

THE STEINHARDT
museum
 of natural
history
 מוזיאון
 הטבע
 שטיינהרדט
متحف
الطبيعة
 شتاينهارت



ANNUAL REPORT 2023/ 2024

THE STEINHARDT MUSEUM
 OF NATURAL HISTORY
 Israel National Center for
 Biodiversity Studies





Annual Report

Academic year 2023/2024

The George S. Wise Faculty of Life Sciences, Tel Aviv University

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

The Lester and Sally Entin Faculty of Humanities, Tel Aviv University

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

The Sackler Faculty of Medicine, Tel Aviv University

- Department of Anatomy and Anthropology
- Department of Human Molecular Genetics and Biochemistry
- The Maurice and Gabriela Goldschleger School of Dental Medicine

The Gershon H. Gordon Faculty of Social Sciences, Tel Aviv University

- School of Social and Policy Studies

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July 2025

TEL AVIV UNIVERSITY PRESIDENT'S FOREWORD

It is my privilege to write the foreword to this 22nd Annual Report of the Steinhardt Museum of Natural History — Israel's National Center for Biodiversity Studies. The Steinhardt Museum is a unique national asset within Tel Aviv University — an academic, cultural, and civic institution that reflects our deepest values and our global mission.

This report covers a year marked by the profound trauma for the Israeli society and the university community. In the wake of the October 7th attacks and the war that followed, the Museum offered both continuity and refuge. It opened its doors to evacuees and families, extended free admission, and continued to serve as a space for science, learning, and connection during one of the most difficult periods in our national life.

The Museum's roots are deeply entwined with the history of the University. In 1953, the Academic Institute of Natural Sciences—led by Prof. Heinrich Mendelssohn with the support of the Tel Aviv Municipality—became the first building block of what would become Tel Aviv University. Mendelssohn went on to establish the Zoological Museum as part of the Academic Institute, laying the groundwork for what is now Israel's National Museum of Natural History—the Steinhardt Museum. Today, its collections comprise millions of specimens—the scientific work of generations—that have served researchers for decades and continue to underpin science, conservation, agriculture, public health, and environmental policy.

While the vision for a national natural history museum was decades in the making, it was during my presidency that the Steinhardt Museum was granted full academic status—an essential and long overdue step. The formal recognition of the Museum as an independent academic unit with its own faculty members has been transformative. This has enabled the Museum to grow and flourish as a truly interdisciplinary research institution focused on biodiversity and ecosystems. More than 20 researchers have already been appointed across diverse fields including ecology, policy, sustainable agriculture, engineering, and environmental data science. Today, the Museum plays an active role in Israel's research landscape while also serving the broader public.

The Museum addresses many of the most urgent challenges of our time. Its scientists advance research on climate resilience, sustainable agriculture, biodiversity loss, and ecosystem restoration. Their work informs government policy on managing Israel's natural capital including land use, fire and flood risk, and the ecological impacts of emerging technologies. The Museum works in close partnership with government ministries, public agencies, environmental NGOs, and scientists across Israel's academic and research institutions—together promoting biodiversity research and science-based conservation and ecosystem management. At the same time, it is deeply engaged in the global scientific community, maintaining and expanding collaborations with international research institutions. Equally important, it fosters scientific curiosity and public trust. Through exhibitions, school programs and the Israel Center for Citizen Science, the Museum makes science accessible, participatory, and relevant to daily life.

In doing so, the Museum embodies the strategic direction I have set for Tel Aviv University. It advances interdisciplinary research, strengthens ties between academia and society, fosters international collaboration, and champions diversity and inclusion. With nearly one million visitors since the Museum's opening in 2018—a quarter of them schoolchildren—it is not only a center of scientific excellence, but also one of Israel's most accessible and inclusive cultural institutions.

I am deeply grateful to Michael Steinhardt and to all our donors and partners in Israel and abroad, whose vision and support made this institution possible. Their investment continues to yield scientific, educational, and societal impact—now and for generations to come.

I am also deeply grateful to Alon Sapan, the Museum's outstanding CEO, for his invaluable contribution to its success. However, no one embodies the Museum more completely than Tel Aviv University's Professor Tamar Dayan. Her unique vision, leadership, entrepreneurial talents, and exceptional ability to deliver have been absolutely crucial, not only for the Museum's initial establishment but also for its ongoing prosperity. Tel Aviv University is indebted to Tamar for this lifetime achievement.

The Steinhardt Museum exemplifies what Tel Aviv University stands for: excellence, relevance, accessibility, and impact. I look forward to its continued growth as a national and international center of knowledge.

Yours,

Prof. Ariel Porat

President, Tel Aviv University

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The Steinhardt Museum of Natural History Organizational Structure

Public, Education & Operations

Sections

- Marketing & strategy
- Operations & Exhibitions
- Education & Science Communication

Special Projects

- Israel Center for Citizen Science
- Environmental News
- Sustainable Nutrition Project

Collections & Research

Sections

- Marine Biodiversity Center
- Entomology
- Terrestrial Vertebrates
- Herbarium
- Paleobiology
- Dan David Center for Human Evolution & Biohistory Research

- Biodiversity informatics, science, communication & policy

Joint Infrastructures

- Molecular Systematics Laboratory
- Frozen tissue collection
- Paleogenomics Laboratory
- eDNA Laboratory

Labs for sorting and absorbing new specimens

Taxidermy Laboratory

Academic Courses & Training

- Academic Courses Unit

Applied Policy-Relevant Research

Centers

- Open Landscape Institute
- National Center for Aquatic Ecology
- Hamaarag – Israel National Ecosystem Assessment Program

Taxonomic Support

- The Entomological Laboratory for Applied Ecology
- Plant Protection Taxonomic Support
- The Feather Laboratory
- Biodiversity Monitoring Support

Special Projects

- Center for Ecological Restoration & Nature Based Solutions
- Compassionate Conservation Middle East

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, Ariel Weiss, Samuel Hayek, Ilan Chet, Ami Federman, Aharon Ciechanover, Shony Rivnay, Shimshon Shoshani, Michael Steinhardt, Martin Weyl.

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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, Tamar Zadok (Observers).

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MUSEUM STAFF

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- Prof. Tamar Dayan — Chair
- Dr Menachem Goren — Deputy-Chair
- Alon Sapan — Director
- Dana Silvera-Sharir — Administrative Manager
- Lahan Yosef — Secretary

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- Daniela Kenan Gazit — Sales, Group Visits Manager

- Ruth Uzar — Customer Service Supervisor and Sales
- Adi Gov — Marketing Communication and Website
- Anat Zohar — Production coordinator, website admin and marketing communications

OPERATIONS DEPARTMENT

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- Doron Ninio — Museum maintenance
- Andrei Lapicov — Museum maintenance
- Anat Shoham — Museum Operations
- Shir Sali Franco — Museum Operations
- Anastasia Karpenko — Museum Operations
- Gabriela Gleizer — Museum Operations
- Dr Elizabeth (Liz) Morgulis — Live Insects display
- Eran Keidar — IT Coordinator
- ~30 ushers and cashiers

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- Dr Ilil Pratt — Head of Education and Science Communication
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- 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
- ~50 graduate students as guides

SCIENCE AND POLICY SECTION

Dr Ronit Justo-Hanani — Biodiversity Regulation and Policy
Prof. Amiyaal Ilany — Data Scientist
Dr Shay Rotics — Data Scientist
Dr Alon Shepon — Sustainable Nutrition
Dr Rotem Zelingher — Agricultural and Ecological Economics
Dr Yehezkel Resheff — Data Science

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, Karin Tamar, Jonathan Belmaker, Roi Holtzman, Shevy Rothman, Noa Shenkar, Omri Bronstein, Frida Ben-Ami, Micha Ilan, Netta Dorchin, Moshe Guershon, Gal Ribak, Gideon Pisanty, Zohar Yanai, Zafrir Kuplik, Liron Goren, Dorothee Huchon, Yuval Sapir, Hila May, Rachel Sarig, Dafna Langgut, Lidar Sapir-Hen, Meirav Meiri.

Dr Revital Ben-David-Zaslow — Chief Collections Manager
Yonatan Gur — Database Manager

The Entomology Section

- Prof. Netta Dorchin — Head of Section & Chief Curator (flies)
- Dr Sergey Zonstein — Curator (spiders)

- Dr Gal Ribak — Curator (beetles)
- Dr Gideon Pisanty — Curator (Apocrita and parasitic wasps)
- Dr Zohar Yanai — Curator (aquatic insects)
- Prof. Vladimir Chikatunov — Curator (beetles)
- 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 Novoselska — 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 Armin Ionescu — Collections Manager (ants)
- Prof. Zoya Yefremova — Collections Manager (parasitic wasps)
- Dr Wolf Kuslitzky — Collections Manager (parasitic wasps)
- Ida Rotter — Technical Assistant
- Noah Michaeli — Technical Assistant
- Dr Avi Keysary — Volunteer
- Dr Binyamin Shalmon — Volunteer
- Amir Weinstein — Volunteer
- Tirza Stern — Volunteer

The Marine & Freshwater Section

Prof. Jonathan (Yoni) Belmaker — Head of Section

Invertebrates

- Prof. Noa Shenkar — Curator (ascidians)
- Prof. Micha Ilan — Curator (sponges)
- Prof. Frida Ben-Ami — Curator (molluscs)
- Dr Omri Bronstein — Curator (echinoderms)
- Dr Zafir Kuplik — Curator (Coelenterata)
- Dr Liron Goren — Curator (worms and crustaceans)
- Dr Stanislav Pen-Mouratov — Curator (nematodes)
- Prof. Joseph Loya — Curator Emeritus (stony corals)
- 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)
- Lion Novak — Collections Manager (ascidians)
- Dr Noga Sokolover — Collection Manager (bryozoans and echinoderms)
- Dana Goldwasser — Technical Assistant (worms and echinoderms)

- Tom Morav — Technical Assistant (sponges)
- Nathan Sharon — Volunteer
- Ronit Vilker Alhadeb — Volunteer

Fishes

- Prof. Jonathan (Yoni) Belmaker — Curator
- Prof. Roi Holzman — Curator
- Dr Bat-Sheva (Shevy) Rothman — Curator
- Dr Menachem Goren — Curator Emeritus
- Dr Nir Stern — Associate Curator (IOLR)
- Avery Lynne — Technical Assistant
- Assaf Nashiv — Technical Assistant
- Moty Ginter — Volunteer

The Terrestrial Vertebrates Section

- Prof. Shai Meiri — Head of Section & 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)
- Dr Karin Tamar — Curator (mammals, reptiles and amphibians)
- 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 Berkowicz — Collections Manager (birds)
- Avigail Ben-Dov Segal — Technical Assistant (birds and feathers)
- Moshe Geizler — Volunteer
- Mira Ideles — Volunteer
- Avraham (Rami) Biran — Volunteer
- David Kobiler — Volunteer
- Matan Hayun — Volunteer
- Igor Gavrilov — Chief Taxidermist
- Dr Stanislav Volynchik — Taxidermist and Preparator
- Yulia Gordover — Technical Assistant
- Tal Vardi — Technical Assistant

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)
- Ehud Behar — Technical Assistant
- Horesh Zaharia — Technical Assistant

The Palaeosciences Section

Dr Dafna Langgut — Head of 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
- Daria Leibin Graiver — Technical Assistant

Biological archaeology

- Dr Dafna Langgut — Curator (palynology and archaeobotany)
- Dr Lidar Sapir-Hen — Curator (archaeozoology)
- Dr Irit Zohar — Curator (fish osteology)
- Dr Meirav Meiri — Curator and Palaeogenomic Lab Manager
- Prof. Miriam Belmaker — Associate Curator (archaeozoology; University of Tulsa, OK, USA)
- Mor Matzliach — Palaeogenomic Lab Operations Manager

Dan David Center for Human Evolution and Bio-History Research

Physical Anthropology

- Prof. Hila May — Director
- Prof. Israel HersHKovitz — Curator Emeritus
- Prof. Rachel Sarig — Curator
- Dr Viviane Slon — Curator
- Prof. Baruch Arensburg — Curator Emeritus
- Nili Zilberberg, Shir Arbel — Administrative Managers
- Yulia Makoviychuk — Technical Assistant
- Alina Revda — Technical Assistant
- Efrat Kaisler — Technical Assistant

Molecular Systematics and Tissue Collection

- Prof. Dorothée Huchon — Curator
- Dr Tamar Feldstein-Farkash — Collections and Molecular Systematics Laboratory Manager
- Sahar Haj Yahya — Technical Assistant

ISRAEL CENTER FOR CITIZEN SCIENCE

- Dr Tomer Gueta — Center Development Director
- Dr Nirit Lavie-Alon — Head of Citizen Science Practice
- Dr Yaela Golumbic — Head of Citizen Science Research & Development
- Shlomo Preiss-Bloom — Content and UI Translator
- Zohar Afek — Training Materials Designer and Developer
- Naama Arkin — Head of Technology Infrastructure Development

Scientific Committee:

- Prof. Ofer Arazy — University of Haifa (Chairman)
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- Dr Ofer Steinitz — Israel Nature and Parks Authority

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- Dr Yael Mandelik — The Hebrew University of Jerusalem
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- Prof. Assaf Shwartz — Technion-Israel Institute of Technology
- Prof. Gil Rilov — Israel Oceanographic and Limnological Research Institute
- Prof. Ron Milo — Weizmann Institute of Science
- Prof. Ayelet Shavit — Tel-Hai College

ACADEMIC COURSES AND TRAINING

Management:

- Dr Menachem Goren — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Dr Tom Shlesinger — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Dr Zafir Kuplik — The Steinhardt Museum of Natural History

Teaching Committee:

- Prof. Shai Meiri — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Prof. Dorothée Huchon — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Dr Dafna Langgut — The Steinhardt Museum of Natural History

Teaching coordinator:

Dr Noga Sokolover — The Steinhardt Museum of Natural History

Scientific Advisory Committee:

- Prof. Michal Segoli — Ben Gurion University of the Negev
- Prof. Moshe Inbar — University of Haifa
- Dr Netta Dorchin — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Dr Oren Shelef — Volcani Institute, Agricultural Research Organization
- Dr Tamar Guy-Haim — Israel Oceanographic and Limnological Research Institute
- Dr Yael Mandelik — The Hebrew University of Jerusalem
- Dr Jotham Ziffer-Berger — The Steinhardt Museum of Natural History & Academic College Levinsky-Wingate

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)
- Dr Rani Amir — Ministry of Environmental Protection
- Sarit Caspi-Oron — Ministry of Environmental Protection
- Amir Erez — Ministry of Environmental Protection
- Dr Asaf Tsoar — Israel Nature and Parks Authority
- Dr Yehonathan Bar-Yosef — Keren Kayemeth Lelsrael — Jewish National Fund
- Dr Doron Markel — Keren Kayemeth Lelsrael — Jewish National Fund
- Dr Menachem Goren — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Prof. Tamar Dayan — The Steinhardt Museum of Natural History
- Hanoch Ilssar — The Rothschild Foundation

Staff

- Dr Yaron Hershkovitz — Director
- Tuvia Eshcoly — Lab Manager
- Noa Zanzuri — Administrative Manager
- Naomi Gordon — Taxonomy
- Avital Katz — Database Manager
- 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-Pnuel — 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 — School of Zoology (TAU) & The Steinhardt Museum of Natural History
- Dr Inon Scharf — Tel Aviv University

Staff

- Dr Ittai Renan — Director
- Gilad Ben Zvi — Lab Manager
- Dr Orr Comay — Red List Coordinator
- Dr Udi Segev — Red List Coordinator
- Ariel Aharonberg — Technician
- Ahikam Gera — Technician
- Yael Miara — Technician
- Itai Namir — Technician
- Adi Ramot — Technician
- Carmel Herold-Lozover — PhD student

HaMaarag — Israel's Nature Assessment Program

HaMaarag Board of Directors:

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- Dr Yehoshua Shkedy — Israel Nature and Parks Authority
- Dr Gilad Ostrovsky — Keren Kayemeth Lelsrael — Jewish National Fund
- Tamar Raviv — Ministry of Environmental Protection

Steering Committee of the State of Nature Report:

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- Dr Anna Trajtenbrot — Ministry of Environmental Protection
- Dotan Rotem — Israel Nature and Parks Authority
- Yahel Porat — Keren Kayemeth Lelsrael — Jewish National Fund

Staff

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- Dr Ron Chen — Quantitative Ecology Coordinator
- Tomer Karni — Monitoring Programs Coordinator
- Dr Orr Comay — Quantitative Ecologist
- Michal Koren — Geographic Information System and Cartography Coordinator
- Ido Livne — Remote Sensing Coordinator
- Ella Pasternak — Ecologist and Zoologist
- Ori Ismach — Research Assistant
- Shira Grossbard — State of Nature Report editor
- Iris Yerushalmi — Administrative Manager
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The Open Landscape Institute

Council (Board):

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- Asaf Krarwani — Keren Kayemeth Lelsrael — Jewish National Fund
- Asaf Zanzuri — Israel Nature and Parks Authority
- Tamar Raviv — Ministry of Environmental Protection
- Yahel Porat — Keren Kayemeth Lelsrael — Jewish National Fund
- Dr Yehoshua Shkedy — Israel Nature and Parks Authority
- Dotan Rotem — Israel Nature and Parks Authority
- Nir Angert — Israel Nature and Parks Authority
- Eran Ettinger — Ministry of Agriculture
- Nir Papay — Society for the Protection of Nature in Israel
- Dror Boymel — Society for the Protection of Nature in Israel
- Milka Carmel — Regional Council's Organization
- Hila Akerman — Regional Council's Organization
- Hanoch Ilssar — The Rothschild Foundation
- Dr Anna Trajtenbrot — Ministry of Environmental Protection
- Prof. Eran Feitelson — The Hebrew University of Jerusalem

- Prof. Yael Mandelik — The Hebrew University of Jerusalem
- Prof. Tali Mozes — Technion
- Dr Hana Sweid — the Arab Center for Alternative Planning
- Prof. Tamar Dayan — The Steinhardt Museum of Natural History
- Alon Sapan — The Steinhardt Museum of Natural History

Staff

- Uri Ramon — Director
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- Dr Aviv Avisar — Head of the Research Unit
- Dr Rona Winter-Livne — GIS Unit Manager
- Achiad Sade — Mazav Hayar survey Manager
- Nadav Sade — Assimilation and Social visibility
- Hila Gil — Hotspots Research Coordinator
- Dr Liron Amdur — Researcher
- Dana Ginosar — Researcher
- Noa Zanzuri — Administrative Manager
- Evgeny Hemlin — GIS Coordinator
- Eitan Romem — Survey Manager
- Bar Shemesh — Head of Botanical Research
- Dvora Lev-Ramati — Survey Manager
- Miryam Ron — Senior Botanist
- Amit Mendelson — Survey Manager
- Idan Talmon — Researcher
- Liraz Cabra-Leykin — Survey Manager
- Einat Gera — Survey Coordinator
- Dar Ben-Nathan — Botanist
- Lior Enmar — Surveyor
- Ella Dagon — Researcher
- Dar Ben-Nathan — Surveyor
- Reut Loria — Botanist
- Ori Moran — Researcher
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- Ori Halberstadt — Surveyor
- Gal Israeli — Surveyor
- Noa Valzer — Surveyor
- Neta Friedman — Surveyor
- Inbar Schnitzer — Surveyor
- Noam Segev — Surveyor
- Daniel Idan — Surveyor

PROGRESS AT THE STEINHARDT MUSEUM OF NATURAL HISTORY

Tamar Dayan and Alon Sapan

The past year was a challenging one for Israeli society, as well as for the Steinhardt Museum. Some members of the museum team have lost dear ones, others served on reserve duty for very long periods of time, yet others were evacuated from their homes. At the beginning of the October 7 war, we were forced to close the museum to visitors, and once we reopened, we did so free of charge for several weeks to give families the possibility of quality activity in a safe space. Moreover, with Tel Aviv University support, we sent out guides with show and tell activities for children and families in evacuation centers, and hosted evacuees in the museum free of charge.

During the first quarter of the year, school groups were unable to visit the museum and to participate in its programs; this activity resumed only three months into the war. Public visitation in Israel's museums dropped precipitously and—although we were able to maintain a relatively high level of activity—this trend was apparent to some extent also in our museum. The number of visitors from abroad dropped, as did our participation in international conferences and various other events.

Nevertheless, the Steinhardt Museum team worked very hard and the museum made a great progress also during this challenging year. Our team continued to develop, and new faculty members joined us. Dr Yaela Golumbic studies Citizen Science from an educational and social perspective and leads the research at the Israel Center for Citizen Science, and Dr Yosef Kiat, our new Curator of Ornithology, studies avian ecology and evolution.

We inaugurated an exquisitely beautiful exhibition on coral reefs that combined refined art with real science. Dr Noga Sokolover of the museum team led the scientific curation of the exhibition with the support of our Curator of Corals, Dr Tom Schlesinger. The art was produced by a world-renowned professional Zuri Gueta. With a large team of coral reef specialists, this exhibition highlighted both the research conducted by the Steinhardt Museum scientists and the beauty and fragility of this important yet threatened ecosystem.

HaMaarag, the Israel Nature Assessment Program operating at the museum with partnership of the Ministry of Environmental Protection, Israel Nature and Parks Authority, and the Jewish National Fund (KKL-JNF), launched Israel's 2023 State of Nature Report, with all partners and much media attention. As this report showed, the Open Landscape Institute and the Israel Center for Aquatic Ecology continued to develop and to lead important projects that inform Israeli professionals and decision-makers on managing Israel's natural capital.

We took part in a Tel Aviv-Yafo municipality program focused on bringing young adults to the city's museums, and developed several special events for this audience. The events were well attended, the participants were clearly enthusiastic, and both the attendees and the museum gained valuable insights from this experience.

The Steinhardt Museum was established to meet the needs of the State of Israel in a national museum of natural history, a national research institute to study biodiversity and the environment, and to share its knowledge and treasures with professionals, decision-makers, and the general public. With passing years, in a world undergoing global change, the importance of the museum becomes increasingly evident, and we are proud to have established it. However, the period since its opening in 2018 has been rocky and the museum has had to operate under challenging conditions. We look forward to more peaceful times and to the continued process of the formal establishment of the Steinhardt Museum.

COLLECTIONS NEWS

The staff members of the Steinhardt Museum of Natural History continued curation and promotion of our collections in 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.

The SMNH staff continued to be involved in a joint Pest Risk Assessment project with the Plant Protection and Inspection Services, coordinated by Dr Zohar Yanai.

During the 2023–2024 academic year, we added over 15,000 new specimens through collecting efforts of our staff, students and through donations. Also, almost 23,000 new records were added to the SMNH database: <https://smnh.tau.ac.il/en/research/collections-database>.

A series (18) webinars were recorded with our researchers, who talked about animals, the natural history collections and everything in between: https://smnh.tau.ac.il/mw_together/webinar.

Researchers of the Steinhardt Museum of Natural History attended and presented talks and posters at dozens of national and international conferences and symposia, many of which were organized on the museum premises (p. 91).

THE ENTOMOLOGY SECTION (INCLUDING ARACHNIDS)

Netta Dorchin, Inon Scharf, Gal Ribak, Sergei Zonstein, Tanya Novoselska, Malkie Spodek, Vladimir Chikatunov, David Furth, Arie-Leib-Leonid Friedman, Oz Rittner, Ofir Tomer, 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, David Saar, Noah Michaeli, Nizan Bibas

Research and curation

The entomological collections was fully functional in the new facilities, with constant optimization as an ongoing process co-ordinated by Moshe Guershon assisted by the collections managers. The staff continued expansion of the collection through field work, collection-based research and provision of services to government agencies, academia and general public. David Furth donated US\$14,000 towards purchase of new metal insect cabinets, awarded US\$3000 from Furth Systematic Entomology grants to two students from the SMNH/School of Zoology, Tel Aviv University, and facilitated Entomology Collections Management Workshop at the Peabody Museum of Natural History (Yale University, US; 28–31 July 2024), which was attended by several SMNH staff members.

Arachnida

S. Zonstein continued day-to-day curation of the SMNH arachnid collection and his active research into mygalomorph and other spiders. During the 2023–2024 academic year, about 700 specimens of spiders (Araneae), harvestmen and pseudoscorpions were sorted, identified and added to the arachnid collection. These included ca. 300 specimens from Israel, 220 from Uzbekistan (collected during his trip in April–May, 2023), 130 from Europe (Belgium), ca. 50 from other countries, including donations from Greece, Spain, China, Argentina, Chile, Thailand, Australia and New Zealand (each sample with one to a few specimens). Currently, the spider collection includes 1045 jars, with 632 species collected in Israel and 502 species from other countries (1134 species in total; some jars contain more than one species each). Of these, 65 species were added during the reporting period. In September–October 2023, Sergei visited the Royal Museum for Central Africa, Tervuren, Belgium, where he collaborated with Dr Arnaud Herrard on the taxonomy of the palp-footed spiders (Palpimanidae) from West & Central Africa. In March–April 2024, Sergei

hosted Dr Yuri M. Marusik (Institute for Biological Problems of the North, Magadan, Russia) to work on the taxonomy of spiders of the families Filistatidae and Oecobiidae; they described three species *Oecobius armiachi* Marusik & Zonstein, 2024 (Israel), *Steriphopus benjamini* Zonstein & Marusik, 2023 (India) and *Zaitunia arabica* Marusik & Zonstein, 2023 (UAE) as new to science. Sergei also went of several short field trips: around Tervuren, Belgium (1–14.10.2023), Golan Heights (17.12.2023), Carmel Ridge (28.12.2023, 9.03.2024), Central Negev (9–10.04.2024) and Central Coastal Plain (5–6.05.2024, 21.05.2024); altogether he collected 435 arachnid (mainly spiders) specimens. Sergei also served as subject editor for *Acta Biologica Sibirica* (Pensoft), *Arthropoda Selecta*, *ZooKeys* and *Zootaxa*, and reviewed 11 manuscripts for *Acta Arachnologica*, *Arachnology*, *ZooKeys*, *Zoology of the Middle East*, *Zoosystematica Rossica* and *Zootaxa*.

Orthoptera

M. Guershon completed a revised checklist of Orthoptera species of Israel, prepared an identification key to small groups (ongoing work on Tetrigidae and Myrmecophilidae), continued revision of the *Gryllotalpa* species complex of Israel, labelled databased Hymenoptera (ca 500 specimens). He also updated the database Taxonomy and Geographic tables, continued databasing of the Orthoptera collection, coordinated work of Avi Keysari, and prepared the digitized data of the wet collection for integration in the main database..

Mantodea

D. Simon and A. Weinstein continued routine curation of the Mantodea collection. They completed their monograph (over 100 pages) on praying mantises of Israel and neighbouring regions, and submitted it for publication in the *Israel Journal of Entomology*.

Hemiptera

T. Novoselska sorted and databased 450 specimens from 23 families of Hemiptera. Most of this material was identified to the genus level, and Tanya was working on identifying it to the species level and on the correct placement of the specimens in the collection. She also continued to sort the alcohol preserved specimens. The material included species that were new to science and/or the Israeli fauna. Tanya's collaborative research with Dolev Fabrikant (The Alexander Silberman Institute of Life Science, Hebrew University of Jerusalem) resulted in the identification, description and publication of *Miropictopallium coloradmonens*, a new genus and species of the Co-



Reconstruction of *Miropictopallium coloradmonens*, a new genus and species of true bugs from the 99-million-year-old Burmese amber. (From Fabrikant & Novoselska 2024)

reioidea (Heteroptera: Pentatomomorpha: Yuripopoviniidae) from the Late Cretaceous Burmese amber. This research significantly enriched the Museum's collection with the deposition of the holotype and a paratype specimens. Tanya participated in a multinational project on *True Bugs (Heteroptera) of the Middle-East* and coauthored a chapter on damselfly bugs (family Nabidae). Tanya also continued her ongoing collaboration with overseas researchers: Prof. Attilio Carapezza (University of Palermo, Italy) on the Miridae in Israel, Dr Petr Kment (National Museum of the Czech Rep.) on the Cappaeini (Hemiptera: Pentatomidae), Dr Jing-Fu Tsai (Hokkaido University, Japan) on the taxonomy of the *Elasmucha grisea* complex (Acanthosomatidae), and with Dr

Nico Nieser and Dr P. (Ping-ping) Chen (Naturalis Biodiversity Centre, Leiden, The Netherlands) on a very important project of revising the collection of waterbugs. In the reporting year, Tanya completed an advanced course in Entomological Collections Management that was hosted online by Peabody Museum of Natural History (Yale University, New Haven, US; 29–31 July 2024).

Coleoptera

Gal Ribak and his research team focused on flight of Coleoptera, Lepidoptera, Odonata and Thysanoptera, including collaborations with Prof. Roi Gurka (Carolina University, SC, USA), Dr Bat-El Pinchasik (Mechanical Engineering, Tel Aviv University) and Prof. Fritz-Olaf Lehmann (Rostock University, Germany) on the aerodynamic and mechanical properties of beetle and fly wings.

L. Friedman continued routine curation of the Coleoptera collection. He mounted, databased and labelled about 1000 insects, mainly from Israel, some from Russia and Japan. A large collection of the Central American weevils and weevils from the southern part of the USA was donated by E.G. Riley (TAMUIC, TX, USA) via D. Furth. A small part of the weevils had been identified to the genus or species level, but all were unmounted; ca. 350 specimens were mounted during the reporting period. About 1000 beetles of different families collected on the top of Mt Meron in 2023–2024 by Meir Finkel and his students, under the supervision of Gilad Ben-Zvi (The Entomological Laboratory for Applied Ecology, SMNH), were sorted and identified, at least half of them to the species level; some of them turned to be rarely collected species, thus increasing significantly their representation in the Museum collection. The collection of the Israeli Buprestidae (jewel beetles) was visited by a renowned specialist Dr Mark Volkovitsh. The jewel beetles collected during the last decade (ca. 300 specimens) were identified, some to the species level, and a part of the old collection was re-identified. The final rearrangement of the Buprestidae collection was planned in the forthcoming spring–summer 2025. From the research corner, the following interesting observations should be emphasized. An apparently new species belonging to the weevil genus *Cleopomiarus* was photographed by an amateur near Sederot inside the flowers of the yellow bellflower (*Campanula sulphurea*, Convolvulaceae), a considerably rare plant occurring very locally, mainly on sandy soils. Only three specimens of this weevil species existed in the SMNH collection. An intensive attempt was made to locate populations of *C. sulphurea* along the coastal sands; however, only in the Sederot area were the weevils found and collected in substantial numbers to allow their further identification and possible description. Two specimens of a supposedly undescribed species of the weevil genus *Pachytichius* had been accidentally collected a few years ago presumably on *Lotus languinosus* in the southern part of the Arava Valley. Only this year it became possible to return at the same season to the same spot, procure an appropriate series of the weevils and prove its association with the suggested host plant. Strange tiny beetles were found on the palm fronds (*Iulavim*) sold before the Sukkot and originated from one of the nurseries in the central part of the Jordan Valley. Laibale identified them as a species of the genus *Synoemis* (Silvanidae), described 13 years ago from the UAE, although the author of the species description doubted if the origin of the species was from South Asia. It was still unclear if the beetle was local, originally distributed throughout the Middle East (and its populations in UAE and Israel swelled for whatever reason), or it expanded its range, and if so — what was its possible route for reaching Israel.

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

Ofir Tomer and Oz Rittner continued routine curation and databasing of the Rhopalocera (butterflies) and Heterocera (moths) collections, respectively. The Citizen Science iNaturalist project AshTag (#עשטג) continued to grow in terms of its membership and the number of observations and identified species.

Diptera

N. Dorchin focused her research efforts on the taxonomy and systematics of gall-midges from Israel, South Africa and Europe, including descriptions of new species, morphological and molecular analyses of specific genera and phylogenetic analyses. She also closely supervised several other projects: Continuous monitoring of the establishment of the seed-feeding beetle *Melanterius castaneus* as a biological control agent against *Acacia saligna* in Israel, following its release in Israel in the spring of 2021; the effect of photosynthetic pathways in host plants on diet breadth of gall midges (supported by a 4-year grant from the ISF (PhD student Yael Kenigsberg); the systematics and ecology of riffle beetles (Elmidae) of Israel (MSc student Dafna Luz) in

collaboration with Dr Yaron Hershkovitz (Israel National Center for Aquatic Ecology); the taxonomy and ecology of the Trichoptera of Israel (PhD student Almog Hershko-Pnuel) in collaboration with Dr Yaron Hershkovitz; The ecology and behavior of the little fire ant, *Wasmannia auropunctata* in Israel (supported by a 3-year grant from the Ministry of Science, in collaboration with Prof. Abraham Hefetz; PhD student Carmel Herold-Lozover, MSc student Ilya Nudelman). As a result of the ongoing projects, our collection 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; several hundred specimens of parasitoids from oak cynipids were reared and added to the collection. Netta actively collaborated with researches from Israel and overseas: Zvi Mendel (Agricultural Research Organization, Bet Dagan, Israel); Cornelia Klak (University of Cape Town, South Africa); 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); Hans-Henrik Bruun (University of Copenhagen, Denmark); Sébastien Carbonelle (Ministry of Environnement & Nature of Wallonie, Belgium); Eckart Stolle (Museum Koenig, Bonn, Germany). In 2023–2024, Netta went on multiple field trips to the Negev, Arava, Galilee and the Golan Heights, mostly during winter and spring together with students and SMNH collection managers; in August 2024, she was on a collecting trip to Hungary (Matráfüred) for sampling gall midges on European oaks with her MSc student Talia Perl; in September 2024, she went on a collecting trip to South Africa (Western Cape) for sampling gall midges on Aizoaceae and Crassulaceae with her South African colleagues. Netta taught the following courses for students of the Faculty of Life Sciences, Tel Aviv University: *World of Insects* (graduate and undergraduate), *Research Skills* (graduate) and *Insects of Israel* (field excursions). She also participated in the Pest Risk Assessment project for Plant Protection and Inspection Services (Israel Ministry of Agriculture), and served on the Flora and Fauna committee of the National Academy of Sciences of Israel, the SMNH steering committee for contemporary exhibitions, the taxonomy initiative scientific committee (SMNH), Advisory board of the Leibniz-Institute for the analysis of biodiversity (LIB, Bonn and Hamburg, Germany), Council of the International Congresses of Dipterology, Steering Committee of the *European Journal of Taxonomy*, and as President for the Entomological Society of Israel.

E. Morgulis continued rearranging the Acalyptratae collection, both alphabetically and phylogenetically. Ida Rotter, an MSc student, started working with Liz during spring 2024. Ida digitized the Diptera collection and already added more than 2000 specimens by the end of the reporting period. Liz pulled out several hundreds of Diptera specimens from material brought by Z. Yefremova, who collected in Mali with Malaise traps; some of these specimens were already identified as new species. Liz continued adding primary type data to the database and started labelling those primary types, which had not been properly labelled. Liz also participated in the Pest Risk Assessment project for Plant Protection and Inspection Services (Israel Ministry of Agriculture), at which I summarized data on agricultural pests of several crops.

Hymenoptera

Hymenoptera (G. Pisanty): Gidi continued his research into taxonomy of mining bees (genus *Andrena*). Based on a worldwide molecular phylogeny of the genus that he produced in 2022, he published a new paper describing three new, early-diverging subgenera of *Andrena*, all of which occur also in Israel (Pisanty & Wood 2024). In August 2024, Gidi visited the Biologiezentrum in Linz, Austria, to study additional Western Palaearctic material of *Andrena*. Gidi continued his research collaboration with Dr Sophie Cardinal (Canadian National Collection, Ottawa, Canada), in an effort to barcode the Israeli fauna of the solitary bee genus *Andrena*, and with Thomas J. Wood (Mons University, Belgium), to identify *Andrena* specimens from Israel and neighbouring countries, and describe new species and subgenera. Gidi also collaborated with Silas Bossert (Washington State University) on a new worldwide molecular phylogeny of *Andrena* based on sampling of over 500 species. Gidi continued the curation of bees and parasitoid wasps, specifically the genus *Andrena* and the family Braconidae. Material from these groups was sorted to species (*Andrena*) or subfamily/genus (Braconidae), labelled and databased. Gidi additionally mounted from alcohol and databased 284 specimens of mostly parasitoid wasps, collected in Malaise traps at Ramat

HaNadiv during 2021–2022 by the Entomological Laboratory for Applied Ecology (SMNH). In total, 535 specimens were newly databased (material collected this year not included): 235 bees of the genus *Andrena* and the rest mostly parasitoid wasps of various families.

Parasitic Hymenoptera (W. Kuslitzky): Wolf attended to routine curation of collections in his care. Wolf also continued to rear insects and worked on description of a new species of Braconidae reared by N. Dorchin, collaborating with Dr George Melika, National Food Chain Safety Office, Hungary.

