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Israel National Red List
of Invertebrates

Pilot Project Report 2018 – 2020

The Entomology Lab for Applied Ecology, SMNH, TAU

TEL AVIV UNIVERSITY אוניברסיטת תל אביב
THE STEINHARDT museum of natural history ISRAEL NATIONAL CENTER FOR BIODIVERSITY STUDIES
HAMAARAG Israel National Ecosystem Assessment Program
ISRAEL NATURE AND PARKS AUTHORITY

Israel National Red List of Invertebrates (INRI)

Executive Summary 2020

The Entomology Lab for Applied Ecology
SMNH TAU

Mission statement

To provide a robust and valuable tool for species and habitat conservation management in Israel, by assessing and identifying invertebrate species that are threatened with extinction.

Project Coordinator
Dr. Tania Bird

Project Director
Ittai Renan

Advisory Committee

Dotan Rotem	NPA
Dr. Noam Leader	NPA
Dr. Yariv Malihi	NPA
Prof. Tamar Dayan	SMNH-TAU
Uri Ramon	OLI SMNH-TAU
Dr. Ana Trakhtenbrot	MoE
Alon Rothschild	SPNI
Yahel Porat	JNF
Dr. Yoav Motro	MoA

Scientific Committee

Dotan Rotem	NPA
Dr. Ofer Steinitz	NPA
Dr. Netta Dorchin	SMNH-TAU
Dr. Yaron Hershkovitz	SMNH-TAU
Laibale Friedman	SMNH-TAU
Dr. Efrat Gavish-Regev	NNHC-HUJ
Dr. Yael Mandelik	NNHC-HUJ

Red List Authorities

Prof. Axel Hochkirch, Chair of IUCN Species Survival Commission (SSC) Invertebrate Conservation Working Group

Dr. Monika Bohm, IUCN SSC Butterfly Specialist Group and IUCN SSC Red List Authority Coordinator, National Red List Director, ZSL

***Lucanus cervus* is one of the most endangered scarab beetles in Israel.**
Photo: Oz Rittner

The Problem

Invertebrates are by far the most diverse taxonomic group and often the least known about. Globally there are millions of species and only a fraction of them are named and described.

Loss of biodiversity across the globe is one of the world's most pressing crises, with many species declining to critically low levels and with significant numbers going extinct.

Invertebrates in particular are facing severe and rapid declines, mainly due to increased use of pesticides, habitat loss and climate change. At the same time, they are crucial species for key ecosystem services such as pollination - insects pollinate 35% of global food production.

Israel has one of the highest uses of agricultural pesticides in the world.
Source: Times of Israel.
Photo: Doron Horowitz/Flash90

The Response

Governments and civil society have responded to this challenge by setting clear conservation targets, such as the Convention on Biological Diversity's Aichi 2020 targets, and the EU Biodiversity Strategy for 2030.

The IUCN Red List of Threatened Species is an internationally accepted, objective standard, used as a tool to tackle the extinction crisis, providing essential information on the risk of extinction and conservation trends for wild species.

70 countries worldwide have undertaken National Red List assessments for invertebrate groups. Of these, 13 are OECD members.

The INRI project was established to provide the first coordinated effort to document, collate and assess risk of extinction for invertebrates in Israel.

The pilot project 2018-2020 investigated the different challenges and solutions within the assessment process.

Activities & outputs 2018 - 2020

Engaged

- Scientific and Advisory Committees convened
- 27 taxonomic groups investigated
- 23 experts attended Red List training workshop in October 2019

Data collected

- 13 teams submitted Metadata for 20 taxa covering **11-13,000 species**
- Species lists were submitted for 17 taxa covering 2,411 species
- 13 *Rapid classification* lists were submitted for 1,186 species

Red List Assessments

- **20 species** across 9 taxa were assessed using the *Selected species* method together with 21 experts
- **58 butterflies** were assessed using the *All species* method together with 5 butterfly experts
- **36 species** were reviewed and approved by IUCN Red List Authorities

Network

- 54 taxonomic experts were contacted and are informed or involved in the INRI
- The project coordinator attended an IUCN led workshop for the Red List of European Hoverflies in Lesbos, Greece
- Two distinguished Red List Authorities are actively supporting the project

Projected Impact 2018-2020

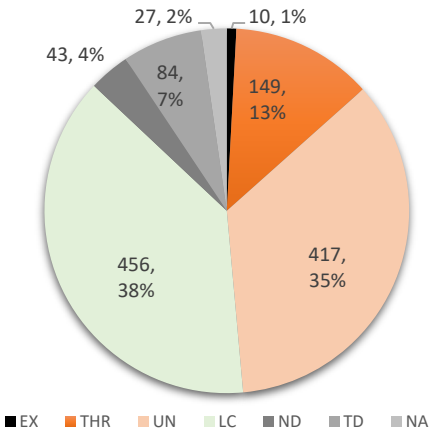
By the end of 2021, we envision:
(1) All (147) butterfly species in Israel to have been assessed and the results to be made publicly available; (2) Significant progress in conducting Red List assessments for three other invertebrate groups; (3) A total of 300 invertebrate Red List assessments to be achieved;
(4) A list of habitats of importance and threats facing endangered invertebrate species produced; (5) Progress made in raising awareness of invertebrates and their conservation issues in Israel.

We also expect to contribute to conservation policy in Israel by informing the Nature and Parks Authority (NPA) and the Ministry of Environmental Protection (MoE) about the invertebrate species in urgent need of conservation. These combined efforts will help to create more secure invertebrate populations in Israel.

Assessment methods

Rapid Classification

Rapid classification (RC) allows experts to provide a quick preliminary judgement regarding the threat status for each species, without having to invest time in conducting a full Red List assessment. Species that are potentially threatened or of unknown status can then be prioritised for detailed assessment.



Rapid Classification of 1,186 species across 23 taxa. Legend: EX- Extinct, THR - Threatened, UN- Unknown, LC- Least Concern, ND- No Data, TD- Taxonomic Deficiency, NA- Not Applicable

1,186 species underwent rapid classification, of which 233 are endemic to Israel. 13% were considered potentially threatened (THR) and a further 35% unknown (UN), indicating that just under half the species potentially require in depth assessment using IUCN Red List protocol.

Red List assessments – IUCN Protocol

Once the RC list is complete, species can be assessed using the highly standardised IUCN Red List protocol.
There are three main methods for assessment:

- ***All species*** within a monophyletic group are assessed
- ***Selected species*** that are likely to be threatened are assessed
- A ***Random sample*** of species within a monophyletic group are assessed

Different taxa will be suited to different methods depending on a) the number of species in the taxon; b) the knowledge of ecology and threats to the species; c) data quality and availability for the majority of the species in the taxon.

Results of Pilot Study

Assessed species

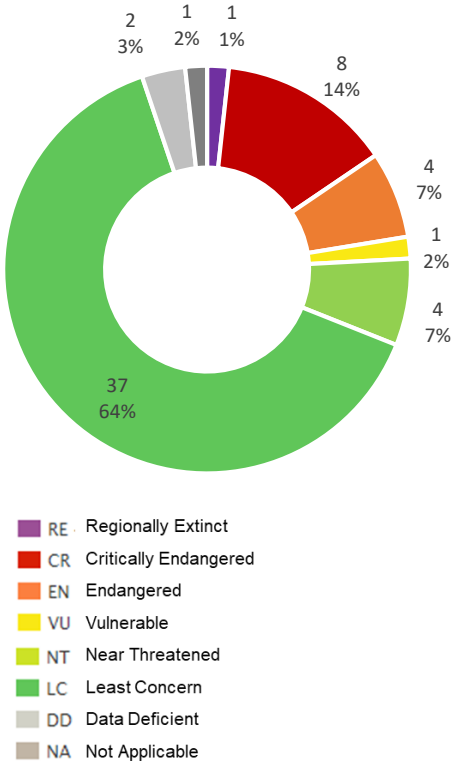
Twenty species were selected by experts, and underwent Red List assessment. The most common threats were urban development and drought due to regional climate change.

The most common conservation needs were site and habitat protection and restoration, while the most common research need was field surveys.

Butterflies

Parnassius mnemosyne is threatened by climate change, which is shrinking its range in Mount Hermon. Photo: Oz Rittner

Three families of butterflies (58 species) were assessed using the *All species* method. 14% were found to be critically endangered, 5 of which are only found in the Hermon. 64% were considered least concern during Rapid classification and were not assessed further.



Red List Assessments of 58 species of butterfly in 3 families.

Recommendations

Butterflies, land snails, scorpions, crabs and mayflies are good candidates for using the *All species* method. Other taxa are also suitable if there is enough technical support to help the experts collate the data.

Bees, moths and freshwater species may be good candidates for the *Selected species* method.

Spiders, ants and beetles may be good candidates for a *Sampled species* approach.

Four taxa were found to require significant technical support to collate data before they can be assessed.

Project needs

- A transparent, reliable database and a strong GIS system are both crucial to ensure successful project outputs and to enable assessment updates to be made when new data become available.
- The success of the National Red List relies heavily on data availability and participation of the experts. Technical support to help handle and capture data will significantly increase expert motivation.
- Many species require field surveys to better understand their distributions, a key parameter in the Red List assessment.
- The results of the National Red List assessment are informative and important, and need to be incorporated into an invertebrate conservation action plan for Israel.

Acknowledgements

We thank the Israel Nature and Parks Authority for their support of this project. In addition, we thank the Advisory and Scientific Committee members for their contributions. Lastly, we thank all the experts who contributed to the pilot project. In particular, we thank Dubi Benyamini, Ofir Tomer, Orr Comay, Israel Pe'er and Guy Pe'er for their participation in the butterfly assessments.

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1. Project Motivation

There is a growing awareness that biodiversity maintains ecosystem function and supports human livelihoods. At the same time, the loss of biodiversity, across the globe is one of the world's most pressing crises, with many species declining to critically low levels and with significant numbers going extinct. Governments and civil society have responded to this challenge by setting clear conservation targets, such as the Convention on Biological Diversity's 2010 target to reduce the current rate of biodiversity loss (Vie et al. 2008). Insects are among the most diverse and abundant organisms on Earth, and they play a major role in ecosystem functioning (Leandro et al. 2017). Recently, more attention has been drawn to the dramatic losses in both richness and abundance of invertebrates in particular over the last few years (Conrad et al. 2006; Brooks et al. 2012; Hallmann et al. 2017; Vogel 2017; Sánchez-Bayo & Wyckhuys 2019; Dornelas & Daskalova 2020). These declines, coupled with a severe lack of knowledge about this taxonomic group, are causing concern for the status and health of all ecosystems on the planet.

The IUCN Red List of Threatened Species is an internationally accepted, objective standard, to be used as a tool to tackle the extinction crisis, providing essential information on the state of, and trends in, wild species. The IUCN Red List places every species in an extinction risk category as shown in Figure 1 (IUCN 2012).

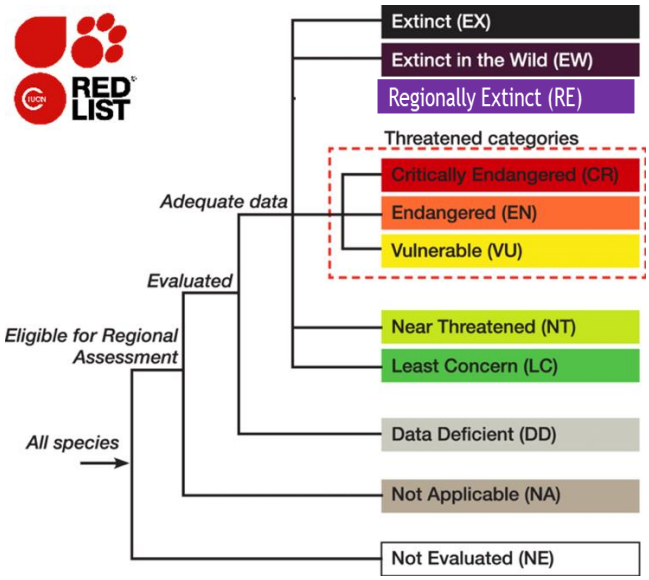

Figure 1: The risk of extinction categories used by the IUCN Red List (IUCN 2012)

The IUCN also provides robust guidelines for adapting the global assessment protocol to regional and National scales (IUCN 2012). This involves conducting an assessment using the same global process and then applying a regional adjustment according to the questions shown in Figure 2.

