

Conservation of the world's amphibians and reptiles

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Abstract

The Third World Congress of Herpetology was held at Prague, Czech Republic, from 2 to 10 August 1997. Two DoC staff attended: Don Newman and Mandy Tocher. Congress organisers invited papers on all aspects of herpetology (that is the study of amphibians and reptiles), and no criteria (topics) were pre-set. The final scientific programme therefore reflected current interests amongst herpetologists, and the foremost amongst these was conservation. In previous World Congresses, the then new genetic and molecular taxonomic techniques had attracted greatest interest. Overall, 735 participants from 58 countries presented 772 scientific papers.

This report lists New Zealand contributions to the Congress, outlines the full Congress scientific programme, and provides summaries of sessions I was able to attend: Herpetofauna and Environmental Contaminants, Declining Amphibian Populations: Geography and Possible Causes, Impact of Human Activities on Amphibian Populations, Declining Reptilian Populations and Strategies for Conservation, Strategies for Conservation of Amphibia and Reptilia, Conservation Biology of Reptiles, and Population Biology of Reptilia. Important findings and observations are highlighted.

1. Introduction

World Congresses of Herpetology are held at roughly four-year intervals; the third such congress was held at Prague, Czech Republic, 2-10 August 1997. It was attended by two Department of Conservation staff members, Don Newman and Mandy Tocher.

Prague was selected as the Congress venue because it offered high standard convention facilities for relatively low (by European standards) cost. Further, the two lands of the Czech Republic, Bohemia and Moravia, have yielded numerous fossil finds, especially of amphibians, and Congress organisers sought to bring together neo- and palaeoherpetologists.

Congress organisers invited papers on all aspects of herpetology, and no criteria (topics) were pre-set. Consequently, the final scientific programme reflected current interests among herpetologists and foremost amongst these was conservation. This contrasted with previous World Congresses where the then new genetic and molecular taxonomic techniques attracted greatest interest.

Overall, 735 scientific participants from 58 countries presented 772 scientific papers. Twelve New Zealanders attended and collectively presented 13 papers. I co-chaired a session on Strategies for Conservation of Amphibia and Reptilia, and presented an invited paper on reptile conservation in New Zealand. Mandy Tocher reported on some of her findings from her PhD research on the effects of forest fragmentation on litter frogs in Brazil's Amazon Basin.

In this report some important findings and observations are first highlighted, then New Zealand contributions and the full Congress scientific programme are listed. This is followed by summaries of sessions I was able to attend (generally six concurrent sessions were held at any one time).

2. Some important findings

- It is vitally important to link natural sciences and social sciences in conservation concepts. Conservation commitment and concern expressed by the general public is likely to be of more value than harnessing the public's observational skill.
- Some habitats and species are more easily "sold" as conservation-worthy than others - focusing on a single area or single species/species group can be costly for others no less important in maintaining diversity.
- New Zealand (DoC) is highly regarded internationally for work on island restoration. Considerable interest is being shown in how DoC sets priorities for species management.
- World-wide, amphibian populations are declining, but there is considerable variation among different places in terms of severity. No single cause can be identified, rather multiple, interacting causes are involved: disease, non-native predators, pesticides and herbicides, acid rain, loss of habitat. Increased UVB radiation is unlikely to have played a major role.
- Some declines in frog populations have been extremely rapid; in eastern Australia and Central America populations have crashed over periods as short as 2-3 months.
- Monitoring for asymmetry of selected morphological traits (in frogs at least) may give early warning of population collapse (fluctuating asymmetry).
- Environmental contaminants can cause population declines of herpetofauna due to (1) lethal and reproductive effects on embryos, juveniles or adults; (2) developmental abnormalities of embryos; and (3) abnormalities of the endocrine system. Endocrine disruptors are capable of stimulating sex reversal. Contaminants include PCBs, DDT, polychlorinated dioxins, furans and biphenyls.
- The Australian Government has banned 84 herbicides from use near water because of their impact on frogs and reptiles.
- In the USA, sea turtle population models are being reviewed to help managers set fair by-catch limits for various fisheries.

