



Animal Behavior and Conservation Biology

Tenth Sede Boqer Symposium in Memory of Merav Ziv

11 June, 2009

**Evans Auditorium, Blaustein Institutes for Desert Research
Ben-Gurion University, Sede Boqer Campus**

**Mitrani Department of Desert Ecology & Blaustein Center for Scientific Cooperation
Blaustein Institutes for Desert Research, Ben-Gurion University, Sede Boqer Campus
The Zoological Society of Israel**

Program

- 09:15** **Reception & refreshments**
- 09:45** **Ecology Student Award in memory of Merav Ziv**
- 10:00-10:45** **Keynote: Elissa Cameron** (Univ. of Pretoria, S. Africa) – Exploring the interface between theoretical behaviour research and conservation biology
- 10:45-11:00** Refreshments
- 11:00-11:45** **Keynote: Alan Templeton** (Washington Univ., USA) - The impact of prescribed forest fires on the dispersal behavior of collared lizards
- 11:45-12:00** Break
- 12:00-12:20** **Tal Peled** (Ben-Gurion Univ.) – Paradigm for behavior and conservation
- 12:20-12:40** **Merav Vonschak** (Tel Aviv Univ.) – Competitive displacement mechanisms by the little fire ant.
- 12:40-14:00** Lunch
- 14:00-14:20** **Igal Berenshtein** (Hebrew University) – Scuba divers and marine predators may increase photosynthesis in branching corals by increasing mutualistic fish residence time in coral branches.
- 14:20-14:40** **Ruth Khait** (Hebrew University) – The enigma of delayed feeding in herbivorous coral-reef fishes: a diel diet shift?
- 15:00-15:10** Break
- 15:10-15:30** **Shirli Bar-David** (Ben-Gurion Univ.) – Movement pattern and reserve design: The Fire salamander and African buffalo as case studies.
- 15:30-16:50** **Noam Weiss** (Intl. Bird-Ringing Center Eilat & Hebrew Univ.) – Conservation of Hume's tawny owl (*Srtix butleri*) in southern Israel: Behavioral and habitat selection perspective.
- 15:50-16:10** Refreshments
- 16:10-16:30** **Shomen Mukherjee** (Ben-Gurion Univ.) – Can one measure carrying capacity using animal behavior?
- 16:30-16:50** **Burt Kotler** (Ben-Gurion Univ.) – Behavioral indicators in conservation: applying optimal patch use.
- 16:50-17:00** Break
- 17:00-17:20** **Roni Ostreiher** (Hatzeva Field Study Center) – Influence of agricultural areas on the ecology and behavior of the Arabian babbler.
- 17:20-17:40** **Eran Levin** (Tel Aviv Univ) – Daily migration behavior of a subtropical bat in the northern Jordan Valley.

Exploring the Interface between Theoretical Behaviour Research and Conservation Biology

Elissa Z. Cameron

Mammal Research Institute, Department of Zoology & Entomology, University of Pretoria, South Africa.

Conservation biology is an integrative science, but has historically tended to overlook behaviour. This is understandable, since conservation biology focuses on population and community processes, while behavioural ecology concentrates on sources of variation among individuals. However, individual variation can impact these ecological processes. Consequently, research on animal behaviour can not only provide valuable insights for conservation, but explain some conservation failures. To date, conservation behaviour has been most common for species in crisis, where individual variation is vital to species survival. I will introduce three areas of research on variation between individuals that have had important implications for conservation: sex allocation, social bonding and harassment, and health or immunocompetence. I discuss these in the context of practical conservation problems with particular emphasis on breeding of rare species, reintroduction, contraception as a management tool, and human-wildlife conflict. These studies show how theoretically-driven behaviour research has an important role in conservation, and is essential to understanding conservation failures. Furthermore, since individual variation is a key component in population ecology, the application of behavioural research to conservation problems is essential for ensuring the continued survival of rare species.