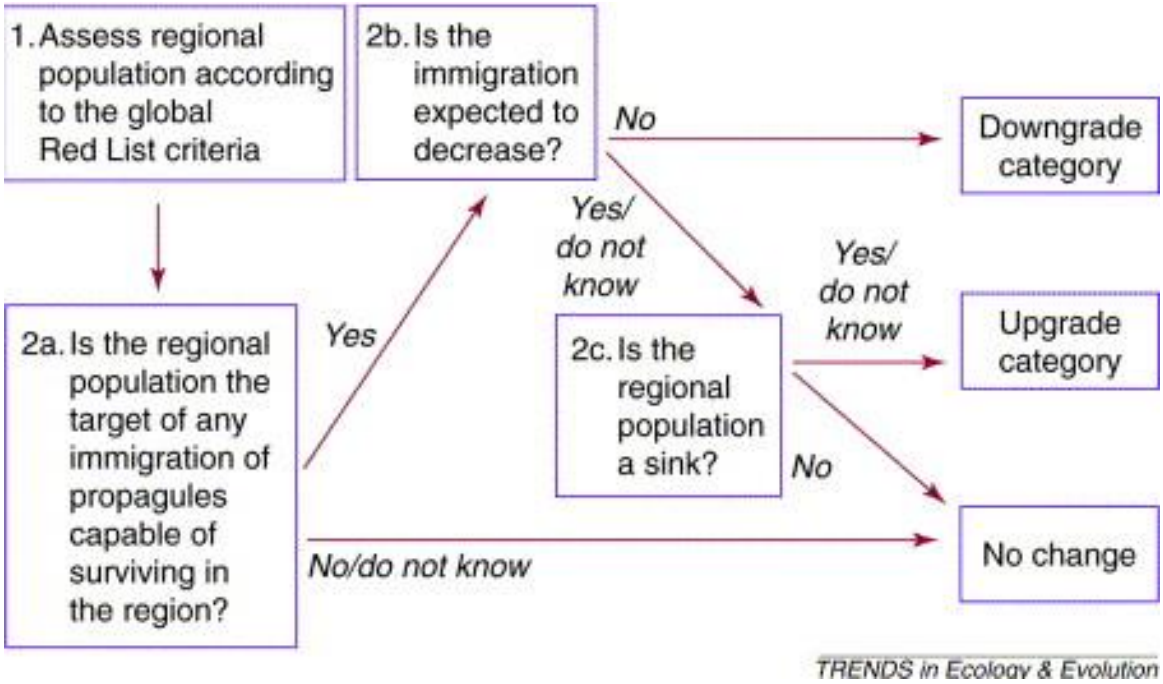

Figure 2: Regional Adjustment workflow for the IUCN National Red List protocol (from Gardenfors & Gärdenfors 2001)

To date, over 70 countries have conducted National Red List assessments on invertebrate species (e.g. Carpaneto *et al.* 2015), and there are European and Mediterranean lists for several taxa (Kalkman *et al.* 2010; Nieto & Alexander 2010; Hochkirch *et al.* 2016; Numa *et al.* 2016). Yet this still amounts to less than 2% of known species, which themselves are only a tiny fraction of the unknown number of species that exist in the world (Zamin *et al.* 2010).

In Israel, National Red Lists currently exist for vertebrates and plants (Dolev & Pervolutzki 2002; Shmida *et al.* 2007) Recently, the bird and plant lists were re-assessed and made available online. However, there is no objective publication that focuses on threats facing invertebrates in Israel. Hence, the Entomology Lab for Applied Ecology, together the Israel National Parks Authority have undertaken to conduct the Israel National Red List of Invertebrates (INRLI). The project aims to evaluate the conservation status of Invertebrate species in Israel, identify the key habitats and understand the main threats currently facing invertebrate conservation. To this end, we have invited senior representatives from across different sectors in Israel to act as an advisory board to ensure effective and successful project outcomes.

The sheer number of invertebrate species, and the rarity of data and ecological knowledge of invertebrates make this project challenging. On the other hand, invertebrates are often highly affiliated to a specific host or habitat, potentially making them more easily assessable than some widespread but sparse vertebrate species. We have convened a Scientific Working Group of highly skilled experts in the fields of entomology and ecology to help provide technical guidance on prioritizing species and dealing with challenging data issues. The project is also guided by an Advisory committee of respected colleagues from numerous relevant sectors.

2. Project Membership

Project Coordinator:
Dr. Tania Bird

Project Director
Ittai Renan

Red List Authorities
Prof. Axel Hochkirch, Chair of IUCN SSC Invertebrate Conservation Working Group
Dr. Monika Bohm, National Red List Director, Zoological Society of London
Dr. Caroline Pollock, Red List Authority Director, Cambridge

Advisory Working Group

The role of the Advisory Working Group is to provide advice and support the delivery of project outputs, and to ensure the achievement of the project goals.

Name	Institute
Dotan Rotem Dr. Noam Leader Dr. Yariv Malihi	The Israel National Parks Authority (INPA)
Prof. Tamar Dayan	The Steinhardt Museum of Natural History- TAU
Uri Ramon	The Open Landscape Institute (OLI)
Dr. Ana Trakhtenbrot	The Ministry of Environment (MoE)
Alon Rothschild	The Society for Protection of Nature in Israel (SPNI)
Yahel Porat	The Jewish National Fund (JNF)
Dr. Yoav Motro	Ministry of Agriculture (MoA)

Scientific Committee

The role of the Scientific Committee is to provide technical insight and advice to the assessment process, to facilitate engagement of relevant taxonomic experts and access to relevant data.

Name	Institution
Dotan Rotem	NPA
Dr. Ofer Steinitz	NPA
Dr. Netta Dorchin	SMNH-TAU
Dr. Yaron Hershkovitz	SMNH-TAU
Laibale Friedman	SMNH-TAU
Dr. Efrat Gavish Regev	NNHC-HUJ
Dr. Yael Mandelik	NNHC-HUJ
Dr. Uri Roll	BGU
Dr. Liat Gidron	MoA
Maor Elron	JNF

3. INRLI Project Goals & Aims

Project Goals: To provide a robust and valuable tool for species and habitat conservation management.

Project Aims:

- To identify threatened invertebrate species according to IUCN Red List criteria.

Specific outputs of the project are:

- Detailed assessments and distribution maps for each prioritized species.
- A list of potential candidate species for future assessment.
- A list of habitats of importance to conservation that harbour endangered invertebrate species, in and outside reserves.
- A list of bio-indicators for threatened habitats as a useful tool for managing reserves & other sites.
- An online resource with public access to the final assessments and species information and distribution maps.

Desired outputs:

- Provide a tool for conservation managers and policy makers, to inform decision making processes.
- Increase interest/ability for conservation management actions to consider endangered invertebrates
- Contribute to national and international commitments,
  - United Nations Sustainability Development Goal (SDG) 15 -Protect & Restore Life on Land
  - Convention for Biodiveristy (CBD) 2030 Aichi Biodiversity Targets 1,2,7,12,19
- Increase motivation and ability for academic and applied research to focus on endangered invertebrates
- Raise public awareness of the status, importance and value of threatened arthropods and habitats
- Create a baseline for which to reassess species' status and detect trends in conservation success

Sources of data:

- Published journal papers
- Expert opinion
- Museum collections
- Ecological surveys and databases (e.g. INPA)
- Citizen science data

4. Project activity

Phase 1: Pilot study to identify methods and relevant species (Dec 2018 – Jun 2020)

- Advisory committee convened
- Scientific committee convened
- 54 taxonomists and other experts representing 27 taxonomic groups were contacted as part of the pilot study
- Introductory workshop for 23 experts and other relevant parties held the Steinhardt Natural History Museum on the 31st October 2019 to
    - Introduce the aims and objectives of the project
    - Provide an in-depth overview of the IUCN Red list protocol, categories and definitions.
    - Identify extensive list of potential candidate species that are likely to fulfil data requirements
- 20 appropriate priority species were selected for detailed assessment across 9 taxa, using the *Selected species* method (see assessment methods below).
- In addition, 58 butterflies from three complete families were assessed using the *All species* method (see assessment methods below).
- Data for priority species collated by experts and with the Project Coordinator.
- Priority species were systematically assessed under the IUCN assessment protocol, via one on one meetings/correspondence with experts or in group workshops.
- Experts reviewed the assessments and approved the final red list status.
- 36 species were reviewed and approved Red List Authority, Dr. Monica Bohn and three by Prof. Axel Hochkirh. (Some final reports are still missing key data such as threats information and therefore remain in process)

Phase 2: Recommendations (2020-2021):

- National Red List of Butterflies
    - Complete the National Red List of Butterflies in Israel (147 species).
    - Publish the National Red List of Butterflies in Israel website
    - Launch event for the publication
    - Submit to the IUCN National Red List website

- Endemics:
    - Submit endemic species assessments from phase 1 (10 species) to the International IUCN red list authority.

Phase 3: Projected (2021- 2023)

- Select taxonomic groups to prioritize and choose appropriate assessment method (*'All', 'Sampled' or 'Selected'* species) for each taxon (see Table 2)
- Collect data and conduct assessments based on selected groups
- Publish the National Red List for Invertebrates in Israel website - including meta-analysis and recommendations for conservation management in Israel
- Submit the Israel National Red List for Invertebrates to the IUCN National Red List website
- Conduct public engagement activities to promote understanding of the outputs

5. Data and assessment status

We asked each expert team to submit three types of data:

i) Metadata

- This process captured total number of species in the taxa, experts that could lead and/or contribute, data status and quality and these data combined allowed us to make recommendations for the strategy for moving forward (assess *all species*, *sampled species*, or *selected species* within a Monophyletic group, or omit the group entirely). See Table 2 in results.

ii) Rapid Species Classification Lists

- This involved producing complete (as much as possible) species lists within a given order/family, and assigning each species to one of the 5 *Rapid classification* codes that were developed for the project (see below).
- This preliminary *Rapid classification* process allowed us to get a quick overview regarding the number of species that would need to be assessed in full under the IUCN red list protocol (problematic species and least concern species are omitted/de-prioritized).

iii) Species assessments

- Each expert group was invited to submit one assessment (or more) of a species of their choice- usually species that they believe are likely to be threatened, or 'difficult' species that they were not sure how they could be dealt with
- This process allowed the experts to familiarise themselves with the assessment process, the data requirements and the methods, which gave them a good understanding of the process that will be involved in phase two of the full project.

Metadata

Experts were requested to provide data on –

i) Their team/other experts that could contribute,
ii) Institutions
iii) Estimate of number of species in each family/order
iv) Estimate of number of endemic species in Israel
v) General comments on threats/status of these species in Israel
vi) If a checklist has been published
vii) The quality of the data (checklist can be outdated, or unpublished but still good)

Each team submitted an excel datasheet and this was later combined by the project coordinator using R. Results are presented in Table 2 below.

Rapid Species Classification

In addition to the metadata of overall numbers, teams were asked to complete rapid species classification lists, which classify species in to seven preliminary categories, to help us understand the challenges faced for this group. These codes (**LC/THR/TD/ND/NA/EX/UN)** are INRLI preliminary coding and similar but NOT always the same as the IUCN Red List extinction risk categories (Figure 1), which will be assigned once fully assessed.

The rapid assessment categories are:

- **Least Concern (LC)** –For species that are considered common and/or not threatened and not in decline, therefore of least concern.
- **Likely to be threatened (THR)** - For species that may be threatened or in declined based on preliminary judgement. This includes species facing threats to their population or habitat, that may have small range or population sizes or that are known to be declining. This category is a considered as preliminary status for the IUCN categories (CR, EN, VU) but note that some THR species may be found to be LC or DD once fully assessed.
- **Taxonomic Difficulty (TD)** –For species that with the taxonomy status is not clear.
- **No data (ND**) - For species that have very few or no records. – for example, they may appear listed in checklists but have never been sampled or there is no further information. These species can be listed as Data Deficient (DD) in the final Red List and this can help identify them as in need of further research.
- **Not Applicable (NA)** - For invasive, vagrant or domestic species, and they will remain as NA in the National Red List.
- **Extinct (EX)** – For species that are extinct in Israel (without any doubt).
- **Unknown (UN**) - This category is for all the rest of species that cannot be categorized by one of the codes above within a few minutes of consideration - it means that the status of the species is not known without further investigation and more effort. This category is included to allow RAPID preliminary assessments.

The *Rapid classification* method allows experts to present their initial opinions independently, and the project coordinator is then able to identify disagreements. Where two experts suggest different categories (e.g. LC and UN, or LC and THR) the species is assumed to be UN and should be assessed.

