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PROCEEDINGS OF THE THIRTY-NINTH MEETING OF THE ZOOLOGICAL SOCIETY OF ISRAEL

HELD AT
TEL AVIV UNIVERSITY
1 DECEMBER 2002

PROGRAM

Greetings, Y. Ayal—The society chairperson.
Greetings, M. Goren—On behalf of the organizing committee.

SCIENTIFIC SESSIONS

Presiding: Z. Arad (Technion), Y. Ayal (Ben-Gurion University of the Negev), B. Galil (Israel Oceanographic and Limnological Research)—session in memory of Ch. Lewinsohn; N. Kronfeld-Shor (Tel Aviv University), U. Paz (Ramat Efal), Y.L. Werner (The Hebrew University of Jerusalem)—session in memory of J.H. Hoofien; Y. Yom Tov (Tel Aviv University).

GENERAL MEETING OF THE SOCIETY AND CLOSING CEREMONY

Board elected: Y. Ayal (Ben-Gurion University of the Negev), R. Ben-David Zaslow (Tel Aviv University), M. Goren (Tel Aviv University), G. Katzir (University of Haifa), R. King (treasurer, Israel Nature and Parks Authority), C. Korine (Ben-Gurion University of the Negev), N. Kronfeld-Schor (Tel Aviv University), H. Steinitz (Tel Aviv University).

The Michael Costa Prize for the best Ph.D. student paper was awarded to S. Shafir (IOLR) for his presentation "Are Elat corals affected by nutrient enrichment from fish farms?". The Gidy Zakai Memorial Prize for the best M.Sc. student paper was awarded to R. Goldshmid (Hebrew University) for her presentation "Nocturnal ventilation of corals by fish". The Ch. Lewinsohn Prize for the best M.Sc. presentation in the field of Marine Biology was awarded to A. Aronov (Tel Aviv University) for his work "Variation in aggregation behavior and anatomy resulting from differences in degree of sperm competition in groupers (Epinephelinae, Serranidae)". The prize for the best poster presentation was awarded to M. Kiflawi (University of Haifa) L. Blaustein (University of Haifa), and M. Mangel (University of California Santa Cruz) for their work "Predation-dependent selection of habitat for oviposition by the mosquito *Culiseta longiareolata*: A test of competing hypotheses".

D. Graur (Tel Aviv University) edited the abstracts.

ABSTRACTS

Variation in aggregation behavior and anatomy resulting from differences in degree of sperm competition in groupers (Epinephelinae, Serranidae)

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A comparative study on the reproductive behavior of three groupers (*Epinephelus costae*, *E. marginatus,* and *Mycteroperca rubra*) was carried out along the Mediterranean coast of Israel during 1999–2001. *M. rubra* was found to differ from *E. costae* and *E. marginatus* in its spawning aggregation behavior and the degree of length domination of males over females. *M. rubra* was also found to posses a much higher testis-somatic index (TSI) of ripe males than the other two species. A comparison of our results with those from *E. gutattus* from La Parguera (Puerto Rico) and *E. streatus* from the Cayman Islands revealed that TSI, which is an indicator of degree of sperm competition, is negatively correlated with the degree of length domination of males over females ($r^2 = 0.95$; $p < 0.02$). This strong correlation, in conjunction with our observations on spawning aggregation, suggests a gradient in the degree of sperm competition and corresponding anatomical and behavioral characteristics. These findings support the division of groupers into two groups according to the presence or absence of sperm competition.

Establishment of the Lessepsian migrant *Cellana rota* (Gastropoda) in the Mediterranean Sea and its demographic effects on the local species *Patella caerulea*

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The Indo-Pacific patellogastropod *Cellana rota* was first recorded in the Mediterranean Sea in 1967. We attempted to elucidate the effects of *C. rota* on the local patellogastropod *Patella caerulea*, which occupies a similar ecological niche. The population densities of both species were measured at 14 sites along the Mediterranean shores of Israel. In addition, a single site (Tel Barukh) was chosen for monthly measures during April–November 2002. We found that the density of *C. rota* declines from south to north. A single-strand-conformation-polymorphism analysis of a fragment of the mitochondrial cytochrome oxidase I gene revealed very low levels of genetic diversity in *C. rota*, supporting a relatively recent Lessepsian migration. Higher population densities of *P. caerulea* were observed at sites where *C. rota* is absent, suggesting disturbance of the local species by the migrant. Gonads were well developed in *C. rota* throughout the study, and recruitment was observed in October. In contrast, *P. caerulea* showed a decline in the number of individuals carrying developed gonads towards the summer, coupled with an increase in recruitment. Although the differences in reproductive patterns may partially explain the coexistence of these two species, the apparently short period since the arrival of *C. rota* precludes firm conclusions regarding the stability of the observed state.

Unique expression of the *sPer1* gene in nocturnal blind subterranean mole rats

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The subterranean *Spalax ehrenbergi* superspecies represents an extreme example of adaptive visual and neuronal reorganization. Despite its total blindness, its daily activity rhythm is entrainable to light–dark cycles, indicating that its atrophied subcutaneous eyes can confer light information to the circadian clock. Although most individuals are active during the light phase under laboratory conditions (diurnal animals), some individuals can become nocturnal. Similar to other rodents, the *Spalax* circadian clock is driven by a set of clock genes, including the *period* (*sPer*) genes. We show that diurnal mole rats, like other rodents, express the *sPer1* and *sPer2* genes with a peak during the light period. Light can synchronize *sPer* gene expression to an altered light–dark cycle and thereby reset the clock. In contrast, nocturnal *Spalax* express *sPer2* in the dark period and *sPer1* in a biphasic manner, with a light-dependent maximum during the day and a second light-independent maximum during the night. This biphasic expression occurs synchronically in the suprachiasmatic nucleus and the Harderian gland, but not in the eye or any other peripheral tissue. Although *sPer1* expression remains light-inducible, this is not sufficient to reset the molecular clockwork. Hence, the strict coupling of light and *Per* expression results in the loss of the circadian clock. This indicates that *Spalax* can dissociate the light-driven resetting pathway from the central-clock oscillator. *sPer* mRNA cycling reflects the adaptation of the clock entrainment mechanism to the subterranean ecotope.

Hormones and behavior in crustaceans: The androgenic gland affects male behavior

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The androgenic gland (AG) regulates male sexual differentiation and secondary male characteristics in Crustacea. Here we show that, in addition to its known morpho-anatomical and physiological effects in decapod crustaceans, AG also affects behavior. We implanted AGs into juvenile females of the crayfish *Cherax quadricarinatus* and examined their effects on agonistic and mating behavior after sexual maturity by means of paired encounters that involved intact males or females, as well as AG-implanted females. In encounters with males, AG-implanted females exhibited higher levels of aggression than intact females. Aggression levels were lower in encounters between pairs of AG-implanted and intact females than in encounters within AG-implanted or intact pairs. The reduction in aggression levels was similar to that normally exhibited in heterosexual interactions. Elements of mating behavior (male-courtship displays and a false copulation attempt) were exhibited in some of the encounters between AG-implanted females and intact females. AG implantation inhibited secondary vitellogenesis in the ovaries as well as morphological traits that facilitate maternal egg brooding. It also induced development of secondary male characteristics. However, male reproductive system and primary sex characteristics were not observed. We attribute the induction of male-like behavior in females to an androgenic factor derived from the AG.