The Impact of Prescribed Forest Fires on the Dispersal Behavior of Collared Lizards

Alan R. Templeton

Department of Biology, Washington University, St. Louis, MO 63130 USA, and Institute of Evolution, University of Haifa, Haifa, Israel

The Eastern Collared Lizard (*Crotaphytus collaris collaris*) lives in open, rocky habitats called glades in the Ozarks, a highland region in the interior of North America. Glades are fire-maintained habitats, and with the effective suppression of forest fires in the Ozarks in the late 1940's, these habitats began to degrade, causing 80% of the collared lizard populations to go extinct by 1980. A glade restoration program was then initiated, followed by the translocation of collared lizard populations into restored glades starting in 1984. However, the forest matrix in which the glades are imbedded was not subjected to managed burns at this time, and fire suppression had changed this matrix such that an open understory with a herbaceous ground cover was replaced by a thick, woody understory with the ground covered by leaf litter. Studies revealed that collared lizards would not disperse through these unburned forests such that even 50 meters of unburned forest represented an almost absolute barrier to dispersal. In 1994 landscape burning was initiated that included both glades and the forest matrix. The lizards dispersed through this burned forest with high probability and over distances up to 2 kilometers. This dispersal allowed the colonization of new glades, an increasing population size, and higher levels of genetic diversity within glades. Using mark/recapture and genetic data, the factors that affect collared lizard dispersal are described, which include age, gender, and various landscape, ecological, and demographic factors.

A new paradigm for behavioral conservation

Tal Peled¹, Oded Berger-Tal¹, Aya Ben-Zvi¹, Tarin Paz², David Saltz¹, Yael Lubin¹ and Burt Kotler¹

¹ Mitrani Department of Desert Ecology, The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev

² Geography and Environmental Development Department, Ben-Gurion University of the Negev

Animal behavior is emerging as a fundamental theme in conservation biology. While the fields of animal behavior and conservation biology are already conceptually intertwined, no unifying framework exists for this field. We created a new paradigm, which combines the disciplines of animal behavior and conservation biology. We recognize three conservation-related behavioral families: 1) movement and space-use patterns; 2) foraging and vigilance; and 3) social organization and reproduction. The paradigm consists of three fundamental elements of conservation where behavior is of concern: anthropogenic impacts on animal behavior, behavior-based management, and behavioral indicators. The connection of each element to the behavioral families is defined by two complementary pathways as follows: I) Anthropogenic impacts may trigger behavioral plasticity or induce changes in behavioral patterns, which may have severe ecological and evolutionary consequences. By contrast, behavioral rigidity in a rapidly changing environment can have similar deleterious effects. II) Behavior-based management can either apply knowledge of a particular set of behaviors or fundamentally change the behavior itself (e.g. conditioning) to meet conservation goals. III) Behavioral indicators can be used to reveal conservation threats to populations, and assess the efficiency of our management efforts. For practical conservation usage, each one of the three elements and its connections to the behavioral families can also be treated as a stand-alone functional unit. The implementation of this paradigm will help elucidate the goals of conservation/behavior studies and set the ground for generating hypotheses and subfields within the paradigm.

Competitive displacement mechanisms by the little fire ant

Merav Vonshak, Tamar Dayan and Abraham Hefetz

Department of Zoology, Life Science Faculty, Tel Aviv University, Tel Aviv 69978, ISRAEL (meravwei@post.tau.ac.il)

Invasive species are currently considered the second greatest threat to biodiversity worldwide. Social insects, and ants in particular, are especially destructive; displacement of local ant species is their most dramatic impact. As ants are an important component of natural ecosystems, and have numerical and biomass dominance in the animal kingdom in almost every terrestrial habitat worldwide, this may have substantial consequences for many other organisms. Despite many studies of invasive ants' impact, little is known about the displacement mechanisms.

We chose to study the little fire ant (LFA; *Wasmannia auropunctata*), a new invasive species in Israel, because of its renowned devastating effect. In a comparative study we found a significant impact of LFA presence, both on ant species richness and abundances, as well as on the abundance of spiders and beetles. These results led us to study the behavioral basis for this species' success.

We conducted a comparative study in the laboratory on the foraging efficiency of the LFA and other non-native species which were displaced by the LFA, with and without between-species interference. We found that the LFA was less competent than the opponent species in both settings, but that LFA survival was higher, implying a possible advantage over time. Indeed, in a long term experiment the LFA either took over the opponent ants' nest and killed all workers and queens, or both nests survived and kept using the same arena. There were no instances of the opponent species taking over the LFA nest.

