The Margolin Biological Collection- Oranim Academic College-Israel

Administrative director: Mr. Hatem Abu Raiya
Academic director and curator of the Insecta collections: Dr. Elad Chiel
Collections director and curator of the ichthyological collections: Dr. Irit Zohar
Database administrative: Eitan Mageni

History of the collections

Beit Margolin at Oranim Academic College was established in 1947 following the death of the naturalist and science teacher Yehoshua Margolin. Margolin founded the Biological-Pedagogical Institute on Yehuda Halevy Street in Tel Aviv. The aim of the Institute was to train school and kindergarten teachers of nature studies. Underpinning this endeavor was the belief that knowledge of nature is the best way to link people, and kids, to their land. For that purpose Margolin established the first zoological collection in Israel, and travelled along Israel to collect specimens, to train teachers, teach kids and develop their love to nature. Margolin's vision was to establish in Jezreel Valley a Biological- Pedagogical Institute, similar to the one he established in Tel Aviv. For that purpose, he traveled and chose the forested area of Tel Alexander as a perfect landscape for the constructing of a new campus for biological studies.

On October 10th, 1947, a month after his death, and opposite to his grave, the cornerstone for Beit Margolin was established at Tel Alexander (**Fig. 1**). Following Margolins will (**Fig. 1**) the biological collection were split between the Biological- Pedagogical Institute of Tel Aviv and Oranim Academic College.

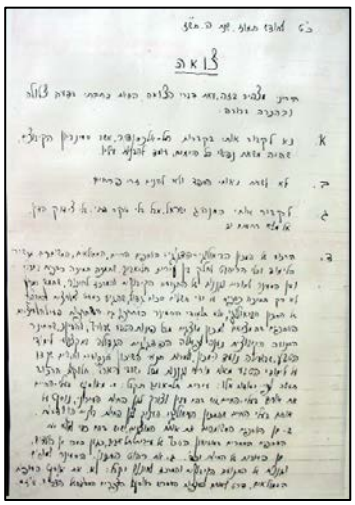

Fig. 1: Margolin's grave at Oranim campus and a copy of Margolin's will.

At Oranim Academic College, the collections housed at Beit Margolin are still used following Margolin's vision and heritage, to educate the university students of natural sciences

(undergraduate, MSc, PhD, Postdocs), natural science teachers, and school kids (in Hebrew and Arabic; more than 4,000 kids per year). In addition, twice a year we conduct a community outreach science event, in which we open the doors of the collections to the public: the European Researchers' Night and the Israeli Research Night. More than 2,000 participants attended each of these events. To further promote the connection between Beit Margolin students and nature, we loaned from the University of Haifa an exhibition on the voyage of the naturalis Henry Baker Tristram in the Middle East, more than 150 years ago (**Fig. 2**). We hope that in the future we will be able to host and develop other exhibitions, promoting the connection between nature, taxonomy and scientific publications.

Fig. 2 Exhibition on Henry Baker Tristram Voyage in the Middle East, more than 150 years ago (on loan from Haifa University).

The Margoling Biological Collection-Today

Beit Margolin Biological collections comprise a large variety of specimens (Table 1; n>25,000), representing different taxonomic groups including fungi, bacteria, nematodes, land and aquatic invertebrates and vertebrates. These specimens are preserved by various methods (dry, slides, in ethanol, deep freeze, etc.). The collections include species collected for a length of more than 80 years, and some are endangered or extinct. For example, one of the earliest specimen collected, is a flea belonging to the family Ceratophyllidae, collected by C. Rotschild in 1938 in London Zoo, from a Patagonian mara (*Dolichotis patagonum*) (**Fig. 3**).

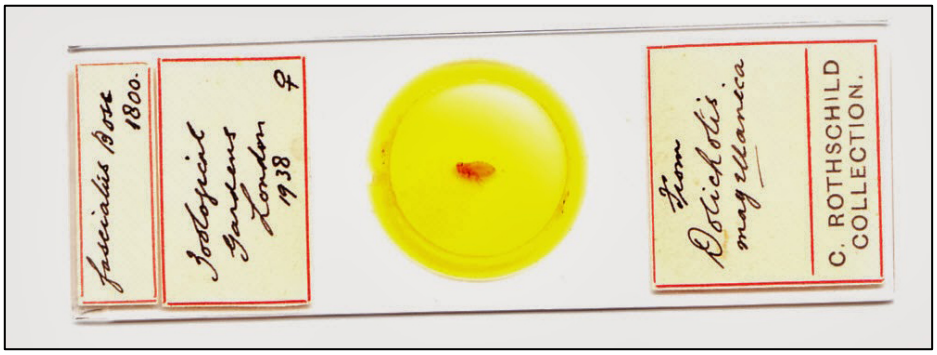

Fig 3. A slide of a flea belonging to the family Ceratophyllidae, collected by C. Rotschild in 1938 in London Zoo, from a Patagonian mara (*Dolichotis patagonum*).

The flea collection includes paratypes identified by late Prof. M. Costa, that was part of Beit Margolin academic researchers.

Another unique and diverse collection at Beit margolin is of Collembola (slides and in ethanol) which was collected and identified by the late Prof. M. Broza, who was an outstanding taxonomst that published several papers describing new species of hexapods (Collembola) (Broza & Izhaki, 1997; Bretfeld, et al., 2000; Broza, et al., 2001; Broza, et al., 2004a,b), and of mole crickets of the *Gryllotalpa gryllotalpa* group (Orthoptera: Gryllotalpidae) (Broza et al., 1998).

To preserve, catalogue, and enhance the collections housed at Beit Margolin, Oranim Academic College, Dr. Irit Zohar was hired as a curator. Mrs. Simchona Weber that is the administrative curator of the insect collection, and Mr. Eitan Mageni that aisd in database managements (conversion to Specify software)- both are teaching instructors at Oranim Academic College, and therefore their work with the collection is performed mainly during the summer vacation. The rest of the personal working in the collection includes part time students.

Since 2013 we imposed new working regulations in regard to: sample collections, processing methods, storage facility, documentation methods, cataloguing, labeling, and storage conditions (room temperature and % humidity). New storage facilities were purchased for the wet collections and for the insect collection.

Assessment and conservation of the collections:

Assessment of the condition of the entire collection is done on a regular basis and the results are recorded, for each collection, accordingly.

Pest control includes fumigation of the entire building, once a year.

In case of deterioration due to pests, we deep freeze in -20^{o}C the damaged specimen or box.
In the wet collection: we routinely assess ethanol level and color.
We provided assessment and evaluation to several private collections such as Beit Hankin, in Kefar Yehoshua, and the Haifa Biological Centre.

Our future goals include the continuity in the effort to catalogue and label each specimen, to convert our databases into online catalogues, to add digitation of each specimen, and to reconstruct a new webpage. Preliminary trial to digitize the Aves collection was performed by one of our students (Itai Bloch) that photographed a small sample of the stuffed birds and eggs (**Fig. 4**).

Fig. 4 Digitation of Common Kestrel *Falco tinnunculus* egg (on left) and of a female Tristram's grackle (*Onychognathus tristramii*) (on the right) (photographed by Itai Bloch).

Research and education

The collection and the curatorial processes that are being applied in the last five years, were presented by Dr. Zohar in several academic meetings and conferences, such as: the Israel society for the conservation and preservation of cultural property; in the SYNTHESYS advanced training in collections management- Modules 2 and 4.
In February 2012 we organized an academic conference at Oranim Academic College, to discuss the issue of conservation and preservation of biological collections that are not sponsored nor recognized as a national natural collection.

MSc and PhD students at Beit Margolin continue with taxonomic studies, some in collaboration with DNA analysis of different taxonomic groups, using many of the collections. Some of these studies include the identification of new species.

Table 1: Beit Margolin biological collections by taxonomic group, scientific curator, number of specimens and cataloguing facility.

Taxonomic group	Scientific Curator	Preservation Method	Number	Cataloging
Fungi- Yeast Cultures	Dr. Yoram Gershman	30% glycerol; at -80°C	34 strains	Catalogued
Bacteria	Prof. Malka Halpern	30% glycerol; 70% LB Broth; at -80°C	2000 strains	In process
Nematoda	Dr. Amir Sapir	-Eppendorf tubes with either 70% Ethanol or 8% formaldehyde	120	In process
Insecta	Dr. Elad Chiel	- 70% Ethanol - Dry in large wooden box	Ca. 6000 specimens 220 boxes, ca. 7000-10,000 specimens 500 slides	Partially Boxes are catalogued
Hexapoda	Dr. Elad Chiel	- 70% Ethanol - Slides	Ca. 2000 specimens 1000 slides	Partially Slides are catalogued
Scorpiones	Dr. Eran Gefen	- 70% Ethanol - Dry in large wooden box		Partially catalogued
Marine invertebrates	Dr. Shai Shafir	- 70% Ethanol - Dry	Ca. 500 > 30,000	Partially catalogued
Fish	Dr. Irit Zohar	- 70% Ethanol - Dry - Skeletons - Otoliths	500 10 700 300	Catalogued
Amphibians	Prof. Uri Shanas	- 70% Ethanol - Skeletons	100 50	Partially catalogued
Reptiles	Prof. Uri Shanas	- 70% Ethanol - Skeletons	300 50	Partially catalogued
Aves	Dr. Shai Markman	- Stuffed - Skeletons - 70% Ethanol - Eggs & nests	500 250 20 800	Catalogued
Mammals	Prof. Uri Shanas	- 70% Ethanol - Skeletons - Stuffed - Skins	150 616 300 76	Partially catalogued
DNA	Dr. Rachel Ben Shlomo	- 95% Ethanol - DMSO - RNA later	nd	n.d.
Paleontological Collection	Dr. Irit Zohar	-Dry	500	Partially catalogued
Geological collection		-Dry	nd	Partially catalogued

Loan to museums and exhibitions:

Few specimens were on loan for temporary exhibition at The Reuben and Edith Hecht Museum, and at the Younes and Soraya Nazarian Library, University of Haifa.
Oranim Academic College legal department is in charge on the agreements of each of the loans.

