

Annual Report Academic year 2019/2020

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

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TABLE OF CONTENTS

Honorary President	5
Scientific and Public Council	5
Board of Directors	5
International Scientific Advisory Board	5
Museum Staff	5
Museum scientists	12
Progress in the Steinhardt Museum of Natural History	13
Collections news	15
Dan David Center for Human Evolution and Bio-History Research	44
Molecular Systematics Laboratory and Tissue Collection	44
The Museum Database	45
The Israel Taxonomy Initiative	46
Education and Science Communication Department	46
The Israel National Center for Aquatic Ecology	49
The Entomology Laboratory for Applied Ecology	51
HaMaarag — Israel's National Nature Assessment Program	53
The Open Landscape Institute	55
Publications	61
Graduate students	75
Visiting scientists at the Steinhardt Museum of Natural History	81
Support for academic and other courses	83
Support for various individuals and organizations	84

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), Aharon Fogel, Itamar Borowitz, Ami Federman, Izhar Kanne, Doron Sapir, Gady Frank, Dudu Zaken, Motti Kohn, Neri Azogui, Mark Shtaif; 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; 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 Benshahar-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
- $\bullet \ \ \, \text{Andrei Lapicov} \text{Museum maintenance} \\$
- \bullet Lyn Geffen Cohen Museum operations
- Sasha Katsnelson Museum operations
- Dr Elizabeth (Liz) Morgulis Live Insects display
- Eran Keidar 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, Eli Geffen, Yossi Yovel, Eran Levin, Jonathan Belmaker, Roi Holtzman, Noa Shenkar, Omri Bronstein, Frida Ben-Ami, Micha Ilan, Netta Dorchin, Moshe Guershon, Gal Ribak, Dorothée Huchon, Yuval Sapir, Israel Hershkovitz, Hilla May, Rachel Sarig, Dafna Langgut, Lidar Sapir-Hen.

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

Yonatan Gur – Database Manager.

The Entomology Section

- Dr Netta Dorchin Chief Curator (flies)
- Dr Sergey Zonstein Curator (spiders)
- Dr Gal Ribak Curator (beetles)
- Prof. Vladimir Chikatunov Curator (beetles)
- Prof. Vasily Kravchenko Curator (moths)
- Dr Amnon Freidberg Curator Emeritus (flies)
- Prof. Abraham Hefetz Curator Emeritus (bees)
- Dr Dany Simon Curator Emeritus (lacewings)
- Dr David Furth Associate Curator (Smithsonian Institution and TAU) (beetles)
- Dr. Inon Scharf Associate Curator (lacewings)
- Dr Yael Mandelik Associate Curator (Hebrew University of Jerusalem) (bees)
- Dr Tatyana Novoselsky Collections Manager (bugs)
- Dr Malkie Spodek Collections Manager (Sternorrhyncha and Auchenorrhyncha)
- Ariel-Leib-Leonid Friedman Collections Manager (beetles)
- Oz Rittner Collections Manager (butterflies)
- Dr Mike Mostovski Collections Manager (flies)
- Dr Elizabeth (Liz) Morgulis Collections Manager (flies)
- 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)
- David Saar Technical Assistant
- Dr Avi Keysary Volunteer
- Dr Binyamin Shalmon Volunteer
- Amir Weinstein Volunteer
- Tirza Stern Volunteer
- Yitzhak Nussbaum 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)
- Dr Sigal Shefer Collections Manager (sponges)
- Alex Shlagman Collections Manager (soft corals), until 20.03.2020
- Zafrir Kuplik Collections Manager (Coelentherata)
- Dr Liron Goren Collection Manager (worms and crustaceans)
- Ya'arit Levitt-Barmats Technical Assistant (crustaceans)
- Dr Lion Novak Collections Manager (ascidians)
- Dr Noga Sokolover Collection Manager (bryozoans and echinoderms)
- Hadas Salman Volunteer

Fishes

- Prof. Jonathan (Yoni) Belmaker Curator
- Prof. Roi Holzman Curator
- Dr Menachem Goren Curator Emeritus
- Dr Nir Stern Associate Curator (IOLR)
- Dr Bat-Sheva (Shevy) Rothman Collections Manager
- Kfir Gayer Technical Assistant

The Terrestrial Vertebrates Section

- Prof. Shai Meiri Curator (reptiles, mammals and 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 Roi Dor Associate Curator (birds)
- Dr Amos Belmaker Collections Manager (birds)
- Daniel Berkowic Collections Manager (birds)
- Erez Maza Collections Manager (reptiles)
- Dr Karin Tamar Collections Manager (mammals)
- Avigail Ben-Dov Segal Technical assistance (birds and feathers)
- $\bullet \ {\rm Arieh} \ {\rm Landsman} {\rm Volunteer} \\$
- $\bullet \ {\rm Moshe} \ {\rm Geizler} {\rm Volunteer} \\$
- Miriam Eidels Volunteer
- $\bullet \ {\rm Ron} \ {\rm Cohen} {\rm Volunteer} \\$
- Igor Gavrilov Chief Taxidermist
- Dr Stanislav Volynchik Taxidermist and preparator
- Hamutal Friedman Technical Assistant in taxidermy

The Herbarium

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

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)
- Prof. Miriam Belmaker Associate Curator (Archaeozoology, University of Tulsa, OK, USA)
- 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 Makoviychuk Technical Assistant
- Elinor Levi Technical Assistant
- Inesa Efraimov Technical Assistant

- Liron Chavoinik Technical Assistant
- Shmuel Francis Technical Assistant

Molecular Systematics and Tissue Collection

- Prof. Dorothée Huchon Curator
- Dr Tamar Feldstein-Farkash Collections Manager
- Alexandra Dorfman Technical Assistant

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. 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
- \bullet 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
- $\bullet \ {\rm Merav} \ {\rm Shemesh} {\rm Technician} \\$
- 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
- Prof. Tamar Dayan TAU
- Dr Yehoshua Shkedy Israel Nature and Parks Authority
- Dr Ittai Renan TAU
- Hanoch Ilsar Yad Hanadiv
- Dr Gilad Ostrovsky Keren Kayemeth LeIsrael Jewish National Fund
- Alon Zask Ministry of Environmental Protection

Steering Committee of the State of Nature Report:

- Prof. Tamar Dayan TAU
- Dr Anna Trajtenbrot Ministry of Environmental Protection
- Dotan Rotem Israel Nature and Parks Authority
- Yahel Porat KKL-JNF

Staff

- Dr Ron Chen Quantitative Ecology Coordinator
- Dr Rael Horwitz Monitoring Programs Coordinator
- Dr Comay Orr National Red List Coordinator
- Dr Tania Bird National Red List Coordinator
- Michal Koren Geographic Information System and Cartography Coordinator
- Ido Livne Remote Sensing Coordinator
- Shira Salingré Research Assistant
- Michal Elbaum Research Assistant
- Ori Ismach Research Assistant
- Yaara Kenet Research Assistant
- Maya Amir Administrative Manager
- Itai Namir MSc Intern
- Zohar Afek MSc Intern

The Open Landscape Institute

Council (Board):

- Yoav Sagi, Chair Society for Protection of Nature in Israel (ret.)
- Amir Ritov, Co-Chair Head of Lev HaSharon Regional Council
- Dr Gilad Ostrovsky Keren Kayemeth LeIsrael Jewish National Fund
- Asaf Krarwani Keren Kayemeth LeIsrael Jewish National Fund
- Yahel Porat Keren Kayemeth LeIsrael Jewish National Fund
- 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
- Dror Boymel Society for the Protection of Nature in Israel
- Milka Carmel Regional Council's Organization
- Hila Akerman 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
- \bullet Prof. Tali Mozes Technion
- Dr Hana Sweid the Arab Center for Alternative Planning
- Alon Sapan TAU

Staff

- Uri Ramon Director
- Aviv Avisar Head of the Research Unit
- Dr Liron Amdur Researcher
- Dana Ginosar 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
- Dvora Lev-Ramati 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
- Liraz Cabra-Leykin Survey Manager
- Nadav Sade Assimilation and Social visibility
- Einat Gera Survey Coordinator
- Dar Ben-Nathan Botanist

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 has been a challenging one. The Steinhardt Museum only opened to the public in July 2018 for a trial run, became fully operational in September, and was gaining significant momentum, but a mere 18 months later, in March 2020, Covid struck and the world as we knew it was transformed. This caught us in the trajectory of an upwards momentum, prior to stabilizing our funding sources and getting government recognition as a museum and in the midst of teambuilding work and rapid content development. This is not something we had bargained for.

That said, our team rose to the occasion. While unfortunately, we had to part with many great hourly workers in the Public Division of the museum and send them on unpaid leave, the remainder of the team stayed with us, and people continued to work as hard as ever in preparation for the museum re-opening, dealing with the many challenges that a new museum affords. The scientific staff continued its work throughout the pandemic. Our scientists and professionals worked in the collections and in the field under very complicated conditions indeed. The collection managers continued promoting the collections and taxonomic work and providing invaluable services to a variety of agencies. The Applied Policy-Relevant Research Division Centers—Open Landscape Institute, HaMaarag, and the National Center for Aquatic Ecology—continued almost business as usual, as did the Entomological Laboratory for Applied Ecology.

The museum was closed for a significant part of the year but during the months that it was open, albeit with restrictions, and particularly during the summer months, we were gratified by the level of renewed public interest.

We wish everyone good health and safety and look forward to the return of normalcy.

COLLECTIONS NEWS

The staff members of the Steinhardt Museum of Natural History (SMNH) continued curation and promotion of our collections. Routine curatorial activities were adversely affected by the outbreak of the Covid-19 in the beginning of 2020, due to general restrictions and to the fact that many staff members had to work from home. Nevertheless, much effort was dedicated to re-arrangement of the collections and to compliance with best curatorial practices. 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 2019–2020 academic year, we added over 17,000 new specimens of various taxonomic groups through collecting worldwide by the our curators and research staff, students, the Israel Nature and Parks Authority, or through donation of private collections. Almost 24,000 new records were added to the Museum database.

THE ENTOMOLOGY SECTION (INCLUDING ARACHNIDS)

Netta Dorchin, Amnon Freidberg, Inon Scharf, Gal Ribak, Sergei Zonstein, Tanya Novoselsky, Malkie Spodek, Vladimir Chikatunov, David Furth, Arieh-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

The entomological collections were generally firmly settled in the newly facilities upon their relocation to the new museum building in 2018, although their constant optimization was an ongoing process co-ordinated by Moshe Guershon during the 2019–2020 academic year. The major highlights include the purchase and distribution of 10 new cabinets, relocation of the Coleoptera and Hemiptera collections, reorganization of the slide collection, and digitization of the whole wet collection prior to its reorganization. The staff continued augmenting the collection through field work, actively continued their collection-based research and provision of services to government bodies, academia and general public. On 28 and 29 July 2020, the Entomology Section accommodated the State Controller and the Minister of Agriculture teams on their inspection tours.

Arachnida

S Zonstein continued sorting and labelling (if it had not been done before) previously accumulated and new material into the families Agelenidae, Araneidae, Clubionidae, Corinnidae, Dysderidae, Gnaphosidae, Lycosidae, Theraphosidae and Zoropsidae. In total, about 800 sorted specimens in 30 jars were added to the existing 450 jars in the collection. At the moment, the absolute majority of spiders in the collection is edentified to the species level; unidentified material exists only in the orders Pseudoscorpiones, Scorpionida and Solifuga. In terms of his studies, Sergei continued his research into the systematics of Mygalomorphae (trapdoor spiders), described one new genus and seven new species in the families Pycnothelidae, Filistatidae and Filistatidae from the Afrotropical and Oriental regions. Sergei also actively collaborated with Dr Y.M. Marusik (Institute for Biological Problems of the North RAS, Magadan, Russia) on the systematics of the above families.

Orthoptera

M. Guershon started to curate the Orthoptera collection and completed and digitized the inventory of the whole collection. Identification keys for all Acridoidea species from *Fauna Palaestina* by Prof. Lev Fishelson were digitized to facilitate further work in the collection. Identification keys for most Grylloidea and Tettigonioidea species were translated into English from an old and rare Hebrew publication by Dr Moshe Shternlicht.

Hemiptera

T. Novoselsky received 15 unit trays of newly collected material. Most of this material was identified to the genus level, and identification to the species level and its incorporation into the collection was ongoing. She also continued sorting alcohol-preserved samples. She also sorted to families the material from Ben-Gurion University collected by Michal Segoli with Dietrick Vacuum Sampler from a range of habitats in Israel; non-Heteroptera specimens (Araneae, Coleoptera, Diptera, Formicidae, Hemiptera, Hymenoptera) were given managers of the relevant collections. She sorted and databased all present material of the Acanthosomatidae Signoret, 1864, a new family record for Israel based on *Elasmucha putoni* Scott, 1874. The Acanthosomatidae are commonly known as Shield Bugs or Parent Bugs, reflecting their habit of maternal care of their eggs and nymphs and protecting them against predators and parasites unlike other pentatomoid heteropterans that practice the 'lay them and leave them' strategy. Tania collaborated with Jing-Fu Tsai (Hokkaido University, Japan) on the Acanthosomatidae identification; Oz Rittner took professional pictures and a joint publication was under prepation. Tania has been invited by Hassan Ghahari (Islamic Azad University, Tehran, Iran) to co-author a chapter on the heteropteran family Nabidae for the book Heteroptera of Iran, and is grateful to Netta Dorchin (SMNH) and Ximo Mengual (Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany) for their kind assistance with postage of the Iranian material for this contribution.

Coleoptera

L. Friedman moved the Coleoptera collection to a larger room, where four new cabinets were added for future expansion. A part of the collection was rearranged, thus freeing some space for newly collected and identified material. About 2,000 insects, with some 1,700 beetles (mainly weevils and leaf beetles), collected in 2019 by L. Friedman in South Africa were mounted, databased, labelled and partly sorted. An important collection of Israeli beetles was donated by Alexandr Orlov (Jerusalem). These specimens were in collected during the last 20 years mostly in the areas east and south of Jerusalem and in the Coastal Plain, but also in other places all over Israel. The collection is well-maintained, the beetles are nicely and properly mounted and labelled, most of the specimens are identified. Small but valuable collections of weevils from Jordan and North Africa, and Oman were donated by Wolfgang Witzbauer (Vienna, Austria) and Gerhard Wagner (Hamburg, Germany), respectively. About 1,500 beetles collected in Nahal Keziv in 09.2019–09.2020 were largely sorted and identified, at least to the family level. Laibale's curatorial efforts and research resulted in publication of five articles on Curculionidae, Chrysomelidae and Scarabaeidae.

V. Chikatunov assisted with identification of beetles and with curation of the SMNH beetle collection, and continued updating his catalogue of Israeli Coleoptera.

D. Furth participated in the 2019 Entomological Collections Network, Entomological Society of America, and The Coleopterists Society meetings in St. Louis, Missouri.

Lepidoptera

V. Kravchenko continued identification and organization of collections of the families Crambidae and Pyralidae. In terms of his research, Vasily worked on several projects: *Peripheral and transit species in biogeographical Crossroad of Southern Levant: Noctuidae sensu lato (Lepidoptera) as a case study; Seasonal adaptation of Noctuidae (Lepidoptera) to extremal biotopes; The Noctuidae (Lepidoptera) fauna of the woody savannah belt in Mali, West Africa; Biodiversity and seasonality of Noctuidae (Lepidoptera) in the woody savannah belt in Mali; Parachalciope (Erebidae: Lepidoptera) new species from Mali Sahel.* Manuscripts from all projects are in preparation. In terms of his international collaboration, Vasily liaised with Prof. Traore Sekou (Malaria Research and Training Center, Bamako University, Mali) on Lepidoptera biodiversity in Mali, and with Prof. Axel Hausman (Zoologische Staatssammlung Munchen, Germany) onLepidoptera biodiversity in the Middle East.

A. Keysary and O. Ritner curated and databased Lepidoptera Rhopalocera families. Approximately 800 samples of the Pieridae species were taken care of.

Diptera

A. Freidberg completed his project on the Afrotropical Schistopterinae (Tephritidae) and published an article with descriptions of a new genus and four new species.

N. Dorchin continued studies on the gall-midge taxonomy and systematics from Israel and South Africa; these projects involved descriptions of new species, morphological and molecular analyses of specific genera and phylogenetic analyses; dozens of microscope slides of gall midges from Israel and South Africa and hundreds of gall-midge specimens were added to the ethanol and pinned collections of the Museum; these specimens were being added to the museum's database on the ongoing basis. Netta also also involved in research on the biological control of Acacia saligna in Israel with the seed-feeding beetle Melanterius castaneus (Omer Segal, MSc project) and on the taxonomy and life history of fireflies (Lampyridae) in Israel and a possible effect of light pollution on their populations (Ella Fishman, MSc project). The last study was conducted in collaboration with the Entomological Laboratory for Applied Ecology (SMNH) and the Society for the Protection of Nature in Israel. Netta collaborated with 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), Cornelia Klak (University of Cape Town, South Africa), Rauri Bowie (University of Berkeley, CA, USA) and Yaron Hershkovitz (Center of Aquatic Ecology, SMNH). She also taught the following courses at the Faculty of Life Sciences, Tel Aviv University: World of Insects (graduate & undergraduate), Research Skills (graduate) and Introduction to Research in Zoology (undergraduate seminar). Netta als continued her active membership in the following scientific committees: Flora and Fauna committee of the National Academy of Sciences, US; Steering committee of the Entomological Society of Israel; Advisory board of the Zoological Research Museum Koenig, Bonn, Germany; Council of the International Congresses of Dipterology; Scientific Committee – Israel National Red List of Invertebrates; and SMNH exhibitions scientific committee.

E. Morgulis started rearranging the Acalyptratae collection, both alphabetically and phylogenetically, revealed additional type material, which had not been labelled properly, and labelled it. Liz spent much time updating the Museum database by adding data (e.g. taxonomic data, type status, etc.) to several thousands of records in the database. She also added hundreds of taxonomic names to the database, for future use. Liz received hundreds of specimens, which had been sent on loan for identification, and handled this material, including its proper placement in the collection, recording the type material and updating the database accordingly. In terms of her research, Liz completed her revision of the molecular and morphological phylogeny of thistle fruit flies *Acanthiophilus* and *Tephritomyia* (Diptera: Tephritidae), which was duly published.

