



Annual Report

Academic year 2018/2019

**The George S. Wise
Faculty of Life Sciences**

- School of Zoology
- School of Plant Sciences
and Food Security

Sackler Faculty of Medicine

- Department of Anatomy
and Anthropology
- The Maurice and Gabriela
Goldschleger School of
Dental Medicine

**The Lester and Sally Entin
Faculty of Humanities**

- The Sonia and Marco Nadler
Institute of Archaeology
- Department of Archaeology
and Ancient Near Eastern
Cultures

Cover design: Blue Collar

Compilation, text & graphics editing and layout: M. Mostovski

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ISBN 978-965-599-160-4

UDC (047)069:5(569.4)

DOI: 10.5281/zenodo.3768034

May 2020

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A unique collection of rare and now extinct animals was assembled by a Catholic priest and zoologist Ernst Schmitz in the Land of Israel in the early 20th century. Most of its items are on display in the *Treasures of Biodiversity* exhibition at the Steinhardt Museum of Natural History. (<https://smnh.tau.ac.il/en/the-father-schmitz-collection>).



HONORARY PRESIDENT

Michael Steinhardt

SCIENTIFIC AND PUBLIC COUNCIL

The Steinhardt Museum of Natural History is a national research infrastructure. The Scientific and Public Council comprises leaders, who represent the public interest in their diverse fields: Itamar Borowitz, Ruth Arnon, Gedalia Gal, Ariel David, Yael Dayan, Ariel Weiss, Samuel Hayek, Ilan Chet, Yaakov Turkel, Ami Federman, Aharon Ciechanover, Shony Rivnay, Shimshon Shoshani, Michael Steinhardt, Brian Sherman, Meir Shalev, Martin Weyl.

BOARD OF DIRECTORS

Tamar Dayan (Chair), Yaron Oz, Aharon Fogel, Itamar Borowitz, Ami Federman, Izhar Kanne, Doron Sapir, Gady Frank, Dudu Zaken, Motti Kohn, Neri Azogui; Menachem Goren, Alon Sapan (Observers).

INTERNATIONAL SCIENTIFIC ADVISORY BOARD

Gretchen C. Daily, Department of Biology, Stanford University, Stanford, CA, USA; **Jared Diamond**, Department of Physiology, University of California, Los Angeles Medical School, Los Angeles, CA, USA; **Paul Ehrlich**, Department of Biological Sciences, Stanford University, Stanford, CA, USA; **Daphne G. Fautin**, Ecology and Evolutionary Biology, Invertebrate Zoology University of Kansas, USA; **Marcus W. Feldman**, Department of Biology, Stanford University, Stanford, CA, USA; **Lord Robert May** of Oxford OM AC Kt FRS, Department of Zoology, Oxford University, Oxford, UK; **Harold A. Mooney**, Department of Biological Sciences, Stanford University, Stanford, CA, USA; **Peter Raven**, Missouri Botanical Garden, St. Louis, MO, USA; **Daniel Simberloff**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN, USA; **Edward O. Wilson**, Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA; **Nancy Knowlton**, Marine Science, US National Museum of Natural History, Washington, DC, USA.

MUSEUM STAFF

- Prof. Tamar Dayan – Chair
- Dr Menachem Goren – Deputy-Chair
- Alon Sapan – Director
- Dana Silvera-Sharir – Administrative Manager

Marketing & Strategy Department

- Tamar Zadok – Head of Marketing & Strategy
- Galit Benschahar-Abadi – Sales, Events and Visitor Front Desk Manager
- Liat Lev – Sales, Group Visits Manager
- Aviva Kimchy – Sales, School Groups Visits Manager
- Moran Maimoni – Production coordinator, website admin and marketing communications

OPERATION DEPARTMENT

- Adi Katz Shapira – Head of Operation
- Doron Ninio – Museum maintenance
- Andrei Lapicov – Museum maintenance
- Lyn Geffen Cohen – Museum operations
- Sasha Katsnelson – Museum operations
- Galit Shenhav – IT Coordinator
- ~30 ushers and cashiers

EDUCATION & SCIENCE COMMUNICATION DEPARTMENT

- Dr Yael Gavrieli – Head of Education and Science Communication
- Dr Mey-Tal Gewing – Manager of Content Development
- Dafna Lev – Coordinator of Educational Projects
- Irit Sidis – Coordinator of Public Programs
- ~70 graduate students as guides

COLLECTIONS AND RESEARCH DIVISION

Museum Committee: Tamar Dayan (Chair), Menachem Goren, Alon Sapan (Observer), Revital Ben-David-Zaslow (Coordinator), Shai Meiri, Roi Dor, Eli Geffen, Yossi Yovel, Eran Levin, Jonathan Belmaker, Roi Holtzman, Noa Shenkar, Frida Ben-Ami, Micha Ilan, Netta Dorchin, Moshe Guershon, Gal Ribak, Dorothee Huchon, Yuval Sapir, Israel Hershkovitz, Hilla May, Rachel Sarig, Dafna Langgut, Lidar Sapir-Hen, Yael Gavrieli (Observer).

Dr Revital Ben-David-Zaslow – Chief Collections Manager.

Yonatan Gur – IT Coordinator.

The Entomology Section

- Dr Netta Dorchin – Chief Curator (flies)
- Dr Sergey Zonstein – Curator (spiders)
- Dr Tatyana Novoselsky – Collections Manager (bugs)
- Dr Malkie Spodek – Collections Manager (Sternorrhyncha and Auchenorrhyncha)
- Dr Gal Ribak – Curator (beetles)
- Prof. Vladimir Chikatunov – Curator (beetles)
- Dr David Furth – Associate Curator (Smithsonian Institution and TAU) (beetles)
- Ariel-Leib-Leonid Friedman – Collections Manager (beetles)
- Dr Dany Simon – Curator Emeritus (lacewings)
- Prof. Vasily Kravchenko – Curator (moths)
- Dr Mike Mostovski – Collections Manager (flies)
- Dr Elizabeth (Liz) Morgulis – Collections Manager (flies)
- Dr Amnon Freidberg – Curator Emeritus (flies)
- Prof. Abraham Hefetz – Curator Emeritus (bees)
- Dr Yael Mandelik – Associate Curator (Hebrew University of Jerusalem) (bees)
- Dr Moshe Guershon – Collections Manager (bees) and Staff Director for Entomology
- Dr Achik Dorchin – Collections Manager (bees)
- Dr Armin Ionescu – Collections Manager (ants)
- Prof. Zoya Yefremova – Collections Manager (parasitic wasps)
- Dr Wolf Kuslitzky – Collections Manager (parasitic wasps)

- Dr Gideon Pisanti – Collections Manager (parasitic wasps)
- Dr Avi Keysary – Volunteer (Palmoni Collection)
- Dr Binyamin Shalmon – Volunteer
- Amir Weinstein – Volunteer
- Tirza Stern – Volunteer
- Yitzhak Nussbaum – Volunteer
- David Saar – Volunteer
- Daniel Kanner – Volunteer

The Marine & Freshwater Section

Invertebrates

- Prof. Noa Shenkar – Curator (ascidians)
- Prof. Micha Ilan – Curator (sponges)
- Prof. Frida Ben-Ami – Curator (mollusks)
- Dr Omri Bronstein – Curator (echinoderms)
- Dr Stanislav Pen-Mouratov – Curator (nematodes)
- Prof. Yehuda Benayahu – Curator Emeritus (soft corals)
- Dr Bella Galil – Curator Emeritus (crustaceans)
- Henk K. Mienis – Collections Manager (mollusks)
- Oz Rittner – Collections Manager (mollusks, beetles and butterflies)
- Dr Rony Izhar – Collections Manager (mollusks)
- Dr Sigal Shefer – Collections Manager (sponges)
- Alex Shlagman – Collections Manager (soft corals)
- Dr Liron Goren – Collection Manager (worms and crustaceans)
- Dr Noga Sokolover – Collection Manager (bryozoans and echinoderms)
- Ya'arit Levitt-Barmats – Technical Assistant (crustaceans)
- Hadas Salman – Volunteer

Fishes

- Dr Menachem Goren – Curator Emeritus
- Prof. Jonathan (Yoni) Belmaker – Curator
- Prof. Roi Holzman – Curator
- Dr Nir Stern – Associate Curator (IOLR)
- Dr Bat-Sheva (Shevy) Rothman – Technical support
- Aviyam Tagar – Technical support

The Terrestrial Vertebrates Section

- Prof. Shai Meiri – Curator (reptiles, mammals and birds)
- Dr Roi Dor – Curator (birds)
- Prof. Eli Geffen – Curator (mammals and amphibians)
- Prof. Tamar Dayan – Curator (mammals)
- Dr Eran Levin – Curator (mammals)
- Prof. Yossi Yovel – Curator (bats)
- Prof. Yoram Yom-Tov – Curator Emeritus (reptiles, mammals and birds)
- Prof. Yoel Rak – Curator Emeritus (early hominids)
- Dr Amos Belmaker – Collections Manager (birds)
- Daniel Berkowic – Collections Manager (birds)

- Erez Maza – Collections Manager (reptiles)
- Kesem Kazes – Collections Manager (mammals)
- Avigail Ben-Dov Segal – Technical assistance (birds and feathers)
- Arie Landman – Volunteer technical assistant
- Moshe Geizler – Volunteer technical assistant
- Miriam Eidelis – Volunteer
- Ron Cohen – Volunteer
- Igor Gavrilov – Chief Taxidermist
- Dr Stanislav Volynchik – Taxidermist and preparator
- Hamutal Friedman – Technical Assistant in taxidermy
- Yiftach Ramot – Technical Assistant in taxidermy

The Herbarium

- Dr Yuval Sapir – Curator
- Dr Yotam Ziffer-Berger – Associate Curator and Collections Manager (plants)
- Bruria Gal – Collections Manager (fungi)
- Yonatan Gur – Collections Manager (fungi)
- Prof. Jacob Garty – Curator Emeritus (lichens)
- Dr Razy Hoffman – Collections Manager (water plants, cyanobacteria and water fungi)

The Paleosciences Section

Paleontology

- Dr Yuri Katz – Curator
- Dr Olga Orlov-Labkovsky – Curator (micropaleontology)
- Prof. Sigal Abramovich – Associate Curator (Ben Gurion University of the Negev)
- Dr Daniella E. Bar-Yosef Mayer – Collections Manager

Biological archeology

- Dr Dafna Langgut – Curator (palynology and archeobotany)
- Dr Lidar Sapir-Hen – Curator (archeozoology)
- Dr Meirav Meiri – Ancient DNA Lab Manager

Dan David Center for Human Evolution and Bio-History Research

Physical Anthropology

- Prof. Israel Hershkovitz – Director
- Dr Hilla May – Curator
- Dr Rachel Sarig – Curator
- Prof. Baruch Arensburg – Curator Emeritus
- Einat Kedar – Administrative Manager
- Julia Abramov – Collections Manager
- Shirly Cohen – Technical Assistant
- Linoy Namdar – Technical Assistant
- Elisia Vanzety – Technical Assistant

Molecular Systematics and Tissue Collection

- Prof. Dorothée Huchon – Curator
- Dr Tamar Feldstein-Farkash – Collections Manager

ISRAEL TAXONOMY INITIATIVE

National Project of the Higher Education and Research Systems; Ministries of Environmental Protection, Agriculture, Energy and Water, Science and Technology, and Health; KKL-JNF, Israel Nature and Parks Authority, Society for the Protection of Nature in Israel.

Directors:

- Dr Menachem Goren and Dr Frida Ben-Ami – Directors
- Dr Daniella E. Bar-Yosef Mayer – Coordinator

Steering Committee:

- Prof. Leon Blaustein
- Prof. Bella Galil
- Prof. Yael Lubin
- Prof. Alan Matthews
- Prof. Yosef Steinberger

APPLIED RESEARCH DIVISION

Applied research institutes/laboratories/programs operating in the Division have each their own steering committees or boards of directors and academic/professional oversight.

The Israel National Center for Aquatic Ecology

Steering Committee:

- Dr Dana Milstein – Israel Nature and Parks Authority (Chair)
- Alon Zask – Ministry of Environmental Protection
- Dr Amir Erez – Ministry of Environmental Protection
- Nissim Keshet – Israel Nature and Parks Authority
- Dr Menachem Goren – TAU
- Prof. Tamar Dayan – TAU
- Hanoch Ilssar – the Rothschild Foundation

Staff

- Dr Yaron Hershkovitz – Director
- Tuvia Eshcoly – Lab manager
- Naomi Gordon – Administration
- Avital Katz – Database management
- Etai Kahana – Dipteran taxonomy and GIS
- Dafi Luz – Coordinator of the Yarqon watershed bioassessment project and molecular taxonomy
- Almog Hershko – Coordinator of the Western Galilee watershed bioassessment project
- Nili Segman – Coordinator of the wastewater bioassessment project and molecular taxonomy

The Entomological Laboratory for Applied Ecology

Academic Committee:

- Dr Menachem Goren – TAU
- Dr Inon Scharf – TAU

Staff

- Ittai Renan – Director
- Gilad Ben Zvi – Lab manager
- Merav Shemesh – Technician
- Ahikam Gera – Technician
- Dr Enav Vidan – Technician
- Tania Bird – Technician
- Itai Namir – Technician
- Dafi Lavi – Technician
- Carmel Herold – MSc Student
- Ella Fishman – Student

HaMaarag – Israel's Nature Assessment Program

HaMaarag Board of Directors:

- Gady Levin, Chair – Israel Academy of Sciences and Humanities
- Dr Yehoshua Shkedy – Israel Nature and Parks Authority
- Dr David Brand – KKL-JNF
- Yahel Porat – KKL-JNF
- Alon Zask – Ministry of Environmental Protection
- Hanoch Ilssar – the Rothschild Foundation
- Prof. Tamar Dayan – TAU

Steering Committee of the State of Nature Report:

- Dr Anna Trajtenbrot – Ministry of Environmental Protection
- Dr Yehoshua Shkedy – Israel Nature and Parks Authority
- Dotan Rotem – Israel Nature and Parks Authority
- Dr Avi Perevolotsky – Agricultural Research Institute and Hebrew University of Jerusalem
- Yahel Porat – KKL-JNF
- Dr David Brand – KKL-JNF
- Dr Ofri Gabbai – SPNI

Staff

- Dr Irina Levinsky – Director (until 31.3.2019)
- Ittai Renan – Director (from 1.3.2019)
- Noa Zanzuri – Administrative Manager
- Dr Idan Shapira – Terrestrial Biodiversity Monitoring Program Coordinator
- Dr Alon Lotan – Israel National Ecosystem Assessment Coordinator
- Dr Michal Sorek – State of Nature Report Coordinator
- Harel Dan – GIS and Cartography Coordinator
- Shira Grossbard – Israel National Ecosystem Assessment Program Assistant
- Dr Rafi Kent – Spatial Ecologist
- Dr Ron Chen – Ashalim monitoring program Coordinator

The Open Landscape Institute

Council (Board):

- Yoav Sagui, Chair – SPNI (ret.)
- Amir Ritov, Co-Chair – Chair of the Regional Councils Organization
- Yaron Ohayon – KKL-JNF
- Dr Omri Boneh – KKL-JNF
- Yahel Porat – KKL-JNF
- Dr Yehoshua Shkedy – Israel Nature and Parks Authority
- Dotan Rotem – Israel Nature and Parks Authority
- Nir Angert – Israel Nature and Parks Authority
- Eran Ettinger – Ministry of Agriculture
- Nir Papay – Society for the Protection of Nature in Israel
- Droe Boymel – Society for the Protection of Nature in Israel
- Milka Carmel – Regional Council's Organization
- Hanoch Ilssar – the Rothschild Foundation
- Dr Anna Trajtenbrot – Ministry of Environmental Protection
- Alon Zask – Ministry of Environmental Protection
- Prof. Eran Feitelson – the Hebrew University of Jerusalem
- Prof. Yael Mandelik – the Hebrew University of Jerusalem
- Prof. Tali Mozes – Technion
- Dr Hana Sweid – the Arab Center for Alternative Planning
- Prof. Tamar Dayan – TAU
- Alon Sapan – TAU

Staff

- Uri Ramon – Director
- Aviv Avisar – Head of the Research Unit
- Dr Liron Amdur – Researcher
- Noa Zanzuri – Administrative Manager
- Gal Kagan – GIS Coordinator
- Dr Amir Perelberg – Head of Survey Unit
- Eitan Romem – Survey Manager
- Merav Lebel – Survey Manager
- Bar Shemesh – Survey Manager
- Miryam Ron – Head of Botanical Research
- Amit Mendelson – Survey Manager
- Idan Talmon – Survey Manager
- Omri Shalev – Survey Manager
- Hila Gil – Hotspots Research Coordinator
- Uri Shapira – Survey Manager
- Liraz Cabra-Leykin – Survey Manager
- Nadav Sade – Assimilation and Social visibility
- Shilo Navon – Researcher
- Einat Gera – Survey Coordinator

MUSEUM SCIENTISTS

Arnon Lotem, School of Zoology, Tel Aviv University

Arnon is active in the museum's Public Programs Division, lecturing on behavior and evolution.

Noga Kronfeld-Schor, School of Zoology, Tel Aviv University

Noga is active in the Applied Policy-Relevant Division, studying the ecotoxicological impact of the Ashalim spill, and in the Public Programs Division, in the partnership with the Israel Forum on Sustainable Nutrition and as Curator of the Galapagos pictures exhibition.

Amir Ayali, School of Zoology, Tel Aviv University

Amir is active in the Public Programs Division, lecturing on behavior and nature inspired engineering.

David Eilam, School of Zoology, Tel Aviv University

David developed an extensive teaching collection, now part of the Steinhardt Museum and used by him and others for academic teaching. Additionally, David is active in the Public Programs Division, lecturing on behavior.

Ofir Levy, School of Zoology, Tel Aviv University

Ofir leads the museum's digital strategy; his laboratory studies the reptile collection.

Takuya Iwamura, School of Zoology, Tel Aviv University

Tak is involved in the development of the Museum's digital strategy and in applied policy-relevant conservation research.

Orr Spiegel, School of Zoology, Tel Aviv University

Orr is active in the Applied Policy-Relevant Division, working with the Open Landscape Institute. Additionally, he is the academic focal point for the Ornithological collection and the Feather Lab.

Avigdor Abelson, School of Zoology, Tel Aviv University

Avigdor is the academic focal point for the Coral collection.

Inon Scharf, School of Zoology, Tel Aviv University

Inon is the academic expert for the Neuroptera collection.

Marcelo Sternberg, School of Plant Sciences & Food Security, Tel Aviv University

Marcelo is active in the Applied Policy-Relevant Division working with the Open Landscape Institute on vegetation conservation, plant invasion and climate change related topics. Marcelo is an experimental ecologist working on climate and land use changes.

Itay Mayrose, School of Plant Sciences & Food Security, Tel Aviv University

Itay studies large-scale phylogeny and evolution of plants, and is active in public outreach for evolution.

Israel Finkelstein, Department of Archeology and Near Eastern Studies, Tel Aviv University

Israel established the animal and plant ancient DNA laboratory at the museum and is its academic head in archeology.

Joseph Hendler, Department of Art History, Tel Aviv University

Sefy conducted collections-based research for his research on plants in Medieval literature. Additionally, Sefy is involved in the Public Programs Division, as member of the temporary exhibitions committee, and develops cooperative projects with the museum.

Eva Yablonka, Cohn Institute of Philosophy, Tel Aviv University

Eva is the Curator of a planned temporary exhibition on the Evolution of the Sensitive Soul.

PROGRESS AT THE STEINHARDT MUSEUM OF NATURAL HISTORY

Tamar Dayan and Alon Sapan

The past year was a wonderful yet challenging one. After a two-month trial run, the museum opened to the public and with almost 200,000 visitors during this past year we have already become the 7th most visited museum in Israel. These numbers were well above our expectations; clearly Israel needed a natural history museum!

The Marketing, Operations, and Education teams were committed to welcome this influx of visitors and to develop a new and innovative array of rich and varied programs: workshops, conferences, science days, tours around the galleries and the zoo and botanical garden, night at the museum, plays, public lectures and cool parties. We worked hard to convey our science and values in museum activities, and were gratified by the very positive response we got from our visitors, and thrilled with developing partnerships, in particular with the Tel Aviv Yaffo municipality.

Transferring over 5.5 million specimens to the new museum building was challenging, as was reorganizing the specimens in the new storage facilities. With full dedication of the museum's Collections Managers and Curators, most of the specimens have already been arranged in the new collection halls, where we can now care for them as we should; but it will still take a significant effort to get all our collections in the long term proper storage.

The Collections and Research team is growing in numbers and in scientific strength and has reached organizational maturity. The Groups (Terrestrial Vertebrates, Entomology, Marine & Aquatic, Paleosciences, Herbarium) have matured into full-fledged Museum Sections working in coordination and with team spirit.

The museum collections database underwent a significant change in the past few years, rearranged on a new software platform that enabled the creation of a unified database that would shortly be publicly available through the museum's website. Until that happens, we continued to send data as requested to colleagues from around the world.

All this was important because hundreds of scientists continued to use our collections for research in the past year, including many colleagues from abroad and graduate students. As a service-oriented institution, we did our best to provide a state-of-the-art research infrastructure for all. Concurrently, the Collections team members continued to record nature assets in areas of their expertise and to promote their taxonomic research and ability to provide crucial services to academia, conservation agencies, agriculture and health authorities, aviation safety, and other missions.

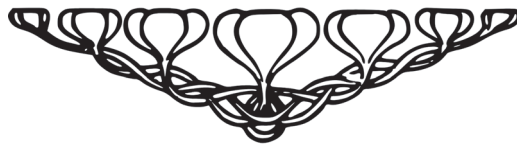
The Open Landscape Institute, HaMaarag and the Israel Center for Aquatic Ecology have moved to the new building and, residing now in close physical proximity on the 5th floor, their scientific and professional cooperation is strengthening both among them and with the collections team and research laboratories. These synergies are vital; we plan for the museum to form a whole that is greater than its parts. Moreover, we find interactions with our colleagues from the Ministry of Environmental Protection, Israel Nature and Parks Authority and Keren Kayemeth Lelsrael (Jewish National Fund) through our joint projects both fruitful and scientifically challenging.

The museum hosted several national and international meetings. Dafna Langgut was a member of the organizing committee of the 5th *Annual Israeli Conference on Environmental History* and organized a session on *The Steinhardt Natural History Museum as an Archive to Environmental Studies*; Shai Meiri was a member of the organizing committee of *Gekkota Mundi II | An International Conference*; Amos Belmaker was a member of the organizing committee of the 11th *Biennial European Bird Curator Meeting*; Bella Galil and Menachem Goren organized a workshop *Guidelines for the Definition of Deep-Sea Protected Areas* within the frame of the *Implementation of the MSFD to the Deep Mediterranean Sea* multilateral project; Dorothee Huchon organized a *Symposium in Honor of Prof. David Wool 86th Birthday*; and Jonathan Belmaker represented the museum on the panel of the 2nd *Conference of the Israel Chapter of the Society for Conservation Biology*

that was held at the Technion in Haifa. The Israel Taxonomy Initiative supported three taxonomic workshops on insects (Hemiptera), arrow worms (Chaetognatha) and Peracarida crustaceans. Ha-Maarag conducted two full-day seminars: *Ashalim Stream Ecosystem Monitoring Program* and *Evrona Nature Reserve Ecosystem Monitoring Program*.

Team building was an important component of the museum's work in the past year and would continue to be so. The museum team members come from various university units and other organizations, with different areas of expertise and scientific background. Additionally, dozens of new ushers, cashiers and guides were recruited in the past year, and, of course, we shared our building and treasures with a tremendous number of visitors. Thus, we all have to learn to accommodate each other's needs in the joint building.

The greatest challenge facing humankind in the 21st century is the need to provide for a rapidly growing global population, while protecting ecosystems upon which we are all dependent. As a national research infrastructure, the key mission of our museum is to record nature, to study it, and to share our knowledge and expertise with decision-makers and the general public. We feel that the State of Israel and Tel Aviv University have entrusted us with a great treasure, one that is timely, of huge scientific interest, of great societal value, and of immense public interest. We are indeed privileged.



COLLECTIONS NEWS

The staff members of the Steinhardt Museum of Natural History (SMNH) continued curation and promotion of our collections. The main efforts during the reporting year focussed on the arrangement of our collections in the new Museum storage facilities. We continued to collect and preserve new scientific material, rescue and incorporate important private and institutional collections, maintain the existing holdings, send scientific material and data nationwide and abroad, and assist graduate students, academic courses, and educational activities.

During the academic year 2018–2019 we incorporated over 23,000 specimens of various taxonomic groups collected worldwide by the collection curators and staff, students, rangers from the Israel Nature and Parks Authority, and others.

THE ENTOMOLOGY SECTION (INCLUDING ARACHNIDS)

Netta Dorchin, Amnon Freidberg, Inon Scharf, Gal Ribak, Sergei Zonstein, Tanya Novoselsky, Malkie Spodek, Vladimir Chikatunov, David Furth, Arie-Leib-Leonid Friedman, Vasily Kravchenko, Oz Rittner, Elizabeth (Liz) Morgulis, Mike Mostovski, Moshe Guershon, Zoya Yefremova, Wolf Kuslitzky, Gideon Pisanti, Armin Ionescu, Dany Simon, Tirza Stern, Alex Shlagman, Avi Keysary, Binyamin Shalmon, Amir Weinstein, Itzhak Nusbaum.

Research and curation

Upon relocation of the entomological collections to the newly built museum in 2018, much effort was put into optimization of the storage facilities, re-arrangement and mapping of the material, and assessment of what needs to be done to comply with best curatorial practices. Another major teamwork, supervised by David Furth and co-ordinated by Moshe Guershon, focused on unpacking and sorting the entomological library, which comprises hundreds of journal titles and books.

Arachnida

S. Zonstein continued his research into the systematics of Mygalomorphae (trapdoor spiders), described 20 new species, established nine new combinations and five new synonyms, and described previously unknown males of 5 species in the families Cyrtaucheniidae, Filistatidae, Nemesiidae and Theraphosidae from the Palearctic and Afrotropical regions. He also hosted Dr Y.M. Marusik (Institute for Biological Problems of the North RAS, Magadan, Russia), who worked on Araneae in the Museum collection from 10–20.03.2019. He also continued curation of the spider collection in the new storage facility. All jars and containers with the pitfall trap samples collected by Y. Mandelik (2001), Y. Mandelik & A. Landsman (2002), M. Vonshak (2006, 2007) and T. Levanony (2007, 2008), were examined (about 4000 samples in the total). All spider specimens in acceptable condition were separated, identified and included in the main spider collection. The separation of large families into jars according to the genus/species level is completed for large families Cyrtaucheniidae, Nemesiidae, Theraphosidae, Filistatidae and Zodariidae; almost finished for all small families; fairly completed for the family Thomisidae; partly done the large families Araneidae, Theridiidae, Dysderidae, Gnaphosidae and Clubionidae s.l.; and is ongoing for the large families Lycosidae, Sparassidae and Salticidae. The primary types of the newly described species in the families Cyrtaucheniidae (9), Dipluridae (1), Filistatidae (5), Holanoproctidae (1), Nemesiidae (3), Palpimanidae (1) and Synsphyridae (1) were separated, labelled as the corresponding primary types and clustered together for keeping separately from other specimens; some paratypes deposited in the Museum spider collection were labelled accordingly.