The Late Bronze Age mollusk fauna of Tel Abu Hawwam

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Tel Abu Hawwam, a coastal Qishon River site in northern Mount Carmel, was used as a port in the Late Bronze Age, the Iron Age, and the Persian and Hellenistic periods. The mollusk fauna from the site was used to reconstruct the marine habitat during the Late Bronze Age and compare it to

present conditions. Seven thousand and thirty specimens (96% of the collected material) were identified to the species level (73 species). Three thousand five hundred and sixty-four specimens belonging to 64 species were found in situ and dated to the Late Bronze Age. The reconstructed environment seems to have been a complex one that included rocky habitats, sandy habitats, a lagoon, and an estuary. This environment was subject to constant changes due to tectonics, alterations in sea–land relationships, and alluvium. The present environment is different from that in the Late Bronze Age, and consists of a heavily polluted sandy habitat. Fourteen mollusk species are currently known to inhabit the site, as opposed to 26 species that were found in the Late Bronze sandy habitat. The distribution of two species, *Nerita sanguinolenta* and *Aspatharia rubens,* indicates a commercial connection with Red Sea and Nile areas. Human activities revealed by our findings include a purple-dye industry and the occasional manufacturing of beads.

Fouling serpulid taxa from the north beach of Elat: Coloration and some preliminary observations on radiolar and prostomial photoreceptors

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Live serpulid tubeworms from a biofouled zone between 5–30 m in depth were studied with digital photomicroscopy to document coloration and the presence of prostomial and radiolar photoreceptors that are difficult to observe in preserved material. Particularly abundant in the samples (hundreds of individuals) were two minute taxa, *Salmacina* sp. and *Josephella marenzelleri,* with paired clusters of prostomial eyespots with lenses surrounded by reddish pigment, ca. 8 and 2 eyespots per cluster, respectively. Atypically, more than 50% of the *Josephella* individuals were anoperculate. Somewhat larger taxa represented by few individuals included *Hydroides exaltatus, H. minax*, *H. perezi, Vermiliopsis infundibulum-glandigerus, Spirobranchus tetraceros*, and up to four *Serpula* species. Radiolar eyespots with lenses surrounded by vermilion pigment were observed along the length of the radioles in *Vermiliopsis* and the *Spirobranchus,* in single and double rows, respectively. Two of the *Serpula* taxa had large eyespots surrounded by pigment at the bases of their radioles, in one, one eyespot, and in another, two eyespots per radiole. Several *Serpula* taxa studied for comparison, including *Serpula hartmanae* Reish from the Indo-Pacific, had ca. 2 rows of irregular round-ovoid hyaline bodies not surrounded by pigment cups along the radioles; their function is presently not clear. The presence and number of these hyaline structures and size of the worms may be correlated. Additional specimens of the present taxa and additional taxa should be surveyed for eyespots and for hyaline bodies, which may prove of taxonomic value.

Calcium provisions to griffon-vulture chicks as part of a management scheme implemented at Gamla

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Gamla Nature Reserve in the Golan area holds the largest griffon-vulture (*Gyps fulvus*) colony in Israel. The colony suffers from a very low reproduction rate. During the last three decades, cattle

replaced the previously abundant goats and sheep as the main food source for the vultures in the area. This replacement caused a chronic shortage in small bones, and subsequently breeding griffon vultures lost their main source of calcium. Consequently, some chicks became affected by rickets, while some died after ingesting artifacts resembling bones that were brought to the nests by the parents. A routine supplement of bone fragments at a local feeding station began in 1998. In 2002 we began to supply bone fragments in foraging areas. A significant positive correlation was found between bone provision and bone amounts in nests. A significant negative correlation was found between bone provisions, on the one hand, and number of chicks affected by rickets and number of ingested artifacts, on the other. We recommend the implementation of this management technique in areas where shortage in bone fragments becomes a limiting factor.

The effects of pregnancy on fast-start performance in *Gambusia affinis*

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It is widely believed that present reproduction decreases the chances of success of future reproductions, a phenomenon dubbed the "cost of reproduction." The cost may be due to a decrease in the amount of resources allocated to somatic growth, which in turn will decrease future survival rates of reproducing females, as well as litter sizes. Survival rates of reproducing females may decrease due to locomotion restrictions as well as due to nutritional limitations. Locomotion constraints during pregnancy have been suggested but only few pieces of supporting evidence are found in the literature, and only two of them concern fish locomotion. Swimming capacity, especially in open-water fishes, is a substantial factor affecting predation avoidance and feeding rate. Body mass, cross-section area, and plasticity are increased during pregnancy, and are likely to affect agility and swimming capacity. Among swimming modes, fast-start, i.e., the quick transition from resting position to fast swimming, is critical in determining the outcome of pray–predator encounters, thus determining the survival rate. Parameters of fast-start kinematics that determine efficiency were measured in pregnant and nonpregnant *Gambusia affinis* females. Fish were stimulated to perform fast-start swimming in an aquarium and were recorded with a high-speed digital video camera (250 frames per second). A frame-by-frame analysis was performed with image-analysis software. The following parameters were measured: startle response time, first and second maximum angles, average and maximum speed, average and maximum, acceleration, and time elapsed from the beginning of the fast start to the peak of first and second angles. Besides the first angle, that was sharper among pregnant *G. affinis*, all other factors indicate that fast-start swimming was faster and stronger in nonpregnant *G. affinis*. In light of these findings, we suggest that fast-start swimming is considerably less efficient in pregnant females, and may result in lower survival rates during pregnancy.

Nubian ibex in the En Gedi oasis: Population changes over the last fifty years and new management recommendations

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The large population of Nubian ibex (*Capra ibex*) at the En Gedi oasis near the Dead Sea is a relatively recent phenomenon that evolved during the last fifty years under rigorous legal protection and the accessibility of forage resources. Until the 1950s domestic animals used En Gedi oasis as pasture, and hunting pressure on the ibex was heavy. Ibex food sources during the dry season have mostly been anthropogenic in origin, i.e., irrigated areas in the Nature Reserve, a plot of cultivated grasses at the border of the reserve, fields, plantations, gardens, and lawns. Ibex

populations have been relatively stable at En Gedi during the last two decades. According to annual censuses taken during September–October, the ibex population was 201 ± 59 during 1980–1984 and 221 ± 48 during 1985–1990. During the drought years 1999–2002, the population reached 233 ± 16 individuals. The results of individual censuses of adult females and kids taken 5 or 6 times per month in April and May during 1993–1998 revealed that the ratio of juveniles to females ranged from 0.44 ± 0.13 in 1993 to 0.71 ± 0.11 in 1995. The combination of nature conservation objectives and the reduction in food sources over the last few years has necessitated a new management policy, which includes the restoration of the native vegetation (trees and shrubs of Sudanese origin), mainly in formerly agricultural areas near the oasis, as a strategic long-term goal.