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 aqcuired material (ants and wasps) into the collections. He also peer-reviewed a manuscript for *Zoosystema*.

Parasitic Hymenoptera (W. Kuslitzky): Devoted considerable time to rearing parasitoids from seed pests of dodder *Cuscuta campestris* (Convolvulaceae) collected in Judean Foothills and from around Rehovot; about 850 specimens of parasitoids were bred, half of which were mounted and labelled and the rest were stored in alcohol; three species of weevil seed pests (*Smicronyx*, Curculionidae) and some ten species of their parasitoids were found. Another project on a complex of phyto- and entomophagous insects on Castor beans *Ricinus communis* (mainly on reproductive organs) and some other plants continued, with over 450 specimens reared and added to the Muse-um collection. The day-to-day curation of the lchneumonoidea collection continued and the newly acquired material (ca. 2000 specimens) was sorted, mounted, labelled and incorporated into the collection.

Parasitic Hymenoptera (G. Pisanty): Finished sorting the Braconidae into subfamilies; sorting of non-Ichneumonoid parasitic wasps (Chalcidoidea and smaller superfamilies) into families was ongoing. A special focus was on the braconid subfamily Microgastrinae (ca. 2500 specimens in the collection), which was completely sorted to genera and databased, with ca. 900 specimens sent overseas to Dr. Jose Fernandez-Triana (Canadian National Collection, Ottawa, Canada) for expert identification and barcoding. Large amount of parasitic wasp material collected by traps and kept in the alcohol collection of the Museum was curated, with about 500 specimens from Israel and DR Congo individually mounted on separate pins. The following subfamilies of the Braconidae were completely databased: Agathidinae (241 specimens), Alysiinae (421), Microgastrinae (1861, loaned

material not databased). In addition, the following groups were partly databased: Chalcididae (99), Cynipoidea (155), Encyrtidae (87), Eupelmidae (75), Eurytomidae (60), Perilampidae (62), Pteromalidae (350). In total, over 3,400 specimens were newly databased, with more than 1000 old database entries accompanied with higher-level identification. In terms of scientific collaboration, Gideon continued working with his colleagues from the Canadian National Collection (Ottawa, Canada) in an effort to barcode the Israeli fauna of the solitary bee genus *Andrena* (with Dr. Sophie Cardinal) and the parasitoid wasp subfamily Microgastrinae (with Dr. Jose Fernandez-Triana), using Next-Gen sequencing to obtain the highest quality bracode data that would be used for species delimitation.

Parasitic Hymenoptera (Z. Yefremova): Expanded the Parasitica collection: a new cabinet was filled with 21 drawers of Cynipoidea (Andricus, Cynips, Dryocosmos, Synergus, Cerroneuroterus), 2 drawers of unsorted Cynipoidea and 6 drawers of reared parasitoids (2 of them Pteromalidae). She started identification and incorporation of oak parasitoids into the collection (3 drawers). Identification of newly collected and old material of the Eulophidae, Encyrtidae and Pteromalidae were ongoing, as were sorting and identification of the material reared from the Cecidomyiidae (Diptera). In terms of her research, Zova contunued working on the following projects: African Euplectrus Westwood, Euplectromorpha Girault and Platyplectrus Ferrière (Hymenoptera, Eulophidae) from Kenya, with description of new species; Review of the genus Kolopterna Graham (Hymenoptera: Eulophidae) associated with Cecidomyiidae (Diptera), with descriptions new species; Eulophinae wasps records from Vietnam, with description of a new genus and new species (Hymenoptera, Eulophidae); Detection of arrhenotokous strain in thelytokous species Diglyphus wani (Hymenoptera: Eulophidae): dominant parasitoid of agromyzid leaf miners in China. Zova also collaborated with Dr Yael Lubin (Blaustein Institutes for Desert Research, Ben-Gurion University of the Negey, Israel), Dr Robert Copeland (International Centre of Insect Physiology and Ecology, Nairobi, Kenya), and Dr Hassan Ghahari (Islamic Azad University, Tehran, Iran).

Bees: A. Dorchin integrated in the collection ca. 1000 bee specimens collected by the Mandelik group (Faculty of Agriculture Food and Environment in Rehovot) during ecological surveys in the Judean foothills, the Central coastal plain and the southern Rift Valley of Israel. Nearly 3000 bee specimens collected during a research project in the Golan Heights and Mt Hermon during spring 2019 were identified and sorted to species (ca. 300 species) by Achik Dorchin, Gidi Pizanti, and different European specialists.

Integration of "Orphaned collections"

A. Keysary completed curation and databasing of the Palmoni collection. All specimens in the collection were moved to standard new drawers. In total, about 1000 specimens were recorded in the database over the reporting period, primarily Hemiptera. By the end of 2019–2020 academic year, about 16,000 Palmoni's records were computerized.

Identification Services

Over 1,200 specimens were identified by the Entomology staff for government, academic and private organizations. Full details of identifications done for the Plant Protection and Inspection Services, Ministry of Agriculture, Israel, were entered into the Museum database and voucher specimens were retained in the collection for future reference.

- Arachnida: S. Zonstein identified 4 specimens for the Plant Protection and Inspection Services, Ministry of Agriculture, Israel.
- Coleoptera: L. Friedman About 70 identifications were made for the Plant Protection and Inspection Services, Ministry of Agriculture, Israel, and ca. 10 directly for agriculturalists and public. Some 50 identifications were done for Dr M. Segoli, Dr E. Groner from the Ben Gurion University, and for the SMNH researchers from the Entomological Laboratory for Applied Ecology, Israel National Center for Aquatic Ecology, etc.
- Hymenoptera (Bees): A. Dorchin identified ca. 1000 specimens of the bee genus *Eucera* from Algeria and Morocco for Denis Michez (Mons University, Belgium) and ca. 100 specimens of the bee genera *Anthophora*, *Eucera* and *Megachile* for Yael Mandelik (Hebrew University of Jerusalem, Israel).

• Hymenoptera (Parasitica): Z. Yefremova identified 58 specimens for Plant Protection and Inspection Services, Ministry of Agriculture, Israel.

Collecting trips and expeditions

Our Natural History Collections actively grow 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. Our scientists often go on joint field trips. The entomology staff added about 10,000 specimens to the collection during the reporting period, excluding those in Malaise trap bulk samples that still need to be processed.

S. Zonstein went on a field trip to Mt Meron and Mt Hermon (16–18.06.2020); as a result, a few specimens were added to the SMNH spider collection, including those representing yet undescribed taxa.

T. Novoselsky collected 384 specimens at Avenat (Nahal Mazin, Rt. 90), Bat Yam, Ben Shemen Forest, Elat, HaMeshar, Har Karmel, Har Zefahot, Kinneret (Moshava), Makhtesh Ramon (Nahal Gewanim), Melehat 'Avrona (Hyphaene thebaica), Melehat Yotvata, Nahal Paran, Nahal Sayif, Nahal Tavor, Paran, Peza'el, Qetura, Tel Aviv – Yafo (Botanical Garden of Tel Aviv University), and Zomet Zihor (Rt. 40)

L. Friedman made 12 collecting trips and collected over 2,200 specimens, mainly beetles (mostly weevils). Three trips were joint expeditions: to the Jordan Valley, Arava Valley and Southern Negev, together with N. Dorchin, M. Guershon, T. Novoselski, G. Pisanty and O. Segal (18-20.02.2020) and together with N. Dorchin (8–10.09.2020); and to the Upper Galilee, Hula Valley and Har Hermon, together with S. Zonstein, M. Mostovski, G. Pisanty and E. Fishman (16-18.06.2020). Among rare and unexpected findings were weevils *Thamiocolus calcaratus* and *Labiaticolla syriaca*, collected for the first time on their host plant, Phlomis brevilabris. Two one-day trips were made to Nahal Dan (27.02.2020 & 16.03.2020), in order to search after a rare vanishing aquatic leafbeetle Donacia bicolor; a few specimens were collected and preserved in alcohol for the further phylogenetic research on a special request by D. Furth; on the way several places in the Jordan Valley and Golan Heights were visited and briefly surveyed. Five night trips to the Carmel Ridge, Lower Galilee and Judean foothills, as well as night collecting in Panyas and 'En Divsha during the trip to the Upper Galilee, were dedicated to the intensive (and successful) search for the fireflies (Lampyridae) together with E. Fishman. A one-day trip was made to Borot Loz (23.03.2020) to check for a few rare weevil species, and a one-day trip to the Samarian Desert was dedicated to a search for the new species of Thamiocolus (Curculionidae: Ceutorhynchinae) on Phlomis brachyodon; both trips yelded a very good catch, but did not reach the main goal. Numerous short (1-3 hours) collecting visits were made to the Coastal Region, Western and Central Samaria (particularly around Qedumim) and Binyamin (mainly along the Alon Road), with a few interesting findings, like revealing a flourishing population of rare leaf-beetles Lilioceris faldermanni on the likewise rare Fritilaria persica in the Rosh ha'Ayin Forest Park. A few interesting findings were made in the Botanical Garden of Tel Aviv University (by permission from Y. Sapir and T. Levanony), e.g. the asparagus leaf beetle Crioceris sp. (Chrysomelidae), either undescribed or not recorded from Israel, and a population of still unidentified Gymnetron sp. (Curculionidae) on Plantago lanceolata.

N. Dorchin went on numerous field trips around Israel as part of her research projects: Eilat, Southern Arava and Southern Negev (18–20.02.2020), Dead Sea Area (1.03.2020 & 4.06.2020), Palmahim, Nizzanim (15.03.2020), Western Negev (27.03.2020), Dimona and Dead Sea Area (16.03.2020), Western Negev (20.04.2020), Palmahim (18.05.2020), Park Hadera (29.06.2020), Wadi Malha and Dead Sea Area (8.07.2020), Western and Central Negev (22.07.2020), Palmahim (28.07.2020), Wadi Malha and Northern Dead Sea Area (18.08.2020), Arava and Southern Negev (8–10.09.2020)

M. Mostovski operated a Malaise trap in Mate Yehuda district; went on a field trip to Kiryat Shmona and Mt Hermon foothils (16–18.06.2020).

W. Kuslitzky collected mainly parasitic Hymenoptera with a sweepnet near Rehovot and Palmahim (March) and in Judean Foothills (April). In May 2020, a Malaise trap was installed in Judean Foothills, which was serviced twice a month; about 2000 specimens (mainly Ichneumonoidea) were caught through this effort. Rearing from various hosts brought another 1300 specimens.

G. Pisanty collected, mounted and databased 2432 specimens (mostly Hymenoptera) during his 14 field trips to the Dead Sea, Negev and Arava (18–20.02.2020), Northern Golan Heights (27.02 \pounds 27.04.2020), Dead Sea Area (1.03.2020), Western Negev (16.03.2020), Western Samaria (Zur Natan, 23.03, 29.03, 2.04, 6.04 \pounds 18.04.2020), Negev Mountains (13.04.2020), Mt Hermon (11.05 \pounds 17–18.06.2020) and the Coastal Plain (11.09.2020).

A. Dorchin carried out several field surveys of bees in April and May 2020, in sandy habitats of the Southwestern Negev, comprising unique Saharan component of the bee fauna of Israel. These surveys yielded rare or previously unrepresented bee species in the SMNH collection.

M. Guershon went on a 3-day collecting trip to Arava in February 2020.

V. Kravchenko and Z. Yefremova went on onemonth long (2–28.12.2019) expedition to the Republic of Mali (Sahel ecozone along the Niger River) with the aim of collecting Chalcidoidea and Lepidoptera for the Museum. The expedition ran stations with light traps and Malaise traps near the settlements of Kangaba, Ouronina and Bankoumana.

Zoya Yefremova with locals during her expedition to the Republic of Mali.



Outreach

M. Guershon hosted *Behind-the-scene* tours in the entomology collections for special guests (Bet Gordon Managerial Board, the Palmoni and Bytinsky-Salzs families, and others).

N. Dorchin was a scientific curator the *Microsculpture* – the insect photography of Levon Biss exhibition at the SMNH and gave a talk on the day of its opening (3.12.2019) and numerous interviews on radio and TV in connection with the exhibition. She also conducted two tours for museum guides around the Microsculpture exhibition, as well as briefing and a tour for reporters. Netta was also interviewed about fireflies on radio and TV (Channel 12), and gave a talk on the Darwin Day event at the Museum.

A. Dorchin wrote a short article for the SMNH Internet site on a possible effect of commercial apiaries installed on Mt Hermon on the unique wild bee communities of the Hermon Nature Reserve; he also presented a talk on bee diversity in Israel on an online tutorial of the Sharon Environmental Unit in Ra'anana, Israel, for the international bee day.

L. Friedman was featured three times on the radio station *Kan Tarbut* talking about various beetles, and in TV broadcasts on wildlife (Israeli Educational *Hayot Shetah* program) and on fire-flies in Israel (HaHadashot 12 Channel).

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

THE INSECTARIUM

Elizabeth (Liz) Morgulis

At the insectarium, we continued to rear the species listed in the Annual Report of 2017–2018 (p. 24; http://doi.org/10.5281/zenodo.2589132), with the addition of *Scantius aegyptius* and *Caenocoris nerii*. The Mediterranean red bug (*Scantius aegyptius*) belongs in the family Pyrrhocoridae and is a common species, which appears in large numbers, as aggregations, during spring and summer. The Mediterranean red bugs are omnivorous, feeding on seeds and fruit, and even hunt; their females lay eggs on the substrate, which hatch after about two weeks. The oleander seedbug *Caenocoris nerii* belongs in the family Lygaeidae. The bugs feed on *Nerium oleander*, with a clear

preference to its fruit (rather than leaves or stem); their females lay batches of eggs, which are glued to the host-plant leaves.

During the year, the *Camponotus sanctus* nest at the museum exhibition continued to develop, and the number of workers rapidly increased. It is now the home of some 250 adult ants and an increasing number of larvae (brood). The ants receive syrup (ca. 70% brown sugar), and dead crickets, as a source of carbohydrates for the adults and protein for the brood, respectively.

The rearing of *Gryllotalpa gryllotalpa* (mole crickets) was partially successful, as two couples, held together in a specious container, did copulate and the females laid eggs. However, the eggs did



The oleander seedbug *Caenocoris nerii* (Lygaeidae).

not hatch, as they were apparently eaten by one of the parents for an unknown reason.

In the near future we will try to breed three stick-insect (Phasmatodea) species (Phyllium latiranti, Ph. ericorai and Trachythorax maculicollis), which will then be available for teaching and/ or exhibition. Both of the Phyllium species feed readily on Psidium guajava (guava) and Rubus sp. (raspberries) leaves. These stick-insects are not easy to rear, since they need a high and steady humidity, and a sufficient amount of daylight. Trachythorax maculicollis is a relatively fastgrowing species, which feeds on several plants: Nerium oleander, Catha edulis (khat), Pyracantha spp. and Gaultheria shallon (salal).

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 171 specimens were collected and added to the collection; 38 of them were collected during excursions to the mesophotic sponge grounds located at the depths of 80–100 m off the Mediterranean coast and 19 from Eilat, including mesophotic depths. These specimens were collected as part of studies conducted by Prof. M. Ilan's lab. The rest of the specimens came from various sources: 101 samples from BioBlitz (October 2019), 1 sample from CSA Ocean Sciences Inc., 8 samples from Dr Bella Galil (SMNH), 4 samples were collected by me from a cave in Akziv.

Taxonomic identification services:

- Eight samples were identified for Dr Bella Galil (SMNH).
- One sample was identified for CSA Ocean Sciences Inc. (Elad Mills).
- 101 samples were identified as part of the BioBlitz in October 2019 (25, Habonim; 36, Akziv; 16, Shiqmona; 24, Gedor).

Curatorial:

All samples were taken out of their boxes and put on the shelves in the storage facility. Most of the identifies samples were organized according to the updated sponge taxonomy. The unidentified samples were arranged according to their geographic provenance. In terms of databasing, 256 samples were captured.

Courses, Training and Conferences:

I participated in the symposium *Red Sea Marine Ecosystems Under Environmental and Anthropo*genic Changes, which celebrated the 50th Anniversary of the Interuniversity Institute for Marine Sciences in Eilat (23–24.10.2019). I also participate in the 56th annual meeting of the Israel Zoological Society at the Hebrew University of Jerusalem (29.12.2019).

THE MOLLUSCA COLLECTION

Henk K. Mienis and Oz Rittner

The activities in the Mollusca collection during the academic year 2019–2020 slowed down drastically due to several reasons. The senior collection manager (HKM) lowered his work load from 60% to 44% starting October 2019, while the junior collection manager (OR) is now also involved in taking care of the Lepidoptera collection. During the second half of the year, the Covid-19 outbreak seriously affected our activities. During March–August, HKM worked at home and visited only occasionally the Museum to pick up some literature from the library. There was also no malacological fieldwork in Israel during the reporting period.

During this period we received sad information that two malacologists with long connections with Israel suddenly passed away.

On 3 December 2019, we were shocked to receive a notice that Mr Ze'ev Bar (formerly of Kibbutz Beth HaEmeq), one of the first individuals in Israel who studied seriously the land snails of Israel, passed away in the Netherlands. One of us was in correspondence with him for over 50 years. Obituaries were published in several journals in Israel and the Netherlands: *Triton, Natural History and Other Notes*, and *Spirula* (Mienis 2020).

Also a Dutch malacologist Ir. J.J. [John] van Aartsen and his wife Jozina passed away on 26 March 2020 (Goud & Menkhorst 2020). John was an expert in marine micromolluscs and published numerous papers dealing with such gastropods and bivalves from the Eastern Mediterranean. He was a long time correspondent of both Prof. Alexander Barash and HKM.

Research and curation

Despite all shortcomings, in 2019–2020 we continued our 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.