Hemiptera

T. Novoselsky sorted and databased material (1528 specimens) of the family Scutelleridae, which is represented in our collection by 61 species in 30 genera. She went over the Scutelleridae collection and put together full list of the species in these families that are represented in our

collection. Five holotypes and eight paratypes were designated by Dr Emeljanov, Dr Wygozinsky, Dr Putshkov, Dr Hoberlandt, Dr Miller and M. Nir, who worked on the families Dictyopharidae, Reduviidae and Rhyparochromidae from our collection. This type material was properly labelled and incorporated into the collection; the primary type were placed in the type collection. She collected over 160 Heteroptera specimens in the field and received 5 unit trays of material from other researchers. Most of this material was identified to the genus level. She worked on identifying it to the species level and distributing species to their proper places in the collection. She also prepared a 6-day course (40 hours, 3 academic credits) for 16 participants on the taxonomy of the Pentatomoidea bugs and hosted Dr Joseph Eger of Dow AgroSciences, Tampa & Research Associate, Florida State Collection of Arthropods, Gainesville, FL., USA, who led the course, and two guest lecturers, Dr Z. Mendel and Mr Elazar Quinn, MSc (both the Volcani Center, ARO).

M. Spodek continued curation of psyllids, mainly going through material in ethanol and integrating new pinned material, and attended the Annual Conference of the Entomological Society of Israel (Rehovot, 9.10.2018). She also collaborated with Dr Michael Wilson (National Museum of Wales, Cardiff, UK), who visited our Museum from February 12–26, 2019 and worked in the Auchenorrhyncha collection. Dr M. Wilson sorted most specimens to family and genus levels where possible to allow for further identifications. M. Spodek started to arrange the collection according to a new checklist.

Coleoptera

L. Friedman added to the collection, databased and partly sorted and identified approx. 3500 beetles (mainly weevils) from Israel, USA, Uzbekistan, Tajikistan and Myanmar. Weevils (mainly Apionidae and Curculionidae) from Lebanon, Iran, Iraq and southern China—carefully labeled and rare materials—were accepted from foreign colleagues and would be deposited in Museum collection after mounting and identification. Water beetles of the family Elmidae, collected by Adi Weiss (a student of Prof. T. Dayan) in the northern tributaries of the Jordan River mostly belong to rare species poorly represented in the Museum collection, two of them being represented by singletons until now. A small but important collection of insects was donated Mr Attay Yofe from the kibbutz Netiv ha-Lamed-He, comprising beetles assembled in the 1960–80s in the Lower Galilee and Judean Mountains. The collection includes some rare specimens, particularly of the leaf beetles *Lilioceris* (Chrysomelidae). The material is being sorted and relabelled.

V. Chikatunov identified beetles collected by students and assisted with curation of the SMNH beetle collection.

Lepidoptera

V. Kravchenko was busy arranging species of the families Noctuidae, Crambidae, Pyralidae, Cossidae, Nolidae and Prerophoridae, and preparing checklists of these families. He was also moving the material into new cabinets. He collaborated with his overseas colleagues on several projects: (1) Preparing a book *The Geomentridae of Israel* with Dr A. Hausmann (Bavarian State Collection of Zoology, Germany); (2) *Species of the family Cossidae in Guinea Conakry* with Prof. R. Yakovlev (Altai State University, Russia); (3) *Ants of the Democratic Republic the Congo* with Prof. Brian Taylor (UK); and (4) *Faunistic surveys of the families Crambidae and Pyralidae of Israel and Pyraloidea of Mount Nimba* with Dr A. Poltavsky (Botanical Garden, Southern Federal University, Russia). He accommodated two visiting researchers, who studied material in the SMNH: Dr A. Saldatis (Institute of Ecology of Vilnius University, Lithuania; 20–25.04.2019, family Arctiidae) and Dr O. Gorbunov (Institute of Evolutionary Animal Morphology & Ecology, Moscow, Russia; 5–12.05.2019, family Sesiidae).

Diptera

A. Freidberg continued working on final drafts and proofs of several chapters for the Manual of Afrotropical Diptera, and resumed his project on the Schistopterinae (Tephritidae).

N. Dorchin was on an academic sabbatical in Cape Town, South Africa, where she conducted research and fieldwork as part of a collaborative study supported by a 3-year grant from South Africa's National Research Foundation. She was based at the facilities of the South African National Biodiversity Institute (SANBI) in Kirstenbosch Research Center. The project focused on the



Top, blooming Karoo (South Africa), where N. Dorchin conducted her field work. Right, *Dasyneuriola prolifica*, a gall midge described by N. Dorchin in 2019 from Israel and Spain (photo by Oz Rittner).

diversity, systematics and evolution of gall midges (Diptera: Cecidomyiidae) on the Aizoaceae in Southern Africa, which is the richest and most diverse speciation center for this plant family, with hundreds of endemic species. The rich fauna of gall midges on the Aizoaceae, numbering dozens of species, had never been studied. The project included intensive field collecting in multiple localities in Namaqualand, Knervlakte, Little Karoo and various localities in the Western Cape, as well as a short collecting trip to southern Namibia, mostly during the southern winters of 2018 and 2019. Hundreds of galls and other plant samples were brought to the laboratory and the gall midges were reared from them for morphological and molecular studies. So far this project yielded about 50 undescribed cecidomyiid species. This material is currently being processed for taxonomic and phylogenetic studies. She also continued research on the biological control of *Acacia saligna* in Israel with the seed-feeding beetle *Melanterius castaneus* (Nir Bonda, MSc thesis) and on the systematics of the ant genus *Messor* in Israel (Maya Sa'ar, postdoc). She collaborated with Moshe Inbar (Haifa University), Zvi Mendel (Agricultural Research Organization, Bet Dagan), John Stireman (Wright State University, Dayton, OH, USA), Michael Wise (Roanoke College, Salem, VA, USA), Jonathan Colville (SANBI, Cape Town, South Africa), and Cornelia Klak (University of Cape Town, South Africa). N. Dorchin was a plenary speaker at the International Congress of Dipterology (Windhoek, Namibia; November 2018) and presented a talk at the Biological Control meeting in Israel (Bet Dagan, Israel; March 2019).

E. Morgulis continued working on the primary-type catalogue of the insect collection, recording label data of the primary types, taking pictures and putting together essential references. She completed the inventory of the general and secondary type material in the Acalypratae collection and re-arranged several families that were in a messy state. She also databased several hundreds of specimens, including primary and secondary types, as well as general material.

M. Mostovski sorted about 2000 specimens of Diptera to the family level and 600 non-Diptera specimens to orders for distribution to corresponding collection managers; sorted, re-arranged alphabetically and labelled accordingly the collection of Limoniidae crane flies (939 specimens representing 57 species); started the inventory of the Nematocera and non-acalyprate Brachycera collections and entered/updated 287 records in the Museum database; prepared and dispatched

Mydidae and Leptogastrinae on loan to Torsten Dikow (Smithsonian Institution, USA). He also continued working on the shoot-flies (genus *Atherigona*, Muscidae) from Israel in collaboration with Burgert Muller of the National Museum, Bloemfontein, South Africa, as well as sorting alcohol-preserved samples for phorids and other Diptera.

Hymenoptera

Ants, Wasps & Wet insect collection: A. Ionescu dedicated much time to mapping, re-arrangement and ongoing maintenance of the three collections, including incorporation of newly acquired material (ants and wasps) into the collections. He was also deeply involved in sorting of reprints concerning ants and wasps, and helped the IT team with sorting, correcting and introduction of data into the SMNH database.

Parasitic Hymenoptera: W. Kuslitzky paid major attention to the organization of the collection of Ichneumonidae and Braconidae. The list of all species present in the collection (about 1200) was compiled; labels with species names were placed in unit trays; permanent holders of external labels were installed on all old drawers, each holder containing a label indicating the family, sub-family, tribe and genus of species placed in the drawer.

Parasitic Hymenoptera: Z. Yefremova identified and incorporated into the collection ca. 1000 specimens of the families Eulophidae, Chalcididae, Scelionidae, Ceraphronidae, Encyrtidae and Pteromalidae; sorted the material reared from the Cynipidae; and labeled two holotypes and

129 paratypes of new species of the family Eulophidae (Tetrastichinae). She participated in three collaborative projects:

Identification and genetic divergence of parasitoids of leafminers in Chinese Eulophidae (Hymenoptera: Chalcidoidea), with Prof. X.-P. Zhou (Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing);

Faunistic research in Chalcidoidea (Eulophidae) of Kenia, with Dr R. Copeland (International Centre of Insect Physiology and Ecology, Nairobi, Kenya);

and *Faunistic research in Chalcidoidea (Eulophidae) of Papua New Guinea*, with Dr C.A. Maier (Entomology Museum of Comparative Zoology, Harvard Univ. Cambridge, MA, USA). She also reviewed 8 manuscripts for *Asian Pacific Entomology*, *Zootaxa*, *Oriental Insects* and *Scientific Reports (Nature)*, as well as a PhD Thesis on *Morphology vs Molecular Phylogeny in diagnosing Indian Chalcididae (Hymenoptera: Chalcidoidea)* submitted by Ms J.G. Prakash, Annamalai University, India.

Bees (M. Guershon & A. Dorchin): A. Dorchin successfully balanced his research and collection management. About

two-thirds of the collection of long-horn bees, tribe Eucerini (Apidae), were sorted to the species level for the first time, including several thousands of specimens collected since the 1930s. The bee collection was preliminary screened to estimate the number of described species deposited. This resulted in around 2000 items estimated at about 1000 species, which are currently in the process of species name update and confirmation. He described a new species group from the Eastern Mediterranean region, Bulgaria and Iran, and revised the included three species. Two species were described as new to science: *Eucera dafnii* from Iran, Israel, Syria, Turkey, Bulgaria and Greece, and *E. watsi* from Israel and Lebanon, and the type material was deposited in the SMNH. An identification key and natural history information including assessment of preferred pollen host plants were also presented. The palynological aspect of research largely depended on bees collected in Israel and was performed in collaboration with Dafna Langgut (Laboratory of Archaeobotany and Ancient Environments, SMNH) and other palynologists, and the study resulted in a publication in *Zootaxa*. He also studied type material in the *Eucera* bee collection of the Muséum National d'Histoire Naturelle, Paris, in September 2019 using the Furth travel fellowship. This study included examination of the type material in the historical collections of Brullé, Lepeletier,



Nesolynx thymus, a newly recorded eulophid parasitoid wasp from Cambodia.

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Pérez, and Benoist from the early 19th and 20th centuries, during which 42 previously undesignated lectotypes were labeled.

Professional work abroad

N. Dorchin was on an academic sabbatical in Cape Town, South Africa, where she conducted research and fieldwork as part of a collaborative study supported by a 3-year grant from South Africa's National Research Foundation.

L. Friedman visited Iziko South African Museum in Cape Town, South Africa, and worked in their beetle collection. He also briefly visited the Smithsonian Inst., Washington DC, USA, and studied their insect collection, one of the largest in the world, thanks to the kind help of Dr D. Furth.

T. Novoselsky visited the Heteroptera collection at the I.I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine in Kyiv with regard to ongoing collaboration on the Heteroptera of Israel (21–27.07.2019).

S. Zonstein collaborated with Y.M. Marusik & S. Kopponen from the Zoological Museum, University of Turku on projects on the systematics of the trapdoor spiders during his month-and-a-half visit to the museum (31.07–13.09.2019).

Z. Yefremova visited the Institute of Plant Protection, Chinese Academy of Agricultural Sciences (Beijing) within the frames of the collaborative project *Identification and genetic divergence of parasitoids of leafminers in Chinese Eulophidae (Hymenoptera: Chalcidoidea)*, carried out with her Chinese colleagues, in particular with Prof. Xue-Ping Zhou, Director General of the Institute of Plant Protection (6–16.01.2019). She also visited the Entomology Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA, and collaborated with Dr C.A. Maier on *Faunistic research in Chalcidoidea (Eulophidae) of Papua New Guinea*.

V. Kravchenko visited Zoologische Staatssammlung in Munich (Germany; 22.01–9.03.2019), where he studied comparative material and worked with Drs A. Hausman, W. Speidel and A. Seeger on several collaborative projects.

Integration of “Orphaned collections”

Avi Keysary continued curation and databasing the Palmoni collection. All specimens in the collection were moved to standard new drawers. In total, about 3,500 specimens were recorded in the database over the reporting period, belonging to the orders Coleoptera, Trichoptera, Orthoptera, Diptera and Hemiptera. By the end of 2018–2019 academic year, about 15,000 Palmoni's records were computerized. There were still two and a half boxes with Hemiptera to take care of.

Identification Services

A total of 887 specimens were identified by the SMNH staff for government, academic and private organizations:

- Coleoptera (L. Friedman): Over 60 identifications were made for PPIS, Ministry of Agriculture of Israel and directly for agriculturalists. These include identification of *Calosoma olivieri* ground beetles (Carabidae), whose population exploded unexpectedly, caused nuisance to people all around the country and nearly terminated export of vegetables to European countries (this danger was evaded after LF's intervention). About 50 identifications were done for colleagues from Ben Gurion University of the Negev (Dr M. Segoli, Dr E. Groner) and over 100 identifications were done for the Museum staff (Entomology Lab for Applied Ecology, Israel National Center for Aquatic Ecology, T. Dayan, Y. Yovel etc.). Seven species of the Israeli Malachiidae were identified from photographs for a Czech colleague.
- Hemiptera Heteroptera (T. Novoselsky): 74 specimens were identified the Plant Protection and Identification Services, Ministry of Agriculture of Israel, Israel National Center for Aquatic Ecology, and Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev.
- Hemiptera Sternorrhyncha (M. Spodek): About 20 psyllids and scale insects were identified for various individuals and government bodies.
- Diptera: N. Dorchin consulted staff of the Ministry of Agriculture regarding two agricultural pests: an undescribed species of gall midge damaging the cut-flower industry and a serious pest of olives. These consultations included visits on site (in the field) to assess the damage and col-

lect the insects. Other services included identification of cecidomyiid material sent from Kenya and from South Africa.

- Diptera: M. Mostovski identified two samples (shoot-flies of the genus *Atherigona*, Muscidae; and scuttle flies of the genus *Megaselia*, Phoridae) for Plant Protection and Inspection Services.
- Hymenoptera (Ants): A. Ionescu together with U. Shalom produced an identification field guide to invasive ant species for IMEP rangers, who would conduct surveys of little fire ant infestation in greenhouses, seedling nurseries, seed orchards, etc. in order to contain the ants' spread.
- Hymenoptera (Bees): A. Dorchin identified around 1000 specimens of *Eucera* bees from Algeria, Morocco and Spain for Denis Michez, Mons University, Belgium.
- Hymenoptera (Parasitica): Z. Yefremova identified about 60 specimens for Plant Protection and Inspection Services, Israel. All identifications were entered into the SMNH Database.
- Hymenoptera (Parasitica): W. Kuslitzky put together an identification key for 10 species—parasitoids of grain pests in storage products—for the Department of Postharvest and Food Sciences, the Volcani Center, ARO (Dr D. Gottlieb).

Collecting trips and expeditions

A dynamic archive, our Natural History Collections grow annually through donations, research projects, and collecting trips and expeditions. Many research projects have added numerous specimens to our collections, while other collections have benefited from focused collecting trips. Here we report on some of the new collecting activities of our scientists. The entomology staff added about 10,000 insect specimens during the reporting period, excluding those in Malaise trap bulk samples that still need to be processed.

S. Zonstein went on a short collecting trip to the Negev (15–18.03.2019) and on two field trips to Uzbekistan (7.04–6.05.2019) and Tajikistan (30.06–20.07.2019).

L. Friedman undertook six collecting trips: four to the Jordan Valley (one of them within the survey by Israel Nature and Parks Authority for 2 days), one to the Central Negev (3 days) and one to Mt. Hermon (for collecting bees, with A. Dorchin, 3 days). Thirteen brief (1–2 hours) collecting events were made, predominantly in the Western Samaria and in the Central Coastal Plain. These trips resulted in collecting 2,147 insects, including a few rare species of weevils (e.g. *Oprohinus* sp. that was collected only once in the 1970s and was still not formally recorded from Israel, and *Bradybatus fallax*, occurring in Israel only above 2000 m on Mt. Hermon). All these trips were not funded, except for the trip to Mt. Hermon. L. Friedman also participated in the field trip (10 days) organized and funded by Dr Netta Dorchin in the Western Cape Province, RSA, under the permit by the Cape Nature Conservation Services, covering as many habitats as possible: Cape Peninsula, Table

Mountain, Kirstenbosch Botanical Garden, Cederberg Mts., DeHoop Nature Reserve and Overberg, Karoo

Desert Botanical Garden in Worcester and Jonkershoek Nature Reserve. About 3,000 insects were collected, mainly weevils (Apionidae, Anthribidae, Curculionidae, Nanophyidae) and leaf beetles (Chrysomelidae), but also other beetles, bugs and flies. The ma-



Left: L. Friedman collecting *Rhinusa* sp. on *Verbascum quibicum* on Mt. Hermon (photo by Nataly Levine). Top: D. Furth and L. Friedman collecting weevils and leaf-beetles in Patuxent Research Refuge, Maryland, USA (photo by Sam Droege).

materials brought from South Africa, including numerous rare and undescribed species, are being mounted, labelled and sorted. A lot of rare and precious information on the host associations of the South African weevils was revealed and recorded, and a few important observations on the weevil biology were made. The majority of the collected species was not represented previously in the SMNH collection. While on a private visit to the USA, L. Friedman made numerous collecting excursions on daily basis to natural and semi-natural habitats: forests, meadows and parks within Ewing and Freehold townships, banks of Delaware and Raritan Rivers, Baldpate Mountain. With the help of Dr D. Furth and on the kind permit by Dr S. Droege, LF visited the "Bees laboratory" in the Patuxent Wildlife Refuge and collected in both wet and dry habitats in the reserve. During these trips ca. 800 insects were collected, chiefly weevils (Apionidae, Rhynchitidae, Curculionidae, Nanophyidae), most of them were not represented previously in the SMNAHTAU collection. Among the most exciting findings are a few specimens of *Pseudotychius watsoni* (Nanophyidae), a rare and enigmatic weevil species, the only species in this genus, distributed in the eastern USA and Canada, extremely rarely collected, with completely unclear host associations.

M. Mostovski installed a Malaise trap in Mate Yehuda district, which was serviced on a monthly basis.

W. Kuslitzky collected over 1000 Hymenoptera (Ichneumonidae, Braconidae and Parasitica) by sweeping, Malaise trapping and rearing from various hosts.

A. Dorchin performed field surveys of wild bees between March and July 2019 at three nature reserves on the Golan Heights and Mt. Hermon. This project was funded by the Israel Nature and Parks Authority (NPA), the SMNH and the University of Haifa (121,400 NIS). The main purposes of this project was to prepare an updated list of species based on standardised sampling methods and to estimate the effect of managed honey bee hives placed near or inside the nature reserves on wild bee species richness and abundance. A total of 2,910 bee specimens were collected and are currently in the process of specific identification by group specialists in Israel and in Europe.

M. Guershon and A. Dorchin participated in field surveys organized by the Israel Nature and Parks Authority in Sartava Nature Reserve in February 2019. A total of 43 bee species were recorded during these surveys.

Z. Yefremova went on a field trip to the Phonsavan area, Laos, collecting Chalcidoidea (Oct.–Nov. 2018).

V. Kravchenko went on several field trips around Israel and collected in Botanical Garden of Tel-Aviv University (Jan. 2019, with permission of Dr T. Levanony), on Phoeniaux Farm (sandy Northern Negev, Jan. 2019), in Majdal Shams (montanan steppe, Apr. 2019), and in Nahal Oren (Mt. Carmel) and in Perat National Park (Judean Desert) in Apr. 2019. He also on two overseas field trips: (1) to the highlands of Laos (Phonsavan area, 25.11–18.12.2018) for collecting leaves of oak trees to breed Glacillaridae leaf-miners (Lepidoptera) and for light-trapping to compare Hymalaian lowland and highland Noctuidae faunas (lowland localities below 300 m: Muang Khom and Thathom hot springs; highland localities: Mt. Phou Samsoum (2500 m a.s.l.) and mountains in Nam Xam protected area (1800 m)); and (2) to Myanmar in May 2019 for light-trapping (Mt. Victoria, 3000 m a.s.l., mountain forest), Kanpetlet (2500 m, mountain forest), Lan Ywar (350 m, Irrawaddy dry forest), Taunggyi (2200 m, mountain forest).

Outreach

M. Guershon hosted a tour around the collection and exhibitions for the Israel Nature and Parks Authority rangers; a tour around the collection for Dr Barret Klein from the University of Wisconsin–La Crosse (USA); conducted a short survey tour in the Botanical Garden for graduate students of the Porter School for Environmental Sciences, TAU; and prepared an 'exhibition drawer' of bees handed on loan to the Kefar Saba Museum.

N. Dorchin was a scientific curator of the exhibition *Microsculpture*, the insect photography of Levon Biss. The exhibition was scheduled for opening at the SMNH in December 2019.

Many team members participated in show & tell activities at the Museum, and offered lectures to the general public.

THE INSECTARIUM

Elizabeth (Liz) Morgulis

The collection of live arthropods became a part of the Entomology Section at Tel Aviv University thanks to Alex Shlagman, an expert in rearing various organisms, over 30 years ago. During these



Milkweed (*Asclepias* sp.) is grown now in the Museum's greenhouse to feed the Gaudi grasshopper, *Poekilocerus bufonius*.

decades, Alex managed to keep and breed dozens of arthropod species, mainly insects. At present nearly all arthropods in the insectarium are born there, rather than collected from nature. Nevertheless, additional individuals are being brought from time to time from the field, which helps revitalizing the stock colonies. Thus, black widows (*Latrodectus tredecimguttatus*) for the live exhibition were collected in Caesarea last year. There was also some success with raising the European mole cricket, *Gryllotalpa gryllotalpa*, a species which had not been reared before in captivity. Several adult females collected in the nature laid eggs in the cages provided for them. The

eggs hatched and the hatchlings were reared to adulthood.

All our arthropods require particular diets and different environmental conditions (such as temperature, humidity, and the terrarium setting), which resemble the natural and preferred habitat of each species. A small greenhouse was acquired to grow food plants for the insects, in particular for the Gaudi grasshopper, *Poekilocerus bufonius* (Orthoptera: Pyrgomorphidae). This species feeds exclusively on certain plants from the Asclepiadoideae (Apocynaceae), and cannot be reared on alternative diet. So far, there are some 15 *Asclepias* sp., six *Calotropis procera* and five *Gomphocarpus fruticosus* plants in the greenhouse. As a result, the population of the grasshopper in the insectarium grew considerably.

THE MARINE & FRESHWATER SECTION

THE PORIFERA COLLECTION

Sigal Shefer

Collection and field survey of Porifera communities along the Mediterranean coast of Israel, and other locations:

This year 224 specimens were collected and some of them would be added to the collection; 102 of them were procured during excursions to the mesophotic sponge grounds located at depth of 80–100 m off Herzliya and from Eilat mesophotic depth, these specimens were collected as part of studies conducted at Prof. Ilan's lab. The rest of the specimens came from other sources: 118 samples from BioBlitz (April 2019) and 4 samples from CSA Ocean Sciences Inc.

Taxonomic identification service:

- Four samples were identified for CSA Ocean Sciences Inc. Company (Elad Mills).
- 118 samples were accepted and identified as part of BioBlitz in April 2019 (21, Habonim; 36, Akziv; 41, Shiqmona; 20, Gedor).

A BioBlitz crew is setting off the Mediterranean coast at Habonim for collecting.



Physical organization:

Since relocation of the collection to the new museum building in June 2018, we finished organizing it according to the current taxonomy for identified sponge specimens, whereas placement of unidentified specimens was done according to their geographical origin or expeditions, and was ongoing.

Courses, Training and Conferences:

I participated in the following courses, both held at Tel Aviv University:

- Structure and Function in Vertebrates;
- Conservation Biology.

THE MOLLUSCA COLLECTION

Henk K. Mienis, Oz Rittner and Revital Ben-David-Zaslow

Personnel

During the academic year 2018–2019 Dr Rony Yizhar was appointed as a Technical Assistant in the Mollusca collection.

Research and curation

During the academic year 2018–2019 we continued to carry out research in the fields of taxonomy, systematics, nomenclature, Lessepsian migration, exotic and invasive species among the mollusc fauna of Israel and various aspects of archaeomalacology.

Numerous changes in the nomenclature of various well-known Mediterranean species formed a real burden on the workload of the few people working in the Mollusca collection since many samples were affected by these changes. A few examples are the common Mediterranean Cowry shell *Erosaria spurca* that is now called *Naria spurca*, and all the native *Nassarius* and *Neritaea* species living in the Mediterranean Sea that are now placed in the genus *Tritia*.

New interesting faunistic records from Israel

Marine molluscs



Anodontia philippiana (figured on the left), an Erythraean species, was reported for the first time from the Eastern Mediterranean (Mienis 2019a).

The presence of two other Indo-Pacific species: *Isognomon legumen* and *Dendostrea sandwichensis*, along the Mediterranean coast of Israel

was confirmed by new records (see under Cooperation with visiting foreign scientists).

The sudden appearance and disappearance of *Perna perna* (on the right) especially in 1965 and later on once again in 1982 along the Mediterranean coast of Israel was cleared up through a study of the original material collected by Dr Zeev Lewy (Mienis 2019b).



Terrestrial molluscs

A puzzling record of a *Helicella jacosta* Mousson as a plant pest species among the land snails by Harpaz & Oseri (1961) was solved. Mousson never described such a taxon, but a species with similar shells was placed erroneously in the (sub)genus *Jacosta* for some time. In fact, *Helicella jacosta* sensu Harpaz & Oseri (1961) is identical to *Xerocrassa davidiana davidiana* (Bourguignat, 1861), a species confined to kurkar outcrops, a local sandstone, in Israel, and is therefore most unlikely to be a plant pest species.

The presence in Israel of the invasive species *Xerocrassa (Xeroclausa) meda* was elucidated in the wake of a discovery of a new population. It still occurs in Jerusalem, while its population in Yafo has been destroyed by recent building developments.

Support with identifications

Various ecologically and malacological studies on the presence of molluscs in Israel were carried out by colleagues at various institutes and by private people like Dr Uri J. Bar-Zeev, Dr Aharon Dotan, Dr Eldad Elron, Dr Liron Goren and Daniel Korkos. They enjoyed our expertise through identification of their material. The major part of their identified material was retained for permanent storage in the Steinhardt Museum of Natural History.

Cooperation with the Israel National Center for Aquatic Ecology

On a regular base samples, which were collected by Dr Yaron Hershkovitz or other people associated with the Center, were received for identification or verification.

Cooperation with the Plant Protection & Inspection Services of the Ministry of Agriculture

Mrs Svetlana Vaisman of the mollusc unit of the Plant Protection and Inspection Services (PPIS) at Bet Dagan continued to work 4–5 hours a week in our mollusc collection. Most of the time she is picking and identifying micro-molluscs from leaf litter and soil samples collected at various anthropogenic sites in Israel.

This academic year Mrs S. Vaisman brought us for verification or in a few cases identification only 35 samples of land and freshwater snails intercepted by inspectors from the PPIS from either agricultural shipments arriving from abroad or found on local material grown in nurseries. For the first time the Palaearctic land snail *Trochulus hispidus* was encountered in a shipment of Golden delicious hand apples from Italy. Other noteworthy interceptions were *Eobania vermiculata* from a shipment of fresh olives from Jordan (that shipment was returned to Jordan) and two interceptions of *Succinea striata* from grapes arriving from South Africa.

Cooperation with the Israel Nature and National Parks Protection Authority

Like in previous, years we received some mollusc material that had been collected during the Bio-Blitz project carried out in several Marine Nature Reserves along the Mediterranean coast of Israel. The results were rather disappointing from both a quantitative and qualitative point of view.

Cooperation with local and foreign archaeologists

During the past academic year we continued to work on the archaeomalacological material from the following sites:

- Jewish Quarter in the Old City of Jerusalem excavated by the late Prof. Nahman Avigad and more recently by Dr Hillel Geva;
- Horbat Bet Loya excavated by Dr Oren Gutfeld;
- Tell es-Safi/Gath excavated by Prof. Aren M. Maeir;
- Tel Erani field P excavated by Dr Iair Milevski.