Ideally all taxa will undergo a *Rapid classification* process before choosing the best assessment method (see next section). However, this may not always be possible, particularly for highly speciose groups. In this case, the *sampled* or *selected species* method may be used without rapid classification of all species.

Species Assessment Methods

Through in-depth discussions with experts, the scientific committee and Red List authorities, three assessments methods were identified as being relevant for different taxon. Where taxa where the species list is not too long, it is preferred that all species will be listed using *Rapid classification*, even if most are listed as UN. From this list, a decision regarding the best assessment method can be ascertained; *'all species'*, '*selected species'* or '*sampled species*'.

If there are more than a few hundred species in the family/order, it is not necessarily appropriate to complete this *Rapid classification* process for all species, and the experts may choose to simply highlight which species they think are THR (and if possible, EX and LC). Here, either a *sampled* or *selected species* approach can be adopted. Where the complete (or nearly complete) list of species is not available, this process can be omitted entirely and the *selected species* approach may be the most appropriate. The advantages and disadvantages of each method are summarised in Table 1.

Table 1: A comparison of the three assessment methods. Within a Monophyletic group, we can assess a) all species, b) a selection of likely threatened species, or c) a random sample of species. Green text implies an advantage; red text implies a disadvantage. Double ticks mean the parameter is biggest for a given method, compared to other methods.

	All species	***Selected species***	***Sampled species***
PROS			
All species assessed	✓	X	X
Unbiased	✓	X	✓
Good for speciose taxa	X	✓	✓
Can be used to calculate trends	✓ (RLI)	X	✓ (sRLI)
No threatened species overlooked	✓✓	✓	X
Quick to assess all species	X	✓✓	✓
Enables accurate analyses	✓	X	✓
Provides complete picture of status of group in Israel	✓✓	X	✓
Important/threatened species will be included	✓✓	✓ (assuming expert knowledge is good)	X
CONS			
Time consuming	✓✓	X	✓
Biased species list dependent on expert opinion	X	✓	X
May overlook some threatened species	X	X (assuming expert knowledge is good)	✓
Many species will be data deficient	✓✓	X	✓
Requires complete/near complete species list	✓	X	✓

Method 1: All species assessments

For some taxa, all species within a Monophyletic group can be assessed using the preliminary *Rapid classification* system described above. This is possible where conditions are met for a combination of factors, including relatively few species in Israel, a readily available data format (digital) and reasonably high quality of the data, as well as the willingness and number of experts that can participate and contribute. Once the *Rapid classification* process has been conducted on all species, the relevant species are then fully assessed:

- ALL **unknown** (UN) and **likely threatened** (THR) species are fully assessed according to the IUCN Red List protocol and may be confirmed to be threatened (CR/EN/VU), or may be found to be data deficient (DD) or least concern (LC).
- **Least Concern** species are NOT assessed in full detail but are assumed to be least concern and can be listed as LC in the final Red list of Israel.
- **Extinct** species will be listed as EX or Regionally Extinct (RE) accordingly.
- **Taxonomic Deficiency** and **No Data** species are not assessed, but can be listed in the final red list as Not Evaluated (NE) – they may be assessed in the future red list phases if issues are resolved.

Under this method, we are able to provide a summary statistic of the percentage of species in that taxa that are threatened with extinction, such as the example given in Figure 3. We can create a figure like this for any complete taxonomic group, which can be useful as a basis for monitoring their conservation status in Israel; Species can be reassessed and this can be used to monitor changes in red list status across species. This is known as the Red List Index (RLI) and can provide important insights in to biodiversity trends at the global and national level (Bland *et al.* 2015). Individual species assessed in the *selected species* method cannot represent the whole taxa, and results will be biased.

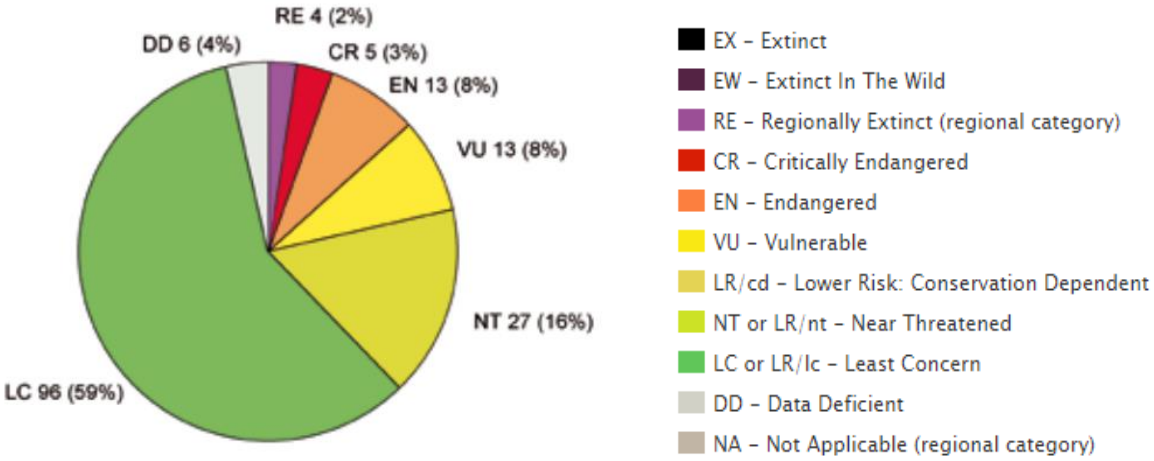

Figure 3: Results from the Mediterranean Red List of Dragonflies, conducted by the IUCN Red List Authority (Riservato *et al.* 2009) (n= 164)

The *All species* method was tested with three families (58 species) of butterflies in collaboration with 5 experts as part of the pilot study (Appendix 4). This method appeared to work well, provided there is enough data, and good participation by the experts, which is driven by high motivation.

Method 2: Selected species assessments

This method is useful for orders/families that have a large number of species, or where most of the species are data deficient (DD). For these taxa, experts may choose to 'select' the species that they feel are most important to assess. Ideally, this decision can be made following *Rapid Classification*.

For some taxa, there would still be too many to assess all the UN and THR species (as would be done in the *All species* method. In this case, it is preferable to select species that we think are worthy of investigation, focusing only on the THR and perhaps ignoring the UN. Unassessed UN species should be listed as NE (not evaluated).

Under this method, we have a biased selection of species, so we cannot use the assessment results to estimate percentage of threatened species in Israel, as we did in Figure 3 above, or use the data to calculate a Red List Index (RLI). However, this method is much faster than the *All species* method, and it is likely that most (if not all) threatened species will be assessed (unlike the *sampled species* method below). This can be useful to conservation managers to design species specific conservation plans, and can also highlight the most common threats facing invertebrates in Israel.

Method 3: Sampled species assessments

For many taxa, mainly hyper-diverse groups, it is not possible within available resources to assess all known species (Henriques *et al.* 2020). A sampled approach can be conducted as a relatively fast and unbiased method, whereby a specified number of species is randomly picked for detailed assessment from a full list of species within a Monophyletic group (Baillie *et al.* 2008). The advantage of this unbiased method is that the results derived from it can be extrapolated for the entire group, allowing an analysis and interpretation of the major threats and status of the taxon within Israel, which is not possible using the selected approach. This method can be useful for conservation managers for national planning and can help to quantify the threats and levels of extinction risk, in a fairly fast process (compared to the *All species* method). In addition, if the red list is updated periodically, the changes in conservation status can be used to calculate the Sampled Red List Index (SRLI) (Seppälä *et al.* 2018).

The disadvantage of this method it is more time consuming that the *Selected species* method, and requires a complete/near complete species list. In addition, many of the species will likely be data deficient which could be considered as a 'wasted effort' to spend time assessing them.

The official SRLI methodology recommends a sample of 900 non-Data Deficient (non-DD) species (Baillie et al., 2008). However, other authors have conducted SRLI on arachnids using 1,500 species (Seppala *et al.* 2018), or 200 non-DD species (Henriques *et al.* 2020). Further investigation in to the appropriate sample size for taxa in Israel is needed, but this method could be very useful for some taxa such as spiders and beetles (see Table 2 below).

6. Results

Metadata

Table 2 below summarises the key data and status of each of the taxa investigated during the pilot study. In total, 13 teams submitted metadata across 21 taxonomic groups. We did not manage to collect data for four of the initial taxa that we investigated. Species richness and the number (no.) of endemic species within a taxonomic group were sometimes given as an estimate (marked with ~). Thirteen *Rapid assessment* lists were submitted covering 1186 species

The number of threatened (THR) and species of unknown status (UN) are based on the summarised data from the *Rapid classification*. These numbers are not additive; for example, an endemic species could be also considered THR, and not all classifications are shown. Species that are not THR or UN may be either least concern, extinct or data deficient (see Table 3). The number of species assessed during the pilot phase are shown for each taxa. Twenty *Selected species* assessments were conducted, and a full assessment process of *All species* in three butterfly families was conducted on 58 butterflies. Finally, our recommendations for the best method for each taxon is listed, together with general comments of lessons learned.

Table 2: Metadata for all taxa investigated during the pilot study. Parentheses in species richness show the number of species for which a *Rapid classification* list was submitted. Number of threated (THR) and unknown (UN) species are mutually exclusive but other data are not additive.

Taxa	Lead experts	Meta data	Species Lists	Rapid classifica-tion	Species Richness	No. endemic	No. THR	No. species assessed in pilot
TERRESTRIAL								
Arachnida								
Scorpiones	Efrat Gavish Regev, Yoram Zvik	✓	✓	✓	26	**5**	**8**	**2**
Opiliones (Harvestman)	Efrat Gavish Regev, Shlomi Aharoni	✓	✓	✓	21	**7**	**2**	**2**
Araneae (Spiders)	Efrat Gavish Regev Igor Armiach, Shlomi Aharoni, Zeana Gorem	✓	✓	✓ (Some families)	~ 1200 (88)	**24**	**13**	**6**
Other Arachnids	Efrat Gavish Regev	✓	✓	✓ (Some families)	~ 55 (4)	**5**		
Insecta								
Hymonoptera: Apoididae (Bees)	Achik Dorchin Gidi Pisanty	✓	✓	X	~ 1000	-	-	**1**
Hymonoptera: Formicidae (Ants)	Armin Ionesco Udi Segev	✓	✓	✓	230	**62**	**9**	**0**
Blattodea (Roaches)	Dani Simon	✓	X	X	19		-	**0**
Coleoptera (Beetles) (selected families)	Leonid Friedman, Eylon Orbach, Ittai Renan, Thorsten Assmann, Oz Rittner, Joern Buse, Guido Sabatinelli, Stefano Ziani	✓	✓ (Some families)	✓ (Some families)	~ 6000 (444)	~ 10-30% (88)	50	5
Lepidoptera (Butterflies)	Dubi Binyamini, Guy Peer, Orr Comay, Ofir Tomer, Israel Peer	✓	✓	✓	147	0	21	60
Moths	Vasiliy Kravchenko, Oz Rittner	✓	X	X	2500-3000	-	-	0
Mantodea (Mantids)	Dani Simon	✓	✓	✓	20	1	2	0
Neuroptera (Ant Lions)	Dani Simon	✓	X	X	140	-	-	0
Orthoptera (Crickets)	None	X	X	X	?	-	-	1
Mollusca								
Land Mollusca (Snails)	Joseph Heller, Ofer Steinitz, Hank Meinis, Oz Rittner	✓	✓	X	112	-	-	0

Taxa	Lead experts	Meta data	Species Lists	Rapid classifica-tion	Species Richness	No. endemic	No. THR	No. species assessed
AQUATIC								
Insecta								
Odonata: Anisoptera (Dragonflies)	Michael Blecher Yaron Hershkovitz	✓	✓	✓	66	0	13	0
Ephemeroptera (Mayflies)	Zohar Yanai Yaron Hershkovitz	✓	✓	✓	29	7	14	3
Plecoptera (Stoneflies)	Yaron Hershkovitz	✓	✓	X	6	-	-	0
Trichoptera (Caddisflies)	Yaron Hershkovitz	✓	✓	X	50	-	-	0
Freshwater Coleoptera (Water beetles)	Laibale Friedman Yaron Hershkovitz	X	X	X	100-300	-	-	1
Freshwater Heteroptera (Bugs)	Tania Novoplansky Yaron Hershkovitz	X	X	X	?	-	-	0
Freshwater Diptera (Flies)	Netta Dorchin Elizabeth Morgulis Mike Mostovski Yaron Hershkovitz	X	X	X	91-100	-	-	0
Other Invertebrates								
Annelids (Leeches)	Liron Goren Yaron Hershkovitz	✓	X	X	18-22	-	-	0
Freshwater Mollusca (Aquatic snails)	Oz Rittner Hank Menis Yaron Hershkovitz	✓	X	X	115	-	-	0
Crustacea								
Class: Malacostraca Order : Decapoda (Cave shrimp & Crabs)	Yaarit Levit Bermatz Yaron Hershkovitz	✓	✓	✓	6	2	3	3 (2 by IUCN)
Class Ostracoda (Seed shrimp)	Liron Goren Yaron Hershkovitz	✓	✓	X (all ND)	52	4	-	0
Class Branchiopoda: Order Cladocera (Water fleas - daphnia)	Liron Goren Yaron Hershkovitz	✓	✓	✓	60	2	6	2 (draft)
Other Branchiopoda (5 orders) (Zooplankton shrimp)	Liron Goren Yaron Hershkovitz	✓	✓	✓	20	4	9	2 (draft)
TOTAL	27	**20**	**17**	**13 groups (1186 species)**	11,000-13,000	**53**	**52**	**83**

Rapid Classification Results

A total of 17 *Rapid classification* lists for 1,186 species were submitted as part of the pilot project. The results of these classifications are given in Table 3.

