



## The National Natural History Collections of the Hebrew University of Jerusalem

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The Hebrew University of Jerusalem is home to the unique and diverse National Natural History Collections (NNHC) of the southern Levant. The collections, which are the most complete existing collections of their kind for the Middle East, serve not only as a secure repository for natural history specimens but also for scientific research in evolution and ecology, taxonomy and systematics, biodiversity, conservation and conservation genetics, agriculture and wildlife forensics. The NNHC also serves academic teaching, public education, and professional advice to other national institutes (i.e. Israel Nature and Park Authority (INPA), the Ministry of Health, etc.) and community outreach. All biological and geological collections are national assets. They provide us with markers and milestones for exploring the continuity of evolutionary biological change and diversity of the biome, especially given the impact of climate change.

**1. Items in the collections:** The NNHC comprise 12 collections: geology (mineralogy), bio-anthropology, archeozoology, paleontology and palaeobotany, Herbarium (botany collection), birds, amphibia and reptilia, fish, mycology, marine and terrestrial invertebrates and the wildlife CryoBank (Table 1). Several collections are recognized as “National Collections” (i.e. Herbarium, arachnology, geology and paleontology). Rare species, extinct and endangered species, including type and voucher specimens, are present in the collections. Presently the number of primary types is ca. 7,660, but species new to science are continually discovered through the research conducted in the collections.

**2. Collection of samples:** Collection started at the beginning of the 20th century. Our three main collection approaches are (a) planned research expeditions, usually a survey of the fauna and flora of a region of interest; (b) research conducted on a specific academic topic; (c) sporadic collections by researchers and the public. All collections activities are conducted under permits from the INPA. On average, 11,500 new specimens are collected each year in addition to bi-anthropological and archaeozoological assemblages (Table 1).

**3. Techniques for conservation:** Ms. Gali Beiner, a professional conservator (MA, ACR) directs the conservation activities, which include:

(1) Preventive Conservation issues, such as environmental monitoring, storage improvement, and maintenance policies. The new housing and storage facilities of “The Israel Aharoni bird collection”

will greatly enhance storage and documentation. All specimens are currently undergoing conservation treatment, documentation and digitization within a new database (Fig. 1).

- (2) Direct treatment of objects and collections including *in situ* conservation work on paleontological, archeozoological and extant zoological specimens, for example the conservation of elephant skeletal parts from the site of Erq el Ahmar (2-1.5 million years ago). The findings were treated *in situ* during excavation (Fig. 2) and further conserved in the Paleontology Laboratory until ready for research and future display, similar to specimens from the site of Revadim (Beiner et al., 2013, see section 11).
- (3) Conservation research to improve materials and methodologies applied in natural history collections, such as materials testing (Beiner et al., 2015, see section 11), materials and methods for labels in wet collections, disinfestation practices for different natural history collections, etc.
- (4) Consultation and mentoring – Israeli institutions consult with Ms. Beiner to create conservation recommendations and guidelines for their collections (e.g. the Beit Gordon Museum in Degania A, Beit Hankin in Kefar Yehoshua). Direct assistance is also given such as for the Upper Galilee Museum of Prehistory in Maayan Baruch (Fig. 3). We also offer professional internships to suitable individuals or institutions, e.g. the Israel Antiquities Authority.

**4. Technical personnel:** Our academic and non-academic staff consist of 52 members (Table 2), excluding temporary workers. They have extensive experience in conducting collections-based projects through local, national and international networking with representatives of other academic and national institutions. Unfortunately, several specialized members are emeriti, a situation that **highlights the pressing immediate need to hire new staff (bio-anthropology, mollusk and fish collections)**. Hence, we are checking the option of recruit academic curators as Research Associates/Senior Research Associates.

A diagram of the personnel structure is in Fig. 4 and indicates the requirements of each position (a comprehensive version is available upon request). The academic curator's (tenure-track) responsibility is to maintain and develop the potential of the collections to be used in advanced research with modern methodologies, to increase the collection-based studies, and develop national and international collaborations. The academic manager (scientific manager) is the key scientist responsible for developing the collection as a foundation/infrastructure for collection-based research, and in-charge of maintaining the collection, collecting new specimens, conducting taxonomic and systematic identification, cataloging all specimens and administrating the collection database. This includes conducting research, supervising students together with the academic curator (MSc, Ph.D. and Post-doc), teaching and providing accessibility to the collections for the scientific community (national and international) and the public.

**5. Catalogs and databases:** Digitization of NNHC-HUJI has been ongoing and in 2013 a major hurdle was overcome with the establishment of custom-made software tailored to our specific needs. Three collections (Fish, Herpetology, and Birds) are completely computerized and digitized and the fourth collection, the Herbarium, is in the process (Table 1). A new and innovative rapid system utilizing a barcode module to create a virtual image of both the specimen and its relevant data is being implemented in the Herbarium (Fig. 5). While building the database, we used publicly available datasets for data quality improvements including, among others: Global Biodiversity Information Facility (<http://www.gbif.org/>); The Plant List (<http://www.theplantlist.org/>); Reptiles Database (<http://www.reptile-database.org/>); and Amphibian Web (<http://amphibiaweb.org>). In addition, NNHC-HUJI is accessible to the public through the collections' remodeled website (<http://nnhc.huji.ac.il/>) and a Facebook page (<https://www.facebook.com/nationalnaturalhistorycollections>). The active Facebook page facilitates the distribution of news related to the collections. The website enables public accessibility to each collection and provides a separate virtual space to communicate with both the academic and non-academic community yet maintaining a uniform look and simple access. Relevant aspects of the computerized data were imported into the website and an application was built in order to allow the proper display and easy editing of information on different collections within the same framework. Since the information of all collections is managed within a central database, one may search for data from all collections in the web site data query page ([http://nnhc.huji.ac.il/?page\\_id=113](http://nnhc.huji.ac.il/?page_id=113)). The website and the Facebook page are part of the means of exposing the research conducted in the collections to the general public and engaging the public in collections activities ("citizen science"), with the purpose of increasing awareness of the activities taking place in the collections.

Presently, about 70% of the specimens curated in the collections are computerized, about 40% of which are cataloged and digitized in the new system (Fish, Herpetology, Avian and 120,000 Herbarium specimens). The process of cataloging and digitizing all of the collections is an ongoing process to which we devote time and efforts. Nevertheless, most of the information pertinent to the other collections is available through the website. Due to our awareness of the importance of digitization and computation of the collection, we have been granted access to VI-SEEM services (IUCN Infinity Cloud; VI-SEEM Archival service; VI-SEEM Data Analysis service). By the end of 2018, two projects will be launched: (1) Transition of the database into a new, more advanced internet catalog system; (2) Establishment of the "Aharoni" Online Digitized Collection Catalog, an innovative project aimed at creating an appropriate platform to present and preserve the greatest Levantine faunal collection from the beginning of the 20<sup>th</sup> century.

**6. Physical infrastructure:** The collections are located in the Edmond J. Safra Campus in laboratories that were designed in the early 1960s. The facility contains storage space, laboratory/open space dedicated to research and offices. Renovation efforts over the years culminated in providing decent

curation conditions for most of the collections. In order to monitor the collections conditions, dataloggers continuously collecting temperature and relative humidity. Results obtained from the dataloggers led to the renovation of the facility in the Herbarium (i.e. new windows and air-conditioning), so as to maintain a cool dry environment installation of air conditioning systems in other collections, e.g. the bird collection. *Nevertheless, the physical conditions in the facilities still require serious upgrading to meet the published standards of conservation in natural history collections as given by the conservation guidelines of the Consortium of European Taxonomic Facilities (CETAF).* Major renovations are needed to achieve those standards, for example: (1) The Herbarium, **the** national collection and the largest botanical collection of the Middle East, is composed of specimens that are currently stored in wooden cupboards but **must** be substituted for metal compactors for protection from damage by fire and insects. (2) There is an urgent need for additional curation facilities and space especially for the paleontological, paleobotanical, herpetological, terrestrial invertebrate and fish collections. The extensive research conducted by the NNHC staff has increased the number of new specimens, e.g. the Miocene research conducted by Prof. Rabinovich, the Paleontology collection, which revealed Proboscidea (elephant) specimens that required the need for additional storage or display space (Fig. 2). (3) All biological type specimens (~7660; Table 1) and special rare books must be stored properly in a safe room to prevent damage from fire or earthquakes.

