# SMALL CARNIVORE CONSERVATION

The Newsletter and Journal of the IUCN/SSC
Mustelid, Viverrid & Procyonid Specialist Group

IUCN
The World Conservation Union

Number 8 April 1993

SPECIES SURVIVAL COMMISSION

Spotted linsang *(Prionodon pardicolor)* from Vietnam - Photo by K. Baranauskas.

The production and distribution of this issue has been sponsored by
"Blijdorp Zoo", Rotterdam, Holland

# A summary of ongoing research into morphometric variation among mustelids

John M. LYNCH

An animal species may be defined as a collection of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups (Mayr, 1963). Phenotypic homogeneity among these groups over the entire distribution of the species is rarely observed due to heterogeneity and discontinuities in the environment or, simply, due to isolation by distance. Biological form and its diversity have been studied by evolutionary biologists for many years, using many different techniques. Furthermore, the study of both geographic and temporal variation in form has allowed the testing of hypotheses concerning many aspects of the Neo-Darwinian synthesis (for review, see Rohlf & Bookstein, 1990; Reyment, 1991).

Morphometrics has been defined as the 'formal treatment of our ideas about dissimilarity of geometrical form among biological objects' (Rohlf & Bookstein, 1990). Morphometrics based on the multivariate (i.e. considering many variables simultaneously) treatment of linear measurements has been traditionally called 'multivariate morphometrics'. Such methodology has been used in the examination of many aspects of mammalian evolution. For example, the effects of domestication, sexual dimorphism (Wiig, 1986), hybridisation between taxa (Kitchener *et al.*, 1992), the systematic status of taxa (Wilson *et al.*, 1991), archeological problems and geographic variation in relation to environmental and genetic factors (Reyment, 1991).

There is great morphological, ecological, and behavioural variation within the Mustelidae. For example, body weight varies from 30 g in the Least weasel *(Mustela nivalis)* to over 45 kg in the Sea otter *(Enhydra lutris)*. Members of the family occupy nearly every habitat, including fresh and salt water, and have diversified into a number of dietic specialists feeding mainly on smaller food. In general, piscivorous mustelids are heavier than carnivorous or omnivorous species, perhaps due to their aquatic lifestyle (Gittleman, 1985).

With the exception of the Eurasian badger *(Meles meles)*, mustelids lead an almost solitary existence outside the breeding season, yet have evolved extremely diversified life-history tactics (Gittleman, 1986). It is through this considerable ecological, morphological, and behavioural diversity that such closely related species can coexist in the same region. Given this high degree of variation within the family, it is somewhat surprising that there has been little systematic examination of morphologic variation within and between mustelid populations.

In early 1990 a study was begun by the Mammal Research Group (UCD) which attempts to collect basic data on cranial variation within selected mustelid species. Herein, I would briefly like to outline some of this ongoing research, and in particular, illustrate the use of cranial morphometry in the examination of (i) the recent history of Irish mustelids, and (ii) sexual dimorphism in the otter.

There exists some confusion as to the means by which mammals recolonized Ireland after the last glacial period. Multivariate techniques have been used to examine cranial variation between Irish, English, and Scottish mustelid populations (Lynch & Hayden, 1993). A hypothesis was formulated that proposed relic status for Stoat *(Mustela erminea)* populations, and immigrant status for badger populations. Little evidence was found for colonization via a landbridge between North Eastern Ireland and Scotland (the previously held method of colonization), and it was thus held that badgers may have been introduced to Ireland by man some time during the past 10,000 years. Some colloborative evidence for this hypothesis is given in Griffiths (1992). Preliminary data suggest a genetic basis to the variation between badger samples (Lynch *et al.*, 1992).

To date, there has been no examination of either morphometric or genetic variation between Irish and the other European otter *(Lutra lutra)* populations. Ongoing multivariate analyses of sexual dimorphism in six European otter populations indicate that dimorphism is greatest in Irish otters (Lynch *et al.*, unpubl.). In this regard, sexual dimorphism in Irish otters is of particular interest and an analysis specific to Irish otters has been carried out (Lynch & O'Sullivan, in press).

Dimorphism was separated into (i) differences due to size (i. e. including shape variation due to size changes -allometry), and (ii) non-allometric shape differences. While size clearly separated the sexes, shape differences accounted for nearly 87% of the variation between the sexes (Lynch & O'Sullivan, in press). Thus the larger male cranium is not simply a 'scaled-up' version of that of the female, but has size-independent shape differences, which primarily relate to the breath of the area between the orbits. We suggest that these differences may allow resource partitioning between the sexes, and that the degree of dimorphism may be influenced by historic as well as current environmental factors.

The studies outlined above form part of a larger quantification of variation within the Mustelidae. Data are continued to be collected, and I would be very grateful if any reader can provide information on any substantial collections of European mustelids. In particular, data on the otter, badger, polecat, ferret, stoat, and American mink would be very gratefully received.

**Acknowledgements**

Aspects of this work were undertaken while in receipt of funding from EOLAS (The Irish Science and Technology Board) and The Mammal Society of Britain and Ireland. Thanks are also due to all the people (too numerous to mention here) who gave me access to material and data in their care. I am particularly grateful to Tom Hayden, Andrew Kitchener, Huw Griffiths, and Liam O'Sullivan for various forms of assistance.

**References**

Gittleman, J. L. 1985. Carnivore body size: ecological and taxonomic correlates. *Oecologica* 67:540-554.

Gittleman, J. L. 1986. Carnivore life history patterns: allometric, phylogenetic, and ecological associations. *Amer. Nat.* 127:744-771.