New interesting faunistic records from Israel

Marine molluscs

The Erythraean Circulus octoliratus, Nerita sanguinolenta, Eunaticina linnaeana, Laevichlamys superficialis and an unknown Chromodoridae species were reported for the first time from the Eastern



Mediterranean along the coast of Israel (Edelman-Furstenberg et al. 2020; Rabi et al. 2020; Malki et al. 2020; Schechter & Mienis 2020; Amar et al. 2020).



Laevichlamys superficialis from the harbor of Ashdod. (Photo: Yariv Malik)

A chromodorid mollusc from Caesarea. (Photo: Rafi Amar)

Several indigenous Mediterranean molluscs, especially cephalopods, were recorded for the first time from the upper slope along the coast of Israel (Goren et al. 2020).

Terrestrial molluscs

Xeropicta zeevbari, a land snail from Har Harif at the border of Israel and Egypt was described as a new species and named after the late Ze'ev Bar (Mienis & Rittner 2020).

A large population of *Allopeas gracile*, an exotic tropical land snail, was discovered in a garden centre near the Bilu Junction (Vaisman et al. 2020).

Connections between terrestrial snails and

other animals

Cases of predation on terrestrial snails by Little owls *Athene noctua* and the Silphid beetle *Ablattaria arenaria* observed in Israel were recorded (Mienis 2019, 2020).

New data on land snails encountered in nest cleaning of Harvest ants *Messor* spp. were also published (Vaisman & Mienis 2020; Mienis & Vaisman 2020).



Xeropicta zeevbari Mienis & Rittner, 2020 from Har Harif, holotype SMNH MO 83601. (Photo: Oz Rittner)

Support with identifications

Various ecological and malacological studies in Israel were carried out by a number of colleagues at various institutes and private people like Dr Aharon Dotan, Dr Eldad Elron and Mr Daniel Korkos. They received our expertise by the identification of their material. The major part of the identified material was retained for permanent storage in the SMNH.

Cooperation with the Israel National Center for Aquatic Ecology

Samples collected by Dr Yaron Hershkovitz and his associates at the INAEC were received on a regular basis for identification or verification.

Cooperation with the Plant Protection & Inspection Services of the Ministry of Agriculture During the academic year 2019–2020, Mrs S. Vaisman brought us for verification or identification 55 samples of land and freshwater snails intercepted by inspectors from the Plant Protection & Inspection Services (PPIS) from either agricultural shipments from abroad or found on local material grown in nurseries.

New records turned out to be:

Zebrina eburnea in Coridothymus capitatus arriving from Turkey;

Milax gagates encountered on tree trunks arriving from Italy;

Boettgerilla pallens found on Peperomia from the Netherlands;

Xeropicta smyrnocretica arriving in *Origanum* from Turkey;

Xerolenta obvia, another unknown *Xerolenta* species and *Candidula rhabdotoides*, all in a shipment of *Hordeum vulgare* imported from Greece;

Fruticicola fruticum encountered on Betula pendula imported from Lithuania.

The new records highlight the importance of the PPIS inspectors' work in harbours and other ports of entry in Israel.

Cooperation with the Israel Nature and National Parks Protection Authority

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

Cooperation with local and foreign archaeologists

Our report on molluscs recovered during excavations outside the medieval town walls of Apollonia/ Arsuf was finally published in the second volume of the Apollonia/Arsuf excavations (Rittner & Mienis 2020). Brief reports dealing with the archaeomalacological material from other excavations at Yehud-Lugano, Tell el-Hammah in the Jordan Valley and Tel Harasim near Kefar Menachem were also published (Mienis 2020).

We continued to work on the archaeomalacological material from sites in the Jewish Quarter of 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 fields D and E excavated by Prof. Aren M. Maeir and Tel Erani field P excavated by Dr Iair Milevski.

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 reporting year. The identifications of the new material was immediately checked and specimens were prepared for permanent storage in the collection.

Name	Brief description of the material
U.J. Bar-Zeev	Land snails from Cuba, India and Morocco
D. Ben-Natan	Land snails Israel
J. Gerritzen	Molluscs from Indonesia
U. Mendel	Freshwater snails from Uganda
L. Meerema	Molluscs from Indonesia
H.K. Mienis	Land- and freshwater molluscs from Israel and the Netherlands
O. Rittner	Land snails from Israel
S. Vaisman	Land snails from Israel

Computerization of the collection

The computerization of the mollusc collection was carried out by Oz Rittner (recent molluscs and occasional arrivals of fossil material), and Dr Daniella E. Bar-Yosef Mayer (fossil molluscs in the paleontological collection of Hanan (Hans) Bytinski-Salz).

At the moment, 64,261 samples (excluding fossil ones) representing 11,119 taxa (including fossil ones) in the mollusc collection have been 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 2019–2020 (donated by Henk K. Mienis):

Anonymous. 1997. Marine shell ornaments from the Plains. *Central Plains Archeology* 5(1): 1–107.

Anonymous. 2000. Freshwater mussels in the Great Plains: Ecology and Prehistoric Utilization. *Central Plains Archeology* 8(1): 1–150.

Levy, G. (Ed.). 1991. Terrestrial invertebrates. Plants and Animals of the Land of Israel – An illustrated Encyclopedia. Vol. 2 Ministry of Defence & Society for Protection of Nature, Israel. 175 pp. (Terrestrial snails by J. Heller on pp. 122–155) [in Hebrew]

Meiri, O., Bloch, Y. & Kaplan, Y. (Eds). 2018. *Out of the Blue*. Bible Land Museum, Jerusalem. 191 pp. Neubert, E. 1998. Annotated checklist of the terrestrial and freshwater molluscs of the Arabian Peninsula with descriptions of new species. *Fauna of Arabia* 17: 333–461.

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

References

For references to works authored or co-authored by Henk K. Mienis and Oz Rittner, please refer to the Publications section in this annual report (p. 000).

Goud, J. & Menkhorst, H. 2020. Dr. Ir. Jacobus Johannes (John) van Aartsen (1936–2020) en Jozina Magdalena van Aartsen-van der Molen (1938–2020). Spirula 423: 44–46.

Malacological fieldwork in Friesland, the Netherlands

Henk K. Mienis

During the period of 6 September - 7 October 2020, I carried out some fieldwork in Friesland, one of the northern provinces in the Netherlands, which the Wadden Sea island Terschelling also belongs to. Most work was undertaken in the area of Friesland that falls under the jurisdiction of the municipality of Fryske Marren (Frisian Lakes) and on the island Terschelling.

The aim of the fieldwork was to get a better understanding of the malacological biodiversity of some nature reserves in the vicinity of Joure (*Put van Nederkorst* and *Swettepoel*) and Wilhelmina Oard in Sint Nicolaasga, as well as the cooling water discharge basin of a well-known coffee factory in Joure. All investigations were follow-ups of work done in previous years.

On Terschelling fieldwork targeted particularly the Kooibosjes, a rather special nature reserve that is famous for the presence of large numbers of invasive species in some of its parts.

Only the most important results are reported below.

Vicinity of Joure

The Put of Nederhorst

On 5 October 2020, the presence of three additional species of freshwater bivalves was confirmed in the Put van Nederhorst: *Unio tumidus, Corbicula fluminea* and *Dreissena bugensis*. All three species were also encountered in the nearby Langweerderwielen, a natural waterway. With these new records, at least 27 species are known to live in this artificial lake.

The Swettepoel

The Swettepoel is an artificial lake like the Put of Nederhorst; however, the former is a rather shallow one while the latter was originally more than 20 m deep. Between 2017 and 2019, I looked in vain for freshwater molluscs in the Swettepoel. During the summer, it suffers heavily from developments of blue-green algae; thus, most of the fish living in the pool died unexpectedly in 2018.

I visited briefly the Swettepoel on 7 September and 7 October 2020, and procured 10 species: Bithynia leachii, Bithynia tentaculata, Valvata piscinalis, Lymnaea stagnalis, Radix auricularia, Radix balthica, Stagnicola palustris, Gyraulus albus, Planorbarius corneus and an unidentified Pea Mussel Pisidium sp. They seem to be the first records of aquatic molluscs for the Swettepoel. In addition, the hygrophilous land snail Oxyloma elegans was encountered on Typha.

The cooling water discharge basin of the J-DE coffee factory in Joure

The small town of Joure is known as the coffee town of the Netherlands since the establishment of a shop of colonial products in 1723. Until today, a large coffee factory is operating in the outskirts of Joure. Water pumped up from the underground aquifer into an open basin next to the factory is used for cooling down the roasting machines.

In the autumn of 2019, I sampled the basin at both ends for the presence of aquatic molluscs. The result was rather poor, with only seven species found. Therefore, I investigated the basin twice in the autumn of 2020. This time I collected 14 species from the thermally polluted waters of the basin. Four out of these 14 species were invasive: *Potamopyrgus antipodarum* originally from New

Zealand, and North-American species, *Physella acuta*, *Ferrissia californica* and *Euglesa compressa*. The last one, a tiny Pea Mussel, was a particular surprise for me, because I had never collected it before in the more than 60 years of my malacological fieldwork. Another Pea Mussel *Pisidium pseudosphaerium* was also an intriguing finding, for it is considered an endangered species in the Netherlands.

Wilhelmina-Oard

In 2019, a few ditches in this nature reserve were surveyed for the presence of freshwater molluscs. This effort resulted in the recording



Euglesa compressa, a North American pea mussel from the cooling-water basin of the coffee factory in Joure, Friesland. (Photo: Oz Rittner)

eight species: Bithynia leachii, Radix balthica, Stagnicola palustris, Anisus vortex, Bathyomplalus contorus, Planorbarius corneus, Planorbis planorbis and Segmentina nitida. On 9 September 2020, the same ditches were sampled again, with another six species: Bithynia tentaculata, Potamopyrgus antipodarum, Lymnaea stagnalis, Physa fontinalis, Hippeutis complanatus and Planorbis carinatus. The last species was encountered exclusively in vegetation dominated by Watersoldier Stratiotes aloides.

Between the old and the new part of Wilhelmina-Oard, I came across a large population of the Amber snail *Succinea putris*. Two individuals were infected by the parasitic flatworm the Greenbanded broodsac *Leucochloridium paradoxum*. One had a heavily pulsating broodsac in both upper tentacles, and the other one had only one broodsac in the upper left tentacle.

Terschelling

The Kooibosjes Nature Reserve

On two days in the autumn of 2019, I surveyed this Nature Reserve for the first time for the presence of land and freshwater molluscs. Only 38 specimens were seen belonging to 11 species (Mienis 2020). In the autumn of 2020, I made seven relatively short visits to the same area. On some days I used pieces of wet carton in order to trap terrestrial snails and slugs during the night. In this way I managed to catch 363 specimens belonging to 17 species. Noteworthy was the find of one specimen of *Columella aspera*, which has to be considered a rare species in Terschelling. In one place even several live Pea Mussels were encountered in *Sphagnum* in the absence of water. Other aquatic molluscs were collected by a kitchen sieve connected to a broomstick. In that way 66 specimens were procurd representing 11 species. Among them were five species of Pea Mussels. Altogether 29 species are now known from the Kooibosjes.

Dellewal

In West-Terschelling, I visited a tiny wasteland at the foot of a dune area—the Dellewal—on several occasions. This area is known among malacologists for the presence of numerous invasive land snails. Although the area was flattened out several years ago, at one point a tiny mound of sand mixed with stones and broken roof tiles was left. It rises to a height of about three meters and is partly covered by the Common evening-primrose *Oenothera biennis*, which is considered to be an invasive species on Terschelling. Seven species of land snails were encountered, some of them adhered to the Common evening-primrose, others were found attached to pieces of wood or stone, but all have to be considered alien species for this island: *Cernuella virgata, Cochlicella barbata, Xeroplexa intersecta* (better known as *Candidula intersecta*), *Monacha cantiana, Cepaea nemoralis, Cornu aspersum and Theba pisana*.

Duinweg

After some rain a very large population of the invasive species *Cernuella cisalpina* was discovered along the Duinweg, just east of Oosterend 65. The snails were actively crawling over the roadside vegetation. This is the first time when this sister species of *Cernuella virgata*, also an exotic species, was encountered on Terschelling. A large camping site is present near the place where *Cernuella cisalpina* was found, therefore I cannot rule out a possibility that this species arrived on Terschelling as a hitchhiker on campers or campingequipment.



Cernuella cisalpina, an exotic species which has established a viable population on Terschelling, Friesland. (Photo: Henk Mienis)

Reference

Mienis, H.K. 2020. A preliminary survey concerning the presence of gastropods and bivalves in the "Kooibosjes" and "Mastenbroeken". *Rinkelbollen* 2020 (1): 13–15. [in Dutch]

THE BRACHIOPODA COLLECTION

Henk K. Mienis and Oz Rittner

In the wake of the revival of the Brachiopod collection (Mienis 2020), we revised and catalogued a small collection of recent, non-local material (Mienis & Rittner 2020).

Most of the material was collected by malacologists and was received with their mollusc collections or in exchange of local mollusc samples. The collection consists of only 38 samples belonging to 24 identified and one unidentified species. The provenance of the material extends to Australia (1); Canada (3); Cayman Islands (1); Chile (3); Falkland Islands (3); Finmark (1); France (1); Greece (1); Greenland (1); Italy (1); Japan (6); Libya (1); New Zealand (4); Norway (2); Scotland (1); South Africa (3); Sweden (1) and USA (4).

In the Paleontological collection, especially that of the late Hanan (Hans) Bytinski-Salz (1903–1986), numerous fossil brachiopod species are present, which require a thorough revision.

References

- Mienis, H.K., 2020. The Brachiopoda collection. In: Mostovski, M. (Ed.), Annual Report. Academic year 2018/2019. Tel Aviv, Israel: The Steinhardt Museum of Natural History, Tel Aviv University, pp. 30–31. http://doi.org/10.5281/zenodo.3768034.
- Mienis, H.K. & Rittner, O. 2020. Catalogue of recent foreign Brachiopoda present in the Steinhardt Museum of Natural History. *Triton* 39: 34–36.

THE BRYOZOA COLLECTION

Noga Sokolover

Collection management and research

We received 45 specimens from the Bytinsky-Zalz collection. These recent specimens were stored in the paleontological collection. The specimens were being processed.

In 2019, a survey of fouling communities in marinas in Israel was conducted and led by Prof. Bella Galil (SMNH) and Prof. Marchini Agnese (University of Pavia, Italy) as part of a larger study to assess the contribution of small marinas in the Mediterranean to the spread of invasive species. Several experts from the SMNH participated, and we collected 57 Bryozoa specimens, out of which 20 represented different species (identified at least to the genus level) and 4 species were not identified yet.

Education and public outreach

We filmed a short movie (not yet broadcasted) for the youth edition of N12 News Channel, as part of the series *You did not know it exists in Israel*.

Conferences

I attended the Larwood Web-Symposia 2020. The annual symposium was planned to take place in Italy this year, but due to Covid-19 crisis it was held online. I was also among editors of the book abstract.

TERRESTRIAL, FRESHWATER AND MARINE FREE-LIVING NEMATODES

Stanislav Pen-Mouratov

The free-living nematodes are one of the most numerous groups among the multicellular animals, participating in fundamental ecological processes, such as decomposition and nutrient cycling. Nematodes are sensitive to ecosystem disturbances and they can be used as stable indicators for understanding processes in the different ecosystems.

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 study the impact of bird nesting and roosting activity on soil biota (Pen-Mouratov & Davan 2019), including the free-living nematode abundance and diversity in Israel. The soil biota, including soil microorganisms and free-living nematodes, was seasonally investigated in the nesting and roosting habitats of the piscivorous and omnivorous 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. Abiotic variables, abundance, trophic structure, sex ratio and genus diversity of soil freeliving nematodes and the total abundance of bacteria and fungi were measured during the wet period following the dry period in the previous study (Pen-Mouratov & Dayan 2019). The main aim of the investigation was to determine the seasonal effect of bird nesting and roosting activity on the soil biota abundance, 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, NO₃, NH₄, P) were investigated. All obtained data on the chemicals and soil biota were subjected to the statistical analysis of variance (ANOVA) using the SAS model. GLM, Duncan's multiple range tests, nonparametric Kruskal-Wallis test and Pearson correlation coefficient were applied to assess differences in soil variables between the birds' habitats and control sites. Preparation of scientific publications reflecting the obtained results was in progress.

To evaluate the species diversity of marine free-living nematode communities in shallow coastal areas of the Israel part of the Mediterranean Sea, we continued to collect nematodes from bottom sediments. The free-living nematodes from each sample were extracted, fixed and prepared for the long term storage in the Museum collection.

Nematode Collection

About 50,000 specimens of soil free-living nematodes were extracted and counted from study sites. The collected nematode samples were prepared for the long term storage in the Museum collection. About 4,000 individual nematodes were mounted on temporary slides and classified according to orders, families, genera and sex using a compound microscope. The best nematode specimens were mounted on permanent slides for the Museum collection.

A total of 80 nematode genera were identified in the present ecological research project according to their trophic guilds:

- 28 bacterivores: Achromadora, Acrobeles, Acrobeloides, Alaimus, Cephalobus, Cervidellus, Chiloplacus, Chronogaster, Diplogasteroides, Stegeletta, Eucephalobus, Eumonhystera, Heterocephalobus, Metoteratocephalus, Mesorhabtidae, Monhystera, Monhysteridae, Panagrellus, Panagrolaimus, Plectus, Prismatolaimus, Protorhabditis, Pseudocrobeles, Rhabditis, Rhabditoides, Teratocephalus, Tylocephalus, Wilsonema;
- 7 fungivores: Aphelenchoides, Aprutides, Aphelenchus, Ditylenchus, Nothotylenchus, Paraphelenchus, Tylencholaimus;
- 22 phytoparasites: Basiria, Boleodorus, Cephalenchus, Criconema, Dolichorhynchus, Filenchus, Helicotylenchus, Hoplolaimus, Longidorella, Longidorus, Malenchus, Meloidogyna, Merlinius, Pratylenchoides, Pratylenchus, Rotylenchus, Trichodorus, Trophurus, Tetylenchus, Tylenchorhynchus, Tylenchus, Xiphinema;
- 23 omnivorous predators: Anatonchus, Aporcelaimellus, Aporcelaimium, Aporcelaimus, Aporcelaimoides, Axonchium, Belondira, Clarcus, Discolaimium, Discolaimoides, Discolaimus, Dorylaimellus, Dorylaimoides, Dorylaimus, Epidorylaimus, Eudorylaimus, Mesodorylaimus, Microdorylaimus, Milonchulus, Nygolaimus, Pungentus, Thonus, Tripyla.