Preventing bird hazards in airfields with Border-collie dogs

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Airfields are favored places for many bird species because they offer a habitat that is relatively rich in food resources and free from the threat of predation. Bird strikes during aircraft takeoff and landings are one of the main hazards of commercial and military aviation. One of the newest and most promising methods of managing bird hazards is the utilization of trained Border-collie dogs. These dogs, which are selected for "intelligence," physical stamina, and strong herding instinct, impose a non-lethal, yet real threat to birds, thereby overcoming habituation, which is the main limitation of most other harassment and control methods. In February 2002, a Border-collie control program was initiated at three major Israeli Air Force bases. The efficacy of the program was monitored through detailed observations of bird populations. Data collected over a nine-month period have shown a decrease of approximately 50% in bird species diversity (calculated by Simpson's index). This reduction is due to the local disappearances of approximately 20% of the species and a deviation from proportional parity among species. The results also indicate that some bird populations exhibit a shift in spatial activity patterns. Significantly, the number of bird strikes at these airfields was reduced by more than 50%, and no damaging bird strikes have occurred since the commencement of the program. These preliminary results demonstrate the effectiveness of the Border-collie control program.

Roosting and foraging activity in breeding female Hemprich's long-eared bats

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Females of desert-dwelling insectivorous bats may be exposed to conditions requiring high-energy expenditure during reproduction, especially during lactation. We examined the relative magnitudes of some behavioral and physiological mechanisms used by Hemprich's long-eared bats (*Otonycteris hemprichi*) to manage their energy balance during reproduction in the Negev Desert, Israel. We used radio telemetry to track their activity and measure body temperature. Micro-dataloggers were used to measure roost temperatures. We found two concentrations of roosts, one 2 km and one 8 km from the main foraging and drinking site of the bats. Our data suggest that this species is a central place forager, i.e., towards the end of pregnancy and during lactation, bats using the distant roost had a single prolonged bout of foraging each night, although the 2-km group foraged for several short bouts. Exit times and foraging bouts varied among days

and among individuals. Roost sites used from late pregnancy to the end of lactation were changed frequently and were unisexual with 3–5 females per roost. The roosts differed in temperature regime with temperatures ranging between 20 and 40 ºC from May to September. The roost with the highest daily mean temperature and the largest daily-temperature amplitude was occupied for the longest time. Preliminary results suggest that bats did not become torpid during lactation.

Suicidal breeding migration during the reproduction cycle of *Salamandra salamandra infraimmaculata* in a xeric habitat

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Salamandra salamandra infraimmaculata breeds in different habitats and its populations in northern Israel have been studied for the last 20 years. This salamander, as many other terrestrial amphibians, migrates to its breeding sites, and subsequently returns to its terrestrial habitat. It is capable of breeding in all types of freshwater habitats (e.g., winter pools, streams, springs, and rock pools). One xeric-habitat rock-pool hole (RPH1) was studied for 12 years. RPH1 has narrow entrances and, therefore, salamanders are unable to exit it. During the study period, RPH1 was never observed to be full of water. Adult salamanders were always found among the rocks. The quantity of water in the RPH1 and in the other breeding pond studied (RPH2) provided suitable breeding sites within the same area. In both breeding locations, the water quality was suitable for larval growth during the winter, but the holes dried up during the summer once the larvae completed their metamorphosis. Some of the adult salamanders that migrated to breed in RPH1 died after a few months or, at most, a year. The adult population in RPH1 was large during winter and spring (December to April) and decreased in summer. Average body weights decreased significantly in spring and summer. Dead salamanders were only found in RPH1, while no adult salamanders were ever found in RPH2 except during the breeding period. We suggest that salamanders migrate to RPH1-like sites to breed, and consequently die, due to their instinctive urge to colonize new habitats. Breeding in new locations is a very important adaptation to existence in xeric habitats, where breeding success is unpredictable.

Structure and efficiency of defensive behaviors of social voles (*Microtus socialis*) and common spiny mice (*Acomys cahirinus*) exposed to barn-owl (*Tyto alba*) attacks

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Defensive behavior in close encounters was studied in voles and common spiny mice that were exposed to barn owls. Voles tended to switch abruptly between “freeze” and “flee” behaviors, whereas spiny mice ambulated nimbly, with frequent and sudden changes in direction. The voles ceased their locomotion regardless of their orientation relative to the owl, whereas spiny mice oriented themselves towards the owl upon stopping their movement. These differences in behavior affect the outcome of the encounter since the owl cannot always spot the inactive vole, but can easily spot the spiny mouse during his orientation movements. I propose that a specific defensive response depends on the integration of several stimuli, and that individual traits in anti-predator response may have ecological effects. My results do not support models suggesting that each specific response is a result of a specific stimulus.

Density-dependent effects of the predator *Notonecta maculata* on species diversity in artificial pools: Testing the intermediate-disturbance hypothesis

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According to the intermediate-disturbance hypothesis, diversity should peak at intermediate levels of environmental disturbance. Predation, which can be thought of as a disturbance, may thus cause the highest diversity at intermediate predator densities. We tested this hypothesis in an experimental temporary pool community with the aquatic predatory true bug *Notonecta maculata*. *Notonecta* prefers large prey such as the cladoceran *Daphnia* over smaller prey such as the intermediate-sized cladoceran *Moina*. We expected that at intermediate densities, *Notonecta* would reduce densities of its preferred prey, which in turn would release the less preferred species from competition, thus increasing species diversity. At higher predator densities, with the depletion of the preferred prey, we expected a shift in predation towards the less preferred species. This would lead to decreased diversity. In artificial pools (volume = ~30 l water), we established a community of crustaceans, and then added 0, 1, 2, or 4 *Notonecta* nymphs. After 11 weeks, species diversity, as estimated by the Shannon–Weiner index, increased from 0 *Notonecta*-per-pool to 2 *Notonecta*-per-pool density, with a statistically insignificant decrease at the 4 *Notonecta*-per-pool density. At the population level, predator density had the largest effect on large and intermediate-sized cladocerans, with *Daphnia* decreasing and *Moina* densities increasing with *Notonecta* density. Despite the opposite trends of *Daphnia* and *Moina*, there was no statistically significant relationship between them. Thus, the increase in *Moina* densities was apparently through an indirect effect of the predator on the community. Because the drop in species diversity at the highest predator density was not statistically significant, the results failed to support conclusively the intermediate-disturbance hypothesis. However, the outcome of this experiment, which simulates the conditions in natural pools with relatively short hydroperiods, does not necessarily imply a total rejection of this hypothesis for *Notonecta*. Longer durations and higher predator densities, typical of pools with long hydroperiods, may ultimately reduce densities of the less preferred prey species, leading to low species diversity at high densities.

Wing morphology and foraging strategy in an insectivorous bat community in the Negev highlands

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We assessed the statistical relationships between wing morphometrics and foraging space in a community of insectivorous bat species in the Negev highlands. Bats were captured using mist nets and their wings were digitally photographed for morphometric analysis. Foraging mode and space were quantified by analysis of the capture site in a three-dimensional space of audio and visual observations. We examined three morphometric variables (wing loading, aspect ratio, and wingtip shape index) with respect to foraging space and mode. There were significant differences in all three variables among the seven bat species examined. Wing loading and aspect ratio for all species were significantly correlated with vegetation density. The results support the hypothesis that each species is characterized by a particular wing morphology and flight mode, which in turn are associated with its feeding mode and foraging-space use. Thus, predictions can be made regarding resource partitioning, habitat use, and community structure, as well as about responses of the bat community to natural or anthropogenic changes in their habitat.