Griffiths, H. I. 1992. Pre- and early historic records of the Eurasian badger, *Meles meles* (L., 1758)(Carnivora, Mustelidae), in Britain. *Studies in Speleology* 9 (In press)

Kitchener, A. C., Lynch, J. M. & McOrist, S. 1992. Morphologic

*silvestris*, in Great Britain. Pp 68-70 *in The biology and conservation of the Wildcat* (Felis silvestris). Council of Europe, Strasbourg (Doc. No. T-PVS 92/69).

Lynch, J. M. & Hayden, T. J. In press. Multivariate morphometrics and the biogeography of Irish mustelids *in* M. J. Costello, ed. *Irish Biogeography: Past, present, and future*. Irish Biogeographical Society, Dublin.

Lynch, J. M. & O'Sullivan, W. M. In press. Cranial form and sexual dimorphism in the Irish otter *(Lutra lutra*, L.). *Biology & Environment* 1.

Lynch, J. M., O'Corry-Crowe, G., Harris, S., Cheeseman, C. L., Duke, E. J. & Hayden, T. J. 1992. Morphometric and genetic variation among badger populations in T. J. Hayden, ed. *The badger*. Royal Irish Academy, Dublin.

Mayr, E. 1963. *Animal species and evolution*. Harvard University Press, Cambridge, MA.

Rohlf, F. J. & Bookstein, F. L. 1990. *Proceedings of the Michigan Morphometrics Workshop*. University of Michigan, Museum of zoology, Ann Arbor.

Reyment, R. A. 1991. *Multidimensional paleobiology*. Pergammon Press, Oxford.

Wiig, Ø. 1986. Sexual shape dimorphism in the skull of the Hooded seal *Crystophora cristata. Zool. J. Linn. Soc.*, 88:339-347.

Wilson, D. E., Bogan, M. A., Brownell, R. L., Burdin, A. M. & Maminov, M. K. 1991. Geographic variation in Sea otters, *Enhydra lutris. J. Mamm.*, 72:22-36.

**University College Dublin**
**Department of Zoology, University College**
**Belfield, Dublin 4, Ireland**

## New zoo and civet project planned in India

Plans are under way for a new zoo in Coimbatore, a large south Indian industrial city. The new zoo was conceived by a group of Coimbatore industrialists who have formed a Registered Society, the Coimbatore Zoological Park Society. They are the same group, by and large, who have been helping Zoo Outreach Organization for the last eight years. Being situated on degraded land in the biosphere area adjacent to natural forest, and central to many protected areas, the possibilities for using this facility to strengthen *in situ* conservation efforts are myriad. In design the zoo will incorporate the innovative style developed in India by the Indian Forest Service. In activity, the zoo will be a holistic conservation centre, starting with flora and fauna which require immediate conservation, developing research projects around special species and habitats and allowing the zoo to evolve around them. One of the projects we intend to carry out is "Exhibiting and breeding civets".

The Malabar civet, *Viverra civettina*, suspected to be extinct until 1987, even now has not been sighted. Researchers have found fresh skins which indicate that the animal still survives. Very little systematic work has been done with any species of Asian civet, so if a Recovery Programme for the Malabar civet should become possible, we would not know to manage the rescued animals in captivity! Even the captive husbandry of the Small Indian civet, *Viverricula indica*, is not known as it has not been kept systematically in any zoo.

The Zoo Outreach Organization and the Society for Conservation of Species and Populations are sponsoring a field research project on the small Indian civet, not in the wild, but how it is being kept (illegally) by individuals in villages for benign collection of 'civet'. Our researcher has collected nearly 200 interviews with persons who are keeping (and occasionally breeding) the small Indian civet. Our report will evaluate this activity and recommend appropriately to the wildlife authorities. It is possible that this could be an opportunity for sustainable use that is not being properly focused. Being associated with the embryonic Coimbatore Zoological Park, we will combine this research with their zoo in the following way:

A policy decision to focus on civet species of the area has which will provide area both for exhibiting and breeding civet species. A research programme will be undertaken to systematically breed the small Indian civet, which is not particularly endangered, so that the basics of civet husbandry and management can be established.

To develop this programme, the literature from other countries' facilities which have kept civet species will be studied along with information from our Research Project on the practical experience of individuals who have been keeping the small Indian civet for 'civet' collection. In developing breeding technology for this species, we hope to improve the husbandry so that even local people who keep the animal for 'civet' collection can have self-sustaining collections instead of the present practice of collecting and keeping the animals without propagating them in captivity.

In the exhibit itself, there is a problem in that civets are nocturnal animals and do not move about much in the light. To combat this exhibition problem and to enhance the educational potential of the exhibit, we propose to have two viewing enclosures. One will exhibit the animal as it lives in the wild in a semi-natural setting and another will show the animal in a typical Kerala village house, kept in a small cage in the compound. Educational graphics will explain the problems and potential of this practice. In this way, visitors who miss the animal in the natural enclosure can have a look at it in the Kerala village. The animals will be interchanged so that no individuals have to spend a long time in a cage. Off-exhibit facilities in the same complex can hold other individuals which may or may not have a turn in the viewing area.

Ultimately we hope to promote systematic breeding and exhibition of civets in other zoos and even find means to manage the genetic material of the zoo captive population interactively with the population kept by the musk collectors. In this way we will gain expertise in the husbandry and management of the more common civets which will enable us better to meet the challenge of a recovery programme for the Malabar civet if and when required.

**Sally Walker, Zoo Outreach Organization**
**Convenor, C.B.S.G., India**