

Annual Report Academic year 2020/2021

The George S. Wise Faculty of Life Sciences

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

Sackler Faculty of Medicine

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- 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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Website: https://smnh.tau.ac.il

For copies please contact: Revital Ben-David-Zaslow +972 (0)3 640 9042 revitbd@tauex.tau.ac.il

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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, Menachem Goren, Alon Sapan (Observers).

INTERNATIONAL SCIENTIFIC ADVISORY BOARD

Gretchen C. Daily, Department of Biology, Stanford University, Stanford, CA, USA; **Jared Diamond**, Department of Geography, University of California, Los Angeles, CA, USA; **Paul Ehrlich**, Department of Biology, Stanford University, Stanford, CA, USA; **Daphne G. Fautin**, Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS, USA; **Marcus W. Feldman**, Department of Biology, Stanford University, Stanford, CA, USA; **Harold A. Mooney**, Department of Biology, 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; **Nancy Knowlton**, Marine Science, Smithsonian 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

OPERATIONS DEPARTMENT

- Adi Katz Shapira Head of Operations
- Doron Ninio Museum maintenance
- $\bullet \ \ \, \text{Andrei Lapicov} \text{Museum maintenance} \\$
- \bullet Lyn Geffen Cohen Museum operations
- Sasha Katsnelson Museum operations
- Orian Oskar Museum operations
- Sivan Bar Lev Museum operations
- Dr Elizabeth (Liz) Morgulis Live Insects display
- Eran Keidar IT Coordinator
- ~30 ushers and cashiers

EDUCATION & SCIENCE COMMUNICATION DEPARTMENT

- Dr Ilil Pratt Head of Education and Science Communication
- Dr Mey-Tal Gewing Manager of Content Development
- Dr Shira Penner Botanical Content Developer
- Inbar Schwartz Belkin Scientific Content Developer
- Dr Yael Navon Furman Online Content Writer
- 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)
- 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 (moths and butterflies)
- Ofir Tomer Collections Manager (moths and 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 Pisanty 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
- Nathan Sharon Volunteer

The Marine & Freshwater Section

Invertebrates

- Prof. Noa Shenkar Curator (ascidians)
- Prof. Micha Ilan Curator (sponges)
- Prof. Frida Ben-Ami Curator (molluscs)
- 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 (molluscs)
- Oz Rittner Collections Manager (molluscs)
- Dr Sigal Shefer Collections Manager (sponges)
- Dr 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 Irit Zohar Curator
- Dr Menachem Goren Curator Emeritus
- Dr Nir Stern Associate Curator (IOLR)
- Dr Bat-Sheva (Shevy) Rothman Collections Manager
- Kfir Gayer Technical Assistant
- Avery Lynne Technical Assistant
- Moty Ginter Volunteer

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, reptiles and amphibians)
- Avigail Ben-Dov Segal Technical Assistant (birds and feathers)
- Arieh Landsman 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 Palaeosciences Section

Palaeontology

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

Biological archaeology

- Dr Dafna Langgut Curator (palynology and archaeobotany)
- Dr Lidar Sapir-Hen Curator (archaeozoology)
- Dr Meirav Meiri Curator and Ancient DNA Lab Manager
- Prof. Miriam Belmaker Associate Curator (archaeozoology; University of Tulsa, OK, USA)

Dan David Center for Human Evolution and Bio-History Research Physical Anthropology

• Prof. Israel Hershkovitz - Director

- Dr Hilla May Curator
- Dr Rachel Sarig Curator
- Dr Viviane Slon Curator
- Prof. Baruch Arensburg Curator Emeritus
- Einat Kedar Administrative Manager
- Julia Makoviychuk Technical Assistant
- Elinor Levi Technical Assistant
- Inesa Efraimov Technical Assistant
- $\bullet \ Liron \ Chavoinik Technical \ Assistant$
- $\bullet \ {\rm Shmuel \ Francis} {\rm Technical \ Assistant} \\$

Molecular Systematics and Tissue Collection

- Prof. Dorothée Huchon Curator
- Dr Tamar Feldstein-Farkash Collections and Molecular Systematics Laboratory Manager

ISRAEL TAXONOMY INITIATIVE

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

Directors:

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

Steering Committee:

- Prof. 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 Yehonathan Bar-Yosef Keren Kayemeth LeIsrael Jewish National Fund
- Dr Doron Markel Keren Kayemeth Lelsrael Jewish National Fund
- Dr Menachem Goren Tel Aviv University
- Prof. Tamar Dayan Tel Aviv University
- Hanoch Ilssar The Rothschild Foundation

Staff

- Dr Yaron Hershkovitz Director
- Tuvia Eshcoly Lab manager
- Noa Zanzuri Administrative Manager
- Naomi Gordon Taxonomy
- Avital Katz Database management
- Etai Kahana Dipteran taxonomy and GIS
- Adi Weiss Taxonomy and Reports
- 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 Tel Aviv University
- Dr Inon Scharf Tel Aviv University

Staff

- Dr Ittai Renan Director
- Gilad Ben Zvi Lab Manager
- $\bullet \ {\rm Orr} \ {\rm Comay} {\rm Red} \ {\rm List} \ {\rm Coordinator}$
- Udi Segev Red List Coordinator
- $\bullet \ {\rm Ariel} \ {\rm Aharonberg} {\rm Technician} \\$
- Ahikam Gera Technician
- Yael Miara Technician
- Itai Namir Technician
- Adi Ramot Technician
- + Ella Fishman MSc Student
- \bullet Carmel Herold MSc Student

HaMaarag – Israel's Nature Assessment Program

HaMaarag Board of Directors:

- Gady Levin, Chair Israel Academy of Sciences and Humanities
- Prof. Tamar Dayan Tel Aviv University
- Dr Yehoshua Shkedy Israel Nature and Parks Authority
- Dr Ittai Renan Tel Aviv University
- 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 Tel Aviv University
- Dr Anna Trajtenbrot Ministry of Environmental Protection
- Dotan Rotem Israel Nature and Parks Authority
- Yahel Porat Keren Kayemeth LeIsrael Jewish National Fund

Staff

- Dr Ron Chen Quantitative Ecology Coordinator
- Dr Rael Horwitz Monitoring Programs Coordinator
- Dr Orr Comay National Red List Coordinator
- Michal Koren Geographic Information System and Cartography Coordinator
- Ido Livne Remote Sensing Coordinator
- Shira Salingré Research Assistant
- Reshef Moria Cartography Coordinator
- 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 Lelsrael Jewish National Fund
- Dr Yehoshua Shkedy Israel Nature and Parks Authority
- Nir Angert Israel Nature and Parks Authority
- Dotan Rotem Israel Nature and Parks Authority
- Asaf Zanzuri 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
- Tamar Raviv 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
- Prof. Tamar Dayan Tel Aviv University
- Alon Sapan Tel Aviv University

Staff

- Uri Ramon Director
- Aviv Avisar Head of the Research Unit
- Noa Zanzuri Administrative Manager
- Dr Liron Amdur Researcher
- Ella Dagon Researcher
- Dana Ginosar Researcher

- Ori Moran Researcher
- Dr Amir Perelberg Head of Survey Unit
- E Einat Gera Survey Coordinator
- Dvora Lev-Ramati Survey Manager
- Amit Mendelson Survey Manager
- Eitan Romem Survey Manager
- Omri Shalev Survey Manager
- Bar Shemesh Survey Manager
- Idan Talmon Survey Manager
- Lior Enmar Surveyor
- Lavi Koren Surveyor
- Miryam Ron Head of Botanical Research
- Dar Ben-Nathan Botanist
- Reut Loria Botanist
- Hila Gil Hotspots Research Coordinator
- Liraz Cabra-Leykin Survey Manager
- Nadav Sade Assimilation and Social visibility
- Evgeny Hemlin GIS Coordinator



MUSEUM SCIENTISTS

Arnon Lotem, School of Zoology, Tel Aviv University

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

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

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

Amir Ayali, School of Zoology, Tel Aviv University

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

David Eilam, School of Zoology, Tel Aviv University

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

Ofir Levy, School of Zoology, Tel Aviv University

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

Takuya Iwamura, School of Zoology, Tel Aviv University

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

Orr Spiegel, School of Zoology, Tel Aviv University

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

Avigdor Abelson, School of Zoology, Tel Aviv University

Avigdor is the academic focal point for the Coral collection.

Inon Scharf, School of Zoology, Tel Aviv University

Inon is the academic expert for the Neuroptera collection.

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

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

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

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

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

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

Joseph Hendler, Department of Art History, Tel Aviv University

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

Eva Yablonka, Cohn Institute of Philosophy, Tel Aviv University

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

PROGRESS AT THE STEINHARDT MUSEUM OF NATURAL HISTORY

COLLECTIONS NEWS

The staff members of the Steinhardt Museum of Natural History (SMNH) continued curation and promotion of our collections. Routine curatorial activities continued to be adversely affected to some extent by the Covid-19 pandemic during the 2020–2021 academic year. Nevertheless, much effort was dedicated to curation 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 2020–2021 academic year, we added over 19,000 new specimens of various taxonomic groups through collecting by our curators and research staff, students and the Israel Nature and Parks Authority, or through donation from private collectors. Almost 30,000 new records were added to the Museum database.

THE ENTOMOLOGY SECTION (INCLUDING ARACHNIDS)

Netta Dorchin, 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 Pisanty, Armin Ionescu, Dany Simon, Tirza Stern, Avi Keysary, Binyamin Shalmon, Amir Weinstein, Yitzhak Nussbaum.

Research and curation

The entomological collections is fully functional in the newly facilities, albeit their constant optimization is an ongoing process co-ordinated by Moshe Guershon assisted by the collections managers. The staff continued expansion of the collection through field work, their collection-based research and provision of services to government agencies, academia and general public.

Arachnida

S Zonstein continued curation of the arachnid collection and his active research into mygalomorph spiders. No new additions and changes in the arachnid orders Acari, Amblypygi, Opiliones, Scorpiones, Solifugae, Pseudoscorpiones and Uropygi were made, but the jars when necessary were re-ordered alphabetically, e.g., for scorpions: Buthidae (*Androctonus, Buthacus, Buthus, Campsobuthus, Hotentotta* and *Orthochirus*), Diplocentridae (*Nebo*), Euscorpionidae (*Euscorpius*) and Scorpionidae (*Scorpio*). Many arachnid groups beside spiders remain to be unsplitted to the genus/ species level. A considerable part of jars with spiders (Araneae) was reordered and replaced, with many new additions to the collection (total; + newly added jars; asterisked are jars that were splitted and identified on the species level):

Infraorder Mygalomorphae: Atypidae (4*; +1), Ctenizidae (1), Cyrtaucheniidae (14*; +5), Dipluridae (2*), Halonoproctidae (1), Idiopidae (1), Nemesiidae (26*; +6), Theraphosidae (15*; +3).

Infraorder Araneomorphae: Agelenidae (18*; +11), Araneidae (28*; +13), Chiracanthiidae (1; yet unsplitted), Cithaeronidae (1*), Clubionidae (1*), Corinnidae (2*; +1), Ctenidae (1*), Cybaeidae (3*; +2), Dictynidae (7*; +2), Dysderidae (6; splitted currently into genera), Eresidae (4*; +2), Filistatidae (25*; +11), Gmaphosidae (87*; +34), Hahnidae (2*), Hersiliidae (3*), Linyphiidae (1;

yet unsplitted), Liocranidae (3*), Lycosidae (17; +2; partially splitted), Mimetidae (1; small family, yet unsplitted), Miturgidae (5*; +2), Mysmenidae (1*; +1), Oecobiidae (8*; +6), Oonopidae (1; small family, yet unsplitted), Oxyopidae (8*; +7), Palpimanidae (2; +1; splitted mostly into genera), Philodromidae (18*; +15), Pholcidae (2; +1; needs further splitting), Phrurolithidae (1*), Phyxelididae (1*; +1), Pisauridae (3*), Salticidae (21; +15; needs further splitting), Scytodidae (6*; +5), Segestriidae (2; +1; needs further splitting), Selenopidae (1*), Sicariidae (1*), Sparassidae (7*; +6), Tetragnathidae (1*), Therediidae (43*; +17), Thomisidae (27*; +11), Titanoecidae (1*), Trachelidae (3*), Uloboridae (1*), Zodariidae (21*; +8), Zoropsidae (2*; +1). In total, there are 462 jars with spiders, with 192 jars added during the reporting period. This work is planned to be entirely completed by the end of 2021–2022 academic year.

The newly designated material in our collection includes the holotypes and paratypes of the following species: *Sahastata weselowskae* Magalhaes, Stockmann, Marusik & Zonstein, 2020; *Sahastata wunderlichi* Magalhaes, Stockmann, Marusik & Zonstein, 2020; *Raveniola mikhailovi* Zonstein, 2021.

Hemiptera

T. Novoselsky received six unit trays of newly collected material, most of which was identified to the genus/species levels and incorporated into the collection. She also continued to sort alcoholpreserved samples, which included some species new to science and/or to the Israeli fauna. She sorted, identified to the species level, databased and re-arranged material of the family Reduviidae (2,707 specimens), and compiled a full list of the Assassin Bug species represented in our collection. She also continued working on final drafts and proofs of her manuscript on the Scutelleridae and Acanthosomatidae. During the reporting period, 12 people used the collections: visits, loans, data requests etc. Tania continued collaborative research with Dr Jing-Fu Tsai, Hokkaido University, Japan, on the taxonomy of the *Elasmucha grisea* complex (Acanthosomatidae) and with Dr Steffen Roth, the Natural History Collections, University Museum of Bergen, Norway, on the DNA barcoding of some species of the family Cimicidae from Israel so that the corresponding sequences were added to the GenBank, with acknowledgment of the SMNH for the specimen loan. Tania was also interviewed by the media about heteropterans occurring along the Israeli seashores.

Coleoptera

Gal Ribak and his group focused their research on flight of Coleoptera, Lepidoptera and Thysanoptera, including collaborations with Prof. Roi Gurka (Carolina University, SC, USA) on the flight of *Batocera rufomaculata* (Cerambycidae) and with Dr Bat-El Pinchasik (Mechanical Engineering, Tel Aviv University) on the aerodynamic and mechanical properties of rose chafer (Scarabaeidae: *Protaetia cuprea*) wings.

L. Friedman moved the major part of the weevil (Curculionoidea) collection to new cabinets and new boxes, permitting to expansion of the collections for other beetle families. The collection of the Scarabaeoidea was rearranged; the newer material sorted, partly identified at least to the genus level and incorporated into the older holdings. The beetles from the collection of Bet Berl Academic College were sorted to families, partly identified and incorporated into the main collection. This material included important specimens collected by the late Michael Dor and his students throughout Israel, but mainly in the Sharon Plain, adjacent to the college, as well as a few spectacular tropical beetles and an old collection of European beetles, well-identified in part, probably bought by M. Dor from the European collectors (Uzi Paz, pers. comm.). The collection of the Histeridae (clown beetles) was intensively studied by German and Italian specialists; a joint article summarizing the knowledge of this family in Israel, is under preparation. About 7,000 insects were mounted, databased and labelled in 2020-2021, including insects collected by Laibale in Israel and the USA, beetles collected by the late A. Freidberg in Papua New Guinea and Kenya in 2013 (preserved dry in capsules) and beetles collected by the late V. Kravchenko in tropical Africa and Asia in 2014–2020 (preserved in alcohol). Laibale also participated in live-panel Fireflies and other beetles on 30.06.2021 and in two online conferences, giving three talks.

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

Lepidoptera

DSc Vasiliy D. Kravchenko, the first manager of the Lepidoptera collections, passed away prematurely on 18 April 2021. A month earlier Mr Ofir Tomer started at the SMNH as a collection manager of Lepidoptera alongside with Oz Rittner, who until then was taking care of the Rhopalocera (butterflies) collection. After Dr Kravchenko's passing, Oz Rittner started to work mainly on the Heterocera (moths) collection, studying the moth fauna of Israel and collecting further material, mainly with light traps. Due to COVID restrictions, field research was poor during this period and included only several light traps in selected localities such as Nizzanim, Devira, Zeta swamp among others. Ofir Tomer works once a week and concentrates mainly on computerizing the collection and identification of butterflies. Until recently, the Rhopalocera collection was fairly heterogenous and composed of several collections. These are now going through the process of integration, specimens are being identified and databased, and the main goal is to create one systematically ordered collection. Recently, Mr Eliav Shney-Dor donated his large collection of worldwide butterflies; a large portion of the collection was transferred to the museum and the rest will be moved in the near future. Another butterflies collection was donated by Mr Israel Peer and his son Dr Guy Peer. Citizens science became an important source of information. During 2020, Oz Rittner started to search macro photographers and insect lovers to check a possibility of forming a group that would collect data on moths through photographs. During the reporting period, a small group was formed and data started flowing through photos taken in the wild and near light sources at night. The group is growing slowly but steadily with more and more incoming observations that are proving to be of high value. These information improvs our knowledge on species distribution and phenology. Plans were being made to make the group grow larger and more efficient.

Diptera

N. Dorchin concentrated her ongoing studies on the taxonomy and systematics of gall-midges from Israel and South Africa. These projects include descriptions of new species, morphological and molecular analyses of specific genera and phylogenetic analyses. She also closely supervised several other projects: Continuous research on the biological control of Acacia saligna in Israel with the seed-feeding beetle Melanterius castaneus (Omer Segal, MSc student); A new study on the possible effect of photosynthetic pathways in host plants on diet breadth of gall midges, supported by a 4-year grant from the ISF (Yael Kenigsberg and Oriel Fischer, MSc students); Continuous study on the taxonomy and life history of fireflies in Israel (Lampyridae) and the possible effect of light pollution on their populations (Ella Fishman, MSc student); New study on the taxonomy and ecology of the Hydropsychidae (Trichoptera) of Israel (Almog Hershko, MSc student), in collaboration with Dr Yaron Hershcovitz (the Israel National Center for Aquatic Ecology); A new study on the ecology and behavior of the little fire ant *Wasmannia auropunctata* in Israel, supported by a 3-year grant from the Ministry of Science (Carmel Herold-Lozover, PhD student), in collaboration with Prof. Abraham Hefetz (Tel Aviv University. As a result of the ongoing projects, the collections grew by hundreds of microscope slides of gall midges from Israel, Europe and South Africa, hundreds of ethanol-preserved and pinned gall-midge specimens, and hundreds of Trichoptera specimens, mostly from the northern part of Israel. Netta actively collaborated with several researches from Israel and overseas: Zvi Mendel, Agricultural Research Organization, Bet Dagan, Israel; Jonathan Colville, SANBI, Cape Town, South Africa; Cornelia Klak, University of Cape Town, South Africa; Rauri Bowie, University of Berkeley, CA, USA; Yaron Hershkovitz, Israel National Center of Aquatic Ecology, SMNH, Tel Aviv University; Abraham Hefetz, School of Zoology, Tel Aviv University; Omri Bronstein, School of Zoology, Tel Aviv University. Netta also taught the following courses for students of the Faculty of Life Sciences, Tel Aviv University: World of Insects (graduate and undergraduate), Research Skills (graduate), Insects of Israel – Field excursions. She also sat on the organizing committee of the 39th annual meeting of the Entomological Society of Israel (Bet Dagan, Israel: October 2020).

E. Morgulis continued rearranging the Acalyptratae collection, both alphabetically and phylogenetically, and added data (e.g. taxonomy, type status etc.) of several thousand specimens to the database. Hundreds of specimens, which had been on loan for identification, were received and taken care of, including the proper placement, listing of types and adding to the database. Liz cooperated with Prof. Valery Korneyev (I.I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine) on a description of a new tephritid species, which had been collected by the late Dr Amnon Freidberg, and to be named after him. During this year, Liz also participated in a project of the Plant Protection and Inspection Services, where she summarized data on agricultural pests of several crops.

Hymenoptera

Ants, Wasps & Wet insect collection: A. Ionescu dedicated most time to re-arrangement, maintenance of the three collections and incorporation of newly collected material (ants and wasps). General-purpose tasks included sorting reprints concerning ants and wasps and introduction of data into the museum's database "toponomasticon". Udi Segev was assisted in producing the red list of ants as part of The National Red List Assessment project for invertebrates (ongoing). Students from Bet Sefer Tefen were trained in ant identification for the 'Nahal Keziv climate change' project conducted by Meir Finkel.