Nitric oxide mediates brood patch function in egg rewarming during incubation

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Avian embryos lack the ability to thermoregulate effectively. The incubating parents maintain eggs and embryos at a relatively constant temperature, although egg temperature (Te) varies when they are off the nest. Birds can regulate heat transfer to and from eggs through the brood patch (BP). Nitric oxide (NO), which is produced in living tissues in minute quantities by nitric-oxide synthase (NOS), is a known vasodilator. It may, therefore, be involved in regulating Te through controlling the blood flow of the BP. We tested the hypothesis that the incubating parent uses NO as a cue for thermoregulation of Te. In incubating barn-owl (*Tyto alba*) eggs, we measured Te and the temperature at the contact between the BP and the egg surface (Tbp). The measurements were made during control periods as well as following injections of 40 mg/kg of the NOS inhibitor, N^G-nitro-L-arginine methyl ester (L-NAME). Following off-nest periods, we calculated the rate constant of rewarming the egg surface (k min^{-1}) after returning to incubate and the steady state Tbp. Injections of L-NAME significantly reduced the rate constant of rewarming the eggs from $k = 0.41$ $min^{-1} \pm 0.02$ SE to $k = 0.25$ $min^{-1} \pm 0.01$ SE (n = 18, $p << 0.001$), but had no effect on Tbp (37.2 ºC ± 0.2 SE vs. 36.9 ºC ± 0.3 SE, n =18). We conclude that NO production in the BP is one of the mechanisms involved in egg rewarming kinetics.

Fish assemblages of shallow and sandy Mediterranean shores: Are they affected by thermal effluents of electric power stations?

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Fish assemblages of the shallow and sandy Mediterranean shores of Israel were sampled between November 2000 and July 2002 using beach seines. Five sites were studied (three in close proximity to thermal effluents of electric power stations and two control sites). A total of 42 species, representing 24 families, were collected. Of these, nine species were Lessepsian migrants of Red Sea origin and one species (*Oreochromis cf. aureus*) was an aquaculture escapee. Thirty species used this habitat only as a nursery ground. Fish assemblages varied greatly among sites. There was no significant difference between the thermally affected and unaffected sites as far as numbers of individuals, numbers of species, and biomass per sample were concerned. This lack of difference may be attributed to the combination of the highly dynamic temporal and spatial nature of the assemblages and the fact that heat from thermal effluents only affects small areas and dissipates quickly.

Roadkills and utilization of under-road passes by animals: A preliminary survey

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Many animals are killed while traversing roads. Roads also cause fragmentation of ecosystems. We characterized species composition of roadkill and studied patterns of utilization of under-road culverts by animals. Twice a month, four roads in the Carmel region and their culverts were surveyed for two consecutive days. About 120 mammalian corpses were counted, most of them dogs, cats, and jackals, but some belonging to rarer species, such as the Eurasian badger. There were no differences between roads in the number of roadkills per unit length. Mortality on roads

with a concrete partition was higher than on roads without one. Mortality was lower in the vicinity of culverts. Most mammals utilized culverts of all forms, but preferred large rectangular passages over pipes. To reduce the adverse effects on animal populations, it is recommended to build many large rectangular passages, fence the roads in a way that will lead the animals to the passages, and minimize the number of concrete partitions.

Interpopulation differences in water-seeking behavior in *Bufo viridis*

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Large interspecific variations have been recorded among terrestrial amphibians in the degree of dehydration needed to evoke a consistent water absorption response. It has been suggested that these differences reflect the variation in the use of opportunistic hydration. Because each of the species studied so far had a fairly narrow ecological niche, it was of interest to study the responses in a species that occupies a wide range of climatic conditions. Such a study would allow us to determine whether the variation is species specific or correlated with habitat. The Eurasian green toad, *Bufo viridis,* which is found throughout the steep north–south gradient of increasing aridity in Israel, provides us with such an opportunity. The frequency of the water-seeking response (WR) in fully hydrated toads and the sensitivity of WR to raised plasma osmolality were determined in samples collected from three sites in Israel, one site in northwest Italy, and one site in north Kyrgyzstan. The sites were characterized by three climatic attributes: altitude, mean annual temperature, and total annual rainfall. The toads were acclimated to laboratory conditions for two weeks during which they were provided with a bath and a dry area. Individual bladder-emptied toads, which had been taken from the dry area, were introduced into observation chambers containing a dry filter-paper disc and one saturated with distilled water. A negative correlation was found between WR frequency and annual rainfall. It is concluded that increased WR rates, i.e., a heightened ability to utilize opportunistic hydration, is an adaptation to aridity.

Bird-species composition in the Hula Nature Reserve

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Bird assemblages are an important management concern in the Hula Nature Reserve and, hence, the assemblages have been monitored intensively for over 20 years. The more than 40,000 records that have accumulated so far were used in a redundancy analysis to study patterns of change in species composition over time. Temporal changes in composition were statistically significant, but time accounted for only 2% of total variance.

Predation-dependent selection of habitat for oviposition by the mosquito *Culiseta longiareolata*: A test of competing hypotheses

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We investigated the mechanism underlying oviposition habitat selection (OHS) in the mosquito *Culiseta longiareolata*. Because of the trade-off between predation risk and the detrimental effects of density, OHS in this species allows us to test two competing alternatives: (1) a polymorphic scenario, in which a fixed proportion of females consistently avoids "predator pools," while the remainder oviposit at random, and (2) a monomorphic scenario, in which all females oviposit in

"predator pools" with a certain probability. By using a simple experimental design, whereby predator incidence (i.e., proportion of pools that contain the predator) in the artificial pools is alternated between 0.25 and 0.75, we were able to distinguish between the two scenarios. Given the proportional use by ovipositing females in predator-free pools under each treatment and a bootstrap estimate of the ratio of daily oviposition rates, we find the monomorphic scenario twice as likely as the polymorphic one.

Negev Desert rodents do not produce allantoin when deprived of water but the fat sand rat (*Psammomys obesus*) excretes sodium oxalate

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Several gerbilline and cricetomyine rodents from the Namib Desert excrete allantoin precipitate in their urine during water deprivation. Shifting nitrogen excretion from urea to allantoin saves water. This phenomenon has not been reported in other species, and it is not known whether this trait is common to desert rodents, or whether it is unique to some Namib species. We found no allantoin precipitate in the urine of any of five water-deprived rodents from the Negev Desert. There was no discernable precipitate in the urine of *Gerbillus andersoni allenbyi, G. pyramidum*, or *Acomys cahirinus*. Sodium oxalate was found in both precipitate and liquid urine of *Psammomys obesus*, and the yet unidentified precipitate in the urine of *G. dasyurus* was not allantoin. Thus, not all gerbilline rodents have the capacity to produce allantoin. The metabolic pathway for allantoin has yet to be described.