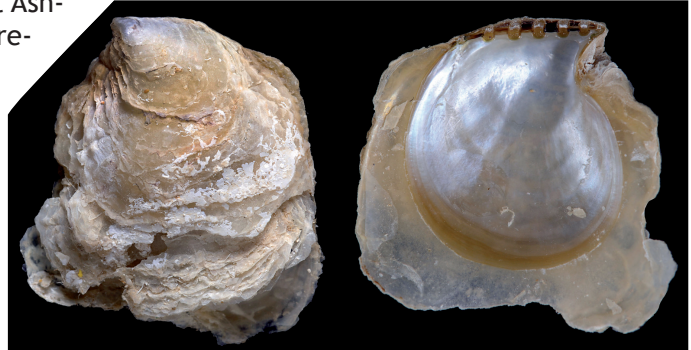
Cooperation with visiting scientists

Dr Paolo G. Albano and Jan Steger of the Department of Paleontology of the University of Vienna, Austria, continued their studies of the historical ecology of ecosystems affected by alien species introductions. During their work in Israel information was discussed and exchanged, focussing specifically on the Lessepsian migration. Samples of *Corbula (Varicorbula) gibba* collected alive during 1960–2000 were sent on loan for a palaeo-dating project.

Dr Agnese Marchini of the University of Pavia, Italy, collected in cooperation with Dr Bella Galil (SMNH) fouling species at various sites along the southern part of the Mediterranean coast of Israel.

The molluscs among them were identified and in part stored in the SMNH Mollusca collection. The following interesting discoveries were made:

- *Isognomon legumen* (figured) was found at Ashqelon, Ashdod and Tel Aviv. It is a fairly recent Lessepsian migrant in the Eastern Mediterranean recorded by Mienis *et al.* (2016) and Crocetta (2018);
- *Dendostrea sandvichensis* was found at Ashqelon, Tel Aviv and Herzliyya. Likewise, it is a Lessepsian migrant, previously recorded from Israel as *Alectryonella crenulifera* by Sharon *et al.* (2005) and Mienis *et al.* (2012).



Cooperation with malacologists abroad

Dr Cesare Bogi, Livorno, Italy, returned 150 lots of marine molluscs to the Mollusca collection, which he had received for identification from Dr Bella Galil.

New acquisitions in the Mollusca Collection (2018–2019)

New material, not only from colleagues at various institutes but also from private collectors was arriving regularly during the past academic year. The identifications of this new material were immediately checked and the samples were prepared for permanent storage in the collection.

Abbreviations used: BSS – Solly Singer, DK – Daniel Korkos.

Name	Brief description of the material
B.S. Galil	Marine molluscs from the Mediterranean Sea of Israel
T. Feldstein	Marine molluscs from Iceland
J. Gerritzen	Molluscs from Indonesia (Sumatra and Nias Island)
L. Goren	Marine molluscs from the Mediterranean Sea of Israel
O. Kerman	Marine molluscs from Costa Rica and Scotland
M. Klein	Marine molluscs from the Mediterranean and Red Sea
A. Marchini	Marine molluscs from the Mediterranean Sea of Israel
L. Meerema	Molluscs from Indonesia (Sumatra and Nias Island)
H.K. Mienis	Land- and freshwater molluscs from Israel and the Netherlands
O. Rittner	Land snails from Israel
W. Segers (via BSS)	Marine molluscs from Tunisia
B.S. Singer	Marine molluscs from the Mediterranean and Red Sea
S. Tsuriel (via DK)	Land snails from Israel
S. Vaisman	Land snails from Israel

Computerization of the collection

The computerization of the Mollusca collection resumed upon the transfer to the new Museum facilities and was carried out by Oz Rittner and Rony Yizhar (recent molluscs and occasional arrivals of fossil material) and Dr Daniella E. Bar-Yosef Mayer (fossil molluscs in the palaeontological collection of Hanan (Hans) Bytinski-Salz).

At the moment, 64,098 samples (excluding fossil ones) representing 11,111 taxa (including fossil ones) in the Mollusca collection are computerized.

The Malacological library

The library is a most important tool for taxonomic and systematic studies in the Mollusca collection and has been expanded through recent donations.

New literature acquisitions in the library of the Mollusca collection in 2018–2019:

- D. Korkos Numerous malacological journals
- H.K. Mienis Numerous reprints

In addition, we received many reprints and numerous journals from Zoological Institutes or Malacological Societies in exchange for *Triton*, an independent malacological journal published in Israel.

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Malacological fieldwork in Israel

Henk K. Mienis and Oz Rittner

During the academic year 2018–2019 fieldwork was confined to a follow up one-day visit to the prehistoric site of Gilgal and its surroundings on 25 February 2019.

Participants were Mrs Svetlana Vaisman of the Plant Protection and Inspection Services of the Ministry of Agriculture in Bet Dagan, and Roni Izhar, Oz Rittner and Henk Mienis of the Steinhardt Museum of Natural History (SMNH).

The fieldwork focused on getting a better idea of:

- the recent terrestrial snail fauna of Gilgal;
- the presence of fossil freshwater molluscs from the last time that the area was covered by a freshwater lake;
- the presence of Cenomanian fossil molluscs in the surroundings of the site.

A fairly large sample of soil was taken from under protruding rocks and from fissures within the rocks in order to check them at the SMNH for the presence of tiny land snails like *Cecilioides*, *Calaxis* and other minute species. The latter work was carried out by Mrs Svetlana Vaisman. The results were rather disappointing because no new species were found.

The fossil freshwater snails found on the soil covering the hills, which were inhabited by the prehistoric inhabitants of Gilgal, consisted mainly of *Melanopsis buccinoidea* and *Melanopsis cerithiopsis*. Both species do not occur anymore in the area. Interestingly, a specimen of *Mercuria tchernovi* fell out of a *Melanopsis* shell. This means that the area of distribution of that tiny freshwater species once included the Lower Jordan valley. Today it is confined to springs in the Dead Sea area and northern Arava Valley.

Three Cenomanian mollusc species were found. All were bivalves: *Pycnodonte vesicularis*, *Plicatula batnensis* and *Lucina dachelensis*.

Besides the molluscs, numerous pincers of the freshwater crab *Potamon potamios* were found in the same area where *Melanopsis* specimens were present.

Malacological fieldwork in Friesland, the Netherlands

Henk K. Mienis

During the period of 9 September – 13 October 2019 fieldwork was carried out in Friesland, one of the Northern provinces in the Netherlands, to which also belongs the Wadden Sea islands Vlieland,

Terschelling and Ameland. Most work took place in the area of Friesland that falls under the jurisdiction of the municipality the Fryske Marren (Frisian Lakes) and on the island Terschelling.

The fieldwork aimed to get a better understanding of the malacological biodiversity of some nature reserves: the Famberhorst in Joure, Wilhermina Oard in Sint Nicolaasga, and the Elm-arboretum and the "Put of Nederhorst" both in Joure. All sites had been investigated once a year always in autumn since 2017.

On Terschelling fieldwork was carried out in several nature areas, some sites had been almost yearly investigated by the author since 1961.

The Famberhorst

This is a small private nature reserve in Joure situated a few hundred meters from the home, where I am staying when in Friesland. So far 66 species of land and freshwater molluscs had been registered as occurring in the Famberhorst (Mienis 2019a). This year special attention was given to the presence of freshwater molluscs in the Jonkersloot, which forms the western border of the Famberhorst. This large ditch is difficult to sample because of the many tree branches present on the bottom of the ditch, while the bank at the opposite side of the ditch is very steep. Fortunately a large dragline was cleaning the ditch during two days. In the mud and among the aquatic weeds were numerous specimens of *Anodonta anatina*, *Unio pictorum* and *Corbicula fluminea*. In the lower areas in the center of the Famberhorst two additional Pea mussels were found: *Cingulipisidium milium* and *Euglena henslowanum*. A single land snail, *Vallonia pulchella*, was also found for the first time. These six species brings the number of molluscs living in the Famberhorst to 72!

The find of the invasive *Corbicula fluminea* (figured), both tiny juveniles and large adults, forms the first inland record for Friesland. Tissues of living specimens have been conserved for a DNA research dealing with problematic *Corbicula* species living in Israel.



Wilhermina-Oard

During 2017 and 2018, only 15 terrestrial gastropods had been encountered in this relatively small nature reserve (Mienis 2018 & 2019b). In 2019, a few ditches in the reserve were surveyed for the presence of freshwater molluscs. This resulted in the recording of eight species: *Bithynia leachii*, *Radix balthica*, *Stagnicola palustris*, *Anisus vortex*, *Bathyomplalus contorus*, *Planorbarius corneus*, *Planorbis planorbis* and *Segmentina nitida*.

The Elm-Arboretum in Joure

Because of the very dry summer and autumn of 2018 only 10 species of land snails were encountered in this unique arboretum (Mienis 2019c). The autumn of 2019 was much wetter and the results were therefore much better this year. Besides the 10 species found in 2018 I recorded 12 additional species, among them five species of slugs: *Carychium minimum*, *Succinea putris*, *Succinella oblonga*, *Vallonia costata*, *Vallonia pulchella*, *Euconulus praticola*, *Vitrina pellucida*, *Deroceras laeve*, *Deroceras reticulatum*, *Arion circumscriptus*, *Arion intermedius* and *Arion rufus*.

The "Put of Nederhorst"

In 2018, I found in this artificial lake near Joure 10 aquatic mollusc species and two terrestrial gastropods within a distance of two metres from the water edge (Mienis 2019d). Shortly after the publication of my preliminary research I received from a member of the Dutch Malacological Society information that three large mussel species—*Amodonta cygnea*, *Anodonta anatina* and *Unio pictorum*—are living in the deeper parts of the lake, and *Sphaerium corneum* in shallow water.

In 2019, I visited the lake on 10 and 12 September and managed to locate ten additional aquatic molluscs species: *Valvata piscinalis*, *Acroloxus lacustris*, *Stagnicola fuscus*, *Stagnicola palustris*,

Ferrissia fragilis, *Bathyomphalus contortus*, *Gyraulus albus*, *Planorbis planorbis*, *Segmentina nitida* and *Pisidium* sp., and eight additional terrestrial species: *Oxyloma elegans*, *Oxyloma sarsii*, *Cochlicopa lubrica*, *Euconulus praticola*, *Vallonia pulchella*, *Zonitoides nitidus*, *Vitrina pellucida* and *Arion intermedius*.

Terschelling

On the island Terschelling I investigated for the first time a ditch north of the graveyard in Hoorn, which is part of the year almost completely dry. There was some water in the western section of it, which harboured the following aquatic molluscs: *Galba truncatula*, *Radix balthica*, *Anisus leucostoma*, *Gyraulus albus* and *Planorbis planorbis*. In the ditch at the eastern side of the graveyard I found two small specimens of *Limacus flavus*.

Nature Reserve the Kooibosjes and the Mastbroeken

For the first time I surveyed this reserve for the presence of terrestrial and aquatic molluscs. This resulted in recording 17 species, the aquatic *Bithynia tentaculata*, *Potamopyrgus antipodarum*, *Valvata cristata*, *Radix balthica*, *Anisus vortex*, *Gyraulus albus*, *Hippeuthis complanatus*, *Segmentina nitida*, *Pisidium obtusale* and *Cingulipisidium milium*, and the terrestrial *Succinea putris*, *Cochlicope lubricella*, *Zonitoides nitidus*, *Aegopinella nitidula*, *Nesovitrea hammonis*, *Oxychilus alliarius*, *Arion circumscriptus* and *Arion intermedius*.



Ceriuella virgata (figured)

On Terschelling this invasive species is slowly but steadily expanding its distribution in West Terschelling. On the mainland in Friesland, it is known from a small area of Highway 7 near the Frisian side of the Afsluitdijk. So far it does seem to expand its range along Highway 7 in southern direction. At the other site of the Afsluitdijk in North-Holland *C. virgata* can be found along Highway 7 almost everywhere.

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THE BRACHIOPODA COLLECTION

Henk K. Mienis

Historically, brachiopods or lamp shells were considered for a long time as belonging to the molluscs. In old shell books often one or two plates were dedicated to the few species living in a certain area. We know now that they form the remnants of an independent ancient phylum consisting of marine shelled animals of which thousands of fossil species are known.

According to Logan *et al.* (2004), 14 species currently live in the Mediterranean Sea, but only six of them have been reported from the Levant basin off Israel (Brunton 1988; Logan *et al.* 2002).

A recent inter-university study of the brachiopods present in the collections of the national natural history collections at the Hebrew University of Jerusalem (HUJ Brach) and the Steinhardt Museum

of Natural History (SMNH Brach) by Yael Leshno Afriat and Henk K. Mienis (2019) has revealed that at least nine species are living in our part of the Levantine Sea. Most of the presented information was based on material present in the HUJ Brach, because the original Tel Aviv University material studied by Brunton (1988) seems to have disappeared.

The Brachiopoda collection has to be established at the Steinhardt Museum of Natural History again from scratch. A first step in that direction was the discovery of a large number of brachiopods belonging to *Gryphus vitreus* in samples hauled from a depth of 550 m off Tel Aviv during a study of deep-water fauna by Dr Menachem Goren and Dr Bella S. Galil in 2017. Only recently it turned out that many of the *Gryphus vitreus* specimens carried on their shells a tiny hitchhiker, *Platidia anomioides*, another brachiopod species not previously recorded from off the Israel Mediterranean coast.



A *Gryphus vitreus* shell with attached specimens of *Platidia anomioides*, from 550 m depth off Tel Aviv. (Photo by Oz Rittner)

Newly collected brachiopods will be lodged in the Brachiopoda collection as an annex to the Mollusca collection of the Steinhardt Museum of Natural History.

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THE BRYOZOA COLLECTION

Noga Sokolover

Collection

The collection was unpacked and organized in the new storage facilities.

During 24–31.03.2019 we hosted a Polish PhD candidate, Anna Piwoni-Piórewicz. As part of a global project investigating CaCO₃ polymorphs in Bryozoa skeletons from the poles to the equator, Ania took subsamples from 65 Bryozoa specimens to be analyzed in Poland.

Taxonomic identification service

Two samples were identified for CSA Ocean Sciences Company.

Courses, Training and Conferences

- I attended the 18th International Bryozoology Association Conference in Liberec, Czech Rep.
- I initiated and participated in a STSM-COST project: “Constructing Bryozoa baseline in the heavily invaded Eastern Mediterranean” the project included a two-week visit to University of Catania, Italy to work with Prof. Antonietta Rosso on samples from the collection. We identified 120 specimens belonging in 55 species.

TERRESTRIAL, FRESHWATER AND MARINE FREE-LIVING NEMATODES

Stanislav Pen-Mouratov

Nematodes are the most common, abundant, and genetically diverse metazoan organisms on the planet. Among of them, the free-living nematodes constitute a large proportion of the total nematode community and are very important and beneficial in the decomposition of organic material and recycling of nutrients in nature. Furthermore, the free-living nematodes have been found to be one of the best biological tools for assessing environmental disturbances. While some 25,000 nematode species have been described, estimates for species diversity range from 100,000 to 10 million (Poinar 2011).

Research goals

- To study the species diversity, abundance, and distribution of roundworms inhabiting the Israeli terrestrial and aquatic ecosystems;
- To determine impact of different natural and anthropogenic disturbances on the free-living nematode communities in terrestrial and aquatic environments.

Research projects

During the reporting period we continued studying the impact of bird nesting and roosting activity (Pen-Mouratov & Dayan 2019) and animal trampling (Pen-Mouratov *et al.* 2019) on soil free-living nematode abundance and diversity in Israel. In addition, I participated in the study of the effect of air pollution on the soil biota in the mining and industrial area in Uzbekistan (Shukurov *et al.* 2018).

(1) Effect of piscivorous and omnivorous colonial birds' activity on soil free-living nematodes

Colonial birds can significantly affect the environment. The large amount of bird feces in nesting and breeding areas affect such soil properties as acidity, salinity and nutrient availability, which has an impact on the abundance and diversity of microbial communities and soil mesofauna. The main aim of this study was to determine the impact of bird nesting/roosting activity on soil biota abundance, and on the trophic structure, sex ratio and generic diversity of soil free-living nematode communities. The soil biota, including soil microorganisms and free-living nematodes along with soil properties (soil moisture, conductivity, pH, NO_3^- , NH_4^+ , P) were recorded in the nesting and roosting habitats of the following colonial birds: black kite (*Milvus migrans*), great cormorant (*Phalacrocorax carbo*), black-crowned night heron (*Nycticorax nycticorax*) and little egret (*Egretta garzetta*), in Israel's Mediterranean region during the hottest period of 2016. A total of 64 soil samples from the 0–5 and 5–10 cm depths were collected. Sixty-two nematode taxa were identified: 26 belonged to the bacteria-feeding trophic group, 6 were fungi-feeding, 17 were plant parasites and 13 were omnivore-predators. Our results showed that different species of colonial birds have different (stimulatory or inhibitory) impacts on the abundance and diversity of the soil biota, affecting the structure of soil free-living nematodes at the generic, trophic guild and sex ratio levels. Moreover, the soil ecosystem in the area of bird activity had a simpler food web, but with higher concentrations of nutrients compared to the control area. Soil properties such as alkalinity (pH) and conductivity, along with contents of NH_4^+ , NO_3^- , and phosphorus were found to be among the main factors influencing prey-predator relationships in the observed habitat and altering the predation success of soil free-living nematodes.

(2) The impact of animal trampling on free-living nematodes

Livestock grazing and trampling is important for formation and development of terrestrial ecosystems. However, despite numerous studies on soil compaction, there is still no consensus as to which kind of effect (positive or negative) animal trampling exerts on soil nematodes. The main goal of this study was to evaluate the animal trampling effect on free-living nematode abundance and diversity, and to define the attenuating effect of the tree canopies (*Cupressus sempervirens*, *Eucalyptus camaldulensis* and *Tamarix aphylla*) during wet and dry periods. The study was conducted at the African Safari Park of about 70 ha (The Zoological Center, Tel Aviv-Ramat Gan). A total of 96 soil samples from the 0–10 cm depth were collected, and 66 nematode taxa were identified: 20 taxa belonged to the bacterivore trophic group (BF), 8 were fungivores (FF), 21

were plant-parasites (PP) and 17 were omnivore-predators (OP). Our results revealed the mostly negative influence of trampling on both free-living nematode abundance and diversity, and their soil habitat. However, the protective effect of the tree canopies, as well as seasonal fluctuations, attenuated this negative impact.

(3) Distribution, mineral forms and bioavailability of heavy metals in soils, and their impacts on soils biogeochemical properties

Numerous studies showed that soil free-living nematode communities, along with soil microorganisms, are among the best biological tools for assessment of soil disturbances, including heavy-metal pollution. Soil, which were heavily impacted by aerial emissions from the coal burning and metal-processing industry of the Angren-Almalyk industrial area (Uzbekistan), were the main subject of our intensive investigation. The main aims of our studies were (i) to assess the relationship between distance from the emission sources and heavy metal concentrations in soil and to analyze the depth distribution of the metals as indication of their mobility along the downwind transect; (ii) to evaluate the mobile and immobile metal forms; and (iii) to determine the influences of heavy metals (Cu, Pb, Zn, Cd and As) on soil microbial and nematode community structure in Angren-Almalyk mining industrial area along the two deposition transect. Soil samples were collected along two 20-km downwind transects in the Akhangaran River valley, near industrial enterprises. A total of 176 soil samples from the upper soil layers were collected, and 48 nematode taxa for the Angren industrial area and 29 nematode taxa for the Almalyk industrial area were identified. Our results revealed that the concentrations of a number of potentially toxic metals varied along the sampling transects, revealing a gradual decrease at rising distance from the emission sources. The highest levels were found for the relatively volatile heavy metals (Cu 457–871, Zn 424–1695 and Pb 163–441) in soils near the Almalyk metal smelter, and Zn (850–1051 ppm) and Pb (270–320 ppm) in soils near the Angren power plant, thus suggesting that the metal pollutants probably derive from local stack emissions. The morphology and internal microstructure of metal-bearing spherical particles found in the heavy mineral fraction suggest that these particles were probably formed during inefficient flue gas cleaning technique of the smelter. Thermodynamic equilibrium calculations suggest that the mobile metal pool in the contaminated soil is mainly controlled by dissolution of metal carbonates formed as weathering product of the metalliferous particles. The effect of pollution on the density, biomass and diversity of soil free-living nematodes was found to be highest at the pollution source. The females of the total soil free-living nematodes were found to be the most resistant to heavy metal pollution levels, while the juveniles were found to be sensitive to changes in heavy metals.

Collaborations

During the reporting year, I continued active and fruitful collaboration with colleagues from different scientific organizations in several countries, who study free-living nematodes. I successfully completed the Identification Course on aquatic nematodes at Ghent University, Belgium, in December 2018.

Nematode Collection

During the reporting period, free-living nematodes from 100 soil samples from the Mediterranean region of Israel were extracted, fixed and prepared for long-term storage in the museum collection for further study.

THE CRUSTACEA COLLECTION

Bella Galil and Ya'arit Levitt-Barmats

The Crustacea is the only large group in the phylum of Arthropoda that is primarily aquatic, with over 50,000 described species. Most crustaceans occupy marine, freshwater, and terrestrial environments all over the world, and some species are even found in extreme—in terms of temperature, pressure, and salinity—environmental conditions. Crustaceans have significance economic and ecological importance, and they constitute an important food source for marine animals and humans.

Research

Bella Galil focussed her reaserch efforts on the issues of alien and invasive crustacean species, as well as on the taxonomy of decapods, describing new species from East Africa and Papua New Guinea.

Ya'arit Levitt-Barmats progressed well with her PhD project on the diversity and spatial distribution of Caridea species along the coasts of Israel.

Razy Hoffman (curator of water plants, cyanobacteria and water fungi collection) also contributed to the study of distribution pattern of some alien amphipods in the Mediterranean sea (please refer to his report on p. 41).

Collection management

Following the relocation to the new Museum facilities, unpacking of crustacean specimens began and some 30% of the material were already shelved. Dr John Pearse of University of California, Santa Cruz, donated Cirripedia collected in the 1960s along the Egyptian coast of the Red Sea. His collection would be catalogued in the coming year.



Collection trips

A 3-day collection trip undertaken in June 2019 focused on investigation of previously undersampled biofouling biota in five marinas along the Mediterranean coast of Israel (B. Galil, Prof. A. Marchini of Pavia University, Italy, L. Goren, B. Rothman). Preliminary results showed the presence of alien balanomorphs, isopods and amphipods.

The crab *Matuta victor* is an alien species in the Mediterranean Sea. (Photo by Oz Rittner)

Taxonomic identification services

- 80 specimens were identified by Ya'arit Levitt-Barmats for the Israel National Center for Aquatic Ecology and their graduate students.
- Approximately 350 specimens were identified by Bella Galil for the National Institute of Oceanography, Israel Oceanographic and Limnological Research.
- 39 species of leucosoid crabs (approx. 300 specimens) collected during three deep-sea cruises to Papua New Guinea and preserved in the Muséum National d'Histoire Naturelle, Paris, were identified by Bella Galil. Of these, one species turned to be new to science, 20 species were new records for Papua New Guinea, with *Cryptocnemus stimpsoni* and *Nursia phylloides* being known only from single type specimens collected during the 'Siboga' Expedition in 1899–1900.

Databasing

Approximately 100 records were added to the crustacean database by Ya'arit Levitt-Barmats.

Education/public outreach

- Ya'arit Levitt-Barmats presented the crustacean exhibition to the incoming cohort of museum guides.
- *Ha'aretz* published a couple of articles based on material supplied by Bella Galil.

Training workshop

Identifying non-indigenous and cryptogenic peracarid crustaceans in mediterranean marinas

Amphipoda, Isopoda and Tanaidacea are small-bodied malacostracan crustaceans, and despite their abundance and ecological importance remain understudied along the Israeli coastline. Recent studies revealed the high potential of littoral peracarids to be transported in vessel fouling. The recent development of marinas and the increasing number of recreational vessels may facilitate

and accelerate the introduction process. Therefore, a workshop focusing on identification of marina inhabiting peracarids was convened at the Steinhardt Museum in June 2019.

This course, led by Prof. Agnese Marchini (University of Pavia, Italy), comprised of introduction to the general biology, anatomy and taxonomy of peracarid crustaceans, and specifically families that are common components of fouling assemblages and species that are non-indigenous or cryptogenic in the Mediterranean Sea. Ten participants collected material in the Tel Aviv marina, sorted and identified it; they learned to recognise the peracarid families commonly occurring in fouling assemblages and to identify non-indigenous and cryptogenic species using taxonomic keys.

International collaboration

- Implementation of the Marine Strategy Framework Directive (MSFD) to the Deep Mediterranean Sea (IDEM) – EU DG Environment funded Symposium

Gaps and needs for the implementation of the MSFD in the Mediterranean deep sea (6.02.2019).

- Implementation of the Marine Strategy Framework Directive to the Deep Mediterranean Sea – EU DG Environment funded Workshops

Gaps and needs for the implementation of the MSFD in the Mediterranean deep sea;

Guidelines for the definition of deep-sea protected areas (5–7.02.2019).

The workshops took place at the Steinhardt Museum of Natural History, with about 20 IDEM partners. In addition, the symposium, which was open to the general public, attracted over 120 participants (invitation and agenda attached). The symposium was introduced by Prof. Tamar Dayan, Chair of the Steinhardt Museum of Natural History, and Dr Stefano Ventura, a Scientific Attaché at the Italian Embassy in Israel.

THE POLYCHAETA COLLECTION

Liron Goren

Collection and field survey of the Polychaeta

In June 2019, following an invitation of Prof. Bella Galil, Prof. Agnese Marchini of the Università di Pavia in Italy, led a taxonomic course at the Museum and later continued collaboration with Prof. Galil that included sampling and identification of almost 200 specimens of polychaetes from Marinas in Israel. The specimens are to be deposited in our collection and the results of this collaboration are to be published as a research article.

Dozens of samples with hundreds of polychaete specimens from soft bottom habitats were received for identification from the Israel Oceanographic and Limnological Research. Their identification was ongoing, after which they would be deposited in the collection.

Taxonomic identification service

More than 50 samples (mostly Hirudinea) were identified for the Israel National Center for Aquatic Ecology at the Steinhardt Museum. Four samples represented a first record of a freshwater nereid (*Namalycastis hawaiiensis*) in Israel. This finding was reflected in a manuscript that was accepted for publication in the journal *BioInvasions Records*.

Courses, training and conferences

In August 2019, I attended the International Polychaete Conference in Long Beach, USA, and presented a talk and two posters detailing our recent findings in Polychaetology in Israel.

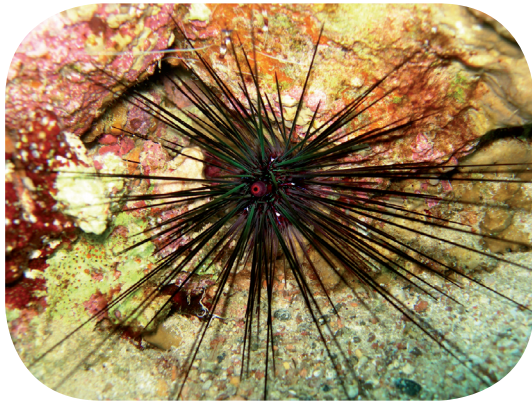
Future plans

- Complete and publish a Checklist of Polychaeta along the Israeli Mediterranean coast.
- Complete identification and description of two *Parasabella* spp. that were found in sponges in the mesophotic sponge grounds and in Marinas in Israel.
- Complete and publish results of the polychaete sampling in Marinas in Israel (with Prof. B. Galil and Prof. A. Marchini).
- Complete the Israel Oceanographic and Limnological Research project.
- Complete computerizing the catalog of the Polychaeta collection.

THE ECHINODERMATA COLLECTION

Omri Bronstein and Noga Sokolover

The collection was unpacked and organized in the new Museum facilities.



Collection

37 new specimens were identified; 45 specimens (all Echinoidea), were revised and discovered to be mis-identified, they were given correct identification.

Museum loans and visits

Two undergraduate students supervised by Omri Bronstein worked on ecological aspects of echinoids and used samples from the collections from both the Mediterranean and the Red Sea for their research.