Capacity building

Some of the museum staff and students were consulted and trained in the use of the compound microscope and the corresponding computer software and a drawing device.

THE CRUSTACEA COLLECTION

Bella Galil and Ya'arit Levitt-Barmats

The Crustacea constitute a large, primarily aquatic, group of the phylum of Arthropoda. There are over 50,000 known crustacean species and it is suggested that 200,000 more are yet to be discovered. Most crustaceans occupy marine and freshwater, but also terrestrial environments all over the world. Familiar crustaceans include shrimps, lobsters, crabs and woodlice, but there are other, less known but still diverse groups such as the barnacles, sand fleas, pillbugs and mantis shrimps. Some crustaceans live in extreme—in terms of temperature, pressure, and salinity—environmental conditions. Crustaceans are ecologically and economically important, and they are an important food source for many marine animals and humans.

The Crustacean Collection of the SMNH comprises over 50,000 specimens marine, freshwater and terrestrial species. Most of the specimens have been collected along the Mediterranean coast of Israel and in the Red Sea; of special interest is a growing collection of Red Sea species introduced into the Mediterranean through the Suez Canal.

Collection management

Following the relocation to the new Museum facilities, unpacking and placement of the crustacean specimens were completed, with most kind help offered by Liron Goren and Avigail Ben-Dov Segal (both SMNH).

Research

Bella Galil focussed her main reaserch efforts on studies of marine non-indigenous species (NIS) in the Mediterranean Sea, as well as on native Crustacea. More NIS have been recorded along the Israeli shelf than elsewhere in the Mediterranean. In fact, the number of the NIS is alarming if the length of the Israeli coastline is taken into account.

Over the reporting year, she assembled, re-examined, validated, and capture both previously overlooked records and recently published records of the NIS along the Mediterranean coast of Israel, along with her Museum colleagues M. Goren, R. Hoffman and H. Mienis. Most of the data were based on the material deposited in the SMNH and in the National Natural History Collections at the Hebrew University of Jerusalem. The team produced the very first list of marine NIS recorded from the Mediterranean shelf. It must be emphasized that this entire effort was solely SMNH-

based, with no involvement of either the national monitoring program of Israel's Mediterranean waters carried out by the Israel Oceanographic and Limnological Research (IOLR), nor the Israel Ministry of Environmental Protection.

Within the framework of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Prof. Galil compiled a global database, supported by quantitative and experimental data, on the impacts of marine invasive alien species on Nature, Nature contribution to people and good quality of life.

Prof. B. Galil studied, with her colleagues B. Rinkevich, J. Douek, G. Paz (IOLR), a single specimen of a pelagic jellyfish collected by R. Gevili next to the Ashdod port, Israel, and referred to the genus *Chrysaora* Péron & Lesueur, 1810, based on molecular examinations. Despite the inability to check morphological features of diagnostic value, the molecular analysis based on the mitochondrial barcoding gene COI, 16S and 28S ribosomal DNA revealed marked dissimilarities from both the Northeast Atlantic—Mediterranean native *Chrysaora hysoscella* (Linnaeus, 1767) and the closest GeneBank/BoLD available congener, the West African *C. africana* (Vanhöffen, 1902). The specimen (SMNHTAU CO37952) is identified as *C. pseudoocellata* Mutlu, Çagatay, Olguner & Yilmaz, 2020, and



Bella Galil with a jellyfish warning flag depicting the newly recorded *Chrysaora*, Betzet, July 2020. (Photo: K. Gayer) is new to the Israeli coast. *Chrysaora pseudoocellata* was described off Turkey but is probably alien to the Mediterranean Sea and possibly the sixth introduced scyphozoan species reported in the Levant Basin.

The ghost crab—*Ocypode cursor* (Linnaeus, 1758)—is a key component of the sandy beach ecosystems and is listed among the threatened and endangered species in Annex II of the Barcelona Convention. In June—September 2020, Prof. Galil studied, with her colleagues K. Gayer and M. Goren, the population structure of the species during its peak activity in the supralittoral zone of nature reserves and adjacent public beaches. Three transects, each 50×5 m, parallel to the high water mark were sampled at each location. All burrow openings were counted and measured for a total of 5010 burrows. The dataset will be analyzed in 2021.

Prof. Galil also studied the impacts of human-modified habitats on the NIS and indigenous species along the Mediterranean coast of Israel.

Ya'arit Levitt-Barmats re-identified 130 specimens from the crustacean collection and obtained 26 gene sequences for nine species as a part of her PhD work on the morphological and molecular investigation of the caridean shrimp fauna along the Mediterranean coast of Israel.

Field work

Within the framework of the Integrated program for establishing biological baselines and monitoring protocols for marine reserves in the Israeli Mediterranean (PI Prof. Omri Bronstein), burrow openings of Ocypode cursor were counted and measured in June–September, 2020, in nature reserves and adjacent beaches in Betzet, Dor and Evtach.

Taxonomic identification services

- Twenty specimens were identified by Ya'arit Levitt-Barmats for the Israel National Center for Aquatic Ecology and their graduate students.
- Bella Galil identified *Lophoura edwardsi* Kölliker, 1853 (Copepoda: Siphonostomatoida: Sphyriidae), a parasite of the hollow snout grenadier *Coelorinchus caelorhincus* (Risso, 1810) from material collected during the IDEM-funded expedition in December 2017 (SMNH); crustacean remains in stomach contents of the Erythraean inasive fish *Lagocephalus sceleratus* (IOLR); scyphozoans, siphonophorans and ctenophorans photographed in the Levant Basin by her Israeli and Turkish colleagues, including newly recorded species in the region (Akdeniz University, Antalya, Turkey); leucosiid crabs collected in Madagascar (Muséum national d'Histoire naturelle, Paris, France) and in the Bay of Bengal (Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, India).

Education/public outreach

• Bella Galil was featured on Channel 17 in November 2019 talking on the role of the Suez Channel in changing the ecilogical structure of the Mediterranean Sea, and in June 2020 on the diversity of marine communities off Israel.

THE ANNELIDA COLLECTION

Liron Goren

Collection management and field survey of the Polychaeta

Identification of samples received from the Israel Oceanographic and Limnological Research (IOLR) in 2019 continued. Following their identification, samples will be deposited in the collection.

Along with other Museum staff, we conducted some fieldwork and collected specimens for a new study of a little known gregarious polychaete, which appear to flourish along the coast of Tel Aviv.

Liron also completed research with Micha Ilan's group on polychaetes and other macroinvertebrates associated with demosponges in mesophotic and shallow habitats along the Mediterranean coast of Israel. A manuscript was prepared and submitted for publication in the *Frontiers in Marine Science*.

Liron also began computerizing the catalogue of the Polychaete collection.

Taxonomic identification service

More than 100 samples of Hirudinea and Polychaea were identified for the Israel National Center for Aquatic Ecology at the Museum. Few of the samples were of a new invasive record in Israel of *Barbronia* sp.

Future plans

- Complete and publish the identification of the new invasive leech species, Barbronia sp.
- Publish a paper regarding three new polychaete records in Israel, found in some of the fieldworks conducted in the last year (*Branchiomma luctuosum*, *B. bombyx*, *Timarete punctata*)
- Publish results of the polychaete sampling in 2019 in marinas in Israel (with Prof. Bella Galil and Prog. Agnese Marchini).
- Complete the IOLR project.
- Complete computerizing the catalog of the Polychaete collection.

THE ECHINODERMATA COLLECTION

Omri Bronstein and Noga Sokolover

Collection management

The collection was re-arranged at the new Museum facilities. All jars were cleaned outside and re-filled with 70% ethanol as needed.

86 new specimens were identified; over 100 specimens (all Echinoidea) were revised and found misidentified, so their identifications were corrected.

Newly collected material confirmed the presence of *Brissus unicolor* on the Israeli Mediterranean coast. Additionally, new samples of the invasive *Diadema setosum* were collected along the Israeli Mediterranean coast, thus making this species to be newly recorded in Israel.

As in previous years, the contribution of citizen science in the form of reports and collections by recreational divers made a huge contribution to our understanding of the local biodiversity, as well as to the detection of cryptic processes, particularly in the Mediterranean.

Museum loans and visits

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

We provided 24 species identifications to the Israel Oceanographic and Limnological Research as part of their Mediterranean BOLD project.

Additional species identifications based on photographed specimens were occasionally provided to both academics and recreational divers upon request.

Research

The irregular echinoid fauna in Gulf of Aqaba – *ecological and taxonomic aspects* (Oz Posner, MSc student)

The overarching goal of this project is to provide the first comprehensive ecological and taxonomical account of shallow-water irregular echinoids along the Israeli coast of the Gulf of Aqaba (GOA). In order to achieve this goal, a taxonomic revision of the irregular echinoid fauna in the GOA is required. Species identification is based on both morphological and molecular techniques using newly collected material in the field as well as the material available at the SMNH: *Clypeaster humilis, rarispinus, reticulatus, Echinocyamus crispus, Jacksonaster depressum, Sculpsitechinus auritus, Echinodiscus bisperforatus, Schizaster gibberulus, Pericosmus akabanus, Brissopsis luzonica* and Lovenia elongata.

Reproduction cycles of Echinoids in a changing world (Lynn Lack, MSc student)

There is increasing evidence of changes in our world, causing *inter alia* global warming and elevated sea surface temperatures. Climate change can influence species extinction rates, affect their distributions and abundances and alter annual patterns of reproduction. Echinoids are mostly gonochoric species reproducing by synchronized spawning, regulated by external environmental cues, particularly temperature, photoperiod, moon phase, tides and food availability. The main

objective of this study was to assess variations in the reproductive cycle of broadcast spawning benthic invertebrates using the irregular echinoids *Lovenia elongata* from the Northern Gulf of Aqaba and *Brissopsis lyrifera* from the Mediterranean, as model taxa.

During this study, the current annual reproductive cycle of *L. elongata* in the northern Gulf of Aqaba is being established. The new data will be compared to published data from the mid-1970s to allow a comparison spanning over almost 60 years. For the Mediterranean echinoid *B. lyrifera*, no comparable reproductive data are available in the literature. Consequently, we resort to historical samples available at the SMNH collection; 5 individuals from each Jan.—May, Jul., Sep., Oct., Dec. 1967 and Jan., May, Jul., Oct. 1977 are used for measurements and histopathological analysis. Histopathological study of the reproductive stages of *B. lyrifera* allows us to compare current and historical reproductive patterns in this species.

Message in a bottle: testing protocols for DNA extraction and amplification from specimen preservatives (Victoria Fidel, Intern)

This project aims to develop and test methods for extraction and amplification of targeted DNA from the preservative solutions used in natural collections. This project has two phases:

(1) First, we use the SMNH collections to test the most suitable DNA extraction protocol. This is done by initially filtering ethanol, in which the specimens have been preserved, followed by a comparison of four different extraction protocols (Phenol-Chloroform, Chellex, Qiagen PowerWater kit and the popular Qiagen DNAesy extraction kit). We compare the total yield and purity of each extraction using a NanoDrop spectrophotometer and the Qubit fluorometer. Finally, we run a fragment length analysis using TapeStation and conduct PCR amplifications using general mitochondrial primers.

(2) Once the most suitable extraction protocol is established, we will compare the feasibility of our approach in amplifying sequences from a diversity of phyla and preservation ages to test our method for the generality of and prove its applicability to replace destructive sampling from valuable museum collections.

Ongoing project

Work on the illustrated guide for the Israeli echinoderms still continued with the part on the Red Sea echinoids nearing its completion.

THE ASCIDIACEA COLLECTION

Noa Shenkar

During the academic year 2019–2020, Noa Shenkar concentrated on her research into interactions of ascidians and various anthropogenic contaminants in the sea: polyethylene terephthalate and polylactic acid plasticware fragments, other phthalates, pharmaceutically-active compounds, and heavy-metals. She also studied development of the solitary ascidian *Polycarpa mytiligera*, an emerging model for regeneration studies, and was involved in projects on monitoring invertebrate invasive species in the Mediterranean Sea and in freshwater systems of Israel. She co-authored nine articles during the reporting period.

MEDITERRANEAN AND RED SEA FISHES

Jonathan (Yoni) Belmaker

The native biota of the Eastern Mediterranean is facing changes that are more rapid than anywhere else. The ongoing influx of invasive Red Sea species, warming water temperature, overfishing and pollution transform fish diversity in this part of the basin. The Mediterranean natural history fish collection at the Museum provides a globally unique resource that is being used to monitor how these immense changes influence fish diversity, biogeography and, more generally, marine ecosystem services and function. Such understanding is vital to identify consequences of these major changes to the integrity of the marine ecosystem and, more importantly, to mitigate adverse influences of human activity.

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

Active external grants that utilize the fish collection

Research

During 2019–2020, we continued to analyze museum data on the morphology of Mediterranean and Red Sea fish in order to test biotic and abiotic constraints on traits diversity associated with fish invasion.

We continued fish sampling based on recreational fisher catch as part of Ori Frid's doctorate project. The goal of this study is to udnerstand temporal dynamics of the catch and by-catch. Representative samples of unique species are deposited in the collections.

We led an intensive fish survey effort in collaboration with the Israeli Nature and Parks Authority along the Gulf of Aqaba (Eilat) coast. The goal was to establish an ecological baseline that can be used to assess the effectiveness of protection efforts. Surveys were conducted in fall of 2020 and involved all lab members.

We engaged in a large-scale fish larvae sampling project funded by the Israeli 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 are deposited in the collections.

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

We used state-of-the-art broadband acoustic methods to sample fish within and outside protected areas in the Mediterranean as part of Sarah Ohayons's PhD project. This will eventually be used to identify fish species remotely by acoustic methods.

THE TERRESTRIAL VERTEBRATES SECTION

Shai Meiri, Tamar Dayan, Yossi Yovel, Erez Maza, Daniel Berkowic, Amos Belmaker, Karin Tamar, Igor Gavrilov, Stanislav (Stas) Volynchik, Hamutal Friedman, Arieh Landsman, Moshe Giezler, Miriam Eidels

Personnel

The main change to the personnel this year was that Kesem Kazes, our collection manager of mammals, resigned and was replaced by Dr Karin Tamar. Karin, Amos and Erez carried on working in the collections, with some help from Daniel. Igor and Stas were helped by Hamutal. Arieh, Moshe and Miriam volunteered in the collections and helped with various projects. Ron Cohen, a volunteer in the reptile collection finished his work and left. With the COVID-19 restrictions, we stopped receiving help from the Aardvark project. We made an effort to accept one Aardvark intern but he was not qualified for the job and left after a couple of months.

Postdocs: One museum postdoc—Marco Antonio Ribeiro Junior—studied the taxonomy of Sand Geckos of the genus *Tropiocolotes* and would continue to study the taxonomy of the Ratsnake from the genus *Elaphe* and the taxonomy of the European Glass Lizard from the genus *Pseudopus*. Two postdocs finished their studies during the reporting period: Karin Tamar on reptile taxonomy and Tali Magori Cohen on bat diversity.

Collection management: equipment, infrastructure, storage and curation

We made little progress in assimilating the Beit Ussishkin, A.D. Gordon and Beit Shturman Museum holdings into our collection. We were still well short of dedicated storage cabinets even for specimens already in the collections. 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 fulfil our expectation that they would keep the material in goog shape in years to come. We made no headway yet in barcoding jars and drawers, so that immediate identification of specimens present in a cabinet or on a shelf is known. This is now routine in several collections around the world and we hope to acquire such technology sooner rather than later. However, shelving, internet and adequate number of electricity outlets are in place, and in general the collection can be used comfortably.

Research and Curation

The amphibian collection

The down trend in collecting amphibians continued during the reporting period. Between October 2019 and September 2020, our amphibian collection grew by only a few specimens totaling to 2926 specimens. We continued with preparation of skeletons from all the Israeli amphibians, with only a skeleton of the Savigny's treefrog (*Hyla savignyi*) missing. One of the reasons that might explain the low collecting rate was the lack of dedicated field research on Amphibians. The amphibian collection remained the smallest and least active among the other tetrapod collections. Due to its small size, the amphibian database was chosen to be the pilot one on the new platform.

The mammal collection

During the reporting period, 156 specimens were added to the mammal collection (from M.16145 to M.16301), excluding many which were still waiting in the freezer. This somewhat low number of catalogued specimens was the result of the Covid-19 restrictions. The 156 added specimens belong to 54 species, the most common of which were Mountain Gazelles (*Gazella gazella*, 15) followed by Southern White-breasted Hedgehog (*Erinaceus concolor*, 12), Long-Eared Hedgehog (*Hemiechinus auritus*, 9), wolves (*Canis lupus*, 7), Striped hyena (*Hyaena hyaena*, 6) and Cape hare (*Lepus capensis*, 6).

Work in the mammal collection was slow this year. While the Covid-19 outbreak restrictions contributed a lot, the main reason is that Kesem Kazes, our previous collection manager, left.

During her absence Erez and Amos kept the basic work running, but not much progress was made. We were looking forward to having Karin start her work in the collection.

The reptile collection

Between October 2019 and September 2020, the reptile collection grew by 380 specimens, from 19172 to 19552 specimens, excluding many which were still waiting in the freezer. Most of the added specimens (215) came from the Beit Ussishkin collection. We expected that its accommodation into our collection would be finished by the end of 2020. The list of the rest (165 specimens) is dominated by the Sinai Fan-fingered Gecko, *Ptyodactylus guttatus* (14 specimens), followed by the European Glass Lizard (*Pseudopus apodus*, 11) and then by Mediterranean Spurthighed Tortoise (*Testudo graeca*, 9). Altogether, the catalogued reptile specimens belonged to 74 species, among them were included the rare Eastern Four-lined Ratsnake (*Elaphe sauromates*, 2 specimens. both o from Beit Ussishkin collection. During the reporting period, we continued entering into the collection specimens from Beit Ussishkin Nature Museum, but not yet from the A.D. Gordon Museum or the Kibbutz Ma'abarot collection. We continued preparing skeletons and we added to the collection 16 specimens belonging in 14 different species. We intend to continue with this project until we have representation from all the species in Israel.

