"Research, nature conservation, and education in zoos" – a glimpse at the course projects

In our Spring newsletter we wrote about the new course, "Research, nature conservation, and education in zoos", in which the students carry out projects in the Zoological Garden. They had to choose one of two types of project: either designing a new exhibition in order to improve the animals' welfare; or planning and implementing an enrichment tool in order to add interest to the animals' daily routine, stimulate their senses, and cause them to be more active. In each of the projects the students learned about the animals they were working with and worked in full cooperation with the animal keepers. Here is a glimpse at three of the projects.
**Enrichment for the fennec foxes** - the students Orr Atalai, Amit Shauly, Enav Marcus, and Shir Goldovsky chose to prepare enrichment tools for our two groups of fennec foxes. They observed the fennecs' behavior, learned about them, consulted Ehud Katzir, their keeper, and then planned and implemented several successful enrichment tools.

- **"Ice lollies"** – made of frozen fruits and vegetables. The ice lollies were served on hot days and helped the fennecs to cool themselves.

- **"Insect lettuce"** – a lettuce in which various arthropods were hidden. The fennecs had to take the lettuce apart and find the delicious food items.

- **"Surprise box"** – full of sand and "surprises" (eggs and insects). The fennecs had to dig in the sand (a natural behavior that we want to encourage) and use their sense of smell in order to reach the delicacies.

- **"Insect mobile"** – a plastic bottle with tiny holes, hung high and from which, when it moves, small arthropods fall. The purpose of the mobile is to encourage the fennecs to move their body, run, and jump high, as though they are hunting flying insects in nature.

**Enrichment for the golden spiny mice** – the students Idan Friedman, Amit Deligdish, Mariana Badarny, and Roi Gerstel carried out their project in the golden spiny mice exhibition in the reptile yard. They observed the spiny mice

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behavior, learned about the exhibition structure and ways to improve it, consulted Barak Levi, the spiny mice keeper, and together they planned and built several simple enrichment tools that the spiny mice quickly used, including the two described below.

- **"A ladder"** on which a bowl with root vegetables is placed. The spiny mice have to locate the food with their sense of smell and then climb the ladder in order to reach the desired food. The ladder presents an interesting and challenging food stand.

- **New "houses"** in long and thick bamboo poles. The houses are safe and warm and their size fits the small spiny mice. The partitions between the sections enable every spiny mouse to find a place of its own, and the material that was chosen – bamboo – encourages chewing, which is very important for maintaining normal growth of the mice’ teeth.

**A new mixed exhibition: a coypu and porcupines** - The project undertaken by Liana Yones, Yara Halabi, and Adan Miari was to plan the connection of the coypu exhibition with that of the porcupines. The students learned about the biology of the two species and their specific needs and designed a joint exhibition that is suitable for both. The students only needed to plan it, but when they started to work we decided to actually carry out the connection. Thus, after the metal works and earthworks were completed and the water pools had been treated, the students, with the help of the keeper Emanuel Bar, were involved in joining the coypu with the porcupines and in observing their behavior in the shared enclosure. A large amount of soil was introduced into the exhibition, in which peanuts, potatoes, onions, and various seeds were mixed, both to give the porcupines a reason to dig, and to grow vegetables in the enclosure. Several wooden logs were also
provided in order to make the terrain more variable. The porcupines enjoy gnawing at the logs, and the logs also prevent the soil from getting into the coyup's pond. Our main problem now is that the porcupines dig deep into the soil all over the enclosure and spend most of the daytime in their new burrows. There is no doubt that their living conditions have been improved, but now we have to find a way for the visitors to be able to see them. The plan is to get them accustomed to receiving desirable food only when visitors are in the Garden.