- Buffer zones must have both a distance and a directional component to be effective at conserving breeding sites.
- Temporary disruption of social relationships (temporary removal of dominant males) may represent a valuable management tool for small or otherwise genetically compromised populations by allowing a greater proportion of males to contribute to the gene pool.
- Pitfall traps do not provide an unbiased estimate of absolute lizard density. Distance sampling is less reliable than capture-recapture techniques for providing estimates of population densities.
- The National Museum of the Czech Republic (at Prague) holds 80 preserved tuatara specimens, which is more than exist in any other world collection, including those in New Zealand.

3. New Zealand contributions

GENERAL

- Reptile conservation in New Zealand: production and implementation of species recovery plans.
Don Newman
Science, Technology & Information Services, DoC, Wellington.
- Is the vulnerability of reptiles to habitat fragmentation predictable?
Stephen Sarre
School of Biological Sciences, University of Auckland.
(Current address: Department of Ecology, Massey University, Palmerston North).
Co-authors: J. Meyers & C. Margules
- Edge effects on Amazonian litter frogs.
Mandy Tocher
Science, Technology & Information Services, DoC, Dunedin.
- Kinship, sexual selection, and female choice in toads.
Bruce Waldman
Department of Zoology, University of Canterbury, Christchurch.
- The effect of estrogen treatment on uterine development in an ovariectomised gecko, *Hemidactylus turcicus*.
Jane Girling
Department of Zoology, University of Otago, Dunedin.
Co-authors: L. J. Guillette Jr. & A. Cree

NATIVE FROGS

- Demographic profiles of terrestrial *Leiopelma* (Anura: Leiopelmatidae) in New Zealand.
Ben Bell
School of Biological Sciences, Victoria University of Wellington.
- Predation, body-size and survival of New Zealand endemic frogs (Anura: Leiopelmatidae).
Ben Bell
School of Biological Sciences, Victoria University of Wellington.
- Is habitat selection related to morphology in ancient New Zealand frogs?
Karen Eggers
Department of Ecology, Massey University, Palmerston North.
Co-authors: I.A.N. Stringer & R.A. Fordham

TUATARA

- Does an omega-3 fatty acid supplement have beneficial effects for captive juvenile tuatara (*Sphenodon punctatus*)?
Tracy Blair
Department of Zoology, University of Otago, Dunedin.
Co-authors: A. Cree, N.M. Grimmond & C.M. Skeaff
- Conservation education and tuatara (*Sphenodon*): from research to textbook to classroom.
Christa Krey
School of Biological Sciences, Victoria University of Wellington.
Co-authors: J. Jones & C.H. Daugherty

NATIVE LIZARDS

- Biennial reproduction and associated aspects of life history in the gecko *Hoplodactylus maculatus* from southern New Zealand.
Alison Cree
Department of Zoology, University of Otago, Dunedin.
Co-authors: J.E. Girling & J. Rock
- Thermal biology and female reproduction in a viviparous gecko, *Hoplodactylus maculatus*.
Jennifer Rock
Department of Zoology, University of Otago, Dunedin.
Co-authors: R.M. Andrews & A. Cree

MARINE REPTILES

- Seasonality in records of marine reptiles in New Zealand, 1880-1996.
Brian Gill
Auckland Institute and Museum, Auckland.

4. Full scientific programme

The full programme was divided into the following sessions - those I was able to attend in all or part (generally six concurrent sessions were held at any one time) are marked with an asterisk.

- * Herpetofauna and Environmental Contaminants
History of Herpetology: Herpetological Expeditions and Voyages
Calling Behaviour in Amphibia
Zoogeography of Amphibia and Reptilia
Paleozoic Amphibians
Early Reptiles
Evolution and Systematics of Reptilia
- * Declining Amphibian Populations: Geography and Possible Causes
Physiology of Amphibia and Reptilia
Behaviour of Reptiles
Mesozoic Amphibians and Reptiles
Morphology of Amphibia
Amphibian and Reptilian Venoms
- * Impact of Human Activities on Amphibian Populations
- * Climatic Variation and its Impact on Herpetofauna
Temperature and Sex Determination in Reptilia
Chromosomal Studies in Amphibia and Reptilia
Evolution of Caudata
Plasticity in Amphibian Reproduction, Development, and Evolution
- * Declining Reptilian Populations and Strategies for Conservation
Reproduction in Amphibia
Biodiversity and Biology of the African Herpetofauna
Morphology of Reptilia
Evolution and Systematics of Anura
Ecology of Reptilia
- * Strategies for Conservation of Amphibia and Reptilia
Reproduction in Reptilia
Ecology of Amphibia
Phylogeny and Systematics of the Viperidae
Development in Amphibia
Growth and Development in Reptilia
Population Ecology of Amphibia
- * Conservation Biology of Reptiles
Behaviour of Amphibia
Evolution and Systematics of Snakes
Neonatology of Reptiles

