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MANUAL

Jellyfish Swarm Forecast Citizen Science Meduzot Baam Training Manual

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Project Introduction

Project Mission

- Provision of a clear definition of Jellyfish Citizen Science
 - Understanding the nature of Citizen Science as a collaboration between individuals/local communities and the scientific community.
 - Citizen science is the practice of public participation and collaboration in scientific research to increase scientific knowledge. Through citizen science, people share and contribute to data monitoring and collection programs while becoming empowered and knowledgeable themselves.
 - Jellyfish sightings have been recorded by volunteer participants (citizens) along the Mediterranean coast of Israel between latitudes 31.53541 N and 33.094052 N since 30 June 2011 and continue up to the present day. Within Iliad we developed the forecast model, and contributed to data standardization and interoperability via OIM.
- Scientific background
 - Jellyfish blooms are a global natural phenomenon that is sometimes considered to be exacerbated by human activities. In the absence of frequent oceanographic surveys of gelatinous zooplankton in both coastal and offshore waters, our ability to follow the jellyfish swarm dynamics in situ is often highly limited. Reports by the public are essential to complement scientific knowledge
 - The data collected from citizen observations are immediately reflected as icons on a jellyfish risk map found on the project's website <https://www.meduzot.co.il/>. The species identified are represented by degree of density and stinging and the map is open for the public to utilize. An algorithm calculating jellyfish density as
- Relevance of project to the training audience
 - Meduzot Baam is a sort of Waze for jellyfish. Similar to the application that has become default for Israeli drivers, this platform also relies on user reports to help everyone select which route/bathing beach to visit. The disappointment associated with traveling to a beach only to discover that the sea is filled with stinging creatures can be avoided by utilizing this application.
 - Jellyfish blooms are a natural phenomenon that is considered to be exacerbated by human activities. As jellyfish swarms affect public health, by stinging events, limit an individual's recreational capacity to utilize their coastal environment, and impact bycatch of the fishing industry, it allows for a better understanding of marine ecology and the people it impacts.
 - The stinging effect of jellyfish may be caused by direct contact with the animal, or with their tentacles that sometimes detach from their bodies. This may cause

many bathers to avoid bathing in the sea. In fact, jellyfish are not found on all beach throughout the summer, they usually stay along the coast en masse for only one month (usually during July). The real-time reports on the location of the swarm, if one exists at all, can help bathers minimize encounters with jellyfish and maximize beach enjoyment.

Operational needs

- Project design
 - Meduzot Baam is designed to receive jellyfish (or absence) observations. This allows the species to be represented as close to real time as possible. Quantity of jellyfish helps to observe swarm seasons or anomalies.
 - To be able to understand jellyfish swarm dynamics, it is crucial to focus on the origin of the bloom and the connectivity of the populations in time and space, whether the individuals we observe in a swarm are from common local origins, have drifted from another region, or have accumulated in a specific region from multiple sources.
 - Meduzot Baam is a citizen science project in with researchers and citizens join forces to improve quality of life on Israel's beaches by reporting and monitoring the swarms of jellyfish on the beaches through a dedicated platform. The accumulated data is studied and analyzed by researchers to gain an understanding and knowledge about jellyfish species- mysterious marine animals whose influence on our quality of life is high.
 - Goals
 - Provide solutions in the form of a real-time forecast and warning about the approach of jellyfish swarms toward our shores
 - Quantification of the jellyfish in the swarm
 - Dissemination of information on avoiding jellyfish stings and how to treat them.
 -
 - Gold user reports are weighted more heavily, due to higher degree of observation accuracy.
 - Participants who have participated in in-person training activities
 - Educated in marine ecosystems and biology
 - Submitting observations for a significant length of time
- Description and practice of project protocols
 - Data collection processes for Meduzot Baam are relatively simple as it focuses on two types of data, jellyfish observations or absences
 - Jellyfish observations include the following information
 - Activity being performed during observation
 - If walking along the shore, the distance traveled
 - If jellyfish were or were not observed