Gall-forming aphids as tree architects

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The aphid *Baizongia pistaciae* (Pemphigidae; Fordinae) forms large, horn-shaped galls on apical buds of *Pistacia palaestina* (Anacardiaceae). The gall often arrests the elongation of the shoot, but in subsequent years the plant may compensate by growing numerous shoots from axillary and dormant buds. The purpose of this study, which was carried out in the Judean hills, was to examine the effect of *B. pistaciae* galls on host-tree architecture, growth, and fruit yield. In each of eight trees we labeled pairs of branches, one branch carrying a gall that had been induced in the previous year; the other gall-free. In August, when the current year growth ended, we recorded the presence of lateral shoots, the number and total length of shoots, the total number of leaves, and estimated the dry mass. These parameters were examined in the first and the second year after gall formation. In the second year we weighed all the fruits from paired branches. Galled branches produced lateral shoots significantly more often than ungalled branches, both in the first and the second year after gall formation, suggesting long-term effects of *B. pistaciae* galls on tree architecture. The number of lateral shoots, their total length, and number of leaves were significantly higher in galled branches (overcompensation). Fruit yield was not affected. The positive effects of the galls on shoot growth indicate that the relationship of *B. pistaciae* galls to the host tree cannot be described as merely parasitic.

Do plants mimic insects as defense against herbivory?

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Some plants mimic animals. For example, orchids mimic insects for the purpose of pollination. Mimicry as part of the defense mechanisms against herbivory is less thoroughly documented; the best-known cases are the stone mimicry found in *Lithops* species and the insect-egg mimicry in *Passiflora*. We here describe three novel types of insect mimicry in plants. In the first type, the epidermis of stems, branches, and petioles of *Xanthium trumarium* (Asteraceae), as well as the petioles and inflorescence stems of *Arisarum vulgare* (Araceae), are covered by dark spots and flecks usually 2–10 mm in length that resemble ants in both size and shape. To the human eye, the shoots of these two species appear to be covered by swarming ants. In the second type, the dark anthers of *Paspalum paspaloides* (= *P. distichum*) (Poaceae) resemble aphids in size, shape, and color, and they sway in the wind like swiveling aphids. Similarly, the stems of *Alcea setosa* (Malvaceae) are covered with dark flecks that look like aphids. In the third type, immature pods of three wild annual legumes (*Lathyrus ochrus*, *Pisum fulvum*, and *Vicia peregrina*) have conspicuous reddish spots that appear to mimic caterpillars. All these morphological traits may serve as herbivore repellents.

Sexual conflict in the subsocial spider *Stegodyphus lineatus* predicts sex-specific investment into body parts under high and low population densities

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In the spider *Stegodyphus lineatus*, infanticidal males fight with egg-guarding females over mating opportunities. Winning males destroy the eggs and mate with the female, thus siring half of the offspring in the replacement clutch. The outcome of the fight is influenced by the size of the cephalothorax of the contestants. The investment in "armament" (i.e., cephalothorax) may be traded-off against the investment in abdomen size, which reduces female fecundity and male longevity. The payoffs to both sexes will depend on the encounter rates, which are assumed to be a function of population density. Both sexes are expected to adjust their resource investment in different body parts accordingly. We tested this hypothesis in two genetically distinct populations of *S. lineatus*, which are characterized by extreme differences in population densities. We found that (1) males had larger cephalothorax/body size ratios (CBSR) than females, (2) males from the low density population had a larger CBSR than males from the high density population, and (3) females from the high density population had a larger CBSR than females from the low density population. The results agree with predictions derived from sexual-conflict theory, and suggest the existence of an interaction between sexual conflict and life-history traits.

Planning for biodiversity: Role of EIA in Israel

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Environmental Impact Assessment (EIA) is the process of determining the potential environmental consequences of development schemes. Since EIA was implemented in Israel in 1982, use of Environmental Impact Statements (EIS) has greatly increased. However, the ability of the EIA to address the ecological impact of development has not been investigated yet. We studied the ecological component of the Israeli EIA system by reviewing 50 EISs produced since 1995, as

well as the corresponding guidelines issued by the Ministry of Environment. Baseline information contained descriptions of landscapes and, frequently, also inventory lists of vascular plants and vertebrates. It lacked, however, any meaningful quantitative data. The majority of EISs specified potential ecological impacts, but failed to quantify these effects, and only a few of them attempted to predict outcomes at the ecosystem level. Apparently, failure of many of the EISs to undertake field surveys and their qualitative character hampered meaningful impact prediction. Most EISs mentioned the need for mitigation measures, but did not provide any description as to what these measures might be, nor their likelihood of success. Most of these shortcomings were already apparent in the guidelines issued by the Ministry of Environment. The upgrading of ecological-impact assessments and the promotion of biodiversity conservation in Israel is predicated on the quality of the ministerial ecological guidelines.

Central-place foraging for self-feeding and offspring feeding: Alternative patch use by parent Palestine sunbirds

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Despite important implications for the evolution of central-place foraging strategies, most studies have not addressed decisions regarding food selection by parents for their own consumption, on the one hand, versus decisions driven by the need to provision the young, on the other. Parent Palestine sunbirds (*Nectarinia osea*) consume nectar and arthropods, but feed only arthropods to their young. This separation of food types allowed us to test trade-offs in the foraging efforts of parent Palestine sunbirds between patches containing nectar for self-feeding and patches with nectar for self-feeding in addition to arthropods for provisioning young. At one side of their territory, parents were offered a variable patch containing a sucrose solution that varied in concentration between 0.25 and 0.75 mol/kg in the different experiments. At the other side of their territory, they were offered a constant patch with a feeder containing a 0.25 mol/kg sucrose solution and a dish of flies. The artificial increase in the sucrose concentration at the variable patch caused parents to consume greater amounts of sucrose solution from this patch, to collect more flies from the constant patch to feed their young, and to use persistently the 0.25 mol/kg feeder near the fly dish. By gradually changing the sucrose concentration in the variable patch, we found that it needed to be 0.47 mol/kg and 0.55 mol/kg for males and females, respectively, to cause them to spend an equal amount of time foraging at both the variable and the constant sites. These significant differences in sucrose-concentration choice by parents of opposite sexes reflect the fact that females are the main food providers for the young, whereas males provide mostly defense against predators.

Genetic isolation of gall-inducing aphids (Fordini) on *Pistacia* trees in a mosaic landscape

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Many species have a metapopulation structure, i.e., they consist of an assemblage of ephemeral local subpopulations (demes) that persist over time in a dynamic equilibrium between local extinctions and recolonizations. Dispersal of individuals permits colonization of suitable empty

patches and gene flow between subpopulations. Galling aphids on *Pistacia* trees can be considered as metapopulations. We used a genetic approach to estimate the number of successful migrants per generation (Nm) from Wright's F statistic. By using random amplification of polymorphic DNA with the polymerase chain reaction (RAPD-PCR), we identified 42 molecular markers in a sample of 117 galls of *Baizongia pistaciae* from 9 *Pistacia palaestina* trees at 4 sites (Avivim and Shomera in the Galilee, Qiryat Tiv'on near Mount Carmel, and Bet Shemesh on the western slopes of the Judean hills). Patch size was defined a priori as the minimal area that permits a genetically distinct deme to be maintained by genetic drift alone (Nm < 1 between neighboring demes). We found that trees separated by more than 50 m hold different subpopulations. The life cycle of the aphids within a subpopulation requires a patch to be a structured area, containing both primary and secondary hosts (*Pistacia* trees and grasses belonging to Poaceae). As far as larger geographic distances are concerned, we found no correlation between gene flow and geographic distances (Nm < 1 in all cases). These results may be explained by assuming that active short-range dispersal is more important than the passive long-range transfer of winged aphids by the wind.