Table 3: Summary of *rapid classification* of 1,186 species. EX= extinct, THR= likely threatened, UN= unknown, LC= Least concern, ND= No data, TD= taxonomic deficiency, NA= Not Applicable

Taxa	Common name	EX	THR	UN	LC	ND	TD	NA	Grand Total
Arachnida									**139**
Scorpiones	Scorpions	1	8	6	10	-	-	1	26
Other Arachnids	Other arachnids	-	-	5	-	-	-	-	5
Opiliones	Harvestmen	-	2	10	7	1	-	-	20
Araneae - Pholcidae	Cellar spiders	-	-	5	3	-	3	-	11
Araneae - Agelenidae	Funnel weavers	-	4	8	5	3	3	-	23
Araneae - Lycosidae	Wolf spiders	-	6	5	16	2	1	-	30
Araneae - Dysderidae	Woodlouse spiders	-	3	6	4	-	9	2	24
Insecta									**935**
Coleoptera- Cerambycidae	Longhorn beetles	-	18	23	58	5	2	-	106
Coleoptera- Scarabaeoidea	Dung beetles	-	11	224	47	-	5	-	287
Coleoptera- Carabidea	Ground beetles	-	21	18	12	-	-	-	51
Ephemeroptera	Damselflies	1	14	2	8	4	-	-	29
Formicidae	Ants	-	9	43	125	24	8	21	230
Lepidoptera	Butterflies	5	21	24	93	1		3	147
Mantodea	Mantids	-	2	11	7	-	-	-	20
Odonata	Dragonflies	2	13	2	48	-	-	-	65
Crustacea									**112**
Decapoda	Crabs & Shrimps	-	2	3	1	-	-	-	6
Crustacea- Branchiopoda	Zoopl. shrimps	1	15	22	12	3	53	-	106
17 taxonomic groups	**Total**	**10**	**149**	**417**	**456**	**43**	**84**	**27**	**1186**
	% of total	0.8	12.6	35.2	38.4	3.6	7.1	2.3	100

In total, 149 pecies were considered likely to be threatened (THR) and another 417 species were classified as unknown (UN) and should be considered for detailed assessment. Therefore, if all these taxa were to be assessed using the *All species* method, we would need to assess 566 species. 38% of species were listed as least concern (LC). A further 154 species were considered not eligible for assessment because they were either data deficient (TD or ND), or not applicable (NA) because they are vagrant or introduced (invasive) species. Ten species are already known to be extinct in Israel, 50% of which are butterflies.

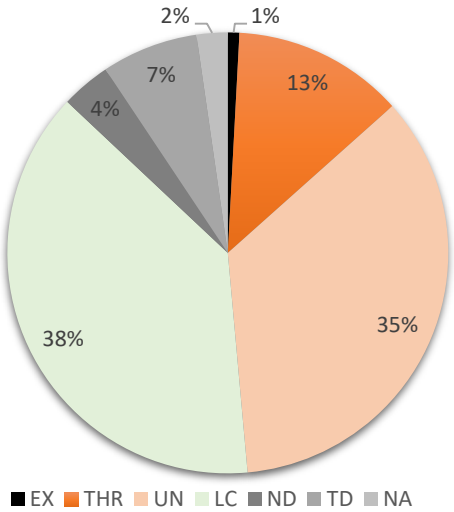

Figure 4: *Rapid classification status* of invertebrate species in 17 taxa (n=1,186).

Table 4 shows the number of endemic species listed during the *Rapid classification* process across 17 taxa. 20% of listed species are considered endemic to Israel. We did not record endemic subspecies. 3% of species were endemic to the region (e.g. Israel and Sinai, or the Levant). This latter number is incomplete as some experts did not record regional endemism.

Table 4: Summary of Endemic species from the *Rapid classification* data

Taxa	Common name	Not endemic	Endemic	Regionally Endemic	Unknown	Grand Total
Arachnida						
Scorpiones	Scorpions	4	5	15	2	26
Other Arachnids	Other arachnids	2	3			5
Opiliones	Harvestmen	1	12	7		20
Araneae - Pholcidae	Cellar spiders	7	2	2		11
Araneae - Agelenidae	Funnel weavers	9	8	6		23
Araneae - Lycosidae	Wolf spiders	22	5		3	30
Araneae - Dysderidae	Woodlouse spiders	4	9	4	7	24
Insecta						
Coleoptera - Cerambycidae	Longhorn beetles	70	36	-	-	106
Coleoptera - Scarabaeoidea	Dung beetles	229	58	-	-	287
Coleoptera - Carabidea	Ground beetles	28	15	-	8	51
Ephemeroptera	Damselflies	20	7	-	2	29
Formicidae	Ants	149	62		19	230
Lepidoptera	Butterflies	147	0	?		147
Mantodea	Mantids	19	1	-	-	20
Odonata	Dragonflies	65	0	-	-	65
Crustacea						
Decapoda	Crabs & Shrimps	4	2	-	-	6
Crustacea- Branchiopoda	Zoopl. shrimps	98	8	-	-	106
17 taxa	**Total**	**878**	**233**	**34**	**41**	**1186**
	% total	74.03	19.65	2.87	3.46	100.00

Species Assessments:

10 taxa were identified as good candidates for conducting full assessment process of *All species* (see Table 2). The *selected species* method was recognised as the best method for five taxa and 20 species were assessed using the method during the pilot study. Five taxa were found to be potentially suitable for a *Sampled species* red list process. Further investigation is needed to apply this method, in order to define the percentage of species that need to be sampled in order to effectively represent the complete group.

Selected Species

A total of 20 pilot species across ten taxonomic groups were assessed with 14 taxonomic experts and their collaborators using the *Selected species* approach. The results ranged from Regionally Extinct, to Critically Endangered to Least Concern. Species were chosen by the experts and so there was a known bias towards species that were most likely to be threatened.

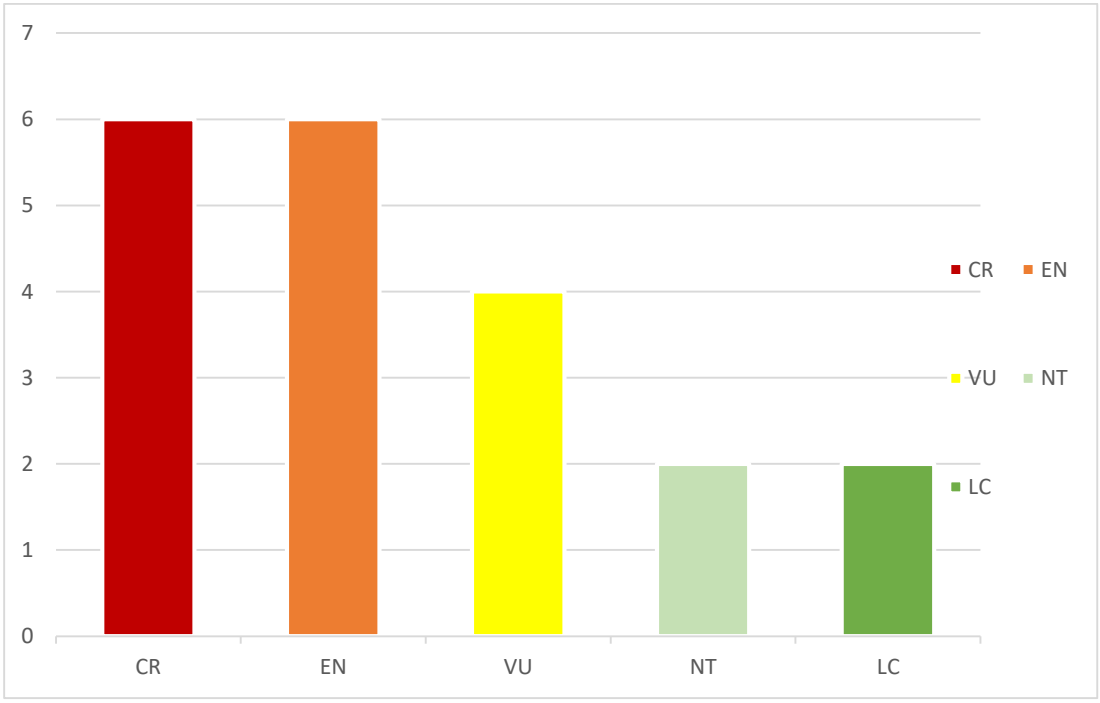

Figure 4: Red List status of selected species (n=20)

Fourteen species' assessments were approved by Red List Authorities; Axel Hochkirch or Monica Bohm. Six species were assessed but remain incomplete due to lack on information regarding threats to their habitat. This component is planned to be completed in collaboration with ecologists.

In addition to the 20 species assessed during the pilot study. Two cave shrimp (*Typhlocaris galilea* and *Typhlocaris ayyaloni*) have been also previously assessed by the IUCN (De Grave 2013a, b) and their assessments have been checked and remain unchanged (both are Endangered).

Table 5: Most common habitats for selected species (n=20 species). Reference codes refer to the IUCN list of Habitat types (IUCN Standards and Petitions Subcommittee 2010)

Habitat type	Count of Species
8.1 Hot Desert	5
5.1. Wetlands (inland) – Permanent rivers/streams/creeks	3
5.7. Wetlands (inland) – Permanent freshwater marshes/pools	2
7.2 Damp caves	2
5.9. Wetlands (inland) – Freshwater springs and oases	2
3.8 Mediterranean Shrubby vegetation	2
4.5 Subtropical dry lowland grassland	2
1.4 Temperate (Mediterranean Forest)	2
5.2. Wetlands (inland) – Seasonal/intermittent/irregular rivers/streams/creeks	2
16. Introduced vegetation	1
5.8 Seasonal Freshwater Pools	1
13.3 Coastal sand dunes	1
5.9. Wetlands (inland) – Freshwater springs and oases	1
Other- stone rocky walls	1
5.3 Shrub dominated wetland	1
Grand Total	**28**

Table 5 shows the range of habitats where species were found. Some species can be found in more than one habitat.

The most common threats facing these 20 species were climate related drought and urban and industrial development. The full summary of the assessments of these 20 species is given in Appendix 3.