Ongoing project

Omri Bronstein continues working on an illustrated guide for the Israeli echinoderms.

THE ASCIDIACEA COLLECTION

Noa Shenkar

The class Ascidiacea belongs to the Phylum Chordata and to the sub-phylum Tunicata. Ascidiaceans, or sea squirts, comprise approximately 3,000 solitary and colonial species that are found in all marine habitats (Shenkar & Swalla 2011). Adult ascidiaceans show little resemblance to typical chordates while the tadpole-like larvae bear the four fundamental characteristics of the phylum: a dorsal tubular nerve cord, notochord, rudimentary pharyngeal gill slits and a post-anal tail. Therefore, the class Ascidiacea presents fundamental opportunities for research in the fields of development, evolution, ecology, regenerative biology, natural products and more. During the reporting period, the Ascidiacea collection at the Steinhardt Museum of Natural History was significantly advanced with the addition of samples from the Mediterranean coasts of Israel, since the arrival and spread of non-indigenous species are of growing concern. During 2019, we conducted numerous field trips along the Mediterranean coast of Israel, including both natural and disturbed habitats such as the fish cages in Michmoret, marinas and ports. The increased sampling effort resulted in over 30 new specimens in the collection, preserved in both formaldehyde for morphological identification and ethanol for molecular studies. We are heading toward reporting a new invasive species, which is rapidly spreading on artificial substrates along the Mediterranean coast of Israel. We continued to provide our professional taxonomic expertise and identified ascidiaceans for several researchers and organizations in Israel and abroad, including the Charles Darwin Research station, the Galapagos, Ecuador, where Noa Shenkar conducted research during her summer sabbatical. International collaborations include material exchange with Prof. Aibin Zhan, China (Chen *et al.* 2019), Prof. Rosana Moreria de Rocha (Universidade Federal do Paraná, Curitiba, Brazil), Prof. Lucia Manni (University of Padova, Italy) and Prof. Inti Keit (Charles Darwin Foundation, Ecuador). Ongoing international collaborations include active participation of Noa Shenkar on the editorial board of the European Aliens Species Information System (EASIN), on the Horizon 2020 scanning team, and her serving as an Editor of the Ascidiacea World Database. Our research was supported by the Israel Scientific Foundation, Regular Research Program (PI: N. Shenkar) “Ascidiaceans (*Chordata*, *Ascidiacea*) as bio-indicators of the marine environment – from ecological, physiological, and cellular perspectives”, with 250,000 NIS per year (2015–2019).

MEDITERRANEAN AND RED SEA FISHES

Jonathan (Yoni) Belmaker

Nowhere is the native biota faced with changes that are more rapid than in the Eastern Mediterranean, where the continual influx of invasive Red Sea species, warming water temperature, over-

fishing and pollution transform fish diversity. The Mediterranean natural history fish collection provides a globally unique resource that is being used to identify how these immense changes influence fish diversity, biogeography and, more generally, marine ecosystem services and function. Such understanding can be used to identify the consequences of these major changes to the integrity of the marine ecosystem and, perhaps more importantly, to mitigate future adverse influences of human activity.

Active external grants that utilize the fish collection

Year	Funder	Title	PIs	Sum, NIS
2015–2020	The Israel Science foundation (ISF)	Hierarchical delineations of ecological communities to enhance ecological predictions	J. Belmaker	1,250,000
2017–2020	Israeli Ministry of Science and Technology	Resolving the “black box” of larval-fish abundance and its sensitivity to climate change	J. Belmaker, R. Holzman, M. Kiflawi, R. Sorek	1,499,790
2017–2020	Israeli Ministry of Science and Technology	Using a novel acoustic broadband echo sounder for fish identification and biomass assessment to optimise fisheries management in Lake Kinneret	J. Belmaker, I. Ostrovsky, B. Katsnelson, A. Ostfeld	1,199,624

Research

This year we continued to analyze museum data on the morphology of Mediterranean and Red Sea fish. This is used to test for biotic and abiotic constraints on traits diversity associated with fish invasion.

We hosted a workshop by the Israel Taxonomic Initiative (ITI) on Chaetognatha taxonomy, attended by students and professionals from around Israel.

We continued fish sampling based on trawl catch as part of Hezi Buba’s PhD. Sampled fish were used to quantify fish functional response which would be inserted into models that estimate how fishes respond to both invasion and warming. Representative samples of unique species were deposited in the collection.

We continued fish sampling based on recreational fisher catch as part of Ori Frid’s PhD. The goal of this study was to understand temporal dynamics of catch and by-catch. Representative samples of unique species were deposited in the collection.

We led an intensive fish survey in collaboration with the Israel Nature and Parks Authority along the Mediterranean coast. The goal was to establish an ecological baseline that can be used to assess the effectiveness of protection efforts. Surveys were conducted in spring and fall of 2019 with participation of all lab members.

In collaboration with Sebastien Villeger (CNRS, France) we conducted an intensive sampling campaign to understand what processes facilitate rabbitfish invasion (project EXOFISHMED: *Exotic herbivorous fish in Mediterranean ecosystems: biological causes and ecological consequences of an ongoing invasion*). Surveys were conducted in the fall of 2018 and spring of 2019.

In collaboration with Paolo Albano (University of Vienna, Austria) we ran an intensive sampling program to document the diversity and invasion impact in small Mollusca assemblages. Surveys were conducted in the fall of 2018 and the spring of 2019.

We engaged in a large-scale fish larvae sampling project funded by the Israel Ministry of Science and Technology. This study used advanced next-generation sequencing methods to understand the

spatiotemporal dynamics of fish larvae and their response to warming. Representative samples of unique species were deposited in the collection.

We began fish sampling along both the Mediterranean and Red Sea coasts using Baited Remote Underwater Video Systems (BRUTS) as part of Shahar Chaikin's PhD research. These surveys will quantify large fish diversity along spatial and depth gradients and will be used for both monitoring and long-term understanding of the marine ecosystem. Analyzed data will be openly available to the museum users.

We employed state-of-the-art broadband acoustic methods for sampling fish within and outside protected areas in Mediterranean as part of Sarah Ohayons's PhD research. This would be eventually used to identify fish species remotely acoustically.

THE TERRESTRIAL VERTEBRATES SECTION

Shai Meiri, Roi Dor, Tamar Dayan, Yossi Yovel, Erez Maza, Daniel Berkowic, Amos Belmaker, Kesem Kazes, Igor Gavrilov, Stanislav (Stas) Volynchik, Hamutal Friedman, Arie Landsman

Personnel

There have been several changes to the collection personnel. To our dismay, Roi Dor will not continue as the curator of birds. We are very sorry to see him go and hope he continues his research at the museum. Kesem, Amos and Erez carry out working in the collections, with some help from Daniel Berkowic. Igor and Stas are helped by Hamutal Friedman. Arie Landsman, Moshe Giezler and Mira Ideles volunteer in the collections and help with various projects. We also have help from the Aardvark project – two international high school graduates volunteer and help out. So far we had two generations of this program.

Postdocs: one museum postdoc worked in the collections this year. Marco Antonio Ribeiro Junior has been studying the taxonomy of Sand Geckos of the genus *Tropicolotes* and will continue to study the taxonomy of the Ratsnake of the genus *Elaphe* and the taxonomy of the European Glass Lizard of the genus *Pseudopus*. Two new postdocs will start to work in the following year: Karin Tamar will work on reptile taxonomy and Tali Magori Cohen will be working on bat diversity.

Move to the new collections facilities

All of the specimens were moved to the new building and the staff continues with the daily work of managing the collection. Much work still needs to be done with organizing the space, labeling shelves and cabinets and other projects to facilitate work in the collections.

Post exhibits establishment work

More than a 1000 specimens were moved from the tetrapod collections for the establishment of the new Museum's exhibits. This year we prepared a list of all specimens currently on exhibit, yet although most of it is completed, much (detective) work is still needed in order to validate their identity.

Research and Curation

The amphibian collection

The down trend in collecting amphibians continued this year. Between October 2018 and September 2019, our amphibian collection grew by only 7 specimens. These include: 3 Levant green frogs *Pelophylax bedriagae*, 2 Green toads, *Bufo* *sitibundus* (notice the name change, following Dufresnes *et al.* 2019, <https://doi.org/10.1016/j.ympcv.2019.106615>), one Treefrog, *Hyla savignyi*, and one Eastern spadefoot toad *Pelobates syriacus*. This year we did not receive even one Salamander or Newt. One of the reasons that might explain the low collecting rate is the lack of field research that focuses on amphibians. The amphibian collection remains the smallest and least active among the other tetrapods. Due to its small size, the Amphibia database was chosen to be the pilot database for the new platform.

The mammal collection

313 mammalian specimens were added to the collection during the reporting year (excluding many that are still waiting in the freezer). These belonged to 55 species, the commonest of which were Geoffroy's Trident Leaf-nosed Bats (*Asellia tridens*, 48) followed by the Southern White-breasted Hedgehog (*Erinaceus concolor*, 41), Grey Wolves (*Canis lupus*, 25), Golden Jackals (*Canis aureus*, 17), Mountain Gazelles (*Gazella gazella*, 15) and Egyptian Fruit Bats (*Rousettus aegyptiacus*, 13 specimens). Many tissue samples of uncommon bat species were received with the completion of Eran Amichai's PhD research, such as the Lesser Mouse-eared Myotis (*Myotis blythii*, with the last specimen received in the collection in 1998).

Our major operation this year was post-move work. The wet collection was relocated entirely, and unpacked according to a new order, which considers the latest taxonomy, the expected species-specific addition rate, and the museum number (in contrast to the order in the old hall that was based on free space). Ron Cohen, a volunteer in the mammal and herpetological collections, carefully mapped each species in the collection. The dry collection was also moved (with the exception of most of the skin collection) and was in the process of reorganization, similarly to the wet collection. During the process of unpacking, we also renewed and improved many of the specimens' packaging and refilled them with preservatives. Arieh continues to be in charge of databasing incoming material, which is now packed using new methods (plastic boxes and improvised extra-large Ziploc bags).

Another project, which was carried out, was reclassification of all rat specimens in the collection, after it had been noticed that many of them were misidentified (*Rattus rattus* as *R. norvegicus* and vice versa). These were some of the commonest species used by researchers visiting the collection and loaning material, and therefore the corrections were much needed.

The reptile collection

Between October 2018 and September 2019, the reptile collection grew by 251 specimens, from 18919 to 19172 (excluding many that are still in the freezer). The list is dominated by the Mediterranean chamaeleons, *Chamaeleo chamaeleon* (19 specimens), which were collected mainly by the Wildlife Hospital, followed by the Coin-marked snake *Hemorrhois nummifer* (13 specimens), then by Red whip snake (*Platyceps collaris*, 13 specimens) and Kulzer's Rock Lizard (*Phoenicolacerta kulzeri*, 12 specimens, all of which but one were received from the Beit Ussishkin Nature Museum). Altogether, reptile specimens catalogued this year belong to 62 species, among them are the rare Eastern Four-lined Ratsnake (*Elaphe sauromates*, 3 specimens, two of them from the Beit Ussishkin collection) and one Transcaucasian Rat Snake (*Zamenis hohenackeri*) also from the Beit Ussishkin collection. The only other specimen from this species at the Steinhardt Museum had been received in 2003. This year we continued adding to the collection specimens from the Beit Ussishkin Nature Museum but not yet from the A.D. Gordon Museum or the Kibbutz Ma'abarot collection. We started a process of preparing skeletons using horse manure and we intend to continue with this project in order to create a representative skeleton collection of all species present in Israel. Ron Cohen, a volunteer in the collection, carefully mapped each species in the collection and labeled the shelves according to their new numbers. The Aardvark interns currently continue labeling the shelves according to families.

The bird collection

Between October 2018 and September 2019, the bird collection grew by 420 specimens (from 21,909 to 22,328). This number represents only specimens that were incorporated into the collection and excludes 340 specimens that were received during the same period but are still in the freezers. The process of entering specimens into the collection has slowed down mainly because we are going back to preparing skins rather than skulls, which was the principal task when the exhibits were being built. While Amos began preparing skins himself he cannot work at a fast enough pace to really tackle the packed freezer. The below analysis pertains only to the 420 specimens that were actually added to the collection.

During the reporting period specimens of 163 species were entered in the collection, which is undoubtedly an impressive number. Of those, the most frequent was the Common Buzzard (*Buteo buteo*) with 16 specimens, followed by the Kestrel (*Falco tinnunculus*, 13 specimens), Black Kite

(*Milvus migrans*, 11 specimens) and the Barn Owl (*Tyto alba*, 10 specimens). One big issue we were trying to deal with was the abundance of large common species, mainly raptors, storks and pelicans. One solution we were testing was preparing skins without stuffing them to save space. This is still a work in progress. On the other hand, the absence of small passerines, even common ones, is a much bigger problem (we only got the first specimens of the Pale Crag Martin, a very common desert species, this year).

As stated above, the entire collection is now housed in the new building and is in a good enough level of organization to allow normal curatorial work. We were still missing storage cabinets as well as shelving and internet access but that is being dealt with. Moshe Geizler finished checking the database for errors and is moving on to cataloguing the neglected pellet collection. Several projects were ongoing, with considerable progress being made in the following:

- The nest and egg collections were being moved by Daniel and Amos to plastic boxes to better protect them and to save space;
- The old preparation sheets were being organized and sorted to facilitate finding specimen data;
- The specimens in the freezer were being individually wrapped in plastic and inventoried to help protect them during storage, organize the freezer and to be better able to locate particular specimens;
- The database was being cleaned up, with better organization of information and the addition of better locality data.

Aside from these projects, the daily work in the collection continued. The use of the collection for the feather identification lab increased, data entry was progressing at a slow but steady pace and visitors were attended. During the last couple of months Amos worked hard organizing the 11th *Biennial European Bird Curator Meeting* that was hosted by our Museum in September 2019. The meeting was very successful and in total we hosted 24 participants from a wide range of collections including the American Museum of Natural History, the Natural History Museum (London) and many more. We learned a lot from the meeting and some practices were already being implemented.

Assimilation of other collections

We were still assimilating the Beit Ussishkin, A.D. Gordon Museum and Ma'abarot collections of birds, reptiles, amphibians and mammals into our collection. The work was progressing very slowly due to shortage of manpower. With the forthcoming addition of the Beit Shturman collection the situation would not likely to change in the near future.

Collection management: equipment, infrastructure, storage and curation

Little progress was made with assimilating the Beit Ussishkin and A.D. Gordon Museum collections. As for cabinets, while we did get six new ones during the reporting year (one of them landed on the curator's toe), we were still well short of dedicated storage cabinets even for specimens already in the collections, and as we hope the mammal skin collection is going to be placed in adequate cabinets, even more cabinets are needed. We continued to use nylon 'sleeves' to store bird study skins individually, and the use of transparent plastic boxes for skull and skeletal material seemed to be fulfilling our expectation that they would keep the material in better shape in years to come. We made no headway in looking into barcoding jars and drawers, so that immediate curation and identification of those specimens present in a cabinet or on a shelf would be known. This practice is now routine in several collections in the world and we hope to acquire such technology sooner rather than later.

Igor and Stas continued to improve the infrastructure of the preparation area, following changes to the structure of buildings in the Zoological Garden itself. Most recently, a new storage/work space was built to replace the old one. Additionally, a container for the dermestid colony was built to help with odor control.

We are anxiously awaiting the move of the databases to a new platform to be able to make individual-based records freely available to the public over the net.

Visits, teaching and loans

According to our records, 130 people (almost all of them academics) used our collections last year (visits, loans, data requests etc.). Most were from Israel, but we also accommodated users

from Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Germany, Italy, Russia, the UK and the USA. Of the 46 Israeli users, 11 were from outside Tel Aviv University. Four courses used collections materials. We loaned specimens to specialists based in 14 institutions (eight in Israel, and one each from Australia, Belgium, Italy, Slovakia, Czech Republic and USA), sent tissue samples to colleagues in three institutions (in Czech Republic, Israel and USA) and specimen data pertaining to 22 projects to scientists in six institutes (in Australia, Austria, Denmark, Israel, UK and USA).

Publications

Despite our appeals to those who borrowed specimens/tissues and/or obtained data, we were not always informed of new publications emanating from the use of our collections. Twelve articles were published during the reporting period.

THE FEATHER IDENTIFICATION LAB

Avigail Ben-Dov Segal, Roi Dor and Tamar Feldstein-Farkash

Military and civilian air traffic has increased dramatically over the years. This heavy traffic shares air space with half a billion migratory birds that pass through Israel twice a year (as well as resident birds). This combination poses a tremendous risk of bird strikes that often lead to substantial material damage and even loss of human lives. Identifying the risks is an important step for preventing collisions and improving flight safety. Therefore, it is essential to identify bird species responsible for accidents, whether high in the sky or around airfields.

Since 2011 the Feather Identification Lab works closely with the Israeli Air Force, the Israel Airports Authority, the Civil Aviation Authority and the Israel Nature and Parks Authority. In 2013, an official contract was signed between the Feather Identification Lab (TAU) and the Israeli Air Force, the Israel Airports Authority and the Civil Aviation Authority, for whom we provide about 150 identifications annually. In addition, we assist the Israel Nature and Parks Authority with detecting poaching of wild birds and identify bird species collected in new surveys on the effects of wind turbines and electric lines on wildlife.

The Lab's main goal is to identify feather remains to the lowest possible taxonomic level. The feathers are identified using various techniques including histological slides for microscopic identification as well as morphological identification of the feathers. We have a comprehensive comparative collection of histological slides of many Palearctic species that is used for microscopic identification, as well as a large comparative feather collection that we continue to expand. Being a part of the Steinhardt Museum of Natural History gives us an opportunity to utilize the largest regional collection of birds (>18,000 specimens), which is an invaluable resource for identifying feathers from different bird species.

The Molecular Systematics Laboratory at the Museum (headed by Dr T. Feldstein-Farkash) routinely provides genetic identifications of bird remains. This additional information compliments our microscopic and morphological identifications. It is particularly important when damage is incurred to aircrafts but the remains do not allow species-level microscopic identification.

During the reporting period of 2018–2019, the lab examined 137 bird strike cases and 303 cases for the Israel Nature and Parks Authority. These identifications included 94 genetic analyses.

THE HERBARIUM

THE WATER PLANTS, CYANOBACTERIA AND WATER FUNGI COLLECTIONS

Razy Hoffman

Curation and field work

Surveys and collecting trips continued and the herbarium was upgraded with the addition of over 600 new herbarium specimens of seaweeds, cyanobacteria, seagrasses and marine fungi. Surveys of 2018–2019 revealed new aliens as well as indigenous Mediterranean seaweeds that had never been reported from the Levantine shore of Israel before. Some of the new non-native species be-

came first records from the Mediterranean Sea. Taxonomic and molecular studies also revealed several new species to science from the Red Sea.

Maintenance and cataloging of the dry collections continued in 2018–2019 as an ongoing project. Seaweeds that were sampled during the ongoing BioBlitz benthic surveys, conducted by Israel Nature and Parks Authority in spring 2019 and autumn 2019 at marine protected areas, were identified and listed as requested. Some collected specimens were dried and added to the algal herbarium.

Dr Yaacov Lipkin, the founder of the seaweeds, cyanobacteria, seagrasses and marine fungi herbaria of the SMNH passed away in March 2019. A memoriam highlighting his contribution to algology was published in the Phycological Society of America Newsletter (Hoffman 2019, see also p. 69).

Research

Examination of the Lipkin collection of slides led to discovery of new details of the reproduction of the Caribbean red alga species *Crouania pumila*, and the findings were published accordingly (Hoffman 2019).

A special workshop for Mediterranean and European marine academic experts on the invasion of marine species to the European waters took place in October 2018 at the European Commission Joint Research Center in North Italy to discuss possible new invasions of alien species and potential ways to prevent them. We produced a manifesto predicting the spread of new invasive species in the Mediterranean and the Atlantic European waters in the next decade (Tsiamis *et al.*, in press).

A collaborative study with Dr Martin Vohnik and his student Viktorie Kolátková from the Institute of Botany, Czech Academy of Sciences, of the fungal parasites of the common seagrass *Halophila stipulacea* from Eilat revealed interesting molecular and biogeographical results, and a manuscript is preparation for submission to *Diversity & Distribution*.

The herbarium provided Lipkin's metadata of the terrestrial angiosperm flora of the Arava Valley (from his PhD), for academic study of seeds collected from archaeological sites in southern Arava, conducted by Prof. Ehud Weiss from the Martin (Szusz) Department of Land of Israel Studies and Archaeology and Dr Yoel Melamed (manager of the national angiosperm seed collection), both from Bar Ilan University.

I collaborated in multidisciplinary ecological and taxonomical research proposal submitted to Yad Hanadiv Programme Grants. In the proposed study we would try to produce a new integrated program for establishing biological baselines and monitoring protocols for marine reserves in the Israeli Mediterranean Sea.

My work on alien and invasive species of algae in the Mediterranean had an exciting outcome that broadened my research interests. A new international and national collaboration with Crustacea taxonomists, ecologists of marine invasive species, terrestrial angiosperm taxonomists and archeobotanic experts were formed during 2019. Crustacea taxonomists and ecologists from Spain (Prof. Jose Manuel Guerra of the University of Seville) and Portugal (Dr Pilar Cabezas Rodriguez from the Research Center in Biodiversity and Genetic Resources and Dr Patricia Esquete Garrote from the Universidade de Aveiro) took part in my research into non-native amphipods of the Israeli Mediterranean shore. I was also collaborating with Prof. Stelios Katsanevakis of the University of the Aegean, Greece, on a manuscript summarising over one thousand new records of alien species (old and new invaders) from and into the Mediterranean Sea.

Studies of the alien rafter amphipod *Paracaprella pusilla* continued. We used direct sequencing of mitochondrial (COI and 16S) and nuclear (28S and ITS) genes to compare genetic differences in presumed native and introduced populations in order to infer its introduction pattern and to shed light on the native range of this species. The temporal pattern of genetic diversity at the westernmost limit of the geographic range of *P. pusilla* in Europe (the Atlantic coast of southern Spain) over an eight-year period was also investigated. Our results confirm *P. pusilla* as a neocosmopolitan species and suggest that the species is native to the Atlantic coast of Central and South America. *Paracaprella pusilla* seems to have been introduced into European waters from multiple introduction pathways and source populations, which are likely to include populations from coastal waters of Brazil (Cabezas *et al.* 2019).

Tasks in progress and plans for 2019–2020

Surveys of the aquatic (mostly marine) flora of Israel and the maintenance of the collections will continue.

Two review manuscripts representing all alien species found are still in preparation. The first review deals with alien species of the Chlorophyta, Phaeophyta and Angiospermae. The second review reports on non-indigenous species of the Rhodophyta, with about 55 alien seaweeds found so far! These reviews are expected to be submitted for publication during 2020–2021.

The ongoing quantitative study of the algal drift, started in 2005 along the northern shores of Israel, will continue in 2020; however, all the data collected so far were processed and a new paper on the algal diversity and the shift in domination of the non-native algal species is in preparation for a high impact factor journal.

The long term major project providing two checklists of the seaweeds of the Israeli Mediterranean Sea and the Red Sea, based on the national algal collections of Israel, will continue in 2020.

Manuscripts describing several new species of seaweeds, mostly from the Red Sea but also from the Mediterranean, are in preparation and expected to be published in 2020–2021.

THE FUNGI COLLECTION

Bruria Gal

The collection was treated this year after being neglected for several years. We finished cleaning and re-packaging all the specimens. We continued to add relevant information to our specimens in the dry collection. More than 700 new items were added to the new collection.

Ongoing projects

- Databasing: We continued correcting old entries, including locations names and adding geo-references (co-ordinates). We were also entering old and new material to the database.
- Preparation of image database of all species in the collection.
- Collecting new material to add to and replenish damaged samples in the existing collection, including identification and preservation of frozen samples for further molecular analysis.

LAND PLANTS COLLECTION

Yuval Sapir and Jotham Ziffer-Berger

In October 2018, Dr Jotham Ziffer-Berger joined the Museum's herbarium staff as the keeper of the land plant herbarium and as an associate curator, thus reviving the vascular plant collection which had been inactive for the duration of several decades.

Research

Dr Jotham Ziffer-Berger has been engaged in a long-term research project funded by the German Research Foundation on the evolution of fruit in the Brassicaceae.

Collection management

The land plant collection comprises now three sections: the already existing lichen collection and the new collections of vascular land plants and bryophytes (mosses, liverwort and hornworts).

As a kick-off start of the new vascular plant section, the herbarium received from Prof. Avi Shmida a generous donation of his Jordan and Sinai plant collection, which comprises over 1000 rare and unique specimens, including numerous first-record specimens, and possibly new taxa that need further investigation.

Additionally, we assumed the role of the house herbarium for the Israel Gene Bank (Volcani Institute) and we have already accessed over ca. 600 specimens collected by the Gene Bank staff in the previous three years.

We have been engaged in sanitizing the Avi Shmida collection, which was adversely affected in the previous storage facility. We have been also checking identifications of the Gene Bank specimens, and we have already verified approximately 100 new specimens.

Scientific collaboration

The vascular plant herbarium scientifically collaborates with several institutions:

- Marek Slovak, The Department of Botany of the Slovak Academy of Sciences
- Gabriella Linc, The Institute of Agriculture, Hungarian Academy of Sciences
- Klaus Mummenhoff, University of Osnabrueck, Germany
- Thameen Hijawi, Al Quds University, Palestinian Authority
- Oz Barazani, the Israel Gene Bank, Volcani Institute
- Avigail Heller, Shaham, Ministry of Agriculture, Bet Dagan, Israel
- Alex Sukhurokov, Moscow University, Russian Federation
- Agostinho Chicaia, Institute of Agricultural Investigation, Angola
- Jeff Connor, Michigan State University, USA
- Avi Shmida, Rationality Center, the Hebrew University, Israel
- Ori Fragman-Sapir, the Jerusalem Botanical Garden, Israel

Field trips

The Herbarium staff went on the following collecting trips:

- Bryophyte collection with Tel Aviv University students in the Sharon area, March 2019
- Crucifer collection, Lower Galilee, March 2019

Visitors

We accommodated Dr Gabriella Szalai of the Hungarian Academy of Sciences (Sept. 2019).

Teaching

The following academic courses were offered at Levinsky College of Education:

- General Botany
- Introduction to Plant Science
- Special Botany

Provision of service

Israel Plant Gene Bank's collection is stored and curated by the land plant herbarium. We are responsible for identification, sanitizing and storage of the collection of vouchers for seed specimens in the Israel Plant Gene Bank collection.

Education and outreach

Dr Jotham Ziffer-Berger was a guest editor of a special issue of the *Israel Journal of Plant Sciences* titled *100 years of botanical research in Israel*, together with Dr Oz Barazani, and authored the Open University textbook *The World of Plants*, to be launched in 2019.

THE PALEOSCIENCES SECTION

THE PALEONTOLOGICAL COLLECTION

Daniella E. Bar-Yosef Mayer

The largest component of the collection is the private collection donated by the late Prof. Heinz Bytinski-Salz, formerly a professor of entomology at Tel Aviv University, who collected fossils as a hobby. This year, following the move of the collection to its new museum building, we decided to change the strategy of handling the collection.

As a first step we had to purchase a cart to allow the move of storage drawers between the collection on the second floor and the offices on the third floor, where computers are available. Instead of entering information into the museum database, as had been done in the past, it was decided to create a preliminary database. All information was inserted into Excel workbooks, with each cupboard inserted into a workbook, and within it, each drawer was given its own sheet.

This new system would give us better control over the location of each item within the collection and for the first time it would provide a broader view of the entire Bytinski-Salz collection. At a later stage the collections manager would check each and every entry to verify taxonomic names, location names and palaeontological information, and this would be followed by migration of entries into the museum database. The new system of preliminary registration already allowed us to identify valuable specimens of sponges, bryozoans and echinoderms, groups that eventually would be offered for specialists to study. To date, 728 items have been entered into the new system.