References cited:

Bretfeld, G., Poliakov, D., **Broza, M**. 2000. Collembola Symphypleona (Insecta, Entognatha) from Israel. Israel Journal of Zoology, 46, 313-341.

Broza, M., Izhaki, I. 1997. Post-fire arthropod assemblages in mediterranean forest soils in Israel. International Journal of Wildland Fire, 7, 317-325. [Collembola included]

Broza, M., Pereira, R.M., Stimac, J.L. 2001. The nonsusceptibility of soil Collembola to insect pathogens and their potential as scavengers of microbial pesticides. Pedobiologia, 45, 523-534.

Broza, M., Poliakov, D., Gruia, M., Bretfeld, G. 2004a. Soil collembolan communities on north- and south-facing slopes of an eastern Mediterranean Valley. Pedobiologia, 48, 537-543.

Broza, M., Poliakov, D., Gruia, M., Bretfeld, G. 2004b. Soil collembolan communities on north- and south-facing slopes of an eastern Mediterranean valley., Pedobiologia. 2004; 48(5-6), p.537-543.

Broza, M., Blondheim, S., Nevo, E., 1998. New species of mole crickets of the *Gryllotalpa gryllotalpa* group (Orthoptera: Gryllotalpidae) from Israel, based on morphology, song recordings, chromosomes and cuticular hydrocarbons, with comments on the distribution of the group in Europe and the Mediterranean region, Systematic Entomology 23, 125-135.

Fungi Collection

Curator: Dr. Yoram Gershman
gerchman@research.haifa.ac.il

The yeasts are eukaryotic, single-celled microorganisms, belonging to the fungi kingdom. Yeast are ubiquitous, found in many diverse environments. Yeasts, and especially *Saccharomyces cerevisiae* are used by humans for food preparation (baking, alcoholic beverage fermentation), production of ethanol as fuel and many others.

The collection of yeast culture has been constructed in the last few years and is under ongoing construction. The collection holds 34 strains (Table 2). The collection includes brewing yeast, genetically-defined yeast (used in many applications), yeast associated with food spoilage and yeast of industrial importance.
The collection is preserved in 30% glycerol, and kept in temperature-controlled room, at -80^{o}C freezer.

Research is performed by Dr. Yoram Gershman that examines evidence of yeasts that are tolerant to high sugar concentrations (osmotolerance and osmophilic) to be used for high gravity fermentation and production of ethanol fuel. To this end Dr. Gershman isolated and screened yeasts from different naturally sugar rich environments, among them honey, flower nectar and many more. From this study there are two patented yeast strains.

This collection is being used for research by Dr. Yoram Gershman, Dr. Elah Pick and their students.

Table 2: Yeast strains collection, by source.

Source	Isolate name	Identification
Spoiled yogurt	AS1	*Pichia manshurica* H4S7K13
	AS12	*Saccharomyces cerevisiae* YC3
Olive press waste water	AS2	*Metschnikowia sinensis* XY103
	AS4	*Metschnikowia sinensis* XY103
	AS6	*Pichia* sp. CBS 241
	AS13	*Pichia* sp. CBS 209
	AS14	*Pichia* sp. CBS 209
	AS15	*P. manshurica*
Food industry waste molasses	AS5	*Zygosaccharomyces rouxii* LL12
	AS10	*Z. rouxii* CBS732
Solandra maxima floral nectar	AS21	*Aureobasidium pullulans* 196B1
	AS22	*A. pullulans* 196B1
Salvia officinalis floral necter	AS37	*Z. bailii* MB508
Date fruit	AS30	*M. chrysoperlae*
	AS29	*M. pulcherrima*
	AS32	*M. pulcherrima*
	AS35	*Z. bailii*
Honey	AS36	*Z.bailii* MB508
	AS38	*Z.bailii* MB508
Wine pomace	AS11	*S. cerevisiae* KKP12
	AS16	*S. cerevisiae* W20
	AS17	*S. cerevisiae* YG3
	AS18	*S. cerevisiae*
	AS19	*S. cerevisiae* SAB
	AS20	*Clavispora lusitaniae* 2
Patented yeast strain**	AS7	*S. cerevisiae* N44
	AS8	*S. cerevisiae* N42
Spoiled chickpea beans	AS25	*C. lusitaniae*
Fermented orange juice	AS31	*A. pullulans* R124
Fermented pomegranate juice	AS26	*Z. bailii*
	AS28	*Z. bailii* GK02 (95% idnt.)
	AS27	*Z. bailii* (97% idnt)
	AS33	*Z. bailii*
	AS34	*Z.bailii*

Bacteria Collection

Curator: Prof. Malka Halpern
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It is estimated that there are about 10^6-10^8 different bacterial species, however, until now, only ca. 14,000 of them were characterized. Prof. Halpern characterized 12 novel species (see the list below).
Malka is listed in the European experts in taxonomy (supervised by Ramon Rossello-Mora, Spain).

The bacteria collection includes more than 2000 bacterial strains (of which 50 are novel) preserved in 30% glycerol, 70% broth and kept at -80^{o}C freezer. These strains were isolated from the various environments, such as chironomid egg masses, raw milk, drinking water, phyllosphere floral nectar and flower visitors. The fact that these are novel species of bacteria makes them a reservoir for novel enzymes and other molecules, all with a potential industrial application (e.g. novel antibiotics). Some of these novel bacteria can produce exopolysaccharides (EPS) that can be used in the dairy industry to improve texture and mouthfeel of dairy products.

The collection is partially catalogued.

Specifically the collection holds many different strains from the following species:

1. *V. cholerae* – more than 40 different serogroups isolated from chironomids, fish and waterbirds.

2. *Aeromonas* – different strains and species isolated from chironomids, fish and waterbirds.

3. *Legionella* sp.– different genotypes isolated from drinking water

Identification of novel bacterial species or genera:

The following list is novel bacterial species that I together with my students have isolated, identified, characterized and named. These species were isolated from raw milk, chironomids, mirid bugs and floral nectar:

Gram-positive bacteria

Phylum Firmicutes

1. *Oceanobacillus chironomi* sp. nov. strain T3944DT (=LMG 23627T, =DSM 18262T). Isolated from chironomid egg masses, GenBank accession numbers for the 16S rRNA gene

sequence is DQ298074 (Bacteria; Firmicutes; Bacilli; Bacillales; Bacillaceae; Oceanobacillus).

Phylum Actinobacteria

2. *Leucobacter chironomi* sp. nov. strain MM2LBT (=LMG 24399T, DSM 19883T). Isolated from chironomid egg masses, GenBank accession number for the 16S rRNA gene sequence is EU346911 (Bacteria; Actinobacteria; Actinobacteridae; Actinomycetales; Micrococcineae; Microbacteriaceae; Leucobacter).

Gram-negative bacteria

Phylum Proteobacteria

3. *Brachymonas chironomi* sp. nov. strain AImA4T (=LMG 24400T =DSM 19884T), solated from chironomid egg masses, GenBank accession number for the 16S rRNA gene sequence is EU346912 (Bacteria; Proteobacteria; Betaproteobacteria; Burkholderiales; Comamonadaceae; Brachymonas).

4. *Rheinheimera chironomi* sp. nov. strain K19414T (=LMG 23818T, = DMS 18694T), Isolated from chironomid egg masses, GenBank accession number for the 16S rRNA gene sequence is DQ298025 (Bacteria; Proteobacteria; Gammaproteobacteria; Chromatiales; Chromatiaceae; Rheinheimera).

5. *Acinetobacter rudis* sp. nov. strain G30T (=DSM 24031T =LMG 26107T =CCUG 57889T) isolated from raw milk and raw wastewater. GenBank accession number for the 16S rRNA gene sequences for strain G30T is EF204258 (Bacteria; Proteobacteria; Gammaproteobacteria; Pseudomonadales; Moraxellaceae; Acinetobacter).

6. *Phaseolibacter flectens* gen. nov. combination nov. GenBank accession number for the 16S rRNA gene sequence of the type strain Phaseolibacter flectens ATCC 12775T is AB021400 (Bacteria; Proteobacteria; Gammaproteobacteria; Enterobacteriales; Enterobacteriaceae; Phaseolibacter).

7. *Rosenbergiella nectarea* gen. nov. sp. nov., isolated from flower nectar. The GenBank accession number for the 16S rRNA gene sequence of the type strain 8N4T is HQ284827 (=LMG 26121T =DSM 24150T). (Bacteria; Proteobacteria; Gammaproteobacteria; Enterobacteriales; Enterobacteriaceae; Rosenbergiella).

8. *Izhakiella capsodis* gen. nov. isolated from a mirid bug. The GenBank accession number for the 16S rRNA gene sequence of the type strain N6PO6T is are KF436763 (=LMG 28430T =DSM 29293T). (Bacteria; Proteobacteria; Gammaproteobacteria; Enterobacteriales; Enterobacteriaceae; Izhakiella).

Phylum Bacteroidetes

9. *Chryseobacterium haifense* sp. nov. strain H38T (=LMG 24029T =DSM 19056T), isolated from raw milk, GenBank accession number for the 16S rRNA gene sequence is EF204450 (Bacteria; Bacteroidetes; Flavobacteria; Flavobacteriales; Flavobacteriaceae; Chryseobacterium).

10. *Chryseobacterium bovis* sp. nov. strain H9T (=LGM 24227T =DSM 19482T), isolated from raw milk, GenBank accession number for the 16S rRNA gene sequence is EF204446 (Bacteria; Bacteroidetes; Flavobacteria; Flavobacteriales; Flavobacteriaceae; Chryseobacterium).

11. *Chryseobacterium oranimense* sp. nov. strain H8T (=LMG 24030T = DSM 19055T) isolated from raw milk, GenBank accession number for the 16S rRNA gene sequence is EF204451 (Bacteria; Bacteroidetes; Flavobacteria; Flavobacteriales; Flavobacteriaceae; Chryseobacterium).