Conservation Actions and Research Needs:

The most commonly reported conservation needs were site and resource protection, as well as habitat restoration. Other conseravation needs included

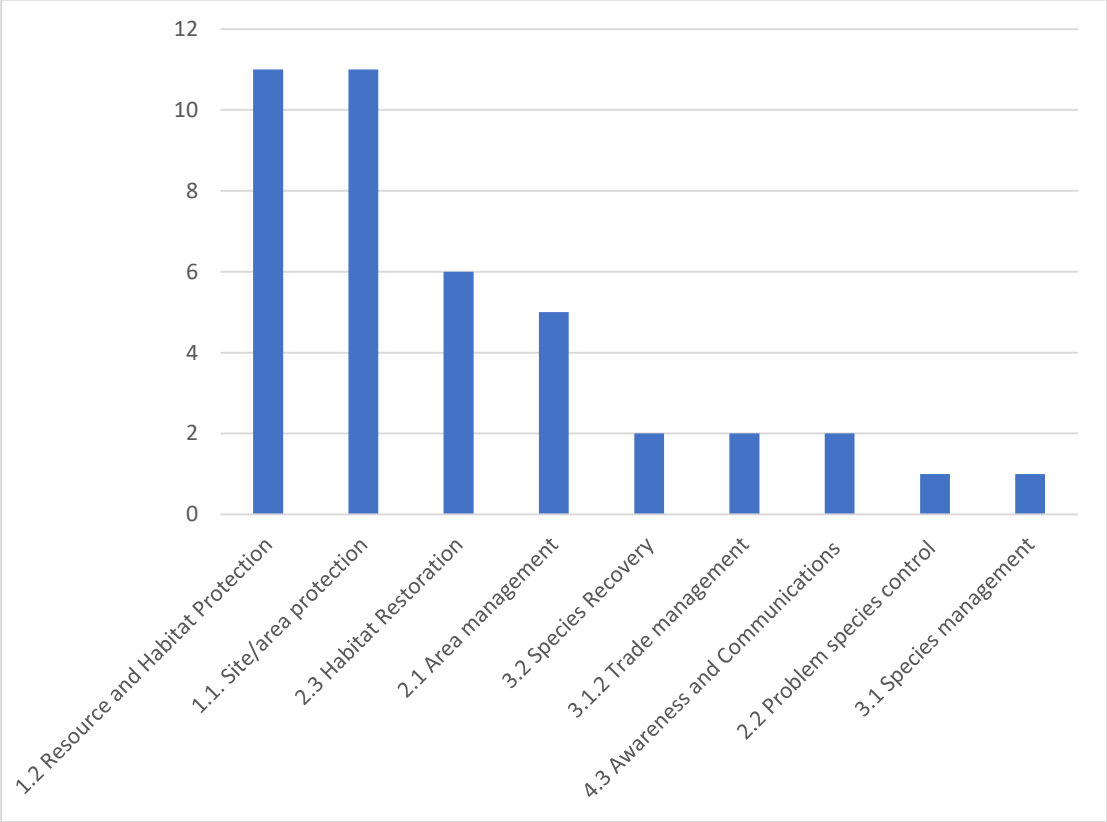

Figure 5 Conservation action needs identified by the experts for 20 selected species. Codes refer to IUCN Red List classifications of conservation action needs (IUCN 2010).

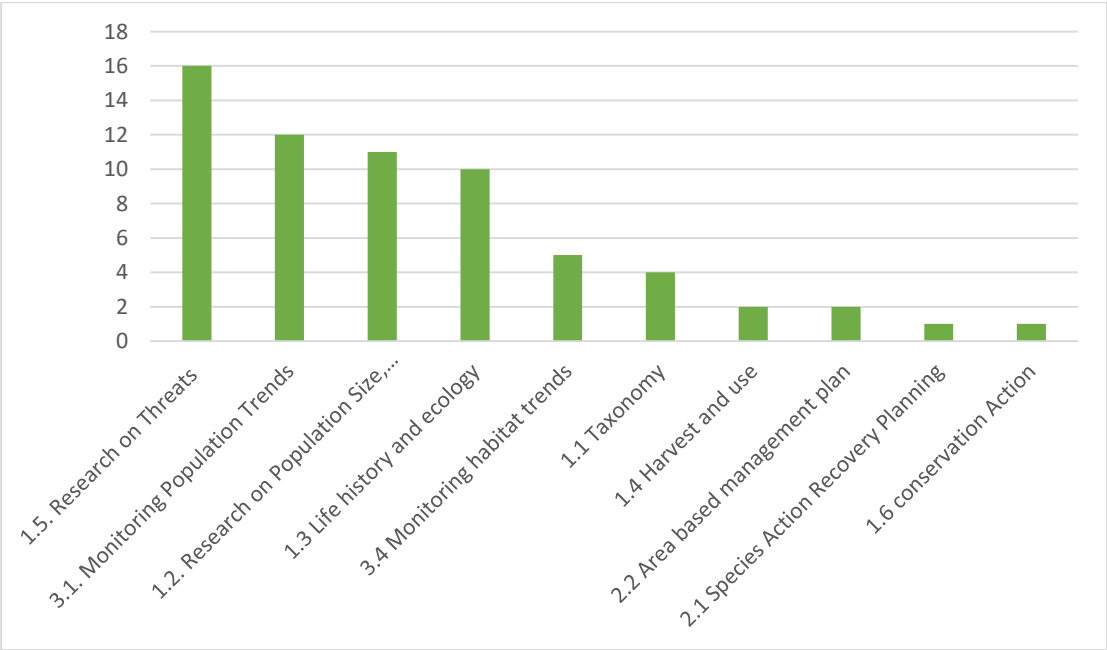

Figure 6 Research needs identified by the experts for 20 selected species. Codes refer to IUCN Red List classifications of research needs (IUCN 2010).

Butterfly assessments

Out of the 147 butterfly species in Israel, three families of butterflies (58 species) were assessed using the *All species* method. 24 species were identified as either potentially threatened (THR) or of unknown (UN) status during the *Rapid classification* process. These 24 species were all assessed in detail (Table 6). A further 34 other species were considered as of least concern (LC) data deficient (DD) or not applicable (NA) (invasive/vagrant species) during the *Rapid classification* process and were not assessed further, but are listed as LC. DD or NA in Appendix 4.

A further 21 THR and UN species in the remaining butterfly families still require detailed assessment in order to complete the full Red list for butterflies in Israel. The remaining 68 species will be classified as LC, NA or DD.

Table 6: Summary of 24 species assessed in detail following the Rapid classification process. The remaining 34 species were considered as LC and not assessed in detail (see Appendix 4 for full assessment summaries)

Species	Family	Heb.name	Hermon only	Red List Category
Colotis chrysonome	Pieridae	דרומי המרואה		RE
Anthocharis gruneri	Pieridae	כתום כנף הדופרית	TRUE	**CR**
Colias libanotica	Pieridae	צַהֲבוֹנִי הַלְּבָנוֹן	TRUE	CR
Erynnis marloyi	Hesperiidae	אֲפֹרִית אַפְלוּלִית	TRUE	CR
Gonepteryx farinosa	Pieridae	לימוני החרמון		CR
Parnassius mnemosyne	Papilionidae	שַׁלְגָּן חֶרְמוֹנִי	TRUE	CR
Pieris pseudorapae	Pieridae	לַבְנִין מְעֹרָק		CR
Pyrgus serratulae	Hesperiidae	אֲפֹרִית הַחַמְשָׁן	TRUE	CR
Thymelicus lineola	Hesperiidae	נְחוּשַׁת הַחֲטָה		CR
Borbo borbonica	Hesperiidae	הֶסְפֶּרִית בְּצוֹת		EN
Iphiclides podalirius	Papilionidae	סְנוּנִיתַן הַוַּרְדִּיִּים		EN
Muschampia proteides stepporum	Hesperiidae	אֲפֹרִית ערבתית		EN
Thymelicus acteon	Hesperiidae	נְחוּשַׁת הַשָּׁעוֹרָה		EN
Muschampia tessellum	Hesperiidae	אֲפֹרִית מַלְבִּינָה		VU
Anthocharis damone	Pieridae	כְּתֹם-כָּנָף צָהֹב		NT
Archon apollinus	Papilionidae	צְבָעוֹן שָׁקוּף		NT
Gegenes nostrodamus	Hesperiidae	הֶסְפֶּרִית עֵשֶׂב		NT
Gomalia elma	Hesperiidae	אֲפֹרִית הָאֲבוּטִילוֹן		NT
Papilio saharae	Papilionidae	זְנַב-סְנוּנִית מִדְבָּרִי		NT
Elphinstonia penia	Pieridae	יְרֹק-כָּנָף הַמַּנְתּוּר	TRUE	DD
Muschampia poggei	Hesperiidae	אֲפֹרִית סוּרִית	TRUE	DD
Gonepteryx rhamni	Pieridae	לִימוֹנִי אֵירוֹפִּי		NA
Papilio alexanor	Papilionidae	זְנַב-סְנוּנִית הַמַּכְבִּים		LC

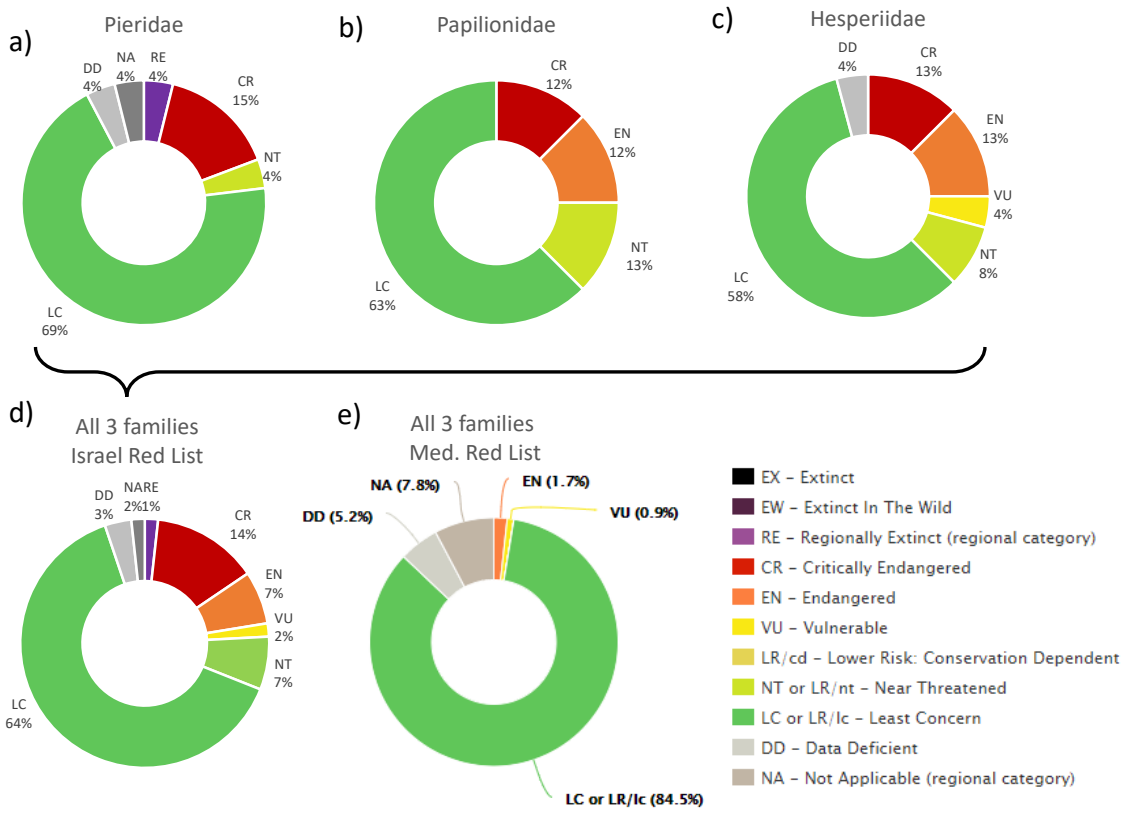

Figure 7: Status of three families of butterflies in Israel (a) Pieridae לבניים (b) Papilionidae צבעוניים, and (c) Hesperiidae הספריתיים following assessment using the *All species* approach. (d) all three families together (n= 58) (e) status of the same three families (including other species) in the IUCN Mediterranean Red List (Numa *et al.* 2016)

As seen in Figure 7 above, species in these three families appear to be at considerably higher risk in Israel than the same families in the Mediterranean as a whole. This is also due to the fact that several species in Israel are found only in very small patches of Mount Hermon (Table 5), while their main range may expand the whole Levant or Mediterranean basin. This does bias the risk for species in Israel, therefore it could be recommended to carry out separate analyses of species within the Hermon and outside of the Hermon. Nevertheless, if the objective of conservation in Israel is to preserve species diversity, then these species are rightly considered Critically Endangered in Israel.

The threats facing the butterflies ranged from loss of habitat due to tourism development (mainly the ski resort in Mount Hermon), agricultural pesticides and overgrazing. Appendix 4 details the full assessment summary for each species including LC and NA species.

7. Recommendations

Based on our investigation of 27 taxa, we made recommendations for continuing the project in the next phase. Table 7 summarises our recommendations for taxa that would be appropriate for assessment under each method. In general, where there is low species richness and/or high endemism it would be preferable to use the *All species* method. The butterflies red list is well on the way to completion and the results for the first 58 species have already been published in a new book of Butterflies of the Levant (Benyamin*i in press* 2020). Our findings are very encouraging and every effort should be made to complete with these taxa assessment and create a base line of their threatened status for the next decades.