*The equipment* at the NNHC is diverse, according to the specific research conducted in each collection. All collections have an office space accessorized with a computer for the use of visitors, Ph.D. students and post-doctoral researchers. The equipment available at the NNHC include: Invertebrate Collections Laboratory - digital Nikon SMZ 25 stereomicroscope with NIS-Elements D (Nikon 2015 version 420) for Multi-layer pictures (Licensed Zerene Stacker (Version 1.04) is also available), in addition to four other stereomicroscope, two compound microscopes, three dissecting microscopes (Nikon and Zeiss), a fluorescent transmitting microscope (Nikon) and an AZ100 zoom stereoscope (Nikon), darkroom area, a temperature controlled insect room, equipment for molecular (PCR machines, temperature blocks and gel equipment) two incubators and several computers. Herpetological and Avian Collections - 2X CO<sub>2</sub>- controlled growing chambers, cooling incubator, drying ovens, microbalance, analytical balances, semi-microbalance, LI-7000-Closed Path CO<sub>2</sub>/H<sub>2</sub>O gas analyzer, CRDS-Picarro G2201-i Analyzer for  $\delta^{13}\text{C}$  for methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>), 16 port manifold for flow through respiratory, PH- meter, ball-mill, grinders, Lyophilizer, Antaris II FT-NIR Analyzer, Dissecting Microscope +Camera, Ocean Optics Flame Spectrometer, video cameras, HH2 Soil Moisture Meter PR2 + Soil Moisture Profile Probe. Wildlife CryoBank equipment to conduct molecular genetics and genomic research spread in physically separated laboratories for ancient vs. modern DNA. Each lab is fully equipped with UV hoods dedicated for preparation of samples, extraction and PCR setting. Each UV hood is equipped with separate set of pipettes to prevent contamination. The laboratory is equipped with additional equipment such as mini-centrifuge, hot plate, hybridization oven,

cross-linker, two 96-well thermocyclers, one 96-well gradient thermocycler, one real time PCR machine, gel electrophoresis apparatus, a small incubator, a water bath for sub-cloning, a camera, computational system for gel electrophoresis documentation and an ABI 3730XL capillary sequencer. Liquid nitrogen container, refrigerators, -20°C freezers and three -80°C freezers and available to curate all specimens. In addition to the laboratory equipment the lab has in house facilities to conduct genetic and genomics analysis: Linux-based Dell PowerEdge T620 server equipped with Intel Xeon-based 2.00GHz 6 cores, 96GB RAM (1333MHz) and 2X4TB hard drives, equipped with all the relevant software intended for analyzing high-throughput Next Generation data. These include: Geneious Pro, SVS Power Seat, GenomeBrows, IGV, BWA, Bowtie, Samtools, GATK, PicardTools, Vcfutils etc, including in-house scripts developed especially for NextGen WGS analyses. In addition, there are six Windows computers and two Mac Pro laptops that are capable of data analysis and are loaded with software such as Sequncher5.4. *Herbarium* storage cabinets, freezers for specimen maintenance, binocular. The NNHC has access to the Nano-Center of the HUJI for any other equipment such as ESEM, a critical point dryer, and a coater. The GIS Center services as well as a computer laboratory, are in the same building.

**7. Researchers using the collection:** The NNHC is active in scientific research and the NNHC staff has extensive experience in conducting collection-based projects through local (HUJ scientists), national and international networks with representatives of other academic institutions. In most cases, the research is conducted *via* collaborative studies between the NNHC scientists and the researcher(s). In many cases, the collections are studied solely by external researchers committed to acknowledge the NNHC. Each year the NNHC hosts ~120 visitors conducting research in the different collections (Fig. 6, based on computerized database information). Visit periods vary from a few days to several months, depending on the project. The diverse research projects include a wide range of scientific fields: taxonomic and systematic evolution and ecology, biodiversity (including field surveys), conservation and conservation genetics, agriculture, ancient DNA and wildlife forensics. Research involving destructive sampling of specimens, such as DNA and Isotope studies, requires the approval of the NNHC sampling committee (application forms at [http://nnhc.huji.ac.il/?page\\_id=1525](http://nnhc.huji.ac.il/?page_id=1525)). Researchers using the collections through their studies are required to acknowledge the NNHC in all of their related scientific publications.

**8. Policy for external users:** The collections are a national asset and as such are open to the public. We welcome researchers that are interested in conducting a collection-based study on the specimens curated in the collections. In order to use them the external researcher must choose whether to request the specimen(s) for loan or visit the collection and work *in situ* on the specimens. In both cases the user must contact the academic curator and/or the scientific collection manager to discuss the availability of

the specimens, the methods to be used to conduct the study, and to finalize the way to carry out the study (Visit/Loan). Type specimens, rare specimens and specimens that have limited presentation in the collections are not loaned. As part of the agreement between the external user and the academic curator, the NNHC has an official form that the researcher needs to sign prior to starting the research ([http://nnhc.huji.ac.il/?page\\_id=1525](http://nnhc.huji.ac.il/?page_id=1525)). The external user is required to acknowledge the NNHC in his or her scientific publication. The number of outgoing loans (parcels) is ~700 every year. Loans are sent only to universities or museums (not to private collectors) and it is free of charge. For example, the Herbarium has been hosting guest researchers since 1928 and its material is also available in the form of specimen loans or or electronic format (scanned specimens). The Herbarium engages in international specimen exchanges with many Herbaria such as Paris, Vienna University, Vienna National Collection, Montreal, Palermo, Missouri and Edinburgh. The outgoing loans of specimens from the Herbarium are controlled through the computerized system. Likewise, due to the importance of the material in the Fish Collection (associated with the Lessepsian migration), there is constant contact with internationally renowned ichthyologists, with whom we exchange loan material and visits. We are in the process of creating an integrated Collection Management System to provide our collections with a unified loan management processes and standards.

**9. Cooperation/collaboration of the NNHC with international natural history collections:** The NNHC was elected as a member of the Consortium of European Taxonomic Facilities (CETAF, <https://cetaf.org>) in April 2018, opening new collaborations with European natural history museums and natural history collections. In addition, we are part of "SYNTHESSYS", an EC-funded project creating an integrated European infrastructure for natural history collections (<http://www.synthesys.info>). A SYNTHESSYS consortium grant proposal was submitted to the European Union and the result will be known in August 2018. Moreover, over the years the academic staff of the NNHC has established collaborations with various natural history collections worldwide (Table 3).

**10. International Membership:** CETAF; HUI Herbarium is listed in Index Herbariorum; staff members are active in the Organization of Phyto-Taxonomic Investigation in the Mediterranean Area (OPTIMA, <http://www.optima-bot.org/index.php/en>).

**11. Outstanding Research and Publications during the last five years:** The diversity of the collections is reflected in the variety of research topics and publications, ranging in subject from pure taxonomy to identifying species new to science, to various collection-based studies:

**Herbarium:** The most comprehensive plant collection in the Middle East. Apart from a sizeable vascular plant collection, the Herbarium contains many sub-collections, including a moss collection, a phytopathogenic fungi collection, a macroalgae collection, and the Aharonson collection - harboring wild wheat specimens. In addition to the biological collection, the Herbarium contains original botanical illustrations, a botanical library and a vast collection of documents and photos detailing the history of botanic research in Israel. The research topics are: Floristics of Israel and Jordan, Autophagy in plants, Ecology of pines, Plant central metabolism; Neotypification of *Gundelis turnefortii*; Distribution and conservation of Israeli endangered plants (the "Red plants" list); Towards recommission of the phytopathogenic fungal collection of the Hebrew University of Jerusalem; Reproductive biology, sex allocation and flower ecology.

