

The wild cats: Ecological diversity and conservation strategy

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Organizers:

Masako Izawa, Chair (University of the Ryukyus), Teruo Doi (Nagasaki University), Noriaki Sakaguchi (Ministry of Environment), Maki Okamura (Iriomote Wildlife Center), Nozomi Nakanishi (Research Institute for Humanity and Nature), Kazumitsu Kinjo (Okinawa International University)

Goal and achievement of the meeting:

The Symposium idea was to gather cat experts working on ecology and conservation of a variety of cat species in different parts of the world to support an exchange of information related to the felid conservation problems. Although, due to financial constraints, the Symposium was small (there were only 10 speakers) it allowed to get an impression that the felids, whatever their size, whatever they eat and wherever they live, they face the same threats, and their survival is mostly dependent on similar factors. Destruction and fragmentation of habitat appears most alarming and inevitable source of concern. However, the hope is that if the conservation actions based on sound scientific data are taken as early as possible, the plight of the worlds' cats might appear to be reversible. More and more such data are currently available on various felids. We have knowledge on population status, distribution, and ecological requirements of many species. And we often know what should be done to protect cats against the main threats. But we often lack a power to convince governmental authorities to undertake relevant actions. During this Symposium we realized that a larger meeting than this one, gathering cat specialists from all over the world would bring ideas and solutions to enhance the effectiveness of our efforts in protecting the cats and their habitats.

Program:

Welcome address

Moshin Morita (President, University of the Ryukyus)

Opening remark

Makoto Tsushiya (CoE Project Leader, University of the Ryukyus)

Introduction: wild cats as the key species of island ecosystem

Masako Izawa (University of the Ryukyus)

Spatial ecology and conservation of four sympatric felids in fragmented forest in north-central Thailand.

Lon I. Grassman, Jr. and Michael Tewes (Texas A&M University-Kingsville, USA)

Ecological research and conservation of the Javan leopard *Panthera pardus melas* in Gunung Halimun National Park, West Java, Indonesia.

Syarial Anhar Harahap and Noriaki Sakaguchi (Biodiversity Conservation, Indonesia and Ministry of Environment, Japan)

Ecological plasticity of the Iriomote cat *Prionailurus bengalensis iriomotensis* as an adaptation to the insular environment – variety of food habit and flexible habitat use.

Shinichi Watanabe (University of the Ryukyus, Japan)

The Eurasian lynx – its ecology and conservation in modern Europe.

Krzysztof Schmidt (Mammal Research Institute, Poland)

Polymorphism of cat MHC genes: important immunological marker.

Naoya Yuhki (Laboratory of Genomic Diversity, USA)

Fat cats and tiger economies: oiling the wheels of collaboration.

Tom Maddox (Zoologica Society of London, UK)

Global conservation efforts for small cats: what's happening?

Jim Sanderson (Center for Applied Biodiversity Science at Conservation, USA)

The Tsushima leopard cat: averting extinction.

Akira Murayama (Tsushima Wildlife Conservation Center, Japan)

ABSTRACTS

Spatial ecology and conservation of four sympatric felids in a fragmented forest in north-central Thailand

Lon I. Grassman, Jr.* and Michael E. Tewes

(Feline Research Program, Caesar Kleberg Wildlife Research Institute,
Texas A&M University-Kingsville, USA)