12. *Epilithonimonas lactis* sp. nov. strain H1T (=LMG 24401T =DSM 19921T) isolated from raw milk, GenBank accession number for the 16S rRNA gene sequence is EF204460 (Bacteria; Bacteroidetes; Flavobacteria; Flavobacteriales; Flavobacteriaceae; Epilithonimonas).

The collection is being used for diverse MSc and PhD studies, as listed below for the last five years.

MS.c. Students	Collaborator		Year
Hila Mizrahi	Dr. Avi Peretz, Poriya Hospital	*Legionella* prevalence in clinical and environmental samples in northern Israel	2015

Ph.D. Students

Yigal Senderovich		The relationships between chironomids, their endogenous bacterial communities and other potential bacterial vectors with specific highlight on *Vibrio cholerae* and *Aeromonas*	2013
Yana Aizenberg-Gershtein	Prof. Ido Izhaki	Interactions among floral nectar secondary metabolites, bacterial communities and nectar consumers	2016
Sivan Laviad-Shitrit		Interactions between *V. cholerae* and its potential hosts and vectors	In progress
Yehonatan Sharaby		Interactions between *Legionella pneumophila* and other Prokaryotes and Eukaryotes in drinking water systems	In progress
Rotem Sela		The role of quorum sensing signals on the interactions between *Vibrio cholerae* and chironomids microbiota	In progress

Tamir Ofek	Prof. Ido Izhaki	Fish microbiome in healthy *vs.* diseased fish	In progress

Post-Doc fellows

Dr. Nof Atamna-Ismaeel		The Role of Quorum-Sensing Signals in the Production of a Secreted Protease by *Vibrio cholerae* in Environmental Mixed Species Consortia on Chironomid Egg Masses	July, 2012 – August 2013
Dr. Michal Samuni-Blank	Prof. Ido Izhaki	Bacterial community composition and diversity in floral nectar: The roles of environmental versus spatial factors along climatic gradient and across Israel	December, 2012 – November 2013
Dr. Sarah Rodríguez-Martinez		High-resolution analysis of *Legionella* spp. populations in drinking water and consumers - assessing factors driving pathogenesis and disease incidence	March, 2012-September, 2016
Dr. Mohanraj Gunasekaran	Prof. Ido Izhaki	Gut microbiome of nectarivorous birds in relation to nectar microbiome and secondary metabolites: ecological and evolutionary perspectives	January 2018-present

List of collaborators in the world (that use or used the bacterial culture collection):

1. Prof. Manfred Höfle and Dr. Ingrid Brettar, Helmholtz center, Braunschweig, Germany (DFG, Grant No. GZ:HO 930/5-1 & 5-2 and a new research proposal to the DFG, pending) (Legionella).
2. Prof. Dina Bahader Bitar, El Quds University, Jerusalem (DFG, Grant No. GZ:HO 930/5-1 & 5-2 and a new research proposal to the DFG, pending) (Legionella).
3. Prof. Brian K. Hammer, Georgia Institute of Technology, USA (CRDF grant no. ILB1-7045-HA; BSF grant no. 2015103) (V. cholerae).
4. Prof. Bimalendu B. Nath, Dept. of Zoology, S.P. Pune University, Pune, India (India, Joint UGC – ISF grant no. 2707/16) (Chironomids and V. cholerae).
5. Dr. Eiji Arakaw National Institute of Infectious Diseases, Tokyo (Tokyo, Japan). (serogrouping of V. cholerae isolates).
6. Maria Jose Figueras Universitat Rovira i Virgili, Spain. Re-identification of Aeromonas species.

List of articles that were published in the last five years (relevant to the taxonomy study):

1. Halpern, M. , Fridman, S., Aizenberg-Gershtein Y. and Izhaki, I. (2013) Transfer of Pseudomonas flectens Johnson (1956) to *Phaseolibacter* gen. nov., in the family Enterobacteriaceae, as *Phaseolibacter flectens* comb. nov. International Journal of Systematic and Evolutionary Microbiology. 63: 268-273.

2. Izhaki, I., Fridman S., Gerchman Y. and Halpern, M. (2013) Variability of bacterial community composition on leaves between and within plant species. Current Microbiology 66: 227-235.

3. Aizenberg-Gershtein, Y., Izhaki, I. and Halpern, M. (2013) Do honeybees shape the bacterial community composition in floral nectar? PLoS One 8: e67556.

4. Senderovich, Y. and Halpern, M. (2013) The protective role of endogenous bacterial communities in chironomid egg masses and larvae. ISME Journal (Nature group) 7: 2147-2158. (IF-9.267, R-4/141, Q1).

5. Halpern, M., Fridman, S. Atamna-Ismaeel, N. and Izhaki, I. (2013) *Rosenbergiella nectarea* gen. nov. sp. nov., in the family Enterobacteriaceae, isolated from floral nectar. International Journal of Systematic and Evolutionary Microbiology 63: 4259-4265.

6. Samuni-Blank, M., Izhaki, I., Laviad, S., Bar-Massada, A. Gerchman, Y. and Halpern, M. (2014). The role of abiotic environmental conditions and herbivory in shaping bacterial community composition in floral nectar. PLoS One 9: e99107.

7. Rodríguez-Martínez, S., Sharaby, Y., Brettar, I., Pecellin, M., Höfle, M. and Halpern, M. (2015) Spatial distribution of *Legionella pneumophila* MLVA-genotypes in a drinking water system. Water Research 77: 119-132.

8.Laviad, S., Lapidus, A., Copeland, A., Reddy, T. B. K., Huntemann, M., Pati, A., Ivanova, N. N., Markowitz, V. M., Pukall, R., Klenk, H. P. Woyke, T. Kyrpides, N. C. and Halpern, M. (2015) High quality draft genome sequence of *Leucobacter chironomi* strain MM2LBT (DSM 19883T) isolated from a *Chironomus* sp. egg mass. Standards in Genomic Sciences 10: 21.

9. Laviad, S., Lapidus, A., Han, J., Haynes, M., Reddy, T. B. K., Huntemann, M., Pati, A., Ivanova, N. N., Mavromatis, K., Lang, E., Rohde, M., Markowitz, V., Woyke, T., Klenk, H. P., Kyrpides, N. C. and Halpern, M. (2015) High quality draft genome sequence *of Brachymonas chironomi* AIMA4T (DSM 19884T) isolated from a *Chironomus* sp. egg mass. Standards in Genomic Sciences 10: 29.

10. Halpern, M. and Senderovich, Y. (2015) Chironomid Microbiome. Review. Microbial Ecology 70: 1-8.

11. Aizenberg-Gershtein, Y., Izhaki, I., Santhanam, R., Kumar, P., Baldwin, I.T. and Halpern, M. (2015) Pyridine-type alkaloid composition affects bacterial community composition of floral nectar. Scientific Reports (Nature group). 5: 11536.
12. Blanky, M., Rodríguez-Martínez, S., Halpern, M. and Friedler, E. (2015) *Legionella pneumophila*: from potable water to treated greywater; Quantification and removal during treatment. Science of the Total Environment 533: 557-565.
13. Rodríguez-Martínez, S., Blanky, M., Friedler, E. and Halpern, M. (2015) *Legionella* spp. isolation and quantification from greywater. MethodsX 2: 458-462.
14. Aizenberg-Gershtein, Y., Izhaki, I., Lapidus, A. Copeland, A., Reddy, T. B. K., Huntemann, M., Pillay, M., Markowitz, V., Göker, M., Woyke, T., Klenk, H. P., Kyrpides, N. C. and Halpern, M. (2016) High quality permanent draft genome sequence of *Phaseolibacter flectens* ATCC 12775T, a plant pathogen of French bean pods. Standards in Genomic Sciences. 11: 4.
15. Laviad, S., Golan, A., Shaked, T., Vaizel-Ohayon, D., Halpern, M. and Pick, E. (2016) *Aeromonas chitinase* degrades chironomid egg masses. Environmental Microbiology Reports. 8: 30–37.
16. Aizenberg-Gershtein, Y., Laviad, S., Samuni-Blank, M. and Halpern M. (2016) *Izhakiella capsodis* gen. nov. sp. nov., in the family Enterobacteriaceae, isolated from the mirid bug *Capsodes infuscatus*. International Journal of Systematic and Evolutionary Microbiology 66: 1364–1370.
17. Laviad, S. and Halpern, M. (2016) Chironomids' Relationship with Aeromonas Species. Frontiers in Microbiology. Review. 7: 736.
18. Halpern, M. and Izhaki, I. (2017) Fish as possible reservoirs and vectors of Vibrio cholerae. Frontiers in Microbiology. Review. 8: 282. (IF- 4.076, R-25/124, Q1).
19. Sharaby, Y., Rodríguez-Martínez, S., Oks, O., Pecellin, M., Mizrahi, H., Peretz, A., Brettar, I., Höfle M. G. and Halpern, M. (2017) Temperature-dependent growth modeling of environmental and clinical *Legionella pneumophila* MLVA-genotypes. Applied and Environmental Microbiology. 83: e03295-16.
20. Laviad Shitrit, S., Goeker, M., Huntemann, M., Clum, A., Pillay, M., Palaniappan, K., Varghese, N., Mikhailova, N., Stamatis, D., Reddy, T. B. K., Daum, C., Shapiro, N., Markowitz, V., Ivanova, N., Woyke, T., Klenk, H. P., Kyrpides, N. C. and Halpern, M. (2017) High quality permanent draft genome sequence of *Chryseobacterium bovis* DSM 19482T, isolated from raw cow milk. Standards in Genomic Sciences. 12: 31.