Parasitic Hymenoptera (Z. Yefremova): Material of the Eulophidae newly collected in Kenya was sorted and identified, over 100 specimens of the Eulophidae reared from the Gracillariidae (Lepidoptera) in Laos were identified and added to the collection, parasitoids reared from the gall midges (Diptera: Cecidomyiidae) were being sorted and identified. About 50 new records of the Chalcidoidea were added to the database. Zoya's research on the genus *Platyplectrus* (Eulophidae) from Kenya, with description of new species was completed, and she focused her studies on the African members of the genus *Euplectrus* (Eulophidae) from Kenya and on the Palearctic and Oriental genus *Kolopterna* (Eulophidae) associated with the Cecidomyiidae gall midges, with descriptions new species in both genera. Zoya continued her collaboration with Dr Robert Copeland (International Centre of Insect Physiology and Ecology, Nairobi, Kenya); Smithsonian National Museum of Natural History, Washington, DC, USA; Prof. George Japoshvili (Institute of Entomology, Agricultural University of Georgia, Tbilisi, Georgia); and Natalie Dale-Skey (Natural History Museum, London, UK).

Aculeata and parasitic Hymenoptera (I. Zonstein): Part of the material belonging to the groups under Irina's supervision had been identified and sorted to the species mainly by Z. Bouček and H. Bytinski-Salz. However, these identifications had to be checked and updated according to the recent taxonomic changes. The material collected in the last 40 years remained largely unsorted (except for the Cynipidae). Among Chalcidoidea, 1556 specimens were sorted to the family level: Chalcididae (1138), Leucospidae (24), Megastigmidae (93), Ormyridae (78), Torymidae (223); 54 specimens remained still unidentified and required more careful taxonomic examination. Some families of the Chalcidoidea were transferred for curation to Prof. Z. Yefremova because of either her ongoing research (Perilampidae, Mymaridae, Agaonidae, Trichogrammatidae), or difficulties in separation from her groups (Aphelinidae, when they are glued, are challenging to be separated from Encyrtidae). Irina focused on the Chalcididae to develop her ability to identify the species of at least one family, using the material identified by Z. Bouček, identification keys and online resources. The Bouček's collection was represented by 150 specimens belonging to 14 genera and 42 species; Irina checked the validity of the identifications and corrected them when necessary according to the new system, arranged the taxa in alphabetical order, and labelled the boxes. She also started to identify the unsorted material; so far, she identified 122 specimens to the species level, 517 specimens to the generic level, and 245 specimens to subfamilies and tribes. Among other parasitoid wasps, Irina sorted 403 specimens to the family level — Ceraphronoidea: Ceraphronidae (10), Megaspilidae (30); Cynipoidea: Cynipidae (144); Diaprioidea: Diapriidae (27); Evanioidea: Evanidae (40), Gasteruptionidae (48); Proctotrupoidea: Heloridae (50), Peleciniidae (2), Proctotrupidae (18), Roproniidae (9); Stephanoidea: Stephaniidae (21); Trigonalioidea: Trigonalidae (4). Among the Aculeata (stinging wasps), the old identified SMNH collection of Sphecidae s.l. contained 57 genera that Irina split into six families (Ampulicidae, Bembicidae, Crabronidae, Pemphredonidae, Philantidae and Sphecidae) according to the most recent phylogenetic studies. These families and their 57 genera were arranged alphabetically, and all the boxes (76) were labelled. Irina also began to alphabetically order the species within the genera; however, the previous specific identifications should be revised first according to the taxonomic changes. For example, a very brief review of the identified species of *Ammophila* resulted in discovering two irrelevant specific identifications and changes in the status of three subspecies. The newly collected material of the sphecoid wasps (12 boxes) was identified to genera. A part of other unidentified material of Aculeata wasps (11 boxes) was identified to the family level, but the SMNH Hymenoptera collection still contained a vast amount of unsorted material. During Irina's sorting the collection, she constantly monitored the specimens' condition and treated the material immediately if pest-caused damage was suspected. Irina also identified to the family level and databased 390 specimens of Hymenoptera reared by Prof. N. Dorchin from Cynipidae galls.

Aquatic insects

Zohar Yanai focused on two main research topics:

- Freshwater invertebrate diversity: gaining knowledge on the local diversity of freshwater invertebrates of selected groups. Most efforts were aimed at mayflies (Ephemeroptera) — Zohar's group of specialty, and dragonflies and damselflies (Odonata), as a collaboration with the Israel National Center for Aquatic Ecology and Prof. Netta Dorchin's lab (a project led by a graduate student Nili Segman). In addition, Zohar contributed to other projects, e.g. caddisflies (Trichoptera), water beetles and annelids.
- Invasive species in freshwater systems. A few projects were in progress, with a major focus on recent crayfish invasions in Israel. With various collaborators, we aimed at understanding crayfish introduction mechanisms, ecological impact and eradication options.

For ongoing projects related to mayfly (Ephemeroptera) taxonomy and systematics, Zohar maintained his collaboration with Dr Jean-Luc Gattolliat (Lausanne, Switzerland) and Dr Pavel Sroka (Prague, Czech Rep.). Zohar took part in an inter-institutional taskforce in the issue of invasive crayfish in Israel. Members of this group worked together to identify, monitor, understand and attempt to eradicate crayfish invasions into the freshwater systems in Israel.

During the reporting period, Zohar gave two talks and presented two posters:

- *Is it time to get used to crayfish in Israeli streams?* Symposium Biological Invasions in Israel: Where are We and Where are We Heading? 27 May 2024, The Steinhardt Museum of Natural History, Tel Aviv, Israel. (Yanai, Z. & Milstein, D.; talk)
- *Following the current: the tragedy of a rheophilic mayfly.* XVII International Conference on Ephemeroptera and XXI International Symposium on Plecoptera. 22–26 July 2024, Turin, Italy. (Yanai, Z.; talk)
- *Sampling techniques affect mayfly-nymph assemblages and may bias bioassessments.* XVII International Conference on Ephemeroptera and XXI International Symposium on Plecoptera. 22–26 July 2024, Turin, Italy. (Yanai, Z. & Dorchin, N.; poster)
- *The cryptic diversity of Alainites (Ephemeroptera, Baetidae) in Europe.* XVII International Conference on Ephemeroptera and XXI International Symposium on Plecoptera. 22–26 July 2024, Turin, Italy. (Sroka, P., Vuataz, L., Yanai, Z. & Gattolliat, J.-L.; poster)

Zohar also prepared technical reports:

Yanai, Z. 2024. *Invasive crayfish in Israel: current status, risk assessment, and possible response*. A report submitted to the Israel Nature and Parks Authority. 64 pp.

Elron, E. & Yanai, Z. 2024. *Hydrobiological survey in the "Southern Gate" area in Zahav Stream*. Elron Ecology & Environment and SMNH, Tel Aviv University. 40 pp.

During the 2023–2024 academic year, Zohar was responsible for the Museum Seminar. Ten speakers from other institutes lectured at this bi-weekly meeting and discussed their work with the SMNH community (staff, students, and academics associated with the Museum). Zohar also served on the Board of Directors of the Entomological Society of Israel, on the Committee for Zoological Terminology, Academy of the Hebrew Language, and led the Pest Risk Assessment project for Plant Protection and Inspection Services, Israel Ministry of Agriculture (see p. 87).

Identification services

Over 1400 specimens were identified by the Entomology staff for the 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, requested by the PPIS, Ministry of Agriculture of Israel, and ca. 100 identifications for private customers in Israel and around the world (both via social media and on the direct request), and for the colleagues from the Ben Gurion University of the Negev (e.g. Dr E. Groner, Dr Y. Ziv, Dr M. Segoli), Bar-Ilan University (Dr E. Weiss), Hebrew University in Jerusalem Rehovot (Dr O. Shelef, Dr Y. Mandelik)

and for the museum colleagues (Entomological Laboratory for Applied Ecology, Israel National Center for Aquatic Ecology, etc.).

- Hymenoptera (Parasitica): Z. Yefremova identified about 36 specimens of Chalcidoidea for Plant Protection and Inspection Services, Ministry of Agriculture, Israel.

Collecting trips and expeditions

Our Natural History Collections actively grew through donations, research projects, and collecting trips and expeditions. Many research projects added numerous specimens to our collections, while other collections benefited from focused collecting trips. Our scientists often went 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 needed to be processed.

N. Dorchin went on multiple field trips to the Jordan Valley, Negev, 'Arava and the Golan Heights, mostly during winter and spring together with students and SMNH collection managers. In June 2024, she collected gall midges on various plants in Denmark; and in September 2024, Netta collected gall midges on various plants in West Virginia (USA).

T. Novoselska collected 133 specimens during her field trips to 'Avrona Nature Reserve, 'En Bodeq, Nahal Gimzo, Nahal Og Nature Reserve, Savyon and Tel Yizhaq Nature Reserve.

L. Friedman collected about 1100 insect specimens, predominantly beetles (mostly weevils), during seven full-day (or several days long) collecting trips, 15 short (part-day) collecting trips and 21 occasional collecting events throughout Israel. One collection trip was a two-days joint expedition with S. Zonstein and Y. Marusik (a spider specialist from the Institute of Biological Problems of the North, RAS, Magadan, Russia) to the Negev Mountains and Arava Valley; two excursions with the entomological course of N. Dorchin (three days each, including the set-up trip) to the Northern and Central Negev, and to the Lower Galilee, Carmel and the Coastal Plain); a day trip around Sederot and six short trips to the coastal dunes (Apollonia, Caesarea, Netanya), searching for the yellow bellflowers (*Campanula sulphurea*, Convolvulaceae); several occasional collecting events were made in Tel Dor Nature Reserve, Palmahim Nature Reserve, Dora Pool in Netanya and on the banks of Nahal 'Ada near Or 'Aqiva. In the spring, several collecting attempts were made in the TAU Botanical Garden (these resulted in interesting findings of saproxylophagous beetles of the families Laemophloeidae, Latridiidae, Silvanidae, Tenebrionidae etc.), and on the vegetation along the way from the University railway station to the Museum (these revealed *Sitona syriacus*, a rarely found species of alfalfa weevils). Ad hoc collecting events, mainly at or around home and during private family travels were made on some 25 occasions in the Upper and Lower Galilee, Samaria, Judea, Southern Coastal Plain, Northern and Central Negev, on Golan Heights and around the Sea of Galilee (Kinneret). Laibale visited his family in New Jersey, USA, in September 2024, and despite relatively rainy weather collected about 80 specimens of bugs, leafhoppers and beetles (Curculionidae, Carabidae, Silvanidae), including previously not collected very peculiar transversely striped flower bud weevils *Anthonomus* sp. On his way back, Laibale spend half a day collecting on the eastern slopes of Monte Pardo, near El Goloso, north-west of Madrid while waiting for his connection flight in Madrid, Spain. The area comprised an open forest of the evergreen oak *Quercus rotundifolia*, *Retama sphaerocarpa* and *Populus* sp. Some 100 beetles were collected, mainly typical representatives of the West Mediterranean, most of them new for the SMNH collection, including weevils *Curculio* sp., *Smicronyx* sp., *Lepidapion* sp., *Ceratapion parens*, large and spectacular leaf beetle *Chrysolina bankii*, ground beetle *Lebia* sp., Coccinellidae spp., as well as bugs and ants.

D. Furth participated in the annual field trip of the Entomological Society of Israel to Dora Park (Netanya) and collected 8 specimens of leaf beetles *Donacia tomentosa* (Coleoptera: Chrysomelidae: Donaciinae).

O. Rittner went on 14 light-trapping events to Ein Avedat nature reserve, Ein Gedi nature reserve, Einot Tzukim (Ein Feshkha) nature reserve, 'Evrona nature reserve, Hamat Gader area, Hirbet Farj, Hosha'aya, Nabi Hazuri (Golan Heights), Ne'ot Semadar, Park Ayalon-Canada, Shoham forest park, and Tel Zafit national park.

Z. Yefremova went on a short field trip to Kéniéroba, Mali, in March 2024, where she collected a variety of insects with a Malaise trap.

G. Pisanty: With the generous support by the Furth Grant in Insect Systematics, Gidi travelled to the Peloponnese Peninsula and Attica region in Greece (26.03–5.04.2024) to collect mining bees *Andrena* spp., together with his colleague Thomas Wood. This trip yielded 1114 insect specimens, of which 506 were mining bees of 77 species. During a family trip to Central Europe (20–31 August 2024), Gidi collected 153 insects (mostly Hymenoptera) in Austria, Czech Republic and Germany. In addition, he collected 337 specimens (mostly Hymenoptera) during several field trips in Israel: Shoham Forest Park (28.11.2023, 4 specimens, *Andrena ungeri*), Nahal Alexander (25.02.2024, 11 specimens, *Andrena decollata*), Nahal Nimra & Nahal Raham (12.04.2024, 137 specimens, *Anthophora* sp., *Camptopoeum* sp.), Petah Tiqwa, Nahal Shilo (20.04.2024, 33 specimens, *Melitturga* sp., *Ammobatoides abdominalis*, *Andrena florea*), Har Meron Nature Reserve (23.04.2024, 96 specimens, *Andrena galilaea*, *Dufourea* sp.), Netanya Iris Reserve and Dora Pool (5.05.2024, 9 specimens), Latrun & Nahal Sha'alvim (11.05.2024, 33 specimens, *Dasypoda toroki*, *Cubiandrena cubiceps*, *Ammobates* sp., *Tetralonia* sp.), and Har Ya'ala (14.05.2024, 14 specimens).

Conference presentations

- XII European Congress of Entomology, Crete, Greece, 16–20 October 2023.
Ermolaev, I.V. & Yefremova, Z.A. Hymenoptera parasitoids (Eulophidae and Braconidae) of the Lime Leaf Miner *Phyllonorycter issikii* (Lepidoptera, Gracillariidae) in invasive areas of Europe and Asia. (talk)
Friedman, A.L.L., Yefremova, Z. & Gur, Y. The love triangle: a new alien bean weevil (Coleoptera, Chrysomelidae) attacking local legumes (Fabaceae) and attacked by local parasitoids (Hymenoptera, Eulophidae) in Israel. (poster)
- XVII International Conference on Ephemeroptera and XXI International Symposium on Plecoptera. Turin, Italy, 22–26 July 2024.
Yanai, Z. Following the current: the tragedy of a rheophilic mayfly. (talk)
Yanai, Z. & Dorchin, N. Sampling techniques affect mayfly-nymph assemblages and may bias bioassessments. (poster)
Sroka, P., Vuataz, L., Yanai, Z. & Gattolliat, J.-L. The cryptic diversity of *Alainites* (Ephemeroptera, Baetidae) in Europe. (poster)
- XXVII International Congress of Entomology. Kyoto, Japan, 25–30 August, 2024.
Furth, D. The re-discovery of a second Reed beetle in Israel. (talk)
Nikelshparg, M.I., Yefremova, Z., Friedman, A.L.L., Nikelshparg, E.I. & Anikin, V.V. Choosing phytophagous or entomophagous insects for biological control of *Cuscuta* species in Europe and the Middle East. (poster)

Outreach

Netta Dorchin appeared in *The Hedgehog and the Fox* podcast about insects (Shmuel Rosner, Feb. 2024; <https://kipshu.com/pod-dorchin-28-2-24>), *The mysterious lives of animals – part 3: Insects* (TAU, Feb. 2024), hosted tours in the insect collection for students from the Open University (May 2024), was interviewed about mosquitoes for Haaretz (Moshe Gilad, Jun. 2024) and for radio station Galatz (Yael Dan, Jun. 2024), provided Entomology coaching for members of the Israeli delegation for the International Biology Olympics (IBO, Jun. 2024; https://noar.tau.ac.il/ist_bio), and gave a popular presentation for pensioners and insect demonstration for kindergarten children in Kfar Hahoreh (Jul. & Aug. 2024).

Moshe Guershon conducted guided tours around the Arthropoda gallery for participants of the museum guides course and for the students of the *Science Communication* academic course, as well as occasional tours around the collection facility for special guests (e.g., the Palmoni family).

Tanya Novoselska's description of the Late Cretaceous *Miropictopallium coloradmonens* received broad coverage in national and international media, e.g.:

- Beautiful defensive adaptations of extinct fossil bug. *Amberscape*, 18 April 2024. <https://www.youtube.com/watch?v=a2CCDqMUq04@>
- Siegel-Itzkovich, J. A 99-million-year-old bug that lived in Myanmar discovered by Israeli researchers. *The Jerusalem Post*, 24 April 2024. <https://www.jpost.com/science/article-798485>
- Israeli, Y. Crystallized in amber: Israeli researchers uncover a type of bug from 99 million years ago. *Ynetnews*, 24 April 2024. https://www.ynetnews.com/health_science/article/skyau4i11a

- Researchers discover 99-million-year-old bug preserved in amber. *Xinhua*, 24 April 2024. <https://english.news.cn/20240424/dbf5183845754374b0ae53ab35455fe2/c.html>
- 99 million-year-old amber yields fossil surprise. *Asian News International (ANI)*, 30 April 2024. <https://www.aninews.in/news/world/middle-east/99-million-year-old-amber-yields-fossil-surprise20240430051355>
- 99 Million-year-old amber offers rare glimpse of dinosaur era. *NDTV*, 30 April 2024. <https://www.ndtv.com/science/99-million-year-old-amber-offers-rare-glimpse-of-dinosaur-era-5553425>

Gidi Pisanty was interviewed on the radio program *Three Who Know* on *Kan Tarbut*, 18 September 2024, on the subject of resource competition between honey bees and wild bees:

<https://omny.fm/shows/three-who-know/2ad3f96a-fa57-4131-b4bc-b1ee00c59feb>

Zohar Yanai guided the annual public trip for families and hobbyists of the Entomological Society of Israel to the Winter Pond in Netanya (Apr. 2024) and provided an expert opinion on a rare case of Sinai hooktail dragonfly (*Paragomphus sinaiticus*) that was spotted in Israel for the first time (English edition of HaAretz, 6 May 2024):

<https://www.haaretz.com/life/nature-environment/2024-05-06/ty-article/0000018f-4d57-dcda-abcf-6f57f15a0000>

THE INSECTARIUM

Elizabeth (Liz) Morgulis

At the insectarium, Liz continued rearing the species listed in the 2022–2023 Annual Report (p. 25; <https://doi.org/10.5281/zenodo.13771530>) with the addition of Lubber grasshoppers *Roma-lea* sp. (restarted after a two-year break), termite colonies *Reticulitermes clypeatus* and *Kaloterms sinaicus* (collected some workers and soldiers during winter–spring 2024, and they started reproducing), and Marbled crayfish *Procambarus virginalis*. On the live insect display at the Museum we displayed the following arthropods: Australian leaf insects *Extatosoma tiaratum*, stick insects *Bacillus atticus*, Oleander stick insect *Trachythorax maculicollis*, desert locust *Schistocerca gregaria*, Mole crickets *Gryllotalpa* sp., praying mantises *Sphodromantis viridis*, Madagascar hissing cockroaches *Gromphadorhina portentosa*, Two-spotted Assassin bugs *Platymeris biguttatus*, Carpenter ant colonies (*Camponotus phellah* and *C. jaliensis*), Black tarantulas *Chaetopelma olivaceum*, Brown recluse spiders *Loxosceles reclusa*, Mediterranean Black Widow spiders *Latrodectus tredecimguttatus*, Two-tailed spiders *Hersilia caudata*, Common Black scorpions *Nebo hierichonticus*, Megarian Banded centipede *Scolopendra cingulata*, terrestrial hermit crab *Coenobita* sp., and Black millipede *Archispirostreptus syriacus*.

THE MARINE & FRESHWATER SECTION

THE PORIFERA COLLECTION

Sigal Shefer

Collection and field surveys

I went on a field trip to the Galapagos Islands, 7–22 April 2024. The aim of this field trip was to survey and collect sponges as part of Dana Goldwasser's MSc research at Prof. Micha Ilans' Lab. I also guided Dana Goldwasser and participated in the identification of these sponge during my stay in the Galapagos and upon return to Israel. It was already clear that many sponges we collected became the first records to these Islands and some of them were candidates to be new to science. On 30 October 2024, we conducted an invertebrate survey for the Israel Nature and Parks Authority off Poleg coast as part of the BioBlitz survey of marine nature reserves.

Physical organization and databasing

Sponge samples collected mainly in the mesophotic depth in the Mediterranean during the 1960–1970s were added to the database (94 entries).

Loans

Loans of *Axinella polypoides* (8 specimens) and *Ircinia variabilis* (9 specimens) were issued to Aleksandra Koinova, School of Zoology, Tel Aviv University, for her PhD studies on the effect of climate change on sponge reproduction.

Public outreach

- Mysteries of the Mediterranean Sea. (Digitel, 18 July 2024):
<https://www.tel-aviv.gov.il/pages/MainItemPage.aspx?WebID=3af57d92-807c-43c5-8d5f-6fd455eb2776&ListID=9dd2da03-5c43-462a-b5b2-d087c179b16c&ItemID=10582>
- Tour in the biodiversity exhibition on Evolution Day (12 February 2024):
https://smnh.tau.ac.il/mw_event/evolution

THE COELENTERATA COLLECTION

COELENTERATA

Zafrir Kuplik

Curatorial

Overall, 233 specimens were adatabased. Most of them were Indo-Pacific Octocoralia samples collected in the 20th century, and brought to the SMNH by Prof. Hudi Benayahu, following his visits to museums abroad. Many of the samples included types and fragments for molecular work.

Research

As a first attempt towards understanding the swarming behavior and coherence of the scyphomedusa *Rhopilema nomadica* (ISF grant), we ran preliminary experiments using the upside-down jellyfish *Cassiopea andromeda*. Using Particle Tracking Velocimetry (PTV) technique, the aim of these trials was to try and understand the physical dynamics involved in the pulsation of scyphomedusae. These experiments involved the usage of an advanced imaging system, owned and led by Dr Ron Shnapp, our collaborator from BGU. In addition, the end of 2023 was also the end of the one-year Research Cooperation Program with Ludwig Maximilians University, Munich, Germany, during which our partners and us, sampled for the freshwater jellyfish *Craspedacusta sowerbii* in the northern streams of the Golan Heights and in the inflow of the streams to the Sea of Galilee. This ecological work was accompanied by advanced modelling and a paper was in preparation.

Conferences and workshops

- *The biology and physics of the Rhopilema nomadica jellyfish swarm dynamics — modelling, experiments and forecasting*. Thalassa 2024, The 2nd Regional Conference in Marine Sciences, Larnaka, Cyprus, 28–29 May 2024.
- *Rhopilema nomadica in the Mediterranean: Where from and why now?* NEOBIOTA 2024, The 13th International Conference on Biological Invasions, Lisbon, Portugal.

Public outreach

- “A meeting with a researcher” — An online interview about jellyfish (SMNH, November 2023; <https://www.youtube.com/watch?v=6HGDU0M5GIw>).
- An interview on Calcalist about the late appearance and negative effect of *Rhopilema nomadica* swarms in Rutenberg Power Station, Ashkelon (January 2024; https://www.calcalist.co.il/local_news/article/by111a6nywut).
- Interview on Israel HaYom about the unusual winter swarms of large *Rhopilema nomadica* in the Israeli coastal waters of the Mediterranean (March 2024; <https://www.israelhayom.co.il/animals/article/15404421>).
- An interview on Israel HaYom about *Turritopsis dohrnii*, the immortal jellyfish (June 2024; <https://www.israelhayom.co.il/tech/space/article/15952528>).
- A lecture about jellyfish as part of the International Wildlife Day (March 2024; <https://www.youtube.com/watch?v=bG6hue0zslw>).
- Provided expert advice for the *Rhopilema nomadica* clip, as part of the *Living Legend* series (Shachar Even Tzur and SMNH; <https://www.youtube.com/watch?v=nGEBKuQ-Jmc>).

SCLERACTINIA

Tom Shlesinger, Yehuda (Hudi) Benayahu and Yossi Loya

Scleractinian corals, commonly known as ‘hard’ or ‘stony’ corals, form a vital and visually captivating component of marine ecosystems. Their significance extends beyond their aesthetic appeal, as they create complex habitats that harbor a myriad of marine life. Representing a diverse group within the phylum Cnidaria, scleractinian corals are characterized by their ability to construct calcium carbonate skeleton, which constitutes the underlying structure for tropical coral reefs. Thus, scleractinians play a crucial role in supporting marine biodiversity. These remarkable organisms are distributed across global oceans, thriving in a range of environments from tropical to temperate waters. Broadly, coral reefs and particularly stony corals also serve as important indicators of environmental state and anthropogenic and climate change impacts on the world’s oceans.

Coral reefs are among the ecological communities most threatened by climate change, with some studies predicting that they may not survive the next century. Efforts to understand the ways in which coral reef communities are changing and will continue to change are, however, impeded by lack of basic knowledge of the vast majority of macrofaunal invertebrates that contribute to the structure and function of one of the world’s most biodiverse ecological communities. Soft corals are the second-most abundant benthic organisms on coral reefs in the Indo-Pacific, where they compete for space with the reef-building scleractinian corals. Changing ocean conditions may shift the future dynamics of these two groups in ways that will fundamentally alter the structure and function of coral reefs. Relative to the well-studied scleractinians; however, little is currently known about the ecology of soft corals: we do not know how many and which species co-occur and contribute differentially to these diverse communities, or how soft coral assemblages change over space and time. At the root of this deficiency is taxonomic uncertainty: we lack the knowledge and resources necessary to discriminate and identify species reliably.

Research

We had two projects based on the scleractinian coral collections housed in the SMNH: (1) As part of her MSc, Nour Alhouda Akel was working on the taxonomy and molecular phylogeny of one of the most common families of corals in the Red Sea. In addition to analyzing samples collected specially for her project, we were also going over the entire collection of specimens of this family in the museum, updating old identifications and examining more species. Nour already identified one suspected new species that we are in the process of describing. (2) As part of her post-doc, Michaela Kolker-Ghatan was looking at the long-term changes in coral diversity in Eilat. In addition to surveys Tom performed in the last decade, we also examined historical coral collections (i.e., from ca. 5–6 decades ago) made in Eilat and housed in the museum. Moreover, this year, the shallow coral reefs at Eilat experienced bleaching for the first time. Accordingly, Tom’s lab team responded and performed detailed surveys of bleaching severity and differences between species.

The overarching goal of the NSF-BSF funded project was to address taxonomic uncertainty of soft corals by validating the species of zooxanthellate soft corals found throughout the Indo-Pacific and generating reliable and up-to-date resources to facilitate their identification. We integrated DNA barcoding, sequence capture of ultraconserved elements and exon loci, and documentation of morphological characters to delimit species among some 5000 specimens available in museums world-wide and new collections. Simultaneously, all available type material was documented with modern imaging, redescribed as necessary, and sequenced to facilitate assignment of correct (or new) binomens to species. Georeferenced, expert-validated specimen data will be compiled within a publicly available, searchable database with the capability to generate regional species checklists and interactive taxonomic keys. The research was a collaboration between PIs Prof. Cathy McFadden (Harvey Mudd College, US) and Prof. Y. Benayahu, and leveraged the combined taxonomic and molecular expertise and resources of US and Israel. Additionally, an examination of about 85 specimens collected in Singapore during a joint expedition with local scientists (June 2023) yielded their taxonomic identifications, mostly in congruence with barcoding results obtained by the US collaborator.

Our recent studies have deepened the understanding of the symbiosis between the coral *Stylophora pistillata* and the bivalve *Leiosolenus lessepsianus*. Historical data and modern tools revealed reproductive synchronization patterns, suggesting co-evolved traits that enhance mutual survival (Noga Gavrieli, MSc; Maya Gross, MSc). Surveys documented *Leiosolenus* distribution and infestation rates across depths and sites, providing insights into temporal changes (Tal Amit, postdoc; Liat Beinuri, MSc). Experiments at the Interuniversity Institute for Marine Sciences (IUI) in Eilat examined *S. pistillata* physiological response and reproductive success under extreme temperature stress, with and without *L. lessepsianus*, illuminating coral resilience and the balance between mutualism and parasitism (Shir Perets, MSc). Future studies will investigate the physiological impacts of *L. lessepsianus* on coral performance and resilience (Mika Doron, MSc). Using high-resolution μ CT, postdoc Nati Kramer analyzed the impact of light pollution and coral bioerosion caused by cryptic bivalves on coral skeletal dynamics. Corals exposed to artificial light at night (ALAN) for 30 months exhibited altered skeletal morphology, increased porosity and reduced reflectance, diminishing their light-harvesting efficiency and indicating stress responses affecting photosynthetic performance and energy acquisition. Dr Kramer also quantified bivalve abundance, size, growth angles and cavity volumes in coral skeletons from three species of the northern Gulf of Eilat.

International research visits

Hudi Benayahu visited (1) Berlin Museum of Natural History (Germany) and sampled some 100 samples of relevant specimens, all collected in the Philippines during the early 20th century, for ongoing examination; (2) Natural History Museum Vienna (Austria) and investigated historical Red Sea soft corals collected during the Pola Expedition (1895/1896); (3) National Center for Biodiversity, Naturalis (Leiden, the Netherlands) to revise the genus *Anthelia* and some related taxa, this visit yielded SEM images of the relevant material.

Field work

As part of a long-term collaboration, Hudi Benayahu undertook a collection trip to Taiwan with a focus on soft coral bleaching. During his trip to Green Island (Pacific side of Taiwan), a comprehensive collection of soft corals family Xenidiidae were collected (to be shipped to SMNH).

FRESHWATER MYXOZOA

Dorothee Huchon and Zohar Yanai

The Myxozoa is a class of parasitic cnidarians, which, with over 2300 described species, exert a substantial negative economic impact on fisheries and aquaculture. Some myxozoans are agents of emerging fish diseases and myxozoan infections have been linked to environmental changes. No treatment exists against myxozoan infections at the moment and relatively little is known about myxozoan biology. Several myxozoan species have been described from Israel; however, there is no accurate checklist of the Israeli species.

Research

The laboratory of Prof. Huchon focused on the evolutionary biology of myxozoans, a group of parasitic cnidarians with complex life cycles that involve both fish and annelid hosts. Over the past few years, we identified several myxozoan species in Israel, including invasive species, highlighting the need to investigate potential host diversity within local freshwater ecosystems. To address this, we conducted a preliminary molecular barcoding study to characterize the diversity of oligochaete annelid hosts present in freshwater environments across Israel. This study was conducted by an undergraduate student, Ms Shahar Anishban, with the assistance of Ms Michal Haddas-Sasson (lab manager). Eleven oligochaete samples were collected from various freshwater bodies and their cytochrome c oxidase I (COI) genes were sequenced to assess species diversity. Based on sequence divergence analyses, we identified six putative species among the eleven oligochaetes. These species belong to the genera *Eiseniella* (two species), *Limnodrilus* (one species), *Potamothrrix* (one species) and *Psammoryctides* (two species). Notably, matching sequences were found in public databases for only two species: *Limnodrilus hoffmeisteri* and an unidentified *Eiseniella*.

species from Cyprus. The success of COI sequencing in all samples demonstrated the reliability and effectiveness of the protocols developed for this pilot study. Furthermore, our findings suggested that the oligochaete fauna in Israel is distinct from that of Europe and likely includes endemic species. These results underscore the largely unexplored diversity of oligochaetes in Israel and highlight the urgent need for further studies to better understand their ecological roles and potential involvement in the Myxozoan life cycle.

Conferences

Prof. Dorothée Huchon presented at the following meeting:

- *Next-generation sequencing to decipher genome evolution of microscopic parasites: insights from Myxozoa (Cnidaria)*. British Society for Parasitology Spring Meeting, 2–5 April 2024, Liverpool, UK.

THE MOLLUSCA COLLECTION

Henk K. Mienis and Oz Rittner

In the 2023–2024 academic year, we worked chiefly on a revision of the shell collection of Simon Rol, a shell collector from Haifa. He was one of the first members of the now defunct Israel Malacological Society. Mrs Anat Shvueli, a daughter of Simon Rol, donated his collection to the Steinhardt Museum of Natural History.

We also continued our research in the fields of taxonomy, systematics, nomenclature, Lessepsian migration, exotic and invasive species in the mollusc fauna of Israel, and various aspects of archaeomalacology.

Interesting faunistic records from Israel

Terrestrial Molluscs

Two populations of the large terrestrial slugs belonging to the genus *Laevicaulis* recently discovered in gardens in Rishon leZiyyon seemed to be well established. According to DNA research carried out by Dr Tamar Feldstein-Farkash we were most probably dealing with *Laevicaulus alte*, a species of African origin, recently also found in Egypt (Ali & Robinson 2020, 2022). The identification of material from Israel had still to be confirmed by the anatomical examination because a quite similar species *Laevicaulus stuhlmanni* was also recently recorded as an exotic species from Egypt and Lybia (Ali *et al.* 2022; Ibrahim & Ali 2024).

All slug specimens so far recorded from Israel as *Ambigolimax valentiana* should be considered as *Ambigolimax* spp. since at least two but most likely even three species may occur in Israel. Their identification on external features is impossible (Hutchinson *et al.* 2022).

Marine Molluscs

In the mollusc collection of Yechezkel Nagy we found a single fine specimen of *Morula chrysostoma*, a well-known species from the Red Sea, which he had collected on the beach of Giv'at Olga in July 1998. It seems to be the first record of this species from the Eastern Mediterranean (Mienis & Rittner 2023).

In another old collection, one more Red Sea species collected on the Mediterranean beach was spotted: *Orphanopusia osiridis*, Shiqmona, leg. E. Halpern, summer 1989 (Mienis 2023).

The presence of both *Morula chrysostoma* and *Orphanopusia osiridis* in the Mediterranean Sea has still to be confirmed by additional finds in order to add them to the constantly growing list of Lessepsian migrants.



Morula chrysostoma, a Red Sea species, found on the Mediterranean beach of Giv'at Olga; height 23.6 mm. (Photo: Oz Rittner)

Species that seem to have established viable colonies in the Eastern Mediterranean include the sea slug *Okenia picoensis* (Grisaru *et al.* 2024) and the scallop *Laevichlamys superficialis*, which additional specimens were found in the harbour of Ashdod in 2024.

Support with identifications

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

Cooperation with the Plant Protection & Inspection Services (PPIS), Ministry of Agriculture

During 2023–2024, Mrs S. Vaisman brought us for verification or identification 106 samples of land and freshwater snails intercepted by the PPIS inspectors from either agricultural merchandise arriving from abroad or found on local material grown in nurseries (samples PPIS 827–932).

Among the intercepted snails and slugs there were several noteworthy records. The North American slug *Pallifera dorsalis* continued to arrive in merchandise arriving from the Netherlands on cuttings of *Syngonium* (PPIS 856) and *Alocasia* (PPIS 857).

The 2024 year started with two interceptions (PPIS 859 & 860) of living freshwater molluscs from the luggage of temporary workers arriving from Thailand.

Sample PPIS 859 consisted of 2 kg of the following living snails:

<i>Filopaludina martens</i>	560
<i>Filopaludina polygramma</i>	2
<i>Filopaludina sumatrensis speciosa</i>	18
<i>Filopaludina</i> sp.	2
<i>Trochotaia trochoides</i>	13
Total	595 specimens

Sample PPIS 860 consisted of 3 kg of the following living snails

<i>Pila grandis</i> (juveniles)	6
<i>Filopaludina martens</i>	850
<i>Filopaludina polygramma</i>	19
<i>Trochotaia trochoides</i>	9
<i>Bithynia funiculata</i>	12
Total	896 specimens

According to the differences in the species composition the snails were either collected in different aquatic biotopes or bought on different markets.

Isaurica lycia snails were discovered in two shipments of stones arriving from Turkey (PPIS 861 & 862).

Although *Eobania vermiculata* is considered a rare species in Jordan (Neubert *et al.* 2015) it continued to arrive in Israel on Jordanian shipments of vegetables to Israel and Palestine (PPIS 875 on cucumbers and PPIS 881 on peppers, see also Mienis & Vaisman 2021).

It happened twice that two specimens of each *Arion intermedius* and *Arion subfuscus* were found in shipments of mosses from the Netherlands (PPIS 880 & 887).

Hygromia cinctella was intercepted for the first time from a commercial shipment of apples arriving from France (PPIS 891).

The common Black lipped garden snail *Cepaea nemoralis* was collected twice from shipments of *Viburnum* arriving from the Netherlands (PPIS 878 & 895).

A shipment of dried herbs from Egypt turned out to contain *Monacha cantiana* (PPIS 908), which had to be considered also an introduced species in Egypt.

From time to time interesting snails and slugs were encountered on imported merchandise, but remained unidentified at the species or even genus level. This was caused by the fact that we did not always know the exact origin of the material. Such examples included a juvenile *Helix* sp. from Turkey (PPIS 828) or a tiny snail species found in a shipment of *Castanea* from China (PPIS 830).

Cooperation with the Israel Nature and National Parks Protection Authority

Yael Artzi of the Hula Nature Reserve supplied us with samples of freshwater mussels collected at various localities in the Upper Galilee and in the Yarmuk drainage area.

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

Cooperation with local and foreign archeologists

Another study of archaeomalacological material from sites belonging to the Palatial Mansions in Areas F-2, P and P-2 in the Jewish Quarter of the Old City of Jerusalem excavated by the late Nahman Avigad and more recently by Hillel Geva was published recently (Mienis 2024). Material from Area M was still being studied at the time of reporting.

Our final study of the shells from the German-Israeli excavation of Tell Iztabba near Bet She'an, directed by Prof. Achim Lichtenberger (Münster University) and Prof. Oren Tal (Tel Aviv University), was in print in the *Monograph Series* of the Institute of Archaeology of the Tel Aviv University at the time of reporting.

The long awaited report dealing with the shells recovered during various excavations at 'En Gedi was also in print in *Qedem* published by the Institute of Archaeology. Due to the large size of the manuscript the chapter dealing with the shells found in the ancient agricultural fields had to be included in volume 46 of *Triton* (Mienis, in print).