New research systems in the Zoological Garden

Dr Gal Ribak is currently building a new research system in the north-east area of the Zoological Garden, for studying the biomechanics and energetic cost of swimming in water birds. The system will comprise two large pools (3 and 12 cubic meters; in the meantime only the larger one has been built and is seen in the photographs), in which water birds will dive and their movements below water will be filmed. The large pool is a canal, one meter deep and 12 meters long, enabling shallow, horizontal underwater swimming conditions, and thus simulates the conditions of swimming along the lake bed in search of food. The shape of the pool directs the birds to swim in a straight line, at a constant depth and velocity, in front of very high-speed video cameras, enabling an exact
analysis of the swimmer's movements during stereotypic swimming. The smaller pool, which will arrive soon, is practically a vertical container in which the birds can dive down to two meters depth, enabling the researcher to study the diving phase of the birds from the surface to the bottom. In the first stage the system will be used to analyze the swimming movements of birds – both below and above the water's surface. In the future it will also be used to measure their metabolic rate during diving. From analysis of the birds' underwater feet movements, Dr Ribak's lab will investigate the swimming efficiency of various water birds (e.g., comparing dabbling ducks and diving ducks, grebes, and cormorants, etc.), and will develop models for estimating the energetic cost of swimming, according to swimming speed and diving depth. Following completion of the construction, the first to use the system will be seven ferruginous ducks (*Aythya nyroca*)that were especially brought over from a zoo in Germany. The ducks have already "made Aliyah", and in the meantime are participating in the reproductive effort of ferruginous ducks in the Jerusalem Biblical Zoo, in the hope of reintroducing this species back into the Israeli nature. In the past, ferruginous ducks nested in the Hula Valley and along the coastal plain, but today they are an endangered species here. The expectation is that in addition to acquiring basic knowledge, the research will also provide information on the ducks' needs in nature and raise awareness of the loss of habitat and of nesting areas of these ducks specifically, and of other water birds as well.

Another new research system has been built in the south-west area of the Zoological Garden. The system was designed for a new joint research by Prof. Noga Kronfeld-Schor's laboratory and researchers from Banaras Hindu University, sponsored by the ISF and The University Grants Commission, India (UGC). The research will study the influence of using artificial night lights on animals (light pollution), and will examine the consequences
of chronic exposure to light pollution in different wavelengths on diurnal and nocturnal mammals (golden spiny mice and Cairo spiny mice) and amphibians (eastern spadefoot). It will be conducted over three years, and examine the effect of exposure to artificial light on the health, reproduction success, and longevity of the investigated species. The aim is to formulate recommendations for minimizing the harm caused to the animals by the use of artificial night-lights.

**Graduation event of Sagol School**

The graduation event of undergraduate students of the Sagol School of Neuroscience took place in the Zoological Garden. About 150 students (first, second, and third year) arrived at the Garden to participate in the event. More than 50 posters illustrating the research projects of the graduate students were set out in a long row in front of the central pond of the Garden. The students presented their works and held stimulating scientific discussions beneath the herons nesting in the trees above. The top five posters won prizes. The students and many faculty members who joined them were given a tour of the Garden and learned about decision-making in birds (Prof. Arnon Lotem), mole rat movements (Prof. David Eilam), and active sensing in bats (PhD student Sasha Danilovich). Everyone left the Garden in the evening in good spirits and with a full stomach.
Zoological Garden newsflash

Thanks to our cooperation with other Israeli zoos, we received from the Zoological Garden Nahariya three **red-crested pochard** (*Netta rufina*) ducklings that had hatched in April-May. For the time being they are in an acclimation area, far from the visitors’ eyes. After they will develop a bit more and become used to their keeper, they will be moved to the water birds’ enclosure and later to the open grass area.

Sharped-eyed Rony Michlin discovered on one of the Garden's trees a **squacco heron** nest – a very rare event in our region. Rony asked Dr Eran Amichai to photograph the nest, so we now have documentation of the happy event.

The two **greylag goose** duckling, on which we reported in the Spring 2018 Garden News, are developing nicely and will soon be released onto the open grass area. As an intermediate stage, the keepers Hadar Yosifon and Ehud Katzir have built them a spacious acclimation area that is in partly on the pond bank and partly inside the water.
This year, as almost every year, the northern bald ibis have produced nestlings. The northern bald ibis is a critically endangered species, so any event of reproduction in captivity is very gladdening. Last July we were very happy to read that this bird is starting to return to Europe's skies.