21. Laviad-Shitrit, S., Lev-Ari T., Katzir, G., Sharaby, Y., Izhaki, I. and Halpern, M. (2017) Great cormorants (*Phalacrocorax carbo*) as potential vectors for the dispersal of Vibrio cholerae. Scientific Reports (Nature group). 7: 7973.
22. Kechker, P., Senderovich, Y., Ken-Dror, S., Laviad-Shitrit, S., Arakawa, E. and Halpern, M. (2017) Otitis media caused by Vibrio cholerae O100: A case report and review of the literature. Frontiers in Microbiology. 8: 1619.
23. Blanky, M., Sharaby, Y., Rodríguez-Martínez, S., Halpern, M. and Friedler, E. (2017) Greywater reuse - Assessment of the health risk induced by *Legionella pneumophila*. Water Research 125: 410-417. (IF-6.942, R-1/88, Q1).
24. Sharaby, Y., Rodríguez-Martínez, S., Pecellin, M., Sela, R., Peretz, A., Höfle, M. G., Halpern, M. and Brettar, I. (2018) Virulence traits of environmental and clinical *Legionella pneumophila* MLVA genotypes. Applied and Environmental Microbiology. 84: e00429-18.
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Nematoda Collection
Curator: Dr. Amir Sapir
amirsapir1@gmail.com

In many deep-sea settings, nematodes were found to be the dominant phylum among benthic meiofauna (animals with body size between 45 micrometer and 1 millimeter). In contrast to many other deep-sea animals, the transparency of nematodes enables direct and detailed morphological analyses of nematodes and their associates. In previous study (Spair et al., 2014) we provided detailed morphological descriptions of several species of Desmodora (Superfamily Desmodoroidea, family Desmodoridae) and Prochaetosoma species (superfamily Desmodoroidea, family Draconematidae). In addition we provided analysis of small ribosomal subunit (SSU) rDNA.

The nematodes collection at Oranim Academic college include samples of different species collected from the Juan-de-Fuca (JDF) hydrothermal vents system of the North-East Pacific at a water depth of 3000 meter below sea level. JDF is a system of active and inactive hydrothermal vents located approximately four hundred and fifty kilometers west of Washington State in the Pacific Ocean. The nematode collection is kept in Eppendorf tubes with either 70% ETOH or in 8% formaldehyde.
For each species identified, we have 40 individuals. We also collected worms that were fixed immediately after sampling either in 70% ETOH or in 8% formaldehyde.

The current study is based on detailed morphological description and 18S rDNA analyses. The 18S analyses revealed that the closest relatives of JDF's nematodes are marine nematodes of clade I, therefore these nematodes belong to the most basal group of nematodes. Therefore, our long-term objective is to rely on nematodes prevalence in specific deep-sea habitats in order to study various aspects of animal biology taking place in this biosphere.

Detailed morphological analyses revealed that, like most species of marine nematodes, the three species are gonochoristic. In accord with previous reports about the reproductive state of nematodes isolated from the deep-sea, most of the isolated worms were reproducing adults i.e. females harbor oocytes in their gonads and a few developing embryos in their uterus and males with sperm cells in their gonads.

Currently, we are in the process of writing a manuscript describing the unique biology of these nematodes. In the future, we plan to samples many more extreme habitats in Israel, e.g., the Dead Sea; and around the world in order to study further the fascinating biology of nematodes I extreme habitats on the Planet Earth.

The nematode study is performed in collaboration with:

Tali Mass University of Haifa

Benjamin Grupe Fisheries and Oceans Canada | DFO · Institute of Ocean Sciences

Publications

Sapir, A., Dillman, AR., Connon ,SA., Grupe, BJ., Ingels, J., Mundo-Ocampo, M., Levin, LA., Baldwin, JG, Orphan, VJ., and Sternberg, PW. (2014). Microsporidia-nematode associations in methane seeps reveal basal fungal parasitism in the deep sea. Front Microbiol.5:43

Insecta Collection

Curator: Dr. Elad Chiel

Elad_c@oranim.ac.il

Collection manager: Simchoma Weber

Simchona_w@oranim.ac.il

The insect collection is one of our largest and diverse collections. The collection includes over 30,000 specimens from Israel and various locations worldwide.

Large bulk of the collection is kept dry in boxes or on slides, while some specimens are stored in 80% ethanol (Fig. 5).

The collection includes insects collected for more than 80 years, by various researcher and biology students at Oranim Academic College. Some of the species are either extinct or endangered due to the loss of their habitat (for example: Lake Hula).

Taxonomic identification of some of the orders includes type species that have been identified by researchers at Oranim Academic College. For example the order Orthoptera was studied by the late Prof. Broza who identified several new species of mole crickets of the *Gryllotalpa gryllotalpa* group (Orthoptera: Gryllotalpidae) (Broza et al., 1998).

Another unique collection is the one fleas, established by the late Prof. Costa (see above)

Storage:

The vast majority of the specimens are stored in wooden boxes (dry collection). In 2015 we transferred the entire collection to new, state of the art, wooden boxes and new cabinets (Fig. 5).

The storage room maintains low room temperature of 16^{o}C, all year round.

Due to safety and health regulations, the new storage facilities do not carry Naphthalene for pest control. Instead, we monitor the boxes on a weekly basis and boxes with damage evidence are freeze-treated.

Fig 5. The Insecta dry collection storage cabinets, on the left, and a collection box of extinct genus of dragonfly (Urothemis) in the family Libellulidae.

Cataloguing

Dry collection: All of the boxes are catalogued to different levels.

Level 1: boxes with specimens identified by order, family and species level.

Level 2: boxes used for teaching and therefore the specimens are organized by subjects such as: mimicry, colors, etc.

Level 3: boxes with specimens collected for the last 40 years by the biology students at Oranim. Each box contain specimens collected from a particular habitat, or geographic area, by date. Some of the specimens are not identified.

We have marked boxes with specimens that are either: extinct, endangered or with paratypes.

At present we catalogued specimens from 12 orders (Table 3) and 44 families (Table 4).

Table 3: List of 14 orders catalogued at the Insecta dry scientific collection.

Order
Lepidoptera
Blattodae
Coleoptera
Diptera
Hemiptera
Hymenoptera
Mantodea
Neuroptera
Odonata
Orthoptera
Phasmatodea
Siphonaptera

Recent research:

- Parasitoids in orchards.
- Examination of populations of natural enemies of crops' parasitoids and pests. This study includes taxonomic study of the arthropods collected from the plants.
- The effects of forest fire buffer-zones on flowers, their bee visitors and pollination webs.

MSc and PhD students:

Alon Ornai

Miriam Kishinevsky

Shlomo Cain

Table 4: List of the 144 families identified at Beit Margolin Insecta dry scientific collection.

Family	Family	Family	Family
Acrididae	Cicadidae	Issidae	Pieridae
Adelidae	Cicindelidae	Lampiridae	Platycnemididae
Aeschnidae	Cimbicidae	Lasiocampidae	Platystomidae
Alleculidae	Cixiidae	Lemoniidae	Polyphagidae
Alydidae	Cleridae	Lestidae	Pompilidae
Andrenidae	Coccinelidae	Libellulidae	Psychidae
Anthicidae	Coenagrionidae	Lucaenidae	Ptinidae
Apidae	Colletidae	Lycridae	Pyralidae
Arctiidae	Conopidae	Lygaeidae	Pyromorphidae
Ascalaphidae	Coreidae	Lymaniridae	Pyrrhocoridae
Asilidae	Coryxidae	Malachidae	Ranatridae
Bacillidae	Cossidae	Mantidae	Reduvidae
Belastomidae	Curculionidae	Masaridae	Sacatomycidae
Berytidae	Cydnidae	Megachilidae	Saturnidae
Bibionidae	Cynipidae	Meloidae	Scarabeidae
Blattelidae	Dartalidae	Melyridae	Scoliidae
Blattidae	Dasytidae	Membracidae	Sesiidae
Bombilidae	Dermestidae	Miridae	Silphidae
Bombycidae	Drepanidae	Muscidae	Sircidae
Bostrichidae	Dytiscidae	Mutillidae	Sphecidae
Braconidae	Elateridae	Myrmeleontinae	Sphingidae
Brenthidae	Evaniidae	Nabidae	Staphylinidae
Bruchidae	Gelechidae	Naucortidae	Stratiomidae
Buprestidae	Geometridae	Nemestrinidae	Syntomidae
Caliphoridae	Gerridae	Nemopteridae	Syrphidae
Calopterygidae	Gomphidae	Nepidae	Tabanidae
Carabidae	Gryllidae	Nitidulidae	Tachinidae
Catantopidae	Gryllotalpidae	Noctuidae	Tenebrionidae
Cephidae	Gyrinidae	Notodontidae	Tephritidae
Cerambycidae	Halicidae	Notonectidae	Tettigoniidae
Cercopidae	Hesperiidae	Nymphalidae	Thentrhredinidae
Chalcididae	Hiposcidae	Oedemeridae	Therevidae
Chrisopidae	Histeridae	Ostomidae	Tineidae
Chrysilidae	Hydrometridae	Pamphagidae	Vellidae
Chrysomelidae	Hydrophilidae	Papilionidae	Vespidae
Cicadellidae	Ichneumonidae	Pentatomidae	Zygaenidae

Collaborations:

Scientific collaboration is performed with collections in Israel and abroad. These includes:

Dr. Ally Harari , Entomology Department, Volcani Center, Bet Dagan, Israel

Dr. Efrat Gavish-Regev , The National Natural History Collections, The Hebrew University, Jerusalem, Israel

Carmit Sofer Arad, Maor Tomer, Almog Avraham, and Dr. Rakefet Sharon, the Northern R&D, MIGAL-Galilee Technology Center, Kiryat Shmona, Israel.

Dr. Netta Dorchin, the Steinhardt Museum of Natural History at Tel Aviv University, Israel.

Dr. Lorenzo Prendini, American Museum of Natural History, Ney York, USA

Visiting researchers:

Dr. Dorchin, A. University of Haifa, Israel

Orbach, E. Kiryat Tivon, Israel

Blecher, M. Ein Gedi Nature Reserve, Israel Nature and Parks Authority, Israel

Dr. Lorenzo Prendini, American Museum of Natural History, Ney York, USA

Collaboration with other collections:

Canadian National Collection of Insects, Arachnids, and Nematodes (CNC).