The bird collection

Between October 2019 and September 2020, the bird collection grew by 619 specimens (from 22328 to 22948). This number represents only specimens that entered into the collections with at least a tissue sample. There are another 246 specimens in the freezers that were collected during this period but were not prepared yet. The process of incorporating specimens into the collection slowed down mainly because main attention was paid to skins rather than skulls, which had been a priority during the exhibitio built-up. Amos began preparing skins himself, but he could not work fast enough to really tackle the packed freezer. The increase in the number of specimens from last year (420 vs. 619) was due to efforts by Igor and Stas, who rapidly prepared skeletons from old specimens in their freezers. Other reasons for the increase were the exchange with Cornell University, which yielded 47 specimens of North American birds, and the addition of specimens from the A.D. Gordon Museum. The below analysis pertains only to the 619 specimens that actually entered the collection.

During the reporting period representatives of 214 species were added to the collection, an undoubtedly impressive number. Of those, the most common species are the House Sparrow (*Passer domesticus*), Blackcap (*Sylvia atricapilla*) and Hoopoe (*Upupa epops*) with 13 specimens each, followed by the Kestrel (*Falco tinnunculus*, 12 specimens) and White-throated Kingfisher (*Halcyon smyrnensis*, 10 specimens).

The pellet collection was getting a facelift with new shelves built for that purpose. Moshe Geizler finished fixing errors in the database and was working on the pellet collection. He was cataloguing each pellet in a new dataset created for this purpose, laminated every old label (moisture damage was evident) and protected them in a plastic box. His work would make the pellet collection better protected and much more accessible. Miriam Eidels started to work on cataloguing the old correspondence to make the relevant information more accessible.

Several projects were ongoing in the collection, with considerable progress being made:

- 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 database was being cleaned up, with better organization of information and the addition of better locality data.

Aside from these projects the daily routine 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 being attended. While the Covid-19 outbreak slowed work considerably, a small number of visitors and courses did allow us to focus on better organizing the collection.

Visits, teaching and loans

According to our records, 37 people (almost all of them academics) used the collections in some capacity (visits, loans, data requests etc.) last year. Most were from Israel but we also got users from the Czech Republic, Italy, Belgium and the USA. This is a marked drop from last year most likely due to the Covid-19 pandemic that adversely affected research activity in many countries. Aming the 32 Israeli users, 13 were from outside Tel Aviv University. Four teaching courses used collections materials. We loaned specimens to members of institutions (two in Israel, one each from Belgium and the USA), sent tissue samples to individuals in three institutions (Czech Republic, Israel and Italy) and sent specimen data pertaining to five projects, to scientists in three.

Publications

Despite our plea 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. Nine articles were published during the reporting period.

THE FEATHER IDENTIFICATION LAB

Avigail Ben-Dov Segal, Amos Belmaker 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 with 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 Steinhardt Museum of Natural History Feather Identification Lab works closely with the Israeli Air Force, the Israel Airports Authority and the Civil Aviation Authority. In 2013, an official contract between the parties was signed and the Lab provides around 150 identifications annually. In addition, the Lab assists the Israel Nature and Parks Authority to identify bird species collected during various surveys on the effects of wind turbines and electric lines on wildlife. This year we also took part in a preliminary examination of the impacts of the Ashalim solar tower on local wildlife. This cooperation has greatly expanded over the years, starting with a few illegal poaching cases to several hundred identifications a year.

The Lab's work is forensic by nature. We receive various animal remains to identify - this can be a partial body, several feathers, just a crumb of a feather or a smear of blood. Our main goal is to identify the animal to the lowest possible taxonomic level using various techniques.

As part of the Steinhardt Museum of Natural History, we can utilize the largest regional collection of birds (>18,000 specimens), which is an invaluable resource for comparing the remains and identifying different bird species.

When only few feathers or feather shreds are found, their microstructure are inspected under a microscope. The feather microstructure has both systematic and diagnostic importance and is an effective tool in identifying bird species. We have a comprehensive comparative collection of feather microscopic slides of many Palearctic species.

The Molecular Systematics Laboratory at the Museum (headed by Dr T. Feldstein-Farkash) routinely provides genetic identifications of bird remains and compliments our microscopic and morphological work. It is particularly important when the remains do not allow species-level morphological identification in high priority cases such as damaged aircrafts, illegal poaching and crucial ecological surveys.

During the reporting period of 2019–2020, the Lab examined 62 bird strike cases (the decline in number of bird strike cases received was due to the Covid-19 outbreak) and 282 cases for the Israel Nature and Parks Authority. These identifications included 88 genetic analyses by the Molecular Lab.
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 700 new specimens of cyanobacteria, seaweeds and seagrasses from the Mediterranean and the Red Sea. Surveys of 2019–2020 revealed some new alien seaweeds that had never been reported from the Levantine shore of Israel before. Some of them were first records from the Mediterranean Sea. Taxonomic and molecular studies also revealed several new species to science from the Red Sea and from the Mediterranean shore of Israel.

Our large alcohol collection, stored in carton boxes, was transferred to its final destination in the new storage facility, and unloading of specimens started with the assistance of a new volunteer. Maintenance and cataloging of the dry collections also continued in 2019–2020.

Collaborative research

Collaborative studies involved both Israeli and foreign partners:

- A research proposal, *An integrated program for establishing biological baselines and monitoring protocols for marine reserves in the Israeli Mediterranean Sea* by O. Bronstein, T. Treibitz, R. Hoffman, S. Rothman and M. Ilan, M., was accepted and approved by Yad Hanadiv Programme Grants (Grant no. 10699).
- A new project with Prof. Martin Langer (Bonn University, Germany) and Dr Orit Hyams-Kapzhan (Geological Survey of Israel), on the dispersal mechanisms in foraminifera with connection to the seagrasses *Halophila stipulacea* from Eilat and *Cymodocea nodosa* from the Mediterranean, was commenced.
- New links with Prof. Hiroshi Kajihara, the top nemertean (ribbon worms) taxonomist from Hokkaido University, and Dr Frederik Leliaert, one of the top modern algal (Chlorophyta) taxonomists and the Research Director of the Meise Botanic Garden in Belgium, were established. After publishing our first paper on ribbon worms collected during algal surveys, new species were found and novel research into this unique group, which had never been studied in the eastern Mediterranean before, continued. Molecular study of some new species of the Chlorophyta collected from the Red Sea and the Mediterranean, started in Meise.

Tasks in progress and plans for 2020-2021

Surveys of the marine flora of Israel and the routine maintenance of the collections will continue. Unloading of the wet collection will continue until all specimens are shelved.

The ongoing quantitative study of the algal drift, started in 2005, along the northern shores of Israel, will continue in 2021.

Three new papers describing several new species of the Chlorophyta, from the Red Sea and the Mediterranean, are in preparation and expected to be published in 2021–2022. A review paper on the ribbon worms of Israel is also in progress.

LAND PLANTS COLLECTION

Yuval Sapir and Jotham Ziffer-Berger

Research

During the 2019–2020 academic year, we ran several projects:

- The systematics and phylogeny of *Raphanus* and associated species (Dr Jotham Ziffer-Berger)
- Fruit evolution in Mediterranean Cruciferae (Dr Jotham Ziffer-Berger)
- Invasive species dynamics in the Congo River Basin (Dr Jotham Ziffer-Berger)
- Systematics of *Trigonella* and *Medicago* (Fabaceae) (Dr Shira Penner Rosenvasser, postdoc).

In November 2019, Shira Penner Rosenvasser joined the Museum's herbarium as a postdoctoral fellow. During the academic year 2019–2020, Shira studied the taxonomy of *Trigonella* and *Medicago* (Fabaceae), in order to enable the delimitation of these two important and closely related genera, and worked on her first manuscript on this topic to be submitted to the *Canadian Journal of Botany*. Shira's research in the present year was funded by The Council for Higher Education and The Planning and Budgeting Committee. In 2020–2021, Shira plans to investigate the specific relationships of phylogeny, biogeography and evolution of propagule traits in *Trigonella* and *Medicago* specimens from our collection, the Hebrew University herbarium and other herbaria around the world, to further promote the delimitation of these two genera. Finally, Shira also plans to generate a revised classification key for *Trigonella* and *Medicago* based on her research.

Collection management

In the past year the land plants herbarium continued incorporating Prof. Avi Shmida's collection of vascular plants from Jordan, Sinai and Hermon. Additionally we were incorporating the collection of Moshe Lustig, a composer and botanical amateur who collected plants in the 1950s; the collection was donated by his family. These projects were run in addition to the routing curation of our in-house collection and the Israel Gene Bank collection.

Databasing

1013 entries were added this year to the database of the land plants herbarium.

Scientific collaboration

The vascular plant herbarium maintained research links with several institutions:

- Avi Shmida, The Hebrew University of Jerusalem
- Uzi Plitmann, The Hebrew University of Jerusalem
- Ilana Herrnstadt-Haas, the Hebrew University of Jerusalem
- Ori Fragman-Sapir, The Jerusalem Botanical Garden
- Oz Barazani, Israel Gene Bank
- Klaus Mummenhoff, University of Osnabrueck, Germany
- Thameen Hijawwi, Al Quds University, Palestinian Authority
- Ronen Stein, Tel Aviv University
- Merav Sayfan, Ben Gurion University of the Negev
- Hinanit Koltay, Volcani Institute
- Einav Mayzlish-Gati, Israel Gene Bank
- Agostinho Chicaia, the African Union

Field trips

The Herbarium staff went on several collecting trips in the midst of the flowering season, when the Covid-19 restrictions were lifted:

- Two field trips to the Golan Heights and Sea of Galilee (Kinnereth) for plant collection;
- Collecting of around 100 species from the Basa wetland area in Herzliya;
- Two joint field trips with Dr Oz Barazani Lab (Agricultural Research Organization) to the cliffs of Tel Aviv to collect *Raphanus* specimens.

Visitors

We accommodated Ornea Reismann-Berman (the Open University), with 6 students from the course *The Plant World*.

Teaching

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

- General Botany
- Introduction to Plant Sciences
- Unique botanical phenomena
- Review of biology in high schools

Provision of service

We continued to house herbarium of the Israel Gene Bank (Volcani Institute) for the second year; provided counseling in botany to the Center for Education Technology, an Israeli non-profit organisation, dedicated to the advancement of the education system in Israel, in the Jewish world and around the globe; advised the European Union Action Group with regard to endangered plants; and provided guidance service to the Ministry of Agriculture with regards to identification of ornamental plants.

Outreach

Dr Jotham Ziffer-Berger gave a speech at the event held at the Jerusalem Botanical Garden in the memory of our dear friend and appreciated botanist Professor Jacob Lorch, who passed away last year.

THE FUNGI COLLECTION

Bruria Gal

The collection of fungi of the late Prof. Binyamini was given a rescue treatment after several years of negligence.

Ongoing projects

- Sorting and treatment of thousands of fungi samples kept in paper envelopes and cartoon boxes continued.
- Databasing of the fungi collection. The list of the fungi names was updated (most of the names had been recorded about 50 years ago and became invalid), according to Mycobank, which provides the up-to-date information based on the molecular analysis and is a reputable resource for all world mycological organizations.
- Ongoing augmenting and updating of the collection: fieldwork, sorting the newly acquired material, identification, databasing, drying and freezing as needed, preparing specimens for future molecular analysis. Overall, 850 specimens were added to the collection during the reporting period.
- Preparation of the check list of the Israeli fungi continued. For the first time, it will include all species found and identified in Israel along the years, with over 600 Basidiomycetes, other higher fungi and Mixomycetes. All previously compiled lists and publications since 1944 were checked. There were still numerous problems with names that were no longer in use and were changed many times by different mycologists. The introduction to the check list includes a general overview of the geobotanical areas of Israel, vegetation, climate *etc*.

THE PALEOSCIENCES SECTION

THE PALEONTOLOGICAL COLLECTION

Daniella E. Bar-Yosef Mayer

The largest component of our holdings is the private collection donated by the late Prof. Heinz Bitinsky-Salz, formerly a professor of entomology at Tel Aviv University, who collected fossils as a hobby.

During the reporting period, our efforts focused on the characterization of the collection. We were busy transferring each fossil specimen from its old (and often filthy) box into a zip-lock bag for better protection. While doing so we were creating a preliminary dataset with information on the contents of each drawer in the collection: the main taxa and periods within each drawer, their provenance and the total number of specimens and their state of curation and cataloguing. This new system for the first time gives us a broader view of the entire Bitinsky-Salz collection, facilitates control over the location of each item within the collection and is instrumental for the

assessment of our needs for new storage cabinets. This year we identified valuable specimens of brachiopods, trilobites and graptolites. At a later stage, the collections manager will check each and every entry to verify taxonomic names, locality names and palaeontological information, and the records will be migrated into the Museum database upon completion of this task.

The re-arrangement in the collections was facilitated by Daniella Baird, an American volunteer sponsored by Aardvark who worked with us in October–December 2019, and by Liat Lev of the museum administrative staff.

THE ARCHAEOBOTANICAL COLLECTION

Dafna Langgut

All research done in the Laboratory of Archeobotany and Ancient Environments is based on our botanical collections. The Laboratory focuses 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 our references collections (pollen, wood and charcoals), mainly from Tel Aviv Botanical Gardens (in cooperation with Dr Y. Sapir).
- We continued to preserve for future studies the ancient waterlogged wood assemblage of the 24,000–10,000 year old site Jordan River Dureijat (JRD).
- We recently received a scanning electron microscope (SEM Tescan VEGA 3) and begin to create a digital wood anatomy reference collection of the Israeli flora.

Research projects and collaborations

<u>2019–2021: Art, archaeology and ecology: the garden courtyard of the palace of Herod the Great in Caesarea Maritima (Israel)</u>

110,000 Euro, Arpmed Grant; P.I. (in collaboration with S. Hendler and R. Cheddady)

This project uses palaeoecological and archaeological data to reconstruct the peristyle courtyard garden of the Herod the Great palace in Caesarea Maritima (*The Promontory Palace*, Israel) in an exhibition produced by the Genia Schrieber Art Gallery in Tel Aviv on the theme of sustainability, ecology and art. The project is an artistic reconstruction of the Herod the Great royal garden at Caesarea, based on the fossil pollen content of archaeological samples collected on site. The botanical composition of the palace gardens of the Roman ruling class in the Levant was an enigma until this study. The extraction of fossil pollen grains from the ancient plasters and cements from such gardens allows to identify the botanical composion of these gardens in a detailed and reliable manner. Based on these archaeobotanical data, it is now possible to re-create such gardens for a wider public.

2019-2021: Reconstructing the Roman Garden of Casa della Regina Carolina, Pompeii

5,000 USD; P.I. (in collaboration with C. Barrett)

This project operates at several excavations in Jerusalem, where varies questions are to be answered based on the identification of pollen and/or charcoal remains. The project answers 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: 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. (in collaboration with S. Mischke, University of Iceland and Gonen Sharon, Tel-Hai College)

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 palynological data will be integrated with other well-preserved environmental proxies—geological, sedimentological, ostracods and isotopes—from JRD sequence.

2016-2020: Archaeobotany of Jerusalem

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

This project operates at several excavations in Jerusalem, where varies questions are to be answered based on the identification of pollen and/or charcoal remains. The project answers 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.

<u>2018–2020: A flower in the desert: Botanical remains of King Herod the Great's horticulture and agriculture activity at Masada</u>

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

Thes project aims to reveal the botanical components in Masada. Within the frame of the project, we are searching for traces of royal display by plants, as well as for evidence of 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.

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 Goren, Atlit Yam (and several other submerged sites along the Carmel coast), Tevet, JRD, Tel Beit Yerah, Timna and several 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 Steinhardt Natural History Museum as an archive to environmental studies*.

Active grants

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

Conferences

- The Annual Conference of the Sonia and Marco Nadler Institute of Archaeology, Tel Aviv University — The 2020 Innovations of the Institute of Archaeology at TAU, October 2020, paper presented: *Climate and environment at the dawn of domestication*.
- 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

Collections management

About 30 shell assemblages from archaeological sites are now stored in the Bioarchaeology storage facilities on the fourth floor of the museum.

Research

Several research activities based on the SMNH malacological collections took place during the reporting year.

Shells from the site of Ramat Rachel were studied and prepared for publication, and a manuscript on Çatalhöyük West Mound was at its final stage of completion.

Shell assemblages from Pre-Pottery Neolithic B sites were studied by Ms Heeli Schechter, a graduate student at the Hebrew University of Jerusalem, under my supervision. The study sites include Kefar Hahoresh, Ahihud, Mishmar Ha-Emek, Beisamoun and Yiftah'el.

Nahal Roded 110, a unique cult PPNB site in the Eilat mountains, and the Besor Valley survey of Palaeolithic sites also yielded small shell assemblages.

The shell assemblage of Jordan River Dureijat, a shell midden on the bank of Hula palaeolake dated by to the late Pleistocene (ca. 20,000–11,000 years ago), continued to be studied. Lacustrine species were identified and their analysis revealed environmental changes throughout the period of the site occupation; my student, Alol Dor, will use this assemblage as the focus of her MA thesis.

A major effort concentrated on the study of use-wear analysis of two of the earliest Middle Palaeolithic shell beads in the Levant from Misliya Cave and Qafzeh Cave. This project culminated in the publication of two major papers, one in PlosOne and the other in an edited volume. The article in PlosOne was broadly cited in the media.

Field trips

- Tinshemet Cave, Middle Palaeolithic site, 14 July 2020.
- Kefar Darom 8, Ashdod, Epipalaeolithic site, 18 August 2020.
- Metsad Hashavyahu, Iron Age site, 27 August 2020.