**Herpetology:** Systematics & taxonomy of reptiles and amphibians, with emphasis on the herpetofauna of Israel and neighboring areas; Life history of reptiles & amphibians; Ecology and geographical distribution of reptiles & amphibians in Israel and in general; Physiology and morphology of reptiles & amphibians; Conservation plan for two critically endangered *Acanthodactylus* lizards; The association between foraging behavior and body pigmentation patterns; The ecology and evolution of lizards' tail coloration; Revision of commonly used movement-based indices for quantifying foraging behavior; Conspicuous traits as an anti-predator mechanism; Explaining variation in hatchling tail coloration of closely related lizards; Why lizards wave hands? Developing a forensic method for identification of illegally wild-caught Negev tortoises (*Testudo weneri* / *kleinmanni*) in the pet trade; Identification of reptile remains in feces of carnivores.

**Invertebrates:** Arachnid systematics, evolution and ecology; Taxonomy phylogeny and biodiversity monitoring of: Araneae, Scorpiones, Amblypygi, Opiliones, Acari (mites and ticks), Pseudoscorpiones, Solifugae; Agroecology - spiders in agroecosystems; Pollination market and bee-flower interactions; Application of game theory to ecology; Arthropod fossil record and how it links with our understanding of arthropod evolution; Research into the evolution of segmentation in arthropods and in other segmented invertebrate taxa; Region specific factors involved in blastoderm patterning in the milkweed bug *Oncopeltus fasciatus*; Evolution of arthropod axis elongation; The evolution of long-germ segmentation in insects; Comparative arthropod genomics.

**Fish:** Taxonomy, nomenclature and distribution of Eastern Mediterranean and Red Sea fishes; Lessepsian migration and settlement of other Indo-Pacific fish in the Eastern Mediterranean; The study of Israel ichthyofaunas: fish specimens of the Red Sea and the Eastern Mediterranean, as well local freshwater; Fish biodiversity in the southern Levant.

**Mollusca:** The mollusc collection is of significant international importance. Apart from the local collections (marine molluscs from the Red Sea and Eastern Mediterranean and land - and freshwater molluscs from the Levant) it is very rich in world-wide material due to the fact that several very important collections were received from abroad:

- 1953, the Giorgio S. Coen collection and malacological library from Italy;
- 1959, received the René Neuville collection and library from France/Israel;
- 1974, Arthur Blok shell collection and library from England.

Both the Coen and Blok collection consisted of approximately 15,000 different species, among them some 2,550 samples of type material of species described by numerous malacologists in the second half of the 19<sup>th</sup> Century and the beginning of the 20<sup>th</sup> Century. A critical catalogue dealing with these type samples is in preparation. Other subjects of research carried out in the Mollusc Collection deal with: (1) taxonomy, systematic and nomenclature of marine molluscs from the Mediterranean and Red Sea; (2) Lessepsian migration of marine molluscs from the Red Sea to the Mediterranean Sea; (3) taxonomy, systematic, nomenclature and distribution of terrestrial and freshwater molluscs; (4) alien land and freshwater molluscs of Israel and the Netherlands and their role as pests in agriculture; (5) archaeomalacological material from excavations carried out in Israel.

Wildlife Cryobank: Conservation genetics on various species such as Nubian ibex (*Capra nubiana*) Oryx (*Oryx leucoryx*), porcupines (*Hystrix indica*) and *Gazelle* spp. (e.g changing the conservation status of *Gazella gazella*); Study of host-pathogen co-evolution in response to environmental changes (tuberculosis, rabies); Genetic survey of the presence of *Batrachochytrium dendrobatidis* and *Ranavirus* in the Levant water frog (*Rana levantina/Pelophylax bedriagae*) populations in Israel; Wildlife forensics (assisting the law enforcement authorities in solving wildlife forensics crimes in Israel); Genetic changes associated with anthropogenic changes of the southern Levant fauna: aDNA studies.

Paleontology and Archaeozoology: Analysis of fauna from Mio-Holocene localities; Reconstruction of the environmental condition during the crucial stages of hominid dispersal along the southern Levantine corridor; Identification of previously unknown species (mainly vertebrates) from key localities.

Bio-anthropology: The past history of Peoples of the Southern Levant as shown by diachronic trends in morphometry and paleopathology complemented by ancient DNA and isotope studies. Specific projects include: Evolution, spread and characteristics of Upper Palaeolithic and Epipalaeolithic cultural entities in the Levant and Caucasus; Burial customs of prehistoric societies; Transition from mobile hunter-gatherers to sedentary farmers; Micro-evolutionary trends in Near Eastern populations and their association with socio-technological changes, Diversity and ritual in Iron Age populations of the Eastern Mediterranean, Ancient DNA and Isotope studies. Forensic analyses of fingerprints using Gel-lifters as an environmentally friendly method for collecting forensic evidence for fingerprint examination and trace DNA analysis.

Geology and Mineralogy: Iron, molybdenum and copper isotope stable isotope studies of low temperature marine sedimentary processes and sub-surface continental mineralization; Paleohydrology

using fluid inclusion stable isotopes and clumped isotopes studies of carbonate speleothems; Petrology and stable isotope studies of igneous and metamorphic rocks in orogenic settings.

### ***Selected Publications (2015-2018)***

- **Beiner, G.G.** and R. Rabinovich. 2013. An elephant task - conservation of elephant remains from Revadim Quarry, Israel. *Journal of the Institute of Conservation* 36 (1), <http://dx.doi.org/10.1080/19455224.2013.796887>
- Fricke, R., D. Golani and B. Appelbaum Golani 2014. *Emmelichthys marisrubri*, a new rover from the southern Red Sea (Teleostei: Emmelichthyidae). *Cybiurn* 38(2): 83-87.
- **Ziffer-Berger J.**, P. J. Weisberg, M. E. Cablk & Y. Osem, 2014. Spatial patterns provide support for the stress-gradient hypothesis over a range-wide aridity gradient. *Journal of Arid Environments* 102, 27
- **Beiner, G.G.**, Lavi, M., Seri, H., Rossin, A., Lev, O., Gun, J., and R. Rabinovich. 2015. Oddy Tests: Adding the Analytical Dimension. *Collections Forum* vol. 29 no. 1-2, pp. 22-36.
- Hadas, L., D. Hermon, A. Boldo, G. Arieli, R. Gafny, R. King and **G. Kahila Bar-Gal**. 2015. Wild Gazelles of the Southern Levant: genetic profiling defines new conservation priorities. *PLoS ONE* 10 (3): e0116401. DOI:10.1371/journal.pone.0116401.
- Hibino, Y., S. Kimura and **D. Golani** .2015. A new ophichthid species from the Red Sea of the genus *Mixomyrophis*, formerly known as Atlantic genus. *Ichthyological Research* 62: 184-188.
- **Golani, D.**, O. Sonin and G. Rubinstein 2015. Records of *Paralichthys lethostigma* and *Sciaenops ocellatus* in the Mediterranean and *Channa micropeltes* in Lake Kinneret (Sea of Galilee), Israel. *Marine Biodiversity Records* 8: e39
- **Golani, D.**, G. Askarov and B. Appelbaum-Golani 2015. First confirm record of the Blue tang, *Acanthurus coeruleus* in the Mediterranean. *Acta Ichthyologica et Piscatoria* 45(3): 311-313
- Shirak, A., Dor, L., Serussi, E., Ron, M., Hulata, G. and Golani, D. 2016. DNA Barcoding of fish species from the Mediterranean coast of Israel. *Mediterranean Marine Science* 17(2): 459-466.
- Tikochinski, Y. Russell, B., Hyams, Y., Motro, U. and **D. Golani** 2016. Molecular analysis of the recently described Lizardfish, *Saurida lessepsianus*, from the Red Sea and the Mediterranean with remarks on its phylogeny and genetic bottleneck effect. *Marine Biology Research* 12(4): 419-425.
- Armiach, I., Bernstein, I., Tang, I., Dayan, T., and **E., Gavish-Regev**, 2016. Activity-density data reveal community structure of Lycosidae at a Mediterranean shrubland. *Arachnologische Mitteilungen /Arachnology Letters* 52: 16-24. DOI: 10.5431/aramit5204
- **Gavish-Regev, E.**, Aharon S., Armiach I., and Y. Lubin, 2016. Cave survey yields a new spider family record for Israel. *Arachnologische Mitteilungen/Arachnology Letters* 51: 39-42. DOI: 10.5431/aramit5105.
- Hadas L., D. Hermon, **G. Kahila Bar-Gal** 2016. Before they are gone – improving gazelle protection using wildlife forensic genetics. *Forensic Science International: Genetics* 24:51–54.
- **Mienis, H.K.**, Ilan, M., Shefer, S., Idan, T., Weinberger, A., Ashkenazi, A. & Levy, M., 2016. A first observation of the nudibranch *Felimare orsinii* in the Mediterranean off Israel (Mollusca, Gastropoda, Chromodorididae). *Triton*, 34: 11-12.
- **Mienis, H.K.**, Rittner, O., Hershkovitz, Y. & Eshcoly, T., 2016. A first record of the Marsh hive *Euconulus praticola* from Israel (Gastropoda, Pulmonata, Euconulidae). *Triton*, 34:21-23.
- Miranda, G.S., Aharon S., **Gavish-Regev, E.**, Giupponi, A.P.L., and G. Wizen, 2016. A new species of *Charinus* Simon, 1892 (Arachnida: Amblypygi: Charinidae) from Israel and new records of *C. ioanniticus* (Kritscher, 1959). *European Journal of Taxonomy* 234: 1-17. <http://dx.doi.org/10.5852/ejt2016.234>.
- Opatovsky, I., **Gavish-Regev, E.**, Weintraub, P. G., and Y. Lubin, 2016. Various competitive interactions explain niche separation in crop-dwelling web spiders. *Oikos* 125: 1586-1596. DOI: 10.1111/oik.03056
- Auman T, **Chipman A.D.** 2017. The evolution of gene regulatory networks that define the arthropod body plan. *Integrative and Comparative Biology*. 57:523-532.