**Surprise in a nest:** in the northern part of the main pond, near the water edge, we discovered a storks' nest. To our surprise, there were no eggs in the nest. Rather, there was a round and beautiful stone that the storks were incubating devotedly. If you look closely at the photograph you will have another surprise: the storks have used heron's wing as a building material.

**A cooling stone:** on one of the hot summer days we discovered that our squirrel uses one of the stones in the thicket aviary for cooling: it lies down on it with its entire body and thus cools itself.
The Society for the Protection of Nature in Israel children's birding group – annual summary

Anat Gal, the group's guide

This year we started the Tel Aviv birding group with a small group of promising young "girl ornithologists" in grades 2-4. The group has since grown somewhat and every week we met in a different area of Tel Aviv and looked for birds and nature. Sometimes the sun shone on us, sometimes we had a little rain, but in every weather we found its particular uniqueness and had a close encounter with nature. Occasionally, when we needed a real refuge, we found our home in the intriguing and inviting Zoological Garden, which was an important anchor for the group.

Head-Bird Birding Center ("Rosh Zipur") – a new birding park that was inaugurated in the Yarkon Park – has become an attraction center for us, and gradually also for the birds. Throughout the year we were lucky enough to see resident and migratory birds that have arrived to swim, bath, and eat in the lake: ducks, kingfishers, and turtle doves, with the highlight being about 50 white wagtails that had a crowded and excited bath.

In the migration season we made an effort to greet the newcomers that had arrived directly from the sea and landed on the hills of HaTsuk Beach. Birds of prey, shrikes, wheatears,
and bee-eaters played hide-and-seek with us among the sand dunes and the vegetation. We also visited the Yarkon estuary, near Tel Aviv port, where we discovered one of the group's most exciting finds: a roosting site of common starlings! Just before sunset we sat down on the grass in front of Reading Terminal and watched the starlings preparing for their night in a spectacular aerobatic dance above the city skyline.

But, of course, there is no place like home! When we didn't want to play hide-and-seek with the birds and instead to have a close look at them we were welcomed in the Zoological Garden. We shared the paths with storks and cranes, watched the endangered vultures and gulls nesting, and had close encounters with the abundance of birds. From the knowledge we had acquired we sought to give something back to the Garden's birds by planning unique feeders for them.

We are waiting impatiently for next year, when we will meet the scientists who carry out their research in the Zoological Garden, the various migratory birds in the Botanical Garden, and the birds that come to spend the winter at the Head-Bird Birding Center in particular and in the whole of Tel Aviv in general.

Sounds like fun? You are welcome to join our group!

For further details and registration: 052-4773977, hug.tzaporut@gmail.com
Evolution in action – gall midges on *Suaeda* plants

Two *Suaeda* species were planted recently in the 'En Gedi' oasis plot: *Suaeda vera* and *Suaeda fruticosa*, belonging to the family Amaranthaceae (until recently the Chenopodiaceae). The two species were used in a study conducted in Dr Netta Dorchin’s laboratory at the School of Zoology, in which insect-plant interactions in gall-inducing insects (gall midges) were examined.* Adult gall midges lay their eggs on or inside the plant tissues and the hatching larvae feed on the tissues and cause the development of the gall, in which they complete their development. Like most gall-forming insects, gall midges are specialists and usually induce galls on one species or several related species of plants. *Suaeda* species grow in salt marshes and deserts and are notoriously difficult to identify because different species are morphologically very similar. In some cases, the specific galls induced by gall midges on certain *Suaeda* species facilitate identification of the plants! During the study, the plants were exposed to gall midges in order to document the preference of the midges for egg-laying and the rates of success in gall development on different *Suaeda* species.

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In one case it was discovered that a gall-midge species that develops on *Suaeda asphaltica* and *Suaeda fruticosa* is in the process of splitting into two separate populations – each on its own host plant, which may eventually lead to the formation of two separate species. This is yet another (local) example of the importance of insect-plant interactions in generating biodiversity in nature.

* A gall is a controlled growth generated in plant tissues, usually as a result of insect activity.

