

Jelly

SYSTEMS AND TOOLS FOR LOCATING  
BLOOM OF JELLYFISH AND PREDICTING  
THEIR DISPLACEMENT TOWARDS  
THE COAST



# Jellyfish Citizen Science spotting efforts in Malta: the Spot the Jellyfish campaign experience

Prof. Alan Deidun  
University of Malta

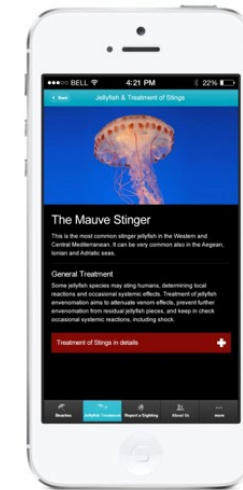


# How do you reach out to potential citizen scientists?



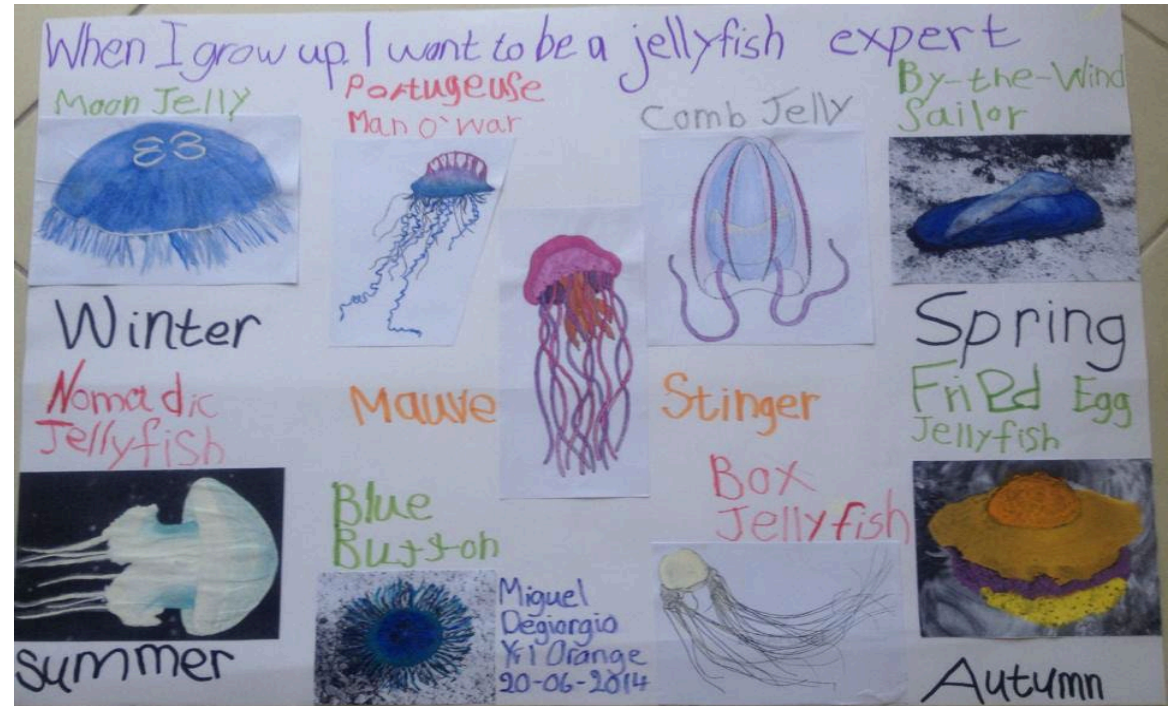
**Spot the Alien**  
@aliensm

Seaside Boards  
Social Media  
Smart Phone Apps  
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# Citizen science – Spot the Jellyfish



International recognition of Spot the Jellyfish as a citizen science initiative:

(see reports at

[http://www.science20.com/citizen\\_science\\_journal/jelly\\_fish\\_reporting\\_citizen\\_scientists\\_malta](http://www.science20.com/citizen_science_journal/jelly_fish_reporting_citizen_scientists_malta) and at

<http://www.scienceforcitizens.net/blog/2010/08/spot-the-jellyfish-here-or-in-malta/>).

# Citizen science – Spot the Jellyfish



Continuous interactive activities with schoolchildren of different ages and at different venues



# The ocean literacy impact of citizen science



**Ocean literacy** is an understanding of the **ocean's** influence on you—and your influence on the **ocean**. There are seven Essential Principles of **Ocean Literacy** comprising 45 Fundamental Concepts.



The Ocean We Need  
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One Planet, One Ocean

LATEST



"We all stand to gain from changing the status qu... about 14 hours ago

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# The Spot the Jellyfish campaign turns 10!