- Auman T, Vreede BMI, Weiss A, Hester SD, Williams TA, Nagy LM, **Chipman A.D.** 2017. Dynamics of growth zone patterning in the milkweed bug *Oncopeltus fasciatus*. *Development*. **144**:1896-1905
- Barros JAS, Cavalcanti JHF, Medeiros DB, Nunes-Nesi A, **Avin-Wittenberg T**, Fernie AR, Araújo WL. 2017. Commonalities and differences in plants deficient in autophagy and alternative pathways of respiration on response to extended darkness. *Plant Signal Behav.* Sep 21:e1377877.
- Barros JAS, Cavalcanti JHF, Medeiros DB, Nunes-Nesi A, **Avin-Wittenberg T**, Fernie AR, Araújo WL. 2017. Autophagy Deficiency Compromises Alternative Pathways of Respiration following Energy Deprivation in Arabidopsis thaliana. *Plant Physiol.* Sep;175(1):62-76.
- Biton, R., Steiner, T., Sharon, G., Oron, M. and **Rabinovich, R.** 2017. Aquatic or terrestrial, does it really matter? The exploitation of turtles from Nahal Mahanayeem Outlet a Mousterian Site in the Hula Valley, Israel. *Journal of Archaeological Science, Reports* 14, 409–419.
- Biton, R., Steiner, T., Sharon, G., Oron, M., **Rabinovich, R.** 2017. Freshwater Turtle or Tortoise? The exploitation of testudines at the Mousterian Site of Nahal Mahanayeem Outlet, Hula Valley, Israel. *Journal of Archaeological Science, Reports* 14, 409–419.
- Rozenbaum, A. G., Shaked Gelband, D., Stein, M., Mienis H. K., **Rabinovich, R.** 2017. First evidence of 'ancient deer' (cervid) in the late Miocene Bira Formation, Northern Israel. PLoS ONE 12(11): e0185268. <https://doi.org/10.1371/journal.pone.0185268>
- **Chipman A.D.** 2017. *Oncopeltus fasciatus* as an evo-devo research organism. *Genesis* e23020.
- **Faerman M., G. Kahila Bar-Gal, E. Boaretto, G. Boeskorov, N.A. Dokuchaev, O.A. Ermakov, F. Golenishev, S.V. Gubin, E. Mintz, V.L. Surin, S.V. Titov, O.G. Zanina, and N.A. Formozov.** 2017. There and back again: Arctic ground squirrels in the Late Pleistocene Beringia. *Scientific Reports* 7:42639, DOI: 10.1038/srep42639.
- Ginzburg N, Cohen M, **Chipman A.D.** 2017. Factors involved in early polarization of the anterior-posterior axis in the milkweed bug *Oncopeltus fasciatus*. *Genesis* e23027.
- Halperin, T., Carmel, L., **Hawlana, D.** 2017. Movement correlates of lizards' dorsal pigmentation patterns. *Functional Ecology*. 31: 370–376.
- Jablonski, D., Sion, G., Bursey, C.R. & Goldberg, S.R. 2017. Sinai Fan-fingered Gecko (*Ptyodactylus guttatus*). Endoparasite. *Herpetological Review* 48: 659.
- **Mienis, H.K.,** 2017. *Palisadia rittneri*, a new species from the Gulf of Aqaba (Mollusca, Gastropoda, Eulimidae). *Triton*, 35: 13-14.
- **Mienis, H.K.,** 2017. *Xerocrassa zviae*, a new species of land snail from the Judean Desert, Israel (Mollusca, Gastropoda, Hygromiidae). *Triton*, 35: 25-28.
- **Mienis, H.K.,** 2017. A final report concerning the mollusks from the PPNB-site of Motza, Judean Hills, Israel. *Triton*, 35: 29-36.
- Jablonski, D. & **Shacham, B.** 2017. Rüppel's Snake-eyed Skink (*Ablepharus rueppellii*). *Herpetological Review* 48: 587.
- **Mienis, H.K.,** 2017. Colonies of breeding Monk parakeets *Myiopsitta monachus* in Kibbutz Netzer Sereni, Israel. *Naturhistorische en Andere Notities – Natural History and Other Notes*, 14: 10-13.
- **Mienis, H.K. & Rittner, O.,** 2017. On the presence of the New Zealand Mudsail *Potamopyrgus antipodarum* in Israel. *Ellipsaria*, 19 (3): 25-27.
- Panfilio, et al. 2017. Molecular evolutionary trends and feeding ecology diversification in the Hemiptera, anchored by the milkweed bug genome. bioRxiv 201731; doi: 10.1101/201731.
- **Rabinovich, R.,** and Lister, A. 2017. The earliest elephants out of Africa: taxonomy and taphonomy of the proboscidean remains from Bethlehem. *Quaternary International* 445, 23-42. DOI: 10.1016/j.quaint.2016.07.010
- **Rabinovich, R** Enzel And O. Bar-Yosef (eds.). 2017. The Archaeozoological Record in a changing environment of the Late Middle to the Late Pleistocene. In Y., *Quaternary of the Levant*. Cambridge University Press. pp. 291-291
- Rothman, S. B-S., **Mienis, H.K. & Galil, B.S.,** 2017. Alien facelinid nudibranchs in the Eastern Mediterranean: first report of *Phidiana militaris* (Alder and Hancock, 1864) and report of *Caloria indica* (Bergh, 1896) 30 years after its previous sighting. *BioInvasions Records*, 6 (2): 125-128.