Parasitic Hymenoptera (W. Kuslitzky): Ichneumonoidea and part of other Parasitica collected during the reporting periodwere mounted and labelled (about 3,000 specimens), other insects were sorted into three groups and stored in alcohol: Parasitica, other Hymenoptera (except ants) and other orders. The labelled material was databased. Since mid-August 2021, the study of pests of *Acacia saligna* seeds began. The American species of the seed beetle *Stator limbatus* (Coleoptera: Chrysomelidae) was found; until the present study, the species was noted only in Iran among Palaearctic countries. Later, this species was also reported from Europe (Cocco et al. 2021). Since May 2021, stems of *Hordeum bulbosum* and *Avena* sp. (Poaceae) infected with *Tetramesa* sp. (Eurytomidae) and *Urospermum pictioides* (Asteraceae) infected with *?Phanacis urospermi* (Cynipidae) were being collected to detect parasites of these pests, and the reared material was processed.

Parasitic Hymenoptera (G. Pisanty): A major study of the molecular phylogeny of the megadiverse bee genus Andrena was completed and published in the journal Molecular Phylogenetics and Evolution. About 230 specimens of Microgastrinae parasitic wasps were barcoded in collaboration with Jose Fernandez-Triana from the Canadian National Collection (CNC), Ottawa, Canada. The results have revealed eight taxa new to Israel, which will be published as part of the revised checklist of Israeli Microgastrinae. All specimens in the genus Andrena were re-arranged by alphabetical order of subgenera (about 70 drawers). Collaboration with experts from the CNC 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) continued, as well as collaboration with Thomas J. Wood from Mons University, Belgium, to identify Andrena specimens from Israel and neighbouring countries, and to describe new species and subgenera. All undetermined material in the parasitic wasp subfamily Braconinae was identified to genus, databased and rearranged alphabetically; databasing the braconid subfamily Braconinae (1716 specimens) was finished. Also, databased were 1070 Andrena specimens and 495 various other Hymenoptera; in total, 3281 specimens were added to the databased (excluding material collected during the reporting period).

Parasitic Hymenoptera (Z. Yefremova): A collaborative study of the arrhenotokous strain in the-



lytokous species *Diglyphus wani* (Hymenoptera: Eulophidae), which is a dominant parasitoid of Agromyzidae leafminers in China was completed and published in *ZooKeys*. Research into *Euplectrus, Euplectromorpha* and *Platyplectrus* (Hymenoptera: Eulophidae) from Kenya continued, new species were described and a manuscript was drafted. A review of the genus *Kolopterna* (Hymenoptera: Eulophidae) associated with Cecidomyiidae (Diptera), including descriptions of new species was being prepared for submission. Material reared from the Cecidomyiidae was being sorted and identified.

Arrhenotokous female of *Diglyphus wani* (Hymenoptera: Eulophidae). (Su-Jie Du, Yefremova et al. 2021, *ZooKeys*)

Eulophidae reared from Gracillariidae (Lepidoptera) in Russia (300 specimens) were identified and added to the SMNH collection, and identification of the material from Mali and Laos continued. Zoya also collaborated with Dr Robert Copeland (International Centre of Insect Physiology and Ecology, Nairobi, Kenya); US National Museum of Natural History, Smithsonian Institution, Washington DC, USA; Prof. George Japoshvili (Institute of Entomology, Agricultural University of Georgia, Tbilisi, Georgia); and Natalie Dale-Skey (Natural History Museum, London, UK).

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 (PPIS), 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 provided ca. 50 identifications, mainly of beetles, for PPIS, Ministry of Agriculture of Israel, ca. 50 for private persons in Israel, abroad, for colleagues from the Ben Gurion University of the Negev (e.g. Dr E. Groner, Dr Yaron Ziv) and for the Museum colleagues (Entomology Laboratory for Applied Ecology, Israel National Center for Aquatic Ecology, etc.). About 1000 beetles of different families collected in Nahal Keziv in 2020–2021 by Meir Finkel and his students, under the supervision of Gilad Ben-Zvi (Entomology Laboratory for Applied Ecology), were sorted and identified, at least half of them to the species level. Remains of insects from caves in the Judean desert were identified for Prof. Kostas Mumcuoglu (Faculty of Medicine, Hebrew University of Jerusalem) and insect remains found on the sunken ship were identified for Prof. Deborah Cvikel (Leon Recanati Institute for Maritime Studies, University of Haifa).
- 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.

N. Dorchin went on multiple field trips to the Jordan Valley, Negev and 'Arava, mostly during winter and spring together with students and SMNH collection managers.

S. Zonstein undertook a brief collecting trip to the Judean Mountains on 28.xii.2021 and to the Upper Galilee, Har Hermon and Golan Heights on 2-3.v.2021, together with L. Friedman.

T. Novoselsky conducted extensive fieldwork, which resulted in expansion of the collection by 959 specimens from 'Arava Valley, Central Coastal Plain, Central Negev, Dead Sea Area, Golan Heights, Hula and Korazim Block, Jordan Valley, Judean Foothills, Judean Hills, Karmel Ridge, Lower Galilee, Mt Hermon, Northern Coastal Plain, Kinneret area, Southern Coastal Plain and Southern Negev.

L. Friedman undertook 30 collecting trips throughout Israel, which yielded approximately 3,400 insect specimens, predominantly beetles (mostly weevils). Five trips were carried out jointly: to the 'Arava Valley, Central and Southern Negev on 9–11.ii.2021 and 11–13.vii.2021, together with N. Dorchin; Nahal Og (ecological camp by the INPA) on 5.iv.2021, together with A. Dorchin and G. Pisanty; to the Judean Mountains on 28.xii.2021 and to the Upper Galilee, Har Hermon and Golan Heights, 2–3.v.2021, together with S. Zonstein. The last one was probably the most rewarding and brought two species of rare aquatic weevils from the Saluqiyye pond, *Picia syriaca* and *Bagous biimpressus*, the latter on its host plant, the rarest water buttercup *Ranunculus saniculifolius*, the Israel Red Data Book species. Three collection trips were made to the previously undeservedly undersampled area, Nahal Ada and Ahu Binyamina, resulting in several rare findings, among them sub-aquatic *Bagous mingrelicus* (Curculionidae) and extremely small and rarely collected Histeridae, found on *Trifolium inflorescence*. As usual, special attention was paid to rarely visited areas in central Samaria (Yitzhar, Har Eval), eastern Samaria and Samarian Desert (Itamar, Gid'onim Ridge,

Umm Zuga), Binyamin (Shilo, Har Qida, Alon Road, Kokhav haShahar, Rimonim), Jordan Valley (Sartava, Wadi Malha Wetlands, Yeriho Plains) and Bet She'an Valley. A few interesting and rare beetles—Meloidae (blister beetles), e.g. Meloe hungaricus, Stenodera spp. and Zonitoschema pallidissima, Curculionidae Neoglocianus albovittatus and Anthribidae (fungus weevils) Platyrhinus resinosus – were collected with the help of amateur naturalists, who also provided Laibale with information on the captured specimens. These beetles are rarely found by researchers, most probably because of their unusual phenological patterns, appearing for a very short period, mostly at night or early in the morning, during unusual seasons; therefore, cooperation with 'citizen scientists' who happen to be in the right place at the right time is most helpful. During private visit to New Jersey, USA, between 31.v–10.vi.2021, L. Friedman used part of his trip for intensive collecting in the vicinity of Trenton, around Mercer and Rosedale Lakes, in the Manasquan River Park and Turkey Swamp Park in Freehold. This excercise yielded nearly 1,000 specimens of insects, mainly weevils, which were labelled and incorporated into the SMNH collection upon his return. Among the interesting and unusual material mentioned should be Silvanidae (flat bark beetles) Uleiota and Silvanus, found under bark of a fallen tree; Curculionidae (true weevils) Bagous on Juncus, several species of Anthonomus on Malus baccatus, Dorvtomus on Salix, Mononvchus vulpeculus on Iris prismatica, Magdalis on Pinus and Malus; Apionidae Neapion on Virburnum; Nanophyidae Pseudotychius watsoni on Decodon verticillatum, which was the first record of the host plant for this tiny and rarely collected weevil. L. Friedman was extremely successful to visit Princeton exactly at the peak of emergence of the periodical cicadas (Homoptera: Cicadidae), observed their mass appearance, listened to their deafening chorus and collected a good sample for the SMNH collection.

W. Kuslitzky collected insects with the Malaise trap in the Judean Foothills until mid-May 2021. As from May 2021, plant material of the families Poaceae and Asteraceae infected with Eurytomidae and Cynipidae was being collected at the Central Coastal Plain sites to detect parasites of these pests.

G. Pisanty collected 2604 specimens (mostly Hymenoptera) during his 18 field trips to the Dead Sea (2.03 & 5.4.2021), Judean Foothills (5 & 15.03.2021), Judean Mountains (30.11.2020), Mount Carmel (14.10.2020, 15.02 & 12.06.2021), Mount Hermon (7 & 16.04.2020), Northern Golan Heights (21.12.2020, 2.01.2021), Northern Negev (27.01.2021), Upper Galilee (26.02 & 4.06.2021), Western Samaria (Zur Natan) (31.10 & 13.11.2020, 27.08.2021).

Z. Yefremova went on an expedition (12–29.09.2021) to the Republic of Mali to collect Apidae and Chalcidoidea in the Sahel ecozone along the Niger River for the Museum. The collecting was done with light traps and Malaise traps near Kangaba, Ouronina and Bankoumana.

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 *Pachypasa otus* and *Dendrolimus bufo*. Larvae of *P. otus* feeds mostly on *Cupressus* spp., develop slowly and the species is univoltine, whereas larvae of *D. bufo* feed mostly on *Polygonum* spp. and develop fast, thus being multivoltine.

During October 2020, Liz collected several specimens of winged (reproductive) termites *Kalotermes phoeniciae* and *Eremotermes arctus*. The specimens were placed in appropriate vials with a substrate and may develop colonies in the near future.

Liz also collected additional species of Blattodea and started rearing them for future use at the insect-faunistic course. These specimens are still to be identified to the genus level.

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, 67 specimens were collected and will be added to the collection: 31 of them were collected during the excursions to the mesophotic sponge grounds located at depths of 80–100 m, off Mediterranean coast and 13 from shallow depth, 1 from Eilat, and 12 from the Mediterranean. These specimens were collected as part of studies conducted at Prof. M. Ilan's lab.

The rest of the specimens are from other sources: 20 samples from Bioblitz (October 2021), 3 samples from a monitoring project (Yad Hanadiv).

I participated in the ASSEMBLE Plus expedition to the Hellenic Centre for Marine Research in Crete together with Dr Liron Goren and Dr Tal Idan. We conducted a study focusing on the relationship between sponges and their endobionts, more specifically we tested the correlation between sponge diversity and its endobionts' richness.

Taxonomic identification

Three new species were described and published. Hence, 3 primary types were added to the collection.

Curatorial

- Four sponge subsamples were loaned to Dr Thierry Pérez from Station Marine d'Endoume Chemin de la Batterie des Lions, Marseille, France: Spongia nitens, Spongia nitens, Spongia zimocca, Coscinoderma sporadense.
- The sponge database includes 1503 specimens, of which 185 samples were entered this year thanks to the valuable help of Tom Morav.

THE COELENTERATA COLLECTION

Zafrir Kuplik

With over 13,000 lots, the Coelenterata collection encompasses specimens from Israel, the Mediterranean and the Red Sea, as well as from many other localities around the world, mostly the Indo-Pacific.

In general, the 2020–2021 academic year was quiet in terms of sample collection, compared to pre-COVID era. Most activity focused on archiving hundreds of items, all octocorals, that were sent to us as a loan return or for taxonomy identification. Additionally, hundreds of samples from the collection were to be re-identified (i.e., reverse taxonomy) using molecular techniques.

Curatorial

- Approximately 250 samples were returned from Leiden, the Netherlands. They represent 9 genera: Acabaria, Dendronephthya, Litophyton, Nephthea, Paralemnalia, Sansibia, Scleronephthya, Sinularia and Stereonephthya.
- More than 300 samples were received from the Philippines for taxonomical identification.
- As part of our long-time collaboration with Prof. Yehuda Benayahu, this year over 600 samples were sent to Prof. Catherine S. McFadden from Harvey Mudd College, Claremont, CA, USA, for reverse taxonomy using molecular approaches. Cross-checking the molecular results with prior morphological identification can validate or reject existing taxonomical determinations.

FRESHWATER MYXOZOA

Aditya Gupta and Dorothée Huchon

With over 2,300 described species, the Myxozoa is a class of parasitic cnidarians that exert a substantial negative economic impact on fisheries and aquaculture. Specifically, certain myxozoans are the agents of emerging fish diseases and myxozoan infections have been linked to



environmental changes. Unfortunately, no treatment exists against myxozoan infections at the moment, and, despite their economic impact, relatively little is known about myxozoan biology. While several myxozoan species have been described from Israel, no accurate compilation exists of the species present in Israel; moreover, most Israeli species have only been described morphologically. It has, however, been shown that myxozoan classification based on spore structure is artificial and does not reflect the true evolutionary relationships. Consequently, it is important to revise the number of species present in Israel using a combination of morphological and molecular approaches.

To revise the number of freshwater myxozoan species in Israel, seven field trips were conducted to Lake Kinneret and one to Lake Hula from October 2020–October 2021. About 150 fish specimens were examined for the presence of external plasmodia followed by dissection. Gills, scales, brain, kidney, intestine and other body parts were removed

Aditya Gupta selecting mullets from Kinneret for identification of their Myxozoa parasites (left) in the lab.

and checked under a stereomicroscope. When plasmodia were identified, myxospores were stained, photographed and measured. Species iden-

tification is currently ongoing based on morphological and molecular results, and preliminary data suggest the presence of about ten novel myxozoan species. New myxozoan species were identified from fishes native to Lake Kinneret (i.e., the Jordan himri *Carasobarbus canis*; the Jordan barbel *Luciobarbus longiceps*; the Levantine scraper *Capoeta damascina* and the blue tilapia *Oreochromis aureus*). Interestingly, myxozoan parasites were also identified on species introduced to Lake Kinneret such as the Thinlip mullet *Chelon ramada* and the Common carp *Cyprinus carpio*.

THE MOLLUSCA COLLECTION

Henk K. Mienis and Oz Rittner

The activities in the Mollusc Collection during the academic year 2020–2021 continued to slow down drastically due to several reasons. The senior collection manager (HKM) lowered his work load from 60% to 40% starting October 2020, while the junior collection manager (OR) serves also as the collection manager of the Lepidoptera Collection and in addition he is the unofficial photographer for most of his colleagues working in the various zoological and paleontological collections of the SMNH.

Nevertheless, 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

Perna perna has been suddenly recorded again along the Mediterranean coast of Israel (Douek et al. 2021), shortly after documenting a similar invasion in 1965 (Mienis 2019).

This year several new nudibranchs have also been observed along the Mediterranean coast of Israel. They included among others *Okenia pellucida*, an Indo-Pacific species not yet recorded

from the Red Sea, but its main food the ctenostome bryozoan *Amathia verticillata* (formerly known as *Zoobotryon verticillatum*) has also arrived in the Eastern Mediterranean and is living commonly along the Israeli coast (Galil & Gevili 2014). Another surprising new arrival was that of *Okenia picoensis*, which is invading rapidly the Mediterranean from the Eastern Atlantic (Lombardo & Marletta 2021).

A typical huge egg mass of the large epipelagic cephalopod *Thysanoteuthis rhombus* was photographed in the waters of the Gulf of Aqaba near Elat. Although this interesting cephalopod was already known from the Red Sea, it is a rare visitor in the Gulf of Aqaba.

Terrestrial Molluscs

A revision of the Orculella samples from the Hermon Mountain and Har Kana'an (Mienis & Rittner 2021) revealed that we deal with two taxa: Orculella sirianocoriensis libanotica and Orculella orientalis. Although the type locality of the latter was a hill near Nazareth, that indication has been considered an error since its description. However, its discovery on Har Kana'an shows that most probably the type locality was correct.

Single living specimens of two Giant African snails were found crawling in public spaces: *Archachatina degneri* in the Central park of the Ashelim Quarter in Rishon le Ziyyon on 11 October 2020 and *Lissachatina*



Orculella orientalis from Har Kana'an (A) and *O. sirianocoriensis libanotica* from Mount Hermon (B). (Photo O. Rittner)

iredalei near a walking stretch of the Eretz Boulevard in Harish on 24 November 2020.

Freshwater Molluscs

Dr Eldad Elron managed to collect some living specimens of *Heleobia* (Semisalsa) longiscata. For a long time this species was thought to be extinct in Israel.

The exotic Apple snail *Pomacea diffusa* was until recently only known from shops dealing in aquarium fish and requisites in Israel. On 27 June 2021, Prof. Avital Gasith found living specimens of it in a freshwater pond in front of the Porter building, Tel Aviv University. He was called to that pond because freshwater crayfish were reportedly walking on the pavements near the pond at night. *Procamborus clarkii* and *Pomacea diffusa* were caught in traps which had been installed on the bottom of the pond. At a later stage, also rather pale egg masses were seen attached to the wall well above the water level on the southern side of the pond, and here and there also to the stalks of the flowering waterlilies.

The connection between terrestrial snails and other animal groups

New data on land snails encountered in nest cleaning of Harvest ants *Messor* species in Netzer Sereni and Zova have been published respectively by Mienis & Vaisman (2020) and Vaisman & Mienis (2021).

Cases of predation on land snails by the Cairo spiny mouse *Acomys cahirinus*, a *Turdus* species, the Stone curlew *Burhinus oedicnemus* and the Ocellated skink *Chalcides ocellatus* along the road Hatzerim–Beer Sheva has been published by Mienis (2021).

Support with identifications

Various ecological and malacological studies on the presence of molluscs in Israel are currently being carried out by a number of colleagues at various institutes and by private investigators. They received our expertise by the identification of their material. A major part of the identified material was retained for permanent storage in the Steinhardt Museum of Natural History.

Cooperation with the Israel National Aquatic Ecology Centre (INAEC)

Adi Weiss was regularly bringning samples, which had been collected by Dr Yaron Hershkovitz and his associates at the INAEC, for identification or verification.

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

This academic year Mrs S. Vaisman brought for verification or identification in a few cases 63 samples of land and freshwater snails, which had been intercepted by inspectors from the PPIS from either agricultural merchandise arriving from abroad or found on local material grown in nurseries (Vaisman & Mienis 2021, 2022).

New or interesting records turned out to be:

Xerotricha barcinensis from a shipment of peat from Spain;

Cepaea nemoralis on second hand spare parts of cars from Germany;

Arianta arbustorum from a shipment of wood from Latvia;

Xeropicta derbentina found in a shipment of Salvia and Hand apples (Malus) from Turkey;

Cochlicella barbara found in four different shipments of table grapes from South-Africa;

Monacha cartusiana, Xerolenata obvia and *Cernuella virgata* estivating on a tractor and adhering agricultural equipment sent from Bulgaria via Romania to Israel.

It shows the importance of the work of the PPIS inspectors in the harbours and other ports of entry in Israel.

A large poster depicting exotic and invasive terrestrial slugs so far encountered on agricultural and horticultural merchandise arriving in Israel was made specially for use of the PPIS inspectors (Vaisman & Mienis 2020).

Cooperation with the Israel Nature and National Parks Protection Authority

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

Dr Dana Milstein found the living specimen of *Archachatina degneri* in Rishon leZiyyon on 11 October 2020. No additional specimens were seen either by her or by Svetlana Vaisman of the PPIS of the Ministry of Agriculture.

Cooperation with local and foreign archeologists

Reports dealing with archeomalacological material recovered during the excavations of area C and the Late Bronze Age layers of Area E at Tell es-Safi by Aren M. Maeir were published in the second volume dealing with that excavation (Mienis 2020).

Some additional shells from the excavation of Giv'at Yasaf (Tell er-Ras) in 1984 carried out by Ora Yogev with some notes on previously published malacological material was published (Mienis 2021), followed by a brief note on some shells from Finkelstein's excavation of Shiloh (1981–1984) (Mienis 2021).

A chapter dealing with some molluscs recovered during the excavation of the Jerusalem Western Wall Plaza carried out by Shlomit Weksler-Bdolah and Alexander Onn saw also the light (Mienis 2021).

Studies of archaeomalacological material from sites in the Jewish Quarter of the Old City of Jerusalem excavated by the late Nahman Avigad and more recently by Hillel Geva, Horbat Bet Loya excavated by Oren Gutfeld, Tell es-Safi/Gath fields D and E excavated by Aren M. Maeir, Tell Erani field P excavated by Iair Milevski and Tell Iztabba excavated by a German-Israeli team led among others by Oren Tal, are still in progress.