In addition to the Bytinski-Salz collection, there are additional fossil collections awaiting cataloging: Nathan Shalem, Yael Khalifa, Vitsker, Bet Ussishkin, Maabarot and Bet Gordon.

FOSSIL FORAMINEFERA

Olga Orlov-Labkovsky

Research

During the academic year 2018–2019, I continued to carry out research into taxonomy, systematics, nomenclature, paleobiogeography and paleoecology of the Upper Paleozoic foraminifera.

In cooperation with Dr Dorit Korngreen of the Geological Survey of Israel (Jerusalem), I continued to work on the project *Foraminifers of the Permian-Triassic (P/T) transition in the Coastal Plain of Israel*. Some results of this project were presented at the Annual Meeting of the Geological Society of Israel, Kfar Blum: “Late Permian distal northern edge of the world-wide Gondwanan Paleozoic siliciclastic belt; insights on the end of the period as recovered from Pleshet 1 and David 1 boreholes by foraminifera and stable isotope systematics, Judea Graben margins, Levant Basin”.

Collections

During the reporting period I focussed on the preparation of the fossil material in the Paleontological collection and the organization of a database for microfossils. I continued to work on the collections of foraminifera (thin-sections or slides) of the Carboniferous system (Upper Paleozoic) of the Central and South Tien-Shan (Central Asia: Uzbekistan, Kyrgyzstan, Tajikistan and Kazakhstan).

In addition, I continued curation of other families of the orders Schwagerinida and Ozawanellida and preparing foraminifera slides for cataloging and databasing:

Family Pseudofusulinidae Dutkevich, 1934, emend. Miklukho-Maclay, 1959

Subfamily Monodiexodininae Kanmera, Ishii & Toriyama, 1976

Genus *Ruzhenzevites* Davydov, 1986

Genus *Pseudofusulinoides* Bensch, 1972

Genus *Cuniculinella* Skinner & Wilde, 1965

Genus *Mccloidea* Ross, 1967

Genus *Eoparafusulina* Coogan, 1960

THE ARCHAEOBOTANICAL COLLECTION

Dafna Langgut

All research done in the Laboratory of Archeobotany and Ancient Environments is based on our botanical collections. The Lab is focusing mainly on the Israeli flora and curates the following divisions:

- Pollen and Spores Collection (a reference collection)
- Wood Collection (a reference collection)
- Thin sections wood anatomical structure (a reference collection)
- Charcoal Collection (a reference collection)
- Archaeobotanical Collection (discoveries from archaeological excavations)

Activities related to the Botanical collection

We collected new samples for all of our references collections (pollen, wood and charcoals), mainly from Tel Aviv Botanical Gardens (in cooperation with Dr Y. Sapir).

Ancient waterlogged wood preservation project. We preserved for future studies a waterlogged wood assemblage of the 24,000–10,000 years old site Jordan River Dureijat (JRD).

We hosted a PhD student, Oriol López Bultó of Universitat Autònoma de Barcelona, Spain, who used our wood and charcoal reference collections for her study, which is related to the ancient flora of Israel (March 2019).

We hosted Ethel Allué, a researcher from the Institut Català de Paleoeologia Humana i Evolució Social (IPHES), Tarragona, Spain, who used our wood and charcoal reference collections for her study which is related to the ancient flora of Israel (March 2019).

Research projects and collaborations

2014–2019: The Neubauer Near East paleo-climate project

250,000 USD; P.I. together with Prof. I. Finkelstein, TAU, Prof T. Litt, Bonn University, Dr Miriam Bar-Matthews, Geological Survey of Israel).

This study was tracing possible links between past climate changes and settlement and demographic processes in the eastern Mediterranean, during the Bronze and Iron Ages (ca. 3500–500 BCE). The project deployed two of the strongest scientific proxies in paleoclimate research: palynology and the study of past isotope signatures in cave formations and lake sediment cores. During the coming year, I am aiming to reach to a full publication of the project. So far two papers have been already published, another two have been accepted for publication, one is currently under review and two more articles are in preparation. Two MA thesis have also been submitted within the frame of this project. The project results were also reported in local and international conferences.

2015–2019: Royal Herodian Gardens Come Alive

315,000 NIS; P.I. ISF grant no. 997/15.

This project is revealing the botanical components of Herod's royal gardens. Samples have been collected from several sites and are currently being analyzed. The samples were retrieved from the courtyard of Herod's Promontory Palace at Caesarea, the peristyle garden of Herod's Winter Palace at Jericho, the Northern Palace of Masada, and the three royal gardens identified at Herodium. To examine the far-reaching impact of Roman cultural influences, the plants identified in Herod's gardens were recently compared to those retrieved from Villa Arianna in Stabiae, Italy. During the last year the results of this project were presented at local and international conferences. In the coming year I am aiming to reach to full publication of this project.

2016–2019: Archaeobotany of Jerusalem

104,000 NIS; P.I. Israel Antiquity Authorities (IAA)

This project operates at several excavations in Jerusalem, where various questions are to be answered based on the identification of pollen and/or charcoal remains. These include questions related to the ancient natural vegetation that surrounded Jerusalem, evidence for agricultural activities, use of plants, burial practices and so on. So far, the results of this project were summarized in three published papers. Another paper was recently accepted for publication. Six scientific reports were submitted to the IAA. One MA thesis was also submitted within the frame of the project. The project results were also reported in local and international conferences.

2017–2020: Crises on the margins of the Byzantine Empire: The paleoenvironmental perspective

125,000 NIS, funded by an ERC grant to G. Bar-Oz, the director of the project.

This study is part of a detailed bio-archaeological project in the Negev Desert, directed by G. Bar-Oz (Haifa University). Within this framework, I am conducting the following studies: (i) Palynological analysis of both archaeological and environmental contexts; (ii) Archaeo-parasitology (identification of fossil parasite remains); (iii) Charcoal assemblages identification; (iv) Wooden objects: anatomical identification and determination of possible uses. The preliminary results of this study were presented at an international conference. A paper about the wooden implements found in Shivta was accepted for publication.

2017–2020: Vegetation and climate reconstruction of the Epipaleolithic Hula Basin

135,000 NIS, funded by the ISF grant to Prof. G. Sharon, the director of the excavation.

The study is based on 60 pollen samples, which I collected in September 2016 and September 2017 from a sediment outcrop at the Epipaleolithic site (~24,000–10,000 years BP) of the Jordan

River Dureijat (JRD). The data, which will emerge from the palynological study, will be integrated with other well-preserved environmental proxies from JRD sequence such as geological, sedimentological, ostracod and isotopic studies. (together with S. Mischke, University of Iceland and Gonen Sharon, Tel-Hai College).

A flower in the desert: Botanical remains of King Herod the Great's horticulture and agriculture activity at Masada

50,000 USD, the Porter Foundation grant to D. Langgut and G.S. Stiebel.

This project aims to reveal the botanical components in Masada. Within the frame of the project, we are searching for traces for royal display by plants, as well as evidence for agricultural activities in this area (the latter are mentioned in Josephus Flavius's texts). We are currently recruiting an MA student to conduct the actual research.

The beginning of olive domestication

The olive (*Olea europaea*) is regarded as the most prominent and probably the most economically important fruit tree of the Mediterranean Region, providing edible fruits and more important storable oil. Different views are expressed in various studies regarding both the geographical origins and time of olive domestication. At the international workshop held on Majorca in September 2017, I suggested to create an olive pollen dataset across the Mediterranean in order to trace the history of olive cultivation. This study will be led by me and will include at least 10 international collaborators, mainly palynologist working in different Mediterranean countries.

The 'Alona Project (Jerusalem): Tracing the invisible hand of ancient agriculture

This interdisciplinary research attempts to evaluate the magnitude, frequency and timespan of human agricultural activities in the natural environment. An excavation license was granted to me by the Israel Antiquity Authority. The primary research objectives are to: (i) Establish an accurate chronology for the agricultural activities in this area; (ii) Identify the type of crops cultivated in this region over time; (iii) Describe the mode of agriculture prior to the terraced landscape. The study will be performed together with Prof. Y. Gadot and Prof. M. Maerker (Pavia University).

Identification of wood and charcoal assemblages

This activity focusses on wood and charcoal assemblages from ongoing excavations in order to reveal the vegetation surrounding the sites, agricultural practices, wood species that were used for construction purposes, for fuel, tree importation, and so on. The remains were collected from Tel Azekah, Tel Megiddo, Hatzor, JRD, Tel Beit Yerah, Timna and excavations in the City of David.

Service on organizing committees

I was a member of the organizing committee of the 5th Annual Israeli Conference on Environmental History, Tel Aviv University (January 2019). Within this meeting I organized a session on *The Steinhart Natural History Museum as an archive to environmental studies*.

Active grants

2014–2019 The Neubauer Foundation: *Climate changes in the Levant during the Bronze and Iron Ages and their impact on settlement patterns and historical processes* (P.I. together with I. Finkelstein, 250,000\$).

2015–2019 Israel Science Foundation: *Royal Herodian Gardens come alive* (P.I., 85,000\$).

2015–2019 Israel Science Foundation, equipment grant: *The Laboratory of archaeobotany and ancient environments* (P.I., 28,500\$).

2017–2020 Israel Antiquity Authorities: *Archaeobotanical remains in Jerusalem* (P.I., 27,500\$).

2018–2020 The Porter Foundation, "Life Under Extreme Conditions at the Dead Sea": *A flower in the desert: Botanical remains of King Herod the Great's horticulture and agriculture activity at Masada* (together with G. Stiebel) (P.I., 50,000\$).

2019–2020 The Mario Einaudi Center for International Studies, Cornell University: *Reconstructing the Roman Garden: The Casa della Regina Carolina Project, Pompeii* (together with C. Barrett) (P.I., 5,000\$).

2019–2020 Archéologie & Patrimoine en Méditerranée. Art, Archaeology and Ecology: *The palatial courtyard of Herod's the Great in Caesarea Maritima (Israel), comes alive* (together with S. Hendler and R. Cheddady) (P.I., 11,000\$).

Scientific meetings and lectures

Local Conferences

- Hecht Museum opening exhibition “The forgotten suitcase – new findings from H.D. Kolt excavations at Shivta 1933–1937”, Haifa University, January, 2019, paper presented: *The wood assemblage from Shivta* (together with Y. Sitry).
- The Annual Symposium in the memory of Prof. Yohanan Aharoni, Tel Aviv University, February 2019, paper presented: *The history of the micro-botanical research at the Institute of Archaeology, Tel Aviv University, from few grains into databases.*
- Life in Extreme Conditions – A Lesson from Nature, The Dead Sea Research Institute Second global scientific summit, Masada, Israel, March 2019, paper presented: *Millefiori – the reconstruction of Herod's royal horticulture.*
- The annual conference of the Department of Israel Studies and Archaeology, Bar Ilan University: “The ancient natural and cultural land of Israel”, May, 2019, paper presented: *Horticulture under the Hegemony of the Assyrian Empire.*
- The Annual Conference of the Sonia and Marco Nadler Institute of Archaeology, Tel Aviv University – The 2019 Excavations of the Institute, November 2019, paper presented: *Jerusalem: Micro and Macro perspective.*

International Conferences

- International Colloquium on Digital Archaeology, Bern, Switzerland, February 2019, paper presented: *The use of mega pollen dataset to reveal early fruit-tree cultivation across the Mediterranean.*
- 18th Conference of the International Workgroup for Palaeoethnobotany, Lecce, Italy, June 2019, paper presented: *Early Roman royal gardens – An archaeobotanical comparison between east and west Mediterranean gardens.*
- 18th Conference of the International Workgroup for Palaeoethnobotany, Lecce, Italy, June 2019, paper presented: *Dung in the Dumps* (together with D. Fuks *et al.*; presenter).
- 7th International Anthracology Meeting – Charcoal Science in Archaeology and Palaeoecology, Liverpool, England, September 2019, paper presented: *Blooming of the Byzantine sustainable agricultural society in the Negev Desert (Israel) and its abrupt decline.*
- 7th International Anthracology Meeting – Charcoal Science in Archaeology and Palaeoecology, Liverpool, England, September 2019, paper presented: *Herod the Great royal Roman gardens come alive: charcoal remains and pollen analysis.*
- Society of Biblical Literature (SBL) 2019 Annual Meeting, San Diego, USA, November 2019, paper presented: *The use of archaeobotanical remains to reveal natural landscape vs. landscape shaped by human.*
- 2019 Annual Meeting of the American Schools of Oriental Research (ASOR), San Diego, USA, November 2019, paper presented: *Tracing ancient disease by the identification of parasite remains: a case study from the ancient core of Jerusalem during the Abbasid Caliphate.*
- Archaeology in Israel – land and sea lightning sessions, Scripps Institution of Oceanography–University of California San Diego, USA, November 2019, paper presented: *Herod's Royal Gardens Come Alive.*

ARCHEOMALACOLOGY

Daniella E. Bar-Yosef Mayer

Several activities that relied on research in the malacological collections at the Steinhardt Museum took place over the past year.

Shells from the Middle Palaeolithic site of Misliya, Mt. Carmel were being studied in collaboration with Prof. Mina Weinstein-Evron and Dr Iris Groman-Yaroslavski from University of Haifa. These items were compared to previously published shells from Qafzeh Cave, that were re-studied using use-wear analysis and the results from both assemblages were being prepared for publication.

The shell assemblage of Jordan River Dureijat, a shell midden on the bank of the Palaeo-lake Hula dating by the end of the Pleistocene (ca. 20,000-11,000 years ago) continued to be studied.

Lacustrine species were identified in the collection and analyzed, revealing environmental changes throughout the site's occupation, and my student, Alall Dor would use this assemblage as the focus of her MA thesis.

Manot Cave, an Upper Palaeolithic site in the western Galilee, yielded ornamental shells of both the Aurignacian and Ahmari cultures. The Manot project is a large collaborative effort with the lead researchers from Ben-Gurion University, the Israel Antiquities Authority, Tel Aviv University, and other institutions both in Israel and abroad. Additional research involves Pre-Pottery Neolithic B shell assemblages, which were studied by Ms. Heeli Schechter, a graduate student at the Hebrew University of Jerusalem, under my supervision. Nahal Roded 110, a unique Pre-Pottery Neolithic B site in the Eilat mountains, and the Besor Valley survey of Palaeolithic sites brought small shell assemblages as well. The archaeomalacological assemblage of Tel Bet Yerah were investigated in collaboration with Prof. Rafi Greenberg from the Institute of Archaeology, Tel Aviv University.

Other research activities included the study of stone beads from Nahal Hemar Cave, and collaboration with colleagues at the University of Reading, UK, for examination of shells and beads from the Pre-Pottery Neolithic A site of Wadi Feynan, Jordan.

ARCHEOZOOLOGY

Lidar Sapir-Hen

During the reporting year, after establishing the laboratory in the Museum and collections in the storage, the laboratory was also equipped with facilities to conduct sampling of bones for stable isotopes analysis.

Overview

During the 2018–2019 academic year, I was deeply involved in several research projects and field work, supervised MA and PhD students and taught courses and presented talks at international conferences. I also accommodated two visiting scholars to the archaeozoological collections.

Active grants

2019–2021: The Porter Foundation, “Life Under Extreme Conditions at the Dead Sea”: *Food for thought: Exploring identity and survivorship mechanism through food refuse from a refugee camp on the fringe of the Judaeian Desert* (P.I., 50,000 US\$).

On-going research projects

- Hunting and herding at the dawn of animal domestication.
- The development of animal husbandry in the Neolithic period.
- The emergence of complex societies in the southern Levant.
- The role of animals in past populations.
- The animal economy in Ancient Jerusalem, religious and socioeconomic diversity during the 8th–2nd century BCE.

Field projects

I actively participated in archeological excavations at Masada, Timna, Azekah, Tel Hadid, Kiriath Jearim and Megiddo. My participation included advising site directors on retrieval methods of findings, and lectures to students at the field school using comparative collections.

Conferences

I presented nine oral talks at six international conferences/meetings (Estonia, Germany, Spain, Turkey, USA) and an Annual meeting of the Department of Israel Studies and Archaeology, Bar-Ilan University, Israel.

Student supervision

I supervised three MA students and one PhD student, who also did her MA in the lab. Two of the MA students submitted their thesis, one of them would continue doing a PhD degree in the lab. The students' work was based on faunal assemblages from archaeological sites (zooarchaeological collection) and relied on comparative collections of mammals and birds.

Teaching

Teaching at Tel Aviv University: Animal remains in archaeology, including a practical workshop in archaeozoology, using collections of mammals and birds, and archaeozoological collections.

Visiting scholars to the Archeozoological collection

Dr Deirdre Fulton of Baylor University, Texas, USA; and Prof. Haskel Greenfield of University of Manitoba, Canada.

ANCIENT DNA**Meirav Meiri**

During the reporting year I worked on the following projects:

Revealing lost diversity of Byzantine grapevine in the Negev Desert

Collaborators: Guy Bar Oz, University of Haifa, Israel; Roberto Bacilieri, INRA-CIRAD-Montpellier, France; and Nathan Wales, University of York, UK.

This is an ongoing project, during which we wish to reconstruct the lost diversity of the Negev grapevine during the Byzantine period. During the Byzantine period between the 5th–7th centuries CE, the Byzantine Negev wine was highly esteemed across the Levant, North Africa and Europe. However, the knowledge of the specific cultivar grown *in situ* by the Negev farmers and its unique capacity to adapt to the arid conditions were lost during the Islamic conquest of the southern Levant in the mid-7th century CE. With the aid of ancient and modern DNA techniques, we want to pinpoint the closest living cultivars to the ancient variety.

In 2018–2019, I carried out work on ten ancient seeds from various archaeological sites in the Negev. The work was partly done in the ancient DNA lab at the Steinhardt Museum, and partly at University of York, UK. I am now at the stage of the analysis of obtained results.

Modelling anthropocene trophic cascades of the Judean desert ecosystem: A hidden dimension in the history of human-environment interactions

Collaborators: Nimrod Marom, University of Haifa, Israel; and Tom Gilbert, University of Copenhagen, Denmark.

I participate in an European Research Council project, which aims to explore the effects of human settlement on mammalian community structure, focusing on the phenomenon of trophic cascades in the area of the Dead Sea from the middle and late Holocene settlement sequence (approximately 4,500 BCE to 2,000 CE). In this project, I mainly concentrate on the changes in genetic populations through time of a few common species in the Judean Desert: leopards (*Panthera pardus*), hyena (*Hyaena hyaena*), ibexes (*Capra nubiana*) and hyraxes (*Procavia capensis*). During the reporting year, we mainly collected samples from different caves in the area of the Dead Sea and send them for radiocarbon dating. I also carried out DNA work on a few ancient leopard samples found by Nimrod Marom. For comparison, we also sent a few modern museum specimens (accession nos. 2045, 9257, 9262) to University of Copenhagen for shotgun sequencing. Once we receive results from Copenhagen, I can start analysis results obtained for the ancient samples.

Taxonomy and phylogeography of extinct Israeli species

Collaborators: Shai Meiri, Tel Aviv University, Israel; Nimrod Marom, University of Haifa, Israel; and Tom Gilbert, University of Copenhagen, Denmark.

We aim to understand the taxonomy and phylogeography of some extinct mammalian species from Israel using ancient DNA techniques. The museum has very rare specimens that were among the last ones of their species in Israel, and therefore represent the best, and perhaps the only opportunity to learn about their extinct populations and phylogenetic affinities. Beyond the importance of such studies for understanding the history of fauna in Israel, should one consider an attempt to reintroduce some of these species into the wild, such data are invaluable.

During the last year, we worked on

- Brown bear (*Ursus arctos*): One specimen from the museum (accession no. 8538, from Hermon 1916/17) was sent to University of Copenhagen for shotgun sequencing. In parallel, I tried to extract DNA from an ancient sample found in the Judean Dessert by Nimrod Marom.

- Water Vole (*Arvicola amphibious*): I extracted DNA from a museum specimen (accession no. 128, from Yesod Hamaala 1946) and sequenced it.

Professional development

Conferences attended

September 2018: I attended the 8th International Symposium on Biomolecular Archaeology, Jena, Germany.

Workshops attended

June 2019: I participated in a Paleogenomics workshop, Berlin, Germany.

Working in other labs

May 2019: I learnt a few ancient DNA techniques in the ancient DNA lab, Univ. of York, UK.

DAN DAVID CENTER FOR HUMAN EVOLUTION AND BIO-HISTORY RESEARCH

Israel Hershkovitz, Hilla May and Rachel Sarig

Ongoing research projects (2018–2019)

- Neshar-Ramla skull (140,000 years old): *Early presence of the Neanderthals in the Levant.*
- Geulla cave teeth (100,000 years old): *Neanderthal-Homo sapiens introgression.*
- Har Safsuf cave human remains: *Human migration in the Chalcolithic.*
- Natufian and Neolithic jaws: *Micro-evolutionary trends in the masticatory system during the Holocene.*
- Manot cave hominins: *Who were the Levantine Aurignacians?*
- Natufian, Neolithic and Chalcolithic femora: *Changes in physical burden during the Holocene.*
- Ancient DNA studies. Project A: *Anatolian migration during the Chalcolithic*; Project B: *The geographical origin of the Natufian people*; Project C: *The Jews from the second temple period and their association to present Jewish populations.*
- The teeth from Misliya and Qesem caves: *Who were the Achelu-Yabrudians?*
- The Qafzeh Cave hominins: *Mal occlusion or mal adaptation?*
- Tel Rehov human remains: *The Assyrian in Israel.*
- Timna human remains: *Who were the people of Timna?*
- Health in the southern Levant. Project A: *Changes in ear infections during the terminal Pleistocene-Holocene of Levant*; Project B: *Changes in the prevalence of osteoporosis in the terminal Pleistocene-Holocene Levant.*
- Violence: *The origin of warfare in the southern Levant.*
- Yarmut human remains: *Reconstructing the life history of the Yarmut people.*
- Yotveta human remains: *The earliest case of Klippel-Feil syndrome in the southern Levant.*
- Yodfat human remains: *Physical evidence of the Roman massacre in Yodfat.*
- Tel Hadid human remains: *The children from Tel Hadid.*
- Asawir human remains: *Reconstructing life history at the early Chalcolithic period.*

Grants (2018–2019)

Granted by Institute/Company	Total Amount
Israel Science Foundation (ISF)	1,300,000 NIS
Israel Science Foundation (ISF)	1,500,000 NIS
Broad-ISF	378,000 USD
Gerda-Henkel Foundation	68,000 Euro
Australian Research Council	254,000 USD

Running field projects

- Manot Cave excavation (Early Upper Paleolithic)
- Tinsmet Cave project (Middle Paleolithic)
- Skhul Cave project (Middle Paleolithic)
- Tabun Cave project (Middle Paleolithic)
- Geulla Cave project (Middle Paleolithic)
- Timna valley project (Early Bronze Age – Iron Age)

Active collaboration projects with foreign researchers

- Gerhard Weber – University of Vienna, Austria
- Anne-Marie Tillier – Université Bordeaux, France
- Dominique Grimaud-Hervé – Muséum national d'Histoire naturelle, Paris, France
- David Reich – Harvard University, US
- Svante Pääbo – Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
- Johannes Krause – Max Planck Institute for the Science of Human History, Jena, Germany
- Rolf Quam – Binghamton University, US
- Bruce Latimer – Case Western Reserve University, Ohio, US
- Luca Fiorenza – Monash University, Australia
- Paul O'Higgins – The University of York, UK

Active collaboration (incl. joint research grants) with Israeli archaeologists

- Dr Yossi Zaidner – Hebrew University
- Dr Uri Davidovich – Hebrew University
- Dr Dina Shalem – Kinneret College
- Prof. Ofer Marder – Ben Gurion University
- Prof. Mina Weinstein Evron – Haifa University
- Dr Reuven Yeshurun – Haifa University
- Dr Dani Nadel – Haifa University
- Dr Ron Shimelmitz – Haifa University
- Dr Omri Barzilay – Israel Antiquities Authority
- Prof. Udi Weiss – Bar Ilan University
- Dr Guy Stibel – Tel Aviv University
- Prof. Erez Ben-Yosef – Tel Aviv University
- Prof. Avi Gopher – Tel Aviv University
- Dr Ido Koch – Tel Aviv University
- Dr Hamudi Khalaily – Israel Antiquities Authority
- Dr Kobi Vardi – Israel Antiquities Authority
- Dr Gonen Sharon – Tel Hai College

Participation in scientific meetings:

- April 2019 – Metazoan evolution: From early multicellularity to humans (Weizmann Institute of Science, Israel)
- August 2019 – International Federation of Associations of Anatomists (London, UK)
- September 2019 – The European Society for the Study of Human Evolution (Liege, Belgium)

MOLECULAR SYSTEMATICS LABORATORY AND TISSUE COLLECTION

Dorothee Huchon and Tamar Feldstein-Farkash

The molecular systematics laboratory of the Steinhardt Museum of Natural History at Tel Aviv University (SMNH) offers identification of museum samples when morphological identification is uncertain. In 2019, we started collaboration with the Israel National Center for Aquatic Ecology

(SMNH) to allow them utilizing molecular tools for monitoring and sample identification. Two staff members from the Center were trained at the molecular lab and performed DNA extractions for molecular identification of samples in question.

Operational

During the reporting period, tissues from 188 animals, including birds, fish, crustaceans, echinoderms, polychaetes, cnidarians, sponges and mammals, were processed for molecular identification. Half of the molecular work concerned the genetic identification of bird remains in collaboration with the Feather Identification Lab, and about a third of the work was done for the genetic identification of marine Caridae (Crustacea) as a part of a taxonomic research of the Levant fauna lead by Ya'arit Levitt-Barmats (SMNH).

Collections management and databasing

The Molecular Systematics Collection consists of frozen or alcohol-preserved tissues of vertebrates and invertebrates. We encourage its use by the international, non-profit research community.

During the past year, 1463 tissue samples were added to the Museum tissue collection, including 229 mammal specimens (34 species), 278 birds (129 species) and 174 reptiles (51 species).

Professional work abroad

T. Feldstein-Farkash visited the Laboratory of Molecular Systematics of the Central Research Laboratories at the Vienna Natural History Museum (NHM). During this visit Tamar practiced the working procedures in a clean-room, while processing formalin-preserved echinoderms from the SMNH collection. She also got familiar with the challenges of running a central lab that is shared by numerous researchers. The visit was supported by both the SMNH and NHM.

THE MUSEUM DATABASE

Yonatan Gur and Tirza Stern

The main project during the reporting year was migration of main databases into a new database infrastructure developed for the Steinhardt Museum of natural History (SMNH) by Prog4Biz. This year we successfully completed a testing phase, where we extracted, transformed and loaded records from 17 active databases into the new system.

23,296 new records were added to the SMNH database, to a total of 502,574 entries in the database. At present, the SMNH database contains the following numbers of entries in the following groups:

- Foraminifera – 792
- Coelenterata – 13383
- Porifera – 1165
- Vermes – 224
- Bryozoa – 259
- Brachiopoda – 47
- Mollusca – 64098
- Arthropoda (other than insects) – 7293
- Insecta – 315244
- Echinodermata – 2323
- Ascidiacea – 1008
- Pisces – 14818
- Amphibia – 2753
- Reptilia – 18900
- Aves – 22091
- Feather Identification Lab – 1264
- Mammalia – 16135
- Fossils – 3410
- Lichens – 1345
- Fungi – 6076
- Water plants – 5905
- Marine parasites – 2
- Molecular Laboratory – 1010
- Archeobotany – 1012

THE ISRAEL TAXONOMY INITIATIVE

Daniella E. Bar-Yosef Mayer

Conservation of biodiversity—the variety of life forms on the planet—depends on scientific knowledge and expertise. Government agencies, research institutes, and conservation organizations around the world have identified an alarming gap between existing taxonomic knowledge of biodiversity and the need for this information to guide conservation practices. Taxonomic research is crucial for identification of the great majority of living organisms, to understand the evolution of life, and to slow down the loss of species; but the state of the discipline is presently inadequate. Many sophisticated tools and models—morphological, biochemical, and genetic—as well as advanced software, are available for taxonomists; however, basic research lags seriously behind needs. The Millennium Ecosystem Assessment—a United Nations taskforce to review the trends and implications of changes in global ecosystems—identifies the lack of knowledge of species and their geographic distributions as one of the impediments to sustainable development; the international treaty of the Convention on Biological Diversity initiated the Global Taxonomy Initiative in an effort to improve this situation.