Other reports dealing with archaeomalacological material from the excavation of the Assyrian fortress in Rishon leZiyyon and Mezaḏ Yeruham, were being prepared for final publication by Prof. Oren Tal.

New acquisitions in the Mollusc Collection 2023–2024

New material from colleagues at various institutes and especially from private collectors continued to flow in regularly during the reporting year. The identifications of the newly acquired material were immediately checked and the specimens were prepared for permanent storage in the collection.

Name	Brief description of the material
Y. Artzi	Freshwater molluscs from Israel
O. Barneah	Dead mussels <i>Energiean</i> off North Israel
B.S. Galil	Marine molluscs from the Mediterranean coast
Y.Gur	Freshwater molluscs from Israel and Greece
Z. Kremenchugsky	Freshwater molluscs from Israel
M. Mendelson	Marine molluscs from the Mediterranean coast
D. Mienis	Land snails from Israel & the Netherlands, and shell buttons
H.K. Mienis	Land- and freshwater molluscs from Israel and the Netherlands
Plant Protection and Inspection Services, Ministry of Agriculture	Intercepted material arriving from abroad
O. Rittner	Land snails from Israel
A. Shvueli	Worldwide shell collection of Simon Rol
M. Singer	Marine molluscs Italy
S. Vaisman	Land snails from Israel

Computerization of the collection

The computerization of the Mollusca collection continued by Oz Rittner and Mrs Ronit Vilker-Alhadeḏ (a volunteer).

The Malacological library

The library is an extremely important tool for taxonomic and systematic studies in the Mollusc Collection.

We continued to receive many reprints and numerous journals from Zoological Institutes or Malacological Societies in exchange of *Triton*, the independent malacological journal published

in Israel (Issue 44 was published in December 2023 and Issue 45 in March 2024), and the quarterly journal *Natuurhistorische en Andere Notities — Natural History and Other Notes*, of which four issues (40–43) were published.

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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

During 2023–2024, Nogs started to look at freshwater Bryozoa, and aim to establish a collection of statoblasts — the dormant structure that allow freshwater Bryozoa to survive dry seasons.

Conferences

Fresh-water Bryozoa from Israel — the known and mainly unknown. The 14th Larwood Symposium. 19–20 September 2024, Lerici, Italy.

Public outreach

- *Beyond the coral reef: Scientific innovation based on marine research* (lecture). <https://www.tel-aviv.gov.il/pages/MainItemPage.aspx?WebID=3af57d92-807c-43c5-8d5f-6fd455eb2776&ListID=9dd2da03-5c43-462a-b5b2-d087c179b16c&ItemID=10582>
- “A meeting with a researcher” — An online interview about Bryozoa “Is it animal, vegetable or mineral?” (SMNH; <https://www.youtube.com/watch?v=ZJ5YpmE6oIU&t>)

TERRESTRIAL, FRESHWATER AND MARINE FREE-LIVING NEMATODES

Stanislav Pen-Mouratov

Besides being one of the most numerous groups of multicellular animals in the world, free-living nematodes play a crucial role in fundamental ecological processes like soil formation, aggregation, decomposition, recycling of nutrients in the environment, biodiversity maintenance, etc. Furthermore, due to sensitivity of nematodes to ecosystem disturbances, they can be used as reliable indicators for understanding ecosystems' processes. Many nematodes are free living and abound in soils and sediments in terrestrial, freshwater and marine ecosystems, including extreme—deep subsurface, permafrost and toxic, to name a few—habitats. As parasites they occur in every multicellular group.

Research projects

Herbivores' activities, abundance, diversity and diets affect the processes, functions and properties of ecosystems, and directly or indirectly effect changes in soil community structure. Through the input of nutrients via their urine and feces, as well as trampling and selective browsing, herbivores can modify the structure and composition of soil ecosystem inhabitants.

The impact of nutrient cycling through feces and urine on soil ecosystems has been well-studied for large herbivores; however, reports on the effects of smaller herbivores' excreta on the soil biota are scarce.

To fill this gap, my colleague, son and a young scientist David Pen, who was then a BSc student in Marine Science and Marine Environment at the Ruppin Academic Center, and I set out to study this issue. For several years, we were working hard to determine the impact of the Indian crested porcupine (*Hystrix indica*) fecal deposits on the abundance, structure and diversity of free-living nematode communities in the Mediterranean region of Israel.

The obtained results of our project confirmed our assumption that medium-sized herbivores also have a significant impact on the soil free-living nematodes and their habitats. Fecal deposits of the Indian crested porcupine were found to have various effects on the observed soil properties, and mainly on the abundance of the soil free-living nematodes. In accordance with earlier findings, we showed that soil properties and the environmental factors have a seasonal effect on the soil free-living nematode communities.

Our preliminary data obtained during the study period were presented at the International Union of Soil Sciences Congress dedicated to 100 years of soil science in Italy and at the European Society of Nematologists Symposium in Spain.

Nematode collection

As a routine, the nematode samples were extracted and counted from soil samples from the above-mentioned study, and 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.

Field work

We continued our study of effect of the Indian crested porcupine activities on the soil ecosystems and collected samples of soil, which was exposed to animals' impact, on the monthly basis. Along with direct observation of wild animals, e.g. through the fecal deposits, we used digital trail cameras to monitor porcupine activity to obtain additional information about the impact of the wild animals on the soil ecosystem.

International collaborations

During the reporting period, I continued active collaboration with scientists from several countries, including USA, Europe, Russia and Asia, and continue to be a member of the Nematological Societies of America and Europe.

Conferences

- *Medium-sized herbivores' excreta have a significant impact on soil biota in a Mediterranean forest ecosystem.* Centennial Celebration and Congress of the International Union of Soil

Sciences: 100 years of Soil Science, Past Achievements and Future Challenges. Florence, Italy, 19–21 May, 2024. (S. Pen-Mouratov and David Pen)

- *Effect of Indian crested porcupine (Hystrix indica) activity on abundance and diversity of soil free-living nematodes*. Symposium of the European Society of Nematologists. Cordoba, Spain, 15–19 April, 2024. (S. Pen-Mouratov and David Pen)

THE CRUSTACEA COLLECTION

Bella Galil

The Crustacea constitute a large, primarily marine and inland aquatic, subphylum of Arthropoda. There are over 67,000 known crustacean species and it is suggested that 200,000 more are yet to be discovered. Most crustaceans occupy marine and freshwater environments, but also terrestrial habitats 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 under extreme—in terms of temperature, pressure, and salinity—environmental conditions. Crustaceans are ecologically and economically important, and they are an essential 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.

Research

Prof. Bella Galil focused her main research efforts on marine indigenous and non-indigenous species in the Mediterranean Sea, as well as on taxonomy of Indo-Pacific decapod crustaceans.

Prof. Galil continued her studies on the outbreak of the widely invasive mytilid mussel *Perna perna* along the Israeli coast. Following the heat wave induced mass mortality in 2021, the newly re-established population was surveyed at several sites in 2022–2024. The main objectives were documentation of the post mass mortality population status, comprising basic data on the population density.

The crustacean biota of the Israeli shelf ecosystem has been profoundly disrupted by the influx of invasive alien species introduced through the Suez Canal. Yet, the role of their parasitofauna has been scarcely monitored, with the exception of the lesser swimming crab *Charybdis (Archias) longicollis* Leene, 1938 parasitized by the rhizocephalan *Heterosaccus dollfusii* Boschma, 1960. Host size, sex ratio, prevalence of ovigerous females, parasitization, and multiple parasitization, have been studied by Prof. Galil over 30 years to determine a long-term host-parasite population dynamics.



Charybdis (A.) longicollis collected off Ashdod, Israel, Nov. 2022, at 40 m depth, carapace width 28.9 mm, bearing 6 parasites. (Photo by Oz Rittner)

A recent study following the proliferation of the invasive silver-cheeked toadfish *Lagocephalus sceleratus* (Gmelin, 1789) that preferentially feeds on *C. longicollis* suggests that predation may have caused a shift in the crabs' temporal activity pattern. Prof. Galil continues tracking this unique set of predator-host-parasite interactions among three successive Erythraean invasive aliens.

Prof. Galil identified decapod crustaceans, part of the fouling communities collected between 2021–2023 from Autonomous Reef Monitoring Structures (ARMS) stationed along the Mediterranean coast of Israel, a project led by Dr Omri Bronstein.

International collaboration

In May 2024, Prof. Galil visited the Muséum National d'Histoire Naturelle, Paris, France, to continue her studies on the deep-sea leucosiid crabs collected off New Caledonia.

Prof. Galil also co-authored a scientific report of the Working Group on Ballast and Other Ship Vectors under the International Council for the Exploration of the Sea, Intergovernmental Oceanographic Commission of UNESCO, and International Maritime Organization, whose aim is to provide scientific support to international decision-making to reduce the risk of spread and establishment of non-native species via maritime transport:

ICES 2024. Joint ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV). *ICES Scientific Reports*, 6(63): 1–41. <https://doi.org/10.17895/ices.pub.26064559>

Identification services

Prof. Galil identified decapod crustaceans for Dr Nir Stern and Dr Hadas Lubinevsky, Israel Oceanographic and Limnological Research Institute (IOLR).

Field work

Periodic surveys of the invasive population of *Perna perna* in Haifa Bay were conducted by Prof. Galil throughout 2024.

Popular outreach

גליל, ב. & מ. גורן, 2024. כי מלאה הארץ מינים פולשים: מדע ומדיניות. טבע הדברים, 340: 39–47.

THE ANNELIDA COLLECTION

Liron Goren

The annelids, or the segmented worms, are a phylum of invertebrates, with over 22,000 extant species including ragworms and other polychaetes, earthworms and leeches. The annelids live in and have adapted to marine (as distinct as tidal zones and hydrothermal vents), fresh water and moist terrestrial environments. In their size, the annelid worms are ranging from microscopic filter feeding marine polychaetes to the Australian and African giant earthworms, which can grow up to 3 m and almost 7 m, respectively. Both terrestrial and aquatic annelids play a very significant role in ecosystems. Earthworms contribute to soil fertility by loosening the soil so that oxygen and water can penetrate it, by mixing organic and mineral matter and by accelerating the decomposition of organic matter and thus making it more quickly available to other organisms, and by concentrating minerals and converting them to forms that plants can use more easily. In marine ecosystems, polychaetes may constitute over one-third of benthic animals around coral reefs and in tidal zones. Burrowing polychaetes increase the penetration of water and oxygen into the sea-floor sediment, which facilitates the growth of populations of aerobic bacteria and minute animals alongside their burrows.

Research

In 2023–2024, I began a project aimed at investigating the changes in polychaete fauna through the decades in the Gulf of Eilat. I went for a preliminary sampling in Eilat and started to add to the database old polychaete samples that were present in the collections but were never properly catalogued. These specimens were mostly collected in the 1960s–1970s from the Red Sea. I was also collaborating with Dr Daniel Martin from CEAB-CSIC in Spain in describing three new species of Terebellidae found in the Mediterranean Coast of Israel, and a *Haplosyllis* sp. found inside of *Theonella conica* sponge in Eilat. Additionally, I was working on a project focusing on understanding how the polychaete *Haplosyllis eldagainoae* is able to survive the toxic arsenic-rich environment of its host, the sponge *Theonella swinhoei*. Collaboration with Dr Yaron Hershkovitz from the Israel National Center for Aquatic Ecology (SMNH) was ongoing regarding the identity and introduction history of a *Barbronia* sp. leech found in a few freshwater systems in Israel. To this aim, I was also collaborating with Dr Ekin Tilic from the Senckenberg Museum in Frankfurt, who hosts several *Barbronia* spp. in his collections. Finally, I spent a week at HCMR, Greece, working with Dr Kleoniki Keklikoglou on cybertaxonomy of polychaete samples from the collection, using micro-CT.

Collection management

Old polychaete samples mostly from the Red Sea (mostly from the Red Sea) were added to the database, as well as more than 80 samples from the mytilid beds in the Mediterranean Sea.

Field work

I went on a field trip to Eilat for preliminary sampling of polychaetes for a project investigating the change in polychaete fauna in the Gulf of Eilat over the last decades. I also collected *Theonella* spp. sponge-inhabiting *Haplosyllis* spp. worms for taxonomic and ecological studies. I went on mesophotic expeditions with Prof. Micha Ilan's research group (School of Zoology, Tel Aviv University) continuing our project on biodiversity of the mesophotic sponge grounds.

THE ECHINODERMATA COLLECTION

Omri Bronstein

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.

Research

This year we had two MSc students working with collection materials, particularly Mai Bono-mo, who completed her Master's thesis on Holothuroidea from the Red Sea, and Yamit Shkalim, who was at the final stages of writing-up the MSc thesis focusing on the echinoid fauna of Israel. In the context of these two studies, we hosted four project students for a duration of about six months each. These studies led to a complete revision of the Israeli fauna of the holothuroids and sea urchins, which included morphological and molecular diagnostics, and identified several new species as well as new records in Israel.

Collection management

During 2023–2024, we received samples from our network of collaborating partners including samples from Canary Islands, Cyprus, Djibouti, Greece, and the Réunion in the Western Indian Ocean. The majority of databased samples (51) originated from the Red Sea, with some collections from the Mediterranean Sea.

International collaboration

In 2023–2024, we signed two Memorandums of Understanding:

- TAU–ETH Zurich (Eidgenössische Technische Hochschule Zürich), since January 2024. Project: *eDNA hindsight — High-resolution temporal monitoring of marine fish communities using environmental DNA*.
- TAU–EPFL (Ecole polytechnique federale de Lausanne), signatures pending. Project under the Transitional Red Sea Center: *Establishing regional scale studies of Red Sea coral reefs and transforming cutting-edge science into environmental protection through regional collaboration*.

In addition, our network of partners around the sea urchin mass mortalities that contributed samples included Jean-Pascal Quod (Reunion Island), Carlos Himenez (Cyprus) and Jose Carlos Hernandez (Canary Islands).

Conferences

During 2023–2024, Omri presented at numerous meetings, including the following:

- Chair: *Aquaculture academy: a science driven industry*. The 19th Annual Meeting of the Israeli Association for Aquatic Sciences, Eilat, Israel. 2024.
- *Non-Invasive DNA sampling of commercially valuable sea cucumbers: A tool for aquaculture sustainability in the Gulf of Aqaba*. The 19th Annual Meeting of the Israeli Association for Aquatic Sciences, Eilat, Israel, 2024. (with Bonomo M.)
- *Textbook invasion — summarising two decades of Diadema setosum research in the Mediterranean Sea*. The 17th International Echinoderm Conference, Tenerife, Spain, 2024.
- *Monitoring MPAs — advancements in the scientific toolbox*. Symposium on Marine Protected Areas in the Mediterranean Sea of Israel, IOLR, Haifa, Israel, 2024. Invited presentation.

- *The rise and fall of diadematoïd sea urchins in Israel: What do we know and where do we go from here?* Israel Ministry of Environmental Protection, Jerusalem, Israel, 2024. Invited presentation.

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

In 2023–2024, we continued focusing on monitoring and discovering non-indigenous ascidian species as well as identifying new species. For this purpose, a new MSc student, Tamar Gali, started her project on the biodiversity of ascidians along the Mediterranean coast of Israel. Noa arranged a visit with Tamar Gali to the Marine and Environmental Research Lab in Cyprus for potential collaboration and species assessment.

Collection management

Ongoing tasks included entering data of old samples into the database and making corrections to wrong fields and data. For work on the database, Nathan Sharon offered great help as a volunteer.

Active grants

2020–2024 *Mechanisms of rapid local adaptation in marine invaders: ascidians as a case study.* (ISF–NNSC; co-PI Prof. Aibin Zhan, Chinese Academy of Sciences)

2023–2025 Impact of global change on ascidian physiology and distribution. (ISF)

Field work

Samples from the Red-Sea and Mediterranean, including still-to-be-identified *Microcosmus* sp. were collected at a sandy site near Michmoret.

Conferences

Noa participated in the following conferences:

- 23rd International Conference on Aquatic Invasive Species, Halifax, Canada, 12–16 May 2024. Oral presentation.
- 12th International Tunicata Meeting, Santa Cruz, USA, 21–26 July 2024. Oral presentation & session chair.

MEDITERRANEAN AND RED SEA FISHES

Jonathan Belmaker, Bat-Sheva (Shevy) Rothman, Roi Holzman and Noa Truskanov

The native fish fauna of the Eastern Mediterranean is facing changes, which are more rapid than anywhere else. The ongoing influx of invasive Red Sea species, rising water temperature, over-fishing 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.

Research

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

fish invasion. We also led an intensive fish survey effort in collaboration with the Israel Nature and Parks Authority along the Gulf of Aqaba (Eilat) coast. The goal was to establish an ecological baseline that can be used to assess the effectiveness of protection efforts. Surveys were conducted in fall of 2024 and included almost all lab members. We continued fish sampling along both the Mediterranean and Red Sea coasts using Baited Remote Underwater Video Systems (BRUVS), visual transects, dedicated fish juvenile surveys, deep visual surveys using remote underwater vehicles (RUV), and acoustic surveys. These surveys will quantify fish diversity along spatial and depth gradients and will be used for both monitoring and long-term understanding of the marine ecosystem. Analyzed data will be openly available to the museum users.

Roi's lab continued to analyze museum data on the morphology of Coral Reef species to test the effects of feeding by biting on the substrate on morphological diversification of body morphologies. We continued the opportunistic collection of the Red Sea fish, particularly those given to us by the Observatory but also collected dead or confiscated by authorities, or used by other researchers. This gave the collection access to dozens of large and/or rare specimens that were otherwise not obtainable. We were working on an AI method of automated morphological measurements of fish, using pictures we took in the museum to develop and validate our method. We participated in visual survey of juvenile and adult reef fish in the Gulf of Aqaba.

During the reported period Shevy worked on two projects: (1) Detecting and identifying aquatic parasites. The focus was on parasites of invasive fish and the changes in parasite-host interactions in the Mediterranean. As a part of an ongoing collaboration with Dr Simona Georgieva from the Bulgarian Academy of Sciences, the parasitic fauna of the lionfish *Pterois* sp. in both its native (Red Sea) and invaded range (Mediterranean coast and Caribbean Islands) was studied and a publication was in preparation. The use of parasites of two invasive fishes (*Siganus rivulatus* and *Parupeneus forsskali*) as bio-indicators was explored in collaboration with Dr Niki Chartosia from the University of Nicosia, Cyprus, to expand our spatial scope. (2) A new project on crypto-benthic fish communities, which were largely overlooked in the past two decades along the Mediterranean coast. As part of his MSc, Asaf Nashiv was examining the crypto-benthic fish in shallow rocky reefs; their depth niche and response to global changes. He examined possible protocols for visual surveys and compiled the available data from the fish collection at the SMNH and published/unpublished sources. His study was substantially delayed due to his recruitment for reserve service for most of the past year.

Noa' Lab investigated various aspects of the behavior of coral reef fish across multiple projects. In one project led by MSc student Maayan Neiger Rachmilevitch in collaboration with Prof. Moshe Kiflawi, we were examining the behavior of facultative cleaner fish species. These fish engage in mutualistic interactions by providing ectoparasite removal services to other fish. However, they exhibit variability in the extent to which they participate in this cooperative behavior. Despite the ecological significance of these interactions, the factors driving individual differences in cooperative behavior remain poorly understood. Our research aimed to determine whether consistent individual differences in cleaning behavior exist within these species, and to identify the underlying causes of such variability. In another project led by MSc student Hadar Hayun in collaboration with Prof. David Eilam, we were investigating the exploratory behavior of coral reef fish that swim upside down. Previous studies suggested that inverted orientation might affect neural processes related to spatial orientation. Our research sought to explore this phenomenon in species where individuals were occasionally observed consistently swimming upside down in the wild.

Collections management and databasing

During 2023–2024, 393 items including some 2263 fish individuals, were registered in the database, including many from the national monitoring campaigns managed by Dr Nir Stern (IOLR) off the Mediterranean coast during 2018–2023, others were confiscated by marine rangers (INPA) or found stranded on the beach in the Mediterranean and the Red Sea. Most items (273) originated from the Mediterranean Sea. We managed to transport a large amount of fish that were collected and stored at the IUI over a long period. The collected fish were to be accessioned in the fish collection in the following year. We had several interesting additions to the collection, such as the Giant guitarfish *Rhynchobatus djiddensis* found dead underwater in Eilat with a fishing hook puncture in its jaw. This was the first specimen of this species in our collection and its tissue was stored separately for

further analysis. A unique addition to the collection was the Slender sunfish *Ranzania laevis* which was collected on the beach of Bat Yam in 1971, preserved dry and attached to a picture frame and remained as an office souvenir until we integrated it into the collection.

Tissue samples of *Thunnus albacares* and *Acanthocybium solandri*, molecularly confirming these as new species records in the Eastern Mediterranean Sea, and the first Giant Guitarfish *Rhynchobatus djiddensis* found in the Red Sea were added to the collection.

Scientific collaboration

Main international collaborations included Dr Paolo Albano (National Institute of Marine Biology, Ecology and Biotechnology, Naples, Italy) to estimate trends in marine invasive species across taxa, Dr Hanno Seebens (University of Giessen, Germany) and Prof. Melodie McGeoch (Monsah University) on developing model for invasive species assessment, and Dr Chia Ying Ko (National Taiwan University) on main depth biodiversity gradients and response to climate change. Shevy also collaborated with Dr Simona Georgieva (Bulgarian Academy of Sciences) advancing fish parasite diversity and taxonomy, and with Dr Niki Chartosia (University of Nicosia, Cyprus) on a new project to be launched in 2025 utilizing fish parasites of invasive fish as bioindicators for ecosystem health and stability.

Our main collaborator in Israel was Dr Nir Stern from the IOLR who managed the fish trawling campaigns as part of the national monitoring program and the fisheries surveys for the fisheries department in the Ministry of Agriculture. These survey efforts were our main source for fish samples. Dr Stern and his students were using fish specimens from the fish collection in order to generate a sequence library of the 12S gene for eDNA studies.

Roi's main collaborations included Dr Matt McHenry (UC Irvine, CA, USA) to study the evolution of hydrodynamics, mechanics and prey capture in the feeding of misfit fish; Dr Uri Shavit and Dr Dan Givoli (Technion, Israel) to study how growing beyond the Kolmogorov scale changes the response of fish embryos and larvae to small-scale water motion; and Dr Shai Avidan (Faculty of Engineering, TAU) to develop the use of machine learning in studying fish movement, feeding and functional morphology.

Conferences

Jonathan Belmaker:

- *Biological interactions and behaviour in the Anthropocene*. 10th ILANIT/FISEB Experimental Biology Conference. Eilat, Israel, 2023.
- *The role of sampling effort in shaping trends in biological invasions*. Species on the Move Conference. Bonita Springs, Florida, 2023. Invited oral presentation.
- *The role of sampling effort in shaping trends in biological invasions*. Species on the Move Conference. Bonita Springs, Florida, 2023. Oral presentation.
- *Life of the edge: edge effects limit the function of marine protected areas*. The 51st Conference for Science and the Environment, Tel Aviv, Israel, 2023. Invited plenary presentation.
- *How to estimating introduction rates of alien species from discovery records?* Symposium on Biological Invasions in Israel, Tel Aviv, Israel, 2023. Invited presentation.
- *Disentangling the effects of protection and habitat quality on species diversity*. European Society for Conservation Biology, Bologna, Italy, 2024. Oral presentation.

Shevy Rothman:

- Chair and session organizer: *Utilizing citizen science and social media for ecological research and conservation*. 60th Annual Meeting of the Israel Zoological Society. Ra'anana, Israel. March 2024.
- *Using observations collected from social media to explore trends in the distribution of sharks and rays in the Mediterranean Sea in the past decade*. 60th Annual Meeting of the Israel Zoological Society. Ra'anana, Israel, March 2024. (with Barash A., Grossmark Y., Salingre S., Khan I., Belmaker J.)
- *Lagging behind — parasitic fauna of alien fishes in the Mediterranean*. NEOBIOTA 2024, The 13th International Conference on Biological Invasions, Lisbon, Portugal. Oral talk.
- *Out of sight out of mind — New fish-parasite systems in the Mediterranean Sea*. Thalassa 2024, the 2nd regional conference in Marine Sciences, Larnaka, Cyprus, 28–29 May 2024. Oral talk.

Roi Holzman:

- *Biomechanics of prey capture in fish: exceptions to the suction feeding paradigm*. SICB, January 2024. Seattle, WA, USA.

Public outreach

Shevy Rothman was extensively interviewed by the media: An online interview *Deep sea fishes* (December 2023; <https://youtu.be/8p2NXPGEFno?si=-bMH4YPU7ZX01z0v>); an interview for Haaretz about the invasion of the lionfish in the Mediterranean (April 2024; <https://www.haaretz.co.il/science/biology/2024-04-25/ty-article-magazine/.premium/0000018f-158f-d2e1-a7df-15af9d3f0000>); an interview for i24 about the mysterious stargazer fish (July 2024); an interview for Ynet about biting fish (July 2024; <https://www.ynet.co.il/environment-science/article/bk21ywodc>); a radio interview about the biting fish in our shores for Galei Tzahal (September 2024); an interview about sea horses for the Tel Aviv University podcast channel. She also gave a lecture about fish collections at the annual meeting of *Sharks in Israel community (citizens scientists)* – 10 years of activity (SMNH, June 2024).

THE TERRESTRIAL VERTEBRATES SECTION

Shai Meiri, Karin Tamar, Yosef Kiat, Tamar Dayan, Yossi Yovel, Eran Levin, Eli Gefen, Amos Belmaker, Avigail Ben-Dov Segal, Igor Gavrilov, Stanislav (Stas) Volynchik, Yoel Rak, Yoram Yom-Tov

Overview

The tetrapod collections' growth kept slowing down. In addition to the causes outlined previously and below, the ongoing war hampered collecting by the public and the Israel Nature and Parks Authority rangers, as well as our ability to reach some stations. We did take greater care to enter more useful specimens and better document their data and metadata. That said, we were caring better for, and organizing better, what we already had. Our main challenge was the chronic shortage of manpower. This was reflected in the lower rate of specimen addition and the increasing backlog of specimens awaiting processing in our freezers. Other major challenges included computing (i.e. adjusting to an inflexible new system) and a diminishing space for storing specimens in the dry collections. So far, there were no forthcoming solutions for any of these issues except slowing the rate of specimen addition. We limited the number of specimens coming in, being more selective of material we decided to keep: we were only adding specimens with full collecting information except for very rare species. We did not accept any specimens without at least the date and place of collection and only added specimens in good condition (unless a skeleton or just a tissue sample was required). We also discarded excess specimens of common species without collection details that were already stored at the collections.

Personnel

This year we were joined by Dr Yosef Kiat as the curator of birds. Yosef was also the director of the Israeli Bird Banding Center so we were looking forward to a fruitful collaboration. Karin managed the herpetology (Amphibia, Reptilia) and mammal collections, and Amos was in charge of birds. Daniel Berkowic, the former manager of the egg and nest collections, left and Avigail was replacing him under Amos' supervision.

Tal Vardi, an MSc student at the School of Zoology, was working part time helping Karin organize and maintain the Mammal and Reptile collections. Yulia Gordover, an MSc student at the School of Zoology, was working part time helping Karin filling details in Yoel Rak collection database.

The bird collection was blessed with several volunteers. Rami Biran was organizing the pellet collection, Dita Friedman and Sima Kotev helped inventory the collection and better organize it, and David Kobiler and Hillel Boch helped out a bit with skin preparation. Yael Piuntkevich, was exploring the keel shape as an independent research project.

Collection management: equipment, infrastructure, storage and curation

We continued working on basic organization of the collections. This included taxonomic organization in the cabinets, better protecting specimens using plastic boxes and plastic sleeves and inventorying the collections. The latter was necessary as in past decades not enough attention had been given to logging where specimens went. Consequently, there were many specimens that we did not know where they were physically located. This process was time consuming and we did not expect it to be finished any time soon. We started the process of moving skeletons to their own shelves. This would free up space in the cabinets. The pellets and eggs were already in their own wooden cabinet but more organization was needed there. We were expecting black curtains to arrive soon to better protect specimens from light damage. Lastly, we were about to start soon adding locks and handles to the mount cabinets to allow them to close better without the need for keys.

We continued assimilation of the A. D. Gordon Museum collection of birds and mammals into our collection. The work was progressing very slowly due to shortage of manpower. The newest addition to this was the bird collection of the late Haim Hovel, including some specimens of reptiles and mammals. This collection included hundreds of skins that needed to be cataloged and bagged. These activities proceeded in conjunction with the progress David, Dita and Sima were making in the inventory of the bird collection to ensure we maintained the order of the specimens in the cabinets. Amos finished cataloging a small skeleton batch that we had received in exchange from Italy. This added several new species to the collection and was most welcome.

While we were making slow progress in the organization of the collections, the view to the future was problematic. In the main hall, we have space for only ten more storage cabinets (four for mammals and six for birds). However, there were plans to vacate and move around some other things (boxes and unused wooden cabinets) to free up room for additional storage. Amos was also moving the skeletons out of the Delta cabinets to free up room. Additional cabinets, when purchased, will quickly fill up, as more room is needed just to space out specimens to prevent their damage. We had little room for the growth of the collection, so we were trying to purge the collection of unimportant specimens (those from captivity or with no collection information). However, this would only buy us a little more space rather than solve the problem in the long run. Thus, even with the current slow rates of collection growth, we will soon need additional space to keep new material.

Research and Curation

Research activities

In keeping with the scientific interests of the curators on the one hand, and the needs of the Israel Nature and Parks Authority (INPA) on the other, we have mainly focused on material collected for the research of students as Michal Zeitzov-Raz (Meriones), Omer Zlotnik (Canids), as well as Karin Tamar's and Shai Meiri's lab interests (reptiles).

- **The osteological differential atlas of all genera of Israel's amphibians** (seven genera, eight species, including the Hula painted frog *Latonia nigriventer*) with detailed photographs of each skeletal element from various angles. This study, led by Karin Tamar, aimed to help identify local species according to their osteological features, as well as to help zooarchaeologists identify bones and bone fragments from archaeological assemblages. This study was designed by Karin and a postdoc Ma'ayan Lev (Haifa University), and carried-out by two BSc students Shiri Shubaev and Tal Vardi.
- **Red-listing Israeli reptile species.** With the INPA, we were leading the effort to red-list and assess the extinction risk facing all species and some subspecies of Israeli reptiles — for the first time since the turn of the current millennium. Meetings were held at the museum during 2024, attended by Karin, Shai, Shai's PhD student, Ben Shermeister, who led the process, the INPA personnel (especially Drs Tal Polak and Noam Leader), and reptile experts from TAU and elsewhere in Israel. We expected to finish the process in the first 1–2 months of 2025.
- **A taxonomic review of Israeli reptiles.** We continued our efforts to revise the taxonomy of reptile species in Israel using traditional morphology (mainly at the SMNH, also in museums abroad),

micro-CT (carried out at the museum in Bonn), molecular analyses at the Molecular Lab and Ancient DNA Lab at the museum (with Tamar Feldstein-Farkash and Meirav Meiri, respectively). We identified a species of gecko new to Israel (*Hemidactylus granosus*) in the far south of the country. Other taxa we focused on included *Ptyodactylus*, *Letheobia*, *Rhynchocalamus*, *Hemidactylus turcicus*, *Myriopholis*, *Telescopus dhara*, *T. fallax*, *Chalcides sepsoides*, *Eirenis levantinus*, *E. rothii*, and *Ablepharus rueppellii*. All these species and complexes seemed to hold the potential to harbor cryptic species across their global geographic distribution or even within Israel. The work was led mainly by Karin and by Shai's postdocs, Roberta Graboksi and Marco Ribeiro-Junior.

The amphibian collection

The downtrend in collecting amphibians still continued. The amphibian collection included 3,078 specimens. The specimens entered to the collection during 2023–2024 were all from Israel. We continued with the process of preparing additional skeletons, now available for all Israeli amphibian genera. The amphibian collection remains the smallest and least active among the other tetrapod collections. Overall, the amphibian collection is taxonomically well organized; we have finished inventorying all specimens, comparing their collection details with the collection's database. Unfortunately, we have discovered that approximately 195 catalogued specimens are unaccounted for.

The mammal collection

Altogether, the mammal collection contained 17,779 catalogued specimens. During 2023–2024, the mammal collection mostly received new specimens from the Israeli Wildlife Hospital (Safari), Israel Nature and Parks Authority stations, Ramat HaNadiv, and Tel Aviv University labs. Many small-sized mammals, mainly rodents and bats, were still kept in the freezer waiting to be prepared before entering the collection. These specimens would likely be prepared and catalogued into the dry collection as skeletons and round skins.

Overall, the mammal collection was fairly well organized, and we finished inventorying most specimens, comparing their collection details with the collection's database. We also commenced improving the maintenance of the collection by placing skulls and skeletons of small-sized species, which were kept in glass tubes, in plastic boxes. We enveloped round skins in plastic sleeves, making sure each specimen had a label. In the wet collection, we transferred mammals (body parts or whole animals) that were kept in old buckets to new buckets and re-labeled them. In the near future, we plan to go over the flat skins collection, including inventorying specimens and enveloping each skin in a plastic bag.

The reptile collection

During 2023–2024, the reptile collection grew to include 20,977 specimens. Newly collected reptiles mainly originated from the labs of Prof. Shai Meiri and Dr Ofir Levy (i.e., collected by Simon Jamison), from private collectors (with NPA permits, e.g., Aviad Bar), the Israeli Wildlife Hospital (Safari), Israel Nature and Parks Authority stations, and Ramat HaNadiv. As in past years, most specimens belonged to well-known species from the Israeli fauna. Interesting specimens added to the collection included a specimen of the Moorish Gecko *Tarentola mauritanica* procured from a shipment from Poland by the INPA, and an adult male of Komodo Dragon *Varanus komodoensis* from the Israeli Wildlife Hospital (Safari). We continued preparing skulls and skeletons, and we intended to continue with this project until we would have representatives of all Israeli species. During the reporting year, we transferred reptiles from old buckets to new buckets and re-labeled them. Overall, the reptile collection was taxonomically organized and we finished inventorying all specimens.

The bird collection

From October 2023 to November 2024, the bird collection grew to 24,857 specimens. Mainly due to the attractiveness of birds, and the dedicated care of Amos, this collection brought in the most volunteers. Each volunteer had his/her own project/task, which s/he worked on independently. This freed Amos up to work on a few research projects, train the volunteers and consult the

Backyard Bird Count.

- David, Sima and Dita worked on a collection-wide inventory. They checked every specimen for data errors and protected it in a plastic sleeve or box, as necessary. David finished everything from Ostriches up until Shorebirds. Dita and Sima started working on Raptors. We expected this project to continue in the next few years. Some of the errors the volunteers found needed more careful attention from Amos.
- Rami Biran, started volunteering with Amos as well to work mainly on the long-neglected pellet collection. He was helping better protect and organize the pellets. The curation of the material should be finished shortly and data curation should start right after.
- Hillel Boch and David helped out with skin preparation. Our freezers are full and we keep on bringing in new material, so this never really ends. On a good note, every bird we brought in was cataloged and bagged so we did not suffer any loss of material due to erased data, tag tears or drying up.
- Rami finished the first step of preparing an elemental bone collection. We now have a new cabinet for this collection and we need to start the next phase of making it accessible to researchers.
- Yael Piuntkevich recently joined the collection and was doing an independent research project. She was investigating the correlates of the keel shape across the bird phylogenetic tree. The project was moving forward in a good pace and we expected to publish a scientific paper from it within a year.

Yoel Rak Collection: Early Hominids

During 2023–2024, we continued assimilation of the early hominids collection of Prof. Yoel Rak from the Faculty of Medicine, Anatomy and Anthropology at Tel Aviv University, comprising 947 specimens, mainly of hominid fossils (e.g., *Australopithecus afarensis*, *Homo erectus*, *Homo habilis*), but of less close relatives as well (e.g., chimpanzee, gorilla and orangutan). This collection comprised plastic and plaster casts of hominid fossils and other primate species. We were in the final stages of inventorying the collection, adding a collection number to each specimen, with original collection information attached to every specimen. This process was very time-consuming as most specimens were lacking available online data and a thorough search was carried out for dozens of specimens. As soon as we finish listing all specimens, we will upload relevant information to the museum's database and label each specimen.

Visits, teaching and loans

During 2023–2024, 11 people visited the collections for a total of 28 times. The visitors were mainly from Israeli academic institutions (Tel Aviv University (5), Haifa University (1), Ben Gurion University (1)), but also from the Israel Nature and Parks Authority (1), or unaffiliated (1). One visitor was from the University of Wyoming, USA.

Nine loans were sent out, four for educational purposes and the rest for research (4) and art exhibits (1). Most of the loans were to Israelis (8) and one was to overseas researchers in Germany. We noted that sending specimens abroad, and receiving them back, was still a serious issue, necessitating much work, often money, and sometimes resulting in specimens getting 'lost'. Three teaching courses used our collection materials.

This year again, we gave animal carcasses to the Vertebrate Biology course at the School of Zoology. The purpose was to allow the students to dissect the animals, learn about them and also learn about the collection. The specimens were then returned to us to prepare skeletons. This exercise was again very successful, and both the students and their teachers thoroughly enjoyed working with a diverse set of species rather than just one as per normal. We were, therefore, making this a feature of the course.