New acquisitions of the Mollusc Collection 2020-2021

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

Some information concerning three important acquisitions

The mollusc collection of the SMNH received the collection and library of Benjamin Solom (Solly) Singer in two batches during 2020 and 2021. His mollusc collection (BSS) is very rich in micromolluscs from the Red Sea, which were collected by various diving members of the former Israel Malacological Society at the special request of Solly Singer. Such material was up to now lacking from the collection. Together with the shell collection we received many unpublished manuscript notes based on that material. His library contained also several highly wanted monographs authored by Daniel Geiger. Mienis (2021) published an article on Singer's collection and his malacological activities.

The SMNH malacological unit received from Batia Heiman the mollusc library of her husband Eduard (Ed) Leib Heiman. It consisted of more than hundred books, which had been absent from the library up to now. Ed Heiman was a member of the Israel Malacological Society for a long time and the initiator of its journal Triton. He published numerous articles and a few books dealing with the recent Cypraeidae. Mienis (2021) published information concerning Ed Heiman, his malacological activities and a list of his publications.

The shell collection of Shmuel Matalon was received with the help of our entomological colleague Dany Simon. After the death of Shmuel Matalon, his shell collection was first transferred to the Tel Aviv School for Nature Studies on the former premises of the Zoological Department of the Tel Aviv University in Abu Kabir, where it was on display for several years until it ended up in the Mollusc Collection of the SMNH. Shmuel Matalon's collection consists of a rather large variety of shells of which numerous species were not represented so far in the SMNH collection. It is a great pity that his shell books and especially the catalogue of his collection were discarded after his death. Most of the shells are of foreign origin, including such exotic places like Guam, Solomon Islands, Fiji Islands and other localities in the Pacific Ocean. There are also numerous shells from Panama and the Bay of California. All the shells were most probably bought during 1962–1968 from well-known shell dealers. Noteworthy is the fact that shells of local origin, i.e. from Israeli localities either in the Eastern Mediterranean or around the Gulf of Agaba (Elat), are almost completely absent. We got the impression that the collection had been assembled abroad and was brought to Israel at a later stage. We will try to find more about Shmuel Matalon and his collecting activities in the near future.

Name

Name	Brief description of the material
R. Ben-David Zaslow	Marine molluscs from the Mediterranean coast of Israel
D. Blum (via BSS)	Marine mollusc from Elat
I.P. Bondarev (via BSS)	Marine molluscs from Dahlak Islands and Somalia
E. Elron	Freshwater molluscs from Israel
M. Fainzilber (via BSS)	Marine molluscs from the Gulf of Aqaba
B.S. Galil	Marine molluscs from the Mediterranean coast
Sh. Matalon	Worldwide collection of marine shells
M. Mendelson	Marine molluscs from the Mediterranean coast
H.K. Mienis	Land- and freshwater molluscs from Israel and the Netherlands
PPIS	Intercepted material arriving from abroad
O. Rittner	Land snails from Israel
B.S. Singer	Marine molluscs from Greece, Israel, Jordan, Egypt, Seychelles,
	South Africa and Fiji
F. Swinnen (via BSS)	Marine molluscs from Ireland and Italy
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 Dr D.E. Bar-Yosef Mayer (fossil molluscs in the paleontological collection of Hanan (Hans) Bytinski-Salz). So far, 11,310 taxa (incl. fossil ones) have been computerized in the mollusc collection.

The Malacological library

The library is a very important tool for taxonomic and systematic studies in the Mollusc Collection. In 2020-2021, the following new literature has been added to the malacological library. Only the most important additions to the library are mentioned.

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Lorenz, F. 2002. New Worldwide Cowries. Descriptions of New Taxa and Revisions of Selected Groups of Living Cypraeidae (Mollusca: Gastropoda). ConchBooks, Hackenheim. 292 pp.

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We have received also many reprints and numerous journals from zological institutes or malacological societies in exchange for *Triton*, the independent malacological journal published in Israel, and the quarterly journal *Natuurhistorische en Andere Notities – Natural History and Other Notes*.

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Malacological fieldwork in Friesland, the Netherlands

Henk K. Mienis

During 23 August – 16 September 2021, fieldwork was carried out in Friesland, one of the northern provinces in the Netherlands, to which also belongs the Wadden Sea island Terschelling. In the first period from 23 August – 5 September, only observations were made concerning the presence of Ladybird beetles Coccinellidae in that area of the Netherlands (Mienis 2021a). Brief malacological investigations were carried out on Terschelling from 6–9 September 2021, and elsewhere in Friesland in the period 11–16 September 2021.

The Wadden Sea island Terschelling

On Terschelling special attention was paid to the presence of invasive species belonging to the genus *Cernuella* (Geomitridae). Two taxa have been reported from that island: the Vineyard snail *Cernuella virgata* since 2004 (Mienis 2005) and the Maritime garden snail *Cernuella cisalpina* since 2020 (Mienis 2021b). Recently some doubts have been circulating among malacologists studying *Cernuella* species whether we are dealing indeed with two different species, therefore a fair number of specimens have been collected at different localities. Large populations of *C. virgata* were found around the workstation of the State Forestry Service in Lies, in private gardens in Midsland near the Sea and at several ruderal plots in West-Terschelling. Typical *C. cisalpina* specimens were found in Oosterend and near West near the Sea.

An effort to obtain aquatic molluscs near the sluice of Lies in the Waddensea dike was hampered by the fences around that area. It was the intention to check the brackish water for the presence of the invasive Wedge clam *Rangia cuneata*. That invasive species from brackish water ha-



bitats bordering the Gulf of Mexico has become a prolific invader of the mainland canals in NW-Friesland near Harlingen (de Boer & Bosma 2021). Only seven species of aquatic snails were found: Bithynia leachii, Potamopyrgus antipodarum, Stagnicola palustris, Radix balthica, Anisus vortex, Gyraulus vortex and Planorbis planorbis. The Potamopyrgus species is an old, invasive gastropod from New Zealand, and is characteristic for a brackish biotope on Terschelling.

The Mainland of Friesland

The cooling water discharge basin of the J-DE coffee factory in Joure Investigations of the cooling water discharge basin of the coffee factory in Joure in 2019 and 2020 had revealed the presence of 15 aquatic mollusc species (Mienis 2021c). Follow up research on 12 September 2021 resulted in the discovery of six additional species: Lymnaea stagnalis, Radix balthica, Planorbarius corneus, Planorbis planorbis, Musculium transversum and Pisidium supinum, which brings the total number of observed aquatic molluscs to 21 species. Among them are five invasive species of which one is from New Zealand: Potamopyrgus antipodarum and four are from North America: Physella acuta, Ferrissia californica, Musculium transversum and Euglesa compressa. Still additional species like large freshwater mussels may be living in the center of the basin. Due to the numerous broken branches of the surrounding trees, which are laying in the water, it was impossible to use a hand dredge to take bottom samples from that part of the reservoir.

A surprise find of an endangered River orb mussel near the Tjonger

On 15 September 2021, I surveyed a stretch of the Tjonger, a canalized stream in the south of Friesland, for the presence of the invasive Asiatic clam *Corbicula fluminea*. Everywhere the water near the banks turned out too deep for my collecting equipment. At a place opposite the village Mildam a short stretch of the original stream was still present near the canalized part of the Tjon-

ger. Surprisingly, I found a large, living specimen of the River orb mussel *Sphaerium rivicola*. This *Sphaerium* species is considered an endangered species in the Netherlands, which was never found before in Friesland.

Finds of invasive Cernuella and Xeroplexa species in Harlingen

On 13 September 2021, I made a visit to Harlingen, a small town on the coast of Friesland, to collect some Vineyard snails *Cernuella virgata* from a recently discovered colony along the Waddenseadike south-west of the town. The population turned out to be present in an area covered by a tall ruderal vegetation over a distance of about 50 m. Numerous specimens were found adhered to the various plants. Most likely the population will become much larger in the near future.

Returning to the bus station I walked along the railroad connecting Harlingen with Leeuwar-

den. Everywhere I saw large numbers of the Wrinkled snail *Xeroplexa intersecta*, another invasive species in the family Geomitridae. Like the Vineyard snail, it is on the move and is rapidly establishing populations especially along the coast of the Netherlands. In Friesland it is still considered a rare species.



The invasive Wrinkled snail Xeroplexa intersecta (Photo O. Rittner)

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THE BRACHIOPODA COLLECTION

Henk K. Mienis and Oz Rittner

The manager of the Palaeontological Collection Dr Daniella Bar-Yosef Mayer transferred the Recent Brachiopoda samples present in the former collection of Prof. Hanan (Hans) Bytinski-Salz (1903–1986) to the Recent Brachiopoda collection in the Steinhardt Museum of Natural History.

The material consisted of 11 samples belonging to nine species:

Lingulidae

Lingula anatina Lamarck, 1801: Philippines, SMNH 61/1.

Cancellothyrididae

Terebratulina retusa (Linnaeus, 1758): Italy, Messina, SMNH BRA 58/5.

Zeilleriidae

Macandrevia cranium (O.F. Müller, 1776): Norway, Bergen, leg. D. Por, 1963, SMNH BRA 57/1. Kraussinidae

Megerlia truncata (Linnaeus, 1767): Italy, Napoli, ex-coll. Stazioni Zoologici, SMNH BRA56/8. Terebratellidae

Magellania flavescens (Lamarck, 1819): Chile, Magellan coast, SMNH BRA 59/2.

Magellania venosa (Dixon, 1789): Falkland Islands ex McArthur's New York, SMNH BRA 60/1. Lagueidae

Laqueus californicus (Koch, 1848): USA, California coast, ex Turtox, SMNH BRA 55/2.

Laqueus rubellus (Sowerby, 1846): Japan, leg. McArthur, 1963, SMNH BRA 54/1.

Terebrataliidae

Terebratalia transversa (Say, 1846): USA, California, ex Ward's Biology Supply, SMNH BRA 53/1; USA, Pacific Coast, ex Museum Chicago, SMNH BRA 51/2; USA, Pacific Coast, SMNH BRA 52/1.

Three species turned out to be new for the Museum's collection: *Lingula anatina*, *Macandevia cranium* and *Laqueus californicus*.

THE BRYOZOA COLLECTION

Noga Sokolover

Bryozoa is a phylum of small aquatic filter-feeding colonial invertebrates. The majority of about 4,000 species are marine and live in tropical seas, with some dwelling in temperate or cold waters, and some in brackish or freshwater basins. The bryozoan fauna of the Mediterranean Sea is among the best studied of all bryozoan faunas, but the main focus of research has been on the Western Mediterranean, leaving the Levant area, including Israel, poorly investigated. The impact of global warming on the composition of marine biotas also affect the Levantine bryozoan communities, which were shown to gradually change from a temperate to a more tropical state.

Collection management and research

All specimens from the Bytinski-Salz collection were processed and databased. Bryozoa specimens collected during the previous survey of fouling communities in marinas in Israel as part of a larger study to assess the contribution of small marinas in the Mediterranean to the spread of invasive species were identified (24 species), curated and databased. Altogether, 223 records were added to the Museum database.

TERRESTRIAL, FRESHWATER AND MARINE FREE-LIVING NEMATODES

Stanislav Pen-Mouratov

The Nematoda, or roundworms, are a major eukaryotic group and display a startling variety of life histories. Many are free living and abound in soils and sediments in terrestrial, freshwater and marine habitats, participating in fundamental ecological processes, such as decomposition and nutrient cycling. Nematodes eat bacteria, fungi, algae, yeasts, diatoms and may be predators of several small invertebrate animals, including other nematodes. As parasites, they occur in every multicellular group. Generally, nematodes are grouped into eight trophic categories based on the nature of their food, the structure of the stoma and esophagus and method of feeding, like plant feeding, hyphal feeding, bacterial feeding, substrate ingestion, omnivory and so on. Due to their being sensitive to ecosystem disturbances, nematodes can be used as useful indicators in different environments.

Research goals

- To study the species diversity, abundance and distribution of free-living nematodes inhabiting the Israeli terrestrial and aquatic (marine and freshwater) ecosystems.
- To determine impact of natural and anthropogenic disturbances on the free-living nematode communities in terrestrial, marine and freshwater environments.
- To study the influence of vertebrates on the free-living nematodes and their habitats.

Research projects

• During the reporting period we continued study (Pen-Mouratov & Dayan 2019) the impact of bird nesting and roosting activity on soil biota in Israel. The soil biota, including soil microorganisms and free-living nematodes along with soil properties (soil moisture, conductivity, pH, ammonium, nitrate and phosphorus), was seasonally investigated in the nesting and roosting habitats of the following colonial birds: *Milvus migrans, Phalacrocorax carbo, Nycticorax nycticorax* and *Egretta garzetta*, in Israel's Mediterranean region. The main aim of this investigation was to determine the seasonal effect of bird nesting and roosting activity on the soil habitat, soil biota abundance, trophic structure, sex ratio and generic diversity of soil free-living nematode communities. As a result of two years of painstaking work, the necessary data were obtained to complete research on 'Seasonal fluctuations attenuate stimulatory or inhibitory impacts of

colonial birds on abundance, structure and diversity of soil biota'.

- The collection of new and analysis of the existing material of nematodes continued for the project 'The influence of vertebrates on the free-living nematodes and their habitats'.
- The collection of new and analysis of the material in the collection of the marine nematodes from the shallow coastal zone of the Israeli Mediterranean Sea continued.

Nematode collection

The soil free-living nematodes were extracted and counted from the above-mentioned study sites. The collected nematode samples were prepared for the long-term storage in the Museum collection. For ecological research, the nematodes were mounted on the temporary collection slides and identified to the order, family, genus and sex using a compound microscope. The best nematode specimens were remounted on permanent slides for the museum collection.

Capacity building

Some of the SMNH staff and students were consulted and trained in the use of a microscope, the corresponding computer program and a device for drawing objects of study.

International collaborations

During the reporting period, I continued active collaboration with colleagues of different scientific organizations from different countries who study free-living nematodes.

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 of 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 and databasing

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).

Ya'arit Levitt-Barmats continued to update and clean the Crustacea database and to prepare it for its migration to the new database system.

Research

Prof. Bella Galil focussed her main reaserch efforts on 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 documented NIS-over 460-is alarming, considering the extent of the Israeli coastline.

Prof. Bella Galil studied with colleagues an outbreak of the highly invasive mytilid mussel *Perna perna*. Four molecular markers, the mitochondrial cytochrome c oxidase subunit I (COI), ribosomal 18S, 28S subunits (18S rRNA, 28S rRNA) and histone H3 have been used to validate samples identities. COI haplotype diversity suggests that the Israeli population is highly polymorphic, originating from multiple propagules. The extensive beds in southern Haifa Bay, adjacent to the Haifa port, possibly point to the vessel-mediated introduction. The dense beds of *P. perna* were found to alter intertidal hard bottom habitats and foul coastal infrastructure (e.g. marine seawalls). 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 May—October 2021, Prof. Galil studied, with her colleagues Dr K. Gayer and Dr 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 4952 burrows. The dataset will be analyzed in 2022.

Prof. Bella Galil also studied the impacts of heatwaves on intertidal NIS along the Mediterranean coast of Israel.

The ghost crap Ocypode cursor. (Photo Y. Yaari)

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

Ya'arit Levitt-Barmats submitted her PhD thesis on the *Taxonomy and Ecology of Decapod Crustaceans from the Infraorder Caridea in Israel*, and received the approval along 2021. Using both molecular and morphological tools, Ya'arit updated the inventory list of caridean species along the Mediterranean coast of Israel to 45 species by adding two new records of shrimp. Along her study, it was suggested that the alien species previously identified as *Saron marmoratus* (Olivier, 1811) and known from the Indo-Pacific Ocean, is in fact a different species introduced from the Red Sea. In addition, two other species' identification requires further investigation due to the lack of material required for morphologic comparison with specimens from other locations. Molecular results of all the caridean species examined in Ya'arit's study, support the Levant caridean population, and perhaps even that of the entire Mediterranean Sea, as a different assemblage compared to that of the Atlantic or the Indo-Pacific Ocean.

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 May—October 2021, in nature reserves and adjacent beaches in Betzet, Dor and Evtach.

Taxonomic identification services

Ya'arit Levitt-Barmats identified approximately 20 specimens for the Israel National Center for Aquatic Ecology and their graduate students at the Steinhardt Museum.

THE ANNELIDA COLLECTION

Liron Goren

Collection management and field survey of the Polychaeta

Along with other Museum staff, we conducted some fieldwork and collected a few hundred specimens for the Museum collection. In June 2021, Liron travelled along with Sigal Shefer (SMNH) and Tal Idan of Prof. Micha Ilan's research group (School of Zoology, Tel Aviv University) to the Hellenic Center of Marine Research (HCMR) in Crete, Greece, to conduct a study on the polychaetes inhabiting two species of sponges. The work was done in collaboration with two scientists from the HCMR.

Liron also published a paper with Micha Ilan's research group on the polychaetes associated with sponges in the Mediterranean Sea.

Liron continued computerizing the catalogue of the Polychaete collection.

Taxonomic identification service

More than 150 samples of Hirudinea and Polychaea were identified for the Israel National Center for Aquatic Ecology at the Museum.

Future plans

- Complete and publish the identification of the new invasive leech species, *Barbronia* sp.;
- Publish a paper on three new polychaete records (*Branchiomma luctuosum*, *B. bombyx*, *Timarete punctata*) in Israel, found during fieldwork conducted last year;
- Publish results of the Crete study;
- Complete computerizing the catalog of the Polychaete collection;
- Create a Polychaete taxonomic course in the museum.

THE ECHINODERMATA COLLECTION

Omri Bronstein and Noga Sokolover

Echinoderms constitute one of the most prominent and wide-spread groups of marine invertebrates. Distributed across all oceans, from the poles to the equator and from the abyssal to intertidal depths, they are among the most ecologically significant components of diverse marine environments. With about 7,000 living species, echinoderms are the second-largest group of deuterostomes, strategically situated at the base of the evolutionary split leading to vertebrates. This unique evolutionary setup coupled with their fundamental ecological role, turns echinoderms into a primary research model taxon.

Collection management

The collection continued to be curated and the jars were re-filled with 70% ethanol as needed.

The identified material was entered into the Museum database, which was increased by 73 echinoderm records during the reporting period.

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

Undergraduate students supervised by Omri Bronstein used samples from the Mediterranean and the Red Sea echinoderm collections for their research projects.

We provided 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.

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 and Lion Novak

Ascidians, or sea squirts, are the largest and most diverse class of the Tunicata, which is thought to be the sister group to the vertebrates according to recent phylogenomic studies. With about 3000 described species, ascidians are found in all marine habitats from shallow water to the deep sea. The exceptional filtering capability of adult sea squirts makes them important bio-indicators for monitoring anthropogenic pollution in marine environments.

Research

During the academic year 2020–2021, Noa Shenkar focused her research on 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 continued studying development of the solitary ascidian *Polycarpa mytiligera*, an emerging model for regeneration studies, was involved in projects on suspension feeding mecanism of *Herdmania momus* and on monitoring invertebrate invasive species in the Mediterranean Sea and in freshwater systems of Israel. Lion Novak studied proteomic profiling of the solitary ascidian *Herdmania momus* as a tool for biomonitoring marine environments. Noa Shenkar and Lion Novak co-authored six articles during the reporting period.

Collection management

Curatorial activities during the reporting period were aimed at the regular maintenance of the material and resulted in the addition of 25 new records to the museum database.

MEDITERRANEAN AND RED SEA FISHES

Jonathan (Yoni) Belmaker

The native fish fauna 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 fish collection at the Museum provides a globally unique resource, which 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 2020–2021, we continued to analyze museum data on the morphology of Mediterranean and Red Sea fishes in order to test biotic and abiotic constraints on traits diversity associated with fish invasion.

A new species of shrimp-goby, *Cryptocentrus steinhardti* (Actinopterygii: Gobiidae), was described from off the southern Israeli Mediterranean coast based on the morphology and a unique DNA (mtDNA COI and Cytb) signature. The phylogenetic analysis demonstrates a paraphyly of *Cryptocentrus* and emphasizes the need for revision of the genus based on integrating morphological and genetic characteristics. This finding constitutes the third record of an invasive shrimp goby

in the Mediterranean Sea. An intriguing ecological issue arises regarding the possible formation of a fish-shrimp symbiosis in a newly invaded territory. Describing an alien tropical species in the Mediterranean prior to its discovery in native distribution is an unusual, although not a unique, event.