We recommend continuing with the remaining butterflies as a priority for phase 2. Land molluscs, scorpions and mayflies may be the best candidates for continuing the red list project using the *All species* method, as well as some families of beetles such as ground beetles and long horn beetles. These taxa are all also good indicator groups for habitat health (Desender & Baert 1995; Rainio & Niemela 2003; Thomas 2005). Ants and dragonflies may also be potentially good candidates; but for these taxa more support would be needed to help the experts collate the data needed for assessment.

Other taxa such as bees may also be good bio-indicators and have several potentially threatened species, warranting conducting selected species assessments. Finally, groups where there are good species lists but too many species, a sampled approach may provide some nice insights.

The format in which the species data is collated also affects assessment efficiency; in general, when the data was entered into a spreadsheet the process went much faster than completing the word template for each species separately. It also allowed for meta-analysis across the assessments. However, if the final output needs to be an attractive document with photos, and a map for each species, an effective GIS database, coupled with an automated process for converting the excel to report format is needed.

As mentioned for the butterfly assessment, there are several species that are endemic to the Hermon area. This may elevate the appraent level of extinction risk in Israel as a whole. Having an effective database will allow meta-analyses of species by habitat and or region. For example, we could conduct a comparison of threats and extinction risks in the Hermon compared to other areas. Nevertheless, asssessing species in the Hermon is still part of the Israel National Red List.

The main constraints that we found when conducting the assessments with taxonomic experts was that while they may have excellent knowledge about the distbribution or declines for a species, they did not always have in depth knowledge about specific threats facing the species. Having a resource of mapped threats could significantly contribute to the ability to use the assessments as a conservation management tool.

Recommendations from the Scientific Committee

The Scientific Committee provided feedback on the report and a few recommendations were made.

1) An alternative calculation to replace the EOO and AOO could be used such as the “alpha hull”. This may provide a more accurate measure of distribution but careful considereation is needed to understand how this should be used in conjuction with the IUCN thresholds for each Red List Category.
2) Expert motiviation is critical to the process and many are time restricted. Support is needed to help them prepare data for the assessments.
3) The assessments should follow the precautionary approach as recommended by the IUCN. On the other hand, this could diminish the importance of conducting further research on species with very little data.
4) Threat maps would significantly improve the discussion times and efficiency of each assessement and would assist taxonomists that may not have extenisve ecological knowledge.
5) The assessments should be available in a format that allows for dynamic updating as and when new data becomes available

Table 7: Recommendations of methods for each taxon, based on number of species, knowledge of taxon and expert motivation.

Taxa	Species Richness	No. endemic	No. THR	No. UN	Method phase 2	Comments
Scorpiones	26	5	8	6	all	Good knowledge of all species. Several more species are endemic to Levant.
Opiliones	21	7	2	10	all	May be several DD but they are a small group so can look at all of them.
Other Arachnids	~ 55	5		5	all	Several orders with 1-10 species and may be worth conducting full assessments just to document them - many will be DD. 50 species of Solifugae are all DD.
Lepidoptera - Rhopalocera (butterflies)	147	0	21	24	all	Keen experts and good data sets make this group a good candidate to conduct a full assessment project – other experts available to help on specific families. 58 species were assessed using the *All species* method following *Rapid classification*; 24 THR/UN assessed and 34 more identified as LC. In addition, two more species were assessed as *selected species*.
Land Mollusca (land snails)	112	-	-	-	all	Some taxonomic issues may need to be resolved mostly keen experts and good data sets make this group a good candidate to conduct a full assessment of all species.
Odonata: Anisoptera (Dragonflies)	66	0	13	2	all	Michael does not think there is enough data on this group to conduct full assessments.
Ephemeroptera (Mayflies)	29	7	14	2	all	Achievable and important group as bioindicators – Some genera will be DD but can do all 12 Baetidae species.
Plecoptera (Stoneflies)	6	-	-	-	all	Doable but may be DD.
Class: Malacostraca Order : Decapoda (Cave shrimp & Crabs)	6	2	3	3	all	Two out of four species of cave shrimp (Infraorder Caridea) have been assessed as EN by the IUCN and have been verified by expert as still correct. One out of two species of crabs (infraorder Brachyura) needs more detail but status is recorded as NT.
Other Branchiopoda	20	4	9	2	all	Not much known about these orders but since there are very few species it might be worth capturing as much data as possible now for future red listing.
Blattodea	19		-	-	all?	Participation in the future is plausible with enough assistance and support to collate data.
Mantodea	20	1	2	1	all?	Participation in the future is plausible with enough assistance and support to collate data.

Taxa	Species Richness	No. endemic	No. THR	No. UN	Method phase 2	Comments
Apoididae (Bees)	~ 1000	-	-	-	sampled?	Only a few genera are known well enough to assess. However, since this group is very important for ecosystem services and indicators, it may be nice to do a sampled assessment and understand the status of bees in Israel
Araneae (Spiders)	~ 1200	(24)	(13)	(16)	sampled	Different families have different data quality, some are small and well known, others are numerous and very little known.
Coleoptera	~ 6000	~ 10-30%	(50)	(275)	sampled	Not all families counted have experts. Data quality varies. Most are too numerous or too DD to do all spp. A sampled or selected approach is recommended depending on objectives. *Rapid classification* was conducted for Carabidae (51), Cerambicidae (106) and Scarabidae (287). For thesegroups, the *All* method may be appropriate.
Freshwater Mollusca	115	-	-	-	sampled	Sampled approach may work well here. More data needed from experts.
Class Branchiopoda: Order Cladocera	60	2	6	15	sampled	Some families are known better than others... Sampled approach may give us an interesting indication of the status of freshwater systems in Israel – not sure if sampled feasible with small groups.
Formicidae (Ants)	230	62	9	43	sampled	A sampled approach may reveal interesting information about the status of ants in Israel - good bio-indicators so recommended to try include if possible. Need more info from experts.
Moths	2500-3000	-	-	-	selected	Keen expert but data is poor and many species, so selected approach may be recommended.
Trichoptera	50	-	-	-	selected	Many DD so can do sampled or bias selection.
Freshwater Coleoptera	100-300	-	-	-	selected	Little known about most species so selected approach will highlight threatened species. Also may be able to do *All* (41) Curculionidae as a complete subset.
Orthoptera	?	-	-	-	selected	One mole cricket assessed by Ittai Renan. No expert in Israel of this taxon. Can include a few species or omit.
Neuroptera	140	-	-	-	selected	Participation in the future is plausible with enough assistance and support to collate data – a selected approach since most are DD.
Freshwater Heteroptera	?	-	-	-	omit	More data from experts is needed.
Freshwater Diptera	91-100	-	-	-	omit	More data from experts is needed.
Annelids (Leeches)	18-22	-	-	-	omit	Not enough knowledge DD group.
Class Ostracoda	52	4	-	-	omit	No data for this class – *All species* are ND.

8. Conclusions

The INRLI pilot project is the first national level red list for invertebrates in Israel. Our approach was to investigate all main taxa, to understand their status, data quality, expert availability and motivation, and to determine the best method for assessing each taxon, usually at the Order level.

In general, it is thought that Red Listing of invertebrates is a more challenging goal than for vertebrates, due to the vast number of species coupled with high levels of data deficiency. However, Red Listing can be performed on the majority of invertebrate groups, even when data are incomplete (Cardoso *et al.* 2011; van Swaay *et al.* 2011). In fact, knowledge on distribution is a key data in the assessment and is often better in invertebrate's species than in other groups, due to the high level of specialization and highly localized ranges.

We found it is possible to include the use of expert-judgement when using sub-criteria such as fragmentation, fluctuations and rescue effects, or for the estimation of population sizes. The IUCN supports the general view that a precautionary approach should be adopted and allows for semi-quantitative data to be used, whereby a species might be considered threatened based on expert opinion, unless there is evidence to the contrary (IUCN Standards and Petitions Subcommittee 2010). This should minimize the use of the DD category whilst maintaining accuracy in assessments, although it does introduce greater subjectivity (Lewis & Senior 2011).

It is extremely important to give detailed information on how trends, distribution ranges and population sizes were calculated and which assumptions were made in the analyses. In addition, it is useful to document the survey efforts for the different taxa/species in order that they may be comparable. As long as the methods, assumptions and range of uncertainty are explained, a reasonable judgement can be made based on the best available data, and future assessments can be adjusted if new information reveals something different.

Uncertainty can be accounted for in a number of ways, such as by including a 5% error margin on the distribution and population trends provided (van Swaay *et al.* 2011), or by calculating the minimum (verified sightings) and maximum (unverified records and/or habitat maps) distribution range, as we did for butterflies.

It is important to recognize that the Red List on its own is not a conservation plan. Rather, it is a tool that can be used to contribute to the conservation and protection of species. There are some known biases in conservation plans based on red listed species; Higher conservation protection for species is often given to the larger, better known, more widespread and more multicoloured species, which are easier to assess (Leandro et al. 2017). This is the case in Europe, where 123 of the 105,000 known European insect species are currently protected. Butterflies, dragonflies and grasshoppers were overrepresented, as were nectarivorous and saproxylophagous species.

In contrast, Hymenopterans and Dipterans, together representing> 40% of European entomofauna, do not appear on the current list of protected species (Leandro et al. 2017).

In our pilot, we found that some speciose groups such as dipterans (flies), heteropterans (bugs) and hymenopterans (wasps and bees) are not readily be assessed as a group. Nevertheless, there are several other taxa with relatively few species and relatively good knowledge and data on the species distributions.

The use of the *Rapid classification* method is an effective way of comparing expert opinion among different teams, which helps set the baseline to focus discussions on the key/most problematic species. In addition, it allows many more species to be assessed than is possible using the *selected species* method.

In conclusion, the pilot study was a very successful phase of investigation and learning. While there are thousands of invertebrate species in Israel, and many families (even entire orders) are data deficient, several taxa can be readily assessed under the different methods available. Consideration of the objectives and intended utilisation of the Natioanl Red list of Invertebrates by conservation managers and policy makers should steer the choice of other taxa to prioritise and which methods are most appropriate.

9. Acknowledgements

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10. References

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11. Appendices:

Appendix 1: Log frame of the INRLI project.

Israel National Red List of Invertebrates (INRLI)		2018	2019												2020											
Activity	**Name**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Project Structure																										
Project Coordinator Appointed	IR																									
Advisory Committee appointed	TB/IR																									
Scientific Working Group appointed	TB/IR																									
Project Schedule Completed	TB																									
List of Experts compiled	TB/IR/ Scientific Committee																									
IUCN Training																										
IUCN Training Course: Assessing Species' Extinction Risk Using IUCN Red List Methodology	TB																									
IUCN Training Course: Facilitating Species Conservation Planning Workshops	TB																									
Arc GIS online	TB																									
IUCN & Kew Gardens: GeoCat online mapping tool tutorial	TB																									
IUCN European Red List assessment workshop for Hoverflies, Lesbos, Greece	TB										10-15/09/19															
Milestones																										
Advisory Committee Meeting	TB/IR							06/06/2019																		
Scientific Committee Meeting	TB/IR								10/07/2019																	
Workshop of the Israel National Red List for Invertebrates for taxonomic experts	TB, IR + Experts											31/10/2019														
INRLI project presented at 2nd Israeli Conference for Conservation Science, University of Haifa	TB					17/04/2019																				
Meeting with Ofer Steinitz & Gal Vine regarding NPA website hosting.	TB						10/05/2019					20/10/19			27/01/20											
Website- Museum PR meeting	IR							28/06/2019																		
Meeting with Monika Bohm , National Red List Director, ZSL London	TB													16/12/2019		19/02/2020										
Meeting with David Allen, IUCN Regional Red List Manager	TB													14/12/2016		17/02/2020										
Species Assessments																										
Pilot species candidates identified	IR/TB																									
Phase 2 species identified	Experts																									
Assessment of Pilot species	TB + Experts																									
Assessments in review together with IUCN Red List Authorities: Axel Hochkirch + Monika Bohm	TB																									
Funding																										
National Red List approached for funding assistance	TB																									
Search for funding opportunities	TB/IR																									
Project summation																										
Submission of final assessments to IUCN	TB																									
Begin phase 2	TB/IR																									
Advisory Committee Meeting	TB/IR																									
Scientific Committee Meeting	TB/IR																									
Butterfly Red List workshop																										
Activity	**Name**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**

Appendix 2: List of Experts contacted in the pilot phase of the project. People marked with * are also on the Scientific committee

