 years old female*: P=0,0012 < 0,05 et*5 years old male*: $P < 10^{-4} < 0,05$). Unfortunately, lack of time and resources meant that it was not possible to prolong the test to obtain higher numbers of tracks for each substratum. It is planned, however, to repeat the test over a longer period, with the collaboration of other parks, to obtain more conclusive results. Despite the short duration of this preliminary study, there are some suggestions that care should be taken to note the substratum type when tracks are evaluated.

Determination of sex from track dimensions

Otters like many mammals, exhibit sexual dimorphism so their tracks can be distinguished. The marked differences in body weights, when males are larger than females, have repercussions on the dimensions of tracks. The comparison of back tracks in mud of otters of known sex and ages, therefore, indicated that otters seem to exhibit sexual dimorphism and that the tracks of male and females could be distinguished with confidence ($P = 5.11^{E-19} < 0.05$). The discriminant analysis demonstrates and chooses seven of the 19 parameters, which are sufficient to distinguish males from females. The correct sex was tested through the discriminant analysis classification for 97,22% of prints. Thus, calculating and comparing the discriminant functions and coefficients for the tracks of back feet on a mud substratum distinguish males from females.

Table 2. The seven parameters conserved for the classification function.

Parameters used	Discriminating coefficients (b1,… bi)	
	male	**female**
Total length	-10,2915888	-7,94367027
Total width	1,78856003	1,49818182
Ball width	-1,5458498	-1,19685888
Thumb length	1,67097378	1,34144676
Forefinger length	-1,23272276	-1,00010705
Middle finger length	15,5776567	12,5073814
Little finger length	1,52623034	1,15367424
Constant (b0)	-317,205353	-227,013809

Discriminant analysis of the various track measurements was used to provide a series of coefficients to assess the difference between male and female tracks (Table 2). Sex was attributed using the formula Y (sex coefficient) = (*Ym* (presumed male coefficient) – *Yf* (presumed female coefficient)). Both the presumed male and female coefficients were calculated by multiplying each of seven track measurements by the appropriate male and female coefficients (see Table 2); and the sex coefficient by subtracting the final presumed female value from the male.

The print was attributed to a male when Y was positive and to a female when Y was negative, the higher the Y value is, the greater the confidence in the result. The following is given as an example of the comparison between two separate back tracks (where 'number*' = the compared measurement) :

Y (**Y_m – Y_f**) = **[(72.5*-10,2915888) + (55.83*1,78856003) + (32.17*-1,5458498) + (54.00*1,67097378) + (67.33*-1,23272276) + (72,67*15,5776567) + (56.00*1,52623034) - 317,205353]** – [(72.5*-7,94367027) + (55.83*1,49818182) + (32.17*-1,19685888) + (54.00*1,34144676) + (67.33*-1,00010705) + (72,67*12,5073814) + (56.00*1,15367424) - 227,013809] = **- 9,32724729**

In this particular case, the print is attributed to a female as the final result is negative.

Although the average lengths of male and female back feet were 89.4 mm and 73.3 mm, respectively, it must be remembered that the prints of young males and older females may be similar and it may be difficult to distinguish it through measurement. In this study, animals of suitable ages were not available in order to determine age limits for the successful application of this measurement technique. However, two young males of one year old, had tracks that were of approximately the same size as those of adult males (Total length = 82 mm) suggesting that the difference may be minimal.

Individualization of otters from tracks

HERTWECK et al. (1997) identified individual European otters from snow tracks using sophisticated equipment, such as a camera and expensive software. They demonstrated that fresh tracks in snow are the best samples to identify otters. The present study, using data from mud substratum only, showed that not all tracks could be used to identify individuals because only 91,67% of prints were correctly individualized. With the actual sample, Figure 2 shows the canonical distribution of each print on mud for the seven individuals. The diversity and the widespread of prints signify that it's not so easy to individualize tracks on mud; a margin of approximately 10% of error is possible.