Scientific collaborations

- Shells and stone beads from the Pre Pottery Neolithic A site Wadi Feynan 16, Jordan. Project headed by Prof. Steven Mithen, University of Reading, UK.
- Delineating pobable sea routes between Cyprus and its surrounding coastal areas at the start of the Holocene: A simulation approach. Project headed by Prof. Phaedon Kyriakidis, Cyprus University of Technology, Limassol, Cyprus.
- Ramat Rachel shells. Project headed by Prof. Oded Lipschits, Institute of Archaeology, Tel Aviv University, Israel.
- JRD shells: Project headed by Prof. Gonen Sharon, Tel Hai College, Israel.
- Çatalhöyük West Mound shells. Project headed by Prof. Peter Biehl, University of Buffalo, NY, USA.
- Tinshemet Cave Middle Palaeolithic shells. Project headed by Dr Yossi Zaidner, Institute of Archaeology, Hebrew University of Jerusalem, Israel.
- Nahal Roded shells. Project headed by Dr Michal Birkenfeld, Israel Antiquities Authority, in collaboration with Dr Uzi Avner, Dead Sea and Arava Science Center, and Dr Liora Horwitz, Hebrew University of Jerusalem, Israel.

- Besor Valley Survey of Prehistoric sites. Project headed by Dr Mae Goder, Ben Gurion University of the Negev, Israel.
- Nahal Efe shells. Project headed by Dr Jacob Vardi, Israel Antiquities Authority, and Dr Ferran Borrell, Spanish National Research Council, Barcelona, Spain.
- Misliya and Qafzeh shells, Use-wear analysis. Collaboration with Dr Iris Groman-Yaroslavski, University of Haifa, Israel.
- Manot Cave, an Upper Palaeolithic site, is a major long-term collaborative effort with the following lead researchers: Dr Ofer Marder, Ben-Gurion University of the Negev, Dr Omry Barzilai, Israel Antiquities Authority, Prof. Israel Hershkovits, Tel Aviv University, and several other institutions both in Israel and abroad.

Conferences

- Delineating Probable Sea Routes between Cyprus and its surrounding Coastal Areas at the Start of the Holocene: A Simulation Approach. Kickoff meeting. Limassol, Cyprus, 4 November 2019.
- *Neo-Lithics*. Tokyo Japan, University of Tokyo, 12–16 November 2019. Although I was unable to attend the conference in person, I prepared a lecture that was read in my place: The Stone beads of Nahal Hemar Cave.
- Annual meeting of the Israel Prehistoric Society. The Steinhardt Museum of Natural History, Tel Aviv University. 19 December 2019.

ARCHEOZOOLOGY

Lidar Sapir-Hen

The research at the Laboratory of Archeozoology is based on the Archeozoological collections. In the 2019–2020 academic year, after establishing the laboratory in the Museum and the collections in the storage, the laboratory was also equipped with facilities to conduct sampling of bones for stable isotopes analysis.

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 Judaean 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 $8^{th}-2^{nd}$ century BCE.
- Urban-rural relationships under the Islamic rule

Field projects

I actively participated in archeological excavations at Masada, Timna, Azekah and Tel Hadid. 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 four papers, was a chair and a respondent at two international meetings.

Student supervision

I advised two MA and two PhD students. In addition, two lab technicians work on archeozoological projects. The students' work was based on faunal assemblages from archeological sites (archeozoological collection) and relied on the Museum mammal and bird comparative collections.

Teaching

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

Visiting scholars to the Archeozoological collection

Dr Deirdre Fulton of Baylor University, Texas, USA; Prof. Haskel Greenfield of University of Manitoba, Canada; and Dr Max Price, Massachusetts Institute of Technology, USA.

DAN DAVID CENTER FOR HUMAN EVOLUTION AND BIO-HISTORY RESEARCH

Israel Hershkovitz, Hilla May and Rachel Sarig

The Dan David Center for Human Evolution and Bio-History Research occupies over 1200 square meters at the Steinhardt Museum of Natural History. The Center includes technical and research laboratories, as well as an exhibition on the origins and evolution of humankind.

The goals of the Dan David Center concentrate on:

- Searching for the origin of modern humans development and migration.
- Studying the origin of diseases, their development and evolutionary history as well as the development of medical knowledge.
- Understanding the dynamics of human demography and its association with cultural, economic and scientific changes through time.
- Biohistory: reconstructing historical events from human fossils remains.
- Creating a digital database that will be accessible to researchers worldwide.
- Initiating scientific collaboration with other leading institutes.
- Preserving and restoring important fossils.
- Initiating excavations in important prehistoric sites.
- Delivering knowledge on human origin and development to the public.
- Fostering scientific and cultural ties with non-Israeli scientists and students.

Researchers and students of the Dan David Center are involved in dozens of projects, conduct field work and pursue active collaboration with Israeli and international colleagues.

MOLECULAR SYSTEMATICS LABORATORY AND TISSUE COLLECTION

Dorothée 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.

Operational

During the reporting period, tissues from 132 animal specimens, including mammals, birds, reptiles, worms (polychaetes and leeches), sponges and marine algae were processed for molecular identification. The molecular work, in collaboration with the morphological identification by collection managers, or researchers working in the different collections, proved to be highly important for the curation of the samples, and promoting the zoological/ecological research. More than half of the molecular work was the genetic identification of birds remains in collaboration with the Feather Identification Lab.

Collections management and databasing

The Molecular Systematics Collection of the SMNH 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, 2075 tissue samples were added to the Museum tissue collection, including 148 mammal specimens (41 species), 537 birds (169 species) and 120 reptiles (45 species).

Tissue samples from the reptile collection were loaned to researchers from the National Museum in Prague (Czech Republic) and the University of Palermo (Italy), and mammalian tissue was loaned to the Zefat Academic College (Israel).

Participation in international meetings

T. Feldstein-Farkash attended the Biodiversity-NEXT meeting held in Leiden, The Netherlands, thanks to support from the Museum. The purpose of this meeting was to create a working platform for the scientific communities, infrastructure operators and science-policy actors in order to build a global infrastructure for biodiversity data and to bridge between the scientific data and policymaking. Following this meeting, the SMNH became a Member of the Global Genome Biodiversity Network (GGBN).

THE MUSEUM DATABASE

Yonatan Gur and Tirza Stern

During 2019–2020, a substantial part of our collection databases was made available to the public via the museum website (https://smnh.tau.ac.il/en/research/collections-database). More than 304,000 records from 14 active collections are currently available to browse and search using an easy and simple interface.

We have reached another milestone for our new, centralized, database Infrastructure, and continue to work towards migrating our databases to the new system. An Alpha version of the new database system was tested successfully by our users, and a production version was planned to be deployed by the end of 2020.

23,822 new records were added to the SMNH database, to a total of 524,375 entries in the database. At present, the SMNH database contains the following numbers of entries in the following groups:

- Foraminifera 792
- Coelenterata 13748 (365)
- Porifera 1316 (151)
- Vermes 240 (16)
- Bryozoa 257
- Brachiopoda 47
- Mollusca 64249 (151)
- Arthropoda (other than insects) -7300 Fungi -6456 (380) (7)
- Insecta 334994 (19750)
- Echinodermata 2328 (5)
- Ascidiacea 1109 (101)
- Pisces 14934 (116)

- Amphibia 2758 (5)
- Reptilia 19291 (391)
- Aves 22711 (620)
- Feather Identification Lab 1665 (401)
- Mammalia 16292 (157)
- Fossils 3410
- Lichens 1345
- Water plants 5908 (3)
- Vascular plants 1013 (1013)
- Marine parasites 47 (45)
- Molecular Laboratory 1153 (143)
- 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.

Due to Covid-19 restrictions, taxonomic courses and research visits planned for the 2019–2020 academic year had to be cancelled.

ITI-sponsored courses in 2019–2020

Applied Ecology was taught by Prof. Tamar Dayan and Dr Ittai Renan at Tel Aviv University.

EDUCATION AND SCIENCE COMMUNICATION DEPARTMENT

Yael Gavrieli

The academic and school year of 2019–2020 was marked by the Covid-19 pandemic. The year was divided into three phases. At the beginning, our operations ran as usual from October 1, 2019 until

the first closure on March 15, 2020. The second phase lasted from the first closure from March 15, 2020 until June 2020, during which all public programs were handled on-line. During the third phase, from June until September 17, 2020, the Museum offered limited activities according to regulations imposed under the 'purple badge'. The Museum educational activities were therefore structured around these three phases, as reviewed below.

PHASE I: BUSINESS AS USUAL

During the first five and a half months of the academic year 2019-2020 (October 1, 2019 – March 15, 2020) all formats of public programs were operational. These included guided tours around the museum and the botanical and zoological gardens, science visits, science days, explore nature, *a night @ the museum*, lectures series and special events. During this period 19,879 visitors participated in educational programs, comparable to 19,299 participants during the same period of 2018–2019.

PHASE II: DIGITAL ACTIVITIES DURING 1ST COVID-19 CLOSURE

During the first closure (March 15, 2020 – June 2020), we developed an on-line project *Nature [Museum] at Home* (מוזיאון). It was comprised of articles and educational resources that focused on animals we encounter around us, either alive or as characters in literature, films etc. The themes covered nature conservation, spiders, bats, ants, Earth Day, Israel's nature and dogs. The following items were made available:

Articles:

- Five things you didn't know about your dog
- A guide to know your dog better
- Israel's nature conservation pioneers
- The military parade of animals in IDF units' tags
- From Corona to climate change celebrating Earth Day
- What can we do to save our seas? (followed by video *The sea and I* from the *Human Impact* exhibition
- Five species of ants at your home
- All you want to know about bats
- About your home spiders
- All about Harry Potter and the Aragog spiders

Exhibit highlights

- The women and the dog exhibit
- The live arthropods from 'Bugs and beyond' exhibition
- Bats skeletons
- The tarantulas
- Guided viewing
- Antz
- Batman
- Spiderman
- Avatar

Videos

- The sea and I from the Human Impact exhibition followed by an article What can we do to save our seas?
- Access to five environmental movies
- \bullet Storytelling the adventures of the ant Humit (brownie) written by S. Izhar and told by Ruth Kanner Theatre Group
- A lecture: The town bat and the country bat by Prof. Yossi Yovel
- A lecture: Spiders withdrugs and without by Dr. Danny Simon

Educational games

- How many bats species can you identify?
- How many spiders can you spot?

PHASE III: ACTIVITIES UNDER PURPLE BADGE

From June 2020, the museum was gradually opening its doors under the purple badge regulations. Only a limited number of visitors were allowed to enter during every time slot. The guided tours were conducted according to the purple badge and the Ministry of Education instructions. Thus, during the third phase only 2,379 visitors participated in educational programs, a mere 9% of the number of participants over the same period of the previous year.

Education in numbers

During the school year of 2019–2020, 22,258 visitors came as groups and participated in our educational programs, as follows:

Visitors according to program

Program	Number of visitors
Guided tour at SMNH	9,430
Guided tour at Zoological Garden	2,982
Guided tour at Botanical Garden	408
Guided tour at Zoological Garden and SMNH	657
Guided tour at Botanical Garden and SMNH	250
Science day	1,473
Science visit	1,852
Series of science visits/days	1,814
Explore nature	1,825
A night @ the Museum	160
Lecture series	733
Special events	674
Total	22,258

Visitors divided by age group

Age group	Number of visitors
Kindergarten	509
Elementary school	7,155
Middle school	2,427
High school	1,441
Higher education students	515
Families	5,902
Adults	3,447
Senior citizens	862
Total	22,258



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, Adi Weiss.

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.

Main activities in 2019-2020

- Ecological assessment as a supporting tool for river basin management: The Western Galilee Watershed. A 2-year project to develop an ecological assessment system. The project was in cooperation with the Western Galilee River and Drainage Authority, the 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. The project was supported by the Yarkon River Authority.
- Ecological assessment as a supporting tool for river basin management: The Kishon river and *its tributaries*. Implementation of an ecological assessment system for the Kishon watershed. This project was supported by the Kishon Drainage and Streams Authority and the Kishon River Authority.
- Ecological assessment of the Jordan River and its main tributaries. The aim of the project was to couple water quality with biological data into a holistic monitoring scheme. This project was in cooperation with the Nature and Parks Authority and the Ministry of Environmental Protection.
- Biological assessment of the Ashalim stream industrial wastewater spill. The 3rd year of monitoring the impact of a wastewater spill on the aquatic ecosystem of Wadi Ashalim (Judean desert). The project was supported by HaMaarag.
- *Biological assessment of the ecological impact of stream wading in nature reserves.* The project was supported by the Nature and Parks Authority.
- *Biological assessment of the impact of cattle grazing in streams*. The project was supported by the Nature and Parks Authority.
- *Biological assessment of the impact of approved wastewater discharge into streams.* The project was supported by the Israel Water Authority.
- Making a taxonomic key of the local aquatic insects using compiled data and identifying endemic species using genetic tools. In collaboration with the Molecular Systematics Laboratory at the SMNH.
- Contribution to the "Israel Red List of Invertebrates and Reptiles" in cooperation with HaMaarag and the Entomology Laboratory for Applied Ecology at the SMNH.

Scientific collaborations

• Ongoing collaboration with the Aquatic Ecology Department at the University of Duisburg-Essen, Germany.

- Collaboration with the Department of Pesticides and Pest Control on environmentally friendly measures of mosquito control.
- Ongoing collaboration with the Soil Erosion Research Station, the Ministry of Agriculture and Rural Development on long-term monitoring of the Kishon River.
- Collaboration with the Department of Water, Sewage and Streams, Ministry of Environmental Protection, on national monitoring of streams in Israel.

Field trips

Field research and data collection conducted in the following:

- Lower Jordan watershed on 15.1.2020, 14.5.2020, 29-30.6.2020, 23.9.2020.
- Western Galilee watershed on 7-9.6.2020.
- Kishon watershed on 17.5.2020, 24-25.2020.
- Hadera stream on 17.6.2020.
- Yarkon watershed on 31.5-2.6.2020.
- Ein Gedi nature reserve on 13.5.2020, 22.9.2020.
- Ashalim wadi on 7.4.2020

Teaching

• The Integrative-organismal lab: Biomonitoring using aquatic invertebrates. School of Zoology, Tel Aviv University.

Talks and presentations

- *Biological assessment of the Ashalim: 2nd Year*. Ashalim stream meeting. Ha'Maarag, SMNH, 29.1.2020.
- Biological monitoring of streams: Building the knowledge base, assimilating biodiversity considerations in policy and strategy setting. The Ministry of Environmental Protection, Biodiversity Course, SMNH, 21.1.2020. Invited talk.
- *Biological monitoring of streams*. Applied Ecology Course of the Israel Taxonomy Initiative and the Life Sciences Faculty, TAU. Ramat Hanadiv, 24.2.2020. Invited talk.
- Streams, agriculture, ecology and everything in between. Invited talk to the Minister of Agriculture. SMNH, 29.7.2020.



THE ENTOMOLOGY LABORATORY FOR APPLIED ECOLOGY

Gilad Ben Zvi

Arthropods are the most diverse group in terrestrial ecosystems, 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 Mount Hermon in the north to Wadi Ashalim near the southern Dead Sea and Halutza sands in the northwestern Negev. The current lab researches deal with monitoring of arthropod communities around borders between agricultural and natural landscapes and ecological corridors; provide operational recommendations for restoration management following ecological disasters in nature reserves; monitor and eradicate invasive insect species; assess anthropogenic pressure on sensitive ecological systems; coordinate the compilation of the *Red List* of the Israeli endangered invertebrate species and compile the Israeli invasive invertebrate species 'Black List'.

The projects run in collaboration with the Ministry of Environmental Protection, the Ministry of Agriculture & Rural Development, the Israel Nature and Parks Authority (INPA), the Society for the Protection of Nature in Israel, Israel's National Ecosystem Management Assessment Program, Ramat Hanadiv, and the Jewish National Fund (KKL–JNF).

This year we ran 11 research projects, published 10 reports and presented our studies at five conferences in Israel. The lab employs one full-time worker and five part-time workers, a PhD student 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

- INPA: Israel national red list of invertebrates pilot report, 2018–2020. With HaMaarag.
- INPA: The effect of the 2016 wildfire on the arthropod community of Hakfira nature reserve a summary of 2017–2019 sampling data.
- INPA: The effect of the 2016 wildfire on the arthropod community of Hakfira nature reserve a summary of spring 2020 sampling data.
- INPA: Arthropod sampling in Sodom salt marsh.
- INPA: Ecological and hydrological changes and their effect on the arthropod community in Einot Tzukim national park.
- HaMaarag and INPA: The effect of the 2017 pollution event on the arthropod community of Wadi Ashalim a summary of 2018–2019 sampling data.
- INPA: The arthropod community in Lower Wadi Kziv in 2019–2020 a comparison with the community as sampled in 1998–2000. Written with Meir Finkel.

- Ministry of Environment Protection and INPA: Methods and protocols for environment-friendly monitoring and eradication of the Little Fire Ant. Written with Hakfar Hayarok.
- INPA: Protocol for dipping tree-pots in order to eradicate the Little Fire Ant.
- JNF, INPA and Ministry of Environment Protection: Effective protocols and insecticides for the eradication of the Little Fire Ant from plant pots, nurseries and various habitats

Invited lectures

- Bioindicator insects tell the tale of pollution effects and trends in Wadi Ashalin. Wadi Ashalim project conference, March 2020.
- Pollution and recovery in Wadi Ashalim the insect version. Wadi Ashalim project conference, December 2020.
- The effect of the 2016 wildfire on the arthropod community of scrubland and thicket habitats in Hakfira nature reserve a summary of 4 years of monitoring. Hakfira Nature Reserve wildfire project conference, December 2020.
- Arthropods in Wadi Ashalim: pollution impact and ecosystem recovery. Wadi Ashalim bridging meeting, November 2020.
- Go to the ant, researcher: bioindicator insects and pollution in Wadi Ashalim. The Israeli Entomological Society conference, October 2020.