There is a paucity of natural history information on free-ranging felids in Southeast Asia. We report on the spatial ecology of 4 sympatric felids in a fragmented forest landscape in Phu Khieo Wildlife Sanctuary, north-central Thailand (16°5'-16°35' N, 101°20'-101°55' E). From February 1999-February 2003, 4 clouded leopards (*Neofelis nebulosa*) (2 males and 2 females), 2 Asiatic golden cats (*Catopuma temminckii*) (1 male, 1 female), 1 female marbled cat (*Pardofelis marmorata*), and 20 leopard cats (*Prionailurus bengalensis*) (14 males and 6 females) were radio-collared and tracked from 3-20 months. The 200 km² study area was dominated by a mixed evergreen forest on an 800-1,100 m elevation plateau. Felids were trapped in box traps, sedated and radio-collared with a VHF transmitter. Clouded leopards exhibited a mean annual home range (95% minimum convex polygon) of 30.8 km², and traveled an average of 1,932 m each day. Range sizes of clouded leopards were similar to those calculated for a female (39.5 km²) and a male (42.2 km²) clouded leopard in Khao Yai National Park, Thailand. Extensive overlap between 2 male clouded leopards ($\bar{X} = 39\%$) in this study was unexpected because both individuals were mature with established ranges. Asiatic golden cats ranged 57.9 km², and traveled an average of 1,597 m per day. In contrast to clouded leopards, Asiatic golden cat movements were not clustered around small core areas and space use within the home range was relatively uniform. A marbled cat was tracked for 1 month and ranged 5.3 km². Leopard cat spatial organization was characterized as weakly territorial with similar intra-sexual range sizes and minimal seasonal variation. Mean annual home-range size (13.2 km²) was larger than observed in previous studies. Core area (50% minimum convex polygon) averaged 2.0 km², and the mean one-day movement was 1,298 m (SD ± 981, range 35-8,653). Leopard cat habitat use was generally in proportion to occurrence. Analysis of 21 scats and 2 observations indicated that medium-sized cats (i.e., clouded leopard and Asiatic golden cat) consumed at least 9 species that consisted of terrestrial and arboreal mammals. No scats were attributed to marbled cats, whereas murids dominated leopard cat diet. Hunting by local people in the study site was opportunistic and typically included birds, primates, small mammals and deer. Illegal aloewood (*Aquilaria crassna*) collection coupled with hunting often entailed large numbers of people for extended periods in the forest and was of particular conservation concern during the study period. The conservation of felids requires increased forest ranger patrols, continuing wildlife conservation education, and implementation of a sustainable-use ethic within appropriate sections of the buffer zone.

Ecological research and conservation of the Javan leopard *Panthera pardus melas* in Gunung Halimun National Park, West Java, Indonesia

Syarial A. Harahap¹ and Noriaki Sakaguchi²

¹Biodiversity Conservation Indonesia, Indonesia;

²Wildlife Division, Nature Conservation Bureau, Ministry of the Environment, Japan)

The Javan leopard *Panthera pardus melas* only distributed in Java is one of the most threatened mammals in Indonesia and plays an important role in the tropical forest ecosystem as a top predator. Gunung Halimun National Park (400 km²) of which 60% was covered by primary forest provides suitable habitats for leopards.

Monitoring research of leopards by camera trap and radio-tracking methods had been conducted to collect ecological data in Cikaniki area (20 km²) of GHNP from 2001 to 2004. Totally seven leopards, three adult males, two adult females and two cubs, were discriminated though the study period. The density of leopards was estimated at one per 6.67 km² (0.15 leopard / km²) according to the number of resident leopards in the study area. The population size of leopards in GHNP was estimated as 41.7-58.2 individuals. Two leopards, male and female, were captured and radio-collared. The home range size of a female leopard collected sufficient data was 9.82 km². The daily activity pattern of leopards figured according to time records of camera traps showed a couple of peaks around early morning 6:00-9:00 and dusk 15:00-18:00. As a result of fecal analysis, leopards showed a variety of food habits, and mainly fed on the grizzled leaf monkey *presbytis comata*, wild boar *Sus scrofa*, lesser mouse-deer *Tragulus javanicus*, Sunda pangoline *Manis javanica*, and barking-deer *Muntiacus muntjak*.

Action plan for the conservation of endangered species in and around GHNP was developed to secure the viability of their population and habitats. The Javan leopard, Javan gibbon and Javan hawk-eagle were selected as target species in accordance with the criteria, not only being endangered also being umbrella or keystone species for the biodiversity conservation of GHNP. In order to develop the action plan, basic information was collected by the research activities and meeting with local communities. Habitat loss and fragmentation, conflict between local people and leopard and poaching are considered to be main factors threatening leopards. Baseline data collection, monitoring activities of target species and their habitats, halting habitat fragmentation and others were set as objectives to achieve the viability of their population and habitat.

The government of Indonesia enlarged GHNP three times larger, involving surrounding habitats such as Gn. Salak. Securing the corridor between Gn. Halimun area and Gn Salak area is essential to halt the habitat fragmentation. Monitoring activities for the protection of leopards and their habitats have been launched as participatory activities involving local communities, national park rangers and NGOs. The conflict between herders and leopards has to be resolved to raise the public awareness and to prevent illegal hunting.