- Schaefer R.J., M. Schubert, E. Bailey, D.L. Bannasch, E. Barrey, **G. Kahila Bar-Gal**, G. Brem, S.A. Brooks; O. Distl, R. Fries, C.J. Finno, V. Gerber; B. Haase, V. Jagannathan, T. Kalbfleisch, T. Leeb, G. Lindgren, M.S. Lopes, N. Mach, A. da Câmara Machado, J.N. MacLeod, A. McCoy, J. Metzger, C. Penedo, S. Polani, S. Rieder, I. Tammen, J. Tetens, G. Thaller, A. Verini-Supplizi, C.M. Wade, B. Wallner, L. Orlando, J.R. Mickelson, M.E. McCue. 2017. Development of a high-density, 2M SNP genotyping array and 670k SNP imputation array for the domestic horse” *BMC Genomics* 18:565-583. DOI 10.1186/s12864-017-3943-8
- Sion, G. 2017. Foot-preference underlies bite-scar asymmetry in the gecko *Ptyodactylus guttatus*, *Laterality: Asymmetries of Body, Brain and Cognition*, DOI: 10.1080/1357650X.2017.1322097.
- Stein O, **Avin-Wittenberg T**, Krahnert I, Zemach H, Bogol V, Daron O, Aloni R, Fernie AR, Granot D. 2017. Arabidopsis Fructokinases Are Important for Seed Oil Accumulation and Vascular Development. *Front Plant Sci.* Jan 10;7: 2047.
- Yanai, Z., Dayan, T., **Mienis, H.K.** & Gasith, A., 2017. The pet and horticultural trades as introduction and dispersal agents of non-indigenous freshwater molluscs. *Management of Biological Invasions*, 8 (4): 523-532.
- **Ziffer-Berger, J.**, Weisberg, P. Cablk, M., Moshe, Y. & Osem, Y. 2017. Shrubs facilitate pine colonization by controlling seed predation in dry Mediterranean dwarf shrublands. *J Arid Env* 147: 34-39.
- Fricke, R., **Golani, D.** and Appelbaum-Golani, B. 2017. *Cynoglossus crepida*, a new species of tounesole from the Gulf of Aqaba, Red Sea (Teleostei: *Cynoglossidae*). *Journal of the Ocean Science Foundation* 25: 77-87.
- Okamoto, M. and. 2017. Three new species of the genus *Acropoma* (Perciformes: Acropomatidae) from the Indian Ocean. *Ichthyological Research*
- Fricke, R., **Golani, D** and Appelbaum-Golani, B. 2017. *Arnoglossus nigrofilamentosus* n. sp., a new species of flounder from off the Mediterranean coast of Israel, probably a new case of Lessepsian migration (Teleostei: Bothidae). *Scientia Marina.* 81(4): 457-465
- Adams, R.P., A. Boratyński, M.D Dagher-Kharrat ,H.V. Leschner, T. Mataraci A.E. Schwarzbach 2017. Geographic variation in *Juniperus drupacea*: DNA sequencing and volatile leaf oils: Further evidence of putative Pleistocene genetic isolation between Europe and Asia. *Phytologia* 99(4), 249-257.
- Vitek E., **H. Leschner** & M. Armağan 2017. *Gundelia tournefortii* L. (*Compositae*) – an approach. *Ann. Naturhist. Mus. Wien, B;* 119(227–233).
- Aharon S., **Gavish-Regev, E.**, and B.A. Huber 2018. Daddy-long-leg giants: Revision of the spider genus *Artema* Walckenaer, 1837 (Araneae, Pholcidae). *European Journal of Taxonomy.*
- Barazani, O. & **Ziffer-Berger, J.** 2018. *Eruca sativa*. In Savo, V. & Pardo, M. (eds.). *Ethnobotany of Southern Europe*. Springer Verlag (in press). Review article, invited.
- Barazani, O. & **Ziffer-Berger, J.** 2018. *Isatis tinctoria*. In Savo, V. & Pardo, M. (eds.): *Ethnobotany of Southern Europe*. Springer Verlag (in press). Review article, invited.
- Barazani, O. & **Ziffer-Berger, J.** 2018. *Lepidium sativum*. In Savo, V. & Pardo, M. (eds.). *Ethnobotany of Southern Europe*. Springer Verlag (in press). Review article, invited
- Borvon, A., Bridault, A., Biton, R., **Rabinovich, R.**, Prevost, M., Khalaily, H., Valla, F.R. 2018. Finding of trout (*Salmo cf. trutta*) in the Northern Jordan Valley (Israel) at the end of the Pleistocene: Preliminary results. *Journal of Archaeological Science, Reports* 18, 59-64, DOI 10.1016/j.jasrep.2018.01.008.
- Eshar, D., Ammersbach, M., Shacham, B ,Katzir, G & Beaufrière, H. 2018. Venous blood gases, plasma biochemistry and hematology of wild-caught common chameleons (*Chamaeleo chamaeleon*). *The Canadian Veterinary Journal.*
- Halperin, T., Kalyuzhny, M., **Hawlana, D.** 2018. How to use (and not to use) movement-based indices for quantifying foraging behavior. *Methods in Ecology and Evolution.*
- Fricke, R., **Golani, D.**, Appelbaum-Golani, B. and Zajonz, U. 2018. *Dysomma alticorpus*, a new species of cutthroat eel from the Gulf of Aqaba, Red Sea (Teleostei: Synbranchidae). *Comptes Rendus Biologies* 341: 111-119.
- **Golani, D.** and Fricke, R. 2018. Checklist of the Red Sea Fishes with delineation of the Gulf of Suez, Gulf of Aqaba, endemism and Lessepsian migrants. *Zootaxa*

- Zohary M. & N. Feinbrun-Dothan A. Danin, D. Heller, O. Fragman-Sapir, M. Kislev, **H. Leschner** & U. Plitmann [Editor in chief]. 2018. FLORA PALAESTINA, Second edition. Part 1. - Ferns, Gymnosperms, Angiosperms: *Salicaceae* - *Caryophyllaceae*. Editorial board: Israel Academy of Sciences and Humanities, Jerusalem. Revised and edited by the editorial board. Published by TROPICOS, Missouri Botanical Gardens.

## **12. Additional points for the Committee:**

**Education and outreach:** The educational impact of the NNHC was not included in the questionnaire, thus we added some relevant information here. The NNHC staff members teach at the HUJ (19 courses) and conduct professional guided tours to the collections as part of university courses such as: Introduction to Paleontology (Ben-Gurion University); ESHMOR course (Ben-Gurion University), Management of Wildlife (Tel Hai) and Evolution (Oranim). In addition, public education and citizen-science projects include:

- Thursday Sorting - monthly activities at the National Arachnid Collection and other collections of the NNHC, open free of charge to the public; number of participants per event ranges from 15-80.
- Professional guided tours and special scientific activities are given to special groups such as biology teachers, excellent high school students, students from east Jerusalem, groups of children from the Society for the Protection of Nature in Israel, etc.
- Training of INPA rangers and staffers in the identification of terrestrial invertebrates.
- Training of Society for the Protection of Nature in Israel guides and workers and INPA rangers and staffers in the identification of reptiles & amphibians (planned project, work in progress).

We would like to raise three points for discussion by the Evaluation Committee:

1. **Botanical Gardens:** Worldwide botanical gardens are recognized as Natural/Biological collections since they keep the local flora biodiversity. At the HUJ a representative from the NNHC is a member in the steering committee of the botanical gardens, advising on various scientific issues, especially conserving flora diversity. Recognition of botanical gardens as part of the NNHC should be discussed by the evaluation committee.
2. **Haasiana:** Haasiana is a journal produced by the NNHC-HUJI publishing collection-based research with an IUSN number. In the last CETAF meeting the need for journals publishing collection-based research was raised. We recommend converting the Haasiana journal to become a peer-reviewed journal (e-journal) representing the NNHC in Israel with the support of the Israel Academy of Sciences.
3. **The Israel Academy of Sciences model supporting National Natural History Collections in Israel:** The report of the Experts Committee for the conservation and development of biological collections in Israel (2001) was used as the basis for the financial support model and policy of the Scientific Steering Committee in managing the NNHC in Israel. Regrettably, the recommendations



of the Expert Committee concerning the Scientific Steering Committee, the support of post-doctoral fellows, and construction/infrastructure were not fully addressed, thus leading to unpleasant situations. We respectfully request (1) Holding a discussion to define the goals and governance of the Scientific Steering Committee, the way its members are elected, the appointment term of Steering Committee members, election of the committee Chair, and the way decisions are taken. Furthermore, we recommend having a public representative in the committee.

(2) Guidelines concerning post-doctoral fellowship support. In the 2001 report of the Expert Committee, it was recommended that post-doctoral research would be conducted abroad. The prerequisite for applying for the fellowship were changed and in the last few years all post-doctoral research was conducted in Israel. This year the prerequisites were changed again by the Steering Committee Chair. As the aim of the fellowship support is to invest in the next generation of researchers that will join various academic institutes in Israel, we believe that the evaluation committee should also take into account the option of supporting also excellent Ph.D. students as potential candidates to join the NNHC. (3) Following the Expert Committee 2001 report concerning infrastructure, we request that the Evaluation Committee consider options to support the NNHC-HUJI as recommended by the Experts Committee. In Section 6, Physical infrastructure, we raised some of the important issues.