University of California Riverside Entomology Research Museum, CA, USA.

American Museum of Natural History, Ney York, USA

Museum für Naturkunde Berlin, Germany

Naturhistorische Museum, Vienna , Austria

Muséum national d'Histoire, Paris, France

The Steinhardt Museum of Natural History**,** Tel Aviv University

Recent Publications:

Chiel, E., Kuslitzky, W., 2016. Diversity and abundance of house fly Pupal Parasitoids in Israel, with first records of two *Spalangia* L. species, Environmental Entomology 45, 283-291.

Danon, G., Ben-Shlomo, R., Keidar, N., Dorchin, N., 2017. Geographic and behavioural isolation promote the differentiation of parapatric host-associated forms in bud-galling midges (Diptera: Cecidomyiidae), Biological Journal of the Linnean Society 121, 163-173.

Kishinevsky, M., Keasar, T. & Bar-Massada, A. Parasitoid abundance on plants: effects of host abundance, plant species, and plant flowering state. Arthropod-Plant Interactions (2017) 11: 155. https://doi.org/10.1007/s11829-016-9476-2

Kishinevsky, M., Cohen, N., Chiel, E., Wajnberg, E., Keasar, T., 2018. Sugar feeding of parasitoids in an agroecosystem: effects of community composition, habitat and vegetation, Insect Conservation and Diversity 11, 50-57.

Kishinevsky, M., Keasar, T., Harari, A.R., Chiel, E., 2017. A comparison of naturally growing vegetation vs. border-planted companion plants for sustaining parasitoids in pomegranate orchards, Agriculture, Ecosystems & Environment 246, 117-123.

Ornai A, Ne'eman G, Potts SG, **Keasar T**. Changes in composition of a Mediterranean bee community after 16 years and their potential drivers (in prep).

Priscila, G.P., J., B.M., Maya, L., Assaf, M., Yair, B.D., Neta, M.D., J., P.S., Lilach, I.K., Elad, C., 2017. An exceptional family: Ophiocordyceps-allied fungus dominates the microbiome of soft scale insects (Hemiptera: Sternorrhyncha: Coccidae), Molecular Ecology 26, 5855-5868.

Shapira, I., Keasar, T., Harari, A.R., Gavish-Regev, E., Kishinevsky, M., Steinitz, H., Sofer-Arad, C., Tomer, M., Avraham, A., Sharon, R., 2018. Does mating disruption of Planococcus ficus and Lobesia botrana affect the diversity, abundance and composition of natural enemies in Israeli vineyards? Pest management science.

Flea and lice collections:

The flea and lice collections are kept dry on slides and stored in boxes. The collection was established by the late Prof. Michael Costa and includes specimens collected from the Middle East, Egypt, Europe, India and Brazil. Some of the specimens were collected by Costa, while others were obtained from different collectors. The latest include specimens collected more than 100 years ago (Fig. 6). Prof. Costa taxonomically identified some of the collected specimens. This includes the species *Leptopsylla algiri costai*, sampeled from a greater white-toothed shrew (*Crocidura russula*).

You tube film on Beit Margolin Flea collection:

https://www.youtube.com/watch?v=w4IZruveXaI

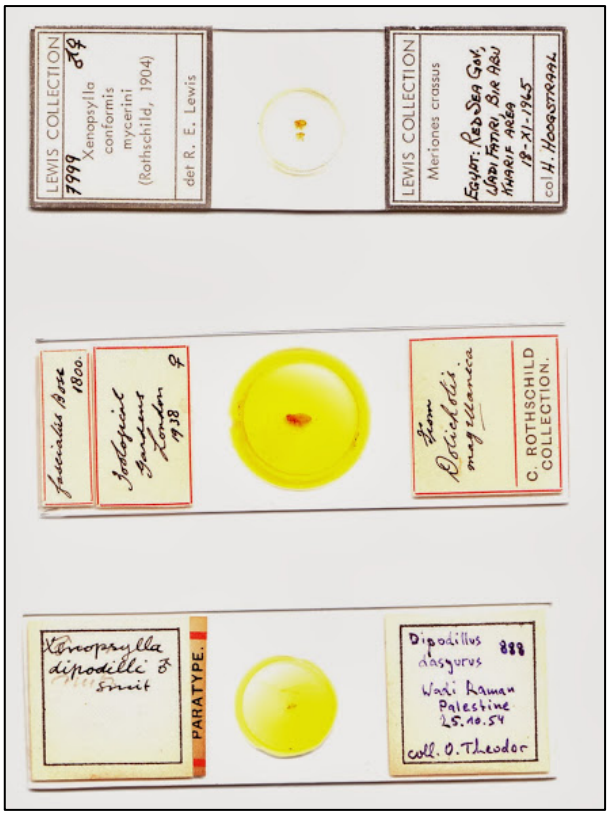


Fig 6. Slide of fleas from Prof. Costa collection.

Cataloguing:

At present the flea collection is catalogued and includes 437 slides of 40 species from 8 families (Table 5). Some of the slides were digitized (Fig. 6). Each slide documents information in regard to the collection date, habitat, host animal, sex, etc. (Fig. 6).

Table 5: Taxonomic list of flea slides catalogued in the collection.

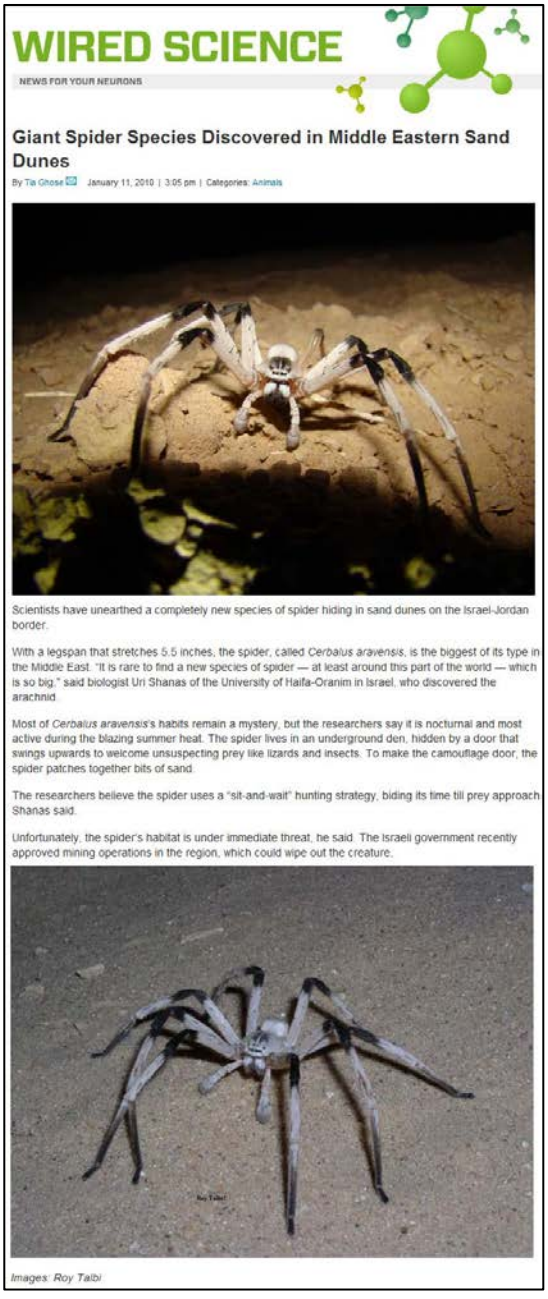
Species	Species	Species
Archaeopsylla erinacei erinacei	*Echidnophaga* sp.	*Polygenis bohlsi jordani*
Callopsylla caspia	*Fssialus Bosc.*	*Polygenis bohlsi tripus*
Ceratophyllus fringillae	*Leptopsylla algira*	*Pulex irritans*
Ceratophyllus garei	*Leptopsylla algira costai*	*Rhinolophopsylla unipectinata*
Ceratophyllus hirundinis	*Leptopsylla segnis*	*Rhodinopsylla sp.*
Chaetopsylla globiceps	*Myoxopsylla laverani*	*Stenoponia tripectinata spinellosa*
Coptopsylla joanae	*Nosopsyllus henleyi henleyi*	*Synosternus cleopatrae*
Ctenocephalidae arabicus multispinosus	*Nosopsyllus iranus attenuatus*	*Synosternus pallidus*
Ctenocephalidae canis	*Nosopsyllus pumilionis*	*Xenopsylla astia*
Ctenocephalidae canis?	*Nosopsyllus sincerus*	*Xenopsylla cheopis*
Ctenocephalidae felis	*Nosopsyllus durii*	*Xenopsylla conformis mycerini*
Ctenocephalidae felis strongylus	*Nosopsyllus londiniensis*	*Xenopsylla dipodilli*
Ctenophthalmus sp.	*Nosopsyllus sincerus*	*Xenopsylla nubica*
Ctenophthalmus congener asiaticus	*Nosopsyllus* sp.	*Xenopsylla ramesis*
Ctenophthalmus levanticus	*Nosopsyllus theodori*	*Xenopsylla sp.*
Echidnophaga murina	*Paraceras melis*	
Echidnophaga popovi	*Parapulex chephrenis*	

Arthropoda (excluding Insecta) Collection

Curator: Dr. Eran Gefen

gefene@research.haifa.ac.il

This collection includes various specimens of non-insect Hexapods (springtails, Diplura, Collembola), spiders, scorpions and more. Recently, the endangered and rare giant spider- *Cerbalus aravaensis* was collected by Prof. Uri Shanas (**Fig. 7**).



WIRED SCIENCE

NEWS FOR YOUR NEURONS

Giant Spider Species Discovered in Middle Eastern Sand Dunes

By Tia Ghose | January 11, 2010 | 3:05 pm | Categories: Animals

Scientists have unearthed a completely new species of spider hiding in sand dunes on the Israel-Jordan border.