Ecological plasticity of the Iriomote cat *Prionailurus bengalensis iriomotensis* as an adaptation to the insular environment-variety of food habit and flexible habitat use

Shinichi Watanabe (Faculty of Science, University of the Ryukyus, Japan)

The leopard cat, *Prionailurus bengalensis*, is one of the most widespread felids and is distributed almost throughout temperate to tropical Asia. The Iriomote cat, *P. b. iriomotensis*, is one of its subspecies and occurs only on Iriomote Island (284 km²) of the southern Ryukyus, Japan. The range of distribution of the leopard cat includes a number of islands, of which Iriomote Island is by far the smallest in area. Another unique feature of Iriomote Island as an island inhabited by the wildcat lies in the absence of native non-volant small mammals, such as rodents, that generally constitute principal prey of small felids. In this presentation, I will highlight a few ecological characteristics of the Iriomote cat that have presumably been enabling this subspecies to persist on such an island with severe environmental constraints for wildcats in general as Iriomote Island. Then, I will also discuss potential ecological plasticity of the leopard cat.

The dietary habit of the Iriomote cat was examined in detail by analyzing 947 contents of scats collected from throughout the island. I also investigated potential prey availability for the cat by carrying out censuses along transects, 242 km in total length. From the scats, 76 prey items were found, representing the highest diversity of prey animals for a single field species. Seasonal variations in frequency of occurrence of 19 principal prey items found in scats were examined and compared with those of their availability. Results indicated that for each prey species the two parameters illustrated similar seasonal patterns, suggesting that the cat shifts principal prey items seasonally in response to changes in their availabilities. To evaluate environmental correlates of availability and frequency of actual intake of each prey species, I analyzed nine topographic and vegetative factors in surrounding environments of locations where each of the principal preys was sighted during censuses or scats containing it were found. The result indicated that both availability and actual predation of each prey item were under the similar influences of some environmental factors. This suggests that the cat most frequently preys on the most abundant prey item in each habitat, and flexibly changes the principal prey items depending on their abundances there.

To analyze habitat use of the cat, I conducted radio-tracking surveys on 15 individuals in seven different areas within Iriomote Island. I examined environmental characteristics of locations used by the cats in regard with nine topographic and vegetative factors. Then, its seasonal and local variations were examined in each study area. The results showed that all studied cats selectively used their habitats but the habitat types preferred varied both seasonally and geographically. It is supposed that the cat flexibly change the habitat use probably in response to seasonal and local variations in availability of their food.

In conclusion, the Iriomote cat seems to have adapted to the islandwide environment by acquiring flexibility needed to change principal prey items and habitat use in response to spatial and temporal variations of food availability. Moreover, I believe that leopard cat may potentially have such flexible and versatile properties in various ecological aspects, but this is only revealed under such varying environmental conditions as those on Iriomote Island.

The Eurasian lynx - its ecology and conservation in modern Europe

Krzysztof Schmidt (Mammal Research Institute, Białowieża, Poland)

The Eurasian lynx *Lynx lynx* has once occurred over most of Europe. Today its range shrunk to the Eastern part of Europe and Fennoscandia and is basically dependent on the distribution of large forests. Although the species shows great ecological plasticity, it is vulnerable to various local constraints related to human influence. In Poland, the lynx occurs in several forest complexes of the north-east and mountainous area in the south. Despite full protection, its range decreased during a recent decade. The research on species ecology has been conducted since 1991 in the Białowieża Primeval Forest (BPF) with use of radio-tracking to provide basic knowledge for its conservation. The main mortality cause in lynx was found to be human related: excessive hunting in the past and poaching in present. The preferred food of lynx were ungulate mammals, especially roe deer *Capreolus capreolus*, which amounted 62% of their prey. The lynx population in BPF took 110-170 roe deer / 100 km² annually. Additive influence of lynx predation, intensive hunting harvest and wolf predation caused a 2-fold decline of the roe deer population from 1991 to 1995. This decline had a negative effect on lynx reproduction. Strong dependence on roe deer was likely the reason that the lynx home ranges were very large – 248 and 130 km² in males and females, respectively. In effect, no more than 40-60 lynx may inhabit the whole forest. Some individuals, especially young males, dispersed for long (> 100 km) distances from the BPF. It showed that lynx of BPF are part of larger population and that long-distance dispersal may be necessary for its subsistence. Findings from BPF seem to be representative to other Polish forests as well. High fragmentation of forests, may have disrupted dispersal and migration processes, and likely caused a recent lynx decline. Therefore, recovering the habitat connectivity and maintenance of high densities of roe deer are indispensable for long-term survival of lynx. A study on lynx genetics is carried out now to show the influence of habitat fragmentation and other factors on genetic variability of lynx populations. It is hypothesised that isolated populations of the Eurasian lynx distributed on the edge of the species range may have undergone a depletion of genetic variability, which may threaten their survival.