- If observed, the species seen (single or multiple can be documented)
 - Reporting jellyfish absence is as useful as reporting their presence
 - Where the jellyfish was observed
 - If on the beach or distance from the shore
 - If a sting event occurred
- Geolocation
 - The location where the observations are reported are done by selecting a beach from a dropdown selection. Automatic GPS selection was disabled, due to a multitude of errors and caveats (e.g. reporting was done from home/elsewhere rather than the beach or Electronic warfare jamming GPS reception or displacing reports to other locations).
- Identification
 - Image references of the jellyfish provided on the observation reports to help the participant select the correct species viewed
- Data analysis
 - Marine biologists and ecologists that operate the program verify species reported (from images) and remove erroneous reports from the data set
- Introduction to the project platform
 - Communication/ Dissemination
 - Communication of results are provided back to the public and volunteer participants through the use of the jellyfish map and dissemination of results from observation reports are done through collaborations with media outlets
 - The Facebook page Meduzot Baam, allows organizers to relay information to volunteers who are active participants (those who report frequently), and reply to interesting species report/photos on the page
 - Data Management
 - Report data is stored securely (EXPAND)

Subject Background

Coast of Israel

The eastern basin of the Mediterranean, which extends along the coasts of Egypt, Israel and Lebanon is 1,363,000 km². Until the digging of the Suez Canal, it was completely dependent on the western basin for hydrological exchanges. The recent extension of the canal removed the former salinity barrier which existed between the Mediterranean Sea and the Red Sea. Currently, the Red Sea is now 10% saltier than the Mediterranean. The Suez Canal also

provides access for non-native species (such as jellyfish) to migrate into the Mediterranean ecosystem.

The subject area of interest is the Mediterranean coastline and coastal water of Israel, the length of which is 195 km, from Zikim in the south to Rosh HaNikra in the north. Jellyfish are typically perceived as a nuisance, negatively affecting human interests such as coastal leisure, tourism, fisheries, aquaculture, power, and desalination plants. They also play an important role in the ecosystem. For all these reasons, understanding jellyfish swarm dynamics and tracking their origins are important. *Rhopilema nomadica* is the largest, most venomous, and most prominent jellyfish species in the Eastern Mediterranean. It is generally a smooth coastline open to the west that gradually changes in orientation from northeast to almost north, with the exception of Haifa Bay, the Mount Carmel headland and a few small rocky promontories (e.g., Jaffa, Atlit, Akko). The Israeli coast can be divided into four sections: The Southern coast, the Central coast, the Carmel coast, and the Western Galilee coast.

Current Systems of the Eastern Mediterranean

The Libyo-Egyptian Current is a major vector spreading jellyfish from the North African coast toward Turkey, via Israel coastal waters. Anticyclonic eddies may develop along this route, to the west of the Israeli coast, impacting the along and cross-slope transport routes. South of Cyprus, an anticyclonic eddy is a fairly persistent feature that significantly impacts Levantine water transport. In addition, the surface currents outside the Israeli coastal zone include cyclonic and anticyclonic eddies associated with the Shikmona Gyre system. South-East of Cyprus, there is an eddy system that can be either cyclonic or anticyclonic. Offshore transport by eddies may thus help explain the large seasonal and interannual fluctuations and complex dynamics in *R. nomadica* swarming.

Jellyfish populations

Swarms of jellyfish on Israel's Mediterranean coast have been known for decades, during such a lengthy period, we should expect to understand these creatures well, and in turn, give gathers a fairly accurate jellyfish forecast and potential solutions to the problems. Currently, the understanding of their habits creates difficulty when attempting to predict how long they will stay on our shores, or the type of jellyfish that will be present. Our list of questions about jellyfish is much longer than our list of answers. In light of lack of knowledge, Meduzot Baam was created to help citizens, visitors or sea workers to gather information about the jellyfish along the coast of Israel/

Since its first observations in the Mediterranean in the 1970s, *R. nomadica* has spread through the Levant and beyond. In an eight year study conducted by the project organizers, they could detect no multiannual trend of increase or decrease in *R. nomadica* swarm along the Mediterranean coast of Israel. Early summer swarms of *R. nomadica* coincided with several

other schyphomedusa species, mainly, *Rhizostoma pulmo*, *Phyllorhiza punctata*, *Aurelia* sp., *Marivagia stellata*, and *Cotylorhiza* sp.