With a legspan that stretches 5.5 inches, the spider, called *Cerbalus aravensis*, is the biggest of its type in the Middle East. "It is rare to find a new species of spider — at least around this part of the world — which is so big," said biologist Uri Shanas of the University of Haifa-Oranim in Israel, who discovered the arachnid.

Most of *Cerbalus aravensis*'s habits remain a mystery, but the researchers say it is nocturnal and most active during the blazing summer heat. The spider lives in an underground den, hidden by a door that swings upwards to welcome unsuspecting prey like lizards and insects. To make the camouflage door, the spider patches together bits of sand.

The researchers believe the spider uses a "sit-and-wait" hunting strategy, biding its time till prey approach, Shanas said.

Unfortunately, the spider's habitat is under immediate threat, he said. The Israeli government recently approved mining operations in the region, which could wipe out the creature.

Images: Roy Talbi

Fig 7. The giant spider- *Cerbalus aravaensis* identified by Prof. Uri Shanas at the Arava desert (photographed by Roi Talbi).

Scorpion systematics and biogeography- Eren Geffen Lab

Recent work revealed that at least four genetically-distinct species within the genus Scorpio (Scorpionidae) occur in Israel.

Following the success of that a collaborative project with Dr. Lorenzo Prendini, the arachnid collection curator at the AMNH, New York, laboratory revealed that at least four genetically-distinct species within the genus Scorpio (Scorpionidae) occur in Israel.

A new project is aimed to resolve the phylogeny, biogeography and ecophysiology of *Buthacus* sp. (Buthidae) populations, which are limited in Israel to fragmented, sandy habitats in the south. In this study we collected specimens from dozens of localities and studied specimens deposited at the National Natural History Collections at the Hebrew University in Jerusalem and at the AMNH. In addition, we examined specimens/photos kindly provided by collection curators in the Paris, Berlin, Vienna and St. Petersburg museums. When the *Buthacus* project is concluded, specimens will be deposited at the AMNH, Hebrew University and the Oranim collections.

References:

Talal, S., Tesler, I., Sivan, J., Ben-Shlomo, R., Muhammad Tahir, H., Prendini, L., Snir, S., Gefen, E., 2015. Scorpion speciation in the Holy Land: Multilocus phylogeography corroborates diagnostic differences in morphology and burrowing behavior among Scorpio subspecies and justifies recognition as phylogenetic, ecological and biological species, Molecular Phylogenetics and Evolution 91, 226-237.

Talal, S., Tesler, I., Sivan, J., Ben-Shlomo, R., Muhammad Tahir, H., Prendini, L., Snir, S., Gefen, E., 2015. Scorpion speciation in the Holy Land: Multilocus phylogeography corroborates diagnostic differences in morphology and burrowing behavior among Scorpio subspecies and justifies recognition as phylogenetic, ecological and biological species, Molecular Phylogenetics and Evolution 91, 226-237.

Marine Invertebrates Collection

Curator: Dr. Shai Shafir

shai_s@oranim.ac.il

The collection of marine invertebrates include over 35,000 specimens from Israel and various locations worldwide. The specimens are kept either dry or in 80% ethanol.

The malacological collection was identified by Henk K. Mienis, from the National Natural History Collections of the Hebrew University and Tel Aviv University.

The malacological collection holds more than 30,000 specimens, belonging to more than 200 families and identified to more than 1,000 species. For the dry specimens: each taxon is in a storage box, labeled by continuous number and location in the cabinet (Fig. 8). Each drawer is labeled with the name of the contents and each cabinet have the name of the group it contains.

The malacological dry collection is under the process of cataloguing and sorting, as a final project of one of the students. This process will include digitation of some of the specimens.

The collection is used for teaching taxonomy of mollusk, corals etc.

Visiting researchers:

Inbar Ktalav from Haifa University, Israel

Inbar used the collection to identify two species of mollusks recovered from archaeological sites, in Israel.

Fig. 8 The malacological collection at Beit Margolin, during the process of cataloguing.

Vertebrate collections

1. Ichthyology Collection

Curator: Dr. Irit Zohar
zoharir@gmal.com

The ichthyology collection includes specimens preserved in ethanol, dry fish and skeletons. In the wet collection:although the initial preservation was done in formaldehyde, the specimens are stored in ethanol 80%.

There are about 300 jars with fish from different aquatic habitats: Lake Hula, Sea of Galilee, Mediterranean Sea, and Red Sea. Some of the species collected are endemic to their habitat: *Mirogrex terraesancate*- endemic species to Lake Kinneret.

This collection has been transferred into a new storage facility (Fig. 9), and in under the process of cataloguing, according to jar number and location.

Some of the jars include fish that wre collected more than 40 years ago, but were not identified.

Fig 9. Wet collection: old storage on the left vs. new storage on the right.

In addition to the wet collection I. Zohar hold her private collection of fish skeletons. This collection is widely used for identification of fish remains from archaeological site. At

present, none of the biological collections housed at the universities in Israel have a reference collection with fish skeletons. This collection holds more than 700 skeletons from 96 families and more than 100 species collected from different habitats in the Middle East, and Egypt (Table 6). Some of the species include more than 20 specimens, in different body sizes. This enables the establishment of regression equations for body mas (weight, total length, standard length) estimation for the archaeological material. The fish represent diverse habitats (Freshwater, Mediterranean Sea, red Sea) that have been exploited in the past.
Such a reference collection is crucial for identification of fish remains recovered from archaeological sites, as environmental and cultural markers. The collection include also a huge collection (>500) of fish ear stones-otoliths.

Research projects:

1) Fishing and fishery during the Epipaleolithic: Ohalo-II as a case study. This study focus on fish remains recovered from an Epipaleolithic fishing village dated to 23,000 B.P. This study included the establishment of a reference collection from local freshwater fish and study of the osteological characteristics of freshwater fish from nearby habitats (Turkey, Syria, Lebanon and Egypt).
2) Fish natural accumulation: this is the first taphonomic model that characterizes fish death assemblage from the lacustrine sediments of Lake Kinneret. This model has been, and is still being used to identify culturally deposited fish from waterlogged sites.
3) The diet of European Otter (*Lutra lutra* L.) in the Jordan Rift Valley. This study enabled me to establish another taphonomic model that characterize fish remains that resulted from animal activities and differentiate them from natural death or cultural accumulations.
4) Ethnographic and taphonomic studies on: fish butchering methods for long term preservation by modern fishermen in Panama and Sinai (in collaboration with Dr. Richard Cooke from the Smithsonian Tropical Research Institute); and the effect of cooking temperature on cooked and burnt fish bones.
5) Study of fish remains from the Epipaleolithic period of the southern Levant, examining evidence of Mediterranean fish exploitation.
6) Study of the connection between the “Sea people” and fish exploitation. This study includes examination of fish remains recovered from Tel Abu-Hawam (in

collaboration with Michal Artzy from Haifa University) and Tel Dor (in collaboration with Prof. Guy Bar-Oz and Dr. Ayelet Gilboa from the University of Haifa).

7) Study of the composition of oxygen isotope in fish teeth: Sparidae, Cyprinidae, and Scariidae as environmental and cultural proxy. This study is performed in collaboration with Dr. Guy Sisma-Ventura.
8) Analysis of fish remains from Paleo Lake Hula the (in collaboration with Prof. Naama Goren- Inbar from the Institute of Archaeology, The Hebrew University of Jerusalem, and Prof. Gonen Sharon from Tel-Hai Academic College). This is the first (and only) study on fish community from paleo-lake Hula and their contribution to hominine diet.
9) Study of the osteological characteristics of Cyprinidae and Cichlidae, including the use of 3D camera, in collaboration with Prof. Leore Grossman (the Institute of Archaeology, The Hebrew University of Jerusalem).
10) Examining the taxonomy of fish remains from various sites located in the Jordan Rift valley. These sites included samples from the Lower Paleolithic site of ‘Ubediya, and the Mousterian site of Nahal Mahanayeem (NMO).

Study of fish remains from the Byzantine Negev, in collaboration with Prof. Guy Bar Oz.

Research collaboration:

Prof. Naama Goren Inbar, Hebrew University of Jerusalem

Prof. Guy Bar Oz, University of Haifa

Prof. Ayelet Gilboa, University of Haifa

Prof. Dani Nadel, University of Haifa

Dr. Guy Sisma, Israel Oceanographic & Limnological Research, Haifa, Israel

Dr. Thomas Tütken, Institute for Geosciences, Johannes-Gutenberg-University of Mainz, Mainz, Germany

Prof. Tamar Dayan, Tel Aviv University

Prof. Gonen Sharon, Tel-Hai Academic College

Prof. Leore Grossman, the Institute of Archaeology, The Hebrew University of Jerusalem

Dr. Richard Cook, Smithsonian Tropical research Institute

Dr. Arturo Morales-Muñiz, Universidad Autónoma de Madrid, Spain

Dr. Aurélia Borvon, Université Paris Ouest Nanterre La Defénse, Nanterre, France

MS.c. Students:

Rachek Blevis, University of Haifa

Table 6: List of fish skeletons, by species and number of specimens.