Scuba Divers and Marine Predators may Increase Photosynthesis in Branching Corals by Increasing the Residence Time of Mutualistic Fish between Coral Branches (Concept Presentation)

Igal Berenshtein and Amatzia Genin

The Interuniversity Institute for Marine Sciences in Eilat and Department of Evolution, Systematics, and Ecology, The Hebrew University of Jerusalem

The morphology of branching corals effectively blocks the ambient water flow and creates a region of reduced water exchange between the inner branches of the coral. Symbiotic algae, which reside in coral tissue, perform photosynthesis during which oxygen is released as a byproduct in the tissue of their host. In the absence of flow, photosynthesis by the symbionts causes a rapid increase of the oxygen concentration inside the coral tissue, which leads to an instantaneous decline in the rate of photosynthesis. Branching corals (*Stylophora pistillata*, *Acropora spp.*) are often inhabited by social groups of mutualistic damselfish (*Dascyllus marginatus*, *D. auranus* and *Chromis viridis*). During the day, these fish forage for zooplankton near the coral, frequently seeking shelter from approaching predators between the coral branches. Once in shelter, the fish exhibit strong fin motions, which effectively enhance the flow over the inner parts of the coral branches, and are therefore expected to enhance photosynthesis. The fish's escape response is also induced by divers and snorklers. Thereby, divers may indirectly enhance photosynthesis in corals. Similarly, overfishing of large predators (e.g. groupers, lizard fish) can negatively affect coral photosynthesis. We believe that this multi-symbiotic phenomenon is significant for the conservation of coral reefs.

The Enigma of Delayed Feeding in Herbivorous Coral-reef Fishes: A Diel Diet Shift?

Ruth Khait and Amatzia Genin

Department of Evolution, Systematics & Ecology, The Hebrew University of Jerusalem
and The Interuniversity Institute for Marine Sciences of Eilat, POB 469, Eilat 88103,
Israel

Many herbivorous coral-reef fishes feed less in the morning than in the afternoon. Since most coral reefs are found in oligotrophic waters, where algae are scarce, this behavior seems maladaptive. Our *in situ* experiments show that this feeding behavior is flexible and depends on the grazing history of the diet. Fish that normally exhibit lower morning feeding, reversed that pattern when feeding on algae that had not been previously grazed. Our findings indicate that the lower feeding rate in the morning is an outcome of a search for rare, possibly more nutritious algae. By noon, after selectively eating the rare algae for a few hours, the fish switch to less-selective, bulk feeding on more abundant species. The nutritious algae eaten by the fish in the morning are known for their extremely high growth rate, and thus are capable of dominating the rocky substrate. By selectively eating fast-growing algae in the morning, the fish prevent those algae from covering extensive areas of the reef, thereby maintaining exposed substrate for coral settlement. Via their feeding behavior, herbivorous fish provide a critical service to the ecosystem.

Movement Patterns and Reserve Design: the Fire salamander and African buffalo as Case Studies

Shirli Bar-David

Mitrani Department of Desert Ecology, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus, 84990 Midreshet Ben-Gurion

Movement patterns affect population dynamics and persistence. Understanding these processes can serve as a basis for developing conservation strategies. Specifically, information on movement patterns of different organisms can contribute to the design of nature reserves. We will present two distinct examples – the Fire salamander and African buffalo – which are of widely different scale in terms of the organism's body size, movement ability, habitat requirements and reserve type. However, both species require the following landscape components in the reserve design: "core areas", "landscape connectivity" and "buffer zones". The Fire salamander (*Salamandra atra*), an endangered amphibian, distributed in northern Israel, requires water sources as breeding sites. These sites may be defined as the core areas for protection. Information on salamander movement patterns enabled us to estimate the importance of protecting also buffer zones and landscape connectivity among the core areas for the species' long term persistence. The African buffalo (*Syncerus caffer*), a large herbivore which moves usually in large herds in African savanna, requires large landscape fragments for its home range. Detailed information on space use patterns enabled us to identify sites to which the herds often return. The inclusion of these sites should be considered within the core areas of the reserves because of their potential importance for the species' dynamics and furthermore for tourism and game within the reserve. A combination of different methods for analysis of movement data used in this study yields results that contribute to our understanding of the spatial dynamics of the species. This information is further applied for identifying landscape components which are important for species protection and management.