Service to professional and government bodies

Karin and Shai attended meetings of the Academy of the Hebrew Language aiming to thoroughly revise, for the first time since 1963 (i.e., in 51 years) the Hebrew names of all reptiles in Israel. This was necessary because of the large number of taxonomic changes that transformed our understanding of the Israeli reptile fauna, especially over the last decade or so, with the taxo-

nomic works of Karin and Shai. We were trying to assign generic names, avoid Hebrew names that reflect English names assigned to other species, and come up with new names to the newly described (e.g., *Tropicolotes yomtovi*, *Rhynchocalamus dayanae*) and identified species (e.g., *Hemidactylus granosus*, *Pseudotrapelus aqabensis*, *Acanthodactylus aegyptius*) and families (e.g., Phyllodactylidae, Micrelapidae) in the region.

Avigail and Amos helped Ohad Hazofe from the Israel Nature and Parks Authority, as well as the Israeli Air Force and the Israel Airports Authority to identify bird remains.

THE HERBARIUM

THE WATER PLANTS, CYANOBACTERIA AND WATER FUNGI COLLECTIONS

Razy Hoffman

Research and curation

In 2023–2024, surveys and collecting trips continued and the herbarium was augmented with nearly 1000 new specimens of seaweeds, cyanobacteria and seagrasses from the Mediterranean and the Red Sea. Freshwater Bryophyta and Charophyta were collected from inland waters. The surveys revealed some new alien seaweeds that had never been reported from the Levantine shore of Israel before. Some of them were the first records from the Mediterranean Sea.

Taxonomical and molecular investigation revealed several new species to science from the Red Sea and also from the Mediterranean shore of Israel.

Maintenance and cataloging of Lipkin's and Hoffman's dry collections continued in 2023–2024.

Collaborative studies

Collaboration with Dr Frederik Leliaert and Prof. Olivier De Clerck from Ghent University, Belgium, continued and the molecular studies that took place in Ghent University and Meise Botanic Garden revealed several green non-native seaweed invaders, as well as some new species of the Chlorophyta. Several new projects commenced with this team.

A collaborative study with Dror Melamed (a citizen scientist from Tel Aviv) of the liverwort genus *Riella* continued, and the collection of sediments again revealed some new strains of the genus.

A collaborative study Prof. Maria Alba Vergés Guirado of the University of Girona (Spain) resulted in a paper, which confirmed that the invasive red alga *Lophocladia lallemandii* is a synonym of *Lophocladia trichoclados* (Rhodomelaceae, Rhodophyta) and pointed to both Atlantic and Red Sea as places of origin of this invasive species.

LAND PLANTS COLLECTION

Yuval Sapir and Jotham Ziffer-Berger

Research

During the 2023–2024 academic year, we worked on the following projects:

- Assessment of the naturally-occurring grapevine populations in Israel, the main candidates for most of today's cultivated grape varieties, in cooperation with Shivi Drori of Ariel University.
- *What do Israelis like in their garden*: A survey of front yard hedges and their characteristics.

Collections management

Approximately 100 new specimens were added to the herbarium, mainly from Israel but also from the UAE. Some 350 specimens were databased.

Collaboration

During the reporting period, we collaborated with Plant Protection and Inspection Services (Ministry of Agriculture and Food Security), Ariel University, Bar Ilan University, Levinsky-Wingate Academic College, and Ashdod port customs.

Field trips

We went on field trips to Sea of Galilee and Upper Jordan Valley (April 2024), Lower Saxony (Germany, June 2024), and Sharjah and Fujairah (UAE, August 2024).

Conferences

Dr J. Ziffer-Berger presented the following talks:

- *How can communities assist in the assessment of long-term forest regeneration*. The 14th European conference on ecological restoration (26–30 August 2024, Tartu, Estonia).
- *How do dwarf shrubs help in the combat against desertification?* International Perspectives on Sustainability: The 7th International Week of the University of Hildesheim (2–7 June 2024, Germany).

Teaching

The following academic courses were offered:

- Introduction to plant sciences (Dr J. Ziffer-Berger, Levinsky College of Education);
- General Botany (Dr J. Ziffer-Berger, Levinsky College of Education);
- Unique phenomena in plants (Dr J. Ziffer-Berger, Levinsky College of Education).

THE PALAEOSCIENCES SECTION

THE PALAEOONTOLOGICAL COLLECTION

Daniella E. Bar-Yosef Mayer

In 2023–2024, databasing of the Bytinski-Salz fossil collection continued by Daria Leibin Graiver, with 1145 new entries added. The transfer of the collection to new metal cabinets was ongoing.

Dr Yuri Katz continued collaboration with his colleagues from the Institute of Geology and Geophysics, National Academy of Sciences of Azerbaijan; Institute of the Physics of the Earth, Russian Academy of Sciences; and Tel Aviv University. His research efforts focused on the analysis of the magneto-tectonic evolution in the Eastern Mediterranean.

Dr Olga Orlov Labkovsky continued curation of the Palaeozoic Foraminifera collection, focusing on the curation of foraminifera (thin-sections or slides) of the Carboniferous System (Upper Palaeozoic) in the Central and South Tien-Shan (Central Asia: Uzbekistan, Kyrgyzstan, Tajikistan and Kazakhstan). The main focus was on the following families: Pseudostaffellidae Putrya, 1956 nom. transl. Rauzer-Chernousova et al., 1996; Eostaffellidae Mamet, 1970 emend. Hance et al., 2011 and Ozawainellidae Thompson & Foster, 1937. Dr Orlov-Labkovsky continued her research collaboration with Subcommission on Carboniferous Stratigraphy (Secretary Dr Markus Aretz, Geosciences Environnement Toulouse Université Paul Sabatier, Toulouse, France, and Vice-Chair Dr Svetlana Nikolaeva, Department of Earth Sciences, The Natural History Museum, London, UK). She also continued to work with the Institute of Geology, of the Russian Academy of Sciences (Moscow, Russia) and the Institute of Geology and Geophysics, National Academy of Sciences of Uzbekistan (Tashkent, Uzbekistan).

THE ARCHAEOBOTANICAL COLLECTION

Dafna Langgut

All research done in the Laboratory of Archaeobotany and Ancient Environments is based on our botanical collections. The reference collections available in the Lab focus mainly on the Israeli flora and include the following:

- 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)

Active grants

2022–2024 Gerda Henkel Foundation. *Early Homo dispersals Out-of-Africa: human adaptability to environmental changes?* (P.I. €30,000).

- 2022–2026 Israel Science Foundation. *The pollen evidence of Early-Pleistocene Milestones in the Out-of-Africa Corridor: A paleoenvironmental study of south Levantine paleo-waterbodies*. (P.I. US\$125,000).
- 2022–2024 Tel-Hai College Research Grants. *Reconstructing the paleo-vegetation and climate of the upper Jordan Valley – new palynology of the 750,000-year-old Benot Ya'akov Formation*. (together with G. Sharon) (P.I. US\$6,000).
- 2022–2024 Irene Levi-Sala CARE Archaeological Foundation, Hebrew University of Jerusalem. *Paleoenvironmental conditions during early Homo dispersals Out-of-Africa: The pollen evidence from the Levantine Corridor*. (P.I. US\$6,000).
- 2023–2024 “TAD and the Humanities”: Research grant from the School of Jewish Studies and Archaeology, TAU. *The reconstruction of Jordan Valley vegetation and climate conditions during the last 2 million years* (P.I. \$11,000).
- 2023–2024 Israel Institute of Advanced Studies. A member of the research group: *Desert Sea Connectivity: Arid-Zone Food Security and Climate Change in Late Antiquity*.

Research projects in 2023–2024

- Paleoenvironment of the Levantine Corridor during early *Homo* dispersals Out-of-Africa.
- The reconstruction of gardens at Pompeii and Stabiae.
- A comparison between elite gardens across the Roman Empire.
- Changes in the woody vegetation of the Jordan Valley during the last million years.
- Tel Megiddo and its environs.
- The wooden beads of Neolithic Nahal Hemar.
- Microbotanical remains in animal and human dung.

Supervision of students

In 2023–2024, I supervised four PhD students (Mark Cavanagh, Nitsan Ben Melech, Yael Hockema, Minji Jin) and one MA student (Roni Sapir).

International conferences

- Interdisciplinary workshop on *Extreme climate events and their impact on cultural changes in the Levant from Late Bronze Age to Persian Period*, Dortmund University, Germany, September 2024. Invited lecture: *The Southern Levant at the end of the Late Bronze Age: Climate and socio-political instability*.
- *Plant management and domestication in Southwest Asia*: International Work Group for Palaeo-ethnobotany, San Sebastian, Spain, September 2024. Talk: *The core area of fruit-tree cultivation: Central Jordan Valley (Levant), ca. 7,000 BP*.

Awards

- *The Kadar Family Award for Outstanding Research* (2024).

ARCHAEOMALACOLOGY

Following retirement of Dr Daniella E. Bar-Yosef Mayer in December 2023, curatorial activities in the archaeomalacological collection were put on hold.

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

- 2020–2023 Israel Antiquities Authority: *Hunting and herding at the dawn of animal domestication* (P.I., 120,000 NIS).
- 2023–2025 Israel Antiquities Authority: *The earliest cities and the transition to farming* (P.I., 180,000 NIS).

Research projects in 2023–2024

- 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.
- Urban–rural relationships under the Islamic rule.

Field projects

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

Student supervision

In 2023–2024, I advised seven MA/MSc and one PhD students. The students' work was based on faunal assemblages from archaeological sites (zooarchaeological collection) and relied on the mammals and birds comparative collections.

Visiting scholars to the Archeozoological collection

- Prof. Haskel Greenfield (University of Manitoba, Winnipeg, Canada);
- Dr Aaron Sasson (San Diego Natural History Museum, CA, USA).

FISH OSTEOLOGICAL COLLECTION**Irit Zohar**

The fish osteological collection includes over 700 fish skeletons from the Mediterranean and Red Sea, the Nile (Egypt) and other freshwater habitats. This collection is used to identify fish remains recovered from lacustrine sediments, animal gut contents and archaeological sites in the southern Levant. The fish osteological collection is vitally important for characterization of environmental changes in aquatic habitats, reconstruction of fish economic and dietary value to past populations, and for detection of past fishing technologies and processing methods.

Collaboration with local and overseas researchers

- Dr Nimrod Marom — University of Haifa, Israel
- Prof. Ayelet Gilboa — University of Haifa, Israel
- Prof. Guy Bar-Oz — University of Haifa, Israel
- Dr Guy Sisma-Ventrura — Israel Oceanographic & Limnological Research, Haifa, Israel
- Prof. Israel Hershkovitz — Tel Aviv University, Israel
- Dr Sarah Borgel — Tel Aviv University, Israel
- Prof. Naama Goren-Inbar — The Hebrew University of Jerusalem, Israel
- Prof. Arturo Morales Muñoz — Universidad Autónoma de Madrid, Spain
- Prof. Eufrosina Rosello-Izquierdo — Universidad Autónoma de Madrid, Spain
- Dr Yolanda Fernández Jalvo — Museo Nacional de Ciencias Naturales, Madrid, Spain
- Dr Jens Najorka — Natural History Museum, London UK
- Prof. Thomas Tütken — Johannes Gutenberg-University of Mainz, Mainz, Germany
- Dr Romina Frontini — Universidad Nacional del Sur, Bahía Blanca, Argentina
- Dr Laura Llorente Rodríguez — University of Leiden, The Netherlands

Conferences

- June 2024 — 3rd Iberian Zooarchaeology Meeting, Museum of Natural Sciences, Barcelona, Spain.
Talk: *The use of Micro CT and Powder X-ray Diffraction (XRD) techniques to reveal anthropogenic-induced micro-structural changes in fish remains from archaeological sites.*

Travel to research laboratories

- December 2023 — XRD laboratory, Department of Core Research Laboratories, Natural History Museum, London, UK.
- June 2024 — Laboratorio de Arqueozoología, Universidad Autónoma de Madrid, Spain.

PALAEOGENOMICS LABORATORY

Meirav Meiri

The Paleogenomics Laboratory continued to work on museum and palaeobiological specimens.

On-going research projects

- *Taxonomic and ecological characterization of the extinct Hartebeest (Alcelaphus sp.) population in Israel.* In this project, we used ancient DNA and morphological analyses to determine the species-level taxonomy of the extinct Levantine hartebeest (*Alcelaphus* sp.), and the environmental niche modelling to address the availability of suitable habitats for this taxon in Israel under modern and ancient conditions.
- *Unravelling the enigma of date palm cultivation in the southern Levantine region.* The project objective was to characterize the date palm (*Phoenix dactylifera* L.) populations in the southern Levant and unravel their cultivation origin. The works included comprehensive analysis of numerous modern and ancient genomes across the region, as well as seed morphometric data from both modern and archaeological seeds. We, along with our postdoc Dr Ernesto Testé, Prof. Guy Bar-Oz (University of Haifa, Israel) and Dr Muriel Gros-Balthazard (IRD Montpellier, France), aimed to study the intricate interplay of biological, ecological, historical and human factors that shaped the diverse landscape of date palms in the southern Levantine region.
- *Modelling anthropocene trophic cascades of the Judean Desert ecosystem: A hidden dimension in the history of human-environment interactions.* The aim of this project was to explore the effects of human settlement on the mammalian community structure, focusing on the phenomenon of trophic cascades in the area of the Dead Sea from the middle and late Holocene settlement sequence (approx. 4500 BCE to 2000 CE). The Judean Desert is an ideal study target for the process of human-induced trophic cascades because of its climatic stability and because of its long settlement history, defined by peaks of intense human occupation, followed by abandonment and the recovery of the ecosystem. In the project, we worked on a few common species in the desert: leopard (*Panthera pardus*), ibex (*Capra nubiana*) and hyrax (*Procavia capensis*). We sequenced modern and ancient DNA of these species to study their genetic history and the effect of humans on their populations.
- *Using palaeogenomics as a tool to identify the contents of ancient pottery.* One of the challenges in archaeology is identifying the contents of vessels. Traditionally, this has been approached by analyzing the vessel's shape, archaeological context, and residue analysis. Our research explored whether paleogenomic techniques could enhance our ability to identify the contents of these vessels. We extracted and sequenced DNA from pottery used for various purposes, such as wine storage and oil lamps, to determine if ancient DNA from specific sources, like grapes or olives, could still be detected.

Active grants

2020–2024 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.*

2022–2024 Tel Aviv University — University of Manchester Research Fund (21,000 NIS).

Project: *Using multiomic approaches to understanding ancient biomolecule preservation.*

Conferences

- Ancient Biomolecules of Plants, Animals and Microbes, Welcome Genome Campus, UK, 3–5 June 2024. Talk: *Exploring the Negev Highlands' wine legacy through ancient DNA analysis in Late Antiquity.*

Student supervision

- Uri Wolkowski, MSc project title: *Taxonomic and ecological characterization of the extinct Hartebeest (Alcelaphus sp.) population in Israel* (joint supervision with Dr Nimrod Maron, University of Haifa).

DAN DAVID CENTER FOR HUMAN EVOLUTION AND BIO-HISTORY RESEARCH

Rachel Sarig, Hila May, Viviane Slon and Israel Hershkovitz

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 focus 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.

Ongoing research projects in 2023–2024

- The teeth from Misliya and Qesem Caves: *Who were the Achelu-Yabrudians?*
- The Qafzeh Cave hominins: *Mal occlusion or mal adaptation?*
- Motza human remains: *Reconstructing life history at the Pre-Pottery Neolithic period.*
- Tel Azeka human remains: *The common burial at the waterhole dated to the Persian period.*
- Yavne human remains: *The bio-history of the people from Yavne from the Chalcolithic to the Roman periods.*
- Yehud human remains: *The bio-history of the people from Yehud dated to the Bronze Age.*

Ongoing field projects in 2023–2024

- Tinsmet Cave Project (Middle Paleolithic);
- Skhul Cave Project (Middle Paleolithic);
- Tabun Cave Project (Middle Paleolithic);
- Timna Valley Project (Early Bronze Age — Iron Age);
- Emireh Cave Project (Upper Paleolithic);
- Qadim Cave Project (Late–Early Neolithic);

Active grants in 2023–2024

Israel Research Foundation (ISF)	1,300,000 NIS
Israel Research Foundation (ISF)	1,000,000 NIS
Israel Research Foundation (ISF)	1,500,000 NIS
BSF	320,000 USD
BSF	284,000 USD
Australian Research Council	254,000 USD
Dan David Foundation	110,000 USD
Yehud Project — Israel Antiquities Authority	227,700 NIS
Yavne Project — Israel Antiquities Authority	155,000 NIS
Research Donations	60,000 USD
Dan David Center for Human Evolution and Biohistory Research	150,000 NIS

Abraham Finkelson Foundation	75,000 NIS
Koret-Berkeley-TAU Initiative	250,000 USD
Gerda-Henkel Foundation	84,000 Euro
Allessia Kantur Foundation	14,000 USD
Alrov Foundation	500,000 NIS

Active collaboration projects with foreign researchers in 2023–2024

- Prof. Gerhard Weber, University of Vienna, Austria;
- Prof. David Reich, Harvard University, MA, USA;
- Prof. Svante Pääbo, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany;
- Prof. Johannes Krause, Max Planck Institute of Geoanthropology, Jena, Germany;
- Prof. Rolf Quam, Binghamton University, NY, USA;
- Prof. Bruce Latimer, Case Western Reserve University, OH, USA;
- Prof. Luca Fiorenza, Monash University, Australia;
- Prof. Stefano Benazzi, University of Bologna, Italy;
- Prof. Frank Ruhli, University of Zurich, Switzerland;
- Prof. Antoine Balzeau, Histoire Naturelle de l'Homme Préhistorique, CNRS, France;
- Dr Matthias Meyer, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany;
- Dr Priya Moorjani, University of Berkeley, CA, USA;
- Dr Marine Frouin, University of Stony Brook, NY, USA;
- Dr Andrew Kandel, University of Tübingen, Germany;
- Dr Maria Spyrou, University of Tübingen, Germany;
- Dr Matasha Mazis, Technical University of Darmstadt, Germany;
- Dr Nohemi Sala, CENIEH, Burgos, Spain;
- Dr Markus Bastir, Museo Nacional de Ciencias Naturales, Madrid, Spain.

Active collaboration projects (including joint research grants) with Israeli archaeologists in 2023–2024

- 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;
- Prof. Gonen Sharon, Tel Hai College;
- Prof. Yuval Gadot, Tel Aviv University;
- Prof. Oded Lipschits, Tel Aviv University;
- Dr Ianir Milevski, Israel Antiquities Authority;
- Prof. Leore Grossman, Hebrew University;
- Dr Ella Assaf, Tel Aviv University;
- Dr Michal Birkenfeld, Ben Gurion University;

- Prof. Dani Rosenberg, Haifa University;
- Dr Pablo Bezer, Israel Antiquity Authority;
- Dr Rabia Khamissa, Haifa University;
- Dr Michael Eisenberg, Haifa University;
- Prof. Lidar Sapir-Hen, Tel Aviv University.

Conferences

- *The compromises of being bipedal*. European Society for the Study of Human Evolution, 21–23 Sept. 2023, Aarhus, Denmark.
- *New potential case of Paleolithic interpersonal violence: First taphonomic approach from Qafzeh-25, Israel*. 93rd Annual Meeting of the American Association Biological Anthropologists, 20–23 Apr. 2024, Los Angeles, US.
- *Sedimentary ancient DNA studies in challenging preservation contexts: Insights from the southern Levant*. Annual Conference of the Society for Molecular Biology and Evolution, 7–11 July 2024, Puerto Vallarta, Mexico.
- *Osteoporosis: An old new disease*. International Society for Evolution, Medicine & Public Health, 6–9 Aug. 2024, Durham, UK.
- *The effect of changing lifestyle, geographic region, climate, and terrain on human femoral robusticity and mobility*. 14th Annual Meeting of the European Society for the Study of Human Evolution, 11–15 Sept. 2024, Zagreb, Croatia.

MOLECULAR SYSTEMATICS LABORATORY AND TISSUE COLLECTION

Dorothee Huchon and Tamar Feldstein-Farkash

The molecular systematics laboratory of the Steinhardt Museum of Natural History (SMNH) offers identification of museum samples when morphological identification is uncertain. Serving as a vital infrastructure, the lab provides guidance and equipment to support research initiatives within both the SMNH and Tel Aviv University (TAU) School of Zoology.

Operational

During the reporting year, a new DNA clean laboratory was built in the area of the Molecular Systematics lab to process environmental DNA samples. Indeed, when working with environmental DNA it is critical to prevent contamination with alien DNA.

In 2023–2024, tissues from 340 specimens, including mammals, birds, reptiles, fish, annelids, mollusks, crustaceans, insects, sponges and fungi were processed for molecular identification. The molecular work, in collaboration with the morphological identification by collection managers, or researchers working in the different collections, proved to be highly important for the curation of the samples, and promoting the zoological/ecological research.

The Molecular Systematics Lab routinely provides genetic identification of bird remains and complements microscopic and morphological work of the Feather Identification Lab (p. 88). The molecular work is particularly important when organism remains do not allow the species-level morphological identification. Examples of such situations are cases of bird collision with aircraft, illegal poaching and ecological surveys based on environmental samples. During 2023–2024, the Molecular Systematics Lab examined 81 bird strike cases from the Israel Airports Authority, 23 cases from the Israeli Air Force, and 35 cases from the Israel Nature and Parks Authority. Altogether, the molecular identifications included 139 genetic analyses of 54 different bird species and three bat species.

Collections management

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 2023–2024, 655 tissue samples were added to our collection, including 163 mammal tissue samples (96 individuals, 32 species), 265 birds (131 individuals, 84 species), 219 reptiles (207 individuals, 57 species) and 8 amphibians (8 individuals, 3 species).

Student training

The Molecular Systematics Lab also provides training in molecular techniques for the staff and students of the SMNH and School of Zoology (TAU). In 2024, 21 students participated in the course Applied molecular species identification (#0431-3896-01, 2 academic credits) and acquired basic techniques in DNA extractions and PCR. 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 MUSEUM DATABASE

Yonatan Gur and Tirza Stern

During 2023–2024, we have continued with improving the usability and performance of our databases and made changes to accommodate new botanical collections that should be incorporated in the near future.

During the reporting year, we continued to take onboard and train eight additional users that joined our growing pool of users.

Our dataset continued to be available to the public and researchers after registration on the Museum's website: <https://smnh.tau.ac.il/en/research-at-smnh-2/collections-database>. The museum database is used by the entire scientific community as evidenced by the growing number of its users, which reached 382 scientists from 42 distinct countries by September 2024. Of these, 79 new individuals from 14 countries registered in the 2023–2024 academic year, of whom 48 from 30 institutions registered for academic usage, 25 registered for private usage, and 5 registered for 'other' type usage, mostly for educational purposes. Overall, 5462 queries were submitted by September 2024, and 1092 data searches were performed by 103 users during the reporting period (2023–2024).

In 2023–2024, 22,882 new records were added to the SMNH database, while quite a few old records were migrated to the new system and erroneous items were removed (hence the seeming discrepancy compared to the previous years' figures in the database), to a grand total of 641,811 entries. At present, the database contains the following numbers of entries in the following groups, with the number of new records in parentheses:

- Amphibia — 2920 (10)
- Aquatic parasites — 65 (0)
- Archaeobotany — 1012 (0)
- Arthropoda (other than insects) — 7043 (182)
- Ascidiacea — 1382 (70)
- Aves — 24538 (303)
- Brachiopoda — 47 (0)
- Bryozoa — 480 (0)
- Coelenterata — 14449 (233)
- Echinodermata — 2508 (51)
- Feather Identification Lab — 3308 (236)
- Foraminifera — 795 (9)
- Fossils — 5589 (1145)
- Insecta — 446700 (18064)
- Lichens — 1911 (0)
- Mammalia — 17779 (163)
- Molecular Laboratory — 3141 (311)
- Mollusca — 68547 (1129)
- Pisces — 16309 (392)
- Porifera — 1905 (94)
- Reptilia — 20884 (263)
- Vascular plants — 3486 (0)
- Vermes — 499 (227)
- Water plants — 5908 (0)

ACADEMIC COURSES AND TRAINING

Noga Sokolover, Tom Shlesinger and Zafrir Kuplik

The Academic Courses Program of The Steinhardt Museum of Natural History continued to provide an exceptional educational platform. Our courses were taught by museum scientists and guest experts, leveraging the unique expertise of our researchers. They focused on the taxonomy, biodiversity and ecology of various phyla, the fauna and ecology of specific habitats, and broader topics related to the science of natural history collections. Due to the unique expertise of the research and scientists in the SMNH the courses were also unique and as far as our knowledge they had no parallels in other Israeli academic institutions.

All courses were conducted in a dedicated classroom equipped with new microscopes and an adjacent wet lab, fostering an ideal environment for both theoretical and practical learning. Most courses incorporated hands-on experiences, including laboratory work and field trips, and were typically limited to ca. 20 participants to ensure high-quality instruction.

The program was open to BSc, MSc and PhD students from all universities, as well as to professionals from government and non-government organizations. Students received academic credits for these courses, further enhancing their academic and professional development. Importantly, the courses were offered free of charge, aligning with our mission to promote accessibility and education in taxonomy, biodiversity and natural history.

In the 2023–2024 academic year, we successfully conducted 15 courses, hosting a total of 147 students from various academic institutions across Israel. With the museum's continued growth and the recruitment of additional researchers, we were planning five new courses for the upcoming year. These would include collaborations with several guest researchers from abroad, further enriching our program. To better structure and streamline our expanding curriculum, we established two dedicated divisions this year:

The **Taxonomy Initiative Division** focusing on courses related to taxonomy, systematics and the phylogeny of groups such as fish, jellyfish and bees.

The **Biodiversity Division** offering courses on biodiversity research, management and policy.

To guide and support our academic initiatives, the program benefited from an scientific advisory committee composed of researchers from diverse institutions and academic backgrounds across Israel. Their collective expertise contributed significantly to the quality and relevance of our courses, fostering collaborations that extend beyond the museum's walls.

Despite the challenges posed by the security situation in Israel this year, as well as many last-minute changes and uncertainties, we successfully executed the program, and only hosting international experts was hampered. Nevertheless, our team's adaptability and dedication ensured the courses proceeded seamlessly.

List of courses

1. Sustainable aquaculture (5 consecutive days; 3 credit points)
by Dr Shevy Rothman and Dr Zafrir Kuplik
2. Science communication (online course, 3 frontal meetings; 3 credit points)
by Dr Yaela Golumbic and Prof. Noa Shenkar
3. Natural history collections as research infrastructure (5 consecutive days; 3 credit points)
by Dr Karin Tamar
4. Taxonomy, ecology and biology of fishes (5 consecutive days; 3 credit points)
by Dr Shevy Rothman
5. Quaternary extinctions: Why? How many? Where? and How do we know it? (5 consecutive days; 3 credit points)
by Dr Meirav Meiri and Prof. Shai Meiri
6. Stream ecology: From fundamental to applied (5 consecutive days; 3 credit points)
by Dr Yaron Hershkovitz
7. Winter ponds ecology (9 consecutive days; 4 credit points)
by Dr Zohar Yanai and Dr Liron Goren

8. Citizen science (Sundays during 2nd semester; 2 credit points)
by Dr Yaela Golumbic
9. Ecology and evolution of Hymenoptera (Sundays & Tuesdays, half of 2nd semester; 3 credit points)
by Dr Gideon Pisanty
10. The enigmatic world of jellyfish (Medusozoa) (Mondays during 2nd semester; 3 credit points)
by Dr Zafir Kuplik
11. Biodiversity crisis: Policy, politics and regulation (5 consecutive days; 3 credit points)
by Dr Ronit Justo Hanani
12. Biological invasions (Sundays during 1st semester; 2 credit points)
by Dr Zohar Yanai
13. Taxonomy and systematics — the foundation of life sciences (5 consecutive days; 3 credit points)
by Dr Liron Goren and Dr Tom Shlezinger
14. Topics in stable isotope paleoecology (5 consecutive days; 2 credit points)
by Prof. Mark T. Clementz
15. Applied ecology (3 credit points)
Dr Ittai Renan and Dr Liat Hadar

EDUCATION, EXHIBITIONS, PUBLIC ENGAGEMENT AND OPERATIONS

Tamar Zadok, Ilil Pratt, Adi Katz Shapira

In 2023–2024, our museum welcomed approximately 155,000 visitors. While many came for individual visits, a significant portion participated in guided school tours and other special events.

The year was marked by the tragic events of October 7, 2023, a day that shook our nation. As our community mourned and healed, our museum endeavored to provide a sanctuary, a place where people could find solace and connection. Many of our staff members were called up for military reserve duty. We adapted our operations to ensure the safety and well-being of our visitors and staff, offering free admission for the first three weeks following the attacks and reduced rates for the remainder of the year.

During this period, we expanded our programs to reach beyond the museum walls. We hosted weekly webinars featuring our curators and collections managers, and attracting over 1500 participants. In addition, we launched a free online lecture series on food and nature, drawing approximately 150 attendees per lecture. Our social media channels featured a series of posts centered around the theme of ‘coming home’, and we provided online games and printable activities for children. Our educators visited evacuation centers in central Israel, on the Carmel coast and at the Dead Sea, offering support and educational programs. In partnership with the neighboring Museum of Jewish People, we organized a special day of respite for evacuees, attracting over 1000 participants, including students from a local school. With the support of Tel Aviv University, our educators also led activities at a school in Ein HaBesor. We participated in the Ministry of Science and Technology’s Science and Innovation Week, conducting workshops in evacuation centers and organizing an additional event at the Dead Sea in collaboration with the *Living Legend* project, who performed there on a large stage with their hit songs.

Overall, the museum’s response to the crisis showed its resilience and commitment to the community. By offering a place of respite and support, we helped to foster a sense of hope and unity. Our staff, who were well-trained in emergency procedures, played a vital role in ensuring the safety and well-being of our visitors. Through our actions, we demonstrated the power of culture and community to overcome adversity.

Educational Activities

The 2023–2024 year saw a noticeable increase in the number of the school students participating in extended science activities (Science Days and Science Visits) compared to the previous year. Due to the ongoing security situation during the academic year, the nature of educational activities underwent changes: guided tours to the Botanical Garden were discontinued, and there was a decrease in the number of students participating in ongoing series. Despite this initial decline, a recovery trend was observed throughout the academic year.

The museum continued to support the advancement of science education in Israel, including an annual award to students who excel in the Biology Research Olympiad organized by the Ministry of Education.

Visitors at the museum

After experiencing a temporary decrease in attendance early in the war, the museum successfully rebounded, with a significant increase in both visitors and guided tours throughout the 2023–2024 academic year.

The museum hosted guided tours and educational activities for students from numerous academic institutions, including Tel Aviv University, Hebrew University of Jerusalem, Bar-Ilan University, Bezalel Academy of Arts and Design, Shenkar College, Holon Institute of Technology, Kibbutzim College, David Yellin College, and many others.

Visitors according to program

Program	Number of visitors
Guided tour at SMNH and Botanical Gardens	19,763
Science activities for schools	5,225
Workshops	8,790
Various events	2,291
Series of science visits/days	583
Activities for evacuees	3,317
Total	39,969

Visitors according to age category (for group visits only)

Age group	Number of visitors
Kindergarten	1,215
Elementary school	12,401
Middle school	6,460
High school	3,148
Higher education students	511
Families	1,145
Adults	1,493
Senior citizens	911
Total	27,284

Exhibitions

Temporary Exhibitions

Due to the war, Israel's cultural community, as well as Israeli academia, was under severe pressure. Numerous exhibitions were canceled, tourists were not coming to the country, and Israeli art was not being exported or exhibited abroad. The full extent of the war's impact on the economic reality was still unclear, but, undeniably, the situation contributed to a long-term damage to the

state of culture in Israel. Therefore, the fact that we managed to launch two successful exhibitions this year could be praised is a sign of the museum's stability and professional strength.

HERE BE DRAGONS

A Surreal Exploration of the Museum's Collections

Nevet Yitzhak

October 2023; Curator: Dr Liora Belford

<https://smnh.tau.ac.il/en/exhibitions-at-the-museum/here-be-dragons-nevet-yitzhak>

The name of the exhibition *Here Be Dragons* comes from the Latin caption HIC SVNT DRACONES. Until the Middle Ages, cartographers used this caption on maps to indicate uncharted regions. This caption was used to mark the borders of the world known to the West, the edges of knowledge, and from there too, the beginning of the unknown.

This exhibition was the result of an artistic research project conducted by artist Nevet Yitzhak in the museum's collections over the two years prior to the opening. Following an extensive period spent in the collection rooms, comprehensive research and meetings with researchers and curators, Yitzhak created a surreal spectacle that blurs the lines between reality and imagination.

Nevet Yitzhak is an award-winning video and installation artist holding an MFA from Bezalel Academy of Arts and Design in Jerusalem. In her work, Yitzhak adopts a critical approach to contemporary political and cultural issues. She challenges our perception of the past by raising issues of cultural heritage and collective forgetting as part of a complex local identity. Yitzhak's works have been exhibited in museums around the world.

The exhibition opened just before the outbreak of the war, during the Sukkot holiday, and received widespread acclaim. As Galad Meltzer of Haaretz noted: "I haven't seen such a mesmerizing work in a long time. As I moved along the long horizontal projection, trying to catch more and more surprises popping up, to notice what was happening in the background, to wait for the giraffe to descend from the ceiling, or for the wild boar to rise from the depths, I saw the dropped jaws of the children, the side-to-side jumps of the adults, and the 'come here quickly' gestures. Yes, the collection curators put on a show." (Haaretz, November 29, 2023)."

The exhibition closed on Saturday, May 4, 2024.

SONG OF THE CORALS

A Scientific and Artistic Journey with Tzuri Gueta

June 2024; Scientific curator: Dr Noga Sokolover, Artistic curator: Limor Margulis

<https://smnh.tau.ac.il/en/exhibitions-at-the-museum/song-of-the-corals>

"Is this the most beautiful exhibition you'll see in Israel this summer?" This was the headline on one of Israel's leading websites when this original exhibition opened its doors to guests.

The exhibition invited visitors to experience the underwater world, marvel at the beauty of coral reefs and appreciate the complexity and uniqueness of this vital habitat, usually hidden from our view.

Tzuri Gueta's artwork, created specifically for this exhibition, aimed to enhance the experience. The installation was inspired by and traces the beauty, shape and texture of the coral reef and its inhabitants, complementing the sense of awe that accompanies divers in the reef. Dr Tom Schlesinger's stunning video footage documenting the reefs in the Gulf of Aqaba further enhanced the visual impact on the gallery walls.

The coral reef is a complex ecosystem full of vitality and motion, and is constantly being shaped and undergoing change due to the interactions that develop between the creatures populating it and years-long evolutionary processes.

Forthcoming exhibitions

- Shay Zilberman's *Thresholds*: Collages of animal creatures, deconstructed and reconstructed from the pages of old animal classification keys.
- *The State of Nature in Israel*: This outdoor exhibition will culminate a decade-long monitoring of Israel's State of Nature.
- Temporary exhibition on *Pollination*: A dynamic display of the fascinating world of pollination.

New additions to our existing exhibitions

- A majestic Komodo Dragon joined our Asian big cats in the *Biodiversity Treasures*.
- The intricate world of ants in our *Insects and Relatives* exhibit featured a remarkable *Camponotus* colony, meticulously curated by our resident arthropod expert Dr Liz Morgulis.
- A new, state-of-the-art terrarium for our Madagascar hissing cockroaches was constructed.

Public outreach

The **Annual Bird Count in Backyards** during January 2024, led by the Israel Center for Citizen Science for the third consecutive year, involved a high level of participation from the museum's marketing and digital teams. Information about the campaign was distributed through various channels and shared with communities on social networks, including the Tel Aviv-Yafo Municipality and the Sustainability Authority, which sent WhatsApp messages to the city neighborhoods. A series of amusing illustrations were specially prepared by the artist Noa Cohen.

A dedicated **activity for a young audience** aged 20–35 was developed to strengthen the interest of this target audience in the natural history museum and the issues at the heart of our vision — to be a source of inspiration and motivation for understanding the natural world and its value to humans, through generation of scientific knowledge and its dissemination to the public combining tools of culture and science.

Devek is an initiative of the Tel Aviv-Yafo Municipality to develop a connection with the young audience for the city's cultural institutions. This is a challenge for museums and cultural organizations around the world, and special programs to address it are being developed. *Devek* focuses on 10 leading cultural institutions in the city each year, which jointly develop tailored content and marketing methods, including late operating hours, different culinary approaches and refreshments. During 2023–2024, in cooperation with *Devek* we held the **Evolutionary** event marking Darwin's International Day and International Women and Girls in Science Day, during which young female researchers from the museum talked about their research alongside lectures by leading female researchers from Israel.

We developed a dedicated **activity for young children** aged 4–6, which included a storytelling hour focusing on the human evolution, based on the book *Grandmother Fish* by Jonathan Tweet. Approximately 1500 participants joined this activity during the 2023–2024 academic year.

Hebrew and Living Creatures: In collaboration with the Academy of the Hebrew Language and as part of our commitment to reach a wider audience, we held a joint event to celebrate the approval of Hebrew names for the beetle families in Israel, thus marking a close link of the Hebrew language and Nature.