Meduzot Baam monitors observations of gelatinous species along the Israeli coast

- *Rhopilema nomadica*
- *Mnemiopsis leidyi*
- *Rhizostoma pulmo*
- *Phyllorhiza punctata*
- *Aurelia aurita*
- *Cotylorhiza tuberculata*
- *Pelagia noctiluca*
- *Beroe ovata*
- *Salp* spp
- *Cassiopea andromeda*
- *Cotylorhiza erythraea*
- *Marivagia stellata*
- *Cestus veneris*
- *Porpita porpita*
- *Chrysaora pseudoocellata*
- *Aquorea forskalea*
- *Hydromedusae*



Additional information on every species can be accessed at www.meduzot.co.il/species

Training Instructions

The aim of this training manual is to provide you, the participant, with all relevant information, ranging from correctly identifying the species of jellyfish observed to reporting the observation on our platform.

Step-by-Step of Data Collection

Monitoring Protocol

The materials necessary for jellyfish observation reports include a mobile or desktop device to report the sighting to the platform. If possible, taking a photo of the jellyfish observation (or lack thereof) can further benefit species validation.

Criteria to observe

- Presence or absence of jellyfish
- Distance of the animal(s) from shore
 - On the beach
 - In the water

- On the beach and in the water
- Species of jellyfish
 - References for identification are available on the platform
- Quantity of specimen
 - Ranked abundance in one given area of water or the total amount from walking distance
- Diameter in centimeters
 - A general approximation, if an item nearby can be used for scale (such as a banana) that can be included in the report photo
- Distance from the beach
 - For bathers or swimmers who observe jellyfish while in the water
- Sting event
 - Take note if you were stung, the severity of the sting and duration of irritation