**Table 1:** Summary of Specimens at the NNHC as of 2018.

Collections	Number of primary types	Number of Individual specimens/objects	% of registered filling cards	% of recorded cards in databases	Average number of new specimens
Palaeontology and palaeobotany	40	10,000	60%	40%	Miocene fossils from active excavations
Mineralogy	nt	10,000	70%	50%	
Bio- anthropology		20,000	85%	70%	Palaeolithic to Ottoman and active excavations
Archaeozoology	50	2,450,000	40%	40%	Several assemblages
Herbarium (Botany)	3500	2,000,000	80%	20%	2500*
Mycology	50	10,000	80%	40%	25
Marine Invertebrates	85	1,500,000	80%	30%	
Terrestrial Invertebrates	300	500,000	25%	30%	3200
Mollusks	3000	1,000,000	40%	30%	2000
Herpetology	335	24,000	100%	98%	300
Fish	300	100,000	100%	98%	350
Birds	5	2,500	100%	100%	25
Mammals (osteology)	5	2,500	80%	100%	50
Wildlife Cryobank		20,000	98%	98%	3000

Nt= not relevant; \*= the Herbarium incorporated several collections such as from Ben-Gurion University (15,000 specimens) and Beit Ussishkin (20,000 specimens). Vouchers of samples collected for seed deposit in the gene bank are deposited in the Herbarium.

**Table 2:** Staff members at the NNHC in 2018.

<b>Scientific Staff</b>	Tenured scientific staff	8
	Post-docs	2*
	PhD students	9
	Curators (not tenured)	6**
	Collection managers / technicians	3
	Other (Associates etc.)	17
<b>Other Staff (not scientists)</b>	Collections Administrator	1
	Manager of GIS Center	1
	Website Manager and Information	1
	Volunteers	4
	<b>Total staff members</b>	<b>52</b>

\* Three new candidates were requested \*\*Looking for additional candidates  
Several of the tenured scientific staff, curators and collection managers are emeritus.

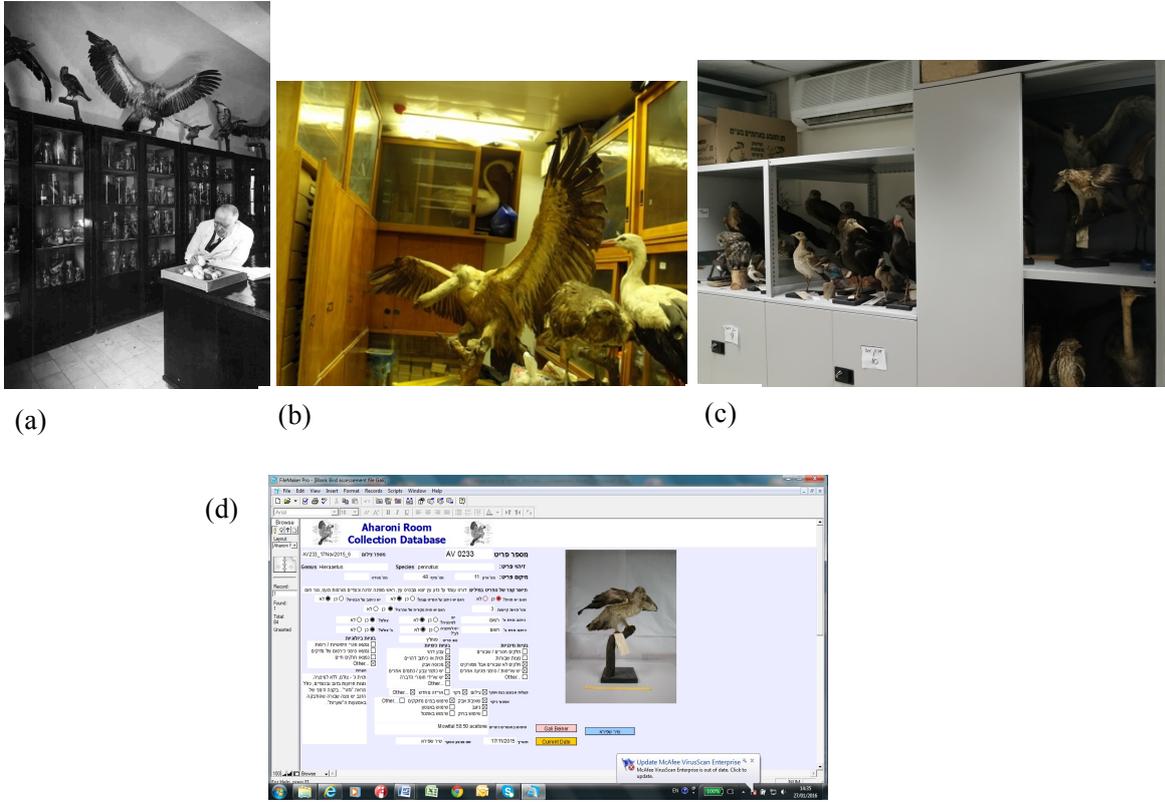


**Table 3: List of International Institutes collaborating with the NNHU-HUJI**

- ❖ The Royal Ontario Museum.
- ❖ The Natural History Museum, London.
- ❖ Southwest University, Xian, China (Shaanxi Key Library for Early Life and Environment).
- ❖ Harvard University, USA.
- ❖ CNRS, France.
- ❖ Democritus University of Thrace, Greece.
- ❖ Georgia Southern University, USA (The U.S. National Tick Collection).
- ❖ American Museum of Natural History, New York, USA.
- ❖ Saint-Petersburg Ecology and Biology Centre “Krestovsky Island”, Russia.
- ❖ Smithsonian, USA (Conservation Biology Institute, Dep. of Entomology).
- ❖ Nairobi National Museum.
- ❖ University of Guelph, Canada (Centre for Biodiversity Genomics).
- ❖ University of Wisconsin-Madison, USA.
- ❖ Eötvös Loránd University, Hungary.
- ❖ Gent university, Belgium.
- ❖ Università degli Studi di Torino Turin, Piedmont, Italy.
- ❖ University of Barcelona Barcelona, Catalonia, Spain.
- ❖ Zoological Research Museum Alexander Koenig, Germany.
- ❖ Zoological museum Copenhagen University, Denmark.
- ❖ The University of Kansas, USA.
- ❖ Queensland Museum, Australia.
- ❖ The Crop Research Institute, Czech Republic.
- ❖ Herbarium Mediterraneum Panormitanum (PAL), Orto botanico dell'Università, Palermo, Italy.

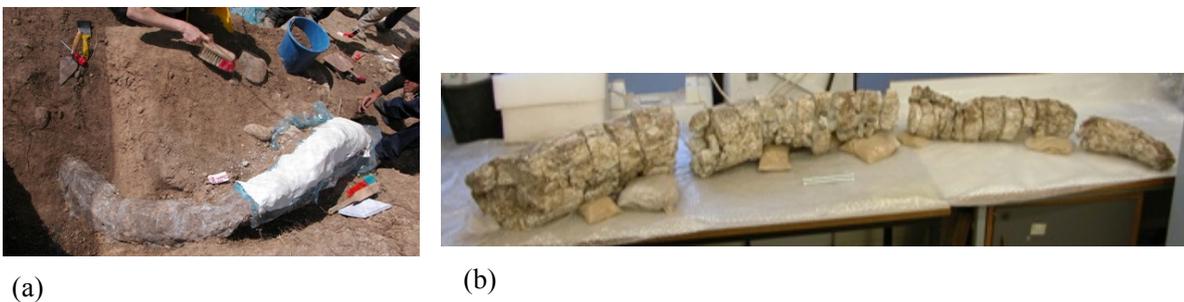
**Figures**

**Figure 1: The Israel Aharoni Bird Collection**



(a) Israel Aharoni with his original collection (b) Old, jumbled storage (c) New storage facilities (d) Bird record in the new database.

**Figure 2: Conservation of an elephant tusk from the site of Erq el Ahmar ((Pliocene): (a) *In situ* during excavation; (b) In the laboratory.**



(a)

(b)

**Figure 3:** Consultation and assistance given to the Upper Galilee Museum of Prehistory at Maayan Baruch: before and after conservation of three of the Natufian burials.