Species	No.	*Species*	No.	*Species*	No.
Abudafduf saxatilis	1	*Echiichthys vipera*	1	*Sarotherodon galilaeus*	39
Acanthobrama lissneri	37	*Epinephalus fasciatus*	1	*Sarpa salpa*	1
Acanthurus nigrofuscus	24	*Epinephalus guaza*	1	*Saurida undosquamis*	3
Alepes djedaba	1	*Epinephalus sp.*	1	*Scarus ghobban*	1
Anguilla anguilla	6	*Epinephelus marginatus*	1	*Scarus madagascarensis*	1
Ariosoma balericum	1	*Euthynnus alleteratus*	1	*Scarus sp.*	1
Arnoglossus laterna	2	*Euthynus alleteratus*	1	*Sciaena umbra*	1
Astatotilapia flaviijosephi	10	*Galeus melastomus*	1	*Scomber japonicus*	1
Atherina boyeri	1	*Garra rufa*	8	*Scomberomorus commerson*	2
Atherinomorus laconsus	1	*Hemigrammocapoeta nanus*	1	*Scorpaena madredensus*	1
Bagrus sp.	1	*Hemiramphus far*	2	*Scorpena scota*	1
Balistes carolinensis	1	*Lagocephalus spadiceus*	1	*Serranus hepatus*	1
Barbus bynini	1	*Lates niloticus*	6	*Siganus luridus*	25
Barbus canis	26	*Lepidotrigla carillone*	1	*Siganus rivulatus*	8
Barbus longiceps	4	*Litogantus mormiros*	1	*Solea vulgaris*	3
Bathus podas	1	*Liza ramada*	3	*Sparus aurata*	2
Bodianus diplotaenia	2	*Macrorhamphus scolopax*	1	*Spheoeroides cutaneus*	1
Capoeta damascina	8	*Mirogrex terraesanctae*	38	*Sphyraena chrysotaenia*	1
Caranx crysos	2	*Mugil cephalus*	1	*Sphyraena viridensis*	3
Chelon labrusus	2	*Mullus barbatus*	3	*Spicara maena*	1
Citharus linguatula	2	*Mylopharyngodon piceus*	3	*Spondyliosoma cantharus*	1
Clarias gariepinus (lazeral)	31	*Noemacheilus panthera*	1	*Symphodus roissali*	1
Ctenopharyngodon idellus	1	*Oncorhynchus mykiss*	1	*Synodus variegatus*	1
Cyprinus carpio	3	*Oreochromis aureus*	44	*Thalassoma pavo*	1
Dentex dentex	1	*Oreochromis aureus.mix*	2	*Tilapia nilotica*	3
Dentex macrophthalmus	1	*Pagrus coeruleostictus*	1	*Tilapia zillii*	44
Diplodus ameranis	1	*Pempheris vanicolensis*	1	*Trachinus mediteranius*	1
Diplodus cervinus	1	*Platichthys flesus*	1	*Trachurus trachurus*	3
Diplodus noct	2	*Polegus eritrenus*	1	*Tristamella simonis*	10
Diplodus puntazzo	1	*Rhinobatos rhinobatos*	1	*Umbrina cirrosa*	1
Diplodus sargus	7	*Salaria fluviatilis*	4	*Upeneus moluccensis*	1
Diplodus vulgaris	1	*Sargocentron robrum*	2	*Uranhoscopus scaber*	1

Papers published with the use of the fish reference Collection- last 5 years:

Zohar, I., Goren, M., and Goren-Inbar, N. (2014)
Fish and ancient lakes in the Dead Sea Rift: The use of fish remains to reconstruct the ichthyofauna of paleo-Lake Hula. Palaeogeography, Palaeoclimatology, Palaeoecology, 405: 28-41.

Goren-Inbar, N., Melamed, Y., **Zohar, I**., Akhilesh, K., and Pappu, S. (2014)
Beneath Still Waters – Multistage Aquatic Exploitation of *Euryale ferox* (Salisb.) during the Acheulian. Internet Archaeology, 37. doi:10.11141/ia.37.1

Sisma-Ventura, G., **Zohar, I.,** Sarkar, A., Bhattacharyya, K., Zidane, A., Gilboa, A., Bar-Oz, G., and Sivan, D. (2015)
Oxygen isotope composition of Sparidae (sea bream) tooth enamel from well-dated archaeological sites as an environmental proxy in the East Mediterranean: A case study from Tel Dor, Israel. Journal of Archaeological Science, 64:46-53

Marder, O., Biton, R., Boaretto,E., Feibel, C.S., Melamed, Y., Mienis, H.k., Rabinovich, R., **Zohar, I**., and Sharon, G. (2015)
Jordan River Dureijat - A new Epipaleolithic site in the Upper Jordan Valley. Mitekufat Ha'even, Journal of the Israel Prehistoric Society, 45: 5-30.

Zohar, I. Ovadia, A., and Goren-Inbar, N. (2016)
The cooked and the raw: A taphonomical study of cooked and burned fish. Journal of Archaeological Science: Reports, 8: 164-172

Zohar, I. Fish exploitation during the Quaternary: Recent knowledge, in: Enzel, Y., Bar-Yosef, O. (Eds.), Quaternary of the Levant: Environments, Climate Change, and Humans, Cambridge University Press, University Printing House, Cambridge, United Kingdom, pp. 369-376.

Zohar, I., Dayan, T., Nadel, D., Goren, M., and Hershkovitz, I. (in press)
Opportunism or aquatic specialization? Evidence of freshwater fish exploitation at Ohalo II- a waterlogged Upper Paleolithic site. PLoS ONE

2. Bird Collection
Curator: Dr. Shai Markman
shaimarkman@gmail.com

The Margolin bird collection contains about 2000 objects preserved for scientific and educational use. Objects include whole birds, skeletons and bones, eggs, and nests. The collection includes more than 250 species from 62 families. These collections are entirely catalogued and some of the birds (n=70) and eggs (n=107) were digitized by one of our former student- Itai Bloch.

Stuffed birds and complete skeletons:

Most of the birds are housed in cabinets, with constant room temperature of 19^{o}C.
The room is under daily inspection, and fumigation is performed once a year. Cleaning of the cabinets is routinely performed.
Half of the collection includes birds collected before 1968, eight are of extinct species and nine are endangered (Table 7).

Aves skulls and eggs:

Most of the skulls were prepared before 1960, which may explain the fact that the rest of the skeleton was not curated. Fourteen species are of extinct on endangered species (Table 7). The entire collection is catalogues and includes ca. 250 skulls and skeletons and 700 eggs.

Research:

Berger, I., Leshem, Y., Tom-Tov, Y., **Markman, S**. (2014) The effect of intruders on territorial Palestine Sunbirds (*Nectarinia osea*) during the pre-egg laying period. J. Orthinol, 155: 291-299

Table 7: Taxonomic list of the birds housed at the margolin Biologica; collections by species, number of specimens and metod of preparation (stuffed or skull).

Species	Stuffed birds	Skull	Species	Stuffed birds	Skull
Alcedo atthis	1	2	*Hydrocoloeus minutus*	3	1
Accipiter gentilis	1		*Ichthyaetus hemprichii*	1	
Accipiter nisus	4	3	*Ichthyaetus leucophthalmus*	1	
Accipiter badius	0	1	*Ixobrychus minutus*	3	5
Acrocephalus scirpaceus	3		*Jynx torquilla*	3	1
Acrocephalus stentoreus	2		*Lanius collurio*	4	
Acrocephalus schoenobaenus		1	*Lanius excubitor*	2	1
Actitis hypoleucos	3		*Lanius nubicus*	1	
Alaemon alaudipes	2		*Lanius senator*	2	2
Alauda arvensis	3	1	*Larus argentatus*	3	
Alcedo atthis	2		*Larus fuscus*	2	
Alectoris chukar	7		*Limosa limosa*	1	1
Alectoris graeca		4	*Locustella luscinioides*	1	
Ammomanes cinctura	1		*Loxia curvirostra*	1	
Ammomanes deserti	2		*Luscini svecica*	4	
Ammoperdix heyi	5		*Luscinia luscinia*	2	
Anas acuta	1		*Luscinia megarhynchos*	1	
Anas clypeata	4	2	*Lymnocryptes minimus*	1	
Anas crecca	3	4	*Macronectes halli*	2	
Anas penelope	3		*Marmaronetta angustirostris*	1	
Anas platyrhynchos	3	3	*Melanocorypha calandra*	1	
Anas querquedula	2		*Melopsittacus undulatus*	1	
Anas strepera	2		*Merops Apiaster*	5	1
Anhinga rufa	2		*Merops orientalis*	1	
Anser albifrons	2		*Merops persicus*	1	
Anser anser domesticus	1	2	*Milvus migrants*		3
Anthus cervinus	3		*Monticola saxatilis*	1	
Anthus pratensis	1	1	*Monticola solitarius*	1	
Anthus similis	1		*Morus bassanus*	2	1
Anthus spinoletta	1		*Motacilla alba*	2	2
Apus apus	3		*Motacilla cinerea*	2	1
Aquila chrysaetos	1		*Netta rufina*	2	1
Aquila clanga	1		*Numenius phaeopus*	1	
Aquila heliaca	2	2	*Nycticorax nycticorax*	4	3
Aquila pomarina	3	1	*Oenanthe deserti*	1	2
Aquila rapax	1	1	*Oenanthe finschii*	5	