Name	Taxa	Institute
Dr. Eitan Recht	Acari, Hemiptera	Plant Protection and Inspection Services, Ministry of Agriculture
Dr. Yaron Hershkovitz*	Aquatic	SMNH-TAU
Dr. Zohar Yanai	Aquatic	TAU
Dr. Eftrat Gavish-Regev*	Arachnid	NNHC-HUJ
Mr. Yoram Zvik	Arachnid	Independent
Mr. Igor Armiach	Arachnid	NNHC-HUJ
Mr. Shlomi Aharon	Arachnid	NNHC-HUJ
Ms Zeana Ganem	Arachnid	NNHC-HUJ
Dr. Sergey Zonstein	Arachnid	SMNH-TAU
Dr. Achik Dorchin	Bees	University of Haifa
Dr. Yael Mandelik*	Bees	NNHC-HUJ
Dr. Gidi Pisanty	Bees	SMNH-TAU
Mr. Laibale Friedman*	Coleoptera	SMNH-TAU
Mr. Oz Rittner	Coleoptera	SMNH-TAU
Prof. Thorsten Assmann	Coleoptera	Leuphana University
Dr. Jorn Buse	Coleoptera	NLP Germany
Mr. Ittai Renan	Coleoptera	SMNH-TAU
Prof. Vladimir Chikatunov	Coleoptera	SMNH-TAU
Dr. David Furth	Coleoptera	The Smithsonian Institute
Mr. Eylon Orbach	Coleoptera- Cerambicidae	Independent
Liron Goren	Crustacea - Ephemeral ponds	SMNH-TAU
Dr. Yaarit Levit Bermatz	Decapoda, Caridean shrimp	SMNH
Dr. Netta Dorchin*	Diptera	SMNH-TAU
Prof. Amnon Friedberg	Diptera	SMNH-TAU
Dr. Elizabeth Morgulis	Diptera	SMNH-TAU
Dr. Mike Mostovski	Diptera	SMNH-TAU
Udi Segev	Formicidae	Independent
Dr. Armin Ionesco	Formicidae	SMNH-TAU
Dr. Gilad Ben-Zvi	Formicidae	SMNH-TAU
Dr. Jean-Jacque Itzhak Martinez	Formicidae	Migdal
Dr. Maya Saar	Formicidae	TAU
Dr. Malkie Spodek	Hemiptera	SMNH-TAU
Moshe Kostyukovsky	Hemiptera	Volcani
Dr. Zvika Mendel	Hemiptera	Volcani
Assaf Nir	Hemiptera	Independent

Name	Taxa	Institute
Elazar Quinn	Hemiptera	Volcani
Dr. Tania Novoselsky	Heterotpera	SMNH-TAU
Mr. Dubi Benyamini	Lepidoptera	Association of Butterfly lovers of Israel
Dr. Orr Commay	Lepidoptera	German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig
Dr. Guy Pe'er	Lepidoptera	German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig
Israel Pe’er	Lepidoptera	National Butterfly monitoring Scheme
Ofir Tomar	Lepidoptera	Association of Butterfly lovers of Israel
Zvika Avni	Lepidoptera	
Racheli Schwartz-Tzachor	Lepidoptera	Ramat Hanadiv
Gadi Ishmam	Lepidoptera	
Dr. Oz Ben Yehuda	Lepidoptera	Achva
Dr. Vasiliy Kravchenko	Lepidoptera - Moths	SMNH-TAU
Dr. Benny Shalmon	Mantodea	Independent
Amir Weinstein	Mantodea	Independent
Dr. Offer Steinitz	Mollusca	NPA
Prof. (Emeritus) Joseph Heler	Mollusca	NNHC, HUJ
Dr. Hank Mienis	Mollusca	SMNH-TAU
Dr. Dany Simon	Neuroptera, Isoptera, Blattodea	SMNH-TAU
Dr. Michael Blecher	Odonata	NPA
Prof. (Emeritus) Meir Pener	Orthoptera	NNHC-HUJ

Appendix 3: Red List status of species selected for assessment.

Species name	Status	Red Status	Hebrew name	Taxa	Expert (s)	RLA	EOO	AOO	No. Locations	Severe Frag?	Extreme Fluctuation?	Endemic?	Threats	Occur in at least one PA	Protected Area (PA)	Regional Adjustment applied?	Countries
Apharitis cilissa	complete	EN B1b(ii,iii,iv,v)c(iii,iv) + B2b(ii,iii,iv,v)c(iii,iv)	נחושתן-הנמלים הגלילי	Lepidoptera (Butterflies)	Dubi Benyamini, Orr Commay, Guy Pe'er, Talia Oron, Gadi Ish Am	Monika Bohm	1353	124	>10	N	Y	N	y	y	Sharon: The Sharon Park ; Caesarea Carobs. Upper Galilee: Mount Meron; Mount Hermon	n	Israel, Syria, Turkey, Iraq, Iran, Lebanon
Baetis golanensis	complete	VU B1ab(iii) + B2ab(iii)	-	Ephemeroptera (Mayflies)	Zohar Yanai, Yaron Herskowitz		177	40	10	N	n	y	y	y	En Tina	n	Israel
Baetis monnerati	complete	LC	-	Ephemeroptera (Mayflies)	Zohar Yanai, Yaron Herskowitz		8006	176	27	n	n	regional	y	y	Hula, Dan, Senir, Banyas, Qelt, Dawid, Arugot streams, and others.	yes	Israel, Jordan
Baetis samochai	complete	NT	-	Ephemeroptera (Mayflies)	Zohar Yanai, Yaron Herskowitz		2510	UN	13	n	n	n	y	y	Hula, Dan, Senir, Parag pool nature reserves.	n	Israel, Syria, Turkey, Iraq, Iran, Lebanon
Brenskiella flavomicans	complete	VU B1ab(ii,iii)	זבלית החוף	Coleoptera	Oz Rittner	Monika Bohm	**225**	-	5-8	Un		y	y	y	Nizzanim. Other dune reserves?	n	Israel
Eucera boyadjiani	complete	CR B1 ab(i,iii,iv,v)+ 2ab(i,iii,iv,v)	מחושית	Apoideae (Bees)	Achik Dorchin	Monika Bohm	4	4	1	y		n	y	n		n	Israel, Syria, Turkey
Evippa sp. Nov	complete	CR B2ab(iii)	-	Araneae - Lycosidae	Igor Armiach, Efrat Gavish-Regev	Monika Bohm	8	8	2	N	un	Y	y	y	Neot haKikar reserve (planned)	n	Israel, Jordan
Graphipterus serrator	complete	EN B1ab(i,iii)		Coleoptera - Carabidae	Ittai Renan	Monika Bohm	1400	-	3	N		N	y	y	Western Negev	n	Israel, Egypt
Gryllotalpa marismortui	complete	CR B1ab(iii,iv) + B2ab(iii,iv) PE		Orthoptera (Crickets)	Ittai Renan	Axel Hochkirch	80	10		n		y	y	y		n	Israel
Icaris sparganii	complete	CR B1ab(iii)+B2ab(iii)	חדקנית האגמון	Coleoptera - Curculionidae	Laibale Friedman	Monika Bohm	4	4	1	y		N	y	y	Ga'ash winter pool שמורת בריכת געש	n	Israel, Most of Europe, Asia, Turkey, Syria
Lucanus cervus	complete	EN B1ab(iii,iv,v),B2ab(iii,iv,v)	איילית סורית	Coleoptera - Scarabidae	Oz Rittner	Monika Bohm	283	72	3	N		N	y	y	Mount Meron, Mount Hermon	n	Israel, Most of Europe, Syria
Lycosa sp. nov.	complete	NT	זאבן הדלתות	Araneae	Igor Armiach, Efrat Gavish-Regev	Monika Bohm	2100	-	- (probably >10)	N		Y	y	?		n	Israel
Ocladius paucisquamis	complete	LC		Coleoptera - Curculionidae	Laibale Friedman	Monika Bohm	16500	-	>10	N		Y	y	y		n	Israel
Tegenaria sp. nov.1	complete	CR B1 ab(iii,v) + B2ab(iii,v); C2a(ii)	-	Araneae	Shlomi Aharon, Efrat Gavish-Regev	Monika Bohm	4	4	1	Na		Y	y	y	Oranit Reserve	n	Israel
Compsobuthus carmelitis	draft	EN C2 a(i)		Scorpionidae - Yoram	Yoram Zvik		4,018	24	6	Yes?	N	Y	y	?	?	n	Israel
Compsobuthus longipalpis	draft	VU /EN		Scorpionidae	Yoram Zvik		3,240	UN	<10	yes?	N	n	y	?	?	n	Israel, Sinai
Dicranolasma hoberlandti	draft	VU /EN		Opiliones	Shlomi Aharon, Efrat Gavish-Regev		4900	36	9	y	n	n	y	?	?	n	Israel, Turkey, Greece, Italy
Haasus judaeus	draft	EN/ VU / LC		Opiliones	Igor Armiach, Efrat Gavish-Regev		6195	40	>10	y	n	yes?	y	?	?	n	Israel
Haasus naasane	draft	CR B1 ab(iii) + B2 ab(iii)	קְטַן-רֶגֶל מְנֻמָּנָם	Opiliones	Igor Armiach, Efrat Gavish-Regev		4	4	1	y	n	y	y	?	?	n	Israel
Tomares nesimachus	draft	EN B2b(ii,iii,iv,v)c(iii,iv)	צמריר הקדד	Lepidoptera (Butterflies)	Dubi Benyamini, Orr Commay, Guy Pe'er, Talia Oron, Gadi Ish Am		5476 - 12000	88-500	>10	n	y	n	?	?	?	n	Israel, Jordan, Turkey, Syria, Lebanon

Appendix 4. Assessment of 58 butterfly species in the Pieridae, Hesperiidae and Papilionidae families in Israel. Species are listed alphabetically within each Red List Category. We assessed 24 species and the rest were considered as Least Concern and were not assessed fully.

ButtID	Species	Family	Heb.name	Hermon.only	Red List Status	Red List Category	Assessment Summary
17	*Colotis chrysonome*	Pieridae	דרומי המרואה		RE	RE	This species is not rare in the Sub-sahara belt. However it is Extinct in Israel since 1950's (and Jordan since 2000's). Prior to the 50's they were found in Ein Gedi. Alluvial plains were converted to agriculture removing their sole host tree species Maerua crassifolia. Restoration efforts replanted the trees in the late 1990's but by the time they grew to maturity, the butterfly population in Jordan was also wiped out for the same reason and there was no population to create a rescue effect.
24	*Anthocharis gruneri*	Pieridae	כתום כנף הדופרית	TRUE	CR B1ab(iii,v) + C2 a(i)	CR	This species is very rarely seen, when it is seen only 3-5 individuals at a time. Seen in the Jerusalem area until the early 1980's but now only sighted in the Hermon. Its distribution in the Galilee is unknown but it has never been recorded. There is one main subpoluation in the Hermon while a few singletons have been found in Mount Ramim (Reches Naftali). These subpopulations are considered highly fragmented and there is evidence of declining populations (reduced sightings) in Hermon and habitat quality is inferred to be declining due to grazing and pesticide use in the area. Therefore this species is CR under category B It is highly unlikely that there are more than 250 individuals in Israel making it eligible for CR under category C2. This species is a protected species in Israel, but its habitat is not protected and overgrazing needs to be carefully monitored and prevented within its range. This species cannot cross the rift valley to Jordan, but it is possible they are connected to sub-populations in Lebanon and/or Syria. However, the status of this butterfly in these neighbouring countries is unknown and may also be in decline therefore no regional adjustment was made.
26	*Colias libanotica*	Pieridae	צְהֻבוֹנִי הַלְּבָנוֹן	TRUE	CR B1a,b(i,iii,iv),c(iv) + B2a,b(i,iii,iv),c(iv)	CR	This species is highly restricted to a small patch of less than 4km2 in mount Hermon, several threats face this species within- most problematic is the development of the ski resort directly on this patch as well as grazing and projected temperature rises due to climate change, which is therefore projected as one single location. Part of this distribution is inside the Mount Hermon reserve and conservation efforts should seek to restore the host plan within this protected area as a matter of urgency
123	*Erynnis marloyi*	Hesperiidae	אֲפִרִית אַפְלוּלִית	TRUE	CR B1a,b(iii) + B2a,b(i,iii,iv); C2 a(ii),b	CR	This species is highly restricted to a small patch of less than 4km2 in mount Hermon, several threats face this species within- most problematic is the development of the ski resort directly on this patch as well as grazing and projected temperature rises due to climate change, which is therefore projected as one single location. Part of this distribution is inside the Mount Hermon reserve and conservation efforts should seek to restore the host plan within this protected area as a matter of urgency
30	*Gonepteryx farinosa*	Pieridae	לימוני החרמון		CR PE B1ab(iii,v); C2 a(i)	CR	Last confirmed sighting was in 2009 with two unconfirmed records in 2010 and 2016, therefore it is considered Possibly Extinct. If there are any unknown small remnants remaining, they are very unlikely to be more than 250 in total with fewer than 50 individuals in a single remnant. It is inferred that the habitat is in decline and threatened by agriculture and pesticides. There has been severe loss of its host tree (Rhamnus spp) in lower elevations where is was previously found. It was pushed to higher elevations due to climate related increase in temperature and it is likely that there is reduced forage availability in higher elevations
8	*Parnassius mnemosyne*	Papilionidae	שְׁלֶגֶן חֶרְמוֹנִי	TRUE	CR B1ab(iii,v)	CR	This species is highly restricted to mount Hermon with a maximum EOO of 30-40km2, Climate change related increases in temperature is driving this species to higher elevations where its host plant may be restricted, therefore it is considered that there is only one location and the species is considered CR
11	*Pieris pseudorapae*	Pieridae	לַבְנִין מְעֹרָק		CR C2a(ii)	CR	The distribution of this species is <200km and there are likely to be between 1-5 locations based on the assumption that separate biotopes will face independent threats, making this species EN under category B1. However sample sizes suggest very few numbers in each subpopulation and in total is it very unlikely that there are more than 250 remaining individuals in Israel. While it is found within a reserve area, the higher elevations are not protected from ski resort development or grazing.