5. Herpetofauna and environmental contaminants

Examples from USA, Canada, Africa and Australia were used to show that environmental contaminants can cause population declines due to (1) lethal and reproductive effects on embryos, juveniles or adults; (2) developmental abnormalities of embryos; and (3) abnormalities of the endocrine system. Endocrine-disrupting environmental contaminants are capable of stimulating sex reversal: male to female in Florida alligators, and in snapping turtles from the Great Lakes-St Lawrence River basin. Skewed sex ratios of turtles at the latter site (Canada) were recorded where organochlorine contamination was high. Embryonic development was most sensitive to polychlorinated dioxins, furans and biphenyls.

Many environmental contaminants can act as endocrine disrupters (EDCs). EDCs can cause abnormal development and reproduction, and several interfere with estrogen function. Tyrone Hayes and Nigel Noriega, University of California, Berkeley, have developed a comparative multi-test system for examining the effects of EDCs. Multiple tests are necessary because of the wide variation in estrogenic effects between species. Also one steroid can do many things, even in the same species (depending upon the life history stage). EDC loads are being measured in free-ranging frogs in California and Kenya. Preliminary results suggest that Californian frogs have higher contaminant loads than frogs from Kenya.

Several compounds such as PCBs and members of the DDT complex (once in organisms, DDT is metabolised to the more dangerous DDE) interfere with thyroid hormone and corticoid function, both important in larval amphibian development. Compounds such as DDT have been found in the eggs of adult females, implying that the contaminant is transferred from the female to offspring - and may be passed to subsequent generations! DDT residues have been implicated in the finding of large numbers of abnormal frogs at certain sites in Minnesota. In Zimbabwe, a lizard population declined in response to annual DDT ground-spraying against tsetse flies - increase in the whole body levels of residues in lizards with time implied accumulation. When DDT is applied (the timing of the dose) may be more important than the magnitude of the dose itself (some life cycle stages may be more sensitive).

The Australian Government has banned 84 herbicides from use near water because of their impact on frogs and tadpoles.

DDT is no longer used in USA because it is considered too dangerous, but it is still manufactured and exported to countries such as Mexico, where food is

produced and exported back to USA. Over recent years, levels of contamination seem to have decreased in USA, but the reporting of frog abnormalities is increasing. Unfortunately, data on frog deformities are not as good as they could be because, in USA, the biodiversity indexing of wetlands is based on vegetation, invertebrates and fish, but only rarely amphibians.

6. Declining amphibian populations

Since 1989, when the phenomenon of declining amphibian populations (DAPS) was first recognised, much research has been directed towards documenting them and towards identifying their causes. It is now clear that the DAP phenomenon is a worldwide one, although there is considerable variation among different parts of the world in terms of their severity. It is also clear that, on a global scale, DAPS cannot be attributed to a single cause. Indeed, in a number of instances it appears that multiple, interacting causes are involved.

Currently there appears to be a "wave of mortality" moving southwards along the mountains of Central America. Frog populations of Costa Rica have been decimated and those of Panama are just starting to be affected. Such a wave is not consistent with mortality due to introduced predators, El Nino Southern Oscillation (ENSO) events, or habitat destruction, but a pattern typical of a disease epidemic. A protozoan causing skin infections (thickening of the skin) has been isolated from some affected frogs, but cannot, as yet, be identified as the principle agent of the epidemic.

Frog populations in non-desert areas of California have declined significantly, and factors thought to be involved are non-native trout, which feed on eggs, larvae and adult frogs, and a variety of pesticides and herbicides.

Acid rain in North America and the United Kingdom has had a documented negative effect on frog populations, while in Canada, chemicals used to protect sports fisheries are known to be extremely toxic to amphibians, e.g. the lampricide 3-trifluoromethyl 4-nitrophenol, and toxaphene, formalin and rotenone, which are used to remove unwanted fish from sports fishing areas.