In Israel, where geographic, topographic, and climatic conditions have contributed to amazing and unique biodiversity, basic taxonomic research is on decline. A recent report submitted to the Israel Academy of Sciences and Humanities demonstrated that within 10 years—the average period for training a young taxonomist—Israel would have no scientists in research or teaching positions, who can pass the knowledge to the next generation of taxonomists. Thus, a major and urgent effort is required to salvage this field and to ensure the existence of this critical discipline.

In addition to nature and environmental conservation, taxonomic research has applied implications for agriculture, the economy, human welfare and health; it is therefore essential that it remains viable in face of fleeting fashions in scientific research.

The Israel Taxonomy Initiative is a consortium of government ministries and agencies, research universities and higher education institutions that aims to promote training of taxonomists and to support fundamental knowledge of Israel's biodiversity by

- Providing doctoral and post-doctoral fellowships;
- Providing funding for overseas training for graduate students;
- Providing funding for biodiversity surveys;
- Inviting taxonomists from the international scientific community to teach short courses on local species groups.

Our goal is to revitalize Israeli taxonomy and deepen our knowledge of biodiversity, thus promoting the contribution of science to conservation of Israel's ecosystems and developing the sustainable use of the country's natural assets.

Grants awarded during 2018–2019

Visiting Scholars:

Annelies Pierrot-Bults, Chaetognatha (arrow worms); Joseph Eger, Pentatomidae (stink bugs); Agnese Marchini, Peracarid Crustaceans; Maria Chatzaki, Ground spiders (Araneae).

Taxonomic Courses

The Israel Taxonomy Initiative offers a series of courses that are given by renowned international experts. Those focus on selected taxa with the intention of enhancing taxonomic knowledge in Israel. The courses include lectures, practicals and field excursions, and are aimed at university students and professionals, who study biodiversity, agriculture and nature conservation. Participants who fulfill all requirements receive academic credits. All courses are free.

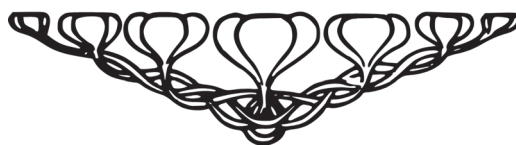
In 2018–2019, three taxonomic courses were offered.

On 7–12 April, 2019, Dr Annelies Pierrot-Bults of University of Amsterdam, The Netherlands, presented a course on arrow worms (Chaetognatha). The course was facilitated by Dr Tamar Guy-Haim (Israel Oceanographic and Limnological Research) and Dr Yoni Belmaker (SMNH & Tel Aviv University).

In June 2019, two taxonomic courses were offered. Dr Joseph Eger of Dow AgroSciences, Tampa & Research Associate, Florida State Collection of Arthropods, Gainesville, FL, USA, presented a 6-day course (40 hours, 3 credits) on the taxonomy of the Pentatomoidea bugs, many of which are agricultural pests. The course was facilitated by Dr Tatyana Novoselsky, Dr Gal Ribak (both SMNH) and Dr David Furth (Smithsonian Institution, Washington, DC, USA, and SMNH), and attended by 16 participants, including MSc and PhD students, agricultural specialists, researchers, technicians and museum staff. Two guest lectures were given during the course, by Dr Z. Mendel and Mr Elazar Quinn, MSc (both The Volcani Center, ARO).

A course on Peracarida—malacostracan crustaceans that include Amphipoda, Isopoda and Tanaidacea—was led by Prof. Agnese Marchini (University of Pavia, Italy) and facilitated by Dr Bella Galil (SMNH). The course comprised an introduction to the general biology, anatomy and taxonomy of peracarids, and specifically families that are common for fouling assemblages and species that are non-indigenous or cryptogenic in the Mediterranean Sea. Ten participants collected material in the Tel Aviv marina, sorted and identified it; they learned to recognise the peracarid families commonly occurring in fouling assemblages and to identify non-indigenous and cryptogenic species using taxonomic keys.

Participants of Prof. Marchini's (front row, left) course on a 1-day collecting event in the Tel Aviv marina.



EDUCATION AND SCIENCE COMMUNICATION DEPARTMENT

Yael Gavrieli

The academic and school year 2018–2019 was our first year of activity as a museum. Since the doors of the Steinhardt Museum of Natural History opened July 2018 a new era began. We officially closed ‘Nature Campus’ and moved on to become the Education and Science Communication Department of the Steinhardt Museum of Natural History, Israel National Center for Biodiversity Studies (SMNH). Beyond the title, changes were many: transferring the activities from mainly the zoological and botanical gardens to the museum’s galleries, expanding the guides team, adapting old programs and developing new ones, intensifying the volume of activities, and of course, developing new working procedures with the SMNH marketing and operations teams.

Below are major accomplishments of the Education and Science Communication Department during the reporting period.

Development & adaptation of new programs

Several new formats of programs were introduced and run:

- **Guided Tour.** The tour is designed for 75–90 minutes and is flexible in adapting to various audiences, from children to adults. Overall, 27,465 visitors went on guided tours, with 56% being school children, 7% families and 37% adults, senior citizens and students.
- **Science Visit.** The program is designed for groups of school children and is focused on a specific topic, such as web of life, fur & feathers, predators & prey, and adaptation. Each program is 2-hour long and consists of three parts: introduction game in which we review the main concepts, hands-on research workshop and a guided tour around the museum’s exhibitions that are relevant to the discussed topic. During 2018–2019, 1291 students participated in science visits. The most popular program was food webs (63%) and the second in line was evolution (24%).
- **Science Day.** An addition of a guided tour around the zoological or botanical garden transforms Science Visit into a Science Day. Over 2018–2019 school year, 2,892 school children participated in Science Days. The three most popular topics were adaptation (18%), evolution (28%) and food webs (36%).
- **Explore the Nature.** Families with 5–10-year old children are invited to explore hands-on specimens from our educational collection in a 50-minute workshop that also includes a “scientific” crafts kit and games. The workshop is offered on weekends, Thursday afternoons and school vacations.
- **Behind the Scene – the Collections.** Once a month we invite the public (from age 10 and above) to meet one of our collections managers and to learn about the collection first hand. During 2018–2019, we had four events at the collections of the birds, reptiles, beetles and butterflies.
- **Explainers @ exhibitions.** On weekends and school vacations guides are stationed at the exhibitions. They offer the visitors interpretations and instigate discourse among the visitors. This activity receives a wonderful feedback from visitors.

Enlisting & Training new guides

In order to expand the museum team of educators, we designed a selection process, including a selection day, when we introduce the SMNH to the candidates and then examine their skills as potential museum educators.

Eighty candidates, some veterans of Nature Campus and others new, were trained in four training courses to become museum guides. The 42–44-hour training course focused on familiarizing with the museum exhibitions and acquiring museum-education skills. Currently we employ about 70 educators, most of them graduate students in Life Sciences.

Education in numbers

During the school year of 2018–2019, 33,426 visitors came as groups and participated in our educational programs, as follows:

Visitors according to program

Program	Number of visitors
Guided tour	27,465
Science visit	1,466
Science day	3,125
Series of science visit/day	1,370
Total	33,426

Visitors divided by age group

Age group	Number of visitors
Kindergarten	4,293
Elementary school	11,686
Middle school	3,262
High school	1,853
Higher education students	1,370
Families	2,183
Adults	5,906
Senior citizens	2,873
Total	33,426

Other characteristics of unique groups

Special audience	Number of visitors
Parents on maternity leave	40
Tour guides	40
Educators	205
Gifted children	215
Special needs	83
Nature & Parks Authority	87
Israel Academy of Sciences and Humanities	18
Ministry of Agriculture & Rural Development	18

Special programs and events

Special events	Date
Kindergarten teachers conference	16 Oct. 2018
ICOM-NATHIST conference	5–6 Nov. 2018
In-service training of Nature & Parks Authority's rangers – south district	11 Nov. 2018
In-service training of Nature & Parks Authority's education and community team	27 Nov. 2018
In-service training of Nature & Parks Authority's rangers – central district	27 Nov. 2018
Interpretation forum	24 Dec. 2018
In-service training of kindergarten teachers Da-Gan	26 Dec. 2018

THE ISRAEL NATIONAL CENTER FOR AQUATIC ECOLOGY

National project for aquatic taxonomy, ecological assessment and river management.

Members: Dr Yaron Hershkovitz, Tuvia Eshcoli, Etai Kahna, Avital Katz, Dafi Luz, Almog Hershko, Nili Segman, Naomi Gordon.

MSc students: Adi Weiss, Lior Bentor.

Steering Committee: Prof. Tamar Dayan, Dr Menachem Goren, Nissim Keshet, Dr Dana Milstein (Chair), Alon Zask, Dr Amir Erez, Hanoch Ilssar.

The Israel National Center for Aquatic Ecology was established in 2015 by the Israel Nature and Parks Authority, The Ministry of Environmental Protection and the Steinhardt Museum of Natural History. The main goal of the Center is development and implementation of the official bioassessment scheme for the aquatic ecosystems in Israel, namely main rivers and their catchments. Although we mostly carry out applied ecological research, the fundamentals of our work rely on taxonomy and basic understanding of species and their biological needs. Ultimately, we aim to disseminate knowledge among practitioners, river managers, academia and stakeholders, as well as the general public.

In 2018–2019, we continued our work to develop bioassessment tools for monitoring of streams in Israel and conducted ad hoc biological surveys for several projects.

Main activities in 2018–2019

- *Biological assessment of the Ashalim stream industrial wastewater spill (2nd year).* A 5-year monitoring plan to assess the impact of highly acidic wastewater spill on the aquatic ecosystem of Wadi Ashalim (Judean desert).
- *Ecological assessment as a supporting tool for river basin management:* the Western Galilee and its tributaries. A 2-year project to develop an aquatic assessment system, compatible with the European WFD methodology for reporting on the ecological status of fluvial ecosystems of the Western Galilee watershed. The project is supported by the Western Galilee River and Drainage Authority, Nature and Parks Authority and The Ministry of Environmental Protection.
- *Ecological assessment as a supporting tool for river basin management:* the Yarkon River and its tributaries. A 2-year project to develop an aquatic assessment system, compatible with the European WFD methodology for reporting on the ecological status of fluvial ecosystems of the Yarkon watershed. The project is supported by the Yarkon River Authority.
- *Biological monitoring of Kinneret basin streams.* The project is supported by Nature and Parks Authority and The Ministry of Environmental Protection.
- *Routine seasonal monitoring of the Kishon River.* The project is supported by the Kishon River Authority.
- *Biological assessment of Einot Zippori restored section.* A program focusing on rehabilitation and restoration of Einot Zippori led by the Kishon Drainage and River Authority along with the Nature and Parks Authority.

Talks and presentations

- Annual meeting of the Israeli Association for Aquatic Sciences, Haifa (11.3.2019). *Toward a standardised ecological assessment of streams in Israel: current state of affair.* Presentation.
- Symposium of the Israel Ministry of Environmental Protection, Jerusalem (12.3.2019). *Biological monitoring as a decision-making tool in stream restoration.* Invited Talk.
- The 2nd Israeli Conference for Conservation Science: A Sustainable Future for Humans and Nature, Technion, Haifa (17.4.2019). *Restoration of streams in Israel – is it realistic?* Invited Talk.
- SEFS11: Symposium for European Freshwater Sciences, Zagreb, Croatia (30.6.2019). *Challenges and opportunities for rehabilitation of streams in a rapidly changing country.* Presentation.

- Integrated Watershed Management Approach in Israel, Beit Dagan (10.7.2019). *Watershed decision-making using biological monitoring*. Invited Talk.
- The 8th World Conference on Ecological Restoration (SER), Cape Town, South Africa (24–28.9.2019). *Just add water, but hold the salt! Monitoring the rehabilitation of the Lower Jordan River (Israel)*. Poster.



THE ENTOMOLOGY LABORATORY FOR APPLIED ECOLOGY

Ittai Renan

Arthropods are the most diverse group in terrestrial systems, accounting for over 85% of all known organisms. Arthropods inhabit a tremendous variety of niches across wide spatial scales and exhibit a variety of feeding habits and life forms that form, after the plants, a basis for most terrestrial food webs. Because of their high and fast reproduction rate, arthropod communities are sensitive to short and long term environmental changes. Large numbers of arthropod species and specimens can be efficiently collected. For these reasons the group is utilized as a rich data source for ecological monitoring and ecosystem management.

Current researches in the lab focus on conservation and ecological management questions, utilizing arthropods as a sensitive tool for the assessment of ecological quality and ecosystem response to anthropogenic activities. Assessment includes multivariate analysis of community structure and composition, integrating various ecological indices and experimental approaches. The taxonomic identification is the basis of the analysis in each research. The identifications rely on insect collections at the Steinhardt Museum of Natural History and the museum specialists, as well as worldwide experts on different insect groups. The large scale arthropod sampling from different sites, seasons and methods, supplements the collection with valuable specimens: rare, new to Israel fauna and species new to science.

The lab's activity spans geographically from Ramot Yissakhar in the north to Sedom in south of the Dead Sea. The current lab researches deal with monitoring of arthropod communities in borders between agricultural and natural landscapes and ecological corridors, providing operational recommendations for management restoration in national parks, estimating impacts of local anthropogenic pressure on sensitive ecological systems and monitoring population of a rear butterfly.

The projects run in collaboration with the Ministry of Environmental Protection, the Ministry of Agriculture & Rural Development, Israel Nature and Parks Authority, The Society for the Protection of Nature in Israel, Israel's National Ecosystem Management Assessment Program, Ramat Hanadiv, and the education program BioBlitz in Arad.

This year we ran seven different research projects, published ten reports and presented our studies in Italy at a conference, and three conferences in Israel. The lab employs one full-time worker and five part-time workers, and a master student.

The Entomology Lab for Applied Ecology aims to provide a high resolution tool for understanding ecological systems in order to conserve the Israel's biodiversity.

Reports (all in 2018)

- KKL: *Little fire ant monitoring, Agamon Hula.*
- Ramat Hanadiv: *Arthropod monitoring in the little fire ant pest control range.*
- INPA: *Little fire ant, background and methods of eradication – A review.*
- SPNI, INPA: *Butterfly survey in the Ein Dor region.*
- INPA: *Distribution map of the little fire ant in Israel.*
- INPA: *Arthropod sampling in national parks in the Lower Galilee.*

Invited lectures (in 2018)

- XIII symposium in memory of Orna Eshed – Invasive species, Ohalo College, Katzrin: *The little fire ant – Where did it come from and where are we going?*
- Green Campus Appreciation Conference for Green Institution Guides, Ben-Gurion University of the Negev, Beer Sheva: *The little fire ant.*
- Life at the Dead Sea – A symposium on the challenges of nature conservation and ecological research in the Dead Sea region, Masada: *Changes in the Arthropod community in wet habitats in the Dead Sea region.*

- Life at the Dead Sea – A symposium on the challenges of nature conservation and ecological research in the Dead Sea region, Masada: *The little fire ant in the Dead Sea region.*
- Round table – Invasive species, the National Park Authorities, Jerusalem: *The threat of the little fire ant in Israel.*
- Agricultural Committee of the Regional Councils, Tel Aviv: *Potential damage by the little fire ant to the Israeli agriculture.*



HAMAARAG — ISRAEL'S NATIONAL NATURE ASSESSMENT PROGRAM

Irina Levinsky and Ittai Renan

Overview

HaMaarag—Israel's National Nature Assessment Program—is a consortium of independent scientists and organisations that are responsible for natural resource management in Israel, operating from the Steinhardt Museum of Natural History. Our partners include the Ministry of Environmental Protection, the Israel Nature and Parks Authority, the Jewish National Fund (KKL—JNF), with additional financial support from a private fund.

HaMaarag's primary mission is to assess the state of nature in Israel. We strive to advance management of open spaces and natural resources through continuous production of scientific knowledge on the state of ecosystems and biodiversity in country. This knowledge is accessible to decision makers as well as to the general public.

Main achievements in 2018–2019

State of Nature report

The State of Nature in Israel report describes the state of nature and its dominant trends quantitatively and qualitatively, and is based on information gathered within the framework of HaMaarag's National Program for Terrestrial Biodiversity Monitoring as well as external monitoring programs. The report provides an up-to-date and reliable assessment of the state of nature in Israel for decision makers, and will be available on our website www.hamaarag.org.il (in Hebrew, with an English executive summary).

Israel National Ecosystem Assessment – Final report

The final report of the Israel National Ecosystem Assessment, including key findings of a 5-year assessment and over 1,000 pages of chapters, is due to be published in 2020. The project is aimed to increase the awareness of Israel's dependence on functioning ecosystems and their multi-dimensional value. In addition, it would produce a knowledge base to assist managers and policy makers in assimilating the value of biodiversity and ecosystem services in the planning and management of Israel's landscapes. Furthermore, the report would include an overall synthesis of the project results and a table of the main Nature's goods and services.

The National Program for Terrestrial Biodiversity Monitoring

We started the fourth cycle of the National Program for Terrestrial Biodiversity Monitoring. The program aims to assess the state of Israel's biodiversity and nature and significant changes that take place within them. The program monitors the flora and fauna over Israel on a regular basis through field surveys, surveillance cameras and sensors.

Evrona Nature Reserve Ecosystem Monitoring Program

We completed the fourth year of the five-year monitoring program, assessing effects of the oil spill in Evrona Nature Reserve, and submitted an interim report to the Israel Nature and Parks Authority. The results indicate that the oil spill affected some of the monitored taxonomic groups.

Ashalim Stream Ecosystem Monitoring Program

A large-scale leakage of acidic affluent with high concentrations of heavy metals from a local fertilizer plant affected 20 kilometers of the Ashalim stream in the Judean Desert in summer 2017. The Israel Nature and Parks Authority appointed HaMaarag to develop, coordinate, monitor and analyse a five-year assessment of the ecological consequences of the leakage, and natural rehabilitation processes in the ecosystem. We designed and developed a monitoring program and completed the second year of it.

National Biodiversity Index

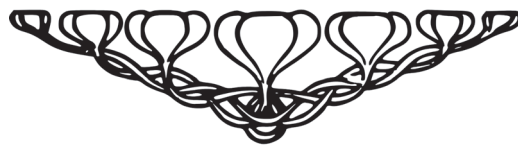
As part of the development of quality of life metrics by the Central Bureau of Statistics, HaMaarag was tasked by the Ministry of the Environment to develop an index for assessment of the biodiversity in Israel. The index was accepted and published by the Ministry of the Environment and the Central Bureau of Statistics.

Update of the Red Book of Reptiles in Israel

Updating the Reptile Red Book is a project managed by the Israel Nature and Parks Authority and has been conducted by HaMaarag.

Conferences

- January 2019 – Ashalim Stream Ecosystem Monitoring Program. A full day seminar conducted by HaMaarag at the Steinhardt Museum of Natural History.
- February 2019 – Evrona Nature Reserve Ecosystem Monitoring Program. A full day seminar held by HaMaarag at the Steinhardt Museum of Natural History.
- February 2019 – Harmonious Cost Action, Czech Republic. *Woody vegetation monitoring combining high-resolution multi-spectral UAV imagery – a case study from a sub-arid region in Israel.*
- April 2019 – Israeli conference for Conservation Science, The Technion. *Evidence for a multi-layer ecosystem damage in the polluted Ashalim desert channel.*
- April 2019 – Israeli conference for Conservation Science, The Technion. *Ecological continuity under pressure: a study case from Shilo River reserve.*
- May 2019 – Natural Resources and Environment Conference, University of Haifa. *Why Nature? The contribution of ecosystems to human welfare in Israel.*
- June 2019 – The Annual Conference for Science and the Environment, Tel Aviv University. *Three years of monitoring in Evrona Nature Reserve.*



THE OPEN LANDSCAPE INSTITUTE

Uri Ramon, Amir Perelberg, Aviv Avisar

This has been the third year of the Institute operation under the Steinhardt Museum of Natural History, Tel-Aviv University. The new location inspires new initiatives and research activities in collaboration with students and faculty members from the Tel Aviv University and other research institutes.

Overview of activities during 2018–2019

Nature and Landscape Surveys were carried out in the following regions: Ecological corridors at the Northern district of Israel, Western Galilee coast, Alonim Hills, Northern Nazareth Ridge & Tura'n valley, Misgav region, Basalt plateaus of the Eastern Lower Galilee, Harod valley, East Iron – Um El-Fahem to Yizreel valley, Dolev and Hame'ara Watersheds, Jerusalem hills, Gomer Hills, Yatir to Judea desert highland ecological corridor, Negev Highlands: Halukim ridge & Upper Zin basin, North Mt. Negev anticlines (Infantry school fire ranges), Hevel Eilat: Southern Arava & Uvda valleys, the 40 Endangered endemic plant species survey and database development, Negev & Southern Judea desert ecosystems.

The Open Landscape Institute (OLI) is a partner in development and implementation of methodology in the following fields: Nature based solutions for streams restoration; Regulatory barriers to reducing light pollution in Israel and comparison to regulations in Europe and the United States; Incorporating biodiversity friendly management practices in avocado orchards (including carrying out an ecological restoration pilot at orchard margins); Guidebook for integrating ecological consultants and ecological products into various planning schemes in plans of the Ministry of Construction and Housing; Visitor management program for the eastern channel of the Jordan (the program integrated the ecological, tourism and agricultural needs of the stakeholders in the region); Identification and mapping endangered and protected plants in forests that will be affected from managements activities; Improving the assessment ecological valence of natural, forested and agricultural landscape; Developing monitoring programs with professionals from HaMaarag and the Nature and Parks Authority (INPA); Surveys of Endemic endangered plant species all around Israel; Identifying and developing conservation tools for sites with high value for biodiversity conservation (hotspots); Planning a model of Bedouin rural settlement, which is environmentally and economically sustainable; Number of studies and projects concerning environment and agriculture were carried out. Additional studies in progress in this field are detailed below.

The main challenges that the Institute faced this years included:

1. Strengthening and expanding activity in fields defined within the Institute's core practices:
 - 1.1. Ecological and landscape background for planning – conducting and developing methodology for nature, landscape and human heritage surveys.
 - 1.2. Agriculture and environment – developing knowledge, expanding dialog circles, supporting professional and public processes. The main field that was investigated in this context is goat grazing.
 - 1.3. Botanical surveys – developing methods and tools like field guides for practitioners from different sectors and organizations.
 - 1.4. Restoration Ecology – developing the knowledge of the field and implementing it in agriculture, water management, planning and development practice.
2. Expanding and assimilating of our products among various target audiences:
 - 2.1. Developing tools for disseminating knowledge: workshops, lectures for planners and university students in relevant fields, instructors and more.
 - 2.2. Increasing professional and public exposure of the accumulated knowledge: A new enhanced website was initiated this year (<http://www.deshe.org.il>).
3. Strengthening connections and expanding collaboration with the partner organizations in the Steinhardt Museum of Natural History and other colleagues.

4. Professional and budget strengthening: determining the budgetary basis for the coming years, preserving current professional staff, absorbing new employees and training them to carry out the intended tasks.

Detailed Report for 2018/2019 – Nature and Landscape Surveys

Ecological corridors at the Northern district of Israel

Mapping of ecological corridors within the ranges of six regional councils in Israel's north district was completed, in order to provide background for planning processes in the district. A draft report was submitted for comments.

Western Galilee coast (Coastal area of Regional Municipality Mateh Asher survey)

This area is characterized by unique rocky beaches and scattered sandy patches, with distinctive sand particles composition. This comprises a series of rare habitats, which are inhabited by many endangered plant species and psammophilic animals. The regional municipality is conducting a detailed planning of this area, and the survey attempts to provide the required ecological background to support the planning process. A draft report was submitted for comments.

Alonim Hills, Northern Nazareth Ridge & Tura'n valley

This survey was carried out in a region that exhibits a range of preserved vegetation landscapes such as open forests of gall oak, which are threatened by strong development pressure from both settlement and infrastructure. A final report is in press.

Misgav region

A botanical survey was conducted in Misgav region (Lower Galilee), to provide a database for a masterplan prepared for the Ministry of agriculture and rural development, regarding a better assimilation and expansion of goat grazing in Mediterranean forests & chaparral, for an improved protection against wild fires and better management of biodiversity.

Basalt plateaus of the Eastern Lower Galilee

A region with expansive open landscapes, which are only partly protected. The survey was carried out along with the preparation of open landscapes master plans for the regional councils in this area and served as a database for these plans. A final report is in press.

Harod valley

A landscape survey was conducted in Harod & South Beit-She'an valleys, along with the preparation of open landscapes master plans for the regional councils in this area. The survey served as a database for these plans. A final report is in press.

East Iron – Um El-Fahem to Yizreel valley

A landscape survey was conducted to support the planning process in this region. A final report is in press.

Dolev and Hame'ara Watersheds, Jerusalem hills (USA park)

In recent years OLI completed several surveys in the western Jerusalem ridge. This survey completed the surveys' coverage of this region, and support planning processes in this area. A final report is in press.

Gomer hills

This is a core area in the Judea lowland region – one of Israel's largest, continuous and most valuable open landscapes, and an ecotone between the Mediterranean and the arid ecoregions. Most of the area is defined as a fire-zone, and the purpose of the survey was to prepare the required background for sustainable management of the military activity in this area, and specifically mitigate the risks of wildfires that burst as a result of this activity. A draft report was submitted for comments.

Yatir to Judea desert highland ecological corridor

INPA is preparing a plan for a national latitudinal ecological corridor, from the Mediterranean shore in the west to the rift valley in the east. This survey is meant to complete the missing information

required for this plan, in the area between Mt. Amasa nature reserve, to the Judea desert nature reserve. First stage of this survey was completed, and a report was submitted. The survey should continue next year and get completed by the end of 2020.

Negev Highlands: Halukim ridge & Upper Zin basin

This survey supported the ongoing process of a master plan for open landscapes in the Negev Highlands Regional Council, which includes large parts of the upper section of the Zin River Basin, as well as relatively small areas of the Ro'ah River and Boker River basins. A draft of this survey report was submitted for comments.

North Mt. Negev anticlines (“BISLACH” Infantry school fire ranges)

The training zones of the Israeli infantry troops school (BISLAH) spread along a substantial area of the Negev northern ridges, between Sede Boqer in the south to Dimona in the north. Most of this region is part of the national ecological corridors network, and a very sensitive landscape. The purpose of the survey was to prepare the required background for sustainable management of the military activity in this area. A draft report in four selected pilot fire ranges was submitted for comments. It is not clear yet whether the survey will expand to all other fire ranges next year.

Hevel Eilat: Southern Arava & Uvda Valleys

This survey supported the ongoing process of a master plan for open landscapes in the Hevel Eilat regional council. This area is characterized with higher endemism within the planning region, in which development pressures are strong. The work was performed in close collaboration with the planning team and advisors from the council. A final report is in press and should be published by the end of 2019.

The 40 Endangered endemic plant species

Survey and database development. The 40 endemic endangered plant species, as reported in the Red Data Book of endangered Plants of Israel, were defined as high priority for conservation. A comprehensive survey of these species conducted between 2013–2018 has been completed, a draft report was submitted for comments. The survey of endangered plant species will continue next year and will include sub-endemic and critically endangered species.

Negev & Southern Judea desert ecosystems

This project aim was to divide the arid area of Israel into ecological units, based on the national scale division done by INPA. A final report was submitted to INPA, and should be published in 2020.

Detailed Plans for 2019/2020 – Nature and Landscape Surveys

Vegetation monitoring as part of the National Assessment of the State of Nature in Israel (HaMaarag)

A survey of additional monitoring units is planned. We intend to further assimilate the usage of high-resolution aerial photographs in the monitoring process, in the next region planned for the autumn of 2019: Internal sands. Monitoring plans for 2020 are not clear yet, due to Hamaarag's financial uncertainty.