During the 2024 summer vacation, we hosted two major events with hundreds of visitors of all ages, in collaboration with the Tel Aviv-Yafo Municipality. We returned to the museum's balcony with live shows of the **Living Legend** project, the first Hebrew zoological music album, created by musician Shahar Even-Tzur and the museum. Throughout the year, new songs were launched — about the golden jackal, the hedgehog, the sparrow, jellyfish, and a moving song about the work of Dr Menachem Goren in returning the endemic Yarkon bream (freshwater fish *Acanthobrama telavivensis* of the family Cyprinidae) to its natural habitat and saving it from extinction. During the summer, the project's success became a reality with invitations to perform in front of thousands of people in National Parks



The Yarkon bream (*Acanthobrama telavivensis*) was being measured before release into its natural habitat. (Photo: Menachem Goren)

and in the Caesarea amphitheater (one of the most prestigious stages in Israel), showcasing the museum as a partner and initiator of the project.

Recognizing the popularity of our online lectures during the war, we expanded our **Steinhardt Museum Plus**, an initiative to include a new series of online courses and lectures customized for adults 45+. By offering these fee-based programs, we aim to reach a broader audience from diverse locations.

Launch of the State of Nature in Israel Report by HaMarag: A decade of monitoring | May 2024

The 2023 State of Nature Report, focusing on biodiversity, presented a comprehensive picture of the Israel's state of nature after a decade of monitoring. The report examined and summarized the impact of the human activity on flora and fauna, as well as the direct and indirect impacts of settlements and agriculture on ecosystems. This joint initiative of the Steinhardt Museum of Natural History, the Israel Nature and Parks Authority, the Jewish National Fund and the Ministry of Environmental Protection, led by the HaMarag program at the Museum, served as a foundation for informed decision-making in management of the natural resources.

Operations

The Operations Department implemented a range of improvements across the museum. These initiatives were designed to enhance the visitors' experience, to streamline operations and to align with modern standards.

Key achievements

- Maintenance and cleaning: Upgraded HVAC, electrical and plumbing systems. Enhanced museum displays in collaboration with Dr Igor Gavrilov, the museum's chief conservator.
- Infrastructure improvements: After a four-year search, a new café concessionaire was secured, providing refreshments for visitors and catering service for museum events. The museum shop, operated by a franchisee, continued to thrive.
- New laboratories: Construction of new laboratories for Dr Tom Schlesinger (marine ecology) and Dr Tamar Feldstein-Farkash (e-DNA) were underway. Planning for Dr Yosef Kayat's avian laboratory has commenced.
- IT and multimedia: Improved hardware tagging and maintenance across the museum, along with timely software updates. The *Raising Walls* project enhanced cybersecurity measures for all museum computers.
- Security and safety: The museum director served as the site safety officer. A safety committee and safety representatives worked to improve safety standards across all laboratories, facilities and offices. Emergency procedures were refreshed during the recent war conflict.
- Accessibility: To enhance physical and cognitive accessibility, the museum introduced a simple-language and engaging pre-visit story, as well as digital and printed accessibility maps. Seminars and training sessions were held for the museum staff to prepare for the start of 'quiet hours' activities at the museum, which would allow visitors with special needs a comfortable visit during hours when the museum is open specifically for them.
- Recycling: Positioning itself as a 'green' institution, the museum implemented a comprehensive recycling program, including designated bins for various materials (packaging, glass, paper etc.) in public areas and on all floors of the building. At museum events, only biodegradable/reusable containers were used.
- Internal communication and team-building: Various initiatives were introduced to foster a strong sense of community among staff, such as holiday gatherings, a staff swap meet, and a study tour to the Tel Aviv Museum of Art that included a workshop and lunch.

Conference venue

The museum hosted almost 100 conferences, workshops and other events during the 2023–2024 academic year (see p. 91 of this Annual Report). These included numerous scholarly conferences

for Tel Aviv University (Faculty of Medicine, Faculty of Engineering, Faculty of Exact Sciences, Faculty of Law, School of Mathematics, Cyber Center, and Institute of Local Government). In addition, the Jewish National Fund, Israel Nature and Parks Authority, Society for the Protection of Nature in Israel, Israel Society of Ecology and Environmental Sciences, Ramat Hanadiv, Matan — Investors in the Community, Israeli Forum for Sustainable Nutrition, Ministry of Environmental Protection, Ministry of Health, Ministry of Science and Technology, Ministry of Education, Israel Medical Association, Jewish Agency, Rothschild Partnerships, JCC Global, Friends of Tel Aviv University and many other organizations held their conferences and events at the museum.

During 2023–2024, the museum offered its premises for a variety of activities by academic institutions (see p. 97 of this Annual Report), including a zoology course by Tel-Hai College, an Upper Galilee preparatory program, snake-catcher training course, research skills course, social events for high-tech companies and various organizations such as Fiverr, Sapiens International Corporation N.V., InterTech Ltd., Elbit Systems Ltd., Akim Israel, Clalit Health Services, as well as the Nickelodeon award ceremony for youth volunteering during the war.

The museum became a home for the theatrical production of Brecht's *Antigone*, which was hosted in the study galleries and made the museum tour part of the audience's experience upon entering the performance.

In September 2024, the museum hosted the second edition of the TRANSMEET Art & Science Festival. Originally scheduled for mid-October 2023, the festival was postponed due to the tragic events of October 7 and the subsequent war. The festival organizers believed that interdisciplinary collaborations were more important than ever, and that art had the power to heal and inspire hope, especially when combined with science.

Environmental News

The museum served as home to applied policy-oriented research centers such as the Open Landscape Institute, HaMaarag (the National Program for Assessment of the State of Nature), the Israel National Center for Aquatic Ecology and the Entomology Laboratory for Applied Ecology. These centers conducted ecological surveys and monitoring of terrestrial and aquatic ecosystems in Israel, producing policy background documents on the conservation and sustainable management of open spaces and ecosystems in Israel. The generated information, events, summaries of reports and articles in the easy-to-understand language were also made available to the public on the museum's website. This activity was supported by the Israel Nature and Parks Authority, the Jewish National Fund and the Ministry of Environmental Protection. Additionally, the Open Landscape Institute was supported by the Society for the Protection of Nature in Israel.

ISRAEL CENTER FOR CITIZEN SCIENCE

Tomer Gueta, Yaela Golumbic, Shevy Rothman, Adi Barash

Scientific committee

The center is guided by a scientific advisory committee with the following objectives:

- To provide professional academic guidance to the center's activities.
- To promote the field of citizen science within academia in Israel.
- To provide leadership and guidance for an annual citizen science conference.
- To enhance multi-organizational and multi-institutional collaborations in citizen science.

Committee Chair: Prof. Ofer Arazy (Haifa University)

Members: Prof. Dror Hawlena (INPA), Dr Ofer Steinitz (INPA), Tamar Raviv (IMEP), Dr Anna Trajtenbrot (IMEP), Dr Doron Markel (KKL-JNF), Dr Gilad Ostrovsky (KKL-JNF), Dr Yoav Perlman (SPNI), Dr Liat Hadar (Ramat Hanadiv), Dr Uri Roll (BGU), Dr Ori Sharon (BIU), Prof. Dan Malkinson (Haifa University), Prof. Jonathan Belmaker (TAU), Dr Shay Rotics (TAU), Dr Yael Mandelik (HUJI), Dr Yehezkel Resheff (HUJI), Prof. Tali Tal (Technion), Prof. Assaf Schwartz (Technion), Prof. Gil Rilov (IOLR), Prof. Ron Milo (Weizmann Institute), Prof. Ayelet Shavit (Tel-Hai College).

Overview

The Israel Center for Citizen Science (ICCS) at the Steinhardt Museum of Natural History was established in early 2022 to promote public participation in environmental research and advance biodiversity science and conservation in Israel. The center fosters sustainable technological, scientific and social approaches to strengthen the foundation of citizen science in the country. It serves as a national hub, providing knowledge and support for both existing citizen science programs and future initiatives.

The Israel Center for Citizen Science and Keren Kayemet Lelsrael — Jewish National Fund (KKL) collaborate to promote citizen science initiatives in KKL. The partnership aims to leverage KKL's vast forest and woodland areas for data collection and scientific research. The collaboration involves the development of citizen science projects, including monitoring biodiversity, tracking plant dynamics and assessing forest health. The goal is to engage the public in scientific research, enhance environmental awareness and contribute valuable data for ecological management and conservation.

The Center's team

The ICCS brings together experts from academic and applied backgrounds with experience in citizen science both in Israel and abroad. Their expertise spans project design, recruiting and retaining volunteers, science communication, education and training, big data, open-code development, information system management, user interfaces, and data science. In 2024, the role of Dr Yaela Golumbic was formalized as a Senior academic tenure track position.

- Dr Tomer Gueta — Center Development Director
- Dr Yaela Golumbic — Senior researcher, Head of Citizen Science R&D
- Dr Nirit Lavie-Alon — Head of Citizen Science Practice
- Naama Arkin — Head of Technology Infrastructure Development
- Shlomo Preiss-Bloom — Content and UI Translator
- Zohar Afek — Training Materials Designer and Developer
- Bella Beizerman — Research Assistant
- Dorit Wolenitz — Volunteer
- Dr Adi Barash — Post doctoral fellow, founder of *Sharks in Israel*

Overview of activities

In 2024, we made significant progress in building the Israeli platform for citizen science. Below is a list of the technological, methodological and social infrastructure that we have built during the reporting period.

Establishment of technological infrastructure:

- Central platform for data collection: During 2024, we established a dedicated platform for the collection, management and presentation of biodiversity data, based on the Living Atlas system. The platform allowed data sharing between different projects, researchers and the general public. The central platform constituted a unified and open observation database for all data coming from citizen science and provided an essential central gateway for various projects. In addition, the platform specializes in the reception, improvement, presentation and accessibility of biodiversity data and allowed exposure and downloading of data by scientists, the general public and all stakeholders, in accordance with the guidelines for nature conservation and protection of sensitive species. The central platform functioned as the nerve center and therefore we built it so that it would: (1) be stable; (2) support all international standards for biodiversity information sharing; (3) seamlessly integrate with specialized platforms; (4) have a permissions system adapted to different types of roles; (5) have the ability to grow (scalable) and be adapted to big data; (6) be easy to maintain and upgrade (modular); (7) provide a quality response to projects for which the specialized platforms (iNaturalist and eBird) were not suitable, through an integral application for data collection.
- Development environments: We set up three Google Cloud environments (production, develop-

ment, and testing). In each environment, about 15 machines (VMs) were installed on with various modules of the LA system.

- BioCollect application: We adapted the BioCollect data collection application to a wide range of citizen science projects. Today, the application allows customization of data collection protocols and public participation.
- Adapting iNaturalist to the Israeli audience: We localized the iNaturalist system and accompanying applications to the Hebrew language for use by the Israeli public.
- Website of the Israel Center for Citizen Science: We developed a WordPress-based website. The site was built by the center's team and is accessible at <https://citizen-science.smnh.tau.ac.il>.

Content Infrastructure Development

- News: We made progress in developing a section of articles that presents point events such as participation of center representatives in conferences and information about new projects that were uploaded to the site.
- Publications: The Israeli Center for Citizen Science produced documents and summary reports for projects such as *Summary of the 2024 Bird Count*, *Summary of the 2023 Bird Count*, *Summary of the 2024 Moth Week*, and *Summary of Neot Smadar Bioblitz*.
- Webinars: We started establishing a channel for the center's online lectures such as moth meetings / bird counts / other online lectures.
- Research: We were establishing a dedicated section on the website that would serve as a stage for the studies carried out at the Israeli Center for Citizen Science. Each article would describe a study with information on partners, goals, course, findings, conclusions and any scientific outputs resulting from the study.
- We were developing an array of resource to be used by citizen science stakeholders. The resources were categorized by scientific domains, target audiences and general topics, for example:
 - ⇒ Guides:
 - ♦ A detailed guide for project development
 - ♦ BioBlitz Guide
 - ♦ A guide to starting a project in iNaturalist
 - ⇒ Policy
 - ♦ Citizen science and policy makers - background
 - ♦ Citizen science and field managers
 - ♦ Citizen science and environmental organizations
 - ♦ Citizen science and planning and development processes
 - ♦ Local authorities
 - ⇒ Research
 - ♦ Publications, conferences and competitions
 - ♦ Mapping grants for citizen science
 - ♦ Data management guide + instructions for uploading data to the portal
 - ♦ Citizen science in the world
 - ♦ Citizen science in streams
 - ♦ Citizen science and climate change
- Social media — content development and design for the center's Facebook page and additional media channels.

Citizen science research

Active grants

2023–2025 Keren Kayemet LelIsrael—Jewish National Fund (KKL-JNF) — Reconnecting people with nature, and encouraging conservation behaviors through citizen science (360,000 NIS).

On-going research projects

- *A Community of Practice approach in Citizen Science initiatives* — This study examines the creation and sustainability of a Community of Practice approach for engaging volunteers and fostering co-creation processes within citizen science initiatives.

- *Bird ambassadors* — A study exploring how ambassador programs can expand participation in citizen science by leveraging peer-to-peer engagement, community networks and personal sharing experiences.
- *Citizen Science as a tool for connecting people to nature* — A study funded by the KKL-JNF that examines ways to develop citizen science projects which promote nature connectiveness among diverse audiences and increases public awareness of the environment and its protection.
- *Volunteer participation patterns in biodiversity monitoring* — This study examines the motivations, preferences and frequency of participation of the most active participants on the iNaturalist citizen science platform for monitoring biodiversity.

Active scientific collaborations

In Israel

- Dr Reuma De-Groot, Mofet institute, Tel Aviv.
- Dr Idit Adler, Constantiner School of Education, Tel Aviv University.
- Prof. Frida Ben-Ami, School of Zoology, Tel Aviv University.
- Taking Citizen Science to School (TCSS) research center, Haifa University & the Technion.
- *Sharks in Israel* NGO, Dr Adi Barash and Dr Shevy Rothman, Tel Aviv University & Ya'ara Grossmark, Technion.

International collaborations

- Dr Corey Callaghan, University of Florida, USA.
- Prof. Alice Motion, School of Chemistry, Sydney University, Australia.
- Dr Joseph Roche, School of Education, Trinity College Dublin, Ireland.
- Dr Joana Magalhães, Science For Change, Barcelona, Spain.

Affiliations with international organizations

- IMPETUS — an EU-funded consortium for advancing citizen science. Dr Yaela Golumbic served as a mentor for newly established projects.
- The European Citizen Science Association (ECSA) — the Steinhardt Museum of Natural History is a member of the ECSA. Dr Y. Golumbic served as the co-chair of the working Group on *Citizen science and universities*: <https://www.ecsa.ngo/working-groups/citizen-science-and-universities>.
- ECS academy — an initiative of the EU-funded consortium European Citizen Science (ECS) for supporting training in and trainers of citizen science. The ICCS is a member of the ECS academy network, sharing resources and experiences from our ongoing activities.

Teaching

- Course on citizen science and its benefits for science and society. Tel Aviv University. Led by Dr Yaela Golumbic.
- Course on science communication. Tel Aviv University. Led by Dr Yaela Golumbic.

Education/public outreach

- May 19, 2024 — Departmental seminar for BA and MA students, Oranim, by Dr Adi Barash.
- June 28, 2024 — Annual Meetup of the *Sharks in Israel* Community celebrating 10 years of the citizen science project. Joint event of the *Sharks in Israel* association, the Centre for Citizen Science of the Steinhardt Museum of Natural History (SMNH) and the Israeli Diving Federation. Held at the SMNH and included museum tours, educational activities, scientific lectures, refreshments and gifts for participants. A total of 100 attendees.
- October and November 2023 — Four lectures for evacuees, delivered in classrooms across Israel by Dr Adi Barash.

Conferences

- April 2024 — *Invasive Species, and Collaborative Discoveries*. STS and Citizen Science workshop, Vienna, Austria.
- April 2024 — *Israel's Backyard Bird Count project: 18 years of changes and insights*. European Citizen Science Association (ECSA) conference, Vienna, Austria.

- April 2024 — *Citizen science in higher education: exploring the opportunities, challenges and synergies*. European Citizen Science Association (ECSA) conference, Vienna, Austria.
- April 2024 — *Introducing Israel center for Citizen Science: "Using Citizen Science and Social Networks for Ecological Research and Nature Conservation"*. 60th Meeting of the Zoological Society of Israel, The Open University, Raanana. (A dedicated session organized by Dr Shevy Rothman)
- September 2024 — *Participation patterns in science*. Science and Environment conference, Beer Sheva.

Publications

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APPLIED POLICY-RELEVANT RESEARCH

THE OPEN LANDSCAPE INSTITUTE

Uri Ramon, Amir Perelberg, Rona Winter-Livne, Yael Grodek

This was the ninth year of the Institute's operation under the Steinhardt Museum of Natural History. Our ties with the Museum staff and our colleagues in the applied science wing strengthened further, and a few projects were conducted in collaboration with the Israel National Center for Aquatic Ecology. The work with the Forestation Department in the Keren Kayemet LeIsrael — Jewish National Fund (KKL-JNF) continued to expand, and the Open Landscape Institute (OLI) staff conducted core surveys for forest management. The Society for the Protection of Nature in Israel (SPNI) continued its annual support together with the Israel Nature and Parks Authority (INPA) and the Ministry of Environmental Protection.

Overview of activities during 2023–2024

Streams restoration is an extensive project of tools development for eco-hydrological restoration of streams, developed over the last three years in cooperation with drainage and streams authorities and government agencies.

Nature and Landscape surveys were concluded in the following regions: Misgav regional council, Mate Asher regional council, Dead Sea & Fault Cliff, North-Western Galilee forests, Shmaria stream upper basin, volcanic mounds in the Golan Heights, Nazareth ridge to Hamoreh hill, wild olive trees on the Atlit ridge, Yarkon basin streams and West Galilee streams. New regional surveys were initiated in the following regions: Central Golan basalt planes, Arava Tichona regional council, Hevel Modi'in regional council and Upper Galilee and Hula valley. The following nationwide surveys were conducted: *KKL-JNF upgrade of the forests survey system*; *Protected nature assets in KKL-JNF forests*; *Integration of remote sensing methods in KKL-JNF forests survey system*; *Long-term monitoring plan of endangered & flag plant species in KKL-JNF forests*; *Endangered plant species — INPA*. Local monitoring surveys meant to assess the success of maintenance protocols were also conducted in the Ashalim stream following the ecological pollution disaster, in Biria forest following snowstorm damages, in Nazareth Ridge and Judea Hills following forest fires, and as a baseline before restoration projects in the Kishon springs, Yarkon-Kana-Hadar streams and Tsipory stream.

The Open Landscape Institute (OLI) is a partner in development and implementation of methodology in the following fields: *Nature-based solutions for streams restoration*; *Agro-ecology — Incorporating biodiversity-friendly management practices in avocado orchards* (including an ecological restoration pilot project at orchard margins and endangered plants species reintroduction), removal of obstacles that hinder passage along national ecological corridors was planned as part of this project; *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*; a number of studies and projects concerning environment and agriculture were also carried out. Additional studies in progress in this field are detailed below.

The main challenges that the Institute faced in 2023–2024 included:

1. War challenges:

- 1.1. Key staff members were on reserve duty for long periods. On their return, they confronted physical and mental problems.
- 1.2. A few staff members were evacuated from their homes. This process poses significant challenges to their families and the entire life routine.
- 1.3. Part of the fieldwork could only be carried out during limited time slots, and some areas were closed for almost a year.
- 1.4. All these pressures caused delays in the delivery of some projects, and incurred budget constraints at some cases.

2. Strengthening and expanding activity in fields defined within the OLI's core practices:
 - 2.1. Ecological and landscape background for planning — conducting and developing methodology for nature, landscape and human heritage surveys.
 - 2.2. Agriculture and environment — developing knowledge, expanding dialog circles, supporting professional and public processes.
 - 2.3. Botanical surveys — developing methods and tools like field guides for practitioners from different sectors and organizations.
 - 2.4. Restoration Ecology — developing the knowledge of the field and implementing it in agriculture, water management, planning, and development practices. The focus this year was streams restoration.
3. Expanding and assimilating of our products among various target audiences: Developing tools for disseminating knowledge: workshops, lectures for planners and university students in relevant fields, instructors, and more.
4. Strengthening connections and expanding collaboration with partner organizations in the Steinhart Museum of Natural History and other colleagues.
5. Professional and budget strengthening: determining the budgetary basis for the coming years, preserving current professional staff, absorbing new employees and training them to carry out the intended tasks.

Detailed Report for 2023–2024: Completed and Ongoing Nature and Landscape Surveys

Dead Sea & Fault Cliff survey

The Dead Sea coast is a unique ecosystem in Israel, characterized by a long narrow strip of an open landscape in the hyper-arid desert, between the Dead Sea and the He'etkim Cliff, along the Syro-African Rift valley. This area has geological features and scenic views existing in no other place in the world. The ecosystems under these extreme conditions include wide alluvial fans at the pass of large streams from the mountains to the coastal plain, perennial and ephemeral streams, the clefts of the Lisan formation, the receded beaches of the Dead Sea, as well as a variety of salt-marshes. The Dead Sea coast is also an important part of migratory birds' route. The uniqueness of this area is threatened by an accelerated rate of landscape change processes, including active geological faults, the retreat of the Dead Sea and the resulting development of sinkholes and structural topographical changes in the streams, as well as the conversion of the southern Dead Sea basin into large-scale industrial saltwater ponds, the diversion of streams, the construction of water reservoirs, changes in the regional groundwater levels, quarrying and other land disruptions, the development of tourist facilities and increased agricultural areas. The purpose of this survey was to create an ecological and landscape database for this region and define valence levels for each area, in order to prepare a background for sustainable planning (including the promotion of proposed reserves), management and maintenance of this unique landscape. The survey was completed and a final draft was submitted.

North-Western Galilee forests survey

The northern part of the Western Galilee, from the Israel-Lebanon border to the Nahariya-Ma'alot road, contains a unique mosaic of natural areas, planted forests and agricultural fields. Three main streams—Betset, Kziv and Shaal—are the northernmost watercourses in Israel that drain the Western Galilee Mountains to the Mediterranean Sea. The perennial parts of Betset and Kziv attract hundreds of thousands of hikers every year. This area has many natural and heritage values in a uniquely large and relatively uninterrupted region of open landscape. KKL-JNF intends to prepare a master plan for the forests of this region. The aim of the survey was to prepare a comprehensive environmental (ecology, landscape, human heritage, and leisure and recreation) background, which would serve as the basis for planning, management and maintenance of the open landscape in general and KKL-JNF forests in particular. The field work was completed and a final report was submitted.

West Galilee streams survey

The survey was planned to be conducted along eight stream basins under the responsibility of the Western Galilee Drainage and Streams Authority. The survey had two main goals: (1) to partially update of the ecological valence survey of the streams that had been carried out about 15 years ago, for the purpose of recommending a sustainable maintenance plan of these streams, conserving biodiversity without compromising drainage requirements; (2) to map and characterize the presence and extent of invasive plant species along the streams, in order to propose an action plan for the treatment of these species. The survey was completed and a final report was submitted.

Misgav regional council

About 90% of the area of the Misgav regional council, located in 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 was meant to provide a detailed background to support future and existing planning processes and an improved database for policymakers. The survey was completed and a final report was submitted.

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 had been already surveyed, or being under survey by other OLI projects. The current study 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. The survey was completed and a final report was submitted.

Nazareth ridge to Hamoreh hill

This region was assessed by the OLI as one of the most urgent places for survey on a national scale, given a lack of the up-to-date detail survey data on one hand and strong environmental pressures on the other hand. This area is characterized by many natural and heritage features in a unique combination of open landscapes in the Lower Galilee (nature reserves/national parks, KKL-JNF forests, agricultural areas and drainage channels located in the ridge of the national watershed between the Kishon basin and the Jordan basin) and two ecosystems which are underrepresented in protected areas — a Mediterranean Batha and Mediterranean alluvial valleys. A comprehensive environmental, ecological, landscape, human heritage, and leisure and recreation background would serve as a basis for wise and sustainable planning and management of the open landscapes. The survey would also aid the needs of KKL-JNF, which intended to prepare master plans and long-term maintenance policies for the forests in this region. The survey was completed and a final draft was submitted.

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 distinct and prominent landscapes at the national level. This unique region harbors various aquatic habitats: springs, winter ponds, shallow wetlands and steep canyons with flowing streams. These features support a nationally exceptional biodiversity that should be carefully protected. The survey was meant to provide a detailed background to support future and current planning processes and an improved database for policymakers. The survey was completed and a final report was submitted.

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 a 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 was meant to map and characterize these plants, to

provide a scientific basis for planning, conservation, management and maintenance of this important population. The survey was completed, and a final report was submitted to Volcani Institute, which continued with the project based on the survey results.

Yarkon basin streams

The Yarkon drainage authority is the last in the Mediterranean Israeli region, where ecological 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 completed the second out of three years of this survey and the annual report was submitted. Field work was completed, and a final report is in preparation.

Shmaria stream upper basin

Shmaria stream is a shallow channel that runs through the agricultural region between Patish and Grar streams. The stream and its tributaries have the potential to serve as a regional ecological corridor, connecting the Lahav Hills in the east to Grar and Patish streams in the west. The importance of this corridor is due to the expansion of the cities of Rahat and Beer Sheva, as well as national infrastructures and main transportation routes. In addition, this area has a large and unused potential to serve as a hiking and leisure place for residents and visitors, partly based on potential attractions such as the Shmaria ruins hill, the Turkish railway remains and the decades-old largest agave plantation in Israel. The geology of the area comprises loess soils, a national-level threatened ecosystem that is underrepresented in national protected areas. The survey was planned to assist the regional municipalities' master-plan to optimally recognize the important natural values, landscapes and human heritage in the survey area, thereby highlighting the possibilities for their preservation, alongside sustainable development. The survey was completed and a final draft was submitted.

Vegetation monitoring of the Ashalim stream following an ecological disaster (for HaMaarag)

On June 30, 2017, a 60-meter wall collapsed in the wastewater reservoir of the ICL Group plant in the Rotem industrial area. As a result, about 100,000 cubic meters of acidic gypsum wastewater flowed along a 20-kilometer route along the Ashalim stream. The pollution caused heavy damage to the ecosystem in the area, and the INPA, together with HaMaarag, began to monitor the ecosystem in spring 2018. The purpose of the monitoring was to examine the effects of pollution on the vegetation in the Ashalim stream over time, thus helping to build rehabilitation plans for the damaged area. The OLI was in charge of the monitoring in the sixth year of study. The work was completed, and a final report was submitted.

Vegetation monitoring of the Kishon springs and the Yarkon—Kana—Hadar streams as baseline before stream restoration projects

In previous ecological streams restoration projects, no baseline surveys prior to restoration were conducted, and therefore it was impossible to define clear indicators for success. Based on this insight, the existing restoration programs focused on building methodology that would take under consideration the current state of the streams and their surroundings before restoration. During the reporting year, we conducted two such baseline surveys — in Kishon springs and in the Yarkon stream. The field work was completed for both projects, and annual reports were submitted.

Vegetation monitoring recovery of the Biriya forest region following a snowstorm

The study focused on monitoring the damage caused by a snowstorm in winter 2014 to the pine forests of Biriya, Miron and Ba'al Shem Tov (*P. brutia* and *P. halepensis*), assessing the impact of sanitation treatments on dead wood coverage and structural diversity over three periods: in 2014, immediately after the storm; in 2015, one year after; and in 2024, 10 years after. The findings revealed that sanitation positively influenced the recovery of forest health, as evidenced by the marked differences in structural components between treated and control plots. Additionally, the study highlighted the combined effects of rock type and pine species on various ecological metrics, underscoring the importance of targeted management practices in post-disturbance forest recovery. The study was completed and a final draft was submitted.

Vegetation monitoring recovery of the Nazareth ridge following a forest fire

The study focused on monitoring the ecological recovery following a wild forest fire in the southern region of the Nazareth Ridge. The research emphasized the critical importance of restoration of the forested areas not only for the local flora and fauna but also for the surrounding communities that rely on these ecosystems for recreational and ecological services. A structured rehabilitation plan was proposed, aimed at returning the environment to its pre-fire state while also seizing the opportunity to enhance the forest structure and natural surroundings. The findings highlighted the resilience of the Mediterranean ecosystems and the necessity of ongoing management to support their post-disturbance recovery. The study was completed and a final report was submitted.

Invasive plant species monitoring of the Judea ridge following a forest fire

Following a large forest fire outbreak in 2021, KKL-JNF was developing a recovery plan for the forest and natural ecosystems located in the burned area. Part of the management related to invasive plant species. The OLI surveyors conducted a detailed mapping of the invasive species presence and density.

Protected nature values in KKL-JNF forests

Thinning of forests and renewal of degraded forest stands are the most important and significant maintenance activities in the Israeli planted forests, essential for the health and proper development of the trees, for the natural regeneration of the forest undergrowth and for increasing its plant diversity. A three-year study was completed, aiming to develop protocols for ecological surveys in JNF forests designated for thinning or renewal, to locate, map and mark protected natural assets before thinning/renewal, and to develop a suitable GIS database to mitigate the damage to these assets as much as possible. The project became a routine process and was embedded in the survey's unit annual plan. An annual report was submitted, and the project was ongoing with a fixed annual budget allocated for it by KKL-JNF.

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 basic development phase was completed, the survey manuals and protocols were prepared, and the project moved into the routine survey phase, aiming to cover all KKL-JNF forests in Israel within 5–6 years. We plan to continue the fourth year of this routine in 2024–2025. In the coming year, we plan to complete the final stages of development in data processing, data refinement and making the materials accessible to KKL-JNF. Additionally, we will continue evaluating the alignment between our processed outputs and the current conditions in the field. The team currently consists of approximately fifteen employees, divided into three regions across the country, in accordance with the KKL-JNF's administrative division. Following the completion of the survey and the submission of outputs, a new step has recently been added: writing a summary report for each forest. This report aims to review the output and highlight key trends for professionals. We hope that in the future, these outputs will serve professionals from various disciplines, enabling multidisciplinary research on forest management in Israel.

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

KKL-JNF manages over 10,000 ha of forests, and the forest survey is one of its major tools for planning and management. The forest database accepts zoning the forests into polygons, characterized by many attributes using traditional field methods. The limitations of this database include the high cost of time and work force required to map the forests, and thus surveying all forests takes at least 10 years. Great advances in remote sensing of forests from space in the past decade, thanks to the access to sensors with improved spatial, temporal and spectral resolutions, and the Google Earth Platform, enable to run global analyses. Recent studies in Israel demonstrated a potential to map natural vegetation in fine detail, but some of those studies were based on drones or on aerial hyperspectral sensors with high abilities; they are costly and cover small areas. In the 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 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; and segmentation of tree canopies (in sparse forests) and of forest stands. The remote sensing analysis is to be accompanied by field surveys of the same variables for calibration and validation of the models, in selected forests in 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. The second year of this research was completed according to the plan and the annual report was submitted, but progress planned for the third year is mostly postponed for next year due to long reserve duty of the leading researcher.

Long-term monitoring of endangered & rare plant species in KKL-JNF forests

KKL-JNF-managed open landscapes are of primary ecological importance in habitats that have been widely affected by human development and under-represented in nature reserves and national parks: deep, heavy soils in valleys (mostly cultivated) and light soils on 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 for rare and endangered plant species, as well as to flag species that are not threatened but represent cultural values and attract visitors. Protection of these assets serves multiple purposes: preventing harm to protected natural values (state law), preserving biodiversity, maintaining proper function of ecosystems, compliance with international treaties' requirements for the protection of biodiversity, and protecting flag species that bear cultural value. All the activities conform to the protocol for the management of sustainable forests adopted by KKL-JNF. The 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 sets a long-term plan composed of two aspects, i.e. monitoring and research. In the monitoring part, annual surveys are performed to map the distribution and size of the target species populations and to assess their habitat quality. In the research aspect, an observational study examines 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. The second year of this research was completed (there was one-year delay in the planned schedule due to administrative issues) and an annual report was submitted. The third and last year of this study was earmarked for completion in 2025.

Endangered plant species survey – INPA

As part of Israel's global commitment to protect endangered species, the INPA prepared a multi-annual plan to survey the endangered plants of Israel. The survey of the endemic species had been completed in 2018, and since 2019 the survey was focusing on: (1) sub-endemic species, (2) very rare species, (3) rare species in strong decline, (4) newly added species to the endangered list with insufficient data, (5) species with taxonomic uncertainty/complexity, and (6) hot-spot habitats of endangered plants. The annual report was submitted to the INPA.

Arava Tichona regional council

The area of Central Arava regional council is characterized by an unusual mosaic of agricultural areas and sparsely scattered settlements, embedded in a national-scale extensive range of natural landscapes, including many scenery and heritage features: the ravines of the Lisan Formation, the anticlines of the Negev Mountains, large Negev streams and their deep canyons, as well as the wide plains of the Arava valley. The wild, open and relatively undisturbed extensive landscape is used for recreational activities by hundreds of thousands of travelers every year. Building an up-to-date extensive database of natural assets, sites and environmental hazards, and the preparation of guidelines for hazard mitigation and natural assets management are necessary tools for officials and planners to facilitate a sustainable use and biodiversity conservation-oriented planning of the

municipality's area, including the restoration of disturbed landscapes that can be made accessible to the public, strengthening the residents' sense of belonging and local identity, and the preservation of natural ecosystems and habitats. The survey was initiated in the reporting year, an intermediate report was submitted, and the project was planned to be completed in 2025.

Hevel Modi'in regional council

The Hevel Modi'in regional council started preparation of a comprehensive master plan. The eastern part of the council had been covered by a nature and landscape survey carried out by the OLI more than a decade ago, but the western part was not surveyed. A full survey in the western part, as well as the completion and update of the data collected in the eastern part, are essential to receive a comprehensive updated information about the natural and cultural assets in the municipality's area. The project should significantly contribute to the preparation of a sustainable master plan that would take into account the natural biodiversity assets, the landscape and the human heritage sites, for the mutual benefit of humans and nature alike. The survey was initiated in the reporting year, an intermediate report was submitted, and the project was planned to be completed in 2025.

Central Golan basalt planes

The National Planning Administration began preparation of a partial update to the North District Regional Development Plan, which would include the entire Golan Subdistrict. As part of the preparation of the ecological background for the strategic plan for the Golan that was recently completed, the OLI prepared the ecology current situation chapter, based on the existing data and analysis, but as of today, no comprehensive survey of the Golan was conducted, except in the Golan volcanic mounds (see above). In order to complete the missing ecological background for the update of the Regional Development Plan, it has been decided that the area where information is most lacking is the basalt plains of the central Golan. This area includes three proposed reserves, as well as a proposed ecological corridor. The survey aims to create a comprehensive ecological and landscape database of this area, and to characterize and value these assets. This could be used as a background for a wise policy-making and planning, which will take into account the values of nature, the landscape, human heritage and leisure and recreation values in the region, and help focus and also direct management operations by field managers. The survey was initiated this year, an intermediate report was submitted, and the project was planned to be completed in 2025.

Upper Galilee & Hula valley

The purpose of the survey in the Upper Galilee regional municipality is to create a database that will serve as a tool for the planning and sustainable management of the natural landscapes within the council's area, taking under consideration the natural ecosystems and biodiversity, as well as the environmental hazards in the area. The database will provide a comprehensive picture of natural assets, sites, habitats, flora and fauna, as well as connectivity, ecological corridors, 'bottlenecks' and stepping stones. In addition, the survey will assist the council to strengthen the familiarity and identification of the residents with the local nature, and prepare an action plan for hazard mitigation. The survey was initiated this year, an intermediate report was submitted, and is planned to be completed in 2025.

Tsipory stream botanical monitoring

Part of the stream was rehabilitated to create flood plains and diverse ecological niches. The OLI surveyors planned and executed the first phase of vegetation monitoring plan, using a new protocol that was developed for this purpose.

Surveys and projects not yet approved

Tamar regional council (awaits bidding), Southern Sharon regional council (awaits bidding), Tanim stream basin (approved by the Open Landscape Protection Fund), Alexander stream basin (approved by the Open Landscape Protection Fund), Southern Pleshet lowland (approved by the Open Landscape Protection Fund), Landscape complexes (approved by the Open Landscape Pro-

tection Fund), Lavan-Ruth hills (approved by the Open Landscape Protection Fund), Central upper Galilee (approved by the Open Landscape Protection Fund), Old Olive trees (approved by the Open Landscape Protection Fund), Grazing monitoring in the Gilboa ridge (submitted to MIGAL, awaits approval), Sha'ar HaNegev regional council and Shikma park (submitted, awaits approval), Sdot Negev regional council (submitted, awaits approval), Taninim-Raz batha (submitted, awaits approval). HaMaarag botanic monitoring: Evrona nature reserve, coastal plain sand dunes, inland sand dunes, conifer forests, Mediterranean maquis (submitted, awaits approval).

Plans for 2024–2025 — New Nature and Landscape Surveys

Vegetation monitoring of Kishon springs and Tsipori stream, as baseline before restoration projects

In previous ecological stream-restoration projects, no baseline surveys prior to restoration were conducted, and therefore it was impossible to define clear indicators of success. Based on this insight, current restoration programs deal with building methodology that will consider the existing state of the stream and its environs before restoration. In 2024–2025, we plan to conduct two such surveys, in Kishon springs and along the Tsipori stream.