Conservation of Hume's Tawny Owl (*Strix butleri*) in Southern Israel: Behavioral and Habitat Selection Perspective

Noam Weiss & Reuven Yosef

International Birding & Research Centre in Eilat, P. O. Box 774, Eilat 88000, Israel

The Hume's Tawny Owl occurs in remote and desolated desert cliff-lined wadis. It is an uncommon resident and breeder with a limited global distribution. After almost a decade of no observations of Hume's Tawny Owls (HTO) in the southern Arava, and following suggestions that the species was extinct in the region, the IBRCE undertook a survey to relocate and understand the current status, habitat selection and behavioral and reproductive characteristics of this rare owl. We analyzed past records, marked potential cliffs, and then conducted transects where we broadcast playbacks every 500m, and listened and watched for a reaction. HTO were found in 7 locations- all on cliffs in deep canyons. All historical sites produced negative results and in their stead found six Pharaoh's Eagle Owl (*Bubo ascalaphus*; PEO) pairs. We found that PEO forage in the agricultural plains of the Arava Valley, and nest in the Rift Valley cliffs. In contrast, HTO, apparently avoiding the larger PEO, have been displaced deeper into the desert, westwards. Only in areas without cultivated fields have the HTO remained close to the Rift Valley and the nearest distance of a HTO to a cultivated area was 6 km. Deep in the desert we observed HTO in territories that exhibited four common features: wadis that collect run-off from a relatively large catchment area, wadis that narrow concentrating the flash floods, wadi intersections that increased the probability of a flash flood from different catchments, and high ground water that allowed the effect of a flash flood to last longer in the desert. We found the HTO were displaced westwards due to the combined effect of human agriculture and PEO predation, and constrained eastwards by the topography and their habitat requirements. These constraints leave a narrow corridor wherein the HTO can actually establish territories and survive. In order to ensure the survival of the species in Israel, it is important to implement a conservation program for this region and to incorporate the habitat requirements of these rare species, and to reconsider settlement and agricultural expansion policies in the Arava Valley and the southern Negev that negatively impact biodiversity.

Can one measure carrying capacity using animal behavior?

Douglas W. Morris^{*} and Shomen Mukherjee^{†*}

^{*} Department of Biology, Lakehead University, Thunder Bay, Ontario P7B 5E1 Canada

[†] Mitrani Department of Desert Ecology, Jacob Blaustein Institute for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus, 84990 Midreshet Ben-Gurion, Israel.

Carrying capacity is among the most important, but least understood and rarely estimated parameter in population ecology and management. A simple behavioral metric of carrying capacity would advance theory, conservation, and management of biological populations. Such a metric should be possible because behavior is finely attuned to variation in environment including population density. We connect optimal foraging theory with population dynamics and life history to develop a simple model that predicts this sort of adaptive density-dependent change in food consumption. We then confirm the model's unexpected and manifold predictions with field experiments. The theory predicts reproductive thresholds that alter the marginal value of energy as well as the value of time. Both effects cause a pronounced discontinuity in quitting-harvest rate that we revealed with foraging experiments. Red-backed voles maintained across a range of high densities foraged at a lower density-dependent rate than the same animals exposed to low-density treatments. The change in harvest rate is diagnostic of populations that exceed their carrying capacity. Ecologists, conservation biologists, and wildlife managers may thus be able to use simple and efficient foraging experiments to estimate carrying capacity and habitat quality.