Relationships among indices of body size

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We analyzed intraspecific correlations between body mass, and dental and cranial traits in carnivores, in order to identify correlated body-size indices that might be used as surrogates for one another. We used data from 7,966 individuals belonging to 23 species from 7 families. Dental and cranial traits were all significantly and positively inter-correlated for all species, r^2 values ranging from 0.14 to 0.91 (mean = 0.60). Eighty-one percent of the correlations between dental or cranial traits, on the one hand, and body mass, on the other, were significantly and positively correlated. The highest correlations were between the upper and lower carnassials, all other traits showing virtually no significant differences in r^2. Coefficients of determination between mass and cranio-dental traits were significantly weaker than those within cranio-dental traits. Correlation coefficients varied among carnivore families. There was a negative interspecific correlation between average species body mass and the coefficients of determination for carnassials and the condylo-basal length/canine diameter. There was no difference in r^2 values between the carnassials of omnivorous and carnivorous species.

Beetles at the "Evolution Canyon" microsite, Mount Carmel, Israel

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We studied the biodiversity of beetles at "Evolution Canyon," lower Nahal Oren (32º43′N; 34º58′E), Mt. Carmel, Israel. So far, in an area of 7,000 m^2 we recorded 644 beetle species belonging to 57 families. From January 1995 to January 1998, beetles were collected at two-week intervals on both slopes and from the valley bottom. Equal effort was invested in the collection on both slopes. Our estimates of species richness are underestimates because there are still families that have not yet been analyzed, several ecological niches (e.g., bird nests) have not been sampled yet, and some species may not be represented in our samples due to their rarity. So far, our collections at the microsite contain about 17% of all beetle species in the fauna of Israel. The family with the highest representation is Dermestidae (35% of its Israeli species were found at the

site); the one with the lowest representation is Tenebrionidae (13%). So far, 36 species are known in Israel only from this microsite and, hence, they represent new records for Israel. At the microsite, beetles seem to be significantly more prevalent on the south-facing slope (407 species) than on the opposite slope (345 species). At the family level, the interslope difference was only significant in family Scarabaeidae.

Social structure and synchrony in bottlenose dolphins (*Tursiops truncatus*) at the "Dolphin Reef" in Elat

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Cooperative coordination is widespread in animals in contexts such as courtship, aggression, and hunting. Addressing the questions of why and how to cooperate, current theories focus on the individual perspective and ignore social aspects. An alternative approach addresses cooperation as an intrinsically social behavior in which participants act together and influence each other. Hence, the behavior itself is incorporated into the proximate causes of cooperation with respect to motivation and rewards. The aim of our research was to document and analyze social dimensions of cooperative behavior in the bottlenose dolphin (*Tursiops truncatus*), a species known for coordinating behaviors that include swimming, hunting, and courting. The study group consisted of 13 dolphins living in a semi-free marine enclosure at the "Dolphin Reef," Elat, Israel. In the first stage of our study, we documented the social structure as well as synchrony levels among individuals. The half-weight index was used to assess the spatial closeness of individuals within a community. Association patterns varied greatly between sexes and among age categories. Using four levels of synchrony in breathing, we found a positive correlation between association levels and synchrony levels.

Effects of gas composition and eggshell covering on the expression of nitric oxide synthase and the development of blood vessels in the chorioallantoic membrane of the avian embryo

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Endothelial nitric oxide synthase releases NO, which induces vasodilatation and is converted into nitrate (NO_3^-) in living tissue. To establish its role in the respiratory organ of the avian embryo, the chorioallantoic membrane (CAM), we measured fresh CAM mass, length density of CAM blood vessels, and NO_3^- concentration and content in CAM of incubated chicken eggs (1) on days 10–20 of incubation, (2) after covering 20% of the shell (equivalent to brood-patch covering) (24 h; day 16), and (3) in 14% and 40% O_2 environments (24 h; day 16). We found that NO_3^- rose from 28 nM to 51 nM on days 10–15, and remained at about 51 nM on days 16–19. Length density of CAM blood vessels was lower (4.51 cm/cm^2) in the covered area as compared to the contralateral side (6.42 cm/cm^2) or control eggs (7.13 cm/cm^2). In 14% O_2, CAM mass rises above normal (2.1 g and 1.6 g, respectively) and NO_3^- decreases (38.54 nM and 51.66 M, respectively). In 40% O_2, CAM mass decreases (0.92 g) and NO_3^- increases (55 nM). The NO_3^- content in CAM in 14% O_2 is similar to that in the control (76.35 nM and 70.71 nM, respectively), while in 40% O_2 it is lower (49.92 nM). We have shown that significant changes in CAM morphometry and NO production occur both as a result of the atmosphere above the CAM and the age of the embryo.

Negative priority effects of early-breeding *Salamandra salamandra infraimaculata* on larval *Triturus vittatus vittatus*

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Little is known about mortality factors in banded newt, *Triturus vittatus vittatus* larvae. A survey of Sekher pond, Mount Carmel, indicated that larvae of late-breeding *T. v. vittatus* hatch towards the end of the larval developmental of early-breeding fire salamanders, *Salamandra salamandra infraimaculata*, resulting in a large size disparity between the larvae of the two species. The impacts of large *Salamandra* larvae on recently hatched *Triturus* larvae were assessed in an outdoor-artificial-pool experiment. We also assessed how artificial vegetation may influence larval *Triturus* performance in the presence or absence of *Salamandra* larvae. After seven days, 90% of *Triturus* larvae disappeared from pools devoid of vegetation. The reduction in the *Triturus* population was milder (70%) in pools containing *Salamandra* and artificial vegetation. The reduction is attributed to *Triturus* larvae being consumed by *Salamandra* larvae. *Salamandra* larvae exert a strong effect on invertebrate abundance by reducing densities of the primary prey species, the diaptomid copepod *Arctodiaptomus similes*, and by decreasing the abundance of egg rafts of the mosquito *Culiseta longiareolata*. *Triturus* snout-to-tail length at metamorphosis was significantly larger in pools with *Salamandra* than in those without, presumably due to a strong thinning effect. *Triturus* time to metamorphosis was affected significantly only by the initial size as measured at the onset of the experiment. Thus, early breeding in *Salamandra* negatively affects larval *Triturus* through both direct (predation) and indirect (decreasing food sources) priority effects.