In Europe, amphibian decline is widespread, but the general cause has been identified as loss of habitat (in particular aquatic breeding sites) in response to agricultural reform.

Increased UVB radiation is unlikely to have played a major role in amphibian decline. Investigations are under way into the sublethal effects of UVB on immune functions and vulnerability to disease.

Some declines in frog populations have been extremely rapid; in eastern Australia and Central America, populations have crashed over periods as short as 2-3 months. Monitoring the symmetry, or asymmetry, of selected morphologi-

cal traits may give early warning of population collapse. Within about a year of collapse, levels of asymmetry often fluctuate markedly (so-called fluctuating asymmetry).

Priorities for future work on DAPS include:

- gaining better geographical knowledge - for instance very little information is available from Africa and large parts of Asia;
- carrying out more research into the causes of decline, e.g. chronic effects (pollution, endocrine disrupters); but frogs are also declining in apparently pristine areas so there is a need to look at several factors which could act synergistically - immunosuppressants, environmental factors, disease;
- raising public awareness of the issue; the public, in turn, can then put pressure on politicians, bureaucrats and companies.

In Australia, 120 conservation and wildlife organisations co-operated to distribute 350,000 questionnaires on frog decline to the general public. A further 250,000 were distributed by a popular magazine. By this means, concern was transmitted and focus directed to changes to the environment. Mike Tyler, University of Adelaide and newly elected Secretary General of the World Congress of Herpetology, noted that, as tacticians, herpetologists should recognise that the commitment and concern expressed by the general public is of more value than harnessing its observational skills!

7. Impact of human activities

7.1 PESTICIDES

Polychlorinated hydrocarbons (PCHs) cause endocrine system disruption in the northern leopard frog *Rana pipiens*.

The pre- or post-market addition of surfactants can alter the toxicological profile of a pesticide. Glyphosate isopropylamine salt had no effect on Australian tadpoles, but the commercial preparation Roundup®, which includes a surfactant, did cause significant mortality.

7.2 FOREST FRAGMENTATION

Road construction associated with oil production in Yasuni National Park (Ecuador's Amazon Basin) caused an initial response in amphibian assemblages extending up to 20 m from the road edge.

In agriculturally-induced forest patches in Indiana, USA, presence of breeding pools was a more important predictor of amphibian assemblages than patch size, or patch isolation.

Comparisons between continuous and fragmented forest sites on the Atherton Tablelands (Australia) showed that average species numbers, as well as individual capture rate per hour, were related to fragment size. No evidence was found of dispersal between fragments.

Mandy Tocher, working north of Manaus, Brazil, found that litter frog species composition in two 10 ha isolates, in two sites on the extreme edge of primary forest, and in two primary forest control sites, was determined primarily by site, rather than by isolation (in the case of isolates), or distance from the edge. Similarly, she found abundance primarily determined by site, with isolation being of secondary importance. Edge effects were = responsible for the observed patterns in the litter community. These findings contrast with reports for other taxa, but highlight the importance of linking habitat between forest fragments to avoid their isolation.

8. Climate variation

This session comprised a series of papers reporting results from mathematically based biophysical models developed to address questions concerning changing climates on activities of desert tortoises, *Gopherus agassizii*, including the importance of thermal refuges such as shade from shrubs and burrows, and on body size and global biogeography of lizards generally. Population growth models were also used to predict if particular life history strategies of chuckwallas would cause populations to go extinct under changing climatic conditions.

9. Declining reptilian populations

A review of sea turtle population models was aimed at identifying research goals, comparing management strategies, and helping managers set fair by-catch limits for the various fisheries that take sea turtles in the United States. Previously, analyses of simple matrix models had revealed the importance of turtle excluder devices to prevent adult and subadult mortality in shrimp trawls, and the low potential benefits of captive rearing programmes. Currently, new quantitative models are being developed for several populations, including the endangered Kemp's ridley. The approaches being used are similar to, and have relevance to, work being carried out in New Zealand to set allowable by-catch levels for marine mammals.

Jersey Wildlife Preservation Trust staff have cleared an island in the Lesser Antilles of rats and have followed up, two years later, with transfer to the island of the threatened St. Lucia whiptail *Cnemidophorus vanxoi*.

The main threat to the endangered pygmy blue tongue lizard, *Tiliqua adelaidensis*, of South Australia, is cultivation. The lizard exclusively inhabits spider burrows; individuals choose the smallest (diameter) burrow possible.