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In [Projects](#) 13:13, 28 Jan 2020

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The **Spot the Jellyfish** citizen science campaign, initiated by [Prof. Aldo Drago](#) as a joint initiative between the Physical Oceanography Research Group within the [Department of Geosciences](#) and the [International Ocean Institute \(IOI\)](#), celebrates its 10th anniversary next June. The campaign,

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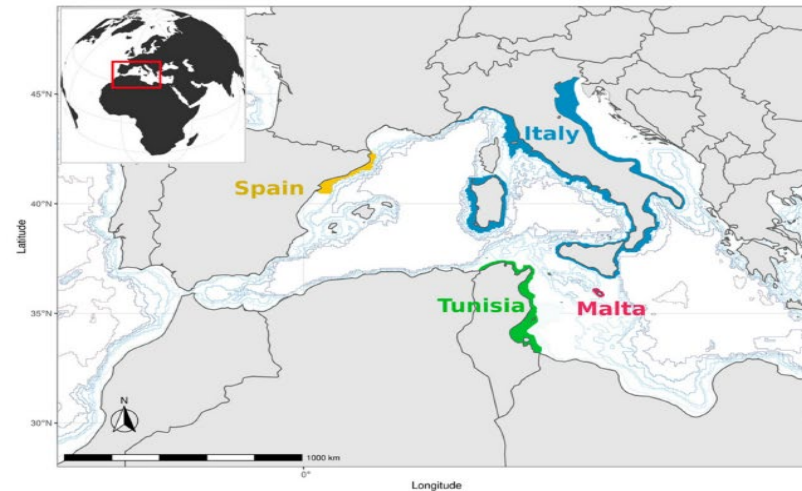
## Categories