ButtID	Species	Family	Heb.name	Hermon.only	Red List Status	Red List Category	Assessment Summary
135	*Pyrgus serratulae*	Hesperiidae	אֲפִרִית הַחַמְשָׁן	TRUE	CR B1ab(iii,iv) + B2 ab(iii,iv); C2a(ii)	CR	This species is highly restricted to a small patch of less than 4km2 (more likely around 200m2) in mount Hermon. Several threats face this species within its small range- most problematic is the development of the ski resort directly on this patch, as well as grazing and projected temperature rises due to climate change, which is therefore projected as one single location. Part of it's distribution is inside the Mount Hermon reserve and conservation efforts should seek to restore the host plant within this protected area as a matter of urgency
137	*Thymelicus lineola*	Hesperiidae	נְחוּשַׁת הַחִטָּה		CR C2a(i) PE	CR	In Jordan is very common in some areas but very few, old sightings in Israel in early 20th Century. Not seen since 1935. Very similar to Thymelicus spp - so it is possible that is it being overlooked. If still exists- possibly in Upper Galilee, Golan Heights and Somaria desert.
144	*Borbo borbonica*	Hesperiidae	הֶסְפֶּרִית בְּצוֹת		EN B1a,b(iii)	EN	This is a migratory species, from the African continent, previously visiting the Hula valley until 50 years ago. It was then not seen for several decades and was considered Extinct. Since 2000 ut has reappeared along the coastal plain near restored freshwater systems. The current EOO for this species in Israel is less than 250km, while the exact number of threats is not known, only 2 localities are currently known in Israel, therefore it is unlikely that there could be more than 5 locations based on threats. In addition freshwater systems in Israel are highly threatened by effluent pollution and degradation, so it is inferred that there is significant decline in habitat quality. No regional adjustment was made since the conditions of freshwater within Israel continue to deteriorate, meaning that any immigration could suffer from a sink effect rather than be considered as a rescue effect.
4	*Iphiclides podalirius*	Papilionidae	סְנוּנִיתַן הַוַּרְדִּיִּים		EN C2 a(i)	EN	The distribution of this species is <5000km and AOO is <500km but there are likely to be between 5-10 locations based on the assumption that separate biotopes will face independent threats, making this species VU under category B1 &B2. However sample sizes suggest very few numbers in each subpopulation and in total is it very unlikely that there are more than 1000 remaining individuals in Israel. Therefore is is considered as EN under category C2.
132	*Muschampia proteides_stepporum*	Hesperiidae	אֲפִרִית ערבתית		EN C2 a(i)	EN	Small EOO of around 382km2 and the habitat is in decline. The number of locations based on the assumption that subpopulations will face independent threats is between 5-10 making this species VU under category B. However is it very likely that there are less than 2500 mature individuals in Israel and <100 in each subpopulation, therefore it is considered EN under category C2.
136	*Thymelicus acteon*	Hesperiidae	נְחוּשַׁת הַשְּׁעוֹרָה		EN C2 a(i)	EN	EOO is relatively large with >5000 km2, but this is shrinking and habitat is in decline and threatened by urban development particularly around Jerusalem. The number of locations is between 5-10, based on the assumption that each subpopulation will face independent threats, making this species VU under category B. However, is it very likely that there are less than 2500 mature individuals in Israel and <100 in each subpopulation therefore it is considered EN under category C2.
133	*Muschampia tessellum*	Hesperiidae	אֲפִרִית מַלְבִּינָה		VU C2a(ii)	VU	EOO is large, but AOO is very small (150km) and there are declines in habitat, and number of locations and population. However number of locations >10 so the species is considered NT under category B. It is likely that there are less than 10,000 individuals in Israel and <1000 in each sub population, so the species can be considered VU under category C2
25	*Anthocharis damone*	Pieridae	כְּתֹם-כָּנָף צָהֹב		NT	NT	This species has a small EOO of around 850 km and the species is known to have extreme fluctuations in population number between years. However there is currently no evidence that pesticide use has affected the population, therefore the species is considered NT until further evidence of declines or threats are found
7	*Archon apollinus*	Papilionidae	צִבְעוֹן שָׁקוּף		NT	NT	This species is fairly commonly found in Israel, and widely distributed in Syrian region. In Israel <10,000km, with possible declines in habitat extent due to overall loss of grasslands and shrublands, and species is disappearing from many urban and peri-urban areas. It is projected that there will be a decline in number of localitiesin the future and more research is needed to monitor this. Until more is known this species is potential facing future threats and therefore using the rprecautionary approach we list this species as Near Threatened.
142	*Gegenes nostrodamus*	Hesperiidae	הֶסְפֶּרִית עֵשֶׂב		NT	NT	EOO is around 6500 km2 and there are known declines in the number of locations and the population, however there are likely to be more than 10 locations based on threats so the species is considered NT

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145	*Gomalia elma*	Hesperiidae	אֲפִרִית הָאַבּוּטִילוֹן		NT	NT	This is a migratory species, from the African continent, however it does breed in Israel in the lower, warmer areas of the rift valley. The EOO for this species in Israel is less than 5000km, and the EOO is less than 2000, while the exact number of threats is unknown it is assumed that the number of locations is between 2-5 based on number of biotopes. There is currently no evidence of threats to this species since it is not directly impacted by agricultural activities in the desert. Climate change is unlikely to reduce its range and may even allow its expansion. However, given the small EOO this species can be considered NT and potential threats in the future may push it to become endangered in future assessments
2	*Papilio saharae*	Papilionidae	זַנָב-סְנוּנִית מִדְבָּרִי		NT	NT	This species is found in the southwest area of Israel, which is the northern edge of its range. The EOO is eligible for EN and there are few localities making it unlikely that there can be more than 5 locations based on independent threats. There are also very likely <10,000 individuals in Israel which could make it partially VU under Category C2. However, there is no evidence for any known threats facing this species in the desert therefore it is currently considered NT
33	*Elphinstonia penia*	Pieridae	יְרֹק-כָּנָף הַמַּנְתּוּר	TRUE	DD	DD	Not enough is known about its distribution or population to determine if this species is at the edge of its range or if the few sightings recorded are vagrants. It is possible this species should be considered NA - not applicable - but until more is known about it we prefer to list as DD.
147	*Muschampia poggei*	Hesperiidae	אֲפִרִית סוּרִית	TRUE	DD	DD	This species has only been recorded twice but looks similar to another Muschampia species so may have been overlooked. Therefore not enough is known about this species to conduct an assessment and the species is DD
29	*Gonepteryx rhamni*	Pieridae	לִימוֹנִי אֵירוֹפִּי		NA	NA	This species is very common in Europe and only expanded its range to Israel in the 1980's since then it has expanded and again receded and now is only found in the Mount Hermon. However since the species is not an original native species, we considered it not applicable NA for the red list of Israel
3	*Papilio alexanor*	Papilionidae	זַנָב-סְנוּנִית הַמַּכְבִּים		LC	LC	This species is distributed across most of the northern half of Israel, although the AOO is fairly small there are likely more than 10 locations and there are no known threats or declines. Therefore this species is considered LC. Future knowledge may reveal threats and this species could become NT in the future.
5	*Allancastria cerisyi*	Papilionidae	צִבְעוֹנִי קָשׁוּט		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
6	*Allancastria deyrollei*	Papilionidae	צִבְעוֹנִי צְהַבְהַב		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
18	*Anaphaeis aurota*	Pieridae	לַבְנִין מְשֻׁיָּשׁ		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
23	*Anthocharis cardamines*	Pieridae	כְּתֹם-כָּנָף הַמִּצְלְתַּיִם		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
9	*Aporia crataegi*	Pieridae	רִשְׁתָּן הָעֵזְרָר		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
124	*Carcharodus alceae*	Hesperiidae	אַפִּרִית הַחֶלְמִית		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
125	*Carcharodus orientalis*	Hesperiidae	אַפִּרִית הַמַּכְבִּים		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
126	*Carcharodus stauderi*	Hesperiidae	אַפִּרִית הַגַּלּוֹנִית		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
34	*Catopsilia florella*	Pieridae	הַגְּרָן הַסֶּנֶא		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
27	*Colias croceus*	Pieridae	צַהֲבוֹנִי הַתִּלְתָּן		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
15	*Colotis fausta*	Pieridae	דְּרוֹמִי הַצָּלָף		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
16	*Colotis phisadia*	Pieridae	דְּרוֹמִי הַסַּלְוָדוֹרָה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment

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20	*Euchloe aegyptiaca*	Pieridae	יְרֹק-כָּנָף מִצְרִי		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
19	*Euchloe ausonia*	Pieridae	יְרֹק-כָּנָף טָלוּא		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
22	*Euchloe belemia*	Pieridae	יְרֹק-כָּנָף מְמֻסְמָּס		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
31	*Euchloe charlonia*	Pieridae	יְרֹק-כָּנָף צְהַבְהַב		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
21	*Euchloe falloui*	Pieridae	יְרֹק-כָּנָף הַמּוֹרִיקָה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
143	*Gegenes pumilio*	Hesperiidae	הֶסְפֶּרִית שְׁחֹרָה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
28	*Gonepteryx cleopatra*	Pieridae	לִימוֹנִי הָאֶשְׁחָר		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
140	*Hesperia comma*	Hesperiidae	נְחוּשָׁה לִבְנַת-פִּתָּמִים	TRUE	LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
130	*Muschampia proteides_lycaonius*	Hesperiidae	אֲפַרְיָרִית חֲלֻדִּית	TRUE	LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
131	*Muschampia proto*	Hesperiidae	אֲפַרְיָרִית הַשַּׁלְהֶבִית		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
1	*Papilio machaon*	Papilionidae	זְנַב-סְנוּנִית נָאֶה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
141	*Pelopidas thrax*	Hesperiidae	הֶסְפֶּרִית הַדֹּחַן		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
10	*Pieris brassicae*	Pieridae	לַבְנִין הַכְּרוּב		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
12	*Pieris rapae*	Pieridae	לַבְנִין הַצָּנוֹן		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
13	*Pontia daplidice*	Pieridae	לַבְנִין הָרִכְפָּה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
14	*Pontia glauconome*	Pieridae	לַבְנִין הָרִכְפְּתָן		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
134	*Pyrgus melotis*	Hesperiidae	אֲפַרְיָרִית מִזְרָחִית		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
129	*Spialia doris*	Hesperiidae	נְקֻדִּית הַחֲבַלְבַּל		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
127	*Spialia orbifer*	Hesperiidae	נְקֻדִּית הַוַּרְדִּיִּים		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
128	*Spialia phlomidis*	Hesperiidae	נְקֻדִּית הַחֶרְמוֹן	TRUE	LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
139	*Thymelicus hyrax*	Hesperiidae	נְחוּשָׁה נָאָה		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
138	*Thymelicus sylvestris*	Hesperiidae	נְחוּשַׁת הַנַּשָּׁרָן		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment
32	*Zegris eupheme*	Pieridae	כְּתֹם-קָצֶה מִדְבָּרִי		LC	LC	To the best of our knowledge this species is Least Concern, has no known threats and/or is not in decline. We did not conduct a full assessment