We studied immediate impacts of changes in human activities on wildlife and environmental threats during the early lockdown months of the COVID-19 pandemic, based on 877 qualitative reports and 332 quantitative assessments from 89 different, including ichtyological, studies. Reports of unusual species observations from suggest that animals quickly responded to the reductions in human presence. Negative effects of the lockdown on conservation also transpared as a reduced ability to perform conservation, restoration and enforcement tasks, resulting in increases in illegal activities such as hunting and fishing. Overall, there is a complex mixture of positive and negative effects of the pandemic lockdown on nature, all of which have the potential to lead to cascading responses which in turn impact wildlife and nature conservation.

A presentation on the effect of global warming on the Mediterranean fish communities was given as part of a public outreach seminar on changing oceans (Tel Aviv, 2021).

In autumn 2020, we surveyed fish communities along the Gulf of Aqaba (Eilat) coast in collaboration with the Israeli Nature and Parks Authority. The survey aimed to establish an ecological baseline that can be used to assess the effectiveness of protection efforts.

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 were deposited in the Museum collection.

Ori Frid completed her doctorate project on the Mediterranean fishes community ecology. The goal of her study was to udnerstand temporal dynamics of the catch and by-catch.

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.

Altogether, 505 records of fishes were added to the Museum database.

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

With no changes to the personnel, 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.

Collection management: equipment, infrastructure, storage and curation

We continued incorporation of the Beit Ussishkin, A.D. Gordon and Beit Shturman Museum holdings into our collection. We were still 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 good shape in years to come. We made little headway yet in barcoding jars and drawers, so that immediate identification of specimens present in a cabinet or on a shelf is known. The main infrastructure—shelving, internet and adequate number of electricity outlets—is, however, in place, and in general the collection can be comfortably used.

Research and Curation

The amphibian collection

The down trend in collecting amphibians continued during the reporting period. Between October 2020 and September 2021, our amphibian collection grew by only a few specimens to the total of 2,791 databased specimens. There was still the lack of dedicated field research on Amphibians, which might explain the low collecting rate. We continued with preparation of skeletons from all the Israeli amphibians. The amphibian collection remained the smallest and least active among the other tetrapod collections.

The mammal collection

During the reporting period, 991 specimens were added to the mammal collection, which now amounts to 17,283 databased specimens. This somewhat low number of catalogued specimens was the result of the Covid-19 restrictions.

Work in the mammal collection geared up this year, with Karin being the driving force assisted by Erez and Amos.

The reptile collection

Between October 2020 – September 2021, the reptile collection grew by 556 specimens, to 19,847 specimens, excluding those that were still not entered into the database. All specimens from the Beit Ussishkin collection—including the rare Eastern Four-lined Ratsnake *Elaphe sauromates* and one Transcaucasian Rat Snake *Zamenis hohenackeri*—were incorporated into our collection. During the reporting period, we started to enter into the collection specimens from the A.D. Gordon Museum collection. We continued preparing skeletons and we intend to continue with this project until we have representation from all the species in Israel.

The bird collection

Between October 2020 and September 2021, the bird collection grew by 631 specimens, to 23,342 databased specimens. This number represents only specimens that entered into the collections with at least a tissue sample. There are still other specimens in the freezers that were not prepared yet. The process of incorporating specimens into the collection was slow mainly because the main attention was paid to skins rather than skulls, which had been a priority during the exhibitio built-up. Amos continued preparing skins himself, but he could not work fast enough to really clear up the backlog in the freezer.

Moshe Geizler continued working on the pellet collection, cataloguing each pellet in a new dataset created for this purpose, laminating every old label (to avoid moisture damage in future) and keeping them in a plastic box. His work would make the pellet collection better protected and much more accessible. Miriam Eidels continued cataloguing the old correspondence to make the relevant information more accessible.

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

- Daniel and Amos continued to move the nest and egg collections to plastic boxes for safekeeping 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. With the Covid-19 restrictions being still in place, we continued to focus on optimising the collection.

Visits, teaching and loans

According to our records, 49 people (almost all of them academics) used the collections in some capacity (visits, loans, data requests etc.) in 2020–2021. Most were from Israel but we also got
users from Cyprus, Denmark, Finland, Germany, Italy, UK and USA. This was a noticeable increase compared to the previous year, with the Covid-19 restrictions being lifted in many countries. Among the 39 Israeli users, 18 were from outside Tel Aviv University. Two teaching courses used collections materials. We loaned specimens to members of institutions (three in Israel, two from the USA and one from Finland), sent tissue samples to colleagues in six institutions (Denmark, Finland, Germany, Italy and Israel) and sent specimen data pertaining to four projects, to scientists in three countries.

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, in addition to 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 in 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 acoustic walls alongside roads. 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, whether 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, utilizing various techniques.

As part of the Steinhardt Museum of Natural History we can utilize the largest regional collection of birds (>23,000 specimens), which is an invaluable resource for comparing the remains and identifying the different bird species.

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

The Molecular Systematics Lab at the Museum (headed by Dr T. Feldstein-Farkash) routinely provides genetic identifications of the 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 2020–2021, the Lab examined 185 bird strike cases and 218 cases for the Israel Nature and Parks Authority. The Molecular Lab examined 135 of these cases.

THE HERBARIUM

THE WATER PLANTS, CYANOBACTERIA AND WATER FUNGI COLLECTIONS

Razy Hoffman

Research and curation (2020-2021)

Surveys and collecting trips continued and the herbarium was upgraded with the addition of over 800 new herbarium specimens of seaweeds, cyanobacteria and seagrasses from the Mediterranean

and the Red Sea. Surveys of 2020–2021 revealed some new aliens seaweeds that had never been reported from the Levantine shore of Israel before. Some of them are first records from the Mediterranean Sea.

Taxonomical and molecular studies also revealed several species new to science and, possibly, a new genus from the Red Sea and from the Mediterranean shore of Israel.

The large alcohol-preserved collection was fully unpacked and is now stored at its final destination in the museum. Maintenance and cataloging of the dry collections continued in 2021 as well.

Collaborative studies

- The collaboration with Prof. Hiroshi Kajihara (Hokkaido University, Japan) was very fruitful and a new paper of the ribbon worms of Israel is about to be published soon.
- Collaboration with Dr. Frederik Leliaert and Prof. Olivier De Clerck (both Gent University, Belgium) was also fruitful and a new paper including molecular study reports two new green nonnative seaweed invaders is almost was submitted for publication.
- A new collaboration with Prof. Jose Gabriel Segarra Moragues (University of Valencia, Spain) and Dror Melamed, a citizen scientist from Tel Aviv, commenced on the genus *Riella* and other liverwort found in freshwater reservoirs of Israel, Australia and Europe based on Dr Yaacov Lipkin's collection of water bryophytes and sediments stored in the museum.
- Another new collaborative study on all red seaweeds of the *Polysiphonia* complex (ten genera now) found along the Levantine Mediterranean shore of Israel and the Red Sea started with the assistance of Prof. Gary William Saunders (New Brunswick University, Canada) and Dr Pilar Díaz Tapia (Instituto Español de Oceanografia, Spain). Molecular studies of specimens collected from both seas will be performed in the collaborators' institutions.

Tasks in progress and plans for 2021–2022

Surveys of the marine flora of Israel as well as the maintenance of the collections will continue. The ongoing quantitative study of the algal drift, started in 2005, along the northern shores of Israel, will continue in 2022.

LAND PLANTS COLLECTION

Yuval Sapir and Jotham Ziffer-Berger

Research

During the 2020–2021 academic year, we ran several projects:

- Flower evolution, pollination biology, conservation, molecular ecology (Yuval Sapir).
- Fruit evolution in Cruciferae (Jotham Ziffer-Berger)
- Ecology of Sarcopoterium spinosum (Jotham Ziffer-Berger)
- Novelties in Flora Palaestina (Jotham Ziffer-Berger)
- Taxonomy of *Medicago-Trigonella* complex (Shira Penner)
- Taxonomy of Kalanchoe (Ronen Stein)

Collection management

- The herbarium moved to a permanent residence near the main museum building. The new herbarium complex includes a modern compactor storage facility with automatic climate control, which provides optimal conditions for the stored material. The complex also includes a storage space for bulky specimens, three laboratories and a preparation area with a walk-in freezer.
- The terrestrial plant specimens were all transferred to the compactors on 82 shelves.
- Dr Shira Penner and Mr Jacob Ashani were updating, organizing and performing maintenance work on the Margalit Galun Lichen collection, which had been stored in temporary cabinets for three decades. Now the collection is being databased and transferred to the herbarium's permanent storage facility.
- This year we received 140 specimens of land plants vouchers from the Israel Plant Gene Bank. The vouchers were validated and now they are being incorporated into the museum's collection.

- Prof. Avi Shmida (Hebrew University) donated approximately 300 specimens collected in the past two years.
- Mr Yair Ur, a senior botanist from northern Israel, donated approximately 100 specimens from his private collection.

Databasing

During the reporting period, we databased approximately 1400 land plant specimens and about 600 lichen specimens.

Scientific collaboration

The vascular plant herbarium maintained research links with several institutions:

- Oz Barazani, Volcani Institute
- Einav Mayzlish-Gati, Volcani Institute
- Thameen Hijawi, Al Quds University (Abu Dis, Palestinian Authority)
- Klaus Mummenhoff, Osnabrueck University (Germany)
- Ilana Shtein, Ariel University
- Daniela Cafri, Minisrty of Agriculture
- Avigail Heller, Ministry of Agriculture
- Agostinho Chicaia, African Union (Addis Ababa, Ethiopia)
- Avi Shmida, the Hebrew University of Jerusalem

Field trips

The Herbarium staff went on several collecting trips to:

- Northern Negev and Judean Desert, 10 March 2021;
- Judean Mountains and Shefela, 22 March 2021;
- Mt Bental, 21 April 2021.

Visitors

We accommodated the Israel Plant Gene Bank staff, who visited the herbarium and botanical garden on 7 October 2021.

Teaching

The following academic courses were offered:

- The ecology of special plant groups in the botanical gardens (Dr Y. Sapir, Tel Aviv University);
- General Botany (Dr Y. Ziper-Berger, Levinsky College of Education).

Provision of service

We were preparing of a list of potential pests in agricultural products for the Department of Plant Protection, Ministry of Agriculture (coordinated by Dr Zohar Yanai). We also continued to house herbarium of the Israel Plant Gene Bank (Volcani Institute).

THE PALAEOSCIENCES SECTION

THE PALAEONTOLOGICAL COLLECTION

Daniella E. Bar-Yosef Mayer

The largest component of the collection is the private collection donated by the late Prof. Heinz Bytinski-Salz, formerly a professor of entomology in the Department of Zoology, Tel Aviv University, who collected fossils as a hobby.

This year we completed the initial treatment of the collection. Each fossil was transferred from its old box into a ziplock bag, and a preliminary dataset with information on the contents of each drawer in the collections was created. The information includes the main taxa and periods within each drawer, their provenance if relevant, as well as the total number of specimens and their state

of curation and cataloguing. This system gives us a better control over the location of each item within the collection and for the first time we can provide an estimate of the entire Bitinsky-Salz collection. We found that most taxonomic groups and most geological periods are represented in this collection. Following this step, we are resuming the formal cataloguing of the collection into the computerized database. This information will assist us in assessing our needs when ordering new cabinets that are much in need.

Dr Yuri Katz continued his research collaboration with the Institute of Geology and Geophysics, National Academy of Sciences of Azerbaijan; Institute of the Physics of the Earth, Russian Academy of Sciences; Faculty of Geosciences, Utrecht University, The Netherlands; Helmholtz-Centre Potsdam, GFZ German Research Centre for Geosciences, Germany; Department of Earth Sciences, University of California Riverside, CA, USA.

Dr Olga Orlov-Labkovsky continued curation of the Palaeozoic Foraminifera collection.

THE ARCHAEOBOTANICAL COLLECTION

Dafna Langgut

All research done in the Laboratory of Archaeobotany 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 (with cooperation of Dr Y. Sapir).
- Ancient waterlogged wood preservation project. We are in the process of preserving the waterlogged wood assemblage of Gesher Not Ya'akov — North Bridge Ashelian for future studies (together with Prof. Gonen Sharon).
- We created a digital wood anatomy reference collection of the desert Israeli flora.

Active grants

2017–2021 Israel Antiquity Authorities: Archaeobotanical remains in Jerusalem (P.I., \$27,500).

2018–2021 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).

Research projects and collaborations

2017-2021: 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.

<u>2018–2021: 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).

Service on organizing committees

I am a member of the organizing committee of the following conferences:

4 40

- New discoveries from the excavations and research of the Institute of Archaeology. Tel Aviv University (October 2021).
- The First Annual Meeting of the Israeli Botanical Forum. Tel Aviv University (organized together with Dr Y. Ziffer-Berger; May 2022).

Scientific meetings and lectures

Local Conferences

- The Annual Conference on new developments in olive cultivation, Israel Ministry of Agriculture, Volcani Center, February 2020, paper presented: *The history of olive cultivation in ancient Israel*.
- The Annual Conference of the Sonia and Marco Nadler Institute of Archaeology, Tel Aviv University — New Discoveries from the Excavations and Research of the Institute of Archaeology, November 2020, paper presented: *Climate and environment at the dawn of agriculture*.
- The Annual Symposium in the memory of Prof. Yohanan Aharoni, Tel Aviv University, February 2021, paper presented: *The cultural impact on the natural vegetation of Jerusalem and its environs*.
- The 46th Archaeological Congress of Israel, Bar Ilan University, June 2021, paper presented: *The reconstruction of the pleasure garden of the Northern Palace, Masada* (together with G.S. Stiebel and M. Cavanagh).
- The 46th Archaeological Congress of Israel, Bar Ilan University, June 2021, paper presented: *The origin and spread of olive cultivation in the Mediterranean Basin* (together with R. Greenberg).

International Conferences

• The 12th International Conference on Quaternary, Paris-Aubervilliers, February 2020, paper presented: Vegetation and climate history in the Mediterranean Levant during the Late Pleistocene.

Media outreach

Our archaeobotanical research was featured in the following popular articles:

- King Herod's history of biblical massacres and bonsai trees (January, 2021): The Times. https://www.thetimes.co.uk/article/king-herods-history-of-biblical-massacres-and-bonsaitrees-g6f5rwgnx
- Archaeologists discover King Herod had a bonsai garden (January, 2021): Haaretz. https://www.haaretz.com/israel-news/2021-01-17/ty-article/.highlight/archaeologists-discover-king-herod-had-a-bonsai-garden/0000017f-dc14-df62-a9ff-dcd7cc340000
- Earliest Olive Pickling Factory Found at 6,500-year-old Site Off Israeli Coast (February 2021): Haaretz.

https://www.haaretz.com/israel-news/earliest-olive-pickling-factory-found-at-6-500-year-old-site-off-israeli-coast-1.9501993

ARCHAEOMALACOLOGY

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

During the reporting period, most project continued from the preceding year. Activities that relied on research in the malacological collections, based at the SMNH included the following:

• Shells from the Upper Palaeolithic site of Nahal Rahaf in the Judean Desert were studied and prepared for publication. Those include both the Mediterranean perforated gastropods that served as ornaments and middens of landsnails that represent activities of *Acomys* spp. (Muridae). Hairs suspected as belonging to the rodents are still under investigation.

- A report was submitted on the shell beads from the Iron Age copper mining sites in the Timna Valley.
- Shell assemblages from the Pre Pottery Neolithic B sites—Kefar Hahoresh, Ahihud, Mishmar Ha-Emek, Beisamoun and Yiftah'el—were being studied by Ms Heeli Schechter, graduate student at the Hebrew University of Jerusalem, under my supervision.
- Nahal Roded 110, a unique cult PPNB site in the Eilat mountains, and the Besor Valley survey of Palaeolithic sites yielded small shell assemblages as well.
- An initial study was carried out on shells from the classical site of Masada, as yet uncompleted.

Field trips

- Timna, Iron Age Copper mines, 26–27 December 2020.
- Nahal Rahaf, Upper Palaeolithic site, Judean Desert, 23 May 2021.
- Ein Gev Epipalaeolithic site and Skhul Cave, Middle Palaeolithic, 26 July 2021.
- Tinshemet Cave, Middle Palaeolithic site, 27 July 2021.

Scientific collaborations

- Scientific advisor for an exhibition on ornaments in prehistoric periods (Ahiad Ovadia, curator of prehistoric periods). Israel Museum Jerusalem.
- Timna Valley project, study of shells and beads, with Prof. Erez Ben-Yosef, Institute of Archaeology, Tel Aviv University.
- Nahal Rahaf Upper Palaeolithic rockshelter in the Judean Desert, with Maayan Shemer, Israel Antiquities Authority and Dr Nimron Marom, University of Haifa.
- Kefar Hahoresh shells, with Heeli Schechter, PhD candidate, and Prof. Nigel Goring-Morris, Hebrew University of Jerusalem.
- Delineating probable sea routes between Cyprus and its surrounding coastal areas at the start of the Holocene: A simulation approach. Project led by Prof. Phaedon Kyriakidis, Cyprus University of Technology, Limassol, Cyprus.
- Ramat Rachel shells. Project led by Prof. Oded Lipschits, Institute of Archaeology, Tel Aviv Univ.
- JRD shells. Project led by Prof. Gonen Sharon, Tel Hai College.
- Tinshemet Cave Middle Palaeolithic shells. Project led by Dr Yossi Zaidner, Institute of Archaeology, Hebrew University of Jerusalem.
- Nahal Roded shells. Project led by Dr Michal Birkenfeld, Ben Gurion University, in collaboration with Dr Uzi Avner, Dead Sea and Arava Science Center, and Dr Liora Horwitz, Hebrew University of Jerusalem.
- Nahal Efe shells. Project led by Dr Jacob Vardi, IAA and Dr Ferran Borrell, Spanish National Research Council, Barcelona, Spain.
- Masada, excavations directed by Guy Stiebel, Institute of Archaeology, Tel Aviv University.

Conferences

- *The earliest strung beads: What they tell us and why it matters.* Prehistory seminar, 27 October 2020. The Hebrew University of Jerusalem.
- *The earliest shell beads*. Keynote speaker. International Webinar on Molluscs and Ancient Human Societies, 28–30 September 2021. Pune, India.

Media outreach

Daniella E. Bar-Yosef Mayer was featured in *The Indian Express* prior to the Webinar in Puna. https://indianexpress.com/article/cities/pune/deccan-college-webinar-molluscs-ancienthuman-societies-7537418

ARCHAEOZOOLOGY

Lidar Sapir-Hen

The research at the Laboratory of Archaeozoology is based on the Archaeozoological collections. Since 2020, the laboratory conducts 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\$).
- 2020–2023 Israel Antiquities Authority: Hunting and herding at the dawn of animal domestication (P.I., 120,000 NIS).

Ongoing 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 $8^{\rm th}-2^{\rm nd}$ 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.

Service on organizing committees

I was a member of the organizing committee of the following conferences:

- Human evolution and paleoecology in the early Pleistocene. Tel Aviv University (2020).
- Animals of the past: Human-non-Human interactions and the ancient Near East. Tel Aviv University (2021).
- New discoveries from the excavations and research of the Institute of Archaeology. Tel Aviv University (2021).

Conferences

- 12th International Congress on the Archaeology of the Ancient Near East, Bologna, Italy, 2021, paper presented: *Looking for secondary products in the Late Neolithic in the Southern Levant*.
- 3rd Zooarchaeology of the Roman Period Working Group Meeting, Dublin, Ireland, 2021, paper presented: The faunal evidence from Early Roman Jerusalem: the people behind the garbage.

Student supervision

I advised three MA, one MSc and one PhD students, and one postdoctoral fellow. One MA student and the PhD student submitted their theses in September 2020. In addition, one lab technicians worked 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: Introduction to archaeozoology, Practical workshop in archaeozoology, Using the archaeozoological collection from various excavation sites.

Visiting scholars to the Archeozoological collection

Prof. Cheryl Makarewicz, Kiel University, Germany.

PALAEOGENOMICS LABORATORY

Meirav Meiri

The Palaeogenomics Laboratory was officially moved to its new spacious location in May 2021. The lab is a well-equipped clean room, where various substrates can be extracted and amplified using archaeological and museum specimens.