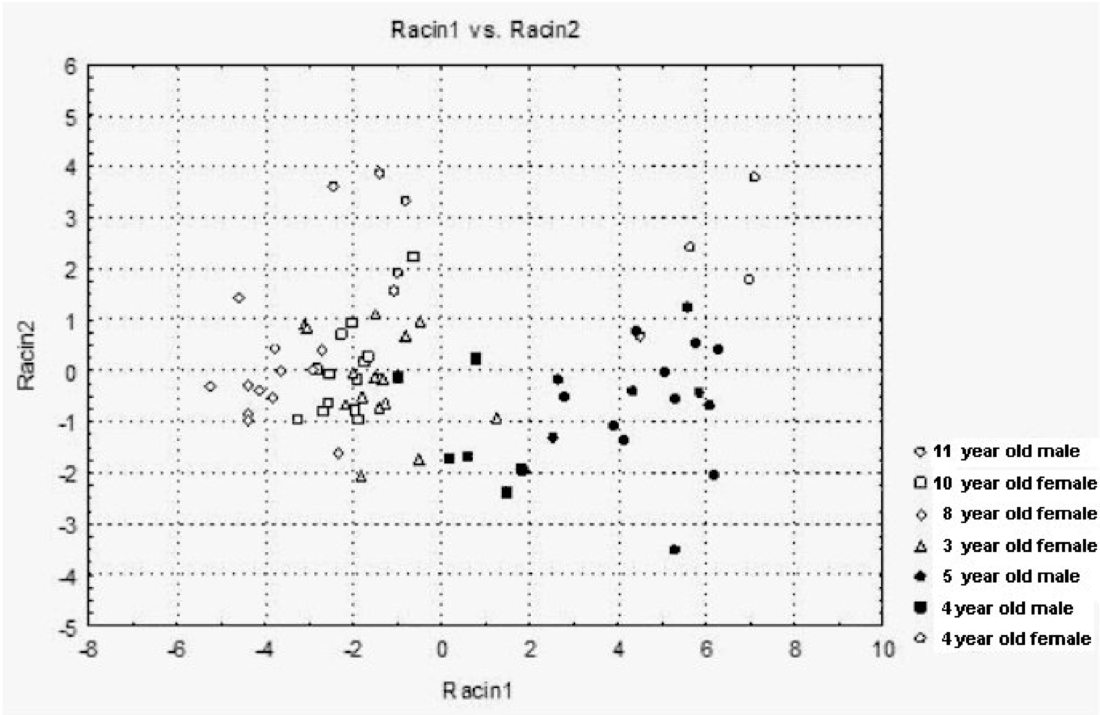


Figure 2: Canonical distribution of prints measured on mud from 7 individuals (from STATISTICA software).

CONCLUSION

The aim of this preliminary study was to find a useful and non-invasive method for field researchers to identify Eurasian otter tracks. On one hand, the statistical tool, STATISTICA software, indicated that 7 of the original 19 parameters measured were sufficient to confidently identify the sex of the otter studied. On the other hand, individualization of otters from tracks in mud was inaccurate for more than 8% of it. Sample size may have been a limiting factor and this technique warrants further investigations. It is also suggested to otter parks to contribute to this study taking the seven principals measurements of prints for a bigger and more significative database. The collaboration could further develop the method and could finally allow obtaining more information on the wild population dynamic.

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RÉSUMÉ: Etude préliminaire des empreintes de pas de la loutre d'Europe (*Lutra lutra*) en captivité, en vue d'une utilisation comme outil de recherche sur le terrain

La recherche des indices laissés par la loutre d'Europe *Lutra lutra* que sont les épreintes et les empreintes, permettent depuis plusieurs années d'apprécier de façon non invasive sa présence. Les empreintes sont généralement de forme imparfaite, mais surtout elles demeurent très variables en taille pour un même individu, notamment en fonction du substrat marqué: neige, sable, limon… Cette étude préliminaire définit une formule statistique, permettant d'estimer si une empreinte postérieure appartient à un mâle ou à une femelle sur sol argilo-limoneux, à partir de sept paramètres biométriques.

Une base de données, regroupant les mesures d'empreintes d'individus captifs, effectuées dans différents parcs zoologiques, pourrait être constituée. Les résultats obtenus sont directement adaptables *in situ*, dynamisant le naturaliste de terrain qui désire en connaître un peu plus sur les individus suivis: sexe des individus fréquentant la zone, âge suspecté…

RESUMEN:
El estudio de 19 medidas de las huellas de nutria de río en tres substratos (nieve, arena, y lodo) se realizó en el verano del año 2003, en el Centro de Reintroducción de Nutrias de Río, Hunawihr, Francia. El objetivo preliminar fue encontrar un método de campo simple y no invasivo para la identificación de huellas de nutria de río europea. Análisis de discriminante indicó que 7 medidas fueron suficientes para identificar el sexo de las nutrias de río estudiadas. Individualización de nutrias de río a partir de huellas en lodo fue inexacto en el 8% de los casos. Tamaño muestral puede haber sido un factor limitante; el uso de esta técnica requiere más evaluación.

L I T E R A T U R E

KANNAN, K., KAJIWARA, N., WATANABE, M., NAKATA, H., THOMAS, N.J., STEPHENSON, N., JESSUP, D.A. & TANABE, S. 2004. Profiles of polychlorinated biphenyl congeners, organochlorine pesticides, and butyltins in southern sea otters and their prey. *Environ Toxicol Chem*. **23**, 49-56

PROCEEDINGS VIIth OTTER COLLOQUIUM

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Sincerely yours,

Arno Gutleb - on behalf of the editors
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EUROPEAN OTTER WORKSHOP
National Park of Cilento and Vallo di Diano
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June 9-12, 2005

The **European Otter Workshop** will be held on June 9-12, 2005 in the National Park of Cilento and Vallo di Diano (Salerno province). More information will be provided as soon as possible.

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The website for the next IUGB was recenty launched:

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Dear Mammalogists,
It is a great pleasure to inform you that the Congress Committee for MAMMAL 2005 (the 9th International Mammalogical Congress; formerly the International Theriological Congress: ITC) has been launched. The Congress Committee will periodically inform you about the preparation of MAMMAL 2005 through e-mail and the web page (www.hokkaido-ies.go.jp/mammal2005/), which is now under construction. Though we are now managing e-mail addresses based on delegate lists of the 7th and 8th ITC, we would like to renew the list of addresses for MAMMAL 2005 with your permission. Are you interested in MAMMAL 2005? Please reply to us (MAMMAL2005@hokkaido-ies.go.jp) to get the periodical information about MAMMAL 2005.

Koichi Kaji and Takashi Saitoh (Secretary General)
Tomoko Takahashi (Secretary)