Platform organization and report submission

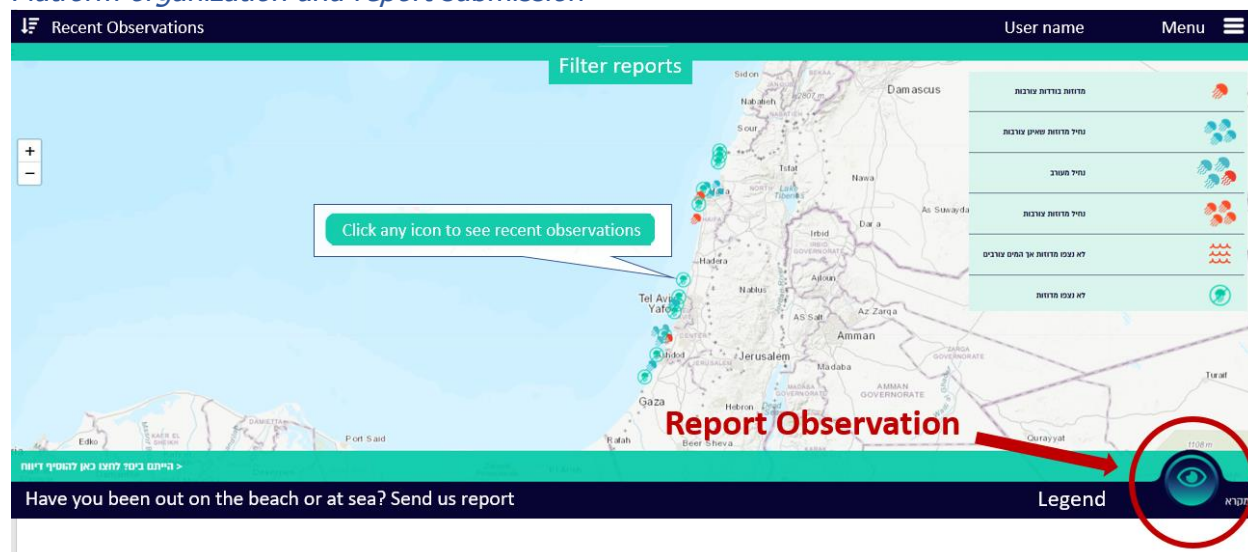


Figure 1 Homepage: Real-time Map, Menu, Recent observations and submit report button

The Meduzot Baam platform (both web and smartphone application) opens to the page displayed in Figure 1. From this location the user can utilize the real time jellyfish map. Visitors can use various menu options, search through recent observations and the "submit report button."

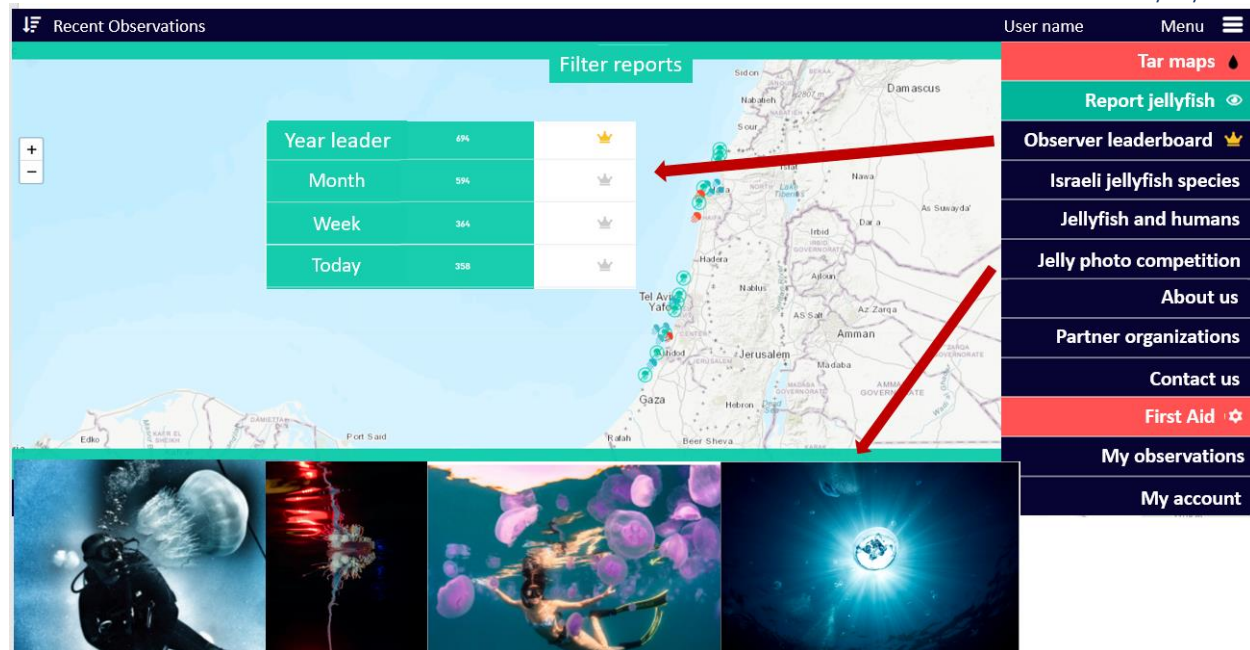
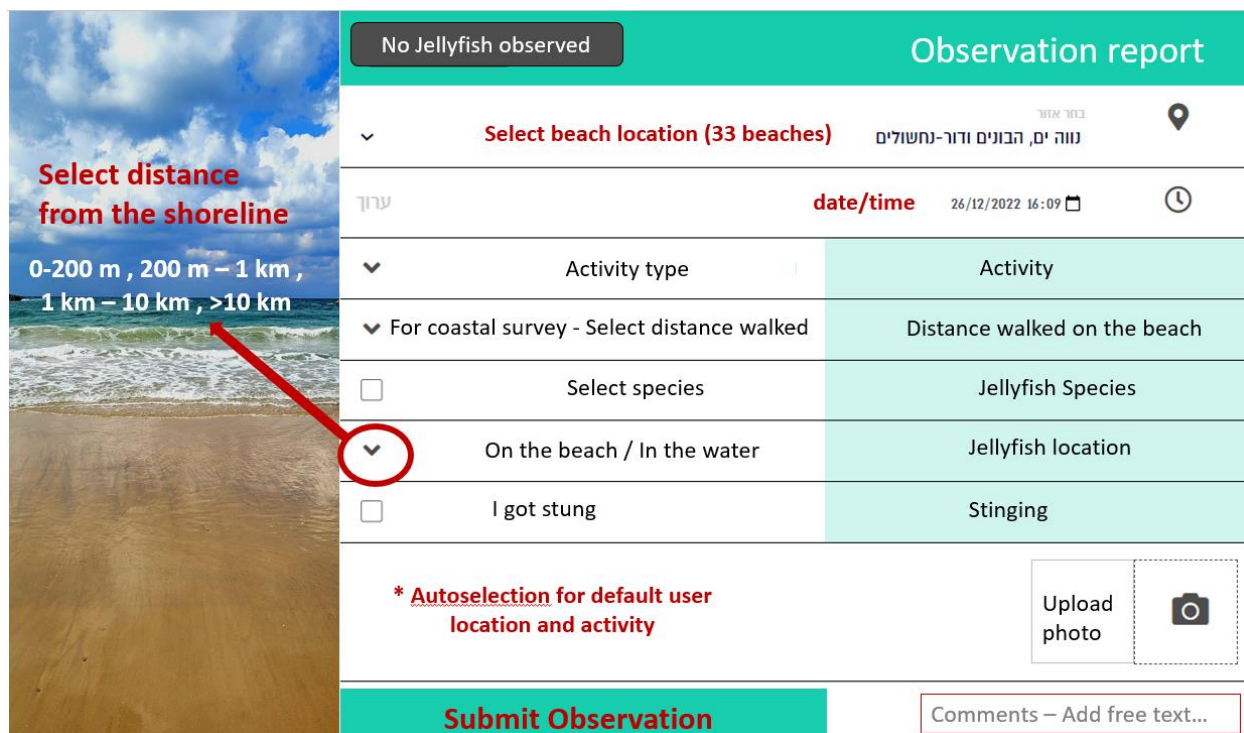