During the previous year, we extracted DNA from numerous ancient representatives of the following species: leopard (*Pantera nimer*), hyena (*Hyaena hyaena*), gazelle (*Gazelle gazelle*), hyrax (*Procavia capensis*) and ibex (*Capra nubiana*).

On-going research projects

- *Revealing the lost Byzantine viticulture of the Negev Highlands*. The aim of this project is to identify the origin and diversity of the Negev grapevine varieties, and to determine the closest living relatives of the Negev Byzantine heirloom cultivars.
- Modelling Anthropocene trophic cascades of the Judean Desert ecosystem: A hidden dimension in the history of human-environment interactions. In this project we explore the effects of human settlement intensity on desert ecological community structure, focusing on the hitherto unstudied phenomenon of trophic cascades in antiquity.

Active grants

2020–2023 The Israel Science Foundation research grant (No. 915/20) with Prof. Guy Bar-Oz, Department of Archaeology, University of Haifa. Project: Revealing the lost Byzantine viticulture of the Negev Highlands.

Conferences

May 2021 *Reconstructing Past Populations using Ancient Biomolecules*. We organized this conference to mark the inauguration of the new Palaeogenomics Laboratory.

Student supervision

- Dr Valentina Roveli, a post doc working on the Judean Desert Ecosystem project.
- Dr Pnina Cohen, a post doc working on the Byzantine viticulture project.

Teaching

Human and Animals relationship: bones & ancient DNA, the MSc and PhD course at the Institute of Archaeology, Tel Aviv University, together with Dr Lidar Sapir-Hen.

DAN DAVID CENTER FOR HUMAN EVOLUTION AND BIO-HISTORY RESEARCH

Israel Hershkovitz, Hilla May, Rachel Sarig and Viviane Slon

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.

Running research projects on historical and prehistorical populations (2021)

- Tinshemet cave hominins (120,000 years old). Research project: A hominin population between continents.
- Nesher-Ramla hominins (140,000 years old): who were they?
- Geulla cave hominins (100,000 years old): Neanderthal Homo sapiens introgression.
- Har Safsuf cave human remains: Human migration in the Chalcolithic.
- Manot cave hominins: Who were the Levantine Aurignacians?
- Ancient DNA studies: the Jews from the second temple period and their association to present Jewish populations.
- The teeth from Misliya and Geula caves: Who were the Achelu-Yabrudians?
- Timna human remains: Who were the people of Timna?
- Violence: The origin of warfare in the southern Levant.
- Yarmut human remains: Reconstructing the life history of the Yarmut people.
- Yotveta human remains: The earliest case of Klippel-Feil syndrome in the southern Levant.
- Yodfat human remains: Physical evidence of the Roman massacre in Yodfat.
- Tel Hadid human remains: The children from Tel Hadid.
- Asawir human remains: Reconstructing life history at the early Chalcolithic period.
- Tel Azeka human remains: Revealing the reason of death of the people uncover under the house ruins.
- Nahal Soreq human remains: Reconstructing life history at the late PPN to early Chalcolithic periods.
- Ashdod Yam human remains: Revealing the cause of death of the people buried in the mass burials at the earliest Levantine Byzantine church in Ashdod Yam.

Running field projects 2021

- Manot Cave excavation (Early Upper Palaeolithic);
- Tinshemet Cave project (Middle Palaeolithic);
- Skhul Cave project (Middle Palaeolithic);
- Tabun Cave project (Middle Palaeolithic);
- Geulla Cave project (Middle Paleolithic);
- Timna valley project (Early Bronze Age Iron Age);
- Emireh Cave project (Upper Palaeolithic);
- Horashim East (Middle Palaeolithic).

Active grants 2021:

Granted by Institute/Company	Total Amount
Israel Research Foundation (ISF)	1,300,000 NIS
Israel Research Foundation (ISF)	1,500,000 NIS
Broad-ISF	\$378,000
BSF	\$320,000
Australian Research Council	\$254,000
Dan David Foundation	\$110,000

Active collaboration projects with foreign researchers (2021):

- Prof. Gerhard Weber University of Vienna, Austria;
- Prof. Anne-Marie Tillier Université Bordeaux, France;
- Prof. Dominique Grimaud-Hervé Muséum national d'Histoire naturelle, Paris, France;

- Prof. David Reich Harvard University, US;
- Prof. Svante Pääbo Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany;
- Prof. Johannes Krause Max Planck Institute for the Science of Human History, Jena, Germany;
- Prof. Rolf Quam Binghamton University, US;
- Prof. Bruce Latimer Case Western Reserve University, Ohio, US;
- Prof. Luca Fiorenza Monash University, Australia;
- Prof. Paul O'Higgins The University of York, UK;
- Prof. Stefano Benazzi University of Bologna, Italy;
- Prof. Frank Ruhli University of Zurich, Switzerland;
- Prof. Antoine Balzeau Histoire Naturelle de l'Homme Préhistorique, CNRS.

Active collaboration projects (incl. joint research grants) with Israeli archaeologists (2021):

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

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 378 animal specimens, including mammals, birds, reptiles, worms, molluscs, insects, 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 corresponding collections, proved to be highly important for the curation of the samples and promotion of the zoological and ecological research. Almost half of the molecular work was the genetic identification of jirds (*Meriones* sp.) as part of an ecological research conducted by Michal Zaitzove-Raz, a PhD student studying these small mammals.

◀ 46

This year we also performed a genetic population analysis of the Eurasian otter (*Lutra lutra*) ordered by the Israel Nature and Parks Authority. We used the high-end technology of double digested restriction-site associated DNA sequencing (ddRADseq) to calculate the genetic distances between *L. lutra* specimens preserved in the SMNH tissue collection in order to promote the conservation of this highly endangered species in Israel and Europe.

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, 2303 tissue samples were added to the Museum tissue collection, including 639 mammal specimens (74 species), 309 (153) birds, 415 (64) reptiles and 7 (4) amphibians. Tissue samples from the mammal collection were loaned to Frieder Mayer from the Leibniz-Institut für Evolutions- und Biodiversitätsforschung (Germany) and to Eli Geffen from the Tel-Aviv University (Israel). A reptilian tissue sample was loaned to Sunandan Das from the University of Helsinki (Finland) and an avian tissue sample to Kiat Yosef from the University of Haifa (Israel).

SMNH tissue collection public database

Prof. Shai Meiri received an award from the Global Genome Biodiversity Network (GGBN) to digitize and publish the SMNH vertebrate tissue collection (GGI-GGBN-2020-270). The vertebrate tissue collection database is now available through the Global Biodiversity Information Facility (GBIF) at https://www.gbif.org/publisher/748bb006-8e16-4703-9936-8be1286aac30

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 policy-making. Following this meeting, the SMNH became a Member of the Global Genome Biodiversity Network (GGBN).

Student training

The Molecular Lab also provides molecular training for students and personnel of the Steinhardt Museum and the School of Zoology, Tel Aviv University. In 2021, eight students have been trained in the Lab.

In addition, a new 2-credit course 'Applied molecular species identification', was offered in 2021 by Dr Tamar Feldstein-Farkash, Dr Omri Bronstein and Prof. Dorothée Huchon. The course, being a part of the Israel Taxonomy Initiative series of courses, provided students with practical knowledge and tools to conduct an independent barcoding genetic study and exposed them to the potentials and limitations of integrating molecular diagnostics in taxonomic research. The course combined both wet-lab practices as well as computer analyses. It focused on the practical aspects of molecular barcoding (rather than theory) and provided hands-on experience and guidance in utilizing genetic sequence data. The emphasis of the course was on the handling of practical problems such as primer design, sequence correction, contaminations, taxon sampling as well as information regarding the shortcomings of public databases (misidentifications, lack of data, contaminations). The course took place between 14–19 February 2021, and 20 participants attended it.

THE MUSEUM DATABASE

Yonatan Gur and Tirza Stern

During 2020–2021, a substantial part of our collections databases was migrated to a new centralized database system with advanced user interface and improved performance, developed specifically for the SMNH. This greatly improves our ability to query and extract information from our databases and share it with our colleagues. We should soon complete the migration of all our active collections, and continue improve the data infrastructure to support research.

We have completed a collaboration with the Global Genome Biodiversity Network (GGBN), an international network of institutions that share an interest in long-term preservation of genomic samples representing the diversity of non-human life on Earth, where we uploaded a substantial Vertebrate tissue dataset with more than 10,000 records .The dataset is also available via GBIF at https://www.gbif.org/dataset/288e1f4c-7c09-4604-ad19-920a61c55462.

In 2020–2021, 39,344 new records were added to the SMNH database, to a total of 557,193 entries. At present, the SMNH database contains the following numbers of entries in the following groups, with the number of new records in parentheses:

- Amphibia 2791 (33)
- Archaeobotany 1012
- Arthropoda (other than insects)
 - 7364 (64)
- Ascidiacea 1134 (25)
- Aves 23342 (631)
- Brachiopoda 47
- Bryozoa 480 (223)
- Coelenterata 13886 (138)
- Echinodermata 2401 (73)
- Feather Identification Lab 2068 (403)
- Foraminifera 786
- Fossils 3544 (134)

- Insecta 368140 (33146)
- Lichens 1345
- Mammalia 17283 (991)
- Marine parasites 47 (45)
- Molecular Laboratory 1575 (422)
- Mollusca 64855 (606)
- Pisces 15439 (505)
- Porifera 1346 (30)
- Reptilia 19847 (556)
- Vascular plants 2313 (1300)
- Vermes 240 (16)
- Water plants 5908 (3)



THE ISRAEL TAXONOMY INITIATIVE

Daniella E. Bar-Yosef Mayer

Preservation of biodiversity—the variety of life forms on the planet—depends on scientific knowledge and expertise. Government agencies, research institutes and nature conservation organizations around the world have identified an alarming gap between the existing taxonomic knowledge of biodiversity and the need for this information to guide the best 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; however, the state of the discipline is still inadequate. Many sophisticated tools and models—morphological, biochemical and genetic—as well as advanced software, are available for taxonomists; still, basic research lags seriously behind needs. The Millennium Ecosystem Assessment—a United Nations endeavour to review trends and implications of changes in global ecosystems—identifies insufficient 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, the basic taxonomic research is in despair. 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. Therefore, 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 direct implications for the agriculture, 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 academic 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 and their repercussions, taxonomic courses and international research visits planned for the 2020–2021 academic year had to be generally cancelled.

ITI-sponsored courses in 2020-2021

- Wild bees in Israel was presented by Dr Achik Dorchin Dr Gidi Pisanty at Tel Aviv University.
- Applied Ecology was taught by Prof. Tamar Dayan and Dr Ittai Renan at Tel Aviv University.
- Applied molecular species identification was offered by Dr Tamar Feldstein-Farkash, Dr Omri Bronstein and Prof. Dorothée Huchon at Tel Aviv University.

EDUCATION AND SCIENCE COMMUNICATION DEPARTMENT

Ilil Pratt

The academic year of 2020–2021 started with the second COVID-19 lockdown announced on 16 September 2020, followed by yet another lockdown on 27 December 2020. The education system returned to its full activity on 18 April 2021. Indeed, these lockdowns were reflected in the dramatically low number of visitors during the beginning of 2021, with a sharp increase from April to the highest values achieved only in the summer of 2021 (June–August).



Due to the practically cancelled school year, we had fewer visitors than expected, especially from the education sector. During the academic year we hosted mostly regular guided tours at the museum (6,567 visitors) and explore nature family activity (4,338 visitors).

The botanical gardens were under renovation and closed to visitors during this academic year of 2020–2021.

In our constant efforts to improve our outreach and science communication skills, our guides participated in a study carried by Anna Pshenichny and Prof. Dina Tsybulsky from the Technion— Israel Institute of Technology, Faculty of Education in Science and Technology. The study aimed to assess Natural History Museums educators' conceptions on the integration of nature of science in guidance.

Program	Number of visitors
Guided tour at SMNH	6,567
Guided tour (incl. Zoological Garden)	637
Science day	658
Science visit	360
Series of science visits/days	494
Explore nature	4,338
Other activities	70
Total	13,124

Visitors according to program

Visitors divided by age group

Age group	Number of visitors
Kindergarten	199
Elementary school	3,993
Middle school	1,095
High school	767
Higher education students	169
Families	4,875
Adults	1,805
Senior citizens	221
Total	13,124

THE ISRAEL NATIONAL CENTER FOR AQUATIC ECOLOGY

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

Steering Committee: Prof. Tamar Dayan (TAU), Dr Menachem Goren (TAU), Nissim Keshet (INPA), Dr Dana Milstein (INPA), Alon Zask (IMEP), Dr Amir Erez (IMEP), Hanoch Ilssar, Dr Doron Markel (KKL-JNF).

Members: Dr Yaron Hershkovitz, Tuvia Eshcoli, Etai Kahana, Avital Katz, Adi Weiss, Dafi Luz, Nili Segman, Naomi Gordon.

MSc student: Almog Hershko-Pnuel.

The Israel Center for Aquatic Ecology (ICAE) was established in 2015 as part of the Steinhardt Museum of Natural History. It is supported jointly by the Israel Nature and Parks Authority, The Ministry of Environmental Protection, the Jewish National Found (HaKeren HaKayemet LeIsrael, KKL-JNF) and Yad Hanadiv Foundation. The ICAE adapts and implements the EU-WFD bioassessment protocols for streams in Israel. We collect and identify macroinvertebrate taxa and calculate biological metrices in streams for assessement of ecological conditions. The results are disseminated to decision makers, river restoration practitioners, stakeholders and the public.

Main activities in 2020-2021

- Development and implementation of a national biomonitoring scheme for streams in Israel. In 2020–2021 we initiated a 2-year project of biological monitoring for the Shikma–Besor catchment. The project is supported by the Shikma-Besor Drainage Authority and the Ministry of Environmental Protection.
- Routine bioassessment as a supporting tool for river basin management:
 - (1) Lower Jordan River and its tributaries. The project is supported by the Lower Jordan River and Drainage Authority and the Ministry of Environmental Protection.
 - (2) The Tzipori stream and its tributaries as part of the Tzipori watershed restoration project.
 - (3) Biological monitoring of the Hula valley streams. The project is supported by the Israel Nature and Parks Authority.
 - (4) Biological assessment of the Ashalim stream industrial wastewater spill (4th year). A 5-year monitoring to assess the impact of highly acidic wastewater spill on the aquatic ecosystem of the Ashalim Wadi (Judean desert).
 - (5) Routine seasonal monitoring of the Kishon stream, supported by the Kishon Stream Authority.

Scientific collaborations

- Ongoing collaboration with the Aquatic Ecology Department at the University of Duisburg-Essen, Germany.
- EU-Horizon 2020: Research and Innovations Actions project MERLIN Mainstreaming ecological restoration of freshwater-related ecosystems in a landscape context: innovation, upscaling and transformation. Preparing of a research proposal.
- Leading the ecological assessment of the Tzipori restoration project. Supported by the Kishon River and Drainage Authority.
- Collaboration with the Open Landscape Institute on examination of climate change effects on streams and springs in Israel.

Teaching

- *Pollution and Rehabilitation of Aquatic Systems*. Porter school of environmental studies, Tel Aviv University.
- *The Integrative-organismal lab: biomonitoring using aquatic invertebrates.* School of Zoology, Tel Aviv University.

Graduate students

Almog Hershko-Pnuel (MSc): Taxonomy and ecology of Hydropsychidae larvae as bioindicator species in freshwater ecosystems in Israel.

Talks and presentations

- *Morphological identification of insect larva by using molecular tools*. 39th Conference the Entomological Society of Israel (14.10.2020).
- Ecological value of aquatic systems in Israel characteristics and distribution. Training course for pest control: the little fire ant, mosquitoes and the pest control scheme. Pest Control Division, Ministry of Environmental Protection. Held at the Steinhardt Museum of Natural History (21.10.2020).
- Water management as a challenge in the Tzipori stream. Panel moderator. AGMA (23.12.2020).
- How do we protect nature? The role of long-term ecological research. The 12th conference of the Israel Nature and Parks Authority (9.3.2021). Hosted by the Israel Center for Aquatic Ecology.
- How to do 'stream ecology' in a challenging region: the Israeli experience. River Ecology and Management Seminar, University of Karlstadt, Sweden (16.3.2021).
- Restoration of streams from a basin perspective how do you check that it works? The 49th Annual Conference on Science and the Environment, the Society for Ecology and Environmental Quality Sciences (8.7.2021).
- Streams in the Kinneret Basin: uniqueness, pressures and challenges. Connecting the Upper Kineret conference challenges and opportunities, Tel Hai College (21.10.2021).
- Israel Center for Aquatic Ecology: the science of streams in the service of man and the environment. The Steinhardt Museum of Natural History (4.11.2020).



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 constitute, after the plants, the 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 research in the Lab focuses on conservation and ecological management, utilizing arthropods as a sensitive tool for the assessment of ecological quality and ecosystem response to anthropogenic activities. The assessment includes the multivariate analysis of the community structure and composition, integrating various ecological indices and experimental approaches. The taxonomic identification is the basis of the analysis in each study. The identification relies on the insect collections in the Steinhardt Museum of Natural History and the Museum's scientists, 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 even 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 research deals with monitoring of arthropod communities along borders between agricultural and natural landscapes and ecological corridors; providing operational recommendations for restoration management following ecological disasters in nature reserves; monitoring and eradicating invasive insect species; assessing anthropogenic pressure on sensitive ecological systems; coordinating the compilation of the Israeli endangered invertebrate species 'red list' and compiling the Israeli invasive invertebrate species 'black list'.

The projects run in collaboration with the Ministry of Environmental Protection, Ministry of Agriculture & Rural Development, 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 Laboratory for Applied Ecology aims to provide a high-resolution tool for understanding ecological systems in order to conserve the Israel's biodiversity.

Reports

- Israel national red list of invertebrates pilot report, 2018–20. Written with HaMaarag for the INPA.
- The effect of the 2016 wildfire on the arthropod community of Hakfira nature reserve a summary of 2017–2019 sampling data. For the INPA.
- The effect of the 2016 wildfire on the arthropod community of Hakfira nature reserve a summary of spring 2020 sampling data. For the INPA.
- Arthropod sampling in Sodom salt marsh. For the INPA.
- Ecological and hydrological changes and their effect on the arthropod community in Einot Tzukim national park. For the INPA.
- The effect of the 2017 pollution event on the arthropod community of Wadi Ashalim a summary of 2018–19 sampling data. For HaMaarag and the INPA.

- The arthropod community in Lower Wadi Kziv in 2019–20 a comparison with the community as sampled in 1998–2000. Written with Meir Finkel for the INPA.
- Methods and protocols for environment-friendly monitoring and eradication of the Little Fire Ant. Written with Hakfar Hayarok For the Ministry of environment protection and the INPA.
- Protocol for dipping tree-pots in order to eradicate the Little Fire Ant. For the INPA.
- Effective protocols and insecticides for the eradication of the Little Fire Ant from plant pots, nurseries and various habitats. For the KKL-JNF, INPA and the Ministry for Environment Protection.

Invited lectures

- Go to the ant, researcher: bioindicator insects and pollution in Wadi Ashalim. 39th Conference the Entomological Society of Israel, October 2020.
- Arthropods in Wadi Ashalim: pollution impact and ecosystem recovery. Wadi Ashalim Bridging Meeting, November 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.



HAMAARAG — ISRAEL'S NATIONAL NATURE ASSESSMENT PROGRAM

Ittai Renan

Overview

HaMaarag—Israel's National Nature Assessment Program—is a consortium of 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 2020-2021

State of Nature report

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

Ashalim Stream Ecosystem Montoring Program

In 2017, a large-scale leakage of acidic contaminant with high concentrations of heavy metals from a local fertilizer plant polluted about 20 kilometers of the Ashalim stream in the Judean Desert. The Israel 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 4th monitoring year. Reports of the findings of the monitoring program were submitted to the State Attorney's Office as part of the mediation process against the polluters, and representatives of HaMaarag and researchers from the monitoring program presented the findings.

A recovered part of the Nahal Ashalim. (Photo R. Horwitz)



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 towards the end 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 knowledge base to assist managers and policy-makers in assimilating the value of biodiversity and ecosystem services into the planning and management of Israel's landscapes. Further to this, the report included a summary of all project results and a trends table of the main Nature's goods and services.

The National Program for Terrestrial Biodiversity Monitoring

The 5th monitoring cycle of the *National Program for Terrestrial Biodiversity Monitoring* started. The program aims to assess the state of Israel's biodiversity and nature, and significant changes that occur to them. The program monitors the Israeli flora and fauna on a regular basis through field surveys, surveillance cameras and sensors. A pilot study for vegetation remote sensing started in 2020 fall and ended in February 2021.