HAMAARAG — ISRAEL'S NATIONAL NATURE ASSESSMENT PROGRAM

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 2019-2020

State of Nature report

The State of Nature in Israel report 2021 is due to be published in October 2021. The report includes analysis of the four first monitoring cycles of The National Program for Terrestrial Biodiversity Monitoring, an updated high resolution land cover map, and additional chapters.

Israel National Ecosystem Assessment – Final report

The final report of the Israel National Ecosystem Assessment, including key findings of a five-year assessment and over 1,000 pages of full chapters, was completed and due to be published in the first trimester of 2021. The project aimed to increase the awareness of Israel's dependence on functioning ecosystems and their multi-dimensional value. In addition, it would produce a know-ledge 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 will include a summering synthesis of the hall project results and a trends table of the main Nature's goods and services.

The National Program for Terrestrial Biodiversity Monitoring

We started the fifth monitoring 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 occur to them. The program monitors the flora and fauna in Israel on a regular basis through field surveys, surveillance cameras and sensors. A pilot for vegetation remote sensing has started in 2020 fall and is due to end during the winter of 2021.

Evrona Nature Reserve Ecosystem Monitoring Program

The fifth year of the-five year monitoring program was nearing completion. The program assesses the effects of the oil spill in Evrona Nature Reserve, and an interim report was submitted to the Nature and Parks Authority. Considering rehabilitation that was conducted in the reserve in the past year, HaMaarag was in the process of building a follow-up plan for monitoring, with an emphasis on examining the impact of the rehabilitation effort on the ecosystem.

Ashalim Stream Ecosystem Montoring 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 Judean Desert in summer 2017. The Nature and Parks Authority appointed HaMaarag to develop, coordinate, monitor and analyze a five-year assessment of ecological consequences of the leakage, and naturally occurring rehabilitation processes within the ecosystem. We designed and developed a monitoring program and completed the third monitoring year. Reports of the findings of the monitoring program were submitted by HaMaarag to the State Attorney's Office as part of the mediation process conducted against the polluters. Representatives of HaMaarag and researchers from the monitoring program presented the findings at the gathering of the parties as part of the mediation mechanism.

National Biodiversity Index

As part of the development of quality of life metrics that the Central Bureau of Statistics, Ha-Maarag was tasked by the Ministry of the Environment to develop an index that would assess the biodiversity in Israel. The index was accepted and published by the Ministry of the Environment and the Central Bureau of Statistics.

Arthropods Red Book

A national monitoring system was built with the aim of identifying long-term trends in the composition of arthropod communities, and of using insects as bio-indicators of the effects of changes in sensitive ecosystems in Israel. A pilot project in two sampling systems (Malaise-trap and Insect mobile) was successfully carried out during the autumn. In an attempt to assess the threat levels of arthropods, assessments were so far carried out for 20 species and were completed for all of Israel's butterflies (147 species).

Ecological Corridors

Animal use of 'bottlenecks' constitutes part of a plan to grant statutory status to ecological corridors in the Central District. In light of discussions in the Central District Planning Committee regarding the statutory status of ecological corridors in the district, HaMaarag was tasked to examine the use of these corridors by animals, as a basis for a long-term monitoring program. A concluding report was submitted to RTG in January 2020.

Conferences

- January 2020 Ashalim Stream Ecosystem Montoring Program. A full day seminar conducted by HaMaarag at the Steinhardt Museum of Natural History.
- January 2020 Deshe online seminar. *Ecological corridors*.
- November 2020 Dead Sea annual conference. Evidence for a multi-layer ecosystem damage in the polluted Ashalim desert channel.
- September 2020 Evrona Nature Reserve Ecosystem Monitoring Program. A full day seminar conducted by HaMaarag at the Steinhardt Museum of Natural History.



THE OPEN LANDSCAPE INSTITUTE

Uri Ramon, Amir Perelberg, Aviv Avisar

This was the fourth year of the Institute operation under the Steinhardt Museum of Natural History, Tel-Aviv University. In the last year, our ties with the Museum staff and our colleagues in the applied science wing strengthened. A new initiative to collaborate in improving access and understanding of our work in wider circles started towards the end of the reporting year. We hope to improve our performance in these fields next year.

Overview of activities during 2019-2020

Streams restoration is an extensive project of tools development for eco-hydrological restoration of streams, developed over the last two years in cooperation with drainage and streams authorities. *Nature and Landscape Surveys* were carried out in the following regions: Yizreel Valley, Eshkol Regional Council (Western Negev), Be'eri forest, the Jewish National Fund (KKL-JNF) upgrade of the forests survey system (a pilot study in three forests: Biria, Adulam and Carmon), Yatir to Judea desert highland ecological corridor, Golan Heights (ecological background for a strategic plan). Nationwide surveys were conducted: *Protected nature assets in KKL-JNF forests* and *Endangered sub-endemic and very rare plant species*.

The Open Landscape Institute (OLI) is a partner in development and implementation of methodology in the following fields: Nature-based solutions for streams restoration; Analyzing regulatory barriers to reducing light pollution in Israel; Agro-ecology — Incorporating biodiversity friendly management practices in avocado orchards (including an ecological restoration pilot project at orchard margins and endangered plants species reintroduction); Implementation of ecological principles in vineyards management at Barkan Winery, removal of obstacles that hinder passage along national ecological corridors was planned as part of this project; Guidebook for integrating ecological consultants and ecological products into various planning schemes of the Ministry of Construction and Housing; Visitor management program for the eastern channel of the Jordan (the program integrated the ecological, touristic and agricultural needs of the stakeholders in the region); Improving the assessment of ecological valence of natural, forested and agricultural landscapes; Developing monitoring programs with professionals from HaMaarag and the Israel Nature and Parks Authority (INPA); 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. The Corona pandemic posed serious administrative difficulties, mostly due to national restrictions on travelling, which complicated our fieldwork, and due to human resources cut-offs, which forced us to release some of our employees for vacation. Fortunately, we eventually managed to complete most of our projects with minor delays. The pandemic also posed serious threats for funding of future projects, as most of our partners faced severe budget cuts and there is no government budget for 2021 yet.

- 2. Strengthening and expanding activity in fields defined within the Institute's core practices:
 - 2.1. Ecological and landscape background for planning conducting and developing methodology for nature, landscape and human heritage surveys.
 - 2.2. Agriculture and environment developing knowledge, expanding dialog circles, supporting professional and public processes. Goat grazing was the main field investigated within this context.
 - 2.3. Botanical surveys developing methods and tools like field guides for practitioners from different sectors and organizations.
 - 2.4. Restoration Ecology developing the knowledge of the field and implementing it in agriculture, water management, planning and development practices.
- 3. Expanding and assimilating of our products among various target audiences:

- 3.1. Developing tools for disseminating knowledge: workshops, lectures for planners and university students in relevant fields, instructors and more.
- 3.2. Increasing professional and public exposure of the accumulated knowledge: A new enhanced website was initiated this year (http://www.deshe.org.il).
- 4. Strengthening connections and expanding collaboration with the partner organizations in the Steinhardt Museum of Natural History and other colleagues.
- 5. 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 2019/2020 – Nature and Landscape Surveys

Yizre'el Valley

The Yizre'el Valley regional council 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 a detailed background and a database to support the planning process, and an improved database for policymakers. A draft report was submitted for comments.

Eshkol regional council county (Western Negev)

The Eshkol regional council is undergoing a detailed regional planning process. This is an area with distinctive characteristics: its northern part 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 a detailed background to support the planning process, and an improved database for policymakers. A draft report was submitted for comments.

Yatir to Judea desert highland ecological corridor

The 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 provide missing information required for this plan, in the area between Mt. Amasa nature reserve to the Judea desert nature reserve. A draft report was submitted for comments.

Be'eri forest

KKL-JNF is preparing a master plan for the Be'eri forest (Western Negev). The area is a mosaic of planted forests, natural habitats and agricultural landscapes, in a mixture of sandy patches, Kurkar sandstone ridges and loess plains — all are endangered ecosystems in Israel, which are also underrepresented in protected areas. The survey is meant to provide a detailed background and database to support the planning process. A draft report was in preparation.

Ecological background for a strategic plan in the Golan Heights

The Israel Land Authority, together with the Regional Council Golan, are preparing a strategic plan for development of the Golan Heights. The project is meant to collect data from existing resources, analyze them, and provide a detailed background to support the planning process, and an improved database for policymakers. A draft report was in preparation.

KKL-JNF upgrade of the forests survey system (a pilot study in three forests: Biria, Adulam and Carmon)

KKL-JNF began a process of unifying and standardizing its national forest surveys, based on the recently approved forest management policy. The process includes four main stages: pre-survey database update, forest condition general field survey, post-survey database update, and pre-thinning detailed field survey. Three forests were selected for the pilot study, one in each KKL-JNF administrative regions: Biria forest (North region), Adulam forest (Center region) and Carmon forest (South region). The first stage of the survey was completed and a report was submitted. The survey should continue next year and get completed by the end of 2021.

Protected nature assets in KKL-JNF forests

Thinning of forests is the most important and significant maintenance activity in the Israeli planted forests, and is essential for healthy and proper development of trees, for the natural regeneration of the forest undergrowth, and for increasing of the plant diversity. In addition, thinning of forests may be an important tool for nurturing and encouraging the general biodiversity—including legally protected species—in forests in the long run. For example, according to studies carried out in the KKL-JNF forests in recent years, there has been a significant increase in the 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 certain species may occur during the thinning process in the forest. The aims of this study are to develop protocols for ecological surveys in the KKL-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. The first stage of this survey was completed and an annual report was submitted. The survey should continue for two more years and get completed by the end of 2022.

Endangered sub-endemic and very rare plant species survey

As part of Israel's global commitment to protect endangered species, the INPA prepared a multiannual plan to survey the endangered plants of Israel. The survey of the endemic species was completed in 2018, and since 2019 the survey focuses on: (1) sub-endemic species; (2) very rare species; (3) rare species in strong decline; and (4) newly added species to the endangered list with insufficient data. In addition, the 2020 survey focused also on one endangered plants habitat: heavy soils (in the southern Golan heights, the Lower Galilee and the Judean Lowland), and on one hotspot of endangered plants: Mt. Keta (Hermon Ridge). A draft report was submitted for comments. The future of this survey next year is uncertain, due to the INPA's severe budget cuts.

Plans for 2020/2021 - 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 use of highresolution aerial photographs in the monitoring process, in the next region planned for the autumn of 2020: Mediterranean maquis and Negev highlands. Monitoring plans for 2021 are not clear yet.

Protected nature assets in KKL-JNF forests

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. This study aims to develop protocols for ecological surveys in 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. The project is planned for three years (2019/20–2021/22) and is running into its second year (2020–2021).

KKL-JNF upgrade of the forests survey system (a pilot study in three forests: Biria, Adulam and Carmon)

KKL-JNF began a process of unifying and standardizing its national forest surveys, based on the recently approved forest management policy. First stage of the survey in three pilot forests: Biria (North region), Adulam (Center region), and Carmon (South region). was completed in 2020, and stages 2-4 should continue next year and get completed by the end of 2021.

Surveys and projects not yet approved

Hof HaCarmel coastal area survey, North-Western Galilee forests survey, Mashabim-Shunra sands (North Negev) survey, Wild Relatives of Crop vegetation survey, Endangered sub-endemic and very rare plant species survey, Assimilation and guidance of the new KKL-JNF forests survey system to KKL-JNF staff and surveyors.

Tools Development and Research – Detailed Report for 2019–2020

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 and the data collected is used in a strategic plan for open landscapes conservation. However, we did not manage to locate funds to expand this project further.

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". We have formulated future recommendations to promote legislation in the field. Further elaboration on this part needs extended resources.

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 for about 2500 ha of avocado plantations. As part of the project, three pilot studies 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 (further details below).

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

This is a literature review on the means of managing travellers in Israel and abroad. After a discussion with different stakeholders, a final report was published in February 2020.

Economic and planning models for incentive and management of goat pastures

Reduction and combusting material and maintaining buffer lines against fires. A final report was delivered to the KKL-JNF staff and was published in the OLI Website.

A master plan for goat grazing in the Carmel and Misgav areas

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

Agricultural practices supporting biodiversity in Megido regional council

Implementation of the Integrated Pest Management agro-principles in agriculture practice the Megido regional council.

Nationwide ecological background development for national planning

With partners from other environmental organizations and agencies, we collect information and map biodiversity in order to create information layers, which will enable incorporation of ecological knowledge into national planning.

1. Project: Research and strategy for the optimal management of open land spaces. Implementation of ecological principles for growing vines at 'Barkan' Winery.

The project is under "Biodiversity in Business" from the Society for the Protection of Nature, the Ministry of Environmental Protection and the Israel Nature and Parks Authority auspices. Barkan Winery controls about 10,000 dunams (1000 ha) of vineyards from the Upper Galilee in the north to Mitzpe Ramon in the south, in the Jerusalem Mountains and the Judean plain. We are starting the implementation of two pilot studies aimed at examining the return of the endangered species Giant Golden-drop (Onosma gigantea) at vineyards margine, in three different sites. We also work on the removal of approximately 2,200 m of fences blocking the national ecological corridor in

the Jerusalem Mountains area (Beit Nekofa area) for the declining Gazella gazella populations. We are also at the process of compiling work protocols on significant issues of biodiversity, which will help implement better work procedures for all Barkan vineyards. Topics of the protocols are (1) restoration and management of field margins of various types (stream edges, buffer with natural area, edges of roads and fences), (2) establishment of a new vineyard, and (3) cover crops.

2. Project: Avocado plantations in Milopri – Phase II

In Phase I, which was covered in the previous report, we prepared the agro-ecological guidelines and carried out pilot studies to test the suitability of the various ecological interfaces for farmers' needs. In the second phase we invested in:

- Rating of all avocado plots according to importance for maintaining ecological connectivity at the local and national level.
- Margins mapping each plot got restoration plan that includes removal of waste (asbestos, agricultural waste and construction waste), treatment for invasive species (according to species and densities), endangered vegetation, and restoration of a buffer strip in the river (in an attempt to reduce pesticide and soil erosion to streams).
- Completion of the construction of another endangered plant shelter in light soils (in addition to existing 3 sanctuaries). In addition, we made an attempt to plant rare species along the edges of agricultural lands in Kabri and Ein Hamifratz. Through this experiment, we try to understand better the extent of the survival rate of rare plants in the agricultural environment.

In collaboration with Tel Aviv University and the Ministry of Agriculture, we have joined the Respiratory Initiative, and collect and zoologically define bumps in order to get a better picture of the diversity of small vertebrates around avocado plots.

Streams eco-hydrological restoration

1. Research: Vegetation as a tool for stabilizing streams and drainage canals

- Literature survey and discussion of the advantages and disadvantages of plant stabilization compared to rigid stabilization.
- A toolbox for decision-making for the Drainage and Streams Authority and operational tools for successful implementation of active rehabilitation using vegetation, compared to spontaneous rehabilitation.
- Case studies and statistical analysis of information collected in 86 plant transects in 17 different streams. We collected information on the bank restoration and maintenance and conducted a field survey to map the plant assemblage and the level of stabilization of the bank.

2. Project: 'Iron' stream planning - Case Study Insights

The purpose of the project is to provide an insight into planning and decision-making processes when planning the restoration of a stream. We focused on a test case of the 'Ein Shemer' section in Nahal Iron with the Sharon Drainage and Streams Authority.

As part of the project, we have mapped the decision-making and basic assumptions that are taken into account at each junction, defining the institutional, organizational and perceptual background that influences planning products, and pointing to barriers, knowledge gaps and thinking habits that make planning eco-hydrological. Finally, a preliminary model is also proposed for similar moves in other streams in the future.

3. Research: Israel's streams under climate change – implications and recommendations for action

The aim of the study—the first of its kind in Israel—is to gather existing knowledge from Israel and the world, to analyze and map knowledge gaps and ways to mitigate the expected change in aquatic habitats during the anticipated climate change in the Middle East. The outcome will be presented as a report detailing the expected changes to springs and streams in various warming scenarios of the Intergovernmental Panel on Climate Change, and as a list of concrete medium-and long-term policy and action recommendations for the public sector decision-makers.

4. Research: Examining the interface of reed in streams and agricultural areas

We seek to map the ecological niche characteristics of the reed in the Ekeon basin in order to understand the preferred growing conditions for the plant, and, consequently, to offer management measures to control the reed extension in a form of best combinations of the ecosystem services such as proper drainage, recreation along streams and aquatic and terrestrial biodiversity.