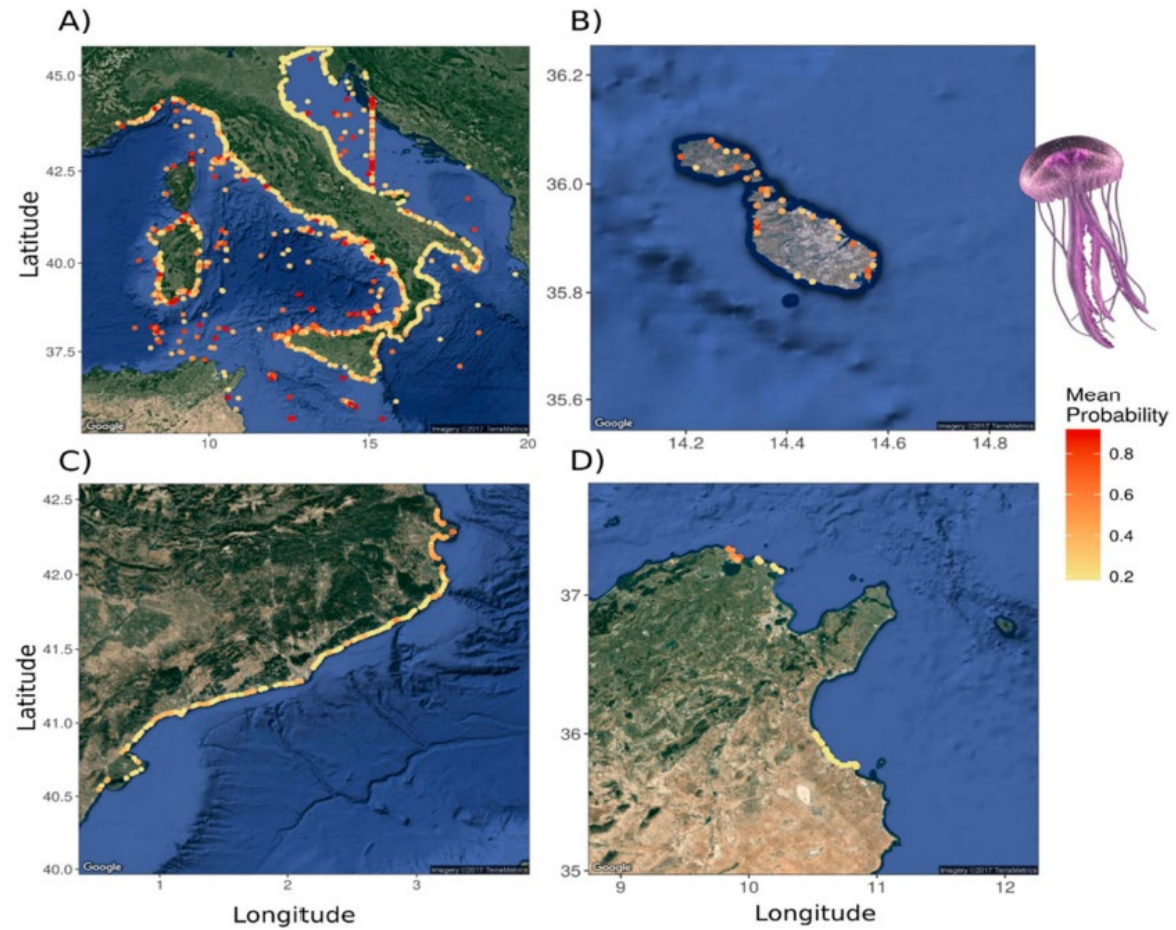
Article

# Unfolding Jellyfish Bloom Dynamics along the Mediterranean Basin by Transnational Citizen Science Initiatives

Macarena Marambio <sup>1</sup>, Antonio Canepa <sup>2</sup> , Laura Lòpez <sup>1</sup>, Aldo Adam Gauci <sup>3</sup>, Sonia K. M. Gueroun <sup>4,5</sup>, Serena Zampardi <sup>6</sup>, Ferdinando Boero <sup>6,7,8,9</sup>, Ons Kéfi-Daly Yahia <sup>10</sup>, Mohamed Nejib Daly Yahia <sup>11,\*</sup>, Verónica Fuentes <sup>1,\*</sup>, Stefano Piraino <sup>8,12,\*</sup>  and Alan Deidun <sup>3,\*</sup>



**Figure 1.** Map with the four countries involved in the study: Italy, Malta, Spain, and Tunisia, where the citizen science jellyfish data was gathered.



**Figure 13.** Ensemble modeling of the potential spatial distribution of *Pelagia noctiluca* blooms in (A) Italy (\* see Section 2.1—Materials and Methods), (B) Malta, (C) Spain, and (D) Tunisia.



# The scientific impact of citizen science

## campaigns

Journal of Coastal Research	SI	85	316-320	Coconut Creek, Florida	2018
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### Is citizen science a valid tool to monitor the occurrence of jellyfish? The Spot the Jellyfish case study from the Maltese Islands

Marija Pia Gatt<sup>†</sup>, Alan Deidun<sup>\*†</sup>, Anthony Galea<sup>†</sup> and Adam Gauci<sup>†</sup>

<sup>†</sup>Department of Geosciences,  
Faculty of Science, University of Malta, Msida, Malta.



www.cerf-jcr.org

### Putting multi-annual citizen science data to good use!

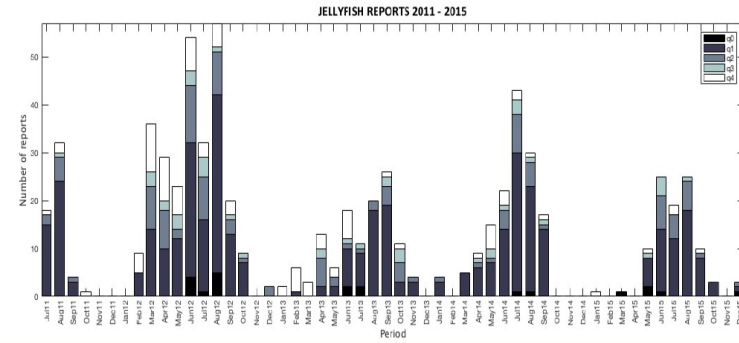


Figure 2. The number of monthly jellyfish reports received for the July 2011 – December 2015 period. The legend represents the 5 abundance classes of jellyfish sighted, where Q0 (black) represents 0 jellyfish reports, Q1 represents 1-5 jellyfish reports, Q2 6-20 jellyfish reports, Q3 21-50 jellyfish reports and Q4 (white) >50 jellyfish reports.

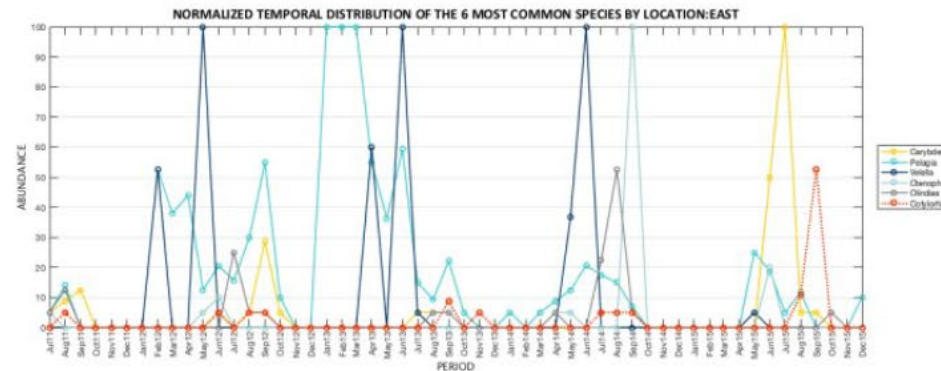


Figure 3. The normalized temporal distribution of the six most common species reported along the eastern flank of the island of Malta.