Evrona Nature Reserve Ecosystem Monitoring Program

The 5th year of the monitoring program was heading towards completion. The program assesses the effects of the oil spill in Evrona Nature Reserve, and an interim report was prepared for the Israel Nature and Parks Authority. Considering rehabilitation that was conducted in the reserve, 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.

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. The analysis of monitoring data of 147 butterfly species was performed. Results of monitoring was contributed to InsectChange, a global database of temporal changes in insect and arachnid assemblages.

Conferences

- November 2020 Dead Sea annual conference. Evidence for a multi-layer ecosystem damage in the polluted Ashalim desert channel.
- December 2020 A full day seminar conducts by the Hamaarag in the Steinhardt Museum of Natural History. *Ashalim Stream Ecosystem Montoring Program*.



THE OPEN LANDSCAPE INSTITUTE

Uri Ramon, Amir Perelberg, Aviv Avisar

This was the fifth year of the Institute operation under the Steinhardt Museum of Natural History. In the last year, our ties with the Museum staff and our colleagues in the applied science wing strengthened, and a few projects were conducted in collaboration with the Israel National Center for Aquatic Ecology and Hamaarag. The work with Forestation wing in Keren Kayemet LeIsrael expanded significantly and the Society for the Protection of Nature in Israel (SPNI) resumed its annual support, which was suspended during the Corona crisis.

Overview of activities during 2020-2021

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, Yatir to Judea desert highland ecological corridor, Hof HaCarmel coastal area, four nature reserves in the northern Negev (including preparation of background for the statutory declaration process of two of them), the Jewish National Fund (KKL-JNF) upgrade of the forests survey system (a pilot study in four forests: Biria, Adulam, Carmon and Masua), Golan Heights (ecological background for a strategic plan), and Jojoba plantations in Hazerim and Beeri. Nationwide surveys were conducted: *Protected nature assets in KKL-JNF forests; Endangered plant species; Four national monitoring units: Coastal sands, Inland sands, Conifer forests and Mediterranean maquis;* and crops wild relatives' survey. We also prepared a draft of ecological corridors for the whole Northern district of Israel.

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; 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 in 2020–2021 included:

- 1. Strengthening and expanding activity in fields defined within the Institute's core practices:
 - 1.1. Ecological and landscape background for planning conducting and developing methodology for nature, landscape and human heritage surveys.
 - 1.2. Agriculture and environment developing knowledge, expanding dialog circles, supporting professional and public processes.
 - 1.3. Botanical surveys developing methods and tools like field guides for practitioners from different sectors and organizations.
 - 1.4. Restoration Ecology developing the knowledge of the field and implementing it in agriculture, water management, planning and development practices. The main focus this year was streams' restoration.
- 2. Expanding and assimilating of our products among various target audiences:
 - 2.1. Developing tools for disseminating knowledge: workshops, lectures for planners and university students in relevant fields, instructors and more.

- 3. Strengthening connections and expanding collaboration with the partner organizations in the Steinhardt Museum of Natural History and other colleagues.
- 4. Professional and budget strengthening: determining the budgetary basis for the coming years, preserving current professional staff, absorbing new employees and training them to carry out the intended tasks.

The published reports are available on the OLI Website: https://deshe.org.il/en/open-landscape-institute-oli.

Detailed Report for 2020–2021 – 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 policy-makers. The final report is now available on the OLI Website.

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. The final report is now available on the OLI Website.

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. The final report is now available on the OLI Website.

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. The final report is now available on the OLI Website.

Hof HaCarmel coastal area

The Hof HaCarmel regional council aims to prepare a master plan for the management of its coastal area — the longest municipal coastal stretch in Israel and one of the busiest from spring to autumn, comprising some of the most attractive and sensitive habitats: sandy beaches and dunes, low Kurkar ridges parallel to the coastline, some submerged and popping out as near-shore islands and others running along the sea frontline, creating rocky gorges, coves, caves, shallow lagoons and fringing abrasion platforms. More inland occur other sensitive habitats such as salinas, estuaries, wetlands, swamps, ephemeral and perennial streams, winter ponds, heavy-soils and inland Kurkar ridges — patch the area and together create a most unique mix of nationally important ecosystems. The survey's main goal is to provide a detailed background and database to support the planning process. A draft report was submitted for comments and is available on the OLI Website.

North Akko valley

The area of the Na'aman basin in the north of Akko valley is comprised with some of the most vulnerable and sensitive habitats in Israel: salinas, wetlands, ephemeral and perennial streams, and heavy-soils. Most of the area is currently used for open field agriculture, but these habitats

are further threatened by various development plans, including photovoltaic farms, expansion of settlements, and construction of new roads and railroads. The ministry of Environmental Protection wishes to confront these plans with evidence-based data, and the survey is meant to provide this missing information. The first phase of this survey was completed during 2021, and the survey will continue in 2022.

Nature reserves in the northern Negev

Four nature reserves in the northern Negev were surveyed: three as a background for the advancement of statutory declaration process of suggested reserves (Lower Grar stream, Revacha stream and Yeroham Iris), and the fourth—Be'eri reserve (declared and approved)—as a background for the management of the reserve. Intermittent reports were submitted, and the surveys will be completed after spring 2022.

Jojoba plantations in Hazerim & Be'eri

Jojoba Desert Company markets its jojoba oil products to the cosmetics industry abroad. As part of its obligation to comply with the international quality standard 'Fair for Life', it is obliged to prepare a management plan for the biodiversity within and nearby its plantations, located in the sensitive and under-represented loess plains of the northern Negev. The survey is meant to provide a background for such a plan. The first stage was completed, comprising the mammals, birds and reptiles' surveys. The second stage confined to the plants and invertebrates' surveys will be conducted during 2022.

Crops Wild Relatives (CWR)

Israel intends to submit an application to UNESCO to declare selected regions as world heritage, due to the fact that Israel is a hotspot of crops wild relatives, recognized by the UN Food & Agriculture Organization as crucial for the worlds' food security. The survey is meant to complete gaps in the distribution of CWR and to serve as a database for validation and calibration of computerized distribution models. In 2021, surveys of CWR were conducted in wetlands and heavy soils habitats, and an annual report was submitted. The survey will continue in 2022.

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

Four national long-term monitoring units were surveyed in 2021: Coastal sands, Inland sands, Conifer forests and Mediterranean maquis. New remote sensing high-resolution aerial photographs methodology was developed and implemented for the Inland sands, Mediterranean maquis and Conifer forests units. Methodology for the coastal sands is yet to be developed. The final report and data were submitted.

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, as well as an improved database for policymakers. The final report was submitted and awaits approval by the customers in order to upload it to the OLI Website.

Ecological corridors in Israel's Northern district

The INPA and Israel's Planning Authority (PA) intend to advance the statutory protection of ecological corridors in the northern region of Israel. OLI prepared a draft for these corridors, based on the methodology developed for our ecological surveys. The report and GIS layers were submitted to the INPA and PA.

KKL-JNF upgrade of the forests survey system (a pilot study in four forests: Biria, Adulam, Masua & 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 three main stages: pre-survey database update, forest condition general field survey and post-survey database update. Four

forests were selected for the pilot study, in each KKL-JNF administrative regions: Biria (North region), Adulam & Masua (Center region) and Carmon (South region). The draft surveys were completed and a report was submitted. In the coming years, the methodology developed during this phase will be used to systematically survey all KKL-JNF forests in Israel.

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 boosting up 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 was 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 to mitigate the damage to these assets as much as possible. The second stage of this survey was completed in 2021 and an annual report was submitted. The survey should be completed by the end of 2022, and pass from the development phase to routine process in the following years.

Endangered 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 2021, the survey focused also on two endangered plants' habitats: heavy soils (southern Golan Heights and Judean Lowland), wetlands (Nucheileh springs, Dan and Hatzbani streams), and on one hotspot of endangered plants (Mt Keta, Hermon Ridge). An annual report was submitted to the INPA. The survey will continue in 2022.

The complete guide for botanic mapping in Israel

The first draft of the guide for botanic mapping in Israel (the Mediterranean region) was published in 2014. Since then, the OLI staff used this guide in many field surveys, when various methodological issues occurred in the application of the current edition, which required revision. In addition, in 2017 we completed a first draft for botanic mapping of the arid region of Israel. This year, we published the first complete draft of the revised and united guide for both regions. The guide will be available soon on the OLI Website.

Advanced field course for botanists

This year, we have continued the development of the botanic skills of field workers, by providing an advanced course in botany. During the reporting period, 14 botanists participated in four workshop days, covering various regions in Israel.

Plans for 2021–2022 – Nature and Landscape Surveys

Misgav regional council

About 90% of the area of the Misgav regional council, located at the northern part of the lower Galilee and the southern part of the upper Galilee, are open areas — mostly natural landscapes and planted forests. The survey is meant to provide a detailed background to support future and current planning processes, and an improved database for policymakers.

Mate Asher regional council

The regional council Mate Asher in the upper western Galilee is characterized by the Mediterranean climate and patched with broad areas of natural Chaparral landscapes, planted and natural forests,

and an open agricultural landscape. Part of its range was already surveyed, or being under survey by other OLI projects. The current survey was meant to cover the yet unsurveyed open areas of the council and to provide a detailed background to support various current and future planning processes, and an improved database for policymakers.

Volcanic mounds in the Golan Heights (in collaboration with Shamir Research Institute)

The area of the volcanic mounds in the Golan Heights is the largest volcanic area in Israel, with distinctive and prominent landscape at the national level. In this unique region, there are various aquatic habitats: springs, winter ponds, shallow wetlands and steep canyons with flowing steams. These support a nationally exceptional biodiversity that should be carefully planned and protected. The survey was meant to provide a detailed background to support future and current planning processes, and an improved database for policymakers.

Wild olive trees on Atlit ridge (in collaboration with Volcani Institute)

The Kurkar ridge around Atlit is full of natural, landscape and cultural assets. Among these, is probably also the wild-type variant of the European Olive (*Olea europaea* var. *sylvestris*), a dominant tree species along this quickly diminishing habitat, but still prominent in the relatively undisturbed parts of the ridge. This unique population might be the last genetic remnant from which modern olive trees were domesticated. The survey is meant to map and characterize these plants, to provide a scientific basis for planning, conservation, management and maintenance of this important population.

Yarkon basin streams

The Yarkon drainage authority is the last in the Mediterranean Israeli region, where ecologic survey of its streams is yet to be done. The aim of the survey is to provide a detailed background to support future and current planning processes, and an improved database for policymakers. We begin with a pilot study this year, covering ca. 20% of the basin streams. The rest of the project was submitted to the Open Landscape Protection Fund for further support (see also below).

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

A survey of additional monitoring units is planned: Mediterranean-desert transition zone, Loess plains of the northern Negev, Negev highlands and Hyper-arid desert (Arava valley). No methodological development is planned for 2022.

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 for increasing its plant 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 to mitigate the damage to these assets as much as possible. The project is aimed for completion in 2022, and pass from the development phase to routine process in the following years.

KKL-JNF upgrade of the forests survey system

KKL-JNF began a process of unifying and standardizing its national forest surveys, based on the recently approved forest management policy. The first stage of the survey in four pilot forests — Biria (North region), Adulam and Masua (Center region), and Carmon (South region)—was completed in 2021. From 2022 and onwards, the developed survey methodology should be systematically implemented in all KKL-JNF forests in Israel. In 2021–2022, 15 forests are planned to be surveyed.

Integration of remote sensing methods in KKL-JNF forests survey system (in collaboration with Prof. Noam Levin, HUJI)

KKL-JNF manages more than 10,000 ha of forests, and the forest survey is one of its major tools for planning and management. The forest database is composed of zoning the forests into polygons, characterized by many attributes using traditional field methods. The limitations of this database

include the high cost in time and manpower required to map the forests, and thus surveying all forests takes at least 10 years. In the past decade, there were great advances in remote sensing of forests from space, thanks to the access to sensors with improved spatial, temporal and spectral resolutions, and the Google Earth Platform, enabling to run global analyses. Recent studies in Israel demonstrated the ability to map natural vegetation in high details, but some of those studies were based on drones or on aerial hyperspectral sensors with high abilities; however, they are costly and cover small areas. In this three-year study (2022–2024), we intend to develop operational tools to collect quantitative metrics for forest surveys using freely available imagery, automatic segmentation and machine learning tools. We will use time series of spectral indices calculated from these sensors to quantify the following variables: percent cover of perennial vegetation, annual vegetation, non-photosynthetic vegetation and bare soil; trends in vegetation cover; canopy height; burnt areas and fire severity; segmentation of tree canopies (in sparse forests) and of forest stands. The remote sensing analysis will be accompanied by field surveys of the same variables for calibration and validation of the models, in selected forests in the three districts of KKL-JNF, representing different climate conditions and forest types. This study will enable KKL-JNF to advance the operational use of remote sensing for monitoring and managing its forests, reducing costs and shortening field work, better directing field surveys, and providing annual products of the state of the forest benefiting the public.

Long-term monitoring of endangered & rare plant species in KKL-JNF forests (in collaboration with HaMaarag)

KKL-JNF managed open landscapes are of primary ecological importance in habitats that were widely affected by anthropogenic development and under-represented in nature reserves and national parks: deep, heavy soils in valleys (mostly cultivated) and light soils in the coastal plain (mostly covered by asphalt and concrete). The predicted further development, according to Israeli population growth forecasts, is expected to exacerbate this trend. Thus, KKL-JNF forests constitute a potential refuge to rare and endangered plant species, as well as to flag-species that are not endangered but represent cultural values and attract visitors. Protecting these species serves multiple purposes: preventing harm to protected natural values (state law), preserving biodiversity, maintaining proper function of ecosystems, fulfilling international treaties requirements for the protection of biodiversity, and protecting flag-species which bear cultural values. All coincide with the protocol for management of sustainable forests adopted by KKL-JNF. Optimal protection of target species requires long-term monitoring, as well as the characterization of environmental factors and management actions that influence the fitness of the populations. This study will lay a long-term plan composed of two aspects, i.e. monitoring and research. In the monitoring aspect, annual surveys will be performed to map the distribution and size of the target species populations and assess their habitat quality. In the research aspect, an observational study will be carried out to examine the effect of selected environmental, management and use variables on the spatiotemporal population dynamics, to optimize forest management for the benefit of the focal species and the forest as a whole.

Surveys and projects not yet approved

North-Western Galilee forests survey (awaits KKL-JNF approval), Shikma park survey (submitted to The Open Landscape Protection Fund), Judea lowlands survey (submitted to The Open Landscape Protection Fund), Shmarya stream basin survey (submitted to The Open Landscape Protection Fund), Central Golan Heights (submitted to The Open Landscape Protection Fund), Yarkon basin streams survey (submitted to The Open Landscape Protection Fund).

Tools Development and Research – Detailed Report for 2020–2021

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

Funding source: The Society for the Protection of Nature, the Ministry of Environmental Protection, the Nature and Parks Authority.

Project partners: The Society for the Protection of Nature.

Current Project status: Towards the concluding steering committee.

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. As part of the project, an endangered plant species was restored to the vineyards margins in the Judean lowlands. This specie was extinct in the area as a result of development and agriculture. In addition, a survey was conducted to map the presence of endangered plant species on the Dalton Plateau (Upper Galilee), and a protocol was written for the timing of the agricultural interface in a way that guard those species. In addition, generic protocols were written. Those protocols relate to different stages in the cultivation of the vineyard and to various elements in its management in a way that assimilates principles of biodiversity conservation.

2. Project: Avocado plantations in Milopri - Phase III

Funding source: Milopri, Israel Land Authority.

Project partners: The Western Galilee Cities Association, the Western Galilee Drainage and Rest Authority.

Current Project status: On-going.

In 2019–2018, various pilot projects were carried out to test the suitability of different ecological interfaces for growing avocados. In the process, cipher plants were planted, supporting various pollinators along fields margins, various cover crops were tested, and a natural winter pond was restored as part of solving drainage problems. 'Shelter gardens' were also established on the of agricultural margin on three sites, where endangered plants species were planted as a future source of seeds. The project resulted in the development of protocols for ecological principles in avocado orchards management, i.e. 'biodiversity protocols'.

During 2020–2021, we implemented the biodiversity protocols among the pilot growers (Kabri and Gesher Haziv). We also tried to adjust a unique protocol for each avocado plot. The plots were rated according to their importance for maintaining ecological connectivity at the local and national levels, and each plot received a set of guidelines based on the level of importance of the plot for ecological connectivity and its age. We also conducted a filed margin survey mapping native habitat, invasive species, restoration potential and other hazards, applied for restoration funding from the Israel Land Authority and were awarded it.

In 2022, we plan to execute our files margin restoration plans. We also continue the biodiversity protocols implementation among the growers. We also accompanied a project for invasive species clearing. Kikion (*Ricinus communis*) species is invasive plant species growing in avocado orchard margins and riverbanks. It is a surrogate for the quarantine pest harming the crops and jeopardizing export. In addition, additional proposals were submitted to the Open Space Fund and the Point Point Foundation for further treatment of the rest of the field.

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

Funding source: Hanadiv foundation.

Research partners: Moran Development and Consulting firm, Stream and Drainage Authorities: Southern-Jordan, Soreq-Lakhish and Yarkon.

Current study status: On-going.

Riverbanks stabilization is a pivotal topic in the rehabilitation and restoration of rivers and streams worldwide. There are several methods to protect riverbanks by decreasing their vulnerability to erosion. The development of riparian plants on banks and buffer zones is a natural and sustainable process, which supports both the goal of stability in banks and the functionality of the stream's ecological system. Still, several core issues in the application of this method are yet to be resolved. The Open Landscape Institute in collaboration with Moran development and Consulting, promote actions that would make nature-based solutions more practical and accessible, incorporated in the development and maintenance scheme of the stream and drainage authorities in Israel.

Project targets: (1) Create a partnership with three stream and drainage authorities, based on a collaborative learning process; (2) Perform data collection, analyze and draw conclusions regarding streams in different geographical areas where riverbank stabilization using vegetation

was executed; (3) Construct a design and execution protocol for the stabilization of riverbanks using vegetation, addressing the differences between disparate streams/geographical areas; (4) Information diffusion and assimilation, in collaboration with "AGMA" knowledge center.

During 2021, a collaboration was established with the Southern-Jordan, Soreq-Lakhish and Yarkon stream and drainage authorities. Following data collection and collaborative design, sample parcels were constructed representing different methods of riverbank stabilization—seeding vs planting, with or without irrigation, local wild species vs cultivated species—in the Tavor, Soreq and Shapirim streams (construction in the latter will be completed during 2022). This process is supported by a three-year-long monitoring project tracking the geomorphological and ecological processes (plant development) occurring in the stream strip in each hydrological year, and its effect on drainage functions.

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

Funding source: Hanadiv foundation.

Research partners: The Society for the Protection of Nature, the Israel Center for Aquatic Ecology. **Current study status:** On-going.

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 mediumand long-term policy and action recommendations for the public sector decision-makers. We completed the literature review of the expected effects of the climate change on streams and mapped bioindicators for various aspects of this process. Also completed is the analysis of the hydrological case study of the Hermon River (one of the pilot streams representing a river where the human impact is minor). The case study also survived the challenges and opportunities around the river, and forecasts for the expected effects of the river as a result of the change in water regime and temperature, as well as indirect effects (i.e. the effect of the climate change on humans and humans on the stream). We have also completed the third chapter addressing policy tools for managing and mitigating the climate change in rivers in Europe, US and Australia. Now we are dealing with the last part of the study, which includes adapting the existing tools in Israel to the reality of the climate change and examining the integration of missing tools from the world into the Israeli reality.

5. Research: Examining the effects of agro-voltaic dual-use on the ecological and agricultural system as reflected in the composition of arthropods

Funding source: The Ministry of Energy.

Research partners: The Entomological Laboratory for Ecological Research.

Current study status: Launching next spring.

In order to meet the Ministry of Energy's targets for reducing 80% of greenhouse gas emissions by 2050, between 100,000 and 800,000 dunams will be required for the production of solar energy. A large part of these areas is expected to be based on agricultural lands. Accepting that the tested solution is effective and uses the land efficiently, the vital ecological functioning of the agricultural areas must also be considered. The existing scientific information regarding the potential effects of agro-voltaic land use on ecological functioning is very limited. Our research seeks to bridge knowledge gaps addressing the ecological effects of the dual use. By monitoring ground-dwelling and flying arthropods and analyzing data regarding agricultural pests and beneficial arthropods in various crops in different parts of the country, we will identify the impact of the voltaic facilities on ecosystems. We will examine the phenology, abundance, and richness of the species and analyze composition parameters of the ecological communities.