Yatir Forest annuals monitoring

In 2009, 21 experimental plots were established in the Yatir Forest as part of a long-term study on the behavior of a pine forest planted in the desert (Grunwald *et al.*, 2023). The experiment examined the effect of forest density and grazing on the tree productivity and forest regeneration, and now (2023) studies were being conducted to expand the area and study the effects of the forest and its interfaces, including a variety of plant species and their strengths. The OLI botanists will make detailed vegetation survey on these plots during the coming spring.

Grunwald, Y., Posner, E., Rotenberg, E., Yakir, D. & Klein, T. 2023. Yatir Forest: The effect of stand density and grazing management on a conifer forest at the desert edge. *Forest — Journal of Forests and Open Lands Management*, 24, iii-iv, 51-58. (in Hebrew, with English abstract) https://www.kkl.org.il/yaar24_article6

Tools Development and Research — Detailed Report for 2023–2024

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

Funding source: Hanadiv Foundation, drainage and streams authorities.

Research partners: Moran Development and Consulting firm; Southern-Jordan, Soreq-Lakhish and Yarkon stream and drainage authorities.

Current project status: Completed.

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 in buffer zones is a natural and sustainable process, which supports both the stability of stream banks and the functionality of the stream's ecological system. Still, several core issues in the implementation of this method are yet to be resolved. The OLI, in collaboration with Moran Development and Consulting firm, promotes actions that would make nature-based solutions more practical, accessible and 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) Collect data, analyze and draw conclusions regarding streams in different geographical areas where riverbank stabilization with vegetation was implemented; (3) Develop planning and implementation protocol and guide for the stabilization of riverbanks using vegetation, addressing dissimilarities of streams and geographical areas; (4) Information diffusion and assimilation, in collaboration with the Agma—Knowledge Center for Waterways, Dams and Streams.

During 2023–2024, the third monitoring survey was conducted in the streams and final reports were dispatched. In addition, a comprehensive insights document was written, based on the monitoring project in Sorek, Gamliel, Shapirim and Tabor streams. During 2025, a guide for vegetation restoration and management in coastal rivers in Israel is planned to be written, which will be based on the experience accumulated from this monitoring project and other restoration projects.

2. Tools for management and maintenance of streams vegetation - knowledge center

Funding source: Hanadiv Foundation.

Research partners: Moran Development and Consulting firm; Agma — Knowledge Center for Waterways, Dams and Streams; Ministry of Environmental Protection; KKL-JNF; Israel Nature and Parks Authority; Society for Protection of Nature; stream and drainage authorities.

Current project status: Ongoing.

The Knowledge Center is being established to support vegetation restoration and management along riverbanks and promote the use of vegetation for stabilizing riverbanks and channels. The center will take the form of a website, designed to make existing information accessible and to advance knowledge through standardized monitoring of various projects and the creation of a comprehensive database. Additionally, the center will develop guides and practical tools to support all stages of vegetation restoration and management, from early planning to implementation, maintenance and monitoring.

During 2023–2024, the existing knowledge was collected and organized, key knowledge gaps were identified, and the design process for a centralized website began.

The website was planned to be launched in 2025, accompanied by continued efforts to expand and disseminate knowledge.

3. 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 Applied Ecology, SMNH.

Current project status: Ongoing.

To meet Israel's targets of 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 sustainable 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 by 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 could identify the impact of the voltaic facilities on ecosystems. We should examine the phenology, abundance and richness of the species, and analyze the composition parameters of the ecological communities. Zero-time sampling (before the establishment of the facilities) of arthropods was carried out, and a report was prepared for submission to the Ministry of Energy.

During 2023, certain challenges—sorting suitable plots and budget constraints—came up. For the time being this project had no further funds.

4. Formulation of principles for planning, restoration and management of forests on river banks in KKL-JNF land

Funding source: KKL-JNF.

Research partners: KKL-JNF.

Current project status: Ongoing.

The study aims to formulate principles for planning, restoration and maintenance of streams on the KKL-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. An ecological field survey in the Baram forests (as a case study) was conducted by a multi-disciplinary group, to determine a generic method for collecting data as a background for the planning and management of streams. The analysis of data was under preparation for KKL-JNF and other stakeholders in the stream's restoration.

5. Basin Atlas Project

Funding source: Ministry of Agriculture and Rural Development.

Research partners: Alluvial Research Station of the Ministry of Agriculture and Rural Development, Western Galilee Drainage and Steams Authority.

Current project status: Completed.

Nature-Based Solutions (NBS) for flood regulation is a new approach that seeks to preserve, rehabilitate and establish functional ecosystems in the basins, capable of providing flood regulation services at a higher level.

The Basin Atlas project is a GIS-based tool that aims to promote the implementation of NBS to reduce flood damage through a catchment basin analysis of the ecosystems and hydrological and geomorphological aspects. The Basin Atlas includes a geo-database that allows accessing existing information, cutting and querying between different layers and datasets, as well as web applications that enable interactive accessibility of content and information. The current project is focused on the catchment basin area of Nahal Hilazon, within the boundaries of the Western Galilee Drainage and Steams Authority. The Basin Atlas enables efficacy in the decision-making process during the planning stages, it enables management of the drainage network in the catchment basin of Nahal Hilazon, and potential sites for applying NBS to regulate floods were mapped. A concluding report of the project and the project's GIS products were submitted to the Ministry of Agriculture and Rural Development. The last stage of the project included the assimilation of the project by the Western Galilee Drainage and Steams Authority. However, following the war in Gaza and in the north of Israel introduction and integration of this project within the Western Galilee Drainage Streams Authority was challenging and needed to be continued and followed up during this last stage.

6. Ancient agriculture systems in the Negev

Funding source: KKL-JNF.

Research partners: The Israel Nature and Park Authority, the Israel Antiquity Authority, the Geological Survey of Israel, Dead Sea and Arava Science Center, the KKL-JNF, the Bedouin Development and Settlement Authority in the Negev, the Southern District Planning Administration.

Current project status: Completed.

The infrastructure of ancient agriculture systems in the Negev is undergoing a massive process of erosion, some of which is accelerated by recent development — transfer of infrastructure, overuse of land, inconsiderate agricultural practices, to name a few. The erosion of the ancient agricultural terraces, soil erosion and desertification processes increase in a positive feedback loop. Although this setup is an ancient and important feature, there is no intention to declare all these systems as 'sites of antiquities', mainly due to the enormous scope of their spread. The project aims to moderate the erosion processes of the ancient terraces, first by promoting awareness of their presence and great importance, and, second, by developing a professional and organizational roadmap to facilitate a change in the planning of infrastructure and implementation and environmental and agricultural development.

During the last two years, we collaborated with numerous role-players such as the Israel Nature and Park Authority, the Israel Antiquity Authority, the Geological Survey of Israel, Dead Sea and Arava Science Center, the KKL-JNF, the Bedouin Development and Settlement Authority in the Negev, the Southern District Planning Administration, and several present-day farmers in the Negev. We examined how these authorities and current settlers (Bedouins or modern farmers) relate and operate in areas where ancient terraces are present. In addition, we located and mapped all current terraces within our study area. We submitted this GIS layer and the final report to the KKL-JNF. Our work on the project included a professional and organizational roadmap for the development of tools and processes that would minimize the damage to this ancient infrastructure and prioritize areas for preservations.

7. Supportive agriculture for natural ecosystems in 'Milopri' Avocado orchards

Research partners: Milopri Corporation, Western Galilee Cities Association, Western Galilee Drainage and Steams Authority, The Israel Nature and Parks Authority, the Entomological Laboratory for Applied Ecology (SMNH), and 25 kibbutzim.

Current project status: Ongoing.

The OLI research unit leads and provides ecological background for the project between Milopri Corporation and Western Galilee Cities Association, Western Galilee Drainage and Steams Authority, and 25 kibbutzim. These are all partners in Milopri Corporation that unites avocado growers of

Western Galilee. The orchards are spread over 35,000 dunams (3500 ha). With our partners, we have raised about NIS 1,200,000 for the restoration of field remnants (small areas that are not cultivated within the farmer's managed territory). We carried out a vast survey of all field remnants in 2021 and 2022. We then continued to the first phase (2023) of ecological restoration in 29 patches, in an aggregate area of about 80 dunams within the scope of seven farms. A further step would comprise preparation of detail plans for the restoration of 120 additional plots in the area of another 14 kibbutzim.

In addition, we accompanied the corporation in the carbon credit audit and prepared materials documenting the project for the controllers of the European Union. We also conducted joint research with the Israel Nature and Parks Authority and the Entomological Laboratory for Applied Ecology at the museum to monitor the effect of a diverse plant cover on avocado pollinators.

8. Tools for effective restoration of ecosystems' main functions

Funding source: The Ministry of Environmental Protection.

Research partners: The Ministry of Environmental Protection.

Current project status: Ongoing.

This is a joint project with the Ministry of Environmental Protection as part of a series of studies to develop restoration tools for ecosystems at risk in Israel. The purpose of the study is to map the current conservation status, to record flora and fauna that characterize it, and to locate opportunities for restoration within this framework. By analyzing various reports and conducting a dedicated survey of areas that underwent spontaneous and active restoration, we try to identify possible tools for the effective restoration of ecosystems. As part of the research, a case study was carried out for the rehabilitation of the Kurkar Quarry in the Carmel Coast area. Another case study will be conducted in the area of a planted forest in the southern district of KKL-JNF.

9. A joint project for the rivers in the JNF-KKL forests: new publications (2023–2024)

Funding source: The Ministry of Agriculture and Rural Development.

Research partners: The Ministry of Agriculture and Rural Development.

Current project status: Ongoing.

A joint publication with the Ministry of Agriculture and Rural Development (Soil Erosion Research Station) will be published in KKL-JNF magazine Ya'ar ('Forest') and will review the ecosystem services of woody vegetation on river banks, describe the woody vegetation typical of the Mediterranean streams in Israel, and address the barriers to its optimal functioning. Finally, the article will define the principles for the vegetation restoration.

Another project will provide guidance and terms of reference for ecological surveys, to enhance background for planning and restoration of streams managed by KKL-JNF. The document will comprise professional guidelines for collecting systematic and ordered hydrological, botanical and zoological information. It will contain an organized proposal for dividing each stream into segments and determining the boundaries of the required survey. The publication will be based on a survey carried out by the OLI in the Baram forest, as well as on the analysis of previous surveys that have been identified as a basis for the work.

10. Tools for multi-purpose management of agriculture, recreation activity and natural ecosystems in the Shikma Region

Current project status: Ongoing.

The research is aimed to develop applied tools in the economic, physical, legal and social fields, which will empower regional councils and landscape managers of open spaces to accommodate visitors optimally, to protect wildlife and natural ecosystem functions while responding to the farmers' distress and promoting economically and socially sustainable agriculture and food production systems. The research refers to fencing, agricultural planning and management, as well as communication methods among different stakeholders.

11. Planning, restoration and streams management in forestry lands: Mapping KKL-JNF's partnership and relationship with other stakeholders

Funding source: KKL-JNF.

Research partners: KKL-JNF.

Current project status: Completed.

The project was intended to support the process of formulating an organizational policy in the KKL-JNF regarding planning and management of streams, following the principles and framework of the strategic plan for forestry lands, and analyzing alternatives of partnerships with other stakeholders. First and foremost, the question arose about cases where KKL-JNF sought to become a leading body in the management of streams and about steps that were required to promote this. In other cases, KKL-JNF could focus on the management of forestry lands only, with limited reference to the entire basin.

12. Assessment of different cultivating methods of marginal agricultural areas

Funding source: Ministry of Agriculture and Rural Development.

Research partners: Soil Conservation and Drainage Department of the Ministry of Agriculture and Rural Development, local farmers.

Current project status: Ongoing.

Examining the effects of cultivating methods for marginal agricultural areas, which are characterized by various problems such as high slopes and erosion risks. The research focuses on presentation of an extensive framework for examining a full range of effects: a review of agronomic aspects such as loss of production and soil erosion and the appearance of agricultural pests, a review of economic aspects — production, quantification of benefits and costs, a review of ecological aspects, recreational uses and interactions between the field and its environment. The project aims to support decision-making processes by the Ministry of Agriculture and Rural Development regarding incentives for better cultivation methods that combine a high level of food production with sustainable cultivation, better ecological functioning and other ecosystem services. The final report was submitted and approved by the Ministry.

13. Ecological evaluation of agricultural landscape in the Tkuma region, following the Gaza war

Funding source: Aviv consulting group.

Research partners: INPA, REED Environmental Design.

Current project status: Completed.

Following the terrorist attack on 7 October 2023 and due to the immense damage caused to the Western Negev by the Gaza war, the region was to undergo significant restoration and development, particularly in construction and infrastructure. The strategic plans for this region, encompassing about 22% of Israel's agricultural lands, were led by *Tkuma Management Committee*, a special management committee established by the government. In order to provide understanding of the contribution of the agricultural landscape to the ecosystem and establish priorities for sustainable conservation, we used GIS data to evaluate the ecological valence of these fields at various scales (national to local), using several spatial sub-indicators, such as ecological units, landscape continuity, floodplains, cover type, growth type and zoological observations. The analysis showed that agricultural areas with high ecological valence were primarily found in intensive field crop plots near major streams (Besor, Patish, Gerar). These areas were crucial due to their location within ecological corridors and proximity to nature reserves. The high ecological valence of these parcels made them essential components of the region's open landscapes and ecosystems. This assessment is now being used as a key planning tool for the strategic development of the Tkuma region.

14. National project for cleaning the public space — A pilot survey

Funding source: Regional government office.

Research partners: Ministry of National Environmental Defense, Regional Government.

Current project status: Ongoing/on hold.

This project intended to support a national-scale survey of the current status of waste and hazards management in open landscape areas. Accordingly, we build a GIS-based survey platform to enable field data collection and additional platforms to visualize the information for decision makers.

The survey started at the north of Israel (Kinneret region) but due to the war the project was halted and put on hold.

THE ISRAEL NATIONAL CENTER FOR AQUATIC ECOLOGY

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

Steering Committee: Prof. Tamar Dayan (SMNH), Dr Menachem Goren (TAU-SMNH), Dr Assaf Tzhoar (INPA), Dr Dana Milstein (INPA), Dr Rani Amir (IMEP), Dr Amir Erez (IMEP), Sarit Caspi-Oron (IMEP), Hanoch Ilssar (Yad Hanadiv), Dr Doron Markel (JNF), Dr Yehonatan Bar-Yosef (JNF).

Members: Dr Yaron Hershkovitz, Avital Katz, Tuvia Eshcoli, Yoni Nisim, Nadine Gavrieli, Nili Segman, Dr Ori Segev, Dmitry Aksenov, Noa Zanzuri, Koral Peleg.

MSc/MA students: Dafi Luz, Nili Segman, Tal Ratner.

The Israel Center for Aquatic Ecology (ICAE) was established in 2015 as a part of the Steinhardt Museum of Natural History. Its primary mission is to conduct a national, long-term biological assessment of Israel's streams. The ICAE's work is supported by major organizations, including the Israel Nature and Parks Authority (INPA), the Ministry of Environmental Protection, the Jewish National Fund and the Yad Hanadiv Foundation. In addition, we conduct ecological monitoring for river restoration projects in cooperation with river authorities, INPA and Agma — Knowledge Center for Waterways, Dams and Streams.

Objectives

- The ICAE's primary objective is to develop and implement a national stream monitoring program within the context of monitoring and assessing the state of streams in Israel.
- Long-term ecological monitoring: To implement long-term biological monitoring programs to determine the ecological status of streams in Israel.
- Stream restoration monitoring: To evaluate restoration projects using ecological indicators.
- Ecological research: To conduct basic ecological research to deepen our understanding of biodiversity, species distribution and ecological characteristics.
- Database management: To manage the ecological databases to store and integrate data to create a comprehensive picture of the factors that affect stream conditions.
- Dissemination: To sharing critical information with decision-makers and the public.
- International partnerships: To strengthen cooperation by partnering with organizations involved in river restoration and monitoring, both in Israel and internationally.

Main activities in 2023–2024

Development and implementation of a national stream monitoring program:

- Biological monitoring in the Dalya and Taninim basins (2nd year) was conducted in cooperation with the Dalya-Taninim Drainage and Streams Authority. As part of the monitoring program, 31 invertebrate samples were collected from 13 streams.
- Biological monitoring in the Sorek and Lachish basins was conducted in cooperation with the Sorek-Lachish Drainage and Streams Authority and the Stream Monitoring Section (INPA). As part of the monitoring, 21 samples were collected from seven streams.
- Biological monitoring in the Alexander Basin was carried out in addition to the monitoring plan for the Hadera Basin, in cooperation with the Sharon Drainage and Streams Authority and the Streams Monitoring Unit (INPA). As part of the monitoring, 16 samples were taken from six streams.

Biological and taxonomic research:

- Ongoing research on the taxonomy and ecology of three major taxonomic groups: dragonflies and damselflies (Odonata), caddisflies (Trichoptera) and riffle beetles (Coleoptera: Elmidae). The studies were conducted by graduate students (Almog Hershko-Penuel, Dafi Luz and Nili Segman) under the joint supervision with Prof. Netta Dorchin (School of Zoology, Tel Aviv University). The aim of these studies was to develop the taxonomic and ecological knowledge of these groups, which would serve as the scientific basis for the implementation of invertebrate-based monitoring (bio-indicators). Research results include a national distribution map and a detailed taxonomic guide to the larvae and adults, with genetic barcodes at the species level. All studies

incorporate ecological knowledge and genetic information intended for use as a molecular monitoring tool (e-DNA and metabarcoding) as an additional means for rapid assessment of biodiversity and ecological status of Israeli streams.

- Implementation of an integrated protocol to identify the ecological status of streams, including characterization of the riparian vegetation zone. The research was conducted by Dafna Shapira (under the supervision of Prof. Tamar Dayan and Prof. Yoni Belmaker) in selected streams in Israel.
- Characterization of the vegetation condition along stream banks using remote sensing technology for description and quantification of the riparian vegetation zones. Extensive information on the composition and structure of the vegetation along stream banks was obtained through analysing images from various sources (drones, satellites etc.). The research was conducted by Dmitry Aksenov (under the supervision of Dr Yaron Hershkovitz).

Biological monitoring of stream restoration projects:

- Seasonal biological monitoring of the Kishon stream, supported by the Kishon River and Drainage Authority.
- The ICAE is a member of the advisory committee for the Tzipori restoration plan and is responsible for monitoring macroinvertebrates led by the Kishon River and Drainage Authority.
- Ecological assessment and biological monitoring of the Tzipori stream as part of the Tzipori restoration plan MERLIN, supported by the Kishon River and Drainage Authority and EU-Horizon 2020.
- Biological monitoring restoration project in Ras Ali part in the Tzipori stream, supported by the Kishon River and Drainage Authority.

Scientific collaborations

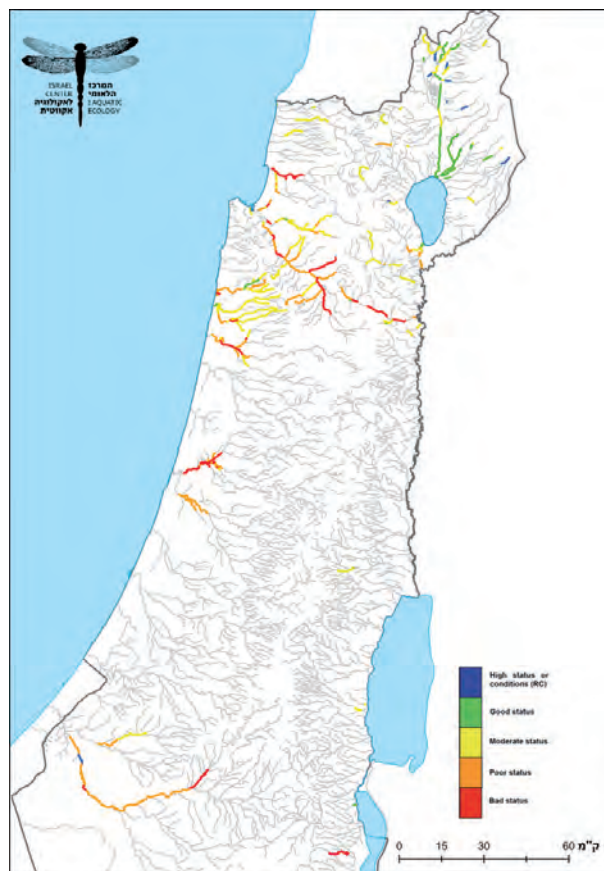
- EU-Horizon 2020: Research and Innovations Actions project MERLIN — Mainstreaming ecological restoration of freshwater-related ecosystems in a landscape context: innovation, upscaling and transformation.
- Development of an Integrated Monitoring Framework to streamline the Management and Restoration of Rivers and their Floodplains (DEMOSTREAM).

Databasing

The ICAE database contains biological data for over 1000 samples that were collected between 2015–2024. In 2024, 91 samples of macroinvertebrates were added. These samples were collected from 28 streams in 5 catchments (Kishon, Dalya, Taninim, Alexander and Sorek-Lachish) and added to the national collection at the Steinhardt Museum of Natural History.

Committees

- *The strategic plan for the protection and rehabilitation of streams in Israel* (expert committee, stream rehabilitation). Ministry of Environmental Protection, Israel.
- *Evaluation tools for assessing stream rehabilitation* (expert committee). Agma, Israel.



Pollution sensitivity of aquatic macroinvertebrates in Israeli streams (2024). Color scheme indicating ecological state: Blue — 'High', Green — 'Good', Yellow — 'Moderate', Orange — 'Poor' and Red — 'Bad'.

- *Identifying knowledge gaps and challenges in riparian vegetation restoration*. Open Landscape Institute and Agma, Israel.
- *Water quality regulations for ecological restoration of streams* (expert committee). Ministry of Environmental Protection, Israel.
- *Citizen science in stream restoration projects: Tzipori stream as a case study* (expert committee). Kishon River and Drainage Authority, Israel.

Field work

The ICAE staff conducted field work at Ein Gedi (6–7.03.2024), Dead Sea (14–15.04.2024, 23–24.06.2024), Einot Tzukim (1–2.05.2024), Dalia-Tananim Basin (5–9.05.2024), Beit Netofa (13.05.2024), Alexander Basin (15–16.05, 19.05.2024), Kishon stream (21.05, 23.05.2024), Sorek-Lachish Basin (26–30.05.2024), and Tzipori stream (4.06, 9.06.2024).

Graduate students

- Dafi Luz (MSc, Tel Aviv University; supervisors Prof. N. Dorchin and Dr Y. Hershkovitz): *Taxonomy and ecology of Elmidae as bioindicator species in freshwater ecosystems in Israel*.
- Tal Ratner (MA, Tel Aviv University; supervisors Prof. D. Rabinowitz and Dr Y. Hershkovitz): *Implementation of integrated watershed management and its connection to the development of social and environmental measures of streams restoration — Tavor Valley case study*.

Talks and presentations

- *Ecological aspects in the Tzipori restoration plan*. Nature and Parks Authority (Northern district) Meeting. Megiddo National Park, November 2023.
- *The ecological importance of riparian vegetation*. Workshop on mapping knowledge gaps and challenges in riparian vegetation restoration. The Steinhardt Museum of Natural History, Tel Aviv, Israel, January 2024.
- *Logic model for stream restoration*. The Annual Conference for Streams in Israel. Tel Aviv, Israel, July 2024.
- *First comprehensive overview of invasive aquatic macroinvertebrates in Israel*. 4th Central European Symposium for Aquatic Macroinvertebrate Research (CESAMIR), Stará Lesná, Slovakia, July 2024.
- *Multi-benefit restoration of floodplains in an agricultural basin*. Ministry of Agriculture and Food Security Seminar, Beit Dagan, Israel, July 2024.
- *Water quality regulations as basis for ecological restoration of streams*. Ministry of Environmental Protection, The Steinhardt Museum of Natural History, Tel Aviv, Israel, July 2024.

Teaching

- *Stream ecology: from fundamental to applied* (course number 1885-0011). Steinhardt Museum of Natural History, Tel Aviv University, February 2024.
- *Monitoring the ecological value of streams*. Ramat HaNadiv and the Steinhardt Museum of Natural History. Guest lecture.
- *Stream ecology in the light of climate change: New challenges — new solutions?* School of Zoology, Tel Aviv University. Guest lecture.

Public outreach

- *MERLIN in the Tzipori restoration project*. Agma webinar, November 2023.
- *Biological monitoring in the Kishon Basin throughout the years*. Kishon River and Drainage Authority Webinar, June 2024.

HAMAARAG — ISRAEL'S NATIONAL NATURE ASSESSMENT PROGRAM

Ittai Renan

Overview

HaMaarag — Israel's National Nature Assessment Program — was founded in 2006 as a partnership framework between the Ministry of Environmental Protection, the Jewish National Fund — Keren Kayemeth Lelsrael (JNF-KKL), the Israel Nature and Parks Authority (INPA) and the Steinhardt Museum of Nature History — the Israel National Center for Biodiversity Studies, Tel Aviv University (SMNH).

HaMaarag's essential mission is to conduct assessments of the state of nature in Israel to enable knowledge- and science-based management of Israel's open landscapes and biodiversity. This knowledge is accessible at the national level to decision-makers and researchers in Israel and abroad, as well as to the general public.

Main achievements in 2023–2024

State of Nature Report 2023 — Biodiversity Volume

<https://hamaarag.org.il/en/report/the-state-of-nature-report>

HaMaarag has been publishing the State of Nature Reports since 2010. The reports reflect on ecosystem trends and processes in Israel and provide a glimpse into the state of nature in Israel. The State of Nature Report — Israel 2023 was published in October 2023. The report was largely based on analyses of data accumulated during the first decade of the National Terrestrial Monitoring Program, operated by HaMaarag. The program covered most of Israel's land territory, and spanned nine habitat-based monitoring units. The main monitoring questions addressed temporal changes in biodiversity and the effect of human settlements and agriculture on the ecosystems. More than a decade of monitoring encompassing 941 sampling plots yielded a great wealth of data, including 30,375 observations of medium-large sized mammals of 40 species, 68,141 birds of 195 species, 2,849 reptiles of 52 species, 267,579 butterflies of 92 species (over 13 years) and 20,365 plants belonging to 139 species.

The report also summarized findings from additional sources: wildlife counts by the Israel Nature and Parks Authority, National Monitoring Programs for Streams (Israel National Center for Aquatic Ecology, SMNH), the Sea of Galilee (Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research (IOLR)), the Mediterranean Sea (The National Monitoring Program of Israel's Mediterranean waters, IOLR) and the Red Sea (The National Monitoring Program at the Gulf of Eilat, the Interuniversity Institute for Marine Science Eilat), and the National Butterfly Monitoring Scheme, which is a citizen-science program. Data collection and processing, presentation of the results and analyses, and a discussion of the findings provided a comprehensive overview of the current state of nature in Israel.



Cover of the State of Nature Report 2023.

Ashalim Stream Ecosystem Monitoring Program

<https://hamaarag.org.il/en/project/ashalim-stream-monitoring-program>

Collaborators: Yael Storz-Peretz and Ofir Katz (Dead Sea Research & Development); Uri Nachshon, Eli Tzadi and Einav Meizlish-Gati (Volcani Institute); Itai Gavrieli and Uri Nachshon (Geological Survey of Israel); Roi Egozi (Ministry of Agriculture); Yaron HersHKovitz (Israel National Center for Aquatic Ecology, SMNH); Ali Najidat and Shimon Rahmilevich (Ben-Gurion University); Uri Ramon (Open Landscape Institute, SMNH); Gilad Ben-Zvi (Entomological Laboratory for Applied Ecology, SMNH); Efrat Gavish-Regev (Hebrew University); Rafi Kent, Noga Kronfeld-Schor, Frida Ben-Ami and Liron Goren (Tel Aviv University); Yoram Tzvik (Dukhifat Company); Noam Dvori and Elad Levonon (Etgar Engineering); Tamar Zohari (Israel Oceanographic and Limnological Research).

Following a severe pollution incident in the Ashalim stream in 2017, HaMaarag headed a multi-annual monitoring program, run by the Israel Nature and Parks Authority (INPA) Science Division. HaMaarag developed, coordinated and analysed a five-year assessment of the ecological consequences of the acid pollution and the naturally occurring rehabilitation processes within the ecosystem. The program included field monitoring, sampling, field and lab experiments conducted by 15 research groups from seven research institutions, specializing in different ecosystem components. The aim of this monitoring program was to identify and characterize the impact of the pollution on the various ecosystems along the Ashalim stream. The monitoring results indicated severe damage to various components of the ecosystem and a slow recovery, mainly in the sandy unit of the Ashalim stream. In May 2023, HaMaarag organized a concluding conference for the Ashalim monitoring program. During the conference, each research group presented their five-year findings. In August 2024, a first draft of the concluding report of Ashalim was submitted to the INPA for review. The report included the findings of all research groups and findings from research conducted in Swan Lake, which received some of the pollution from the Ashalim stream.

The National Biodiversity Monitoring Program

<https://hamaarag.org.il/en/project/the-national-biodiversity-monitoring-program>

HaMaarag operates a long-term monitoring program to identify and track significant changes in Israel's terrestrial biodiversity, thus understanding the state of the various ecosystems in Israel and the human impact on them. Since 2012, research teams have been monitoring the diversity of plants and animals in different ecological units in Israel. Using the collected data, HaMaarag examines the influence of different processes and threats on the biodiversity and functioning of the local ecosystems.

During 2023–2024, HaMaarag finished the fifth cycle of the terrestrial biodiversity monitoring that focused on mammals, birds, reptiles and arthropods.

Evrana Nature Reserve Ecosystem Monitoring Program

<https://hamaarag.org.il/en/project/evrona-reserve-monitoring-program>

Collaborators: Roey Egozi (Ministry of Agriculture); Rotem Golan (Volcani Institute); Ravid Rosenzweig (Geological Survey of Israel); Zeev Ronen and Shimon Rachmilevich (Ben-Gurion University); Gilad Ben Tzvi and Yossi Yovel (Tel Aviv University).

The contamination of the Evrona Nature Reserve by crude oil in 2014 was one of the most serious environmental disasters in Israel. Following this event, the Israel Nature and Parks Authority established a five-year restoration and monitoring plan, whose goal was to characterize the impact of the pollution on the ecosystem. The monitoring program, aided by 12 research groups from different research institutes in Israel, was set up and managed under the leadership of HaMaarag. The monitoring program had two goals: (1) to characterize the pollution, and (2) to study the response of the ecosystem to the pollution.

Based on the findings of the five-year monitoring program that ended in 2020, it was decided to implement restoration actions in the Evrona Nature Reserve that involved removal of the contaminated soil. It was also decided to establish a second five-year monitoring plan to evaluate the restoration effort.

The second monitoring cycle started in February 2023. The program involved research teams from various academic institutions and two research partners — the Dead Sea and Arava Science Center, and an environmental consulting company. During the reporting period (2023–2024), all

research groups conducted time-zero samplings and field surveys (before soil removal) in our test plot to understand the current condition of the Evrona Reserve ecosystem. The soil removal was scheduled to begin in May 2025.

The Red Book of Invertebrates in Israel

<https://hamaarag.org.il/en/project/the-red-book-of-invertebrates-in-israel>

The Red Book of Invertebrates in Israel is being compiled by the Entomological Laboratory for Applied Ecology (SMNH) and HaMaarag, in collaboration with Israel's Nature and Parks Authority, the JNF-KKL and researchers from Israel and abroad. The main goals of the book include: (1) a qualitative and quantitative assessment of the threat to species in various taxonomic groups as a future baseline for the monitoring and conservation of these species and the management of their habitats; (2) identifying bio-indicators for vulnerable habitats, as an interface tool for nature reserves and managed sites, and for the promotion of the protection of natural open areas; and (3) identifying key habitats for conservation, both within and outside protected areas. So far, threat assessments for 421 species have been prepared, including butterflies, flower chafers, land snails and slugs, scorpions, ants and mayflies.

National Biodiversity Index

<https://hamaarag.org.il/en/project/biodiversity-index>

The National Biodiversity Index that quantitatively represents the state of biodiversity in Israel is being developed with the aim of assessing the state of the ecosystems in the country. The Biodiversity Index constitutes a part of the national "indicators of well-being, sustainability and resilience" report, published by the Israel Central Bureau of Statistics. The indicators take into account the size of open natural areas, their continuity and the state of species within them.

For the purpose of calculating the Biodiversity Index, three key bodies have been collaborating since 2015 — HaMaarag, the Israel Ministry of Environmental Protection and the Israel Central Bureau of Statistics. In this way, Israel has joined the leading OECD countries that consistently conduct measurements of the state of their ecosystems as a key indicator to assess their populations' well-being.

Thus far, three biennial time points have been calculated, the most recent one in 2023 (based on data from 2021–2022). The index shows a downward trend compared to the reference level of the year 2013, mainly due to the decline of the extent and quality of natural areas.

Central Bureau of Statistics. 2023. *National Biodiversity Index 2022*. Central Bureau of Statistics, Ministry of Environmental Protection, HaMaarag. https://www.cbs.gov.il/he/publications/doclib/2023/1912_well_being_2022/prt07_7_h.pdf

Monitoring forest fires in the Judean Mountains

<https://hamaarag.org.il/en/project/monitoring-forest-fires-in-the-judean-mountains>

In August 2021, a severe wildfire swept through the Ya'ar HaKdoshim Forest in the Judean Mountains, affecting a vast area with its intensity and scale. The forest's future composition and landscape would be largely determined by natural regeneration processes following the fire, coupled with targeted management activities supporting essential restoration efforts.

To address this, HaMaarag launched an inclusive long-term monitoring program in collaboration with the Jewish National Fund. The main objectives of the program focused on (1) assessment of the fire impact on the key components of the ecosystem, (2) understanding of the recovery processes in the forest, and (3) development of the optimal restoration strategies for Ya'ar HaKdoshim.

The monitoring program employed both ground-based and remote sensing techniques, leveraging extensive prior knowledge and existing data layers of the affected area. The insights gained from this program were expected to inform future monitoring and restoration efforts for similar fire-damaged forests in the region, providing valuable guidance for forest management and conservation practices.

The effect of environmental factors on trends in the population of two butterflies — *Tomares nesimachus* and *Cigaritis cilissa*

<https://hamaarag.org.il/en/project/the-effect-of-environmental-factors-on-trends-in-the-population-of-two-butterflies-tomares-nesimachus-and-cigaritis-cilissa>

Over the past two decades, we observed a sharp decline in the population density of the threatened butterflies *Tomares nesimachus* and *Cigaritis cilissa* in Israel. The project explores the impact of various environmental factors, including climatic conditions, habitat type and urban development, on the abundance of these butterfly species. A significant portion of these data was gathered through citizen science initiatives, particularly the Israeli Butterfly Monitoring Scheme (BMS-IL). The research was conducted by the MSc student Zohar Afek under the guidance of Prof. Tamar Dayan and Dr Orr Comay.

Monitoring and evaluating the density and composition of stray cat populations in rural areas

<https://hamaarag.org.il/en/project/monitoring-and-assessing-the-density-and-composition-of-stray-cat-populations-in-the-countryside>

HaMaarag operates a monitoring program that evaluates the density and composition of stray cat populations in rural areas in Israel, as part of the call for *Cat Monitoring Research* funded by the Ministry of Agriculture and Rural Development. The project focused on (1) establishing the link between the density and composition of stray cat populations and their proximity to settlements; (2) determining the change in the density and composition of stray cat populations over time and in relation to the undertaken population management activities and to the available food sources; and (3) understanding the relationship between the density and composition of stray cat populations and the diversity and activity of other wild animals. The research was conducted by the MSc student Bar Pezarker under the guidance of Prof. Tamar Dayan and Dr Orr Comay.

Conferences organized by HaMaarag

- May 19, 2024 — *State of Nature Report 2023 Launch Event*. The Steinhardt Museum of Natural History, Tel Aviv.
- September 17, 2024 — *Remote Sensing Symposium for Nature Conservation*. The Steinhardt Museum of Natural History, Tel Aviv.

Conference presentations

- September 20, 2024 — *Trends in Israel's butterflies*. The 41st Annual Conference of the Israeli, Technion, Haifa.
- September 25–26, 2024 — The 52nd Annual Conference for Science and the Environment, Ben-Gurion University of the Negev, Beer Sheva.

Presentations:

- *Decline in bird abundance in Israel — Findings from the 2023 State of Nature Report*.
- *State of Nature Report — Biodiversity: Citizen Science reveals sharp declines in the abundance and richness of Israel's butterflies*.
- *Long-term trends in vegetation cover in the Coastal Plain sands*.