**Figure 4:** NNHC staff organization diagram.

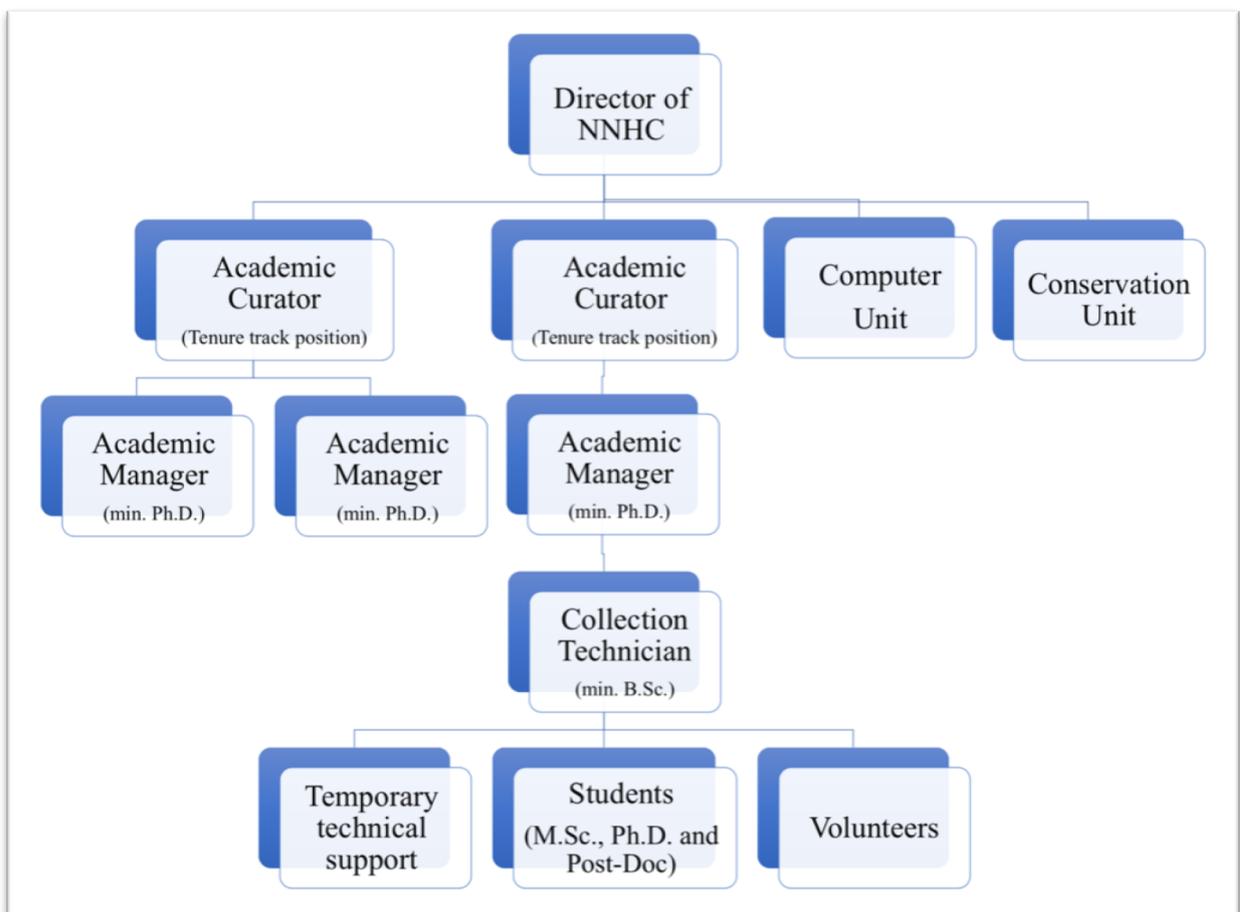
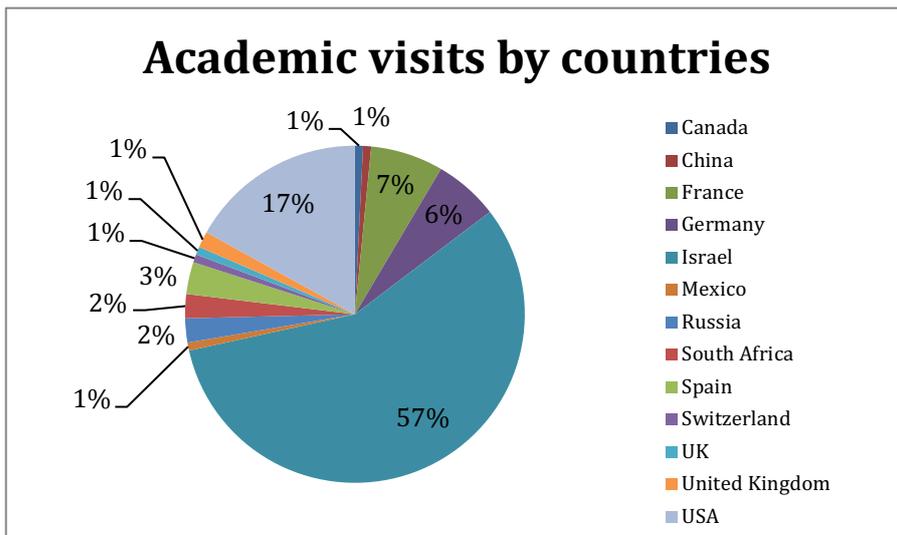


Figure 5: Digitized sheet in the Herbarium.



#	Scientific name	Locality
130000	<i>Triplachne nitens</i> (Guss.) Link	Rosh-Hanigra Beach
130001	<i>Picris altissima</i> Delile	near Tel Abu-Henzir (Tel Shipon)
130002	<i>Cornucopia cucullatum</i> L.	Fields of Kibbutz Shomrat
130003	<i>Desmantha phillipsiae</i> (Rostk.) H. Scholtz	Acco, Muslim cemetery
130004	<i>Bromus pseudobrachiostachyis</i> H. Scholtz	Shomrat area
130005	<i>Trigonella berythae</i> Boiss. & Blanche	Bezet - Rosh-Hanigra Beach
130006	<i>Lolium perenne</i> L.	Hazerot Yassaf Beach
130007	<i>Alpeyus myosuroides</i> Huds.	Rosh-Hanigra Beach
130008	<i>Zinnia pentandra</i> (L.) Jeffrey	Bet She'an
130009	<i>Amaranthus blitum</i> L.	Tiv'on
130010	<i>Oxalis corniculata</i> L.	Tiv'on
130011	<i>Conyza bonariensis</i> (L.) Cronquist	Tiv'on
130012	<i>Cheopodium murale</i> L.	Tiv'on
130013	<i>Setaria adhaerens</i> (Forsk.) Chiov.	Tiv'on
130014	<i>Salsola vergens</i> L.	Nesher, on the way to the cemetery and Nesher Quarry
130015	<i>Amaranthus graecians</i> L.	Nesher, on the way to the cemetery and Nesher Quarry
130016	<i>Amaranthus blitum</i> L.	Nesher, on the way to the cemetery and Nesher Quarry
130017	<i>Amaranthus bitoides</i> S. Watson	Nesher, on the way to the cemetery and Nesher Quarry
130018	<i>Amaranthus albus</i> L.	Nesher, on the way to the cemetery and Nesher Quarry
130019	<i>Suaeda splendens</i> (Poir.) Gren. & Godr.	Nesher, on the way to the cemetery and Nesher Quarry
130020	<i>Atriplex davisi</i> Aellen	Nesher, on the way to the cemetery and Nesher Quarry
130021	<i>Ripidithum thomasi</i> (Duby) Kurth	Tiv'on
130022	<i>Sorghum virgatum</i> (Hack.) Stapf	Nesher, on the way to the cemetery and Nesher Quarry
130023	<i>Gundelia tournefortii</i> L.	Ha'ela Zomet
130024	<i>Hypochaeris glabra</i> Delile	Horvat Socho

Fig. 6: Percent of academic visits to the National Natural History Collections by country of origin.