6. Tools for the preservation and restoration of coastal salt marshes in Israel

Funding source: Ministry of the Environment. Current study status: On-going. The shoreline habitat has been studied very little in recent decades and is a direct continuation of Danin's geo-botanical research from the 1970s. The aim of the study is to map the physical conditions (soil and hydrology) that allow the development of salinity, and the unique plant assemblage. The study maps the coastal salt marshes in Israel and classifies them into different types and focuses on the Naaman salt marsh. We also study test cases where salinity was restored and provide a toolbox for their restoration. Our research established the knowledge base and collaborations required to advance this goal.

7. Formulation of principles for planning, restoration, interface, and maintenance of forests on river banks in KKL-JNF land

Funding source: KKL-JNF.

Current study status: On-going.

The goal of the study is to formulate principles for planning, restoration, interface and maintenance of streams in the JNF land. Through a literature review, we answered key questions dealing with river management, and through a field case study, we offered solutions to mitigate the challenge of river management. We are conducting a filed survey in the Baram forests (as a case study), to determine a generic method for collecting data as a background for the planning and maintenance of streams.

8. Research: Multifunctional agriculture – development of tools for a better co-use

Funding source: The Open Landscape Protection Fund.

Research partners: The Ministry of Agriculture and rural Develpoment, the Ministry of Environmental Protection, the Society for the Protection of Nature, the Nature and Parks Authority, KKL-JNF, Israel's Planning Authority, Regional Councils Center, Drainage and Streams Authorities.

Current study status: Final report submitted to The Open Landscape Protection Fund.

The study aims to formulate a "road map" for authorities in cases of need in a multifunctional usage of an agricultural land. Based mainly on a case study method, the report presents a comparative analysis of several economic, legal and social marketing tools and points out the benefits of a cooperative approach. The conclusions emphasize the importance of taking into account the diverse needs of stakeholders, including a trusted mechanism for proper compensation to farmers, in case of damage to crops, as a result of other planned public uses.



PUBLICATIONS

The Steinhardt Museum of Natural History is an important research infrastructure, used by scientists nationally and internationally. Below is the list of 2020–2021 publications, which covers all works of researchers affiliated with the SMNH. It also includes publications of researchers from other institutions if they are entirely or partly based on our holdings, but our follow-up is far from complete in this regard. Publications that were inadvertently omitted from the previous Annual Report are also included below.

Articles in refereed and other journals

- 1. Abbas, J., Peled N, Hershkovitz, I. & Hamoud K. (2021) The role of vertebral morphometry in the pathogenesis of degenerative lumbar spinal stenosis. *BioMed Research International*, Art. 7093745. https://doi.org/10.1155/2021/7093745
- 2. Alama-Bermejo, G., Hernandez-Orts, J.S., Huchon, D. & Atkinson, S.D. (2021) Two novel myxosporean parasite species of *Ceratomyxa* Thelohan, 1892 from the banded cusk-eel *Raneya brasiliensis* (Kaup) (Ophidiiformes: Ophidiidae) off Patagonia, Argentina. *Parasitology International*, 85, Art. 102433. https://doi.org/10.1016/j.parint.2021.102433
- 3. Ali, J., Aitchison, J.C. & Meiri, S. (2020) Redrawing Wallace's Line based on the fauna of Christmas Island, eastern Indian Ocean. *Biological Journal of the Linnean Society*, 130, 225-237. https://doi.org/10.1093/biolinnean/blaa018
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- 6. Amdur, L., Zeidan S., Avlagon D., Galssar Z., Gera E., Ramon U. & Dayan, T. (2021) Goats grazing an economic solution for forest management and fire hazard mitigation. *Forest, Journal of Forests and Open Lands Management*, 21, 47-49. [in Hebrew]
- 7. Amichai, E. & Yovel, Y. (2021) Echolocating bats rely on an innate speed-of-sound reference. *Proceedings of the National Academy of Sciences of the USA*, 118 (19), Art. e2024352118. https://doi.org/10.1073/pnas.2024352118
- Anderson, G. & Shenkar, N. (2021) Potential effects of biodegradable single-use items in the sea: polylactic acid (PLA) and solitary ascidians. *Environmental Pollution*, 268, Art. 115364. https://doi.org/10.1016/j.envpol.2020.115364
- 9. Ashkenazi, E., Tepper Y., Zituni R., Langgut, D., Dafni, A. & Bar-Oz, G. (2021) Poplar trees in Israel's desert regions: Relicts of Roman and Byzantine settlement. *Journal of Arid Environments*, 193, Art. 104574. https://doi.org/10.1016/j.jaridenv.2021.104574
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- 11. Assmann, T., Boutaud, E., Buse, J., Drees, C., Friedman, A.-L.-L., Harry, I., Khoury, F., Orbach, E., Renan, I., Schmidt, C., Schmidt, K., Wrase, D.W. & Zumstein, P. (2021) The ground beetle

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- 223. Frumkin, A. & Comay, O. (In press) The last glacial cycle of the southern Levant: Paleoenvironment and chronology of modern humans. *Journal of Human Evolution*. https://doi.org/10.1016/j.jhevol.2019.04.007
- 224. Grimaud-Hervé, D., Albessar-Ball, L., Pokhojaev, A., Balzeau, A., Latimer, B., McDermott, Y., May, H. & Hershkovitz, I. (In press) The endocast of the late Middle Paleolithic Manot 1 specimen, Western Galilee, Israel. *Journal of Human Evolution*. https://doi.org/10.1016/j.jhevol.2019.102734
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- 232. Sarig, R., Fornai, C., Pokhojaev, A., May, H., Hans, M., Latimer, B., Barzilai, O., Quam, R. & Weber, G.W. (In press) The dental remains from the Early Upper Paleolithic of Manot Cave, Israel. *Journal of Human Evolution*. https://doi.org/10.1016/j.jhevol.2019.102648
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- Bar-Yosef Mayer, D.E. (2020) Imported and worked mollusc shells at Tel Rehov. In: Mazar, A. & Panitz-Cohen, N. (Eds), Tel Rehov, a Bronze and Iron Age city in the Beth-Shean Valley: Volume V: Various objects and natural-science studies. The Institute of Archaeology, The Hebrew University of Jerusalem, Qedem, Vol. 63. The Institute of Archaeology, Jerusalem, pp. 635-640. https://www.jstor.org/stable/27110854
- 3. Bar-Yosef Mayer, D.E. (2021) Chapter 10: The Beads. In: Dagan, Y., Sadeh, S., Bar-Yosef Mayer, D., Cohen-Weinberger, A. & Nagar, Y. (Eds), 'En Esur ('Ein Asawir) III. Israel Antiquities

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- 14. Mienis, H.K. (2021) Molluscs. In: Weksler-Bdolah, S. & Onn, A. (Eds), Jerusalem Western Wall Plaza Excavations III. The Roman and Byzantine Periods: small finds from the Roman Refuse Dump and Other Contexts. Israel Antiquities Authority Reports, Vol. 67. Israel Antiquities Authority, Jerusalem, pp. 175-180.
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- Schechter, H.C. & Bar-Yosef Mayer, D.E. (2020) Chapter 11: Shells and shell beads. In: Ullman, M. (Ed.), The Early Pre-Pottery Neolithic B Site at Nesher-Ramla Qarry (NRQN), Israel. The Zinman Institute of Archaeology, University of Haifa, Haifa, pp. 149-168.
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- 18. Sapir-Hen, L. (In press) The faunal remains from the Persian-Hellenistic tombs. *In*: Edrey, M. (Ed.), *The Tel Aviv University Excavations in Ancient Jaffa*. Vol. II. Monograph Series. Tel Aviv University, Tel Aviv.
- 19. Sapir-Hen, L. (In press) Animal subsistence economy during the Late Bronze Iron Age I: Continuity vs. Change. In: Koch, I., Sergi, O. & Lipschits, O. (Eds), From nomadism to monarchy-30 years later. Mohr Siebeck, Tübingen & Eisenbrauns, University Park, PA.
- 20. Sapir-Hen, L. & Sahlev, Y. (In press) Animal rituals from the Persian period at Tel Dor. In: Yahalom-Mack, N., Davidovich, U. & Matskevich, S. (Eds), Material, Method, and Meaning: Papers in Eastern Mediterranean Archaeology in honor of Ilan Sharon. Zaphon, Münster.
- 21. Sapir-Hen, L. (In press) Post-Ghassulian and Middle Bronze Age faunal assemblages. In: Paz, Y. & Nativ, A. (Eds), Yesodot (Khirbet Umm el-Kalkha): Pottery Neolithic, Chalcolithic and Middle Bronze Age settlements at the Lower Shephelah (Salvage Excavation Reports). Tel Aviv.
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Conference proceedings and abstracts

- 1. Cohen, P., Inbar, Sh. & Privman, E. (2020) Genome Wide Association Study of nestmate recognition in *Cataglyphis niger* ants. 2nd Meeting of the Israeli Society for Evolutionary Biology ISEB 2020. 9-10 December 2020, Open University of Israel, Tel Aviv. Abstract Book, p. 16.
- 2. Eppelbaum, L.V. & Katz, Yu.I. (2021) Integrated geological-geophysical study of the junction zone of Eurasia and Gondwana. *Transactions of the 16th European Geosciences Union Assembly.* Vienna, Austria, 19-30 April. *Geophysical Research Abstracts*, 23, EGU21-3021.
- 3. Eppelbaum, L.V., Yaniv, A., Salomonski, N., Ginzburg, B., Sheinker, A. & Katz, Yu.I. (2021) Quantitative multilevel analysis of Hebron magnetic anomaly (Israel). *Transactions of the IAGA-IASPEI Joint Scientific Assembly*. Session D1. Hyderabad, India, 21-27 August.
- 4. Eppelbaum, L.V. & Katz, Y.I. (2021) Tectono-paleomagnetic mapping as unique combined interpretation tool: Implication in geologically complex regions of Israel (Eastern Mediterranean). *Transactions of the VIII International Scientific Conference "Geophysics and Geodynamics: Prediction and Monitoring of Geological Medium"*. Lviv, Ukraine, 4-7 September, pp. 1-4.
- May, H., Pokhojaev, A., Sella-Tunis, T. & Sarig, R. (2021) New insights into Natufians' daily life based on their osteobiographies. 12th International Congress on the Archaeology of the Ancient Near East. 6-9 April 2021, Bologna, Italy. Universita di Bologna. Abstract Book: Papers & Posters, p. 195.
- Linoy, N., Vardi, J., Paz, Y. & Sapir Hen, L. (2021) Looking for secondary products in the Late Neolithic in the Southern Levant. 12th International Congress on the Archaeology of the Ancient Near East. 6-9 April 2021, Bologna, Italy. Universita di Bologna. Abstract Book: Papers & Posters, p. 216.
- Maor, R., Dayan, T. & Jones, K. (2020) Novel daytime activity does not explain the Cenozoic mammal radiation. 2nd Meeting of the Israeli Society for Evolutionary Biology ISEB 2020. 9-10 December 2020, Open University of Israel, Tel Aviv. Abstract Book, p. 39.
- 8. Spiciarich, A. & Sapir Hen, L. (2021) The faunal evidence from Early Roman Jerusalem: the people behind the garbage. *ICAZ-Zooarchaeology of the Roman Period* 3rd Working Group Meeting: Animals in the Roman Economy: production, supply, and trade within and beyond the Empire's frontiers. 11-12 March 2021, University College Dublin, Ireland. Abstracts, p. 11.

Papers presented at scientific meetings

- 2020 Analyzing butterfly monitoring data from Israel, where butterflies fly year-round. *The Annual Conference for Science and Environment*. The Israeli Society of Ecology and Environmental Sciences, online event. (Comay O., Ben Yehuda O., Benyamini D., Schwartz-Tzahor R., Pe'er I., Pe'er G.)
- 2020 Genome Wide Association Study of nestmate recognition in *Cataglyphis niger* ants. 2nd *Meeting of the Israeli Society for Evolutionary Biology ISEB 2020*. 9-10 December, Open University of Israel, Tel Aviv, online event. (Cohen P., Inbar Sh., Privman E.)
- 2020 Genomic insights into the evolution of Myxozoa (Cnidaria). *Biodiversity Genomics* 2020. 5-9 October, online event. (Huchon D.)
- 2020 Insect collecting trip to Papua New Guinea, 2012-2013: Flies and Failures. *Entomological Collections Network #ECN2020*. Annual Meeting, 9-11 November 2020, online event. (Friedman L.)
- 2020 Novel daytime activity does not explain the Cenozoic mammal radiation. 2nd Meeting of the Israeli Society for Evolutionary Biology ISEB 2020. 9-10 December, Open University of Israel, Tel Aviv, online event. (Maor R., Dayan T., Jones K.)
- 2020 The earliest strung beads: What they tell us and why it matters. *Prehistory seminar*. 27 October, Hebrew University of Jerusalem. (Bar-Yosef Mayer D.E.)
- 2020 The history of olive cultivation in ancient Israel. *The Annual Conference on new developments in olive cultivation*. February, Israel Ministry of Agriculture, Volcani Center. (Langgut D.)
- 2020 Vegetation and climate history in the Mediterranean Levant during the Late Pleistocene. *The 12th International Conference on Quaternary*. February, Paris-Aubervilliers, France. (Langgut D.)
- 2020 Genomic insights into the evolution of Myxozoa (Cnidaria). *Biodiversity Genomics* 2020. 5-9 October, online event. (Huchon D.)
- 2021 Looking for secondary products in the Late Neolithic in the Southern Levant. 12th International Congress on the Archaeology of the Ancient Near East. 6-9 April, Bologna, Italy. (Linoy N., Vardi J., Paz Y., Sapir Hen L.)
- 2021 New insights into Natufians' daily life based on their osteobiographies. 12th International Congress on the Archaeology of the Ancient Near East. 6-9 April, Bologna, Italy. (May H., Pokhojaev A., Sella-Tunis T., Sarig R.)
- 2021 The cultural impact on the natural vegetation of Jerusalem and its environs. *The Annual Symposium in the memory of Prof. Yohanan Aharoni*. February, Tel Aviv University. (Langgut D.)
- 2021 The earliest shell beads. *International Webinar on Molluscs and Ancient Human Societies*. 28-30 September, Pune, India, online event. (Bar-Yosef Mayer D.E., keynote speaker)
- 2021 The faunal evidence from Early Roman Jerusalem: the people behind the garbage. 3rd Zooarchaeology of the Roman Period Working Group Meeting. 11-12 March 2021, University College Dublin, Ireland, online event. (Spiciarich A., Sapir Hen L.)
- 2021 The origin and spread of olive cultivation in the Mediterranean Basin. *The 46th Archaeological Congress of Israel*. June, Bar Ilan University, Tel Aviv. (Langgut D., Greenberg R.)
- 2021 The reconstruction of the pleasure garden of the Northern Palace, Masada. *The 46th Archaeological Congress of Israel*. June, Bar Ilan University, Tel Aviv. (Langgut D., Stiebel G.S. Cavanagh M.)
- 2021 The tour in the National Entomological Collection, the Steinhardt Museum of Natural History, Tel Aviv University, Israel. *International Online Weevil Workers Meeting*. 22-23 October 2021, online event. (Friedman L.)
- 2021 The weevil research in the Holy Land. *International Online Weevil Workers Meeting*. 22-23 October 2021, online event. (Friedman L.)

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 many others from Israel and abroad who used the collections are not included.

PhD students

2013—	Aviv Avisar (T. Dayan)			
	Ecological restoration following eucalypt removal from the Nahal Alexander			
	National Park.			
2013-	Sigal Orlansky (F. Ben-Ami)			
	The costs and benefits of resistance to parasites: The case of Daphnia similis.			
2013-2020	Roi Maor (T. Dayan)			
	The evolution of activity patterns in mammals: a macroevolutionary and			
	macroecological approach.			
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 (Milvus migrans) in the North-West			
	Negev.			
2015—	Hezi Buba (J. Belmaker)			
	Functional response in Mediterranean fishes.			
2015—	Yael Goll (E. Geffen)			
	Leadership in rock hyrax society.			
2015—	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)			
0015 0001	Mesophotic octocorals of Eilat, northern Red Sea.			
2015-2021	Tal Idan (M. Ilan)			
2011	Mediterranean mesophotic sponge gardens.			
2016—	Ruth Kallevag (H. May)			
	Changes in lumbar intervertebral discs characteristics with the development of			
2047	lumbar spinal curvature.			
2016—	Andressa Duran (S. Meiri and D. Chapple)			
2017	Lizard Macroecology.			
2016-	Uni Frid (J. Belmaker)			
2016	Understanding marine protected areas, recreational fisheries catch and by-catch.			
2010-	Fouling communities along Mediterranean and Red sea coasts			
2016	Touting communities along mediterranean and Red sea coasts.			
2010-	The mechanics and behavior of aerial interception by insects			
2016_	Michaela Kolker (P. Holzman and S. Meiri)			
2010-	Farly life history of fish in the Mediterranean Sea			
2016—	Itay Nudel (R. Sarig)			
2010	Secondary dentin evaluation using computerized tomography: application for			
	anthropology and forensics			
2016-	Renanel Pickholtz (J. Belmaker)			
2010	Stress and movement patterns of fishes.			

2016—	Lilah Raijman (M. Ilan) Red Sea mesophotic sponges.				
2016-	Svetalana Vaisman (T. Dayan)				
2014	Exotic and invasive molluses in Israel (provisionary title).				
2016—	The social, economic and symbolic uses of marine mollusks in the Neolithic of the				
	Southern Levant.				
2016-2020	Tal Gordon (N. Shenkar) Polycarpa mytiligera as a model organism for regenerative studies.				
2017—	Amal Bader Farrai (R. Sarig)				
	The evolutionary changes in root morphology of molars and their relation to function				
2017	Wasoom Habashi (P. Sarig)				
2017-	The effect of biomechanics and enamel chemical composition on dental attrition.				
2017—	Tal Amit (Y. Loya)				
2017—	Ecology and physiology of coral symbiotic populations. Assaf Ben-David (T. Davan)				
	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)				
	Middle Paleolithic child from Tinshemet cave.				
2018—	Hadas Avni-Levine (H. May)				
	The impact of incompatibility between the shape of the proximal femur and the				
	acetabulum on the risk for developing osteoarthritis of the hip.				
2018—	Rona Nadler-Valency (T. Dayan)				
	Wolf-rancher interactions in the Golan Heights: which practices support				
2019	COexistence:				
2016-	LITON ISTAELY (I. Dayan and O. Mosne) Optimizing rippring buffer restoration in paricultural landscapes: Ecological				
	opulling inpartain purfer restoration in agricultural landscapes. Ecological,				
2019	Curry Sinaika (S. Mairi and Ch. Diatrich)				
2016-	Guy Sinaiko (S. Meiri and Ch. Dietrich)				
2019	faxonomy of the teamopper genus <i>Neodifturus</i> (Cicadettidae) in Israet.				
2018-	Saran Unayon (J. Belmaker) Wideband accuration methods for estimating fish shillower distance from Marine				
	Protostod Area				
2019	FIDIELIEU AIEd. Shahar Chaikin (L. Bolmakor)				
2010-	Dialiai Chaikili (J. Dellilaker) Drocossos underlying fich donth distributions				
2019	FIGUESSES UNDERLYING TISH DEPLITOSLI DULIONS.				
2010-	Nitsail Dell Melecii (T. Gaudi aliu D. Laliggut) Chronology and landscape archaeology: The use of OSL define in the Judger Attra				
	chronology and landscape archaeology. The use of OSE dating in the Judean Mins.				