Yatir to Judea desert highland ecological corridor

INPA is preparing a plan for a national latitudinal ecological corridor, from the Mediterranean shore in the west to the rift valley in the east. This survey is meant to complete the missing information required for this plan, in the area between Mt. Amasa nature reserve, to the Judea desert nature reserve. First stage of this survey was completed, and a report was submitted. The survey should continue this year and completed by the end of 2020.

North Mt. Negev anticlines (“BISLACH” Infantry school fire ranges)

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military activity in this area. A draft report in four selected pilot fire ranges was submitted for comments. During next year, it is planned to complete the survey in all other fire ranges. Due to changes in budget priorities, it is still not clear whether this survey will continue next year.

Regional municipality Yizre'el valley survey

Regional municipality Yizre'el valley is undergoing a detailed regional planning process, in an area with distinctive characteristics: it is a national latitudinal ecological corridor for terrestrial and aquatic animals, and a major route for migrating birds. It also contains two of the most endangered ecosystems in Israel: heavy soils and wetlands. The survey is meant to provide detailed background and database to support the planning process.

Regional municipality Eshkol survey

Regional municipality Eshkol is undergoing a detailed regional planning process. It is an area with distinctive characteristics: its northern area is heavily agricultural, and its southern part is used as a military fire-range. The area is a unique mixture of sandy patches, Kurkar sandstone ridges and loess plains. Most of these are endangered ecosystems in Israel and underrepresented in protected areas. The survey is meant to provide detailed background to support this planning process, and an improved database for policymakers.

Development of protocols for ecological surveys in order to locate, map and mark protected natural assets in JNF forests designated for thinning

Thinning of the forest is the most important and significant maintenance activity in the Israeli planted forests, and essential for the health and proper development of the trees, for the natural regeneration of the forest undergrowth, and to the increase of its plant community diversity. In addition, thinning of the forest may be an important tool for nurturing and encouraging the general biodiversity of the forest in the long run, which also includes legally protected species. For example, according to studies carried out in the JNF forests in recent years, there has been a significant increase in total plant species richness, and in the abundance of several species of protected geophytes, several years after forest thinning. However, it is clear that direct or indirect damage (whether temporary, local or even fundamental) to specific species may occur during the thinning process in the forest. The aims of this study are to develop protocols for ecological surveys in the JNF forests designated for thinning, in order to locate, map and mark protected natural assets before thinning, and to develop a suitable GIS database, in order to mitigate the damage to these assets as much as possible.

Possible other surveys and projects not approved yet

Ruth hills – Lavan River survey. Betset basin survey. Division of the Mediterranean area of Israel into ecological units project. National scale remote sensing mapping of vegetation.

Tools Development and Research – Detailed Report for 2018–2019

Identifying critical sites for nature conservation in Israel: 'Hotspots'

This project is designed to locate, map and classify sites with great importance for biodiversity in Israel, and to describe their state and existing threats to them as a basis for advancing conservation efforts to protect associated natural values. The project is ongoing.

Agricultural practices, which support biodiversity and suit Israel

This project is designed to identify agricultural practices that support biodiversity and are relevant to Israel in terms of her climate, agricultural crops and farm structure. The first part of the project analyzing the Mediterranean climate zones was completed in 2017. The project was presented at a number of Israeli and international scientific conferences. The second part of the project dealing with desert and arid zones is to be completed in 2019.

Developing a methodology for surveying agricultural landscapes as part of nature and landscape surveys

Examining and experimenting with methods for estimating the importance of agricultural landscapes, with different spatial and farming characteristics, for biodiversity conservation. A draft of

the project's final report was completed on 2017 to be presented to the expert panel in 2018. The final report should be available in 2019.

Barriers for treating light pollution in Israel. Standardization, planning and enforcement

Part A – Standardization. "Light pollution – standardization gaps between Israel and other countries". The first chapter reviews literature on light pollution standards in Israel and abroad. In the second chapter, interviews with key figures from state institutions and green organizations will be presented. The interviews are an efficient tool in mapping position toward light pollution.

Part B – Planning. "Barriers to planning for the treatment of light pollution in Israel". This part needs further resource to be completed.

Assimilation of agro-ecological principles in working instructions in avocado plantations with Milopri Agricultural Corporation

Assimilation of agro-ecological knowledge (cover crops, hedgerows) into mandatory working instructions of about 2500 hectares of avocado. As part of the project, three pilots are currently in operation: Adjusting summer-nectar plants for use in plantation fences, re-introducing endangered plants species into previous agricultural habitats, and restoration of runoff for an agricultural winter pool.

Alternatives for managing visitors along the eastern canal of the Jordan River, while meeting nature conservation challenges

This is literature review on the means of managing travelers in Israel and abroad.

Economic and planning models for incentive and management of goat pastures

Reduction and combusting material and maintaining buffer lines against fires.

A master plan for goat grazing in the Carmel and Misgav

Protection from fires and preservation of the ecosystem functions, and the economic aspect.

Agricultural practices supporting biodiversity in Megido regional council

Implementation of Integrated Pest Management agro-principles in Megido's agriculture practice.

National scale ecological background development, for national planning

We collect information from various bodies engaging in endangered biodiversity mapping, in order to create information layers that will enable incorporation of ecological knowledge into national planning.



IN MEMORIAM

Dr Yaacov Lipkin (1935–2019)

Razy Hoffman

Dr Yaacov Lipkin, one of the early pioneers to study the algae and seagrasses of the Israeli coast and the Sinai Peninsula, passed away in March 2019.

Dr Lipkin received his MSc from the Hebrew University of Jerusalem in 1962. His Master's thesis study *Ecological observations on the Mikmoret Coast*, carried out under the supervision of Prof. I. Friedman, won a distinction. In 1963, he embarked on his doctoral studies at the Hebrew University, under the supervision of Profs. M. Zohary and G. Orshan. That same year, as a doctoral candidate, he began teaching at the Botany Department of the then recently established Tel Aviv University. Dr Lipkin completed his thesis on the *Vegetation of the Southern Negev Desert* in 1972, when he earned his PhD. He continued his research and teaching at Tel Aviv University until his retirement in 2005.



In the spring of 1962 and autumn of 1965, Dr Lipkin participated in two International expeditions that explored the marine fauna and flora of the Southern Red Sea off Eritrea (mostly of the Dahlak Archipelago). In 1972–1973, he was a post-doctoral fellow at Texas Tech University, USA. There, he worked with Prof. V.W. Proctor on the study of desert algae and the Charophyte algae of Israel. He was a research fellow at the University of California in Berkeley in 1973–1974 and 1977. While there, he studied specimens from his 1960's expeditions to the Southern Red Sea (Eritrea) with Prof. G.F Papefuss and Dr P. Silva. Lipkin and Silva completed and published this study in 2002. Dr Lipkin returned to Berkeley again in 2004. In 1981–1982, Dr Lipkin was a research fellow at the University of Adelaide in Southern Australia, where he studied the local marine flora with Prof. B. Womersley. He continued these studies at the universities of Sydney and New South Wales in 1982, 2000 and 2005. Dr Lipkin described new species of *Pterocliadiella*, *Hypnea* and *Sargassum* with Papefuss and Silva. He was a member of several international phycological and other associations, participated in many international conferences and symposia, and published numerous articles and professional publications. He taught and supervised many undergraduate students, MSc students and several PhD students. In addition, he amassed a comprehensive professional library and created Israel's largest collection of dried and preserved algae and seagrasses (now at the Steinhardt Museum of Natural History).

Dr Lipkin was a true naturalist. When Sinai was still under Israeli rule, he led his students and associates, as well as international groups of seagrass researchers (including Prof. C. den Hartog), on yearly week-long trips to the Sinai Red Sea shores. There, they studied so far unknown seagrass flora, as well as macroalgae and the mangrove-associated biota. While pioneering scientific SCUBA diving in Israel during those days, he spent long evenings explaining natural phenomena to his followers – he was a 'walking encyclopedia' of natural history knowledge! Dr Lipkin was also instrumental in describing the migration of the seagrass *Halophila stipulacea* from the Red Sea to the Mediterranean; this species has now spread as far as the Caribbean. Dr Lipkin was a meticulous author who demanded that every detail of his scientific findings be confirmed and re-confirmed

before publishing them. Accordingly, many of his papers are now considered as key publications on marine macrophyte ecology.

After his retirement, Dr Lipkin pursued some of his non-academic interests. Among others, he threw himself into the study of Israeli and Jewish history, as well as genealogy. He was survived by his wife, four children and eight grandchildren.



PUBLICATIONS

The Steinhardt Museum of Natural History is an important research infrastructure, used by scientists within and outside of the Tel Aviv University. Below is the list of 2018-2019 publications, which covers all works of the TAU members affiliated with the SMNH. It also includes publications of researchers from other institutions if they are entirely or partly based on our holdings, but our follow-up is far from complete in this regard.

Articles in refereed and other journals

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<https://doi.org/10.1093/cz/zoy065>
11. Barazani, O., Hanin, N., Bajpai, P.K., Waitz, Y., Barzilay, M., Keren-Keiserman, A., Faraj, T., Mayzlish-Gati, E., Westberg, E. & Ziffer-Berger, J. (2018) Genetic diversity among and within populations of *Raphanus raphanistrum* and *Brassica tournefortii* (Brassicaceae) in Israel: a case study for planning ex situ conservation program of crop wild relatives. *Israel Journal of Plant Sciences*, 65(3-4), 153-160. <https://doi.org/10.1163/22238980-00001027>
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- 2018 Reassessing zooarchaeology's approach to the biblical foodways and taboos. *The 13th Meeting of the International Council of Archaeozoologists*. 2–7 September 2018, Ankara, Turkey. (Sapir-Hen L.)
- 2018 The evolution of floral host preference in longhorn bees of the genus *Eucera* (Hymenoptera, Apidae, Eucerini): is association with pollen from bee-flowers advantageous? The talk was presented at: (1) *The 37th Annual Meeting of the Entomological Society of Israel*. October 2018, Rehovot, Israel; (2) *The 55th Annual Meeting of the Israel Zoological Society*. December 2018, Ramat Gan, Israel. (Dorchin A., Langgut D., Neumann F., Vereecken N.)
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- 2018 Invasive biota in the deep-sea: an emerging issue in marine conservation and management. *Alien CSI, COST Action CA17122*. 27–29 November 2018, Akrotiri Environmental Education Centre, Cyprus. (Galil B.S., Danovaro R., Rothman S., Goren M.)
- 2018 The Mediterranean is Red. *The XIII Orna Eshed Annual Conference*. 5 December 2018, Katzerin, Israel. (Goren M.)
- 2019 Environmental reconstruction with shells: Çatalhöyük as a case study. *Israeli Association of Environmental History*. Tel Aviv, Israel. (Bar-Yosef Mayer D.E.)
- 2019 Donkeys and camels – the history of work animals through the zooarchaeological evidence. *Annual Meeting of the Department of Israel Studies and Archaeology, Bar-Ilan University*. Ramat Gan, Israel. (Sapir-Hen L.)
- 2019 The effect of variation in hindwing morphology on elastic wing deformation during free-flight in scarab beetles. *The Society for Integrative and Comparative Biology Annual Meeting*. 3–7 January 2019, Tampa, FL., USA. (Ribak G.)
- 2019 Wing kinematics during sidedlip maneuver in damselflies. *The Society for Integrative and Comparative Biology Annual Meeting*. 3–7 January 2019, Tampa, FL., USA. (Ribak G.)
- 2019 Invasive biota in the deep Mediterranean: an emerging issue in marine conservation and management. *RAC/SPA conference on marine invasive species*. 16–18 January 2019, Antalya, Turkey. (Galil B.S., Danovaro R., Rothman S.B.S., Goren M.)
- 2019 The subfossil record shows massive modifications of soft substrate molluscan assemblages on the Israeli Mediterranean shelf. *Discussion meeting, The Royal Society*. 28–29 January 2019, London, UK. (Steger J., Galil B.S., Hinterplattner A., Zuschin Z., Albano P.G.)
- 2019 The use of mega pollen dataset to reveal early fruit-tree cultivation across the Mediterranean. *International Colloquium on Digital Archaeology*. 4–6 February 2019, Bern, Switzerland. (Langgut D.)
- 2019 The Levantine upper slope, surprises and conservation concerns. Gaps and needs for the implementation of the MSFD in the Mediterranean deep sea. *Implementation of the MSFD to the Deep Mediterranean Sea*. 5–7 February 2019, Tel Aviv, Israel. (Galil B.S., Danovaro R., Rothman S., Mienis H., Goren M.)
- 2019 New data of the geodynamic evolution of the eastern Mediterranean. *AAPG Conference "Exploration and Development of Siliciclastic and Carbonate Reservoirs in the Eastern Mediterranean"*. 26–27 February 2019, Tel Aviv, Israel. (Eppelbaum L.V., Katz Y., Ben-Avraham Z.)
- 2019 Guidelines for the definition of deep-sea protected areas. *The IDEM guidelines to the EU and DG ENV*. March 2019, Rome, Italy. (Galil B.S., Goren M.)
- 2019 The deeper, the bluer: Life along the continental slope. *Symposium in Honor of Prof. David Wool 86th Birthday*. 10 March 2019, The Steinhardt Museum of Natural History, Tel Aviv University, Israel. (Galil B.S.)
- 2019 Guidelines for the identification of deep-sea protected areas – the IDEM guidelines to the EU and DG ENV. *Implementation of the MSFD to the Deep Mediterranean Sea, Italian Ministry for the Environment, land and sea*. 14 March 2019, Rome, Italy. (Galil B.S.)

- 2019 Late Permian distal northern edge of the world-wide Gondwanan Paleozoic siliciclastic belt; insights on the end of the period as recovered from Pleshet 1 and David 1 boreholes by foraminifera and stable isotope systematics, Judea Graben margins, Levant Basin. *Annual Meeting of the Geological Society of Israel*. 26–28 March 2019, Kfar Blum, Israel. Abstracts, p. 71. (Korngreen D., Orlov Labkovsky O., Zilberman T.)
- 2019 Massive impacts of the Lessepsian invasion on molluscan communities of the Israeli Mediterranean shelf. *European Geosciences Union, General Assembly 2019*. 7–12 April 2019, Vienna, Austria. (Steger J., Galil B.S., Hinterplattner A., Zuschin Z., Albano P.G.)
- 2019 The color of personal ornaments in prehistoric periods of the Levant. *The 84th Annual Meeting of the Society of American Archaeology*. 10–14 April 2019, Albuquerque, New Mexico, USA. (Bar-Yosef Mayer D.E.)
- 2019 Shells at death – the use of shells in Neolithic mortuary contexts. *The 84th Annual Meeting of the Society of American Archaeology*. 10–14 April 2019, Albuquerque, New Mexico, USA. (Schechter H., Goring-Morris N., Bar-Yosef Mayer D.E.)
- 2019 Genetic rescue in space: inbreeding depression, ecological fit and the *Iris*. *The 2nd Israeli Conference for Conservation Science*. 16–17 April 2019, Technion, Haifa, Israel. (Sapir Y.)
- 2019 Coastal dune conservation: Can we restore mobile dune biodiversity in the face of shrub encroachment in the coastal dunes of Israel? *The 2nd Israeli Conference for Conservation Science*. 16–17 April 2019, Technion, Haifa, Israel. (Bird T.)
- 2019 The effect of agriculture on resident birds' community structure in three habitats along Israel's precipitation gradient. *The 2nd Israeli Conference for Conservation Science*. 16–17 April 2019, Technion, Haifa, Israel. (Friedman H.)
- 2019 How does fire effect the arthropod community in thicket and scrubland habitats. *The 2nd Israeli Conference for Conservation Science*. 16–17 April 2019, Technion, Haifa, Israel. (Herold C.)
- 2019 Food, pork consumption and identity in ancient Israel – An updated view. *Minerva Gentner Symposium, Food and Identity Formation in the Iron Age Levant and Beyond: Textual, Archaeological and Scientific Perspectives*. 29 April–1 May 2019, München, Germany. (Sapir-Hen L.)
- 2019 Urbanism and purity: the animal economy of Jerusalem in the Iron Age IIB. *Minerva Gentner Symposium, Food and Identity Formation in the Iron Age Levant and Beyond: Textual, Archaeological and Scientific Perspectives*. 29 April–1 May 2019, München, Germany. (Sapir-Hen L.)
- 2019 Animal palaeopathology in the Southern Levant – From the Neolithic revolution to the Secondary Products revolution. *The 7th meeting of the ICAZ Animal Palaeopathology Working Group*. 23–26 May 2019, Tartu, Estonia. (Sapir-Hen L.)
- 2019 What geckos are – and the lizards geckos are not: an ecological biogeographic perspective. *Gekkota Mundi II | An International Conference*. 26–28 May 2019, Tel Aviv, Israel. (Meiri Sh.)
- 2019 Taxonomic revision of the dwarf-lizard genus *Tropicolotes* (Squamata: Gekkonidae): uncovering cryptic diversity. *Gekkota Mundi II | An International Conference*. 26–28 May 2019, Tel Aviv, Israel. (Ribeiro-Júnior M.A., Maza E., Meiri Sh.)
- 2019 Early Roman royal gardens – An archaeobotanical comparison between east and west Mediterranean gardens. *The 18th Conference of the International Workgroup for Palaeoethnobotany*. 3–8 June 2019, Lecee, Italy. (Langgut D.)
- 2019 Dung in the dumps. *The 18th Conference of the International Workgroup for Palaeoethnobotany*. 3–8 June 2019, Lecee, Italy. (Fuks D., Langgut D.)
- 2019 New Kingdom military-administrative centers along 'The Way of Horus', Northern Sinai. *Archaeozoology of Southwest Asia and Adjacent Areas 19th International Meeting*. 3–7 June 2019, Barcelona. Abstract Book, p. 50. (Horwitz L.K., Lernau O., Oren E., Mienis H.K.) https://aswa2019.sciencesconf.org/data/pages/ABSTRACT_BOOK_ASWA2019.pdf
- 2019 Human–animal relationships during the Late Neolithic period in the Southern Levant. *Archaeozoology of Southwest Asia and Adjacent Areas 19th International Meeting*. 3–7 June 2019, Barcelona, Spain. Abstract Book, p. 36. (Namdar L., Paz Y., Vardi J., Khalailah Kh., Sapir-Hen L.) https://aswa2019.sciencesconf.org/data/pages/ABSTRACT_BOOK_ASWA2019.pdf

- 2019 The citadel and the slaughterhouse: faunal remains from Hellenistic Jerusalem. *Archaeozoology of Southwest Asia and Adjacent Areas 19th International Meeting*. 3–7 June 2019, Barcelona, Spain. Abstract Book, p. 51. (Spiciarich A., Sapir-Hen L.)
- 2019 The use of bivalves by the earliest modern humans: a view from psychotherapy. *Workshop: Ontologies and material culture in indigenous hunter-gatherer groups: can we identify ontologies in the past?* 6 June 2019, Jerusalem, Israel. (Bar-Yosef Mayer D.E., Steinhardt L.)
- 2019 Insights on the mitochondrial genome of appendicularians. *The 10th International Tunicate Meeting*. 7–12 July 2019, Villefranche sur Mer, France. (Huchon D., Novosolov M., Garic R., Shenkar N., Stach T., & Gissi C.)
- 2019 Insights on the mitochondrial genome of appendicularians. *SMBE 2019 – Annual meeting of the Society for Molecular Biology and Evolution*. 21–25 July 2019, Manchester, UK. (Huchon D., Novosolov M., Garic R., Shenkar N., Stach T., Gissi C.)
- 2019 Limited growth and hindered reproduction causes the demise of native mollusks on the Israeli Mediterranean shallow shelf. *World Congress of Malacology*. 11–16 August 2019, Pacific Grove, CA, USA. (Albano P.G., Steger J., Guifarro Z., Galil B.S., Zuschin M.)
- 2019 Babysitting hosts: An efficient transmission mechanism of invasive *Gastrocotylinea* species. *The XVI European Congress of Ichthyology*. 2–6 September 2019, Lausanne, Switzerland. (Rothman S., Diamant A., Goren M.)
- 2019 The evolution of floral host preference in longhorn bees of the genus *Eucera* (Hymenoptera, Apidae, Eucerini): is association with pollen from bee-flowers advantageous? *The 9th Dresden Meeting on Insect Phylogeny*. September 2019, Germany. (Dorchin A.)
- 2019 Blooming of the Byzantine sustainable agricultural society in the Negev Desert (Israel) and its abrupt decline. *The 7th International Anthracology Meeting – Charcoal Science in Archaeology and Palaeoecology*. 2–6 September 2019, Liverpool, UK. (Langgut D.)
- 2019 Herod the Great royal Roman gardens come alive: charcoal remains and pollen analysis. *The 7th International Anthracology Meeting – Charcoal Science in Archaeology and Palaeoecology*. 2–6 September 2019, Liverpool, UK. (Langgut D.)
- 2019 Parasitoids (Hymenoptera, Chalcidoidea, and Icheumonoidea) of Spotted Stem Borer *Chilo partellus* (Swinhoe) on the pearl millet in Mali. *The 6th International Entomophagous Insects Conference*. 9–13 September 2019, Perugia, Italy. Abstracts, p. 130. (Yefremova Z., Kravchenko V., Yegorenkova E., Traore M.M., Traore S.F.)
- 2019 The complex evolution of Myxozoa mitochondrial genomes. *The 19th International Conference on Diseases of Fish and Shellfish*. 9–12 September 2019, Porto, Portugal. (Huchon D.)
- 2019 The History of the Steinhardt Museum of Natural History. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Dayan T.)
- 2019 The Bird Collection of the SMNH. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Belmaker A.)
- 2019 The Feather Identification Lab of the SMNH. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Ben-Dov Segal A.)
- 2019 The History of Nature Studies in Israel. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Gal B.)
- 2019 The Egg Collection of the SMNH. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Berkowic D.)
- 2019 Testing flat skins as a way to conserve space in a crowded collection. *The 11th Biennial European Bird Curator Meeting*. 24–26 September 2019, Tel Aviv, Israel. (Belmaker A.)

GRADUATE STUDENTS

Much active scientific research is conducted by graduate students. Below is the list of graduate students of faculty members affiliated to the Steinhardt Museum of Natural History. We list also a few graduate students from other higher education institutions, but names and affiliations of many others from Israel and abroad who used the collections are not included.

PhD students

- 2009– Ittai Renan (A. Freidberg and Y. Ziv)
Taxonomic revision and ecology of the *Graphipterus serrator* group (Coleoptera: Carabidae: Lebiinae).
- 2012– Einat Shachar (N. Dorchin)
Taxonomy and ecology of oak gall wasps in Israel (Hymenoptera: Cynipidae).
- 2013– Roi Maor (T. Dayan)
The evolution of activity patterns in mammals: a macroevolutionary and macroecological approach.
- 2013– Aviv Avisar (T. Dayan)
Ecological restoration following eucalypt removal from the Nahal Alexander National Park.
- 2013– Sigal Orlansky (F. Ben-Ami)
The costs and benefits of resistance to parasites: The case of *Daphnia similis*.
- 2013–2019 Ya'arit Levitt-Barmatz (N. Shenkar)
Diversity and spatial distribution of *Caridea* species along the coasts of Israel.
- 2014– Tali Magoty Cohen (R. Dor)
Ecology and genetics of a recent avian invasive species in Israel.
- 2014–2019 Alex Slavenko (S. Meiri and A. Allison)
Patterns and drivers of morphological diversity in reptiles.
- 2014–2019 Yishai Weissman (E. Geffen)
Procaviidae vocalizations: From specific elements to phylogenetics.
- 2014–2019 Dayana Yahalomi (D. Huchon)
Evolution of Myxozoan mitochondrial genomes.
- 2015– Daniel Berkowic (R. Dor, N. Sapir and Y. Leshem)
Movement ecology of overwintering black kites (*Milvus migrans*) in the North-West Negev.
- 2015– Hezi Buba (J. Belmaker)
Functional response in Mediterranean fishes.
- 2015– Yael Goll (E. Geffen)
Leadership in rock hyrax society.
- 2015– Tal Idan (M. Ilan)
Mediterranean mesophotic sponge gardens.
- 2015– Noa Katz (I. Scharf)
Dispersal and habitat selection in the context of animal personality.
- 2015– Victoria Roul (H. May)
3-D shape of the femur and its association with osteoarthritis of the knee.
- 2015– Corrine Jacobs (R. Holzman)
Broad scale patterns in the evolution of teleost suction feeding.
- 2015– Erez Shoham (Y. Benayahu)
Mesophotic octocorals of Eilat, northern Red Sea.
- 2016– Ruth Kallevag (H. May)
Changes in lumbar intervertebral discs characteristics with the development of lumbar spinal curvature.
- 2016– Andressa Duran (S. Meiri and D. Chapple)
Lizard macroecology.

- 2016— Ori Frid (J. Belmaker)
Understanding marine protected areas, recreational fisheries catch and by catch.
- 2016— Tal Gorgon (N. Shenkar)
Polycarpa mytiligera as a model organism for regenerative studies.
- 2016— Itai Granot (J. Belmaker)
Fouling communities along Mediterranean and Red sea coasts.
- 2016— Ziv Kassner (G. Ribak)
The mechanics and behavior of aerial interception by insects.
- 2016— Michaela Kolker (R. Holzman and S. Meiri)
Early life history of fish in the Mediterranean Sea.
- 2016— Itai Nodel (R. Sarig)
Secondary dentin evaluation using computerized tomography: application for anthropology and forensics.
- 2016— Renanel Pickholtz (J. Belmaker)
Stress and movement patterns of fishes.
- 2016— Lilah Raijman (M. Ilan)
Red Sea mesophotic sponges.
- 2016— Abra Spiciarich (L. Sapir-Hen)
Religious and socioeconomic diversity of ancient Jerusalem and its hinterland during the 8–2 centuries BCE: A view from the faunal remains.
- 2016— Svetlana Vaisman (T. Dayan)
Exotic and invasive molluscs in Israel (provisionary title).
- 2016— Heeli Schechter (D.E. Bar-Yosef Mayer and N. Goring-Morris)
The social, economic and symbolic uses of marine mollusks in the Neolithic of the Southern Levant.
- 2017— Amal Bader Farraj (R. Sarig)
The evolutionary changes in root morphology of molars and their relation to function.
- 2017— Waseem Habashi (R. Sarig)
The effect of biomechanics and enamel chemical composition on dental attrition.
- 2017— Tal Amit (Y. Loya)
Ecology and physiology of coral symbiotic populations.
- 2017— Assaf Ben-David (T. Dayan)
Citizen science as a tool for strengthening one's sense of community and sense of place through ecological research on the effect of land use on biodiversity.
- 2017— Francesca Falco (T. Dayan)
Solving scale mismatches in agro-biodiversity conservation policy: an effectiveness comparative analysis.
- 2017— Talya Shalom (T. Dayan)
Other dimensions of globalization: The evolutionary development of environmental standards for the agricultural industry in a country that leans upon exporting its agricultural production.
- 2017— Rachel Schwarz (S. Meiri and D. Chapple)
The relationship between habitats and lizards: Eco-physiological, morphological and behavioral traits.
- 2017— Tomer Urca (G. Ribak)
The dispersal flight of (*Batocera rufomaculata*): The biomechanics, physiology and ecology of a tree-boring beetle.
- 2017— Gay Yohananoff (M. Ilan)
Measuring sponge filtration.
- 2018— Sarah Borgel (H. May and I. Hershkovitz)
The hominin child from Tinsmet Cave
- 2018— Hadas Avni-Levine (H. May)
The impact of incompatibility between the shape of the proximal femur and the acetabulum on the risk for developing osteoarthritis of the hip.