Ardea alba	1	1	*Oenanthe hispanica*	2	1
Ardea cinerea	1	1	*Oenanthe isabellina*	2	
Ardea purpurea	1	3	*Oenanthe leucopyga*	2	
Ardea goliath	1		*Oenanthe lugens*	3	
Ardeola ralloides	1	1	*Oenanthe monacha*	1	
Asio flammeus	1		*Oenanthe oenanthe*	2	
Asio otus	1		*Oenanthe xanthoprymna*	1	
Athene noctua	2	3	*Onychognathus tristramii*	3	
Aythya ferina	1		*Oriolus oriolus*	4	2
Aythya fuligula	3		*Otis tarda*	1	
Aythya nyroca	3		*Otus scops*	5	2
Balearica pavonina		1	*Pandion haliaetus*	2	
Botaurus stellaris	1	1	*Parus major*	2	
Bubo bubo	3	1	*Passer domesticus*	6	3
Bubulcus ibis	1	3	*Passer hispaniolensis*	2	
Bucanetes githagineus	1		*Passer moabiticus*	4	
Bucorvus abyssinicus	1		*Pelecanus onocrotalus*	1	3
Burhinus oedicnemus	3		*Pernis apivorus*	2	
Buteo buteo	2	6	*Phalacrocorax carbo*	1	
Cacatua sp.		4	*Phalacrocorax pygmeus*	1	
Calandrella cinerea	2		*Phasianus colchicus*	1	
Calidris alpina	1		*Phoenicopterus ruber*	3	
Calidris minuta	3		*Phoenicurus ochruros*	5	
Caprimulgus europaeus	3	2	*Phoenicurus phoenicurus*	1	1
Carduelis cannabina	6		*Phoenicoparrus* sp.		1
Carduelis carduelis	3	2	*Phylloscopus trochilus*	1	
Carduelis chloris	2	1	*Philomachus pugnax*		1
Carduelis spinus	1		Pica pica		1
Cecropis daurica	1	2	*Platalea leucorodia*	1	
Cercomela melanura	3		*Plegadis falcinellus*	2	1
Cercotrichas galactotes	2		*Pluvialis apricaria*	1	
Ceryle rudis	3	1	*Pluvialis squatarola*	1	
Charadrius alexandrinus	1		*Podiceps cristatus*	3	3
Charadrius hiaticula	1		*Podiceps nigricollis*	3	
Charadrius morinellus	1		*Polemaetus bellicosus*		1
Chlamydotis undulata	1		*Porphyrio alleni*	1	
Chlidonias niger	1		*Porphyrio porphyrio*	1	
Chroicocephalus genei	1		*Porzana parva*	2	
Chroicocephalus ridibundus	4	7	*Porzana porzana*	1	2
Ciconia ciconia	2	8	*Porzana pusilla*	1	
Ciconia nigra	2		Prinia gracilis	2	2

Cinnyris osea	6		*Prunella modularis*	1	
Circaetus gallicus	2		*Pterocles alchata*	5	
Circus aeruginosus	1		*Pterocles coronatus*	1	
Cisticola juncidis	1		*Pterocles lichtensteinii*	1	
Clamator glandarius	5		*Pterocles senegallus*	3	
Coccothraustes coccothraustes	4		*Puffinus assimilis*		1
Columba livia	2		*Puffinus puffinus*	1	1
Coracias garrulus	3	3	*Puffinus yelkouan*	1	
Corvus corax	2		*Pycnonotus xanthopygos*	3	
Corvus cornix	1	3	*Pygoscelis adeliae*		2
Corvus corone	5		*Rallus aquaticus*	5	1
Corvus frugilegus	5		*Ramphastos* sp.		1
Corvus monedula	1	1	*Recurvirostra avosetta*	1	
Corvus ruficollis	1		*Rhodospiza obsoleta*	3	
Coturnix coturnix	3	2	*Riparia riparia*	1	
Crex crex	2	3	*Rostratula benghalensis*	1	
Cuculus canorus	1	2	*Saxicola rubicola*	4	
Cursorius cursor	2		*Scolopax rusticola*	3	1
Cygnus olor	1		*Scotocerca inquieta*	2	
Delichon urbicum	1		*Serinus canarius*	3	1
Dendrocopos syriacus	2		*Serinus syriacus*	2	
Egretta garzetta	1		*Spilopelia senegalensis*	2	
Emberiza caesia	4		*Stercorarius pomarinus*	1	
Emberiza calandra	3	1	*Sterna hirundo*	3	
Emberiza hortulana	5		*Streptopelia decaocto*	4	
Emberiza melanocephala	2		*Streptopelia senegalensis*	3	
Eremophila bilopha	5		*Streptopelia turtur*	1	
Erithacus rubecula	7		*Strix aluco*	4	
Falco biarmicus	1		*Sturnus vulgaris*	6	5
Falco columbarius	2		*Sylvia atricapilla*	2	
Falco naumanni	2	1	*Sylvia borin*	1	
Falco peregrinus	1		*Sylvia communis*	1	
Falco subbuteo	2	2	*Sylvia crassirostris*	1	
Falco tinnunculus	5	7	*Sylvia curruca*	2	1
Falco vespertinus	1		*Sylvia melanocephala*	3	
Ficedula albicollis	1		*Sylvia melanothorax*	1	
Ficedula semitorquata	1		*Tachybaptus ruficollis*	3	3
Ficedula hypoleuca		1	*Tadorna tadorna*	3	
Francolinus francolinus	5		*Tangara desmaresti*	1	
Fringilla coelebs	6	5	*Threskiornis aethiopicus*	1	
Fringilla montifringilla	2		*Tringa erythropus*	1	

Fulica atra	2	7	*Tringa nebularia*	1	
Galerida cristata	1		*Tringa ochropus*	1	
Gallinago gallinago	2	1	*Tringa totanus*	1	
Gallinula chloropus	4	2	*Tringa* sp.		2
Gallus g. domesticus		2	*Turdoides squamiceps*	3	
Garrulus glandarius	5	3	*Turdus merula*	4	2
Glareola pratincola	1	2	*Turdus philomelos*	2	3
Grus grus	2	1	*Turdus pilaris*	4	
Grus virgo		3	*Turdus torquatus*	1	
Gyps fulvus	1	2	*Turdus viscivorus*	2	1
Halcyon smyrnensis	7	6	*Tyto alba*	4	9
Hieraaetus fasciatus	2		*Upupa epops*	4	4
Himantopus himantopus	3	2	*Vanellus spinosus*	3	1
Hirundo rustica	3		*Vanellus vanellus*	5	8

3. **Reptiles and Mammals Collections**
Curator: Dr. Uri Shanas
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The reptile and mammals collections include specimen preserved in 80% ethanol, skeletons, and dried skins. Few mammals are preserved stuffed, and are on exhibition with the birds. These collections represent the fauna of the Middle East.

The mammal collection includes 616 specimens from 37 families and 89 species (Table 8). The skins and skeletons are stored in wood cabinets. These cabinets are inspected routinely for pest control.

The collection was catalogued according to their exact location. New labels were printed and each specimen was cleaned and inserted into a bag and a box (Fig. 10).

The reptile collection includes more than 250 specimens preserved in 80% ethanol. The collection is under the process of cataloguing. Preliminary observation identified 26 species of reptiles.

Fig 10. Storage of the mammal skulls and bones, at Margolin Biological collections.

Research:

Talbi, R., Izhaki, I., Bar-Massada, A. The impact of Cattle Egret on lizard community structures in Mediterranean woodlands

Talbi, R. Does genetic diversity among Israeli sub-populations correspond to a geographical gradient, and does the northern Golan sub-population differ morphologically and genetically from the southern ones?

Talbi, R. The Effects of Landscape Management on Reptile Assemblages in a Mediterranean Forest Ecosystem in Israel

Table 8: Taxonomic list of mammals housed at Margolin Biological collections.

Species	No.	Species	No.	Species	No.
Alcelaphus sp.	3	*Felis concolor*	1	*Mus musculus*	10
Acomys cahirinus	21	*Felis silvestris lybica*	17	*Mustela lutreola*	2
Acomys russatus	13	*Gazella dorcas*	2	*Myocastor coypu*	17
Apodemus mystacinus	2	*Gazella gazella*	3	*Myrmecophaga sp.*	1
Apodemus Sp.	3	*Gerbillus andersoni*	1	*Oryctolagus cuniculus*	26
Asellia tridens	8	*Gerbillus Dasyurus Dasyurus*	2	*Ovis aries musimon*	3
Asellia tridens tridens	1	*Gerbillus gerbillus*	8	*Panthera leo*	3
Axis axis	1	*Gerbillus nanus*	1	*Panthera pardus*	2
Bos primigenius	13	*Gerbillus pyramidum*	8	*Panthera sp.*	1
Camelus dromedarius	12	*Giraffa sp.*	1	*Paraechinus aethiopicus*	3
Canis aureus	10	*Gorilla gorilla*	1	*Paraechinus aethiopicus?*	2
Canis lupus	3	*Hemiechinus auritus*	4	*Pipistrellus nathusii*	1
Canis lupus familiaris	16	*Herpestes ichneumon*	11	*Procavia capensis*	27
Capra aegagrus	15	*Hyaena hyaena*	8	*Psammomys obesus*	4
Capra ibex	1	*Hystrix indica*	9	*Rattus norvegicus*	17
Capra nubiana	3	*Jaculus jaculus*	8	*Rattus rattus*	6
Capreolus capreolus	4	*Jaculus orientalis*	2	*Rhinolophus ferrumequinum*	2
Caracal caraca	1	*Lepus europaeus*	20	*Rhinolophus sp.*	5
Cavia porcellus	3	*Lutra lutra*	2	*Rousettus aegyptiacus*	22
Cercopithecus sp.	1	*Macaca mulatta*	3	*Sciurus sp.*	4
Cricetulus migratorius	2	*Macropus sp.*	1	*Sekeetamys calurus*	1
Crocidura russula	6	*Martes foina*	2	*Sekeetamys calurus calurus*	9
Delphinus sp.	2	*Meles meles*	17	*Spalax ehrenbergi*	24
Dipodillus sp.	1	*Meriones crassus*	6	*Sus scrofa*	11
Dryomys nitedula	5	*Meriones sacramenti*	1	*Talpa europaea*	1
Eliomys melanurus	10	*Meriones shawi*	1	*unknown monkey*	1
Equus asinus	6	*Meriones sp.*	27	*Vormela peregusna*	16
Equus caballus	4	*Meriones tristrami*	8	*Vulpes rueppelli*	1
Erinaceus europoeus	16	*Mesocricetus auratus*	5	*Vulpes vulpes*	12
Felis catus	12	*Microtus guentheri*	8	*Vulpes zerda*	1

Table 9: List of mammals skins, housed at Margolin Biological collections.

Species	No. of Skins
Canis aureus syriacus	4
Canis lupus	1
Capra ibex nubiana	2
Felis caracal	1
Felis chaus	6
Felis sp.	6
Gazella sp.	10
Herpestes ichneumon	4
Hyaena	3
Hyaena hyaena syriaca	1
Lepus europeus	2
Lutra lutra	2
Martes foina	3
Meles meles	9
Monkey?	2
Procavia capensis syriaca	6
Vormela peregusna	11
Vulpes vulpes	2