2018—	Amir Sarig (G. Ribak) Minjaturization constraints on flight of insects smaller than 1 mm.				
2018—	Ronen Liberman (Y. Benayahu and D. Huchon) Symbiotic zooxanthellae in mesophotic octocorals.				
2018–2020	Árnav Upadhyay (D. Huchon) Evolution of mitochondrial genome in Aplousobranchians.				
2019—	Michal Pe'er (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.				
2019—	Shani Shoham (M. Ilan) Arsenic cycle within <i>Entotheonella</i> sp.				
2020—	Boaz Orel (M. Ilan) Sponge mariculture.				
2020—	Raz Moskovich (M. Ilan) Sponge filtration.				
2020—	Maya Weinberg (Y. Yovel) Basic physiology and microbiology of fruit bats: the influence of the fruit bat microbiota on the social behaviour in the colony.				
2020—	Ofri Eitan (Y. Yovel) Vocal-based coordinated group flight in bats and birds.				
2020—	Yomiran Nissan (Y. Yovel) The genetic basis of behaviour in the Egyptian fruit bat.				
2020—	Omer Mazar (Y. Yovel) Why a jamming avoidance response does not help bats deal with jamming.				
2020—	Yifat Tarnovsky (Y. Yovel) Understanding the compensation mechanisms for the broad dynamic range of sensory input received in the hearing system.				
2020—	Ksenia Krivoruchko (Y. Yovel) Communication and decision-making in freely behaving bats.				
2020—	Xing Chen (Y. Yovel) Echolocating bat navigation, on a large-scale map using machine learning methods.				
2020—	Mark Cavanagh (D. Langgut and E. Ben Yosef) Coping with hyper-arid conditions -paleoenvironment, sustainability and seasona- lity in the ancient copper mines of Timna through the archaeobotanical evidence.				
2020—	Yael Hochma (D. Langgut and Y. Gadot) Reconstruction of natural and cultural arboreal environment and wood economy of Judah during the Iron and Persian periods.				
2020—	Nitsan Ben Melech (D. Langgut and Y. Gadot) Chronology and landscape archaeology: Optically Stimulated Luminescence dating in the Jerusalem Highlands.				
2020—	Carmel Herold-Lozover (N. Dorchin) Biology and ecology of the Little Fire Ant, <i>Wasmannia auropunctata</i> , as means towards its containment in Israel.				
2020—	Shahar Dubiner (S. Meiri and E. Levin) Comparative physiology of reptiles.				
2020—	Tal Raz (S. Meiri and U. Roll) Global conservation of reptiles, addressing knowledge shortfalls.				

2020—	Ayelet Barash (T. Dayan and Y. Dekel)
	of Canidae.
2021–	Krishna Chaitanya (S. Meiri)
	Taxonomy & phylogeny of Indian dragons (Agamidae: Draco).
2021–	Talya Shalom (T. Dayan and E. Feitelsohn)
	Biodiversity conservation under agricultural governance structures.
2021–	Shlomo Preis-Bloom (T. Dayan)
	How do lethal wolf management and anthropogenic land use shape the mammal community structure of the Golan Heights?

MSc / MA students

2013–	Michal Zeitzov (T. Dayan)			
	Barn owls as biological control agents in the northern Negev.			
2016-	Tal Gavriely (J. Belmaker)			
	Fish movement ecology.			
2016-2020	David David (S. Meiri and S. Gafny)			
	Captive breeding and the conservation of <i>Pelobates syriacus</i> .			
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—	Adva Olga Peretz (S. Meiri and N. Marom)			
	The water vole in Israel: from archaeology to extinction to reintroduction?			
2017—	Olga Rybak (R. Dor)			
	Breeding biology and conservation of Little and Common Terns in Israel.			
2017—	Amir Rubinstein (J. Belmaker)			
	Scaling of bird co-occurrence and phylo-diversity.			
2017–2020	Dvora Lev (J. Belmaker)			
	Resolving the "black box" of larval-fish abundance and its sensitivity to climate			
	change.			
2017–2020	Samuel Francis (H. May)			
	Does femoral bone morphology reflect muscle force?			
2017–2020	Raz Moskovich (M. Ilan and G. Yahel)			
	Sponge filtration mechanism.			
2017–2020	Lior Bentor (T. Dayan)			
	The ecological role of riparian corridors in agricultural landscape: the macroinver-			
	tebrate community of the Zippory stream as a model.			
2017–2020	Carmel Herold (T. Dayan)			
	Effects of fire on the arthropod community in Kfira National Park.			
2017–2020	Adi Weiss (T. Dayan)			
	Identifying the eco-hydrological to assess the impact of prolonged drought in the			
	Upper Jordan River.			
2017–2021	Hamutal Fridman (T. Dayan)			
	Anthropogenic effects on resident bird communities in Israel.			
2018-	Nitzan Yitzhak (J. Belmaker and N. Stern)			
	The ecology of alien Tetraodontidae in the eastern Mediterranean Sea.			
2018—	Gali Ofer (S. Meiri and U. Roll)			
	Distribution of reptiles and mammals in Israel and beyond.			

2018—	Elinor Levy (H. May) Gracilization of the human skeleton during human history: The biomechanical vs. the 'self-domestication' theories.				
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.				
2018–2020	Shira Salingré (J. Belmaker and A. Bar Massada) Non-stationarity of biotic interactions among Mediterranean fishes.				
2018–2020	Daphna Shapiro Goldberg (J. Belmaker) Analyzing the grazing behavior of the invasive S. <i>luridus</i> and S. <i>rivilatus</i> in the eastern Mediterranean Sea				
2018–2021	Liron Kraushar (J. Belmaker and R. Holzman) Chaetognath community structure.				
2018–2021	Liat Dror (S. Meiri and N. Kronfeld-Schor) Activity rhythms of reptiles.				
2018–2021	Tatiana Orli Milkewitz-Sandberg (D. Huchon) Mitochondrial genome evolution of Myxobolidae (Myxozoa, Cnidaria).				
2019—	Diana Medellin Martinez (D. Langgut and O. Sergey) Horvat Tevet wood economy during the Iron Age IIA. Reconstruction of the natural and cultural environment by an anthracology study.				
2019—	Inbar Fridman (D. Langgut) Environmental reconstruction of the Negev Desert during the Early Pleistocene based on palynological analysis.				
2019—	Noy Shapira (J. Belmaker) Functional diversity of Red Sea fishes.				
2019—	Karin Maschini (R. Sarig) Teeth: An ideal model to study microstructural sexual dimorphism.				
2019—	Itai Namir (J. Belmaker and A. Bar Massada) Temporal activity patterns of mammals in Israel under different human disturbance levels.				
2019—	Helena Gondra (H. May) Changes in osteoporosis prevalence during the Holocene Levant.				
2019—	Itzik Dishon (R. Sarig and I. Hershkovitz) Comparing ancient microbiom in dental calculus before and after agricultural revolution.				
2019—	Ariana Dann (H. May) Changes in the shape of the calcaneus following the transition to sedentism.				
2019—	Liron Chavoinik (H. May) Biohistory of the early chalcolithic population from Ein Asawir.				
2019—	Yulia Makoviychuk (H. May) Who are the people from Nahal Yarmut? A Prepottery Neolithic B site.				
2019—	Zohar Afek (T. Dayan) Population dynamics of rare butterfly species (Lepidoptera).				
2019—	Yulia Gordover (T. Dayan and L. Sapir-Hen) Human-animal relationship in Middle Pre-Pottery Neolithic B Ein Miri.				
2019—	Omer Segal (N. Dorchin) Development and dispersal of the weevil <i>Melanterius compactus</i> in Israel as a biocontrol agent against <i>Acacia saligna</i> .				
2019—	Alol Dor (F. Ben-Ami and D.E. Bar-Yosef Mayer) Freshwater molluscs as indicators for paleoenvironmental reconstruction: Jordan River Dureijat as a case study.				
2019—	Goni Barki (U. Roll and S. Meiri) Human factors affecting reptile conservation.				

2019—	Katarina Biljman (Y. Yovel) The role of sound in spatial navigation and memory				
2019–	Bar Fogel (M. Ilan)				
	Agelas orides microbiome.				
2019—	Dorin Shoshan (M. Ilan)				
	Aquaculture of the sponge Sarcotragus spinosulus for biotechnological				
	applications.				
2019-	Yulia Kushnarev (G. Ribak)				
	Flight control during the approach of miniature insects to visual targets.				
2019—	Hagar Csillag (G. Ribak)				
	Waterfowl swimming hydrodynamics.				
2019—	Or Filc (G. Ribak and BE. Pinchasik)				
	Aerodynamics and mechanical properties of flapping wings.				
2019–2021	Doron Bereza (N. Shenkar)				
	Trends in container shipping in relation to marine bioinvasions.				
2019–2021	Romi Shapira (G. Ribak)				
	Role of the hindwing in maneuverability of functionally two winged insects.				
2019–2021	Anna Zimin (S. Meiri and U. Roll)				
	Drivers of squamate viviparity.				
2019–2021	Shlomo Preis-Bloom (T. Dayan; transferred to the direct PhD track)				
	Cascading effects of wolf culling in the Golan Heights.				
2020-	Raz Platin (N. Shenkar)				
	Ecological aspects of the invasive ascidian Styela plicata along the Mediterranean				
2020	coast of Israel.				
2020-	Shir Michael (M. Ilan)				
	sponge associated-bacteria with the potential of arsenite oxidation for arsenic				
2020	Adi Bachum (V. Vevel)				
2020-	Aul Rachulli (1. 10vel) Changes in behavior of Equation fruit bats in continity and the wild				
2020	Ella Fichman (M. Dorchin)				
2020-	Light in the dark $-$ life history distribution and effects of light pollution on				
	fireflies (Coleontera: Lampyridae) in Israel				
2020-	Yael Kenigsberg (N. Dorchin)				
2020	Photosynthetic pathways in plants and diet breadth of galling insects				
2020-	Almog Hershko (N. Dorchin)				
2020	Taxonomy and ecology of Hydropsychidae (Trichoptera) as bioindicators for stream				
	health in Israel.				
2020-	Oriel Fischer (N. Dorchin)				
	A test of the plant vigor hypothesis in relation to photosynthetic pathways in				
	plants.				
2020-	Daria Leibin Graiver (D.E. Bar-Yosef Mayer, O. Lipschitz and I. Koch)				
	Shells from Iron Ages sites in Judah.				
2020-	Minji Jin (D. Langgut and O. Lipschits)				
	Reconstruction of paleoenvironment and wood exploitation at Tel Azekah between				
	the Middle Bronze Age and the Hellenistic Period.				
2020—	Yael Klirs (D. Huchon)				
	The mitochondrial genome of Oikopleura dioica (Appendicularia).				
2020—	Einav Lazar (Y. Benayahu and D. Huchon)				
	The soft corals genera <i>Cladiella</i> and <i>Klyxum</i> : taxonomy and their symbiotic				
2020	unicellular algae.				
2020—	Amal Atalian (L. Sapir-Hen)				
	ways of life, culture and environment in Masada during the Great Revolt, as				
	reflected in the analysis of animal dones.				

2020-	Petunia Fernandez (L. Sapir-Hen)				
	Animal economy in Azekah during the Middle Bronze Age and the nature of the				
	settlement.				
2020-	Bin Wang (L. Sapir-Hen)				
	The donkey economy in the Middle Bronze Age Southern Levant: Tel Azekah as a				
	case study.				
2020-	Timrat Leniado (S. Meiri and U. Roll)				
	Effects of taxonomic practice on reptile threat assessments.				
2020-	Eli Finarov (S. Meiri, U. Roll and A. Shwartz)				
	Control measures for the common mynah.				
2020-	Eran Shwartzfuchs (T. Dayan and D. Orenstein)				
	Analyzing human-wildlife interactions in the urban context.				
2020-	Zohar Afek (T. Dayan)				
	Butterfly effect: the survival and crash of the butterflies Tomars nesimachus and				
	Apahatis cilissa.				
2020-	Ziad Nasser el-Din (T. Dayan)				
	Status of the Arabian wolf (Canis lupus arabs) in Palestine.				
2020-2021	Jacob Dembitzer (S. Meiri and R. Barkai)				
	Quaternary extinctions of mammals.				

Post-doctoral fellows

2015—	Guy Sion, Laterality in gecko brains – relationships with behaviour and morphology.				
2014—	Liat Koch, Characterising larval starvation using hypothalamic appetite-				
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—	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 Medi- terranean.				
2018–2021	Marco Antonio Ribeiro Junior, Species-complexes of cryptic taxa widely distributed in Eastern Europe, Western Asia and Northern Africa (Western Paleartic lizards).				
2019—	Shira Penner Rosenvasser, Taxonomy of Trigonella and Medicago (Fabaceae).				
2019-	Gopal Murali, Drivers of species diversification rates and endemism in Squamates.				
2019-2021	Tali Magory-Cohen, Phylogeny and taxonomy of Israeli bats.				
2020-	Aditya Gupta, Myxozoans of Israel.				
2020-	Zohar Yanai, Taxonomy and ecology of Hydropsychidae larvae (Insecta:				
	Trichoptera) in Israel.				
2020—	Gabriel Henrique de Oliveira Caetano, New methods of assessment of the conservation status of reptiles.				
2020-	Pnina Cohen, The Byzantine viticulture.				
2020–2021	Yonatan Meresman, Intra-specific wing-shape diversification: a geometric- morphometry approach.				
2020–2021	Abra Spiciarich, The Tel Moza Archaeozoological collection: Faunal remains from an Iron Age agricultural and cultic center in Ancient Judah.				
2021-	Reut Vardi, Citizen science, urbanization & reptile distribution and physiology.				

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 2020–2021. The Covid-19 restrictions adversely affected our ability to acommodate visitors. Much use was made of the collections by 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 loans of scientific material were dispatched abroad to researchers at their home institutions.

Date	Name	Institute	Country	Expertise
2020/10	A. Drabkin	Tel Aviv University	Israel	Mammals
2020/11	Z. Hagbi	Tel Aviv University	Israel	Mammals
2020/11	B. Amir	Haifa University	Israel	Birds
2020/11	K. Yosef	Haifa University	Israel	Birds
2020/11	A. Spiciarich	Tel Aviv University	Israel	Mammals
2020/11	Y. Kushnarev	Tel Aviv University	Israel	Mammals
2021/1	R. Shafir	Haifa University	Israel	Mammals
2021/1	M. Shemer	Israel Antiquities Authority	Israel	Prehsitory
2021/3	M. Lev	Haifa University	Israel	Reptiles/Amphibians
2021/3	D. Eilam	Tel Aviv University	Israel	Mammals
2021/4	E. Barak	Private	Israel	Birds
2021/4-7	M. Zaitzove Raz	Tel Aviv University	Israel	Mammals
2021/4	L. Namdar	Tel Aviv University	Israel	Mammals
2021/4	A. Ben-Dov	Private	Israel	Birds
2021/5, 6	A. Zimmin	Tel Aviv University	Israel	Birds
2021/6	Sh. Meiri	Tel Aviv University	Israel	Reptiles
2021/6	M. Belmaker	The University of Tulsa	Israel	Mammals
2021/6	Y. Charka	Keren Kayemet Lelsrael	Israel	Birds
2021/7	A. Ovadia	Israel Museum, Jerusalem	Israel	Prehistory
2021	Ch. Makarewicz	Kiel University	Germany	Zooarchaeology

SUPPORT FOR ACADEMIC AND OTHER COURSES

The natural history collections of the Steinhardt Museum are extensively used in higher education institutions. Some courses are offered at Tel Aviv University, several of which are compulsory for first and second year students and are taught to hundreds of them. Other universities (Bar-Ilan University, Levinsky College of Education) use our facilities for their specialized courses. 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
World of Insects	N. Dorchin	Tel Aviv University	Insects
Research Skills	N. Dorchin	Tel Aviv University	Insects
Insects of Israel – Field excursions	N. Dorchin	Tel Aviv University	Insects
Pollination Ecology	A. Dag	Bar-Ilan University	Hymenoptera (Anthophila)
Wild bees in Israel	A. Dorchin, G. Pisanty	Tel Aviv University	Hymenoptera (Anthophila)
Marine invertebrates	N. Shenkar	Tel Aviv University	Marine invertebrates
General botany	J. Ziffer-Berger	Levinsky College of Education	Plants
Ecology of some plant groups in the botanical gardens	Y. Sapir	Tel Aviv University	Plants
Zoology	G. Ribak	Tel Aviv University	Metazoa
Animal locomotion	G. Ribak	Tel Aviv University	Metazoa
Introduction to archaeozoology	L. Sapir-Hen	Tel Aviv University	Mammals, birds
Archaeozoology workshop	L. Sapir-Hen	Tel Aviv University	Mammals, birds
Tracking course	A. Ben-David	Tel Aviv University	Mammals
Mammal and Reptile Faunistics	S. Meiri	Tel Aviv University	Mammals, reptiles
Vertebrate evolution: anatomy, form & function	S. Meiri	Tel Aviv University	Vertebrates
Zoological Garden & Museum Tours	Sh. Meiri, T. Dayan, R. Dor, Y. Yovel	Tel Aviv University	Vertebrates
Human and animals relationship: bones & ancient DNA	M. Meiri, L. Sapir- Hen	Tel Aviv University	Vertebrates
Applied molecular species identification	T. Feldstein- Farkash, O. Bronstein, D. Huchon	Tel Aviv University	Metazoa

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 2020–2021. 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. Wood	Mons University, Belgium	Insects
Loan	J. Freyhof	Museum für Naturkunde, Berlin, Germany	Fish
Loan	L. Sapir	Tel Aviv University, Israel	Mammals
Loan	S. Das	University of Helsinki, Finland	Reptiles
Loan	T. Feldshtein	Tel Aviv University, Israel	Birds
Loan	E. Maza	Tel Aviv University, Israel	Birds
Loan	Y. Kalderon	Private, Israel	Birds
Loan	Venice Bianale	Israel	Tetrapoda
Loan	O. Yotam	Air force, Israel	Birds
Loan	M. Lev	University of Haifa, Israel	Reptiles/Amphibians
Tissue loan	F. Mayer	Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Germany	Mammals
Tissue loan	E. Geffen	Tel Aviv University, Israel	Mammals
Tissue loan	S. Das	University of Helsinki, Finland	Reptiles
Tissue loan	Y. Kiat	University of Haifa, Israel	Birds
Tissue loan	M. Pavia	Museo di Geologia e Paleontologia, Torino, Italy	Birds
Molecular ID	A. Dolev	Israel National Park Authority	Mammals
Molecular ID	A.L.L. Friedman	The Steinhardt Museum of Natural History	Insects
Molecular ID	M. Zaitzove-Raz	Tel Aviv University, Israel	Mammals
Molecular ID	L. Raijman	Tel Aviv University, Israel	Sponges
Molecular ID	Sh. Meiri	The Steinhardt Museum of Natural History	Reptiles

Purpose	Name	Institute	Taxonomic group
Identification	L. Gidron	Plant Protection and Inspection Services	Insects
Identification	I. Renan	The Steinhardt Museum of Natural History	Insects
Identification	M. Spodek	Arava Institute, Israel	Insects
Identification	Y. Hershkovitz	The Steinhardt Museum of Natural History	Insects
Identification	G. Sinaiko	The Steinhardt Museum of Natural History	Insects
Identification	M. Dally	The Hebrew University of Jerusalem	Insects
Identification	M. Maor	Plant Protection and Inspection Services	Insects
Identification	Sh. Samra	Plant Protection and Inspection Services	Insects
Identification	V. Seplyarsky	Plant Protection and Inspection Services	Insects
Identification	D. Ben-Natan	The Steinhardt Museum of Natural History	Insects
Identification	U. Segev	The Steinhardt Museum of Natural History	Insects
Identification	G. Ben-Zvi	The Steinhardt Museum of Natural Historyecology	Insects
Identification	Sh. Gelbart	Bet sefer Tefen	Insects
Identification	Y. Mandelik	Hebrew University of Jerusalem, Israel	Insects
Identification		Plant Protection and Inspection Services	Insects
Academic course	Orr Comay	Tel-Hai Academic College, Israel	Rodentia (owl pellets)
Consultations	E. Zchori-Fein	Newe-Ya'ar Research Center, Israel	Insects
Molecular skills training	A. Drabkin	Tel Aviv University, Israel	Metazoa
Molecular skills training	M. Kazavchinsky	Tel Aviv University, Israel	Metazoa
Molecular skills training	A. Hershko	Tel Aviv University, Israel	Metazoa
Molecular skills training	J. Levine	Tel Aviv University, Israel	Metazoa

Purpose	Name	Institute	Taxonomic group
Molecular skills training	O. Hirshberg	Tel Aviv University, Israel	Metazoa
Molecular skills training	M. Zaitzove-Raz	Tel Aviv University, Israel	Metazoa
Molecular skills training	A. Bar	Tel Aviv University, Israel	Metazoa
Molecular skills training	E. Lazar	Tel Aviv University, Israel	Metazoa
Data provision	P Flint	Private, UK	Birds
Data provision	BD. Amir	Private, Israel	Birds
Data provision	S. Sfenthourakis	University of Cyprus	Reptiles