Figure 2- Menu selection page

1. Menu selection options
 - a. Tar maps
 - i. Reports of oil tar buildup along coastline from Mediterranean oil spills
 - b. Report Jellyfish
 - i. Jellyfish observation reporting page
 - c. Observer leaderboard
 - i. Leaderboard of volunteer participants who have reported the most observations on the site
 - ii. Israeli jellyfish species
 1. Information on the animals
 - a. Common and Latin name
 - b. Stinging level
 - c. Physical characteristics
 - d. Origin of species and its presence in the Mediterranean
 - d. Jellyfish photo contest
 - i. Winners and images from the 2020 jellyfish photo contest
 - e. About Us
 - i. Aim and mission statements

- ii. Project organizer biographies
- iii. Israeli Society for Ecology and Environmental Sciences vision
- f. Partner Organizations
- g. Contact information
 - i. Contact inquiry form and link to project Facebook Page



Observation report

No Jellyfish observed

Select distance from the shoreline
0-200 m , 200 m – 1 km , 1 km – 10 km , >10 km

Select beach location (33 beaches)

date/time 26/12/2022 16:09

Activity type	Activity
For coastal survey - Select distance walked	Distance walked on the beach
Select species	Jellyfish Species
On the beach / In the water	Jellyfish location
I got stung	Stinging

* Autoselection for default user location and activity

Upload photo

Submit Observation

Comments – Add free text...