Lectures for stakeholders and general public

- December 14, 2023 — *The activities of HaMaarag*. Lecture for the CEO of Yad Hanadiv.
- January 29, 2024 — *The activities of HaMaarag*. Lecture for the Chief Scientist of the Ministry of Agriculture and Rural Development.
- February 15, 2024 — *The activities of HaMaarag*. Tour for KKL Partnerships and Engagements Members.
- February 18, 2024 — *The activities of HaMaarag*. Visit of Amir Halevi and Galit Cohen to the Steinhardt Museum of Natural History.
- May 3, 2024 — *Butterfly survey with public participation at the Biblical Zoo in Jerusalem*. Butterfly BioBlitz Conference in Memory of Pinchas Amitai.
- June 9, 2024 — *Bird monitoring*. Webinar for volunteer bird monitors as part of a pilot for monitoring using citizen science.
- June 16, 2024 — *The butterflies of Mount Hermon from a biogeographical perspective*. Lecture for the Israeli Lepidopterists' Society.
- June 23, 2024 — *The activities of HaMaarag and the State of Nature report*. Teacher training as part of an educational seminar at the Steinhardt Museum of Natural History.

- July 2, 2024 — *Presentation of remote sensing outputs from HaMaarag reports and the planned seminar on remote sensing for nature conservation applications*. Lecture for the Survey of Israel within the framework of the Subcommittee Meeting for One Map for Israel.
- July 14, 2024 — *The activities of HaMaarag and the State of Nature report*. Israel Nature and Parks Authority, Southern District.
- July 14, 2024 — *The activities of HaMaarag and the State of Nature report*. Lecture for the residents of Midreshet Ben-Gurion.
- August 2, 2024 — *The butterflies and us: From observing nature to change*. First grade students at Alonim School, Tel Aviv.
- September 11, 2024 — *The activities of HaMaarag and the State of Nature report*. Lecture for the Board of Directors, Steinhardt Museum of Natural History.
- September 23, 2024 — *The activities of HaMaarag*. Lecture for Prof. Benny Chefetz, CEO of the Volcani Institute.

Contributions to teaching courses

- June 7, 2024 — *State of Nature Assessment*. Introduction to Ecology course, Ben-Gurion University of the Negev.
- July 1, 2024 — *The activities of HaMaarag and the State of Nature report*. Seminar at Porter School, Tel Aviv University.
- July 1, 2024 — *The activities of HaMaarag and the State of Nature report*. The Steinhardt Museum of Natural History, Tel Aviv.

Publications

- Grossbard, S. & Renan, I. (Eds) 2024. *State of Nature Report 2023 — Biodiversity*. HaMaarag — Israel's National Ecosystem Assessment Program, Steinhardt Museum of Natural History, Tel Aviv. 465 pp. (in Hebrew)
- Renan, I., Ben-Moshe, N., Gabay, T., Grossbard, Sh., Chen, R., Yerushalmi, I., Livne, I., Pasternak, E., Comay, O., Koren, M. & Karni, T. 2024. Summary of the first decade of biodiversity monitoring in Israel: Situation picture and major threats. *Forest — Journal of Forests and Open Lands Management*, 27, 7-17. (in Hebrew) https://www.kkl.org.il/yaar27_article15
- Stavi, I., Islam, K.R., Rahman, M.A., Gusarov, Y., Laham, J., Comay, O., Basson, U., Xu Chi, Xu Zhiwei & Argaman, E. 2023. Unexpected consequences of afforestation in degraded drylands: Divergent impacts on soil and vegetation. *Journal of Environmental Management*, 345, Art. 118703. <https://doi.org/10.1016/j.jenvman.2023.118703>

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 eukaryote species. Arthropods occupy 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 efforts in the Lab focus 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 experts. The large-scale arthropod sampling from different sites, seasons and methods, supplements the collection with valuable specimens.

The Lab's activity spans geographically from the Northern Golan Heights in the north to Eilat Mountains in the south. The current research projects include

- Long-term monitoring of arthropods across Israel's ecological units;
- Surveying and monitoring arthropods in newly established reserves and in unstudied existing reserves;
- Monitoring of arthropod communities in borders between the agricultural and natural landscapes and ecological corridors;
- Agricultural practices and agri-voltaic implements and their effect on the arthropod diversity;
- Providing operational recommendations for restoration management following ecological disasters in nature reserves;
- Assessment of the anthropogenic pressure on sensitive ecological systems;
- Monitoring and eradicating invasive insect species;
- Monitoring endangered arthropod species;
- Coordinating the compilation of the Israeli endangered invertebrate species 'red list'.
- Compilation of 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, Open Landscape Institute, Ramat Hanadiv and the Jewish National Fund (KKL-JNF).

This year we ran 18 research projects, published 13 reports and presented our studies at three national conferences. The lab employs two full-time and four part-time workers.

Reports

- *Assessing the effects of agri-voltaic land use on the agro-ecosystem as manifested in arthropod community composition — summary of 2022–2024 sampling seasons.* For the Ministry of Energy and Infrastructure and the Ministry of Environmental Protection.
- *Negev Highlands snails sampling in the winters of 2021–2024: the fall of Xerocrassa and the rise of Sphincterochila.* For HaMaarag.
- *Butterfly survey in Mount Dalton — spring 2024.* For INPA.
- *Restored plot margins and their effect on pollinator diversity in avocado plantations.* For Open Landscape Institute and Milopri.
- *Treating and monitoring Little Fire Ants in the zoological garden of Tel Aviv University — 2024 season.* For the Zoological Garden, Tel Aviv University.
- *Treating and monitoring Little Fire Ants in Kibutz Ein Gedi: Eradication efforts of an "island" population with all-year-round activity.* For INPA.
- *Little Fire Ant in parks across Northern Tel Aviv: treatment experiment using feeding stations.* For INPA, "Adama-Agan" and Tel Aviv Municipality.
- *Terrestrial arthropod communities sampling in Ein Gedi nature reserve in spring 2024: the emergence of stable preferences for tree species and visitor numbers.* For INPA.
- *The effectiveness of Advion and Victor in eradication of the Little Fire Ant.* For the Ministry of Environment Protection and "Adama-Agan".
- *Developing protocols treating Little Fire Ants in avocado and banana plantations.* For the Ministry of Agriculture & Rural Development.
- *Liometopum microcephalum: its distribution in the Upper Jordan Basin and its interaction with the Little Fire Ant.* For INPA and KKL-JNF.
- *The effect of agri-voltaic implements on pests and their natural enemies in cucumber greenhouses.* For Open Landscape Institute.
- *Bioacoustics and molecular research at the service of the Dead Sea Mole-Cricket survey of 2023.* For INPA.

Invited lectures

- *Bioacoustics and molecular research at the service of the Dead Sea Mole-Cricket survey of 2023.* The Entomological Society of Israel 2024 Conference.

- *Effects of soil removal on the recovery of oil-polluted soils in Evrona Nature Reserve – 1st year of monitoring.* The INPA Evrona Monitoring Conference, 2024.
- *Developing protocols treating Little Fire Ants in avocado and banana plantations.* The avocado growers course of the Ministry of Agriculture and Rural Development, 2024.

PEST RISK ASSESSMENT PROJECT FOR PLANT PROTECTION AND INSPECTION SERVICES

Zohar Yanai

Food security has become a crucial issue in recent decades due to the rapid increase in global trade in agricultural products. In order to provide a sufficient, nutritious diet, and to meet market demands, plant products are being imported to and exported from countries, and agricultural pests travel around the globe accordingly. Such organisms often arrive as stowaways and sometimes escape captivity, establish populations, and become notorious pests that cause severe damage to local crops. If established, they may impose serious risk to exported goods that would be banned in other countries (a very common practice in the EU, the leading export destination from Israel), which, in turn, may adversely affect the country's economy. In addition, this pathway may promote the introduction of invasive species hazardous to native biodiversity and ecosystems. The main taxonomic groups of relevant pests include molluscs, nematodes and arthropods — particularly mites, beetles, flies, aphids, scale insects, true bugs and moths. Potential risks raise great concerns among stakeholders, and, therefore, in most countries import of agricultural goods is continuously monitored and regulated. In Israel, the key responsibility in the efforts for defending agriculture and biodiversity against foreign pests rests with the Plant Protection and Inspection Services (PPIS) at the Ministry of Agriculture.

Rightfully considered among the strictest and most advanced services in the world, the Israeli regulators seek to prevent any introduction of unwanted stowaway. Inspectors often encounter unwelcome invertebrates in imported goods, and these are collected and documented and sent to taxonomic experts for identification and risk evaluation. The taxonomists of the Steinhardt Museum of Natural History (SMNH) are often the only specialists available, with relevant knowledge and experience, alongside access to the largest reference collections in the Middle East, to identify local and alien species, and advice regarding their biology and invasion potential. Decisions based on their opinion may have heavy economic outcomes.

In addition, as a preventing measure, a pest risk assessment (PRA) is prepared for every agricultural product that is requested by an importer. PRAs require thorough investigation of the existing knowledge on potential pests, and the only proper institution for the task in Israel is SMNH with its professional staff. Accommodating over 90% of active taxonomists in the country, SMNH has been approached to perform the initial analyses for each PRA. As a result, since December 2021, the SMNH staff have been involved in a joint PRA project with the PPIS. This file aligns with the international standards of PRAs and includes various details regarding potential pests that may infest, and/or transfer with, a product. Upon the PPIS's request, the SMNH staff is responsible for the first step in this assessment process, where relevant pest lists are obtained, and each of them is being analyzed by the in-house expert who summarizes information regarding their biology, distribution, economic impact and other relevant data. Based on this information, the PPIS officers can formulate product-specific regulations and measures. This joint project is of the highest importance for protecting Israel's food security, as well as the local agriculture and nature from invasive pests.

During 2023–2024, the project was coordinated by Dr Zohar Yanai and involved Prof. Netta Dorchin, Mr Leonid Friedman, Dr Liron Goren, Dr Moshe Guershon, Dr Armin Ionescu-Hirsch, Dr Liz Morgulis, Dr Tatyana Novoselsky, Dr Gideon Pisanty, Mr Oz Rittner, Dr Dany Simon, Dr Malkie Spodek and Mr Ofir Tomer. These experts contributed a total of 178 labor-hours and assessed 12 products.

THE FEATHER IDENTIFICATION LAB

Avigail Ben-Dov Segal, Amos Belmaker and Tamar Feldstein-Farkash

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 all available techniques.

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

Since 2011, the Steinhardt Museum of Natural History Feather Identification Lab works closely with the Israeli Air Force, the Israel Airports Authority and the Civil Aviation Authority. In 2013, an official contract between the parties was signed and the Lab provides around 150 identifications every year.

In addition, the lab assists the Israel Nature and Parks Authority to identify bird species collected during surveys on the effects of infrastructures on wildlife. The assessments include wind turbines, electric lines (electrocution and collision), trains, acoustic walls alongside roads and the solar power station at Ashalim. This cooperation has greatly expanded over the years, starting with a few illegal poaching cases to several hundred identifications a year now.

As part of the Steinhardt Museum of Natural History, we can consult the largest regional collection of birds (almost 25,000 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 fine details are inspected under the microscope. The feather microstructures have both systematic and diagnostic importance and are an effective tool for identifying the bird species. We have a comprehensive comparative collection of feather microscopic slides of many Palearctic species.

The Molecular Systematics Laboratory at the Museum (headed by Dr T. Feldstein-Farkash) regularly provides genetic identifications of the bird remains and compliments our microscopic and morphological work. This approach 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 2023–2024, the Lab examined 155 bird strike cases and 342 cases for the Israel Nature and Parks Authority. The Molecular Lab assisted with 139 of these cases.

During the reporting period, the Lab also assisted with identification of feather remains from an archeological site in Omer River, dated back to about 1500 years ago. Feather remains in archeological sites in Israel are a rare discovery, and we had a great opportunity to aid this archaeozoological research. Many whole feathers were found and their microscopic structures remained intact. This allowed identifying different bird orders and even exact species quite easily.

CENTER FOR ECOSYSTEM RESTORATION AND NATURE-BASED SOLUTIONS

Noam Ben-Moshe

Steering committee: Prof. Tamar Dayan (Steinhardt Museum of Natural History), Dr Doron Markel (KKL-JNF), Dr Gilad Ostrovsky (KKL-JNF), Dr Orit Skutelsky, Dr Asaf Tzoar (INPA) Dr Tamar Raviv (Ministry of Environmental Protection).

The Center for Ecological Restoration and Nature-Based Solutions was established in mid-2023 as a joint venture between the Steinhardt Museum of Natural History and the Jewish National Fund (KKL-JNF). Globally, ecological restoration is gaining significant attention. The United Nations

has declared the current decade (2021–2030) as the Decade of Ecosystem Restoration. In Israel, a small country with a high population density and growth rate, the imperative to restore the functionality, health and integrity of degraded, polluted or destroyed ecosystems, including agro and urban ecosystems, is particularly critical. The recent war has also left significant tracts of land damaged by military activity and rockets, necessitating urgent restoration efforts.

Despite these critical needs, the field of ecological restoration in Israel is still relatively nascent, with significant gaps in knowledge, experience and public awareness.

The Center's primary goal is to advance scientific and professional knowledge and expertise in ecological restoration and allied activities in Israel and to serve as a bridge between researchers, professionals and practitioners. This can be achieved through the following key activities:

- Gathering and analyzing knowledge from ecological restoration protocols, recent projects and case studies, making this information readily accessible to the public.
- Organizing conferences, seminars and professional courses.
- Providing support to researchers and students through scholarships and research grants.
- Facilitating communication, cooperation and synergy among academia, executive bodies, policy-makers, landowners, entrepreneurs, and local and international stakeholders.

The reporting period covers the inaugural year of the Ecological Restoration Center. As the first of its kind in Israel, the initial year was dedicated to knowledge acquisition and infrastructure development.

Initial mapping of the ecological restoration field in Israel

A comprehensive list of researchers, academics and practitioners from various government agencies, land management bodies and private companies involved in ecological restoration in Israel has been compiled. An initial mapping of ecological restoration projects in Israel has been conducted. A survey of approximately 30 professionals in the field was carried out to identify key areas for advancement, challenges and barriers.

Developing educational materials on ecological restoration

I have created and delivered a series of lectures on the principles of ecological restoration and practical applications, drawing on examples from both Israel and abroad. These lectures have been presented and well received at conferences including *Restoring the Tkuma region* (the October 7 affected area) and *Challenges in riparian vegetation restoration*, and academic courses *Challenges in Nature Conservation in Israel and the World* (Tel Aviv University) and *Applied Ecology* (Inter-University Institute, Ramat Hanadiv).

Workshop on challenges and barriers in riparian vegetation restoration

In recent years, a significant number of streams and freshwater bodies in Israel have been subject to, or are planned for, ecological restoration initiatives. A central challenge in these restoration efforts is the reintroduction and establishment of riparian vegetation in sensitive habitats. The workshop brought together over 60 professionals engaged in riparian vegetation restoration to discuss the primary challenges facing the field in Israel and to explore potential solutions. The outcomes of the workshop led to the identification of topics requiring further research, development and collaboration in order to develop an action plan with priorities. This plan is now in place, and some of the identified issues are already in further stages of research and implementation.

The workshop was organized in collaboration with the Open Landscape Institute (SMNH), KKL-JNF and Agma — the Knowledge Center for Streams and Basins.

Guidelines for the IDF on initial restoration of natural areas affected by military operations

During the ongoing war, numerous natural areas in Israel were damaged as a result of military activities. These damages included the construction of new roads, buildings within natural areas and reserves, littering and construction waste, fencing, and soil disturbances caused by vehicle traffic. Until now, the IDF lacked specific guidelines on how to vacate areas it had impacted and what actions it could take to minimize the incurred damage. The Center conceived a document with guidelines for the IDF to address this issue, and such a first-of-its-kind document was written. The document not only defines the actions that should be taken before vacating areas that have

been damaged, but also includes a communication and coordination system with the managers of open lands in Israel and defines professionals from these organizations who can guide the IDF's actions towards proper evacuation and initial restoration of the sites.

The document was made in collaboration with KKL-JNF, the Israel Nature and Parks Authority, the Society for the Protection of Nature in Israel and the Planning Directorate at the IDF.

Ongoing projects

- Publishing Guidelines for standards and principles for ecological restoration (in Hebrew), adapting the international standards (based on the foundational documents of the International Society for Ecological Restoration) to the Israel stakeholders. The manual will include the Hebrew vocabulary relevant to the field. The publishing is due in mid-2025.
- Building a website for the Center that will serve as a comprehensive resource for ecological restoration in Israel, featuring professional documents, research, case studies, an interactive map of restoration sites, and a calendar of upcoming events.

Conferences

- *Principles and standards in ecological restoration, opportunities for the plans of Tkuma*. The restoration of Tkuma Region (the areas affected by 7 Oct. attacks), Ministry of Environmental Protection, February 2024.
- Initiating and hosting a *Panel on restoration ecology*. The 4th Israeli Conference for Conservation Science, Hebrew University of Jerusalem, October 2024.

Publications

Ben-Moshe, N., Markel, D., Skotelsky, A., Ostrovsky, G., Porat, Y. & Dayan, T. 2024. Basic principles of ecosystem restoration. *Ecology and Environment*, 15(1), [1-11]. (in Hebrew)

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HOSTED CONFERENCES AND EVENTS

During the 2023–2024 academic year, the Steinhardt Museum of Natural History hosted 95 conferences, workshops and other events. These included numerous scholarly conferences for Tel Aviv University (Faculty of Medicine, Faculty of Engineering, Faculty of Exact Sciences, Faculty of Law, School of Mathematics, Cyber Center, and Institute of Local Government). In addition, the Jewish National Fund, Israel Nature and Parks Authority, Society for the Protection of Nature in Israel, Israel Society of Ecology and Environmental Sciences, Ramat Hanadiv, Matan – Investors in the Community, Israeli Forum for Sustainable Nutrition, Ministry of Environmental Protection, Ministry of Health, Ministry of Science and Technology, Ministry of Education, Israel Medical Association, Jewish Agency, Rothschild Partnerships, JCC Global, Friends of Tel Aviv University and many other organizations held their conferences and events on the museum's premises. Highlighted are the conferences organized—entirely or in part—by the SMNH and the museum staff.

- 1. The annual meeting of the Sharks Association in Israel**
The Steinhardt Museum of Natural History
- 2. Conference of the Hayamim Association** (Prof. Roi Holzman)
The Steinhardt Museum of Natural History
- 3. Seminar for biology teachers on the 2024 State of Nature report**
The Steinhardt Museum of Natural History
- 4. Symposium *Biological invasions in Israel: where are we and where are we heading?***
The Steinhardt Museum of Natural History (27.05.2024)
- 5. Seminar on remote sensing**
HaMaarag, the Steinhardt Museum of Natural History
- 6. Workshop on *Challenges and barriers in riparian vegetation restoration*** (1.10.2024)
Center for Ecological Restoration (SMNH), Open Landscape Institute (SMNH), KKL-JNF, and Agma – the Knowledge Center for Streams and Basins
- 7. Alternative Proteins meeting**
The Israeli Forum for Sustainable Nutrition
- 8. Workshop on research interfaces between society, nature conservation and ecology**
The Hebrew University of Jerusalem
- 9. TRANSMEET Festival (19–21.09.2024)**
The Fetter Museum of Art and Nanoscience, Bar Ilan University
- 10. Resource management course**
Forum of Managers of Cultural Institutions
- 11. A meeting of cultural leaders: *Canva Course***
Forum of Managers of Cultural Institutions
- 12. KKL Educators' seminar** (16.07.2024)
The Jewish National Fund
- 13. Seminar** (19.12.2023)
Pre-Military Preparatory School in the Upper Galilee
- 14. Event for women students in mathematics** (31.01.2024)
Faculty of Exact Sciences, School of Mathematics, Tel Aviv University
- 15. The event of the Center for Industrial Relations** (8.02.2024)
Center for Industrial Relations, Tel Aviv University
- 16. TAD joint workshop with Google** (19.02.2024)
Center for Artificial Intelligence and Data Science, Tel Aviv University
- 17. "Friends Plus" activities of the Friends Association** (21.02.2024)
Tel Aviv University Friends Association
- 18. Ankuri Conference** (1.03.2024)
Ankuri

19. Tel Aviv University Faculty of Medicine event (12.03.2024)
Faculty of Medicine, Tel Aviv University
20. Event of the Faculty of Medicine (23.06.2024)
Faculty of Medicine, Tel Aviv University
21. The Israeli Radiological Association Conference (24.09.2024)
The Israeli Radiological Association
22. Philanthropy Conference (for the next generation leadership community) (22.05.2024)
Tel Aviv University Alumni Organization
23. Third conference of the Tel Aviv University Epidemic Research Center (2024)
Center for Combating Pandemics, Tel Aviv University
24. Farewell event for Prof. Adriana Kemp (Head of School of Social and Policy Studies) (28.07.2024)
Faculty of Social Sciences, Tel Aviv University
25. Conference: Shmerologim 2024 (15.05.2024)
Faculty of Life Sciences, Tel Aviv University
26. The Math School event (31.05.2024)
Faculty of Exact Sciences, School of Mathematics, Tel Aviv University
27. Year-end meeting of the Tel Aviv Women In Mathematics (TWIM) organization and awards of excellence (18.09.2024)
Faculty of Exact Sciences, School of Mathematics, Tel Aviv University
28. Biosoft Center Conference (School of Physics) (27.06.2024)
Faculty of Exact Sciences, School of Physics, Tel Aviv University
29. Minerva Conference for Human Rights (20.06.2024)
Faculty of Law, Tel Aviv University
30. Farewell event for Attorney Keren Raplansky-Elad
Faculty of Law, Tel Aviv University
31. Center for Artificial Intelligence and Data Science (TAD) Conference: Physical sciences in AI (18.06.2024)
Center for Artificial Intelligence and Data Science, Tel Aviv University
32. Cyber Week 2024 (24–27.06.2024)
Tel Aviv University Cyber Center
33. Meeting No. 2 LEAD: 2024 (7.05.2024)
Tel Aviv University Rector's Office
34. Tel Aviv University Rector's office meeting (30.07.2024)
Tel Aviv University Rector's Office
35. Switzerland Institute conference (26.09.2024)
Tel Aviv University, Faculty of Medicine, Shaw Institute
36. Brecht's Antigone (play)
EVE — Independent Theater and Performance Artists Organization
37. Tu Beshvat meeting: parents and children (25.01.2024)
eToro (Israel) Ltd.
38. Celebrating 35 years for InterTech (26.09.2024)
InterTech Ltd.
39. Investors in Research Conference, by Prof. Kobi Shuyer (5.03.2024)
Elbit Systems Ltd.
40. Parents and children event
Akim Israel
41. Brainstorming session: proposal with the possibility of splitting (11.07.2024)
The EcoPeace Middle East organization promotes cooperation in the fields of ecology
42. The Faculty of Life Sciences event
Faculty of Life Sciences, Tel Aviv University
43. The Annual meeting of the Directors of the Foreign Friends' Societies
Tel Aviv University Foreign Relations

44. Meeting of Union Managers: The meeting of the professionals. Board of Trustees
Tel Aviv University Foreign Relations
45. The event *Coming to the first grade* for the children of the university's employees
(7.07.2024)
Human Resources Division, Training and Welfare Section, Tel Aviv University
46. Human Resources Division meeting (18.06.2024)
Human Resources Division, Training and Welfare Section, Tel Aviv University
47. Managers' meeting with the rector: the university management and academic managers
(10.12.2023)
Human Resources Division, Training and Welfare Section, Tel Aviv University
48. Workshop (19.05.2024)
Human Resources Division, Training and Welfare Section, Tel Aviv University
49. The conference of the Institute for Local Government was postponed due to the war
(15.01.2024)
Institute of Local Government, Tel Aviv University
50. A meeting of students from Musrara School (7.01.2024)
Musrara — The Naggar Multidisciplinary School of Art and Society
51. Training day for experienced chain managers from all over the country (21.05.2024)
GCC Global
52. Expert Committee: The Israel Society of Ecology and Environmental Sciences
The Israel Society of Ecology and Environmental Sciences
53. Interns' team-building day (24.01.2024)
The Israel Child and Adolescent Psychiatric Association
54. A meeting on the topic of building international collaborations in the young academy
(29.09.2024)
The Israel Academy of Sciences and Humanities
55. Study day: Prof. Yossi Leshem (11.12.2023)
Society for the Protection of Nature in Israel
56. Oil Law Study Day
Society for the Protection of Nature in Israel
57. Seminar for Taglit instructors (8.05.2024)
The Israeli Experience / Taglit
58. Professional seminar for the Israel Medical Association
The Israel Medical Association
59. Directors conference (19.06.2024)
Hye Ltd.
60. Conference of the Edmond de Rothschild Bridge for Higher Education (25.06.2024)
The Edmond de Rothschild Partnerships
61. Friends of the Tel Aviv Museum of Art: Parents and children event: Hanukkah
Friends of the Tel Aviv Museum of Art
62. Preparatory event (10.05.2024)
Pre-Military Preparatory School in the Upper Galilee
63. Zoology course for students of the Tel-Hai Academic College
Tel-Hai Academic College
64. Activities (11.03.2024)
ORT Israel Research & Development Center
65. Sessions of the second cycle of the senior program *Tave/* of the Ministry of Education
(20.03.2024)
The Heschel Center for Sustainability
66. Meetings of the second cycle of the senior program *Tave/* of the Ministry of Education
(3.04.2024)
The Heschel Center for Sustainability

67. Learning session (10.07.2024)
Ministry of Science and Technology
68. Event *We Go to Grade A* (summer 2024) (26.07.2024)
Sapiens International Corporation N.V.
69. Finance Department Meeting
Adi Katz Shapira, Steinhardt Museum of Natural History
70. Haaretz event (28.01.2024)
Haaretz newspaper
71. Meeting of the *Out for Change* Association
Association *Out for Change*
72. Training for academic staff and senior administrative staff from a variety of academic institutions across the country (11.09.2024)
Matan: Investing in Community
73. Event of the youth association leading a change (18.06.2024)
Aharai: Follow Me! Youth Leading Change
74. Amyloidosis Association Israel Conference (7.06.2024)
Amyloidosis Association Israel
75. The Orange Heart: Nickelodeon Children's Volunteer Awards
Ananey Paramount
76. Parents and children event (20.08.2024)
Fiverr
77. Event *We Go to Grade A* (summer 2024) (3.07.2024)
Medical Fund *Clalit*
78. *Quality Indicators in Medicine* Conference (20.05.2024)
National Institute for Quality in Medicine & Kaleidoscope Productions Ltd.
79. Ramat Hanadiv training
Ramat Hanadiv
80. The Israel Nature and Parks Authority annual conference on nature conservation
Israel Nature and Parks Authority
81. Snake catchers course 2024 (training 1)
Israel Nature and Parks Authority
82. Snake catchers course 2024 (training 2)
Israel Nature and Parks Authority
83. Snake catchers course 2024 (training 3)
Israel Nature and Parks Authority
84. ORT network managers' conference update (20.12.2023)
ORT Israel
85. Training day for young social workers (15.05.2024)
The Edmond de Rothschild Partnerships
86. The Edmond de Rothschild Partnership Training Day (19.05.2024)
The Edmond de Rothschild Partnerships
87. The Edmond de Rothschild Partnerships Training (26.06.2024)
The Edmond de Rothschild Partnerships
88. Training day for young social workers (29.05.2024)
The Edmond de Rothschild Partnerships
89. Daily meeting (10.04.2024)
The Edmond de Rothschild Partnerships
90. Meeting (23.07.2024)
The Edmond de Rothschild Partnerships
91. Summary meeting for the 5th cycle of *Leaders in Academia* program (14.12.2023)
The Edmond de Rothschild Partnerships

92. Rothschild Ambassadors Program Meeting (20.05.2024)
The Edmond de Rothschild Partnerships
93. Meeting 29.07.2024)
The Edmond de Rothschild Partnerships
94. Tour for teachers: *Battle plan for engagement in society's education for high schools*
(7.05.2024)
Karev Foundation
95. Study evening in honor of Esther Zandberg's retirement: *Planning and society / planning and communication* (23.05.2024)
Tamar Zandberg



SUPPORT FOR ACADEMIC AND OTHER COURSES

The natural history collections of the Steinhardt Museum are extensively used in higher education. Some courses are museum-based, others 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 higher education institutions (Bar-Ilan University, Levinsky College of Education) use the museum's facilities for their specialized programmes. The Museum's Education and Science Communication Department also make use of the collections for diverse audiences.

Museum-based courses

During the 2023–2024 academic year, the Steinhardt Museum of Natural History offered 15 elective academic courses, which were given by the museum researchers and/or by visiting scientists at no participation fee, and were approved for credit points. The courses were aimed at undergraduates and advanced students, of all Israeli academic institutes, as well as at professionals of governmental and non-governmental organizations.

1. Sustainable aquaculture (5 consecutive days; 3 credit points)
by Dr Shevy Rothman and Dr Zafrir Kuplik
2. Science communication (online course, 3 frontal meetings; 3 credit points)
by Dr Yaela Golumbic and Prof. Noa Shenkar
3. Natural history collections as research infrastructure (5 consecutive days; 3 credit points)
by Dr Karin Tamar
4. Taxonomy, ecology and biology of fishes (5 consecutive days; 3 credit points)
by Dr Shevy Rothman
5. Quaternary extinctions: Why? How many? Where? and How do we know it? (5 consecutive days; 3 credit points)
by Dr Meirav Meiri and Prof. Shai Meiri
6. Stream ecology: From fundamental to applied (5 consecutive days; 3 credit points)
by Dr Yaron Hershkovitz
7. Winter ponds ecology (9 consecutive days; 4 credit points)
by Dr Zohar Yanai and Dr Liron Goren
8. Citizen science (Sundays during 2nd semester; 2 credit points)
by Dr Yaela Golumbic
9. Ecology and evolution of Hymenoptera (Sundays & Tuesdays, half of 2nd semester; 3 credit points)
by Dr Gideon Pisanty
10. The enigmatic world of jellyfish (Medusozoa) (Mondays during 2nd semester; 3 credit points)
by Dr Zafrir Kuplik
11. Biodiversity crisis: Policy, politics and regulation (5 consecutive days; 3 credit points)
by Dr Ronit Justo Hanani
12. Biological invasions (Sundays during 1st semester; 2 credit points)
by Dr Zohar Yanai
13. Taxonomy and systematics — the foundation of life sciences (5 consecutive days; 3 credit points)
by Dr Liron Goren and Dr Tom Shlezinger
14. Topics in stable isotope paleoecology (5 consecutive days; 2 credit points)
by Prof. Mark T. Clementz
15. Applied ecology (3 credit points)
Dr Ittai Renan and Dr Liat Hadar

Courses taught by museum scientists at higher education institutions

1. Introduction to natural sciences (Levinsky Wingate Academic College)
by Dr Jotham Ziffer-Berger
2. Introduction to archaeobotany (Faculty of Life Sciences, Tel Aviv University)
by Prof. Dafna Langgut
3. Practical workshop in archaeobotany (Faculty of Life Sciences, Tel Aviv University)
by Prof. Dafna Langgut
4. Introduction to archaeozoology (Faculty of Life Sciences, Tel Aviv University)
by Prof. Lidar Sapir-Hen
5. Practical workshop in archaeozoology (Faculty of Life Sciences, Tel Aviv University)
by Prof. Lidar Sapir-Hen
6. Vertebrates (Faculty of Life Sciences, Tel Aviv University)
by Prof. Shai Meiri
7. Bird and amphibian faunistics (Faculty of Life Sciences, Tel Aviv University)
by Prof. Orr Spiegel, Prof. Eran Levin and Prof. Eli Geffen
8. Mammal and reptile faunistics (Faculty of Life Sciences, Tel Aviv University)
by Prof. Eran Levin, Prof. Eli Geffen and Prof. Shai Meiri
9. World of insects (Faculty of Life Sciences, Tel Aviv University)
by Prof. Netta Dorchin
10. Research skills (Faculty of Life Sciences, Tel Aviv University)
by Prof. Netta Dorchin
11. Insects of Israel — field excursions (Faculty of Life Sciences, Tel Aviv University)
by Prof. Netta Dorchin
12. Applied molecular species identification (Faculty of Life Sciences, Tel Aviv University)
by Prof. Dorothee Huchon, Dr Omri Bronstein and Dr Tamar Feldstein-Farkash
13. Gelatinous zooplankton (Inter-University Institute for Marine Sciences, Eilat)
by Dr Zafrir Kuplik
14. Advanced *Invertebrate Zoology*: Platyhelminthes, Annelida (Tel Aviv University)
by Dr Liron Goren
15. Zoology (Tel Aviv University)
by Prof. Noa Shenkar
16. The invertebrates: Comparative functional biology (Tel Aviv University)
by Prof. Noa Shenkar
17. Discovering the sea (Tel Aviv University)
by Prof. Noa Shenkar
18. Open space conservation and biodiversity
by Open Landscape Institute staff
19. Challenges in nature conservation in Israel and the world (Tel Aviv University)
by Dr Noam Ben-Moshe
20. Applied ecology (Inter-University Institute, Ramat Hanadiv)
by Dr Noam Ben-Moshe

Other courses and behind-the-scene tours for academic organizations and professionals

During the 202–2024 academic year, The Steinhardt Museum of Natural History hosted dozens of tours around the collections and *ad hoc* one-day courses or seminars for students, educators, professionals and employees of government organizations. Examples of such events are listed below.

1. Training for staff of the Veterinary Services and Animal Health Department, Ministry of Agriculture and Food Security.
2. A course on activities and strategies that promote thinking in science education for School of Education, Faculty of Humanities, Tel Aviv University.
3. A guided tour for Dr Dov Hanin, the Chairman of the Climate Forum, and students of the Porter School of Environmental Studies, Tel Aviv University.
4. A guided tour for doctors and employees of the Tel Aviv Sourasky Medical Center – Ichilov.
5. A guided tour for employees of the Department of Computing, the Hebrew University of Jerusalem.
6. A guided tour for Hagit Peleg Rotem (BA, MA), and expert in visual culture, art, design, architecture and urban trends.
7. A guided tour for employees of the Israel Antiquities Authority (facilitated by Dan David Center).
8. A guided tour for employees of the Ministry of Defense.
9. A guided tour for teachers of the Maritime Education School.
10. A guided tour for science teachers of the Lehava Amit School, Kedumim.
11. A guided tour for graduate students from the Life Sciences Department of Bar-Ilan University.
12. A guided tour for international MSc students of the Sagol School of Neuroscience, Tel Aviv University.
13. A guided tour for graduate students of the Bezalel Academy of Arts and Design.
14. A guided tour on insects for students from the Open University.
15. A guided tour for students of the Kibbutzim College of Education, Technology and the Arts.
16. A guided tour for students of the Shenkar College.
17. A tour on *Plants of Israel* for students of the Open University.
18. A seminar *Animal lexicon – Issues in multi-sexual history* for students of the Cohn Institute for the History and Philosophy of Science, Tel Aviv University.
19. Guided tours for employees of the Plant Protection and Inspection Services, Ministry of Agriculture.
20. Guided tours for teachers and students of the Tel-Hai Academic College.
21. *Introduction to Evolution* for students of the David Yellin College of Education.
22. Seminar for management and teaching staff of the Branko Weiss Institute.



PUBLICATIONS

The Steinhardt Museum of Natural History is an important research infrastructure, used by scientists nationally and internationally. Below is the list of 2023–2024 publications, which covers all works of researchers affiliated with the SMNH. It also includes other publications if those have been 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 2022–2023 Annual Reports are also included below.