Polymorphism of cat MHC genes: important immunological marker

Naoya Yuhki

(Laboratory of Genomic Diversity, National Cancer Institute at Frederick, MD., USA)

Biodiversity of immune system against infectious diseases in wildlife has become one of the most important issues for conservation and management. The major histocompatibility complex (MHC) was originally identified as transplantation antigen(s) in human and also as an immuno-regulatory genetic loci in mouse. Gene products encoded in this complex (MHC antigens) are known to have extremely high polymorphism in populations. More than seventeen hundred of alleles for MHC antigens have been found in human populations. These highly polymorphic MHC antigens play crucial roles in controlling immune systems against infectious diseases and tumors by presenting a wide spectrum of short peptides to T lymphocytes. Each MHC antigen has a unique peptide binding region which defines a range of the spectrum for its peptide binding capacity. Accordingly, the highly polymorphic nature of MHC antigens will give species better chances to survive and reproduce offsprings when they encounter newly emerging pathogens or pathogens which they will face when they expand their habitat or migrate to a new territory. In addition to this basic function for adaptive immunity, the MHC antigens also play roles in controlling innate immunity by interacting receptors which express on the surfaces of certain immune cells, such as Natural Killer (NK) cells. Recent advances in scientific technologies for rapid and large scale sequencing & also progress in genome sequence projects allow us to examine these important gene complex for immune system in cats. In this session, unique features of the MHC in cats will be presented and significance of biodiversity of these gene complex will be discussed.

Fat cats and tiger economies: oiling the wheels of collaboration

Tom Maddox (Jambi Tiger Project, Zoological Society of London, UK)

The frequently alarming conservation status of many of the world's best known cats leads many people to the conclusion that the cats are a particularly fragile and vulnerable taxon requiring sanctuary in the remotest wild areas. In many cases this is not the case, with some of the most endangered species displaying both a surprising tolerance to a variety of habitats together with a remarkable fecundity. On their own, these characteristics are unlikely to be enough to ensure survival, but by recognising cat's intrinsic survival abilities may open the doors to some non-conventional conservation approaches.

In many parts of South East Asia the landscape is dominated by industry; logging concessions, crop plantations and mineral extraction. For many these industries represent the future in an area still suffering from past economic crises. For others they represent both the biggest threat and potential key to the future of conservation, but the line between success and sell out is very thin.

The debate on whether conservation should or could be compatible with commercial interest continues to rage. In this presentation we search for compatibility between one of the world's most endangered species, the Sumatran tiger, and some of the industries responsible for the biggest threats to tigers and their environment in Indonesia. Accompanying a sister paper in the main IMC event that looks in more detail at biodiversity on and around an oil palm plantation, this presentation concentrates more on the wider implications across the industrial landscape, using the tiger as the focus species.

The presentation focuses on four particular questions. Firstly, how necessary is tiger conservation in the industrial landscape? Secondly, when can tigers survive in such areas and how? Thirdly, what needs to be done by industries and conservationists to make a collaboration work? And finally, what implications do these answers have for other species, felids and beyond? The presentation is based on findings from the Jambi Tiger Project, a research-based conservation project representing a collaboration between the Zoological Society of London, the Indonesian government and a commercial oil palm plantation in Sumatra Indonesia.

Global conservation efforts for small cats: what's happening?

Jim Sanderson (Center for Applied Biodiversity Science at Conservation , USA)

Research and conservation efforts for large cats such as tigers and cheetahs have enjoyed continued support from the global community. Despite a slow start, increasingly more concern is now being focused on the plight of smaller cats. I will present a summary of conservation efforts on small cats around the world, including those found in Chile. I will discuss current efforts and also suggest where more resources must be directed. I do not believe funding resources are in any way limiting conservation activities. The financial resources are ready. Dedicated conservation efforts that deal with humans and their relationship to wild cats are needed in the field. Sometimes government policy is at fault in the mistaken belief that humans can manage wild nature better than nature can manage itself. Enforcement of already existing laws dealing with illegal skin trade is also required. The importance of “presence” should not be underestimated in thwarting illegal activity.