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Books/Chapters in Books

- 1. Bar-Yosef Mayer, D.E. (2020) Shell Beads of the Middle and Upper Palaeolithic: A review of the earliest record. *In*: Mărgărit, M. & Boroneanț, A. (Eds), *Beauty and the Eye of the Beholder: Personal adornments across the millennia*. Cetatea de scaun, Târgoviște, pp. 11-25.
- 2. Belmaker, J., Abelson, A., Haddas-Sasson, M., Yamaguchi, N., Shefer, S. & Geffen, E. (In press) Potential pitfalls in the definition of Lessepsian migrants: The case of *Brachidontes*. *In*: Jawad, L.A. (Ed.), *The Arabian seas: Biodiversity, environmental challenges and conservation measures*. Springer, Cham. https://doi.org/10.1007/978-3-030-51506-5_62
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- 8. Paz, U. &. Yom-Tov, Y. (2019) *The Nubian ibex in Israel*. Dan Pery, Jerusalem. 120 pp. [in Hebrew]
- 9. Pines, M. & Sapir-Hen, L. (2020) The animal economy of Byzantine Sozousa and its immediate hinterland (areas M, O, AA1 and CC). *In*: Tal, O. (Ed.), *Apollonia-Arsuf final report of the excavations, II. Excavations outside the Medieval town walls.* Monograph 38. Tel Aviv University & Sonia and Marco Nadler Institute of Archaeology, pp. 305-320.
- Rittner, O. & Mienis, H.K. (2020) Mollusc remains (Areas AA-DD). In: Tal, O. (Ed.), Apollonia-Arsuf final report of the excavations, II. Excavations outside the Medieval town walls. Monograph 38. Tel Aviv University & Sonia and Marco Nadler Institute of Archaeology, pp. 321-338.
- 11. Sapir-Hen, L. (In press) The Late Bronze animal economy. *In*: Finkelstein, I., Martin, M. & Adams, M.J. (Eds), *Megiddo VI: the 2010-2014 Seasons*. Sonia and Marco Nadler Institute of Archaeology, Tel Aviv.
- 12. Yefremova, Z.A., Viggiani, G., Ghahari, H., Gibson, G.A.P. & Doğanlar, M. (2020) Eulophidae. *In*: Book Ghahari H., Gibson G., Viggiani G. (Eds), *Chalcidoidea of Iran*. Wallingford, UK, pp. 1-88.
- 13. Yom-Tov, Y. (2020) Wildlife in human settlements. Dan Pery, Jerusalem. 167 pp. [in Hebrew]

Papers presented at scientific meetings

- 2019 Filling the gap: reconstructing consumption habits of Jerusalem's Persian and Early Hellenistic. *Society of Biblical Literature Annual Meeting*. 23-26 November 2019, San Diego, USA (Sapir-Hen L.)
- 2019 Rich and poor, secular and holy: the animal economy of Iron Age II Jerusalem. Society of Biblical Literature Annual Meeting. 23-26 November 2019, San Diego, USA (Sapir-Hen L.)
- 2019 Animal Studies and the Bible / Ecological Hermeneutics. Society of Biblical Literature Annual Meeting. 23-26 November 2019, San Diego, USA (Sapir-Hen L., chair)
- 2019 Nature imagery and conceptions of nature in the Bible. Society of Biblical Literature Annual Meeting. 23-26 November 2019, San Diego, USA (Sapir-Hen L., respondent)
- 2019 The acra and the slaughterhouse: faunal remains from Hellenistic Jerusalem. *The American Schools of Oriental Research Annual Meeting*. 21-23 November 2019, San Diego, USA (Sapir-Hen L.)
- 2019 Pigs in Iron Age Jerusalem. *The American Schools of Oriental Research Annual Meeting*. 21-23 November 2019, San Diego, USA (Sapir-Hen L.)
- 2019 A new record of recent brachiopods: digitizing the National Natural History Collections, the Hebrew University of Jerusalem. *In*: Raes, N. & Banki, O. (Eds), SS77 - *Digital biodiversity data as a frontier for new research avenues. Biodiversity Information Science and Standards*, 3, Abs. e37451 (Leshno Afriat Y., Mienis H.K.) https://doi.org/10.3897/biss.3.37451
- 2019 Delineating probable sea routes between Cyprus and its surrounding coastal areas at the start of the Holocene: A simulation approach. Kickoff meeting. 4 November 2019, Limassol, Cyprus. (Bar-Yosef Mayer D.E.)
- 2019 The Stone beads of Nahal Hemar Cave. *Neo-Lithics*. 12-16 November 2019, University of Tokyo, Japan. (Bar-Yosef Mayer D.E.)
- 2019 Safety and suitability of the seed-feeding weevil *Melanterius compactus* for biological control of *Acacia saligna* in Israel. *Acacia in the Arava Past, present & future 5th conference.* 6 November 2019, Hazeva, Israel. (Dorchin N.)
- 2019 Evolution of feeding modes and diversification rates in the mega-diverse gall midges (Diptera: Cecidomyiidae). 1st meeting of the Israeli Society for Evolutionary Biology. 11-12 December 2019, Tel Aviv, Israel. (Dorchin N.)
- 2020 Modeling drift-induced maritime connectivity between Cyprus and its surrounding coastal areas during early Holocene. *EGU General Assembly*. 4-8 May 2020, online. (poster; Bar-Yosef Mayer D.E. *et al.*) https://doi.org/10.5194/egusphere-egu2020-19782
- 2020 Tectono-paleomagnetic mapping of transition zones from ocean to continent (on example of the Eastern Mediterranean). *Transactions of the 15th EUG Meeting, Vienna, Austria. Geophysical Research Abstracts*, 22, EGU2020-2049. (Eppelbaum, L.V., Katz Yu.I.)
- 2020 Herbivory is associated with increased speciation rates in the mega-diverse gall midges. 9th ILANIT/FISEB conference (Federation of the Israeli Societies for Experimental Biology). 17-18 Feb 2020, Eilat, Israel. (Dorchin N.)



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 <i>Graphipterus serrator</i> group (Coleoptera:
	Carabidae: Lebiinae).
2012-2020	Einat Shachar (N. Dorchin)
	Taxonomy and ecology of oak gall wasps in Israel (Hymenoptera: Cynipidae).
2013-	Roi Maor (T. Davan)
	The evolution of activity patterns in mammals: a macroevolutionary and
	macroecological approach.
2013-	Aviv Avisar (T. Davan)
	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.
2014-	Tali Magoty Cohen (R. Dor)
	Ecology and genetics of a recent avian invasive species in Israel.
2015-	Daniel Berkowic (R. Dor, N. Sapir and Y. Leshem)
	Movement ecology of overwintering black kites (<i>Milvus migrans</i>) 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 osteoarthrithis of the knee.
2015—	Corrine Jacobs (R. Holzman)
	Broad scale patterns in the evolution of teleost suction feeding.
2015-	Erez Shoham (Y. Benayahu)
2011	Mesophotic octocorals of Eilat, northern Red Sea.
2016—	Ruth Kallevag (H. May)
	Changes in lumbar intervertebral discs characteristics with the development of
2017	lumbar spinal curvature.
2016-	Andressa Duran (S. Meiri and D. Chapple)
2017	Lizard macroecology.
2016-	Un Frid (J. Belmaker)
2016	The Corgon (M. Shonkar)
2010-	Idi Guiguii (N. Shenkdi) Polycarna mytiliaara as a model organism for regenerative studies
2016	rolycurpu mythigeru as a model organism for regenerative studies.
2010-	Fouling communities along Moditorrangan and Pod sea coasts
	י טענווא כטווווועווונופי מנטוא אפטונפורמוופמון מווט גפט גפמ נטמצנג.

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
2016—	Renanel Pickholtz (J. Belmaker) Stress and movement patterns of fishes.
2016—	Lilah Raijman (M. Ilan) Red Sea mesophotic sponges.
2016—	Svetalana 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.
2016–2020	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.
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 (<i>Batocera rufomaculata</i>): 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 Tinshemet Cave
2018—	Hadas Avni-Levine (H. May) The impact of incompatibility between the shape of the proximal femur and the
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)
2018	Sarah Obayan (L. Balmakor)
2010-	Wideband acoustic methods for estimating fish spillover distance from Marine
	Protected Area
2018-	Shahar Chaikin (1 Belmaker)
2010	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.
2019—	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.
2019—	Linoy Namdar (L. Sapir-Hen)
	Villagers of the Islamic and Ottoman periods.

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, Hypopthathmichthys molitrix.
2016—	David David (S. Meiri and S. Gafny)
	Captive breeding and the conservation of <i>Pelobates syriacus</i> .
2016-	Tal Gavriely (J. Belmaker)
	Fish movement ecology.
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, lernning 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—	E. Ben-Dor Cohen (M. Ilan and O. Yarden)

	Mesophotic sponge associated fungi.
2017—	R. Moskovich (M. Ilan and G. Yahel)
2017_	Adva Olga Peretz (S. Meiri and N. Marom)
2017	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
2017_	Lior Bentor (T. Davan)
2017-	The ecological role of riparian corridors in agricultural landscape: the macroinver-
	tebrate 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
2040	Upper Jordan River.
2018—	Daphna Shapiro Goldberg (J. Belmaker)
	rivilatus in the eastern Mediterranean Sea
2018-	Liron Kraushar (J. Belmaker and R. Holzman)
2010	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 A. 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.
2019	the 'self-domestication' theories.
2010-	Distribution of rentiles and mammals in Israel and beyond
2018—	Liat Dror (S. Meiri and N. Kronfeld-Schor)
2010	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).
2018–2020	Elijah Kolin (L. Sapir-Hen)
	The animal economy of a border town: Iron Age II and Persian Period faunal
2010_	Terrialins from tel Azekan. Diana Medellin Martinez (D. Langgut and O. Sergev)
2017-	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)
2010	Functional diversity of Red Sea fishes.
2019-	Teeth: An ideal model to study microstructural sexual dimorphism
2019—	Itai Namir (1. Belmaker and Δ . Bar Massada)
2017	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)
2040	Biohistory of the early chalcolithic population from Ein Asawir.
2019—	Yulia Makoviychuk (H. May) Wha are the people from Nabal Varmut? A Propettory Neolithic Picita
2010	Zohar Afok (T. Davan)
2019-	Population dynamics of rare butterfly species (Lenidoptera)
2019—	Yulia Gordover (I Sapir-Hen)
2017	Human-animal relationship in Middle Pre-Pottery Neolithic B Fin Miri.
2019—	Omer Segal (N. Dorchin)
	Biological control of Acacia saligna in Israel with the seed-feeding beetle
	Melanterius castaneus.
2019—	Ella Fishman (N. Dorchin)
	Taxonomy and life history of fireflies (Lampyridae) in Israel and a possible effect
	of light pollution on their populations.
2020—	Alol Dor (D. Langgut and F. Ben-Ami)
	Freshwater molluscs as indicators for paleoenvironmental reconstruction: Jordan
	River Dureijat as a case study.

Post-doctoral fellows

2015—	Guy Sion, Laterality in gecko brains – relationships with behaviour and morphology.
2014—	Liat Koch, Characterising larval starvation using hypothalamic appetite-stimulating neuropeptides.
2016—	Tatiana Tunis-Sella, 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—	Iris Bernstein, Ecological tools and their applications for integrating biodiversity aspects in land-use planning.
2016—	Ronit Justo-Hanani, Understanding ecological policy innovation in the EU: science and politics in the new bio-invasion legislation and management reform.
2018—	Marco Antonio Ribeiro Junior, Species-complexes of cryptic taxa widely distributed in Eastern Europe, Western Asia and Northern Africa (Western Paleartic lizards).
2018—	Gal Eyal, Comprehensive and taxonomical study of the mesophotic coral fauna from the Gulf of Eilat/Agaba.
2018—	Or Givan, The Morphological trait structure of nonindigenous fishes in the Mediter- ranean.
2018—	Yonatan Meresman, Functional morphology of insect wings.
2018–2020	Zohar Yanai, Mayfly (Ephemeroptera) diversity of Israel.
2019—	Shira Penner Rosenvasser, Taxonomy of Trigonella and Medicago (Fabaceae).
2040 2020	

2019–2020 Maya Saar, Novel management methods for pest ants.

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 2019–2020. The Covid-19 restrictions adversely affected our ability to acommodate visitors. Much use was made of the collections by other scientists, who did not visit our premises 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
2019/09	Federica Montesanto	University of Bari	Italy	Ascidia
2019/09	Michael Blecher	Nature and Parks Authority	Israel	Insects
2019/09	Irene Blecher	Dead Sea and Arava Science Center	Israel	Insects
2019/10	Harding Sierra	Haifa University	Israel	Mammals
2019/10	Natalia Kolesova	Vologda State Univ.	Russia	Insects
2019/11-12	Linda Amos	University of Liverpool	UK	Birds
2019/12	Yosef Kiat	Haifa University	Israel	Birds
2019/12	V. Kobanina	Darwin Museum	Russia	Tetrapods
2019/12	Shada Kaidbeh	Tel Aviv University	Israel	Tetrapods
2019-2020	S. Vaisman	Plant Protection and Inspection Services	Israel	Mollusca
2020/01	Asaf Ben David	Tel Aviv University	Israel	Birds
2020/01	Shlomit Liphshiz	Tel Aviv University	Israel	Birds
2020/01	David Eilam	Tel Aviv University	Israel	Birds
2020/01	Abra Spiciarich	Tel Aviv University	Israel	Mammals & birds
2020/01	Mark Volkovitsch	Zoological Institute	Russia	Insects
2020/01	Yehiam Shlesinger	Elat	Israel	Marine biology
2020/01	Lynne Schepartz	University of the Witwatersrand	South Africa	Paleoanthropology
2020/02	Thorsten Assman	Institute of Ecology, Lueneburg University	Germany	Insects
2020/02	Dorit Sivan	Haifa University	Israel	Marine geomorphology
2020/02	Adi Almakaes	Private	Israel	Birds
2020/02	Dorit Sivan	University of Haifa	Israel	Molluscs
2020/04	Avi Shmida	Hebrew University of Jerusalem	Israel	Insects
2020/05	Sigal Abramovich	Ben Gurion University	Israel	Paleontology

Date	Name	Institute	Country	Expertise
2020/06	Harold Salant	Privaat	Israel	Insects
2020/06	Gaya Kolman	Private	Israel	Birds
2020/06	Guy Zer	Tel Aviv University	Israel	Birds
2020/07	Hagar Reshef	Haifa University	Israel	Mammals & birds
2020/07,09	Ma'ayan Lev	Haifa University	Israel	Reptiles
2020/08	Rafi Yavetz	Haifa University	Israel	Cnidaria
2020/08	Yael Lampert	Haifa University	Israel	Cnidaria
2020/08	Dalit Meron	Haifa University	Israel	Cnidaria
2020/08	Magori Tali	Tel Aviv University	Israel	Mammals
2020	Ornea Reismann- Berman	The open University	Israel	Plants



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
Pollination ecology	A. Dag	Bar-Ilan University	Insects (Hymenoptera)
Behavioral ecology of pollination	Sh. Shafir	Hebrew Univ. of Jerusalem	Insects (Hymenoptera)
Marine invertebrates	N. Shenkar	Tel Aviv University	Marine invertebrates
General botany	Y. Sapir	Levinsky College of Education	Plants
Introduction to plant science	Y. Sapir	Levinsky College of Education	Plants
Unique botanical phenomena	Y. Sapir	Levinsky College of Education	Plants
Review of biology in high schools	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
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-Hen	Tel Aviv University	Mammals, birds, archaeozoology
Practical workshop in archaeozoology	L. Sapir-Hen	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	Th. Assmann	University of Lüneburg, Germany	Insects
Loan	J. Yamasako	Institute for Agro-Environmental Sciences, Japan	Insects
Loan	J. Skevington	Canadian National Collection of Insects, Canada	Insects
Loan	M. Schwarz	Private, Austria	Insects
Loan	A. Ebmer	Private, Austria	Insects
Loan	F.V. Vencl	University Stony Brook, USA	Insects
Loan	H. Kippenberg	Private, Germany	Insects
Loan	S. Roth	University Museum of Bergen, Norway	Insects
Loan	A. Mueller	Private, Switzerland	Insects
Loan	M. Terzo	University of Mons, Belgium	Insects
Loan	M. Kuhlmann	Kiel University, Germany	Insects
Loan	H. Dathe	Deutsches Entomologisches Institut, Germany	Insects
Loan	A. Pauly	Institut royal des Sciences naturelles de Belgique, Belgium	Insects
Loan	J. Straka	Charles University in Prague, Czech Republic	Insects
Loan	Th. Wood	University of Mons, Belgium	Insects
Loan	Yu.M. Marusik	University of Turku, Finland	Spiders
Gift	B. Korotyaev	Zoological Institute, Russia	Insects
Loan	A. Gorczalzany	Israel Antiquities Authority	Birds
Loan	D. Gecht	Haifa University, Israel	Amber
Loan	N. Sheftelovitz	Tel Aviv University, Israel	Molluscs
Loan	L. Sapir-Hen	SMNH, Israel	Mammals
Loan	S. Goldberg	Whittier College, USA	Reptiles
Loan	L. D'Alba	Ghent University, Belgium	Reptiles
Loan	Sh. Barkan	Bar Ilan University, Israel	Mammals/Birds
Loan	G. Sinaiko	Tel Aviv University, Israel	Reptiles
Loan	G. Ribak	Tel Aviv University, Israel	Birds
Loan	S. Asaf	Tel Aviv University, Israel	Mammals
Loan	M. Zytzove-Raz	Tel Aviv University, Israel	Mammals
Loan	K. Hasin	Private	Tetrapoda

Purpose	Name	Institute	Taxonomic group
Loan	Ben-David Asaf	Tel Aviv University, Israel	Tetrapoda
Tissue sample	J. Smid	National Museum in Prague, Czech Republic	Reptiles
Tissue sample	T. Karin	Tel Aviv University, Israel	Reptiles
Tissue sample	R. Melfi	University of Palermo, Italy	Reptiles
Tissue sample	A. Barash	Tel Aviv University, Israel	Mammals
Identification		IOLR (Mediterranean BOLD project)	Echinodermata
Identification		Marine & Environmental Research (MER) Lab Ltd., Cyprus	Ascidia
Identification	L. Gidron	Plant Protection and Inspection Services, Israel	Insects
Identification	M. Maor	Plant Protection and Inspection Services, Israel	Insects
Identification	V. Soroker	Volcani Center	Insects
Identification	C. Herold	Entomology Lab for Applied Ecology, SMNH, Israel	Insects
Identification	M. Finkel	Nahal Keziv Project	Insects
Identification	Y. Hershkovitz	Israel National Center for Aquatic Ecology, SMNH, Israel	Insects
Identification	E. Elron	Ecology and Environment, Israel	Insects
Identification	E. Mills	CSA Ocean Sciences Inc., USA	Sponges
Identification	Y. Mandelik	Hebrew University of Jerusalem, Israel	Insects
Identification		BioBee	Insect
Identification		Ministry of Agriculture	Ornamental plants
Data provision	T. Bird	Entomology Lab for Applied Ecology, SMNH, Israel	Insects
Data provision	Brown Stav	Tel Aviv University	Reptilia
Data provision	Sunandan Das	Presidency University	Reptilia
Data provision	Daniel Jablonski	Comenius University in Bratislava	Reptilia
Data provision	Nimrod Marom	Haifa University	Mammals
Data provision	Mila Kazavchinsky	Tel Aviv University	Mammals
Data provision	Shlomo Preiss- Bloom	Tel Aviv University	Mammals
Data provision	Idu Tsurim	Ben-Gurion University	Mammals
Data provision	Drabkin Ariel	Tel Aviv University	Mammals
Data provision	L. Clark	University of California, San Diego, USA	Molluscs