Figure 3- Observation Report Page

On the platform reporting page there are several characteristics asked for to obtain precise and scientifically accurate data.

2. Location
 - a. A dropdown selection contains 33 different beach locations where the observation was conducted.
3. Date/Time
 - a. Auto-selection is enabled for time and date. This criteria is important for gathering seasonality patterns and understanding the depth in the water column the animals are located at throughout the day.
4. Coastal survey

- a. This criteria is for the distance a participant traveled along the beach and the quantity of jellyfish observed along that distance, either submerged or out of the water.
 - i. Having both the distance traveled in addition to total quantity of jellyfish spotted, it allows us to better understand the spatial range of the bloom.

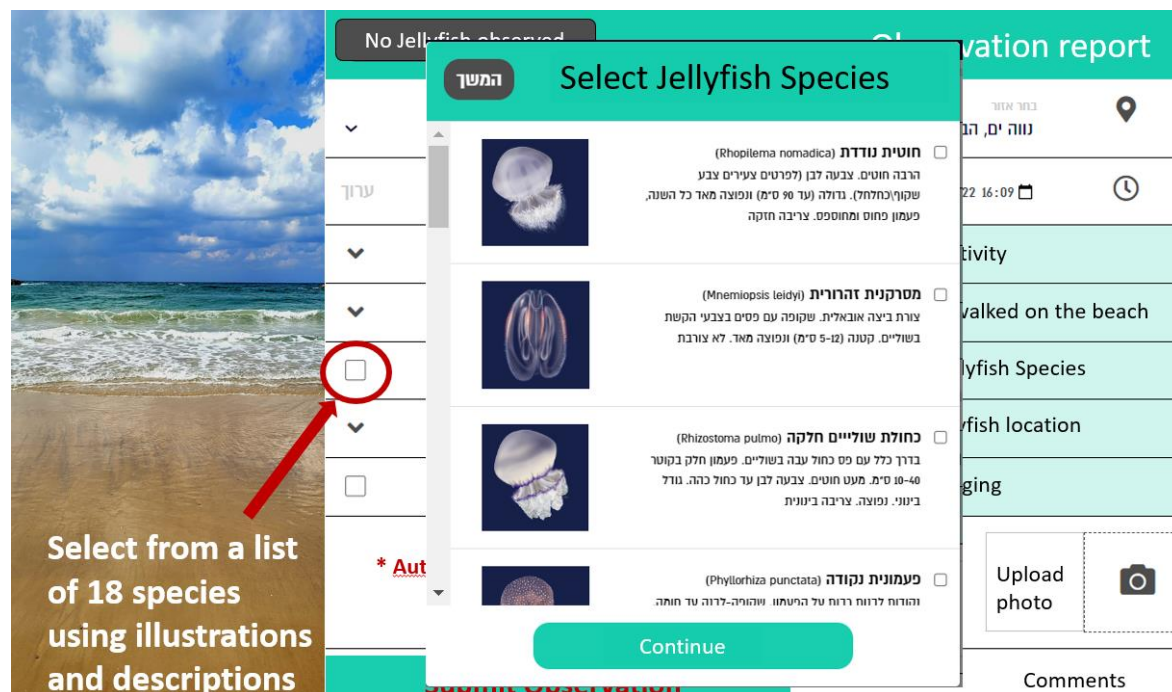


Figure 4- Species reporting window

5. Selecting jellyfish species (Figure 3)
 - a. "Select Species"
 - b. Users can select singular or multiple species that were observed during their time at sea. Photo references are shown next to the species information to assist the user in selecting the correct specimen.
6. Jellyfish location
 - a. If observed specimen was in the water or along the beach
7. Upload photo
 - a. Photo of the present of jellyfish observed
 - i. This information can assist researchers in identifying new species and the presence of non-native species
8. Comments
 - a. Additional comments for the report