A statistical look at the eye of the gecko

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The function of the vertebrate eye depends on its absolute size, which is presumably adapted to specific needs. We studied eye-size variation in lidless spectacled gecko lizards at taxonomic levels ranging from the intra-individual to the inter-specific. The study was based on 1,343 museum specimens belong to 52 species from the subfamilies Diplodactylinae and Gekkoninae. As far as the intra-individual level is concerned, eye size showed significant directional asymmetry in *Stenodactylus sthenodactylus*. A latitudinal study of four species confirmed that eye size undergoes negative allometry during postnatal ontogeny. Intraspecifically, in species with sexual size dimorphism, the larger sex (male or female) often possessed larger eyes in absolute terms but, due to body-plan isometry, not relative to head-and-body length. However, in *Gekko gecko,* the eyes of the females were smaller in absolute terms than those of the males, but were larger than those of the male when measured relative to head-and-body length. Moreover, even relative to the head length alone, the eyes of the females were larger than those of the males. Interspecifically, eye size exhibited negative allometry, with a slope differing from the intraspecific ontogenetic allometry. Finally, eye size was significantly larger in nocturnal than in diurnal species, and significantly larger in ground-dwelling than in climbing species.

Constitutive fratricide in porcupines

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Indian crested porcupines (*Hystrix indica*) are monogamous rodents, with both parents caring for the precocial offspring. Data on litter size and offspring survival were collected from animals in captivity. Thirty-three couples were observed for 5 years. The average litter size was 1.9 ± 0.8 (n = 132). Forty-four litters were of size 1, 59 of size 2, 25 of size 3, and 4 of size 4. Average porcupette weight was 307 ± 70 g (n = 25). All porcupettes in 4-cub litters died within 48 h after parturition. An interesting phenomenon was observed in 3-cub litters. At the end of the "licking phase" by the mother, the cubs did not immediately approach the nipples; instead two brothers proceeded to attack (bite) the third. All the while, the parents did not interfere. Only after the attacked porcupette was fatally incapacitated, did the attacking cubs proceed to suck milk from the mother. During the first hours after parturition, mothers were observed eating placental remains and nibbling on the flesh of the dead porcupette. For days after birth, the abandoned corpse accumulated bite marks (made by its brothers and mother). The lack of parental interference is most probably related to the limited ability of the parents to provide for the offspring. In the literature, mammal fratricide is considered a facultative phenomenon. My findings indicate that in porcupines, fratricide may be a constitutive phenomenon, i.e., whenever the litter size is 3, one brother will be killed by the other two. In birds, the killing of a nestling by an older nestmate is called "cainism." By extension, we coin the term "josephism" (see *Genesis* 37:20) for the behavior observed in porcupines.

***Lacerta media israelica* on Mount Carmel, Israel: Should supplemental release of captive-bred animals be contemplated?**

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Levant green lizard (*Lacerta media israelica*) populations are believed to be in decline in Israel for at least two decades. Main suspect causes are habitat destruction and fragmentation, insecticide use, and the anthropogenic increase in predators, such as crows and feral cats. A qualitative and quantitative herpetofaunal survey of Mount Carmel was carried out in 2001. The observation methodology included transections along trails, and mapping and documenting all active or hiding reptiles. Fourteen transects were trekked on eleven dates during May–June. Search effort totaled 48 h in search time and approximately 26 km in treks. We observed 325 reptiles from 24 different species (1 tortoise, 14 lizards, and 9 snakes). *L. m. israelica* were only observed three times. Study of literature, collection catalogues, and interviews with veteran researchers indicate that this lizard has always been relatively rare, although now it may be even rarer. The transect sampling method proved more efficient for compiling reptile-species lists than the plot-sampling method used by previous workers on Mount Carmel. A full report of the findings includes reservations concerning plans to create a breeding colony of *L. m. israelica* for the eventual supplementation of the population in the Carmel Nature Reserve. Such a colony must initially serve as a tool for studying the life history, ecology, behavior, and genetics of the subspecies, of which we know very little, and only then can a supplementation plan be conceived according to the guidelines of the IUCN.

Reproduction and water economy in the golden spiny mouse (*Acomys russatus*)

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Reproduction of mammals living in xeric ecosystems is limited to the time of year in which water is relatively abundant in its free form or in vegetation. While mammals living in predictable ecosystems may well benefit from timing their reproductive season according to an external cue,

such as photoperiod, in unpredictable ecosystems, such as deserts, the animals may need a more proximate signal. Water content, or the relative concentration of salt in vegetation, may provide this cue. We found that golden spiny mice (*Acomys russatus*), living in extreme deserts, will go into reproductive hiatus whenever salt concentration in their drinking water reaches 5%. In females, a reproductive hiatus means an imperforate vagina and a significant decrease in the mass of the ovaries and the uterus. In females treated with vasopressin (VP), a hormone whose levels are correlated with water stress, we found a significant decrease in body mass and uterus mass. Such females also exhibited an increased number of atretic ovarian follicles, as compared with saline-treated females. Surprisingly, VP also led to a significant decrease in renal medullary thickness. It is, thus, suggested that VP acts as a modulator linking the reproductive system with water economy.

Salinity and predator effects on oviposition site selection and community structure of mosquitoes in the Southern Dead Sea Basin

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In an artificial pool experiment, we studied mosquito oviposition habitat selection and community structure in response to salinity and presence of a predator, *Anisops couteirei* (Hemiptera: Notonectidae). The experiment was conducted in the Southern Dead Sea Basin, where salinity varies considerably among pools and *Anisops* is common. The presence or absence of *Anisops* was crossed with three salinity concentrations (0, 15, and 30 g/l NaCl), and each combination was replicated four times. The two most prevalent mosquito species found were *Aedes caspius* and *Culiseta longioreolata*. *C. longioreolata* egg rafts were oviposited only in fresh water (0% salinity), and 90% of them were found in the pools devoid of predators. The numbers of *A. caspius* eggs were found to be positively correlated with salinity. *A. caspius* oviposition was higher in non-predator pools at high and intermediate salinities, but the reverse was true in freshwater pools. Removal of *C. longioreolata* larvae from the freshwater pools with no predators caused an immediate increase in *A. caspius* oviposition in these pools. These results suggest that gravid female mosquitoes may take into account salt concentrations, as well as presence or absence of predators and competitors, when selecting an oviposition site.

Systematics of Middle-Eastern dwarf-snakes commonly assigned to *Eirenis coronella*

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Since 1978 the name *Eirenis coronella* has been used for a small dwarf-snake with 15 dorsal scale rows and beige ground color with dark transverse dorsal bands, and with a distribution from Sinai in the west to southeastern Iran in the east and from southern Turkey in the north to Saudi Arabia in the south. Two juveniles from Jordan having a distinct "crown" on the head and a dark ventral stripe stimulated a reexamination of *E. coronella* taxonomy. We examined 110 snakes from the entire distribution area, and analyzed the results for males and females separately by using principal coordinate analysis (PCO). The analysis divided the snakes into two main groups, which were accordingly given species status. The first species, *E. coronella*, comprises all the specimens from Sinai, Israel, and western Saudi Arabia, as well as some specimens from Jordan, Iraq, and Syria. Specimens from Sinai were given subspecies status, and specimens from western Saudi

Arabia retained their former subspecies status. The second species, *E. coronelloides*, is distinguished from *E. coronella* by crown, ventral stripe, or both, and comprises all specimens from Turkey, as well as the remaining specimens from Jordan, Iraq, and Syria. A scatter-diagram of ventrals against sub-caudals was found to distinguish between the two taxa almost diagnostically. The systematic status of the snakes from eastern Saudi Arabia and western Iran remains unresolved.