The Tsushima Leopard Cat: Averting Extinction

Akira Murayama (Tsushima Wildlife Conservation Center, Japan)

The Tsushima leopard cat is one of the most endangered species in Japan. The population is estimated to be between 80 and 110 animals (Ministry of the Environment Japan 2005). It is recognized as a subspecies of *Felis bengalensis*, and is one of only two species of wild cats in Japan. The Tsushima Leopard Cat is a solitary animal and needs a home range of 70 to 560 ha. Their main preys are mice and moles, but they will also take birds, insects and scavenge when necessary.

The population has been in steady decline for a number of years. This has been caused by the usual suspects; habitat destruction, traffic accidents, traps, dogs, and the introduction of invasive species, in particular feral cats. To avert extinction of this species, it is essential that both in situ and ex-situ conservation efforts are conducted effectively.

In-situ Conservation

Even after extensive study of the Tsushima leopard cat, there is still a knowledge gap in our understanding of its biology and behaviour. There is increasing pressure on this conservation project, with budget constraints and the obvious need to reverse, or at least halt, the declining population as quickly as possible. It is essential that we continue and expand our studies to encompass all aspects of the animal's life. This is the only way in which we can create a truly effective conservation plan, based upon sound scientific research. The continued study of the distribution and population is of great importance, but further study of the reproductive physiology, genetic diversity and possible infectious diseases are also of paramount importance for the success of the project.

The primary concern is that their only habitat, the island of Tsushima, must be conserved to aid the recovery of wild population. Historically, Tsushima played a key role in foreign affairs because of its location as the closest island to the continent. This meant that human activity has been prevalent in the area since ancient times. Ninety percent of the land is owned privately, with little restriction on people's activities. One of the most challenging problems faced is creating a successful balance between the local economy and the conservation of the natural environment.

Ex-situ Conservation

The report, a 'Basic Concept for Reintroduction of the Tsushima Leopard Cat' was released by the Japan Ministry of the Environment in 2004. This report highlighted the need to establish a self-sustainable captive population. Once this captive population was established, supplementation and reintroduction could then be undertaken to prevent the complete extinction of the animal in the wild.

"Reintroduction" is not our primary goal however. Preventing the extinction of the wild population has to be our number one concern. All conservation plans and actions should be based on how it will affect the population. As previously highlighted, there is no easy way to conduct In-situ conservation due to the socioeconomic issues of the island.

We must therefore go back to the captive breeding population and recognize that it is essential to establish a disease free, self-sustainable captive population with enough genetic diversity. Ex-situ conservation efforts have been conducted in partnership with Fukuoka-city Zoo. Although the program has been a success, there is concern due to it being based on only 5 founding members. The genetic diversity must be increased by the introduction of new founding members as soon as possible. This can most successfully be achieved by the use of rescued Tsushima Leopard Cats.

Reintroduction

To make it possible for the Tsushima Leopard Cat to be reintroduced we must first restore the native habitat. Prior restoration of the habitat is essential for a successful reintroduction programme. This habitat restoration will obviously also be of great benefit to the native population.

The process of restoring the ecosystem will involve the re-growth of various native species across the island. The "Reintroduction project" can be viewed as benefiting a number of endangered species and not just the Tsushima Leopard Cat. It will also be very positive for the protection of the natural environment.

The Japan Ministry of the Environment has taken a central role in the conservation of the Tsushima leopard cat since 1994. Averting extinction of this species is of great importance and urgency. Its success or failure will have a large bearing on the recovery of all the endangered species in Japan.

However the crucial issues are yet to be addressed. A substantial recovery plan, based on sound scientific research and study, should be established as soon as possible. Allied to this, the Tsushima leopard cat recovery implementation team needs to be established with stakeholders such as local and national government, academics, specialists, and interest groups, as well as individuals in order to achieve our common goal; the establishment of the self-sustainable wild population of the Tsushima leopard cat.

Meeting



Unfortunately, Lon Grassman was not able to attend due to a sudden event, so his talk was presented by Nozomi Nakanishi.



Anhar Harahap showing the Javan leopard study.



Shinichi Watanabe presenting his brilliant talk on using GIS in an ecological study of the Iriomote cats.



Eurasian lynx situation based on Poland case showed by Krzysztof Schmidt.



Audience



Poster session



Naoya Yuhki is trying to convince us about advantage of using MHC genes to study population ecology of cats.



Tom Maddox oiling the wheels of collaboration between tiger conservationists and an oil-palm company.



Jim Sanderson bewitching us with his cats' pictures.



Akira Murayama talking about the situation of the Tsushima leopard cat.



Banquet



Participants

Field excursion to the Iriomote island



Underspass for the Iriomote cat and ecological research – a phototrap