A West Indian Iguana Specialist Group has been formed to prioritise conservation activities and raise public awareness of the 10 large iguanid lizards of the West Indies: all except *I. iguana* are endemic to the West Indies and are globally threatened. Hybridisation is a problem on Guadeloupe, where the common iguana is 'swamping' the island's endemic species to the extent that if nothing is done, the latter is likely to become extinct within 30 years.

Male Cuban rock iguanas, *Cyclura nubila*, kept in captivity, were assigned high or low dominance rank based upon observed aggressive interactions. Dominant males had greatest access to potential mates. After one year, five high-ranking males were removed for the duration of the breeding season. In their absence, the five largest previous low-ranking males assumed control of the vacant territories, thereby ensuring access to resident females. When the dominant males were returned, they immediately took on their original status, i.e. their temporary removal caused no long-term disruption of the original social relationships. This work suggests that temporary alteration of social structure may represent a valuable management tool for small or otherwise genetically-compromised populations by allowing a greater proportion of males to contribute to the gene pool.

A nationwide project was launched in the UK in 1995 aimed at conservation of the grass snake. Of paramount importance are the provision of egg-laying sites (these sites can be artificial) and foraging areas. Comprehensive management guidelines have been developed and promoted among a range of 'critical' landowner/manager groups (farmers, foresters, local authorities, etc.).

In England, the validity of translocation as a conservation tool is being tested using the slow-worm, *Anguis fragilis*. Three criteria have been established for translocation success: Level One: Survival of translocated animals; Level Two: Breeding of translocated animals; Level Three: Breeding of offspring of translocated animals.

10. Strategies for conservation of Amphibia and Reptilia

Ken Dodd Jr, US Geological Survey, has monitored the amphibian community which uses a small temporary pond in north-central Florida for reproduction. He tabulated the angles of orientation at which these amphibians entered and exited the pond basin. His analyses showed that movements of species between the pond and terrestrial refugia were non-random in orientation, but

that narrow corridors do not appear to be used. Ken concluded that, for buffer zones to be effective at conserving pond-breeding amphibian communities, they will need both a distance and a directional component.

Over the past 25 years, Trevor Beebee, University of Sussex, has been co-ordinating a proactive conservation recovery programme for natterjack toads, *Bufo calamita*, in England. Management of heath and dunes has been focused on restoration of early successional stages by removal of scrub and woodland, and on renewal or creation of ephemeral breeding pools. Whenever possible, low density livestock grazing has been established for long-term maintenance of sites. Successful translocations have been carried out, leading to the establishment of new and thriving populations.

Jeanette Covacevich, Queensland Museum, contrasted the status of Australia's Wet Tropical Rainforest Biogeographic Region (a World Heritage Area) with the open forests of the Brigalow Belt Biogeographic Region. Both areas support diverse and endemic reptile faunas and, while all species of the former appear to be secure, those at the latter (Brigalow) are at considerable risk. The rainforest receives a huge piece of the research/management "money cake" available from the Queensland funding allocation; Brigalow receives a pitifully small amount. Conservation lessons from this situation are: (1) World Heritage Listing is indubitably an advantage in the research/management stakes for an area, but can be costly also. (2) Some habitats are more easily "sold" as conservation-worthy than others. (3) Focusing on a single area or species/species group can be costly for others no less important in maintaining diversity.

Ernst Baard, Cape Nature Conservation, noted that conservation authorities in South Africa are grossly understaffed with regard to herpetologists, and cooperative programmes with non-governmental organisations, zoos, museums and universities are essential to design and implement conservation strategies for preserving that country's unique herpetofauna (currently 93 herp taxa are listed as threatened in the South African Red Data Book).

Christa Krey, Victoria University, spoke about the success of the New Zealand tuatara 'roadshow' organised jointly by the University and WWF NZ. Since 1993, teaching kits on the natural history, conservation and cultural significance of tuatara have been distributed to all New Zealand primary schools. Additionally, live young tuatara have been brought into classrooms around the country.

A similar programme in Italy was outlined by Nicola Bressi, Museum of Natural History, Trieste. Non-poisonous amphibians and reptiles are brought to the classroom to get children in contact with nature and so create ecological consciousness in people.