Behavioral Indicators in conservation: applying optimal patch use

Burt P. Kotler

Mitrani Department for Desert Ecology, Ben-Gurion University, Blaustein Institutes for Desert Research, Midreshet Ben-Gurion, 84990, ISRAEL

Informed management can enable successful conservation efforts. This may require up to the minute information on habitat quality, human impacts, and population growth rates. Behavioral indicators based on foraging theory can provide appropriate leading indicators. Behavioral indicators may be based on activity densities, patch use behavior, vigilance behavior, and more. I present some patch use theory and introduce the use of giving-up densities (GUDs; the amount of food left in a resource patch follow exploitation) as a behavioral indicator. GUDs can reveal habitat and microhabitat quality, and in conjunction with activity data, used to identify core and refuge habitats. I discuss examples that include ibex in Israel and springbok, hyrax, klipspringers, and goats in South Africa to illustrate some uses. Examples reveal how GUDs identify key habitats, and allow us to quantify the effects of structure, refuge, and risk of predation on habitat quality and impacts of tourists. They even allow us to track range quality. The use of inexpensive, easy to use, leading behavioral indicators in wildlife and range management programs can serve to make management easier, more widely available, more effective, and allow the integration of high-value eco-tourism activities with traditional livestock farming to enable more sustainable rural development.

Influence of Agricultural Areas on the Ecology and Behavior of the Arabian Babbler

Roni Ostreihar

Hatzeva Field Study Center, Hatzeva, Israel

The Arabian babbler is a cooperative-living songbird, resident along the wadis in the southern and eastern parts of Israel. A group of babblers consists of permanent members, defending their territory together and cooperating in breeding and raising offspring. The human settlement in the Arava reduced the living space of many animals and changed their lives. At the beginning of 2009, there were about 520 active farms which cultivated about 33,000 dunams. There are many garbage sites situated next to the agricultural fields, and the organic remnants disposed of at the sites attract many animals. Babblers are an excellent indicator for human influence for several reasons:

- a. They are the subject of long-term research and there is a lot of information about their ecology and behavior.
- b. Some of the groups live in relatively undisturbed areas, some live around the agricultural fields and some live inside the human settlements. We can, therefore, compare the human influence on different conditions.
- c. The babblers are at the middle of the ecological contexture. They are omnivorous, and act both as predators and as prey. Influencing them, therefore, is widespread.

The current study compared ten groups living around agricultural areas with ten groups living in "natural" areas and without access to agriculture. Around the agricultural areas the territories are smaller, the individual's life span is shorter, the lifetime of the groups is shorter, and replacement of groups in the area is higher. Although foraging time is shorter, parental investment required from a group is higher. In addition, around the agricultural areas the number of confrontations between individuals within the group and between neighbor groups is high in relation to "natural" areas. For the babblers, the agricultural areas have changed the ecological and social balance. This, in turn, has changed their social behavior dramatically. In order to reduce the influence of the agricultural areas on the babblers, some recommendations for the farmers, the settlements and the authorities are suggested.

Daily Migration Behavior of a Subtropical Bat in the Northern Jordan Valley

Eran Levin¹, Amit Dolev², Noga Kronfeld-Schor¹ and Yoram Yom-Tov¹

¹Department of Zoology, Tel-Aviv University

² Israel Mammals Research Center, S.P.N.I. Tel-Aviv

The insectivorous bat fauna of Israel is rich in species and includes bats originating from diverse zoogeographic regions. The Israeli bat populations decreased significantly during the past decades. Knowledge of the natural history of bats is essential for the conservation and rehabilitation of bat populations; but little information exists. Since 2003 we have been studying the population genetics, physiology and behavior of the Greater mouse-tailed bat (*Rhinopoma microphyllum*) in Israel. This medium-sized, insectivorous bat occurs in subtropical parts of Africa and Asia, and in Israel it is found in the Jordan valley from the Dead Sea to the Hula valley, which is the northern border of its world distribution. We found that during summer, there is complete geographic segregation between male and female mouse-tailed bats. During this period both males and females feed on alate ants of the genus *Camponotus*, which have a very high fat content. Using radio tracking we studied these bats' foraging behavior, and were surprised to find that foraging areas of both males and females are located a long way from their day roosts: Males cross the Hula valley every night and forage at the groves on the western slopes of the valley, while females fly to the north-west of lake Kinneret (Bteha) and forage in the vicinity of wet habitat and woody vegetation, where the ants are common. We suggest that mouse tailed-bats take advantage of the special structure of the Jordan valley: they roost in the warm and dry eastern slopes of the valley, whose climate resembles the conditions in their African origin, but travel every night to feed in the cooler and wetter areas (about 12km from their roost). Understanding the “daily migration” behavior patterns may contribute to the conservation of the species, and indicates the need to protect both its roosting and foraging sites.