## Appendix I: List of collaborators (national and international)

### International

- ❖ Dr. Gergely Babocsay. Curator of vertebrate collections at the Hungarian Natural History Museum, Budapest, Hungary. Herpetology, ornithology, mammalogy, ecology, nature conservation, natural resource management. P: ++36-37-505530, F: ++36-37-505531, gergely.babocsay@gmail.com.
- ❖ Dr. Hervé Seligmann. Associate Professor at URMITE, Faculté de Médecine, Aix-Marseille Université, Marseilles, France. Herpetology, ecology, natural history, tail autotomy and regeneration, genomics. P: ++33-(0)4-91-324300, F: ++33-(0)4-91-324496, timonuslepidus@gmail.com.
- ❖ Dr. Bernhard Huber, Curator of Arachnida, Zoological Research Museum Alexander Koenig (Leibniz Association), B.Huber@leibniz-zfmk.de. Sexual selection in spiders, function and evolution of copulatory organs in spiders and other arthropods, systematics and biology of pholcid spiders (daddy-longleg spiders), Pholcids of Israel.
- ❖ Dr. Miquel A. Arnedo, Evolutionary Biology, Systematics & Biogeography of spiders and allies, Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Fac. Biologia, Universitat de Barcelona, molecular systematics.
- ❖ Prof. Adrian Lister, a.lister@nhm.ac.uk, Natural History Museum London, Evolution of elephants.
- ❖ Dr. Silvia Bello, s.bello@nhm.ac.uk Natural History Museum London, animal butchery patterns of the Neanderthals.
- ❖ Prof. Prashant P. Sharma, The university of Wisconsin Madison, Taxonomy & systematics, Biogeography, evo-devo., prashant.sharma@wisc.edu. Arachnid evolution in caves, Opiliones of Israel.
- ❖ Prof. Gustavo Hormiga, George Washington University, Systematics and Evolutionary Biology of Spiders, hormiga@gwu.edu, Linyphiid systematics.
- ❖ Prof. Deborah Smith, The University of Kansas, Systematics, population biology and biogeography of spiders, debsmith@ku.edu, Argyrodinae spiders - evolution of Kleptoparasitism in spiders.
- ❖ Dr. Lorenzo Prendini, American Museum of Natural History, Curator, Arachnida, Myriapoda Collections, systematics, biogeography and evolution of scorpions, lorenzo@amnh.org, Scorpiones of Israel.
- ❖ Dr. Petra Sierwald, Curator of Arachnida and Myriapoda, Field Museum Chicago, Evolutionary Biology; biodiversity, phylogeny, biogeography and systematics of Arthropoda, especially Arachnida and Myriapoda, psierwald@fieldmuseum.org, Millipedes of Israel.
- ❖ Dr. Nikolaj Scharff, Curator of Arachnida, Zoological museum Copenhagen University, Denmark, Systematics and Evolutionary Biology of Spiders, NScharff@snm.ku.dk, Linyphiid systematics.
- ❖ Dr. Maria Chatzaki, Molecular Biology & Genetics Dept, Democritus University of Thrace, Alexandroupolis Greece, maria.chatzaki@gmail.com, ecology and systematics of spiders of the East Mediterranean.
- ❖ Dr. Tamás Szűts, Eötvös Loránd University, Hungary, tszuts@gmail.com, Systematics and Evolutionary Biology of Spiders.
- ❖ Dr. Milan Řezáč, The Crop Research Institute Czech Republic, rezac@vurv.cz ecology and systematics of spiders.
- ❖ Dr. Mark Alderweireldt, Environment Province East Flanders & Gent university, Belgium, mark.alderweireldt@oost-vlaanderen.be, ecology and systematics of spiders.
- ❖ Dr. Robert Bosmans, Gent university, Belgium, rop\_bosmans@telenet.be, ecology and systematics of spiders.
- ❖ Dr. Marco Isaia, Università degli Studi di Torino Turin, Piedmont, Italy, marco.isaia@unito.it, subterranean spiders and cave ecosystems.
- ❖ Dr. Robert Raven, Head, Terrestrial Biodiversity & Senior Curator, Chelicerata Queensland Museum, Australia, robert.raven@qm.qld.gov.au, , ecology and systematics of spiders.
- ❖ Dr. Gustavo Miranda, Smithsonian Institution, Department of Entomology, smiranda.gustavo@gmail.com, biodiversity, taxonomy, systematics and phylogeography of arachnids
- ❖ Prof. Oleg Valerskiy, Head of Entomology Club, Saint-Petersburg Ecology and Biology Centre “Krestovsky Island”, Russia: Studied the insect collection.



- ❖ Prof. Ann Bridault Chargée de Recherches CNRS, Hdr ArScAN UMR 7041, Equipe Archéologies environnementales, Maison d'Archéologie et d'Ethnologie, Nanterre.
- ❖ Prof. Tal Simmons, Graduate Program Director, Department of Forensic Science, Virginia Commonwealth University, Monroe Park Campus, Harris Hall South, Richmond, USA
- ❖ Dr. Alexander P. Sukhorukov, Dept. Higher Plants, Biological Faculty, Moscow State University, Russia: Chenopodiaceae (Amaranthaceae) of SW Asia.
- ❖ Dr. Ronald Fricke, Staatliches Museum für Naturkunde, Rosenstein 1 Stuttgart, Germany.
- ❖ Prof. Giacomo Bernardi, University of California Santa Crus, USA.
- ❖ Dr. Barry Russell, Museum & Art Gallery of the Northern Territory, Darwin, Australia.
- ❖ Dr. John E. Randall, Bishop Museum, Honolulu, Hawaii, USA.
- ❖ Prof. Seishi Kimura, Mie University, Mie, Japan.
- ❖ Dr. Christian Capapé, Université Montpellier, II, Montpellier, France
- ❖ Prof. Yukio Iwatsuki, University of Miyazaki, Miyazaki, Japan.
- ❖ Prof. D. Reich, Department of Genetics, Harvard Medical School USA
- ❖ Dr. F. Bouquentin, Faculty University of Bordeaux and CNRS) French Center for Scientific Research.
- ❖ Prof. S. Fox, Adjunct Professor U. of Arizona USA.

## National

- ❖ Israel Nature and Park Authority – Departments of Science, law enforcement, GIS and Database.
- ❖ Society for the Protection of Nature in Israel.
- ❖ Dr. Eric Palevsky, Prof. Ally Harari and Dr. Yael Meller Harel, The Volcani Agriculture Research Organization, Israel (ARO).
- ❖ Yoram Zvik, Yeruham Center of Ecology and Ornithology.
- ❖ Dr. Eran Gefen, Shlomo Cain, Dr. Tamar Kesar, Dr. Irit Zohar and Prof. Dan Tchernov
- ❖ Haifa University- Oranim.
- ❖ Prof. Israel Hershkovitz and Dr. Hila May, Department of Anatomy and Anthropology, Tel-Aviv University.
- ❖ Dr. Yafit Atiya and Avi Keysary, Israel Institute for Biological Research.
- ❖ Prof. Kosta Y. Mumcuoglu, Prof. Charles Greenbaltt, Prof. School of Medicine, Microbiology and Molecular Genetics, HUJ.
  - ❖ Prof. Yair Achituv, Dr. Udi Wise and Prof. Aren Maeir, Bar-Ilan University, Israel.
- ❖ Dr. Shirly Bar-David, Prof. Yael Lubin, Ben-Gurion University, Israel (Mitrani Department of Desert Ecology).
- ❖ Prof. Rivka Amit, Dr. Rani Calvo and Prof. Yael Edelman-Furstenberg, The Geological Survey of Israel
- ❖ Israel Gene Bank, Volcani Agriculture Research Organization, Israel (ARO)
- ❖ Dr. Shay Covo, Dept. of Plant Diseases and Microbiology, Fungal Chromosome Biology, The Robert H Smith Faculty of Agriculture, Food and Environment, HUJ.
- ❖ Dr. Yaron Tikochinski, Ruppin Academy Center.
- ❖ Prof. Yedidia Bentur, Rambam Hospital.
- ❖ Dr. Ianir Milansky, Head of Prehistory, Israel Antiquities Authority.
- ❖ Prof. Liran Carmel, bioinformatics, Faculty of Life Sciences HUJ.
- ❖ Dr. Uri. Zilberman Head of pediatric dental clinic, Barzilai Medical University Center, Ashkelon, Israel.
- ❖ Dr. Zchi Izenberge, Koret School of Veterinary Medicine, The Hebrew University.