Articles in refereed and other journals

1. Abadi, I., Torfstein, A., Friesem, D.E., Langgut, D., Jin, M., Rabinovich, R., Steiner, T., Zurro, D., Gur-Arieh, S., Ovadia, A. & Goring-Morris, N.A. 2024. Heinrich Event 2 (ca. 24 ka BP) as a chrono-climatic anchor for the appearance of Epipaleolithic backed bladelets microlith industries in the Southern Levant. *Quaternary Science Reviews*, 33, Art. 108649. <https://doi.org/10.1016/j.quascirev.2024.108649>
2. Adair, R.J., Kolesik, P., Bronstein, O. & Dorchin N. 2024. Seven new *Rhopalomyia* gall midges (Diptera: Cecidomyiidae) from Australia broaden the scope of the genus. *Austral Entomology*, 63(3), 332–359. <https://doi.org/10.1111/aen.12703>
3. Amit, T., Beninger, P.G., Yahel, G. & Loya, Y. 2024. Coral hosts provide more than shelter to boring bivalves. *Ecology*, 105(8), e4376. <https://doi.org/10.1002/ecy.4376>
4. Amit, T., Beninger, P.G., Yahel, G. & Loya, Y. 2024. The perks of life as a coral-boring bivalve. *Bulletin of the Ecological Society of America*, 105(4), e2177. <https://doi.org/10.1002/bes2.2177>
5. Amit, T., Moskovich, R., Jacobi, Y., Shumway, S., Ward, J.E., Beninger, P.G., Yahel, G. & Loya, Y. 2023. Feeding on the smallest cells: an *in situ* study of picoplankton capture by bivalve molluscs from oligotrophic waters. *Frontiers in Marine Science*, 10, Art. 1184773. <https://doi.org/10.3389/fmars.2023.1184773>
6. Arlé, E., Knight, T.M., Jiménez-Muñoz, M., Biancolini, D., Belmaker, J. & Meyer, C. 2024. The Cumulative Niche Approach: a framework to assess the performance of ecological niche model projections. *Ecology and Evolution*, 14(2), e11060. <https://doi.org/10.1002/ece3.11060>
7. Atzeni, L., Ilany, A., Geffen, E., Cushman, S.A., Kaszta, Ž. & Macdonald, D. 2024. Reviving the Arabian leopard: Harnessing historical data to map habitat and pave the way for reintroduction. *Biological Conservation*, 291, Art. 110440. <https://doi.org/10.1016/j.biocon.2024.110440>
8. Avidan, C., Day, S.W. & Holzman, R. 2023. A power amplification dyad in seahorses. *Proceedings of the Royal Society B: Biological Sciences*, 290(1996), Art. 20230520. <https://doi.org/10.1098/rspb.2023.0520>
9. Azrieli, B., Cohen, E., Livne, L., Ramon, D., Tsemel, A., Bigal, E., Shemesh, E., Zemah-Shamir, Z., Barash, A., Tchernov, D. & Scheinin, A. 2024. Characterising a potential nearshore nursery ground for the blackchin guitarfish (*Glaucostegus cemiculus*) in Ma'agan Michael, Israel. *Frontiers in Marine Science*, 11, Art. 1391752. <https://doi.org/10.3389/fmars.2024.1391752>
10. Bar, A., Gilad, T., Massad, D., Ferber, A., Ben-Ezra, D., Segal, D., Foitzik, S. & Scharf, I. 2023. Foraging is prioritized over nestmate rescue in desert ants and pupae are rescued more than adults. *Behavioral Ecology*, 34(6), 1087–1096. <https://doi.org/10.1093/beheco/arad083>
11. Bar, S., Levy, L., Avidan, S. & Holzman, R. 2023. Assessing the determinants of larval fish strike rates using computer vision. *Ecological Informatics*, 77, Art. 102195. <https://doi.org/10.1016/j.ecoinf.2023.102195>
12. Bar-Yosef Mayer, D.E. & Schechter, H.C. 2024. Shells as personal adornments in Neolithic cultures: An introduction. *Journal of Archaeological Science: Reports*, 56, Art. 104573. <https://doi.org/10.1016/j.jasrep.2024.104573>
13. Barzilai, O., Marder, O., Tejero, J.-M., Ayalon, A., Bar-Matthews, M., Abulafia, T., Lavi, R., Goder-Goldberger, M., Shemer, M., Edeltin, L., Wiegmann, A., Frumkin, A., Karasik, A., Yasur, G., Yeshurun, R., Zohar, I., Berna, F., Hans, M., Goldberg, J.S., McDermott, Y., Spurlock, L., Pokhraj, A., Habashi, W., May, H., Sarig, R. & HersHKovitz, I. 2024. Early human collective

- practices and symbolism in the Early Upper Paleolithic of Southwest Asia. *Proceedings of the National Academy of Sciences of the USA*, 121(51), e2404632121. <https://doi.org/10.1073/pnas.2404632121>
14. Beitlilum, I., Rayyan, F., Pokhojaev, A., Tal, H. & Sarig, R. 2024. A novel micro-CT analysis for evaluating the regenerative potential of bone augmentation xenografts in rabbit calvarias. *Scientific Reports*, 14(1), Art. 4321. <https://doi.org/10.1038/s41598-024-54313-4>
 15. Benita, M., Menahem, A., Scharf, I. & Gottlieb, D. 2024. Inter-and intraspecific female behavioral plasticity drive temporal niche segregation in two *Tribolium* species. *Behavioral Ecology*, 35(1), arad116. <https://doi.org/10.1093/beheco/arad116>
 16. Ben-Moshe, N., Markel, D., Skotelsky, A., Ostrovsky, G., Porat, Y. & Dayan, T. 2024. Basic principles of ecosystem restoration. *Ecology and Environment*, 15(1), [1-11]. [in Hebrew] <https://magazine.isees.org.il/pdf/57663.pdf>
 17. Bereza, D., Grey, E. & Shenkar, N. 2023. Prioritizing management of high-risk routes and ports by vessel type to improve marine biosecurity efforts. *Journal of Environmental Management*, 336, Art. 117597. <https://doi.org/10.1016/j.jenvman.2023.117597>
 18. Binvignat, P., Chaurasia, A., Lahoud, P., Jacobs, R., Pokhojaev, A., Sarig, R., Ducret, M. & Richert, R. 2024. Isotopological remeshing and statistical shape analysis: Enhancing premolar tooth wear classification and simulation with machine learning. *Journal of Dentistry*, 149, Art. 105280. <https://doi.org/10.1016/j.jdent.2024.105280>
 19. Bodner, L., Jasinska, W., Bouchebti, S., Scharf, I., Brotman, Y. & Levin, E. 2024. Metabolomics analysis of larval secretions reveals a caste-driven nutritional shift in a social wasp colony. *Insect Biochemistry and Molecular Biology*, 169, Art. 104128. <https://doi.org/10.1016/j.ibmb.2024.104128>
 20. Bouchebti, S., Gershon, Y., Gordin, A., Huchon, D. & Levin, E. 2024. Tolerance and efficient metabolism of extremely high ethanol concentrations by a social wasp. *Proceedings of the National Academy of Sciences of the USA*, 121, e2410874121. <https://doi.org/10.1073/pnas.2410874121>
 21. Braz Sousa, L., Kenneally, C., Golumbic, Y.N., Martin, J.M., Preston, C., Rutledge, P. & Motion, A. 2024. Teacher experiences and understanding of citizen science in Australian classrooms. *PLoS ONE*, 19(11), e0312680. <https://doi.org/10.1371/journal.pone.0312680>
 22. Briski, E., Kotronaki, S.G., Cuthbert, R.N., Bortolus, A., Campbell, M.L., Dick, J.T.A., Fofonoff, P., Galil, B.S., Hewitt, C.L., Lockwood, J.L., MacIsaac, H.J., Ricciardi, A., Ruiz, G., Schwindt, E., Sommer, U., Zhan, A. & Carlton, J.T. 2024. Does non-native diversity mirror Earth's biodiversity? *Global Ecology and Biogeography*, 33(1), 48-62. <https://doi.org/10.1111/geb.13781>
 23. Buba, Y., Kiflawi, M., McGeoch, M. & Belmaker, J. 2024. Evaluating models for estimating introduction rates of alien species from discovery records. *Global Ecology and Biogeography*, 33(8), e13859. <https://doi.org/10.1111/geb.13859>
 24. Burton, A.C., Beirne, Ch., Gaynor, K.M., ... Belmaker, J., ... Namir, I., ... Zorn, A. & Kays, R. 2024. Mammal responses to global changes in human activity vary by trophic group and landscape. *Nature Ecology and Evolution*, 8, 924-935. <https://doi.org/10.1038/s41559-024-02363-2>
 25. Četković, I., Serena, F., Barash, A., Mrdak, D., Giovos, I., Ikica, Z., Đorđević, N., Pešić, A., Divanović, M. & Milošević, D. 2024. Combining official fisheries monitoring and citizen science data to create the first chondrichthyan checklist of Montenegro. *Acta Adriatica*, 65(1), 21-31. <https://doi.org/10.32582/aa.65.1.4>
 26. Chaikin, S. & Belmaker, J. 2023. Fish depth redistributions do not allow maintenance of abundance in a region of rapid change. *Oikos*, 8, e09650. <https://doi.org/10.1111/oik.09650>
 27. Chaikin, S., De-Beer, G., Yitzhak, N., Stren, N. & Belmaker, J. 2023. The invasive silver-cheeked toadfish (*Lagocephalus sceleratus*) predominantly impacts the behavior of other non-indigenous species in the Eastern Mediterranean. *Biological Invasions*, 25(4), 983-990. <https://doi.org/10.1007/s10530-022-02972-7>

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31. Dann, A., Pokhojaev, A., Anton, M., Yalovitsky, G., Kallevag-Pelleg, R. & May, H. 2024. Changes in human calcaneal morphology throughout the Pleistocene-Holocene Levant. *Frontiers in Earth Science*, 12, Art. 1294350. <https://doi.org/10.3389/feart.2024.1294350>
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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*.
- 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— Yael Goll (E. Geffen)
Leadership in rock hyrax society.
- 2015— Victoria Roul (H. May)
3-D shape of the femur and its association with osteoarthritis of the knee.
- 2015— Erez Shoham (Y. Benayahu)
Mesophotic octocorals of Eilat, northern Red Sea.
- 2016— Ruth Pelleg-Kallevag (H. May)
Changes in lumbar intervertebral discs characteristics with the development of lumbar spinal curvature.
- 2016— Andressa Duran (S. Meiri and D. Chapple)
Lizard macroecology.
- 2016— Ziv Kassner (G. Ribak)
The mechanics and behavior of aerial interception by insects.
- 2016— Michaela Kolker (R. Holzman and S. Meiri)
Early life history of fish in the Mediterranean Sea.
- 2016— Lilah Rajzman (M. Ilan)
Red Sea mesophotic sponges.
- 2016— Svetlana Vaisman (T. Dayan)
Exotic and invasive molluscs in Israel.
- 2016— Heeli Schechter (D.E. Bar-Yosef Mayer and N. Goring-Morris)
The social, economic and symbolic uses of marine mollusks in the Neolithic of the Southern Levant.
- 2016—2023 Itay Nudel (R. Sarig)
Secondary dentin evaluation using computerized tomography: application for anthropology and forensics.
- 2017— Tal Amit (Y. Loya)
Ecology and physiology of coral symbiotic populations.
- 2017— Assaf Ben-David (T. Dayan)
Citizen science as a tool for strengthening one's sense of community and sense of place through ecological research on the effect of land use on biodiversity.
- 2017— Francesca Falco (T. Dayan)
Solving scale mismatches in agro-biodiversity conservation policy: an effectiveness comparative analysis.

- 2017— Talya Shalom (T. Dayan)
Other dimensions of globalization: The evolutionary development of environmental standards for the agricultural industry in a country that leans upon exporting its agricultural production.
- 2017— Tomer Urca (G. Ribak)
The dispersal flight of (*Batocera rufomaculata*): The biomechanics, physiology and ecology of a tree-boring beetle.
- 2017— Gay Yohananoff (M. Ilan)
Measuring sponge filtration.
- 2017—2023 Amal Bader Farraj (R. Sarig)
The evolutionary changes in root morphology of molars and their relation to function.
- 2017—2023 Waseem Habashi (R. Sarig)
The effect of biomechanics and enamel chemical composition on dental attrition.
- 2018— Sarah Rapoport (H. May and I. HersHKovitz)
Middle Paleolithic child from TinsHemet cave.
- 2018— Rona Nadler-Valency (T. Dayan)
Wolf-rancher interactions in the Golan Heights: which practices support coexistence?
- 2018— Liron Israely (T. Dayan and O. Moshe)
Optimizing riparian buffer restoration in agricultural landscapes: Ecological, economic, and social considerations.
- 2018— Guy Sinaiko (S. Meiri and Ch. Dietrich)
Taxonomy of the leafhopper genus *Neoaliturus* (Cicadellidae) in Israel.
- 2018— Amir Sarig (G. Ribak)
Flight biomechanics of miniature insects .
- 2018— Mark Cavanagh (D. Langgut and E. Ben Yosef)
The paleoenvironment of the southern Arava during historical periods.
- 2018— Nitsan Ben Melech (D. Langgut and Y. Gadot)
Chronology and Landscape Archaeology — The use of OSL dating in the Judean Mountains.
- 2018—2024 Shahr Chaikin (J. Belmaker)
Processes underlying fish depth distributions.
- 2018—2024 Sarah Ohayon (J. Belmaker)
Wideband acoustic methods for estimating fish spillover distance from Marine Protected Area.
- 2018—2024 Gal Vered (N. Shenkar)
Monitoring the effects of microplastic in tropical environments.
- 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 *Entotheonella* sp.
- 2019— Yael Hockema (D. Langgut and Y. Gadot)
The use of wood beams in monumental buildings in ancient Jerusalem.
- 2019— Gal Eviatar (O. Bronstein)
Unraveling patterns of sexual reproduction — echinoderm reproductive behavior.
- 2019—2023 Michal Pe'er (R. Sarig)
Thermal alteration of teeth: Changes in volume and morphology.

- 2019—2024 Hanna Rapuano (O. Bronstein and Y. Loya)
Aspects of aging in colonial and solitary scleractinian corals.
- 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— Carmel Herold-Lozover (N. Dorchin)
Biology and ecology of the Little Fire Ant, *Wasmannia auropunctata*, 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)
Analysis of regulatory sequences in developmental genes involved in domestication of Canidae.
- 2020— Mai Lazarus (R. Holtzman and J. Belmaker)
Examining relationships between larval, juvenile and adult fish communities.
- 2020— Dror Malul (R. Holtzman and Uri Shavit, Technion)
The mechanical properties of coral tentacles and their contribution to the efficiency of mass transfer.
- 2020— Tal Perevolotsky (R. Holtzman and A. Genin, HUJI)
Biomechanics and evolution of algal grazing in coral reef fish.
- 2020— Gal Navon (N. Shenkar)
Assessing the extent and impact of pharmaceutical contamination along the coasts of Israel.
- 2020— Merav Lebel (Y. Sapir and J. Belmaker)
Predicting success of rare species translocations.
- 2020— Tal Gavriel (J. Belmaker)
Disentangled the influence of rare, transient, and absent species (dark diversity) on reef fish diversity patterns.
- 2021— Amit Hadad (H. May)
The association between lower limb morphology and hip osteoarthritis development.
- 2021— Nihan Dilşad Dağtaş (V. Slon)
Methodological advancements in sedimentary ancient DNA research.
- 2021— Avery Deveto (J. Belmaker)
Predicting fish invasion success.

- 2021— Krishna Chaitanya (S. Meiri)
Taxonomy & phylogeny of Indian dragons (Agamidae: Draco).
- 2021— Anna Zimin (S. Meiri and U. Roll, BGU)
Ecological and morphological traits that shape extinction risk in reptiles.
- 2021— Talya Shalom (T. Dayan and E. Feitelsohn)
Biodiversity conservation under agricultural governance structures.
- 2021— Shlomo Preiss-Bloom (T. Dayan)
How do lethal wolf management and anthropogenic land use shape the mammal community structure of the Golan Heights?
- 2021— Lachan Roth (O. Bronstein)
Maintaining genetic diversity in marine broadcast spawners through Cryptic Female Choice (CFC).
- 2021— Lisa-Maria Schmidt (O. Bronstein)
Reproductive dynamics of broadcast spawners revealed through environmental DNA (eDNA).
- 2021— Rotem Zirler (O. Bronstein)
Using Autonomous Reef Monitoring Structures (ARMS) to evaluate marine biodiversity in the Eastern Mediterranean Sea.
- 2021— Shir Bar (R. Holzman)
Using machine learning to study fish movement, feeding and morphology.
- 2022— Inbar Dahan (J. Belmaker)
Mesophotic reef diversity.
- 2022— Jacob Dembitzer (S. Meiri and P. Raia; University of Naples, Italy)
Morphological and lineage diversification in Mesozoic and recent Synapsids and Sauropsids.
- 2022— Michele Maurici, University of Naples L'Orientale, Italy (D.E. Bar-Yosef Mayer, with Prof. Andrea Manzo, University of Naples and Prof. Gianluca Miniaci, University of Pisa, Italy)
Shells and shell artifacts from archaeological contexts of ancient Egyptian and Nubian cultures between the third and first half of the second millennia BCE.
- 2022— Minji Jin (D. Langgut)
Early Pleistocene palynological reconstruction at 'Ubeidiya.
- 2022— Raz Platin (N. Shenkar)
Natural products from the solitary ascidian *Styela plicata*.
- 2022— Sagi Marom (R. Holzman)
Client loyalty in biological markets.
- 2023— Hagar Csillag (G. Ribak)
The hydrodynamic of foot propulsion in diving and surface swimming ducks.
- 2023— Ori Stearns (G. Ribak)
The aerodynamics and biomechanics of dispersal flight in the mango stem borer *B. rufomaculata*.
- 2023— Mayyan Dassa (H. May)
Characterization of non-carious cervical lesions.
- 2023— Michal Graitzer Hadad (H. May)
The growing trunk: New insights into the transition to bipedal locomotion on muscles and bones characteristics.
- 2023— Giulia Di Crosta (V. Slon)
Ancient DNA of Prehistoric populations in the southern Levant.
- 2023— Dheeraj Chaudhary (V. Slon)
The Pleistocene to Holocene transition in Central Europe through sedimentary ancient DNA.
- 2023— Yael Klirs (D. Huchon)
Molecular evolution of tunicate mitochondrial genomes.

- 2023— Almog Hershko-Pnuel (N. Dorchin)
Taxonomy and ecology of Israeli Trichoptera.
- 2023— Yael Kenigsberg (N. Dorchin)
Insect-plant-fungus interactions in cecidomyiid galls.
- 2023— Ayala Porat (T. Shlesinger)
Sex allocation in hermaphroditic organisms.
- 2024— Eden Harel (N. Shenkar)
Plastic interaction with benthic marine organisms.

MSc / MA students

- 2013— Michal Zeitsov (T. Dayan)
Barn owls as biological control agents in the northern Negev.
- 2017— Amir Rubinstein (J. Belmaker)
Scaling of bird co-occurrence and phylo-diversity.
- 2018— Nitzan Yitzhak (J. Belmaker and N. Stern)
The ecology of alien Tetraodontidae in the eastern Mediterranean Sea.
- 2018— Elinor Levy (H. May)
Gracilization of the human skeleton during human history: The biomechanical vs. the 'self-domestication' theories.
- 2019— Helena Gondra (H. May)
Changes in osteoporosis prevalence during the Holocene Levant.
- 2019— Itzhak Dishon (V. Slon)
Pleistocene faunal and floral characterization at the archaeological site of Sefunim Cave, Israel.
- 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— Yulia Gordover (T. Dayan and L. Sapir-Hen)
Human-animal relationship in Middle Pre-Pottery Neolithic B Ein Miri.
- 2019— Alol Dor (F. Ben-Ami and D.E. Bar-Yosef Mayer)
The freshwater shells of the Epipalaeolithic site of JRD as paleoclimate and paleoenvironment indicators.
- 2019— Bar Fogel (M. Ilan)
The sponge *Agelas orides* microbiome.
- 2019—2023 Yulia Peleg-Kushnarev (G. Ribak)
Flight control during the approach of miniature insects to visual targets.
- 2019—2023 Hagar Csillag (G. Ribak)
Waterfowl swimming hydrodynamics.
- 2019—2023 Or Filc (G. Ribak and B.-E. Pinchasik)
Aerodynamics and mechanical properties of flapping wings.
- 2019—2023 Karin Meschiany Sabag (R. Sarig)
The evolutionary transition from the second to the first molar dominance.
- 2020— Adi Rachum (Y. Yovel)
Changes in behavior of Egyptian fruit bats in captivity and the wild.
- 2020— Amal Atallah (L. Sapir-Hen)
Ways of life, culture and environment in Masada during the Great Revolt, as reflected in the analysis of animal bones.
- 2020— Timrat Leniado (S. Meiri and U. Roll)
Effects of taxonomic practice on reptile threat assessments.

- 2020— Ziad Nasser el-Din (T. Dayan)
Status of the Arabian wolf (*Canis lupus arabs*) in Palestine.
- 2020— Yuval Goth (J. Belmaker and Y. Ram, TAU)
Phase shifts and alternative stable states.
- 2020— Yamit Romano (J. Belmaker and J. Benayahu)
Apolonia beach yellow spill.
- 2020—2023 Zohar Afek (T. Dayan)
Butterfly effect: the survival and crash of the butterflies *Tomars nesimachus* and *Apahatis cilissa*.
- 2020—2023 Fatma Rayyan (R. Sarig)
Histomorphometric study of a novel magnesium-based bioresorbable membrane in critical size defects of rabbit's calvaria.
- 2020—2023 Petunia Fernandez (L. Sapir-Hen)
Animal economy in Azekah during the Middle Bronze Age and the nature of the settlement.
- 2020—2023 Bin Wang (L. Sapir-Hen)
The donkey economy in the Middle Bronze Age Southern Levant: Tel Azekah as a case study.
- 2020—2024 Eran Shwartzfuchs (T. Dayan and D. Orenstein)
Analyzing human-wildlife interactions in the urban context.
- 2020—2024 Einav Lazar (D. Huchon and Y. Benayahu)
The soft corals genera *Cladiella* and *Klyxum*: taxonomy and their symbiotic unicellular algae.
- 2021— Yakir Carmeli (H. May)
Development of the articular vertebral process of the lumbar spine during growth: a three-dimensional study.
- 2021— Dafna Luz (N. Dorchin)
Taxonomy and ecology of Elmidae (Coleoptera) in Israel.
- 2021— David Bilbinder (L. Sapir-Hen)
The microfauna from Sefunim Cave.
- 2021— Uri Wolkowski (M. Meiri and N. Maron, University of Haifa)
Taxonomic and ecological characterization of the extinct Hartebeest (*Alcelaphus* sp.) population in Israel.
- 2021— Aliza Leit (J. Belmaker and G. Rilov, IOLR)
Restoration of abrasion platforms.
- 2021— Jonathan Ben-Simon (S. Meiri and U. Roll, BGU)
Comparing biological traits of extinction and threat.
- 2021— Anuj Shinde (S. Meiri and U. Roll, BGU)
Comparison of activity time in snakes and lizards.
- 2021— Chen Donghe (S. Meiri and U. Roll, BGU)
Macroecology of snake traits — species distribution models.
- 2021— Yan Liberman (S. Meiri and F. Ben-Ami)
Biodiversity in winter pools.
- 2021— Shoham Zoref (S. Meiri and F. Ben-Ami)
Biodiversity in winter pools in different seasons of the year.
- 2021—2023 Yaara Shafrir (D.E. Bar-Yosef Mayer, D. Friesem and I. Groman-Yaroslavski)
The plaster beads from Nahal Hemar Cave: Typology, micro-geoarchaeology and utilization.
- 2021—2024 Noga Gavrieli (Y. Loya)
Life history traits of the scleractinian coral *Stylophora pistillata* and its associated boring bivalve *Leiosolenus lessepsianus* in the Gulf of Eilat/Aqaba.
- 2021—2024 Ori Hepner (J. Belmaker)
Soft bottom fish community structure.

- 2022— May Hershkovich-Reshef (G. Ribak)
Effect of larval growth conditions on the adult flight performance.
- 2022— Racheli Hadjez (D. Huchon)
The genome of the myxozoan *Henneguya salminicola*.
- 2022— Elad Ben Yehuda (L. Sapir-Hen)
Iron I cultures.
- 2022— Ilya Nudelman (N. Dorchin)
Chemical Ecology of the Little Fire Ant (*Wasmannia auropunctata*).
- 2022— Maya Gross (Y. Loya)
Physiological effects of the boring bivalves *Leiosolenus lessepsianus* on the skeleton properties of their coral host *Stylophora pistillata*.
- 2022— Yamit Shkalim (O. Bronstein)
The echinoid fauna of Israel.
- 2022— Aran Sofer (O. Bronstein)
From a drop of water to biodiversity — using eDNA in metabarcoding analyses.
- 2022—2024 Bar Gabso (N. Shenkar and Y. Yovel)
Learning and memory storage in the solitary ascidian *Polycarpa mytiligera*.
- 2022—2024 Amit Unger (N. Shenkar)
Impact of global change on ascidian physiology and distribution.
- 2022—2024 Daria Leibin Graiver (D.E. Bar-Yosef Mayer, O. Lipschitz and I. Koch)
Shells from Iron Ages sites in Judah.
- 2022—2024 Mai Bonomo (O. Bronstein)
Holothuroid ecology, biology, and taxonomy in the Gulf of Aqaba (Red Sea).
- 2022—2024 Tal Ratner (D. Rabinowitz and Y. Hershkovitz)
Implementation of integrated watershed management and its connection to the development of social and environmental measures of streams restoration — Tavor Valley case study.
- 2022—2024 Dana Kruger (R. Holzman)
Suction flows in pipefish.
- 2023— Ofri Weiss-Lipshitz (J. Belmaker)
Consequences of an ongoing invasion by a key herbivore in temperate reefs.
- 2023— Yuval Mendelson (Y. Yovel and J. Belmaker)
Acoustic monitoring of reef fish diversity.
- 2023— Tamar Hamiel (N. Truskanov and J. Belmaker)
Spatial propagation of fear-response to fishing.
- 2023— Yonat Gefen (R. Holzman and J. Belmaker)
Cross-taxa comparison of alien introduction rates.
- 2023— Dan Golanski (G. Yahel and J. Belmaker)
Heat wave influences on fish behavior.
- 2023— Shoval Segal (O. Bronstein and N. Stern)
eDNA as a complementary tool for long-term marine monitoring using Mediterranean fish assemblages as test group.
- 2023— Tamer Genaim (H. May)
Evaluation of micro gap penetration characteristics of implant-supported prosthesis connections — *in vitro* study.
- 2023— Roni Sapir (D. Langgut and D.E. Bar-Yosef Mayer)
The wooden beads from Neolithic Heimar Cave.
- 2023— Nimrod Katzir (L. Sapir-Hen)
Human-animal relations at Motza II: The Animal Management Strategy of a 'Megashite' in the FPPNB Levan.
- 2023— Shaul Beirach Shva (L. Sapir-Hen and I. Kreimerman)
The animal ritual at MB Tel Hazor.

- 2023— Talia Perl (N. Dorchin)
Biology and taxonomy of oak gall midges in Israel and the natural enemies of oak galls in their terrestrial phase.
- 2023— Eyal Sabag (G. Ribak and B.-E. Pinchasik)
Wing deformation in flexible insect inspired flapping wings.
- 2023— Ahmad Ayoub (N. Shenkar)
Ocean acidification effects on the solitary ascidian *Herdmania momus*.
- 2023— Noa Lev (N. Shenkar)
Challenging the physiological tolerance of the invasive ascidian *Styela plicata* as a tool for mitigation and control.
- 2023— Shir Perets (Y. Loya)
Coral-boring bivalves association in an era of global warming.
- 2023— Asaf Nashiv (B.Sh. Rothman and J. Belmaker)
Crypto-banctic fish communities in shallow rocky reefs in the Mediterranean Sea.
- 2023— Nour Alhouda Akel (T. Shlesinger)
Taxonomy and phylogeny of the scleractinian coral family Pocilloporidae.
- 2023— Itai Grisaru (T. Shlesinger)
The reproductive and trophic phenology of a deep-reef stony coral.
- 2023— Sean Ben-Shaprut (T. Shlesinger)
Modeling coral population dynamics across depth.
- 2024— Mika Doron (Y. Loya)
The effect of boring bivalves on coral host physiology.
- 2024— Liat Beinuri (Y. Loya)
The diversity and abundance of coral-boring bivalves' symbiosis.
- 2024— Hadar Hayun (N. Truskanov and D. Eilam)
Spatial orientation and the creation of a spatial representation during inverted movement.
- 2024— Maayan Neiger Rachmilevitch (N. Truskanov and M. Kiflawi)
Individual differences in cooperative behavior in facultative cleaner fish.
- 2024— Noa Ben-Ami (T. Shlesinger)
The rapid recent invasion of a soft coral to the Mediterranean Sea: A study of abundance and reproductive patterns between two seas.
- 2024— Raz Levi (T. Shlesinger)
Long-term monitoring of corals translocated to artificial structures and nurseries in Eilat.

Post-doctoral fellows

- 2019— Shira Penner Rosenvasser, *Taxonomy of Trigonella and Medicago (Fabaceae)*.
- 2020—2023 Gabriel Henrique de Oliveira Caetano, *New methods of assessment of the conservation status of reptiles*.
- 2021— Reut Vardi, *Citizen science, urbanization & reptile distribution and physiology*.
- 2021— Eduardo Arlé, *Modeling invasive species distribution changes*.
- 2022— Roberta Graboski Mendes, *A phylogenetic-taxonomic survey of the Israeli reptile fauna*.
- 2022—2024 Netanel Kramer, *Quantifying attributes of boring bivalve populations in corals using micro-computed tomography*.
- 2022—2024 Yaela Golumbic, *Bridging citizen science and science communication*.
- 2023— Aurora Campo, *Evolutionary insights into non-synonymous mutations of the gene MTHFR*.
- 2023— Pnina Cohen, *Reconstructing our evolutionary past using sediment DNA: Best practices and applications*.
- 2023— Ernesto Testé, *Unraveling the enigma of date palm cultivation in the southern Levantine region: Integrating genomic and seed morphometric approaches*.

- 2023— Stanislava Eisová, *Physical loadings during the transition to a sedentary way of life.*
- 2023— Prajval Singh, *Archeogenomics in warm climates — studying ancient human occupations and the environment in North India and the southern Levant.*
- 2023— Valentina Vanghi, *Characterization of archaeological sediments to facilitate the a priori selection of samples for ancient DNA analyses.*
- 2023— Adi Barash, *Using observations collected from social media through the MECO project to explore trends in the distribution of sharks and rays in the Mediterranean Sea.*
- 2024— Nicolas Perez, *Dynamics of jellyfish swarms.*
- 2024— Michaela Kolker-Ghatan, *Shifting seascapes: Examining half a century of coral diversity in the Red Sea.*
- 2024— Aviv Avisar, *Transportation infrastructure's underpasses as a tool for improving ecological connectivity.*



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 2023–2024. 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
2023-2024	S. Vaisman	Plant Protection and Inspection Services	Israel	Mollusca
2023-2024	H. Greenfield	University of Manitoba	Canada	Archaeozoology
2023-2024	A. Sasson	San Diego Natural History Museum, CA	USA	Archaeozoology
10/2023	D. Melamed	Citizen scientist	Israel	Bryophyta
11/2023	M. Miller	Reneco International Wildlife Consultants	UAE	Conservation genetics
11/2023	A. Carapezza	University of Palermo	Italy	Heteroptera
12/2023	S. Ziani	Meldola	Italy	Coleoptera
01/2024	N. Hasegawa	Hokkaido University	Japan	Ascidians
01/2024	J. Buse	Black Forest NP	Germany	Coleoptera
01/2024	A. Israel	Oceanographic and Limnological Research	Israel	Seaweeds aquaculture
01/2024	M. Clementz	University of Wyoming	USA	Tetrapoda
01-03/2024	A. Zimmin	Tel Aviv University	Israel	Tetrapoda
03/2024	E. Hadad	Israel Nature and Parks Authority	Israel	Tetrapoda
02/2024	N. Yap	St John's Island National Marine Laboratory	Singapore	Cnidaria
02/2024	K. Fadeev	Zoological Institute, St. Petersburg	Russia	Hymenoptera
02/2024	S. Kadowaki	Nagoya University	Japan	Archaeology
02-05/2024	Yuri Marusik	Inst. Biol.Problems of the North, Magadan	Russia	Spiders
03/2024	G. Sabatinelli	Musee Historie Naturelle, Genève	Switzerland	Coleoptera
03/2024	Ch. Feld	University of Duisburg-Essen	Germany	Aquatic ecology

Date	Name	Institute	Country	Expertise
03/2024	A. Lorenz	University of Duisburg-Essen	Germany	Aquatic ecology
03/2024	D. Sokoloff	School of Plant Sciences and Food Security, TAU	Israel	Microscopy
04/2024	J. Eberle	University of Salzburg	Austria	Coleoptera
04/2024	D. Lukic	University of Salzburg	Austria	Coleoptera
04-09/2024	C. Martino	University of Pavia	Italy	Crustacea
06/2024	S. Abramovich	Ben Gurion University	Israel	Palaeontology
06/2024	M. Husemann	Leibniz Institute for Biodiversity, Hamburg	Germany	Insects
07/2024	D. Cafri	Ministry of Agriculture and Rural Development	Israel	Bryophyta
07/2024	E. Levin	Tel Aviv University	Israel	Tetrapoda
07/2024	U. Roll	Midreshet Sde Boqer	Israel	Tetrapoda
07/2024	C. Ujma	Haifa University	Israel	Tetrapoda
07/2024	A. Shitrit	Private, Art	Israel	Tetrapoda
08/2024	E. Ben Yehuda	Tel Aviv University	Israel	Tetrapoda
09/2024	M. Kazavchinsky	Tel Aviv University	Israel	Tetrapoda
09/2024	Me'ir Orbach	Haifa University	Israel	Tetrapoda
09-11/2024	M. Volkovitsh	Zoological Institute, RAS, St. Petersburg	Russia	Coleoptera: Buprestidae

SUPPORT FOR ORGANIZATIONS & INDIVIDUALS

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 2023–2024. The list is not exhaustive, for under the current condition of under-staffing we are unable to monitor and record all such activities. The Museum's database was extensively used by the research community worldwide (p. 54).

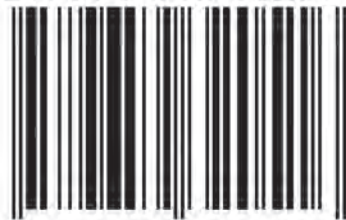
Purpose	Name	Institute	Taxonomic group
Loan	A. Koinova	Tel Aviv University	Porifera
Loan	C. McFadden	Harvey Mudd College, CA, USA	Octocorallia (~400 samples for genetic analysis)
Loan	L. Sapir-Hen	Tel Aviv University, Israel	Mammalia
Loan	Education Dept.	SMNH, Israel	Mammalia
Loan	Jin-Koo Kim	Ichthyology Laboratory, Yongso-ro, Nam-gu, South Korea	Fish
Loan	A. Dorchin	Mons University, Belgium	Hymenoptera
Loan	A. Muller	Private researcher, Switzerland	Hymenoptera
Loan	Th. Wood	Naturalis Museum, the Netherlands	Hymenoptera
Loan	G. Melika	George Melika National Food Chain Safety Office, Hungary	Hymenoptera
Loan	L. Fusu	Alexandru Ioan Cuza University, Romania	Hymenoptera
DNA loan	M. Miller	Reneco, United Arab Emirates	Birds
Tissue loan	D. Bilyeli Øksnebjerg	University of Copenhagen, Denmark	Birds
Tissue loan	C. Vilà	Estación Biológica de Doñana, Spain	Birds
Tissue loan	R. Dor	The Open University, Israel	Birds
Tissue loan	D. Jablonski	Comenius University in Bratislava, Slovakia	Reptiles
Tissue loan	S. Carranza	Universitat Pompeu Fabra, Spain	Reptiles
Tissue loan	A. Riesgo	Museo Nacional de Ciencias Naturales de Madrid, Spain	Sponges
Tissue loan	N. Stern	Israel Oceanographic and Limnological Research, Israel	Fish

Purpose	Name	Institute	Taxonomic group
Tissue loan	P. Rask Møller	The Natural History Museum of Denmark	Fish
Tissue loan	S. Manel	University Montpellier, France	Fish
Molecular ID	H. Noyberger	Ministry of Agriculture, Israel	Crustaceans
Molecular ID	B. Galil	SMNH, Israel	Crustaceans
Molecular ID	A. Belmaker	SMNH, Israel	Birds
Molecular ID	Sh. Rothman	SMNH, Israel	Fish
Molecular ID	B. Gal	SMNH, Israel	Fungi
Molecular ID	D. Simon	SMNH, Israel	Insects
Molecular ID	O. Rittner	SMNH, Israel	Insects
Molecular ID	Z. Efremova	SMNH, Israel	Insects
Molecular ID	T. Novoselska	SMNH, Israel	Insects
Molecular ID	H. Mienis	SMNH, Israel	Mollusca
Molecular ID	L. Goren	SMNH, Israel	Polychaeta
Molecular ID	D. Furth	Smithsonian National Museum of Natural History, USA	Insects
Molecular ID	M. Ilan	Tel Aviv University, Israel	Porifera
Molecular ID	Sh. Meiri	Tel Aviv University, Israel	Reptiles
Molecular ID	O. Bronstein	Tel Aviv University, Israel	Echinoderms
Molecular ID	F. Ben-Ami	Tel Aviv University, Israel	Crustaceans
Molecular ID	M. Zaitzove-Raz	Tel Aviv University, Israel	Mammals
Molecular ID	G. Ben Zvi	SMNH, Israel	Insects
Identification	L. Segal	Independent artist, Israel	Glass artifacts
Identification	Plant Protection and Inspection Services, Israel		Insects, molluscs
Identification	Entomological Laboratory for Applied Ecology, SMNH		Insects
Identification	N. Stern	Israel Oceanographic and Limnological Research	Crustacea
Identification	H. Lubinevsky	Israel Oceanographic and Limnological Research	Crustacea
Identification	A. Regev	Aquatech Fisheries, Ramat HaNegev	Porifera

Purpose	Name	Institute	Taxonomic group
Identification	Israel Nature and Parks Authority		Fishes, seaweeds
Identification	R. Trivizky	Atarim (Tel Aviv)	Marine invertebrates, Fishes
Identification	Y. Mandelik	Hebrew University of Jerusalem	Hymenoptera
Identification	U. Paz	Private, nature photographer	Anthophila
Identification	M. Gezunterman	Private	Anthophila
Identification	H. Segre	Volcani Institute	Hymenoptera
Identification	INaturalist		mainly Hymenoptera
Identification	Wild Bees of Israel Facebook Group		Hymenoptera
Identification	Hymenopterists Forum Facebook Group		Hymenoptera
Identification	Wild Bees Wattsapp group		Hymenoptera
Identification	D. Cafri	Ministry of Agriculture and Rural Development	Bryophyta
Identification	Y. Hershkovitz	Israel National Center for Aquatic Ecology, SMNH	Ephemeroptera
Identification	Israel Oceanographic and Limnological Research		Echinodermata
Deposition of specimens	R. Shtein	Tel Aviv University	Crassulaceae



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