Microhabitat heterogeneity as a possible mechanism for species coexistence in temporary pools

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Immature individuals of the mosquito *Culiseta longiareolata* and the green toad *Bufo viridis* are common in temporary ponds. Despite their frequent co-occurence in nature, experimental studies have shown that they interact strongly and negatively through competition and intra-guild predation. Here, we examine microhabitat heterogeneity as a mechanism allowing co-existence. We conducted two similar artificial-pool experiments, except that in the first, water depth was even across the pool (10 cm), whereas in the second, the pools were tilted, thereby creating microhabitat heterogeneity, i.e., water depths ranged from 1 to 15 cm. Both *Bufo* and *Culiseta* larvae aggregated, yet when together, they tended to affect each other's aggregating behavior only in the single-depth experiment. Both *Bufo* and *Culiseta* preferred the deeper parts of the pools in the variable depth experiment. When *Culiseta* was present, fewer tadpoles were observed in the deep part of the pools. *Bufo* did not affect *Culiseta* preference for deep water. Fewer *Bufo* tadpoles survived in the presence of *Culiseta* larvae in the single-depth experiment, but no such effect was noticed when the pools were tilted. *Culiseta* reduced *Bufo* size at metamorphosis, but this negative effect was smaller in the tilted pools. These results support the hypothesis that habitat heterogeneity reduces the magnitude of the negative interactions between the two species.

Predicting species similarity in the land-snail fauna of Israel

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Variation in species composition among sites is a fundamental attribute of ecological communities. I tested the hypothesis that the degree of similarity in species composition among sites can be estimated from information on environmental and geographical distances. Based on recent theories integrating the concepts of ecological niche and dispersal limitation, I predicted that species similarity would decay with both environmental and geographical distance. The land-snail fauna of Israel served as a model system for this study. Field data were obtained from a sampling project that was designed to represent a wide range of environmental and geographical distances. Twenty-seven 1-km^2 sampling sites were sampled for species composition, and the data were summarized in a species-similarity matrix. A multiple regression model based on environmental and geographical distances showed that both types of distances had a significant effect on species similarity and explained 70% of the variance in species similarity among sites. A comparison of these results with data collected for birds at the same sites revealed that birds were characterized by a significantly lower rate of decline in species similarity with geographical distance. This finding is attributed to differences in dispersal ability between birds and snails.

Do ectoparasites harm their rodent host? An integrated approach of field and laboratory manipulations

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Parasitism is traditionally defined as an interspecific interaction, in which one species (the parasite) benefits, while the other species (the host) is harmed. While there is agreement as far as the benefit for the parasite is concerned, the impact on the host remains controversial. We studied the impact of ectoparasites on *Gerbillus andersoni allenbyi* under field and laboratory conditions. In the laboratory, we manipulated flea burden using three infestation levels: (1) no fleas, (2) natural flea burden, and (3) twice the natural burden. In the field, we manipulated ectoparasite burden over four months by applying an insecticide to randomly chosen individuals. Energy demands in adults in the laboratory, body mass in the laboratory and the field, and mobility and survival in the field were unaffected by natural ectoparasite load. However, under double flea burden, infested gerbils had higher energy demands and lost body mass faster than uninfested animals. In contrast to adults, body mass and survival rate decreased in infested juveniles. Our results suggest that under natural conditions ectoparasites predominantly affect the young. The effect on juvenile survival may reduce population growth rate.

Diversity and composition of wintering bird assemblies in semi-desert habitats

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Birds experience drastic changes in the physical and biotic environments between the breeding and non-breeding periods. The determinants of habitat selection and the mechanisms that shape the structure of species assemblies during the non-breeding periods are poorly understood. We sampled species composition and associated habitat characteristics in non-breeding wintering granivorous passerines at several locations in the northern Negev Desert, Israel. We also characterized species-specific foraging behavior by direct observation and experimental manipulation. We show that the number of non-breeding granivorous bird species wintering in open semi-desert habitats is positively correlated with an index of productivity. We also show that species composition in a patch is significantly correlated with habitat structure. We suggest that patch productivity may influence total bird biomass, while the structural characteristics of the habitat may determine the identities of the species using the particular patch. Indeed, habitat architecture may influence resource abundance and distribution, as well as the risk of predation. Our evidence supports the hypothesis that species divide the habitat according to trade-offs based on differential perceptions of predation risks.

Novelties in the herpetofauna of Israel since 1985

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The last scientific review of the herpetofauna of Israel, updated to 1985, appeared in *The Zoogeography of Israel* in 1988. Subsequent changes warrant summary as follows. Promotion to species level: *Mauremys rivulata* (formerly *M. caspica rivulata*); *Ptyodactylus guttatus, P. hasselquistii,* and *P. puiseuxi* (formerly subspecies of *P. hasselquistii); Cerastes cerastes* and

C. gasperettii (formerly subspecies of *C. cerastes*). New taxa: *Hyla* sp. (formerly part of *H. savignyi*, also present); *Testudo werneri* (formerly part of *T. kleinmanni*, now extralimital); *Acanthodactylus beershebensis* (formerly part of *A. pardalis*, extralimital); *Eirenis levantinus* (formerly part of *E. modestus*, extralimital); *Cerastes gasperettii mendelssohni* (formerly within *C. gasperettii*). Newly validated existing names: *Rana bedriagae (*formerly part of *R. ridibunda,* extralimital); *Tropiocolotes nattereri* (formerly part of *T. steudneri,* extralimital); *Ablepharus rueppelli rueppelli* and *A. r. festae* (formerly parts of *A. kitaibelii,* extralimital); *Acanthodactylus* cf. *longipes* (formerly part of *A. scutellatus,* also present); *Lacerta media israelica* (formerly part of *L. trilineata,* extralimital). New or resurrected genus names: *Mediodactylus kotschyi orientalis, M. amictopholis,* and *Cyrtopodion scabrum* (formerly within *Cyrtodactylus*); *Laudakia stellio, Trapelus pallidus, T. savignyi,* and *Pseudotrapelus sinaitus* (formerly within *Agama*). New to Israel through corrected identification: *Coluber sinai* (formerly considered *C. elegantissimus*, also present).

A new record of *Aedes albopictus* in Israel and the disappearance of *Aedes aegypti*

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A survey of adult mosquitoes by the Ministry of the Environment in 2002 (~50 years after the disappearance of *Aedes aegypti*) was the first to reveal the presence of *Aedes albopictus* in Israel. Both these *Aedes* species are outstandingly endophilic and anthropophilic, breeding in containers or small water bodies and possessing eggs that can withstand dessication. Adults are active during daytime and their flying range is short. *A. aegypti*, a vector of yellow fever and dengue, is distributed in the tropics and subtropics and bred in Israel in the coastal plain and the Jordan Valley until the 1950s. The decrease in the use of water jars, the improved supply of piped water, and the use of DDT and other insecticides are possible reasons for the disappearance of *A. aegypti*. *A. albopictus*, a vector of dengue and West Nile virus, invaded North and South America from southeast Asia, and since the 1980s has reached several European countries via imported tires. *A. albopictus* was first found breeding in used tires in Ginnaton near Ben-Gurion airport at Lod. Subsequent findings were from the Modi'in area, Tel Aviv, Hadera, Kordani, and Kabri, indicating that it has adapted to the local conditions and has extended its distribution range.