**Tamarind – an African tree with an Indian name**

Tamarind (*Tamarindus indica*) has recently flowered in the medicinal plants section. It is a tropical tree of the family Leguminosae (Fabaceae). Despite its name, which comes from the phrase "Tamar Hindi" (the meaning in Arabic is Indian date), it originates in Africa. It would seem that the tree had arrived in India in the distant past, and from there to the rest of the world. The pulp that surrounds the seeds in the pods can be eaten, though it is very sour. The fruit is commonly used in Indian kitchens as well as in other cuisines around the world. It is used to prepare cooked dishes as well as drinks and sweets (when sugar is added). The fruit is a source of vitamin B3. We hope to enjoy these wonderful fruits after their flowering.
Home herbalism

How to prepare a therapeutic ointment, what is ‘infusing oil’, and which are the best plants to relieve a cough?

All these and more taught in a special seminar that took place in the Botanical Garden last June. The activity, which included a lecture and workshop, was held by the Israeli Association of Medicinal Plants, under the instruction of Boaz Zur, a certified herbalist.

In the Botanical Garden the participants were introduced to the different medicinal plants, some of which are native to Israel. Under Boaz’s guidance they prepared some special and useful remedies.

Warning: It is not advisable to practice herbal medicine at home without proper knowledge. Some plants are highly toxic and can be harmful!

Stay Healthy!

Thank you Eyar

Eyar Cohen completed his civil service in the Botanical Garden this July. Over the past year Eyar worked with our gardening team and was responsible for the Menashe medicinal plants collection. Eyar’s calm nature, along with his willingness to help and to learn, made him a great asset to the Garden. We thank him for his significant service and are certain that he will succeed wherever he goes.

Garden news are also available at our website
Revealing the hidden half

The 10th symposium of the International Society of Root Research (ISRR) was held in Israel in July 2018. Researchers from TAU Faculty of Life Sciences participated and also led one of the professional tours, which included a visit to the Root Research Laboratory in the Botanic Garden. The three-story building is a unique research facility in which plants can be grown while exposing their roots, thus allowing the study of various aspects of the structure and function of the plant world’s hidden half. The lab was initially established during the 1970s by the late Prof. Yoav Waisel, who was then the Director of the Botanic Garden and conceiver of the idea. At the time the lab was built it was the first facility of its kind in the world. Today, Prof. Amram Eshel directs the studies conducted in the lab, and he led the tour of the symposium participants.

The jackal invasion

The Botanic Garden presents a green open area, sustaining a semi-natural ecological system within the bustling urban space of ”Gush Dan”. As such, it attracts a variety of animals, some as permanent residents and others as visitors by day or by night. Among the latter are the jackals (golden jackal, Canis aureus), which enter the garden at nightfall and usually leave at dawn.

The jackals are social and playful mammals and their visits usually result in light damage to the irrigation pipes and trampled plants. This summer, however, the jackals strayed from their usual habits and caused heavy damage: one night they entered the Tropical House and dug out the vegetation planted around one of the pools, and on another night they found their way inside the cacti shed, where they overturned pots and tore the irrigation pipes.
Many animals seek food, reproduce, and nest in the Botanic Garden grounds. The presence of wild animals in proximity to humans is a nation-wide phenomenon that is on the increase, due to the reduction in natural habitat and the reduced availability of natural food sources. The conservation of open areas and ecological corridors is therefore essential for our future coexistence.

Follow-up

Add a little salt?
The Nile tamarisk (*Tamarix nilotica*) from the Yotvata region, which was planted last spring in the salt marsh collection of the Garden, has become well acclimatized. Salt tolerant plant species grow in the salt marsh habitat collection, and the Nile tamarisk is adapted to high levels of salinity in the ground. To make such species feel "at home", we periodically spread salt on the plot prior to irrigation. We thereby create a suitable environment for their development, and also reduce competition by invasive weeds, which are not adapted to such harsh conditions.

Garden news are also available at our [website](http://www.gardenwebsite.com)
Five kilograms of seeds

At the beginning of the summer, the gardeners' team gathered to separate the teff (*Eragrostis tef*) seeds from the sheaves that had been harvested in late spring. The tiny seeds stood out in their dark color against the bright plastic sheet used for threshing. After cleaning the chaff, a sack with numerous seeds remained, weighing only 5 kg.