11. Conservation biology of reptiles

Klaus Henle, Projektbereich Naturnahe Landschaften, Leipzig, in opening this session stressed the vital importance of linking natural sciences and social sciences in conservation concepts. He suggested that inventories should be improved by using more sophisticated statistical tools for data analysis and by planning them as monitoring programmes.

Jane Lecomte, Laboratoire d'Ecologie, Evolution et Systematique, University Paris, presented results of experiments designed to determine the effect of corridors on the population dynamics of the common lizard *Lacerta agilis*. The factor most affected by the presence or absence of a corridor was the survival of juveniles. Dispersal was more likely from poor habitats than from good habitats.

Michael Lambert, University of Greenwich, UK, reported on death from pesticides among non-target reptiles in sub-Saharan Africa. Deaths in lizards and snakes occurred from treatments against tsetse flies with DDT, endosulfan, and dieldrin. Death of lizards also resulted from contact with soil heavily contaminated with organochlorines (dieldrin, BHC and heptachlor). Dead lizards were found after organosphosphate chlorpyrifos was sprayed against locusts.

I spoke about reptile conservation in New Zealand: production and implementation of species recovery plans. There was considerable interest in how the Department of Conservation sets priorities for species management, especially from Fauna & Flora International, English Nature, Scottish Natural Heritage, and Cape Nature Conservation. From comments received it is clear that New Zealand (DoC) is highly regarded internationally for work on island restoration.

Stephen Sarre, University of Auckland, posed the question: Is the vulnerability of reptiles to habitat fragmentation predictable? Data tested came from research on geckos in the Western Australian wheat belt. For any given species, spatial distribution and abundance patterns in undisturbed habitat were used to estimate habitat generalism. Habitat specificity was defined in terms of the number of habitats occupied, distribution within the study site, and relative abundance before habitat fragmentation. These indices were used to predict the relative response of certain geckos to habitat fragmentation.

12. Population biology of Reptilia

Gordon Rodda, US Geological Survey, presented a review of lizard population densities (individuals/ha) and biomasses (kg/ha). Maximal lizard biomasses approach 100 kg/ha, exceeding those of more conspicuous vertebrates such as mammals. Island populations are often denser than comparable mainland

populations. Unlike those of birds or insects, island lizard assemblages often have greater biomass than mainland assemblages of the same groups. Within islands, communities lacking certain predators have strikingly higher lizard densities than do comparable islands with such predators. Herbivorous species tend to have higher biomasses than do lizards with other food habitats.

I spoke to Gordon about monitoring methods. It is his view that pitfall trapping (even with the use of drift fences) does not provide an unbiased estimate of absolute lizard density. During US Geological Survey biodiversity monitoring/assessment, pitfall traps caught only a small number of reptile species known to live within certain areas. Distance sampling also does not provide absolute estimates of population densities - as a method it is less reliable than capture-recapture.

Craig Weatherby, Adrian College, Michigan, USA, when reporting on daily movement patterns of radio-tracked tortoises *Terrapene carolina*, announced that his colleague Robert Kenwood has developed a "R4 Program" for analysing radio tracking data which could output distances travelled every 24 hours, home range size (various methods), activity nuclei, site fidelity and habitat preferences.

Thomas Fritts, US Geological Survey, spoke about the biological bases for problem snake populations on islands, based upon observations of the impact of the introduction of the brown tree snake, *Boiga irregularis*, to Guam. More than a decade after most of Guam's birds disappeared in the early 1980s, the snake has declined as much as 50%, but still remains at pest densities. After snakes removed shrews and most birds, lizard biomass on the island increased from 14 g/ha to 33 g/ha - this increased lizard biomass now sustains the snake population, i.e. the preferred prey of moderate size (shrews and birds) has been largely extirpated allowing smaller, alternative prey species (lizards) to increase in number thus indicating that the snake problems will not disappear just because of the preferred prey species decline. Clearly, details of how introduced species simultaneously cause decreases in some species and increases in others are important for predicting the effects of introductions in various ecological contexts and the management of exotic species problems.

13. Further information

Congress participants were issued with a book of Abstracts of all papers presented. If you would like further details on any presentation, please contact Don, Mandy, or any other New Zealand participant.

14. Acknowledgements

My thanks to the Department for giving me the opportunity to attend and contribute to this, the most substantial, regular gathering of world herpetologists.