- 2018– Rona Nadler-Valency (T. Dayan)
Human—large carnivore coexistence.
- 2018– Liron Israely (T. Dayan)
Agricultural landscape complexity – The case study of Beit Natufa valley.
- 2018– Guy Sinaiko (S. Meiri and Ch. Dietrich)
Taxonomy of the leafhopper genus *Neoliturus* (Cicadellidae) in Israel.
- 2018– Sarah Ohayon (J. Belmaker)
Wideband acoustic methods for estimating fish spillover distance from Marine Protected Area.
- 2018– Shahar Chaikin (J. Belmaker)
Processes underlying fish depth distributions.
- 2018– Mark Cavanagh (E. Ben-Yosef and D. Langgut)
The paleoenvironment of the southern Arava during historical periods.
- 2018– Nitsan Ben Melech (Y. Gadot and D. Langgut)
Chronology and landscape archaeology: The use of OSL dating in the Judean Mtns.
- 2018– Amir Sarig (G. Ribak)
Miniaturization constraints on flight of insects smaller than 1 mm.
- 2018– Ronen Liberman (Y. Benayahu and D. Huchon)
Symbiotic zooxanthellae in mesophotic octocorals.
- 2018– Arnav Upadhyay (D. Huchon)
Evolution of mitochondrial genome in Aplousobranchians.
- 2019– Yael Hockema (Y. Gadot and D. Langgut)
The use of wood beams at monumental buildings in ancient Jerusalem.
- 2019– Michal Peer (R. Sarig)
Thermal alteration of teeth: Changes in volume and morphology.
- 2019– Mila Rajapova (Hejja) (I. Hershkovitz)
Vertebral body volume and lumbar spinal pathologies.
- 2019– Einat Kedar (I. Hershkovitz)
The evolution of the human sinus and their functional significance.
- 2019– Hanan Rapoport (I. Hershkovitz)
Knee morphology in ancient and modern populations.

MSc / MA students

- 2013– Michal Zeitzov (T. Dayan)
Barn owls as biological control agents in the northern Negev.
- 2015– Jamie Shapiro (D.E. Bar-Yosef Mayer and E. Spanier)
Humanfish consumption in Lake Kinneret: Comparisons between an Early Bronze Age city, the modern fishery, and current food habits of the Saint Peter's fish, *Sarotherodon galilaeus*, and the silver carp, *Hypophthalmichthys molitrix*.
- 2016– David David (S. Meiri and S. Gafny)
Captive breeding and the conservation of *Pelobates syriacus*.
- 2016– Tal Gavriely (J. Belmaker)
Fish movement ecology.
- 2016–2019 Nir Bonda (N. Dorchin)
Acclimation of the weevil *Melanterius compactus* for the biological control of *Acacia saligna* in Israel.
- 2016–2019 Shirad Galmour (L. Sapir-Hen)
The early Neolithic at Ahhud: hunters, farmers, and the rest.
- 2016–2019 Gal Navon (N. Shenkar)
Influence of pharmaceutical residuals on benthic filter feeders.
- 2017– Yoli Bitterman (R. Sarig)
Population characterization based on dentin trait: lower premolar transverse crest.
- 2017– Darar Bega (I. Scharf)
The influence of surface complexity, learning and motivation on food foraging in *Cataglyphis niger*.

- 2017– Barel Asraf (F. Ben-Ami)
The significance of multiple infections for the host population.
- 2017– Anna Azem (F. Ben-Ami)
The significance of host age in host-parasite coevolution.
- 2017– Guillermo F. Anderson Benaim (N. Shenkar)
Development of a biological assay for bioplastic products.
- 2017– Eyal Ben-Dor Cohen (M. Ilan and O. Yarden)
Mesophotic sponge associated fungi.
- 2017– R. Moskovich (M. Ilan and G. Yahel)
Sponge filtration mechanism.
- 2017– Adva Olga Peretz (S. Meiri and N. Marom)
The water vole in Israel: from archaeology to extinction to reintroduction?
- 2017– Olga Rybak (R. Dor)
Breeding biology and conservation of Little and Common Terns in Israel.
- 2017– Samuel Francis (H. May)
Does femoral bone morphology reflect muscle force?
- 2017– Amir Rubinstein (J. Belmaker)
Scaling of bird co-occurrence and phylo-diversity.
- 2017– Dvora Lev (J. Belmaker)
Resolving the “black box” of larval-fish abundance and its sensitivity to climate change.
- 2017– Lior Bentor (T. Dayan)
The ecological role of riparian corridors in agricultural landscape: the macroinvertebrate community of the Zippory stream as a model.
- 2017– Hamutal Fridman (T. Dayan)
Anthropogenic effects on resident bird communities in Israel.
- 2017– Carmel Herold (T. Dayan)
Effects of fire on the arthropod community in Kfira National Park.
- 2017– Adi Weiss (T. Dayan)
Identifying the eco-hydrological to assess the impact of prolonged drought in the Upper Jordan River.
- 2017–2019 Hadar Elazar (S. Meiri and R. Dor)
Common Myna behavior in invasion core versus invasion front.
- 2017–2019 Bar Shemesh (T. Dayan)
Calibrating a potential species richness accumulation curve to sampling timing, during detailed botanic transects in the Mediterranean phytogeographic region of Israel.
- 2017–2019 Linoy Namdar (L. Sapir-Hen)
Human animal interaction in the Pottery Neolithic.
- 2018– Daphna Shapiro Goldberg (J. Belmaker)
Food and Fear – analyzing the grazing behavior of the invasive *S. luridus* and *S. rivulatus* in the eastern Mediterranean Sea.
- 2018– Liron Kraushar (J. Belmaker and R. Holzman)
Chaetognath community structure.
- 2018– Nitzan Yitzhak (J. Belmaker and N. Stern)
The ecology of alien Tetraodontidae in the eastern Mediterranean Sea.
- 2018– Shira Salingré (J. Belmaker and Avi Bar Massada)
Non-stationarity of biotic interactions among Mediterranean fishes.
- 2018– Elinor Levy (H. May)
Gracilization of the human skeleton during human history: The biomechanical vs. the ‘self-domestication’ theories.
- 2018– Gali Ofer (S. Meiri and U. Roll)
Distribution of reptiles and mammals in Israel and beyond.

- 2018– Liat Dror (S. Meiri and N. Kronfeld-Schor)
Activity rhythms of reptiles.
- 2018– Eshel Mor (D. Langgut and R. Greenberg)
Reconstructing Tel Bet Yerah's natural and anthropogenic environment during the Early Bronze Age through wood remains.
- 2018– Tatiana Orli Milkewitz-Sandberg (D. Huchon)
Mitochondrial genome evolution of Myxobolidae (Myxozoa, Cnidaria).
- 2019– Elijah Kolin (L. Sapir-Hen)
Animal economy of the Persian Period at Tel Azekah.
- 2019– Diana Medellin Martinez (D. Langgut and O. Sergey)
Horvat Tevet wood economy during the Iron Age IIA. Reconstruction of the natural and cultural environment by an anthracology study.
- 2019– Inbar Friedman (D. Langgut)
Environmental reconstruction of the Negev Desert during the Early Pleistocene based on palynological analysis.
- 2019– Noy Shapira (J. Belmaker)
Functional diversity of Red Sea fishes.
- 2019– Karin Maschini (R. Sarig)
Teeth: An ideal model to study microstructural sexual dimorphism.
- 2019– Itay Namir (I. Renan)
Temporal activity patterns of mammals in Israel under different human disturbance levels.
- 2019– Helena Gondra (H. May)
Changes in osteoporosis prevalence during the Holocene Levant.
- 2019– Itzik Dishon (R. Sarig and I. HersHKovitz)
Comparing ancient microbiom in dental calculus before and after agricultural revolution.
- 2019– Ariana Dann (H. May)
Changes in the shape of the calcaneus following the transition to sedentism.
- 2019– Liron Chavoinik (H. May)
Biohistory of the early chalcolithic population from Ein Asawir.
- 2019– Yulia Makoviychuk (H. May)
Who are the people from Nahal Yarmut? A Prepottery Neolithic B site.

Post-doctoral fellows

- 2015– Guy Sion, *LateralitY in gecko brains – relationships with behaviour and morphology.*
- 2016– Tatiana Sella Tunis, *The evolutionary history of the human chin.*
- 2016– Liron Goren, *The diversity of sponge-inhabiting Polychaeta in Israel.*
- 2016– Shane Blowes, *Scale-dependencies in the drivers of large-scale diversity gradients.*
- 2016– Ronit Justo-Hanani, *Understanding ecological policy innovation in the EU: Science and politics in the new bio-invasion legislation and management reform.*
- 2017– Orr Comay, *Mountainous Levantine micromammal communities as tools paleoecology: Implications for Manot Cave.*
- 2017–2019 Zafir Kuplik, *The ascidian fauna along the Mediterranean coast of Israel: Taxonomy and ecotoxicology.*
- 2018– Marco Antônio Ribeiro-Júnior, *Species-complexes of cryptic taxa widely distributed in Eastern Europe, Western Asia and Northern Africa (Western Palearctic lizards).*
- 2018– Bat-Sheva (Shevy) Rothman, *Fish parasitofauna along the Israeli Mediterranean coast with emphasize on invasive hosts and the taxonomy of monogenean species.*
- 2018– Or Givan, *The morphological trait structure of nonindigenous fishes in the Mediterranean.*
- 2018– Yonatan Meresman, *Functional morphology of insect wings.*
- 2018–2019 Maria Novosolov, *Appendicularian mitochondrial genomes.*

VISITING SCIENTISTS AT THE STEINHARDT MUSEUM OF NATURAL HISTORY

The attached list includes visitors, who came personally to use the collections of the Steinhardt Museum of Natural History during 2018–2019. Much use was made of the collections by other scientists, who did not visit them in person. Some researchers got identification services for their projects and others had lists of specimens and locations mailed to them. Moreover, during this period numerous parcels with scientific material were mailed abroad to researchers at their home institutions.

Date	Name	Institute	Country	Expertise
2018 Oct	J. Chapman	University of Exeter	UK	Insects (Lepidoptera)
2018 Oct	J.R. Lomelí Flores	Colegio de Postgradvades	Mexico	Insects (Hymenoptera)
2018 Oct	E. Rodríguez-Leyva	Colegio de Postgradvades	Mexico	Insects (Hymenoptera)
2018 Nov	S. Raguza	Palermo	Italy	Mites (Phytoseiidae)
2018 Nov	B. Levi	The Volcani Center & Nature and Parks Authority	Israel	Insects (Diptera, Coleoptera)
2018 Nov	G. Friedman	Tel Aviv University	Israel	Aves
2018 Dec 2019 Aug	Ph. Weintraub	Gilat, ARO	Israel	Insects (Hemiptera Auchenorrhyncha)
2018 Dec	S. Georgieva	University of Valencia	Spain	Fish parasites
2018 Dec	Yap Wei Lang	National University of Singapore	Singapore	Sea anemones (Actinaria)
2018 Dec	I. Horáček	Charles Univ. of Prague	Czech Rep.	Mammals
2018 Dec	H. Shochat	Haifa University	Israel	Mammals
2018 Dec	Y. Wasserlauf	Tel Aviv University	Israel	Aves
2018 Dec	Y. Kiat	Haifa University	Israel	Aves
2019	D. Korngreen	Geological Survey of Israel	Israel	Foraminifera
2019	S. Vaisman	Plant Protection and Inspection Services	Israel	Mollusca
2019	D. Fulton	Baylor University	USA	Archaeozoology
2019	H. Greenfield	University of Manitoba	Canada	Archaeozoology
2019	Y. Yom-Tov	Tel Aviv University	Israel	Mammals
2019	Fruit Fallen project	Private	USA	Mammals/Aves
2019	U. Paz	Hebrew University	Israel	Mammals
2019	M. Belmaker	University of Tulsa	USA	Mammals
2019	A.I. Lazagabaster	Haifa University	Israel	Mammals

Date	Name	Institute	Country	Expertise
2019	S. Harding	Haifa University	Israel	Mammals
2019 Jan	L. Weissbrod	Haifa University	Israel	Mammals
2019 Jan	A. Eran	Tel Aviv University	Israel	Mammals
2019 Feb	L. Kolska-Horwitz	Hebrew University	Israel	Aves
2019 Feb	Y. Motro	Ministry of agriculture	Israel	Reptiles
2019 Feb	Th. Assman	Institute of Ecology, Lueneburg University	Germany	Insects (Coleoptera)
2019 Feb	L. Schild	Institute of Ecology, Lueneburg University	Germany	Insects (Coleoptera)
2019 Feb	Yu. Marusik	Institute of Biological Problems of the North	Russia	Spiders
2019 Feb	M. Wilson	National Museum of Wales	UK	Insects (Hemiptera)
2019 Feb	E. Recht	Plant Protection and Inspection Services	Israel	Insects (Hemiptera)
2019 Feb 2019 Jun	L. Gidron	Plant Protection and Inspection Services	Israel	Insects (Hemiptera)
2019 Mar	O.G. Gorbunov	Institute of Ecology and Evolution	Russia	Insects (Lepidoptera)
2019 Mar	A. Harush	The Volcani Center	Israel	Store pest
2019 Mar	C. Hasin	private	Israel	Reptiles
2019 Mar	A. Pinoni-Podericz	Inst. of Oceanology	Poland	Bryozoa
2019 Mar	B. Palmer	Weizmann Institute	Israel	Insects (Lepidoptera)
2019 Mar	H. Karmit	private	Israel	Reptiles
2019 Mar	L. Namdar	Tel Aviv University	Israel	Mammals
2019 Mar	Sh. Shefer	private	Israel	Aves
2019 Mar	H. Greenfield	University of Manitoba	Canada	Aves
2019 Mar	O. Comay	Tel Aviv University	Israel	Mammals
2019 Apr	N. Ananieva	Zoological Institute	Russia	Reptiles
2019 May	E. Kwast	Niederlausitzer Heidemuseum	Germany	Insects (Hymenoptera)
2019 May	T. Kwast	Leipzig	Germany	Insects (Coleoptera)
2019 May	D. Eilam	Tel Aviv University	Israel	Mammals
2019 May	T. Gilbert	Natural History Museum of Denmark	Denmark	Mammals
2019 May	N. Lauper	private	Israel	Tetrapoda
2019 Jun	M. Blecher	Nature and Parks Authority	Israel	Insects (Odonata)
2019 Jun	A. Summers	Univ. of Washington	USA	Fish
2019 Jun	J. Eger	Florida State Coll. of Arthropods	USA	Insects (Hemiptera)
2019 Jun	Z. Mendel	ARO, Volcani Center	Israel	Insects (Hemiptera)
2019 Jun	A. Marchini	University of Pavia	Italy	Amphipoda, Isopoda
2019 Jun	E. Quinn	ARO, Volcani Center	Israel	Insects (Hemiptera)
2019 Jun	E. Flesch	Hebrew University of Jerusalem	Israel	Reptiles
2019 Jun	A. Spiciarich	Tel Aviv University	Israel	Aves

Date	Name	Institute	Country	Expertise
2019 Jun	M. Zytzove-Raz	Tel Aviv University	Israel	Mammals
2019 Jun	I. Ktalav	Haifa University	Israel	Aves
2019 Jun	N. Marom	Haifa University	Israel	Mammals
2019 Jul	D. Korkus	private	Israel	Molluscs
2019 Jul	E. Dankovicz	Smithsonian Institution	USA	Insects (Diptera)
2019 Jul	H. Schechter	Hebrew University of Jerusalem	Israel	Archaeomalacology
2019 Jul	M. Sapija	University of Edinburgh	UK	Mammals
2019 Jul	L. Hagar	Haifa University	Israel	Mammals
2019 Jul	A. Hulme-Beaman	University of Liverpool	UK	Mammals
2019 Aug	Y. Leshno	Hebrew University of Jerusalem	Israel	Brachiopoda
2019 Sep	S. Atkinson	Oregon State Univ.	USA	Myxozoa
2019 Sep	S. Benazzi	University of Bologna	Italy	Anthropology
2019 Sep	L. Fiorenza	Monash University	Australia	Anthropology
2019 Sep	G. Szalai	Hungarian Academy of Sciences	Hungary	Botany
2019 Sep	A. Ben-David	Tel Aviv University	Israel	Mammals
2019 Sep	J. Mlikovsky	Charles Univ. of Prague	Czech Rep.	Aves
2019 Sep	H. Feibish	private	Israel	Aves
2019 Sep	E. Argaman	Homa ve Migdal - Kibbutz Hanita Museum	Israel	Mammals
2019 Oct	N. Mercier	University of Bordeaux	France	Anthropology
2019 Oct	A. Galy	Université de Pau et des Pays de l'Adour	France	Anthropology
2019 Oct	Ch. Pecheyran	Université de Pau et des Pays de l'Adour	France	Anthropology
2019 Dec	J.-J. Hublin	Max Planck Inst. for Evol. Anthropology	Germany	Anthropology



SUPPORT FOR ACADEMIC AND OTHER COURSES

The natural history collections of the Steinhardt Museum are extensively used in higher education institutions. Some courses are TAU-based, several of which are compulsory for first and second year students and are taught to hundreds of them. Other universities (Technion, Bar-Ilan University, the Open University) use our facilities for their specialized courses, as does the Bezalel Academy of Arts and Design. Many activities of the Museum's Education and Science Communication Department also make use of the collections for varied audiences.

Course	Name	Institute	Taxonomic group
General botany	Y. Sapir	Levinsky College of Education	Plants
Introduction to plant science	Y. Sapir	Levinsky College of Education	Plants
Special botany	Y. Sapir	Levinsky College of Education	Plants
Integrative Organismal Laboratory	N. Kronfeld-Schor	Tel Aviv University	Aquatic macroinvertebrates
Animals in motion	G. Ribak, D. Eilam	Tel Aviv University	Metazoa
The Israel Taxonomy Initiative	T. Novoselsky, G. Ribak, D. Furth	Tel Aviv University	Insects (Hemiptera)
The Israel Taxonomy Initiative	Y. Belmaker	Tel Aviv University	Arrow worms (Chaetognatha)
The Israel Taxonomy Initiative	B. Galil	Tel Aviv University	Peracarida crustaceans
Zoological Garden & Museum Tours	Sh. Meiri, T. Dayan, R. Dor, Y. Yovel	Tel Aviv University	Vertebrates
Mammal faunistics	E. Geffen, Y. Yom-Tov, R. Dor	Tel Aviv University	Mammals
Zoology	R. Dor, G. Ribak, N. Shenkar	Tel Aviv University	Vertebrates, invertebrates
Vertebrates	D. Eilam	Tel Aviv University	Vertebrates
Vertebrate structure and function	R. Holzman, D. Eilam	Tel Aviv University	Vertebrates
Animal remains in archaeology	L. Sapir-Pen	Tel Aviv University	Mammals, birds, archaeozoology
Practical workshop in archaeozoology	L. Sapir-Pen	Tel Aviv University	Mammals, birds, archaeozoology



SUPPORT FOR VARIOUS INDIVIDUALS & ORGANIZATIONS

The Steinhardt Museum of Natural History functions as a national facility by providing services to the scientific community, other organizations and to the general public. Below we list samples of the services provided by our staff during the past academic year. The list is not exhaustive, for under the current condition of under-staffing we are unable to monitor and record all such activities.

Purpose	Name	Institute	Taxonomic group
Loan	L. Steindler	Haifa University	Sponges (Porifera)
Loan	P. Baňář	Moravian Museum, Czech Rep.	Insects (bugs)
Loan	J. Gebert	Büro für Faunistik und Ökologie, Dresden, Germany	Insects (beetles)
Loan	L. Toledano	Museo Civico di Storia Naturale, Verona, Italy	Insects (beetles)
Loan	K. Burgarth	Stelle, Germany	Insects (beetles)
Loan	Th. Assmann	University of Lüneburg, Germany	Insects (beetles)
Loan	A. Pauly	Institut royal des Sciences naturelles de Belgique, Belgium	Insects (bees)
Loan	R. Kundrata	Palacky University, Czech Republic	Insects (beetles)
Loan	S. Csoz	Hungarian Natural History Museum, Hungary	Insects (ants)
Loan	J.-B. Huchet	Université de Bordeaux, France	Insects (beetles)
Loan	N. Nieser	Naturalis Biodiversity Center, The Netherlands	Insects (bugs)
Loan	H. Bohn	Zoologische Staatssammlung, Germany	Insects (cockroaches)
Loan	J. Skevington	Canadian Nat. Coll. of Insects, Arachnids and Nematodes, Canada	Insects (flies)
Loan	A.E. Whittington	Plymouth Marjon University, UK	Insects (flies)
Loan	Th. Pape	Natural History Museum of Denmark, Denmark	Insects (flies)
Loan	G. Pisanty	Agriculture and Agri-Food Canada, Canada	Insects (bees)
Loan	J. Straka	Charles University, Czech Republic	Insects (bees)
Loan	M.R. Wilson	National Museum of Wales, UK	Insects (cycadas)
Loan	P. Cerretti	Sapienza Università di Roma, Italy	Insects (flies)
Loan	J.E. Bond	University of California Davis, USA	Spiders
Loan	Ch. Praz	University of Neuchâtel, Switzerland	Insects (bees)
Loan	E. Gavish-Regev	The Hebrew University of Jerusalem, Israel	Spiders
Loan	H. Baur	Natural History Museum Bern, Switzerland	Insects (parasitic wasps)
Loan	T. Dikow	Smithsonian Institution, USA	Insects (flies)
Loan	H. Dathe	Deutsches Entomologisches Institut, Germany	Insects (flies)

Purpose	Name	Institute	Taxonomic group
Loan	G. Sinaiko	SMNH / Tel Aviv University	Insects (cycadas)
Loan	A. Mueller	Zurich, Switzerland	Insects (bees)
Loan	A. Thomas-Cabianca	Universidad de Alicante, Spain	Insects (flies)
Loan	M. Terzo	University of Mons, Belgium	Insects (bees)
Loan	M. Kuhlmann	Zoological Museum of Kiel University, Germany	Insects (bees)
Loan	A. Ben-David	Tel Aviv University, Israel	Birds
Loan	I. Atad	SMNH, Israel	Birds
Loan	G. Ribak	Tel Aviv University, Israel	Birds
Loan	Ch. Broeckhoven	University of Antwerp, Belgium	Reptiles
Loan	K. Date	Victoria Museums, Australia	Reptiles
Loan	R. Tal	Tel Aviv University, Israel	Reptiles
Loan	R. Aguilar	Victoria Museums, Australia	Reptiles
Loan	L. Sapir-Hen	SMNH, Israel	Reptiles
Loan	S. Cleuren	Monash University, Australia	Reptiles
Loan	S. Goldberg	Whittier College, USA	Reptiles
Loan	L. D'Alba	Ghent University, Belgium	Reptiles
Loan	I. Sidis	SMNH, Israel	Mammals/Birds
Loan	Sh. Barkan	The Open University, Israel	Mammals/Birds
Loan	A. Peretz	Tel Aviv University, Israel	Mammals
Loan	A. Arnon	Haifa University, Israel	Mammals
Loan	I. Berger	Tel Aviv University, Israel	Mammals
Loan	E. Mori	Univ. degli Studi di Siena, Italy	Mammals
Loan	E. Amichai	Tel Aviv University, Israel	Mammals
Loan	T. Feldstein	Tel Aviv University, Israel	Mammals
Loan	Sh. Galmor	Tel Aviv University, Israel	Mammals
Loan	T. Karni	Ben-Gurion University, Israel	Mammals
Loan	E. Maza	SMNH, Israel	Mammals
Loan	M.-T. Gewing	SMNH, Israel	Mammals
Loan	M. Bar	Tel Aviv University, Israel	Mammals
Loan	M. Zytzove-Raz	Tel Aviv University, Israel	Mammals
Loan	O. Comay	Tel Aviv University, Israel	Mammals
Loan	R. Rabinovich	Hebrew University, Israel	Mammals
Loan	S. Nudel	Beit Ussishkin Natural History Museum, Israel	Mammals
Loan	Y. Levi-Paz	Ramat HaNadiv, Israel	Mammals
Loan	S. Asaf	Tel Aviv University, Israel	Mammals
Loan	H. Karmit	private, Israel	Tetrapoda
Gift	Y. Wiesenberg	Kfar Saba Museum, Israel	Insects
Tissue sample	Y. Kiat	Haifa University, Israel	Birds
Tissue sample	J. Smid	National Museum in Prague, Czech Republic	Reptiles
Tissue sample	A. Arnon	Haifa University, Israel	Mammals
Tissue sample	E. Bar-Ziv	Ben-Gurion University, Israel	Mammals

Purpose	Name	Institute	Taxonomic group
Tissue sample	E. Dvir	Tel-Hay College, Israel	Mammals
Tissue sample	E. Shpirer	Tel Aviv University, Israel	Mammals
Tissue sample	H. Shochat	Haifa University, Israel	Mammals
Tissue sample	M. Meiri	Tel Aviv University, Israel	Mammals
Tissue sample	O. Golan	Ben-Gurion University, Israel	Mammals
Tissue sample	Sh. Bar-David	Ben-Gurion University, Israel	Mammals
Tissue sample	T. Gilbert	Natural History Museum of Denmark, Denmark	Mammals
Tissue sample	M. Belmaker	University of Tulsa, USA	Mammals/Birds
Training	M. Saar	Tel Aviv University, Israel	Insects (ants)
Molecular identification	O. Hatzofe	Israel Nature and Parks Authority	Birds
Identification	Th. Prohaska	Montanuniversität Leoben, Austria	Corals Alcyonacea
Identification	M. Wieser	University of Calgary, Canada	Corals Alcyonacea
Identification	C.S. McFadden	Harvey Mudd College, CA, USA	Corals Alcyonacea
Identification	L. Gidron	Plant Protection and Inspection Services, Israel	Insects
Identification	I. Renan	Entomology Lab for Applied Ecology, SMNH, Israel	Insects
Identification		Jacob Blaustein Institute for Desert Research, Israel	Insects (bugs)
Identification	C. Herold	Entomology Lab for Applied Ecology, SMNH, Israel	Insects (bugs)
Identification	A. Avisar	Open Landscapes Institute, SMNH, Israel	Insects (bugs)
Identification	G. Sinaiko	SMNH / Tel Aviv University, Israel	Insects (bugs)
Identification	Y. Hershkovitz	Israel National Center for Aquatic Ecology, SMNH, Israel	Insects (bugs)
Identification	D. Michez	Mons University, Belgium	Insects (bees)
Identification	H. Giladi	Israel Nature and Parks Authority	Insects (ants)
Identification	M. Saar	Tel Aviv University, Israel	Insects (ants)
Data provision	A. Ben-Dov	private, Israel	Birds
Data provision	A. Reichman	Israel Nature Reserves and Parks Authority	Mammals
Data provision	A. Arnon	Haifa University, Israel	Mammals
Data provision	A. Schertler	University of Natural Resources and Life Sciences Vienna, Austria	Mammals
Data provision	A. Hulme-Beaman	University of Liverpool, UK	Mammals
Data provision	D. Huchon	Tel Aviv University, Israel	Mammals
Data provision	E. Bar-Ziv	Ben-Gurion University, Israel	Mammals
Data provision	M. Sapija	University of Edinburgh, UK	Mammals
Data provision	M. Zytzove-Raz	Tel Aviv University, Israel	Mammals
Data provision	M. Belmaker	University of Tulsa, USA	Mammals
Data provision	N. Marom	Haifa University, Israel	Mammals

Purpose	Name	Institute	Taxonomic group
Data provision	O. Hatzofe	Israel Nature Reserves and Parks Authority	Mammals
Data provision	O. Goelman	Israel Nature Reserves and Parks Authority	Mammals
Data provision	T. Pollock	Monash University, Australia	Mammals
Data provision	T. Magory	Tel Aviv University, Israel	Mammals
Data provision	T. Gilbert	Natural History Museum of Denmark, Denmark	Mammals
Data provision	U. Vazana	Israel Nature Reserves and Parks Authority	Mammals
Data provision	Z. Amar	Bar-Ilan University, Israel	Mammals
Data provision	Z. Yanai	SMNH, Israel	Insects (bugs)