# The Age of Discovery has never ended!



Upside-down jellyfish - alien



Nomadic jellyfish - alien



Australian spotted jellyfish - alien



Compass  
jellyfish -  
indigenou  
s

Blue button –  
indigenous





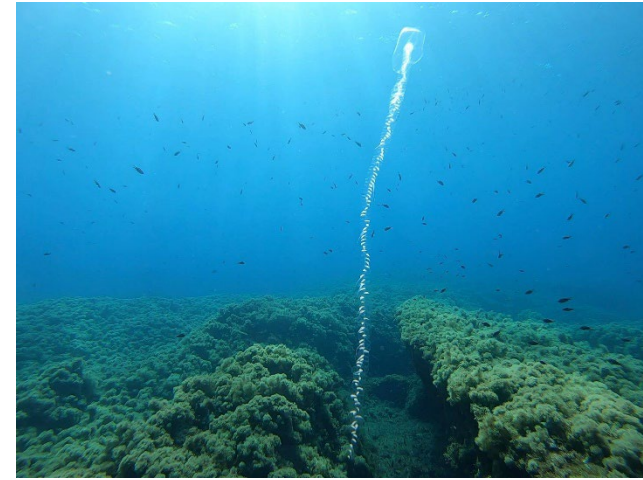
# The Age of Discovery has never ended!



Barbed-wire jellyfish

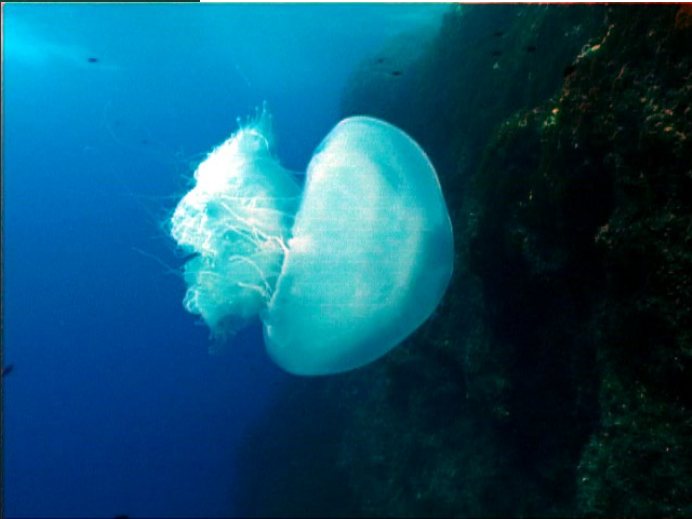
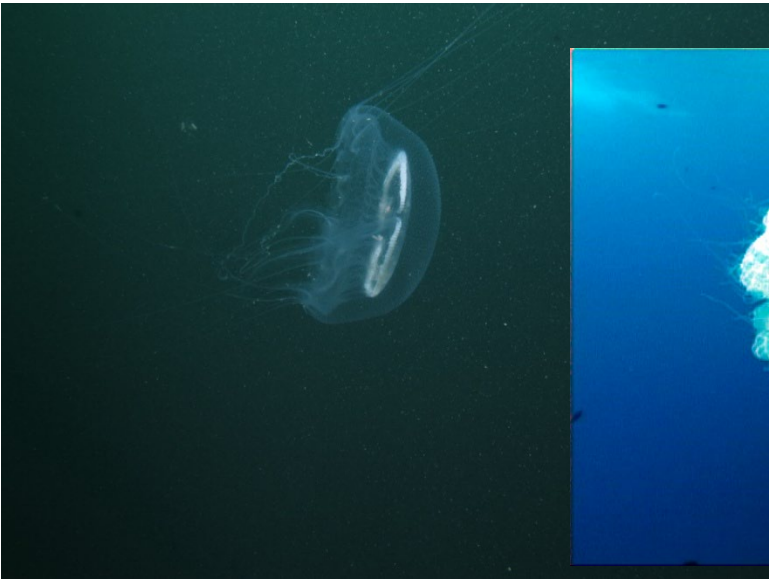


Hula skirt siphonophore



*Praya dubia*

## Siphonophore bonanza







03/03/2015

PERSEUS International Jellyfish Workshop  
Spain

Cadiz,





*Verella verella* massive bloom  
April/May 2014



# Spot the Jellyfish citizen science campaign featured in The Guardian

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In Projects 12:38, 05 Jul 2021

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UM collaborates with Maltese company which will fund more efficient PV



OCEAN

# 'Every second breath you take comes from the ocean,' says expert

In partnership with **The European Commission**





# The evolution of seaside boards

Spot the Jellyfish – kicked off in June 2010 – recognised as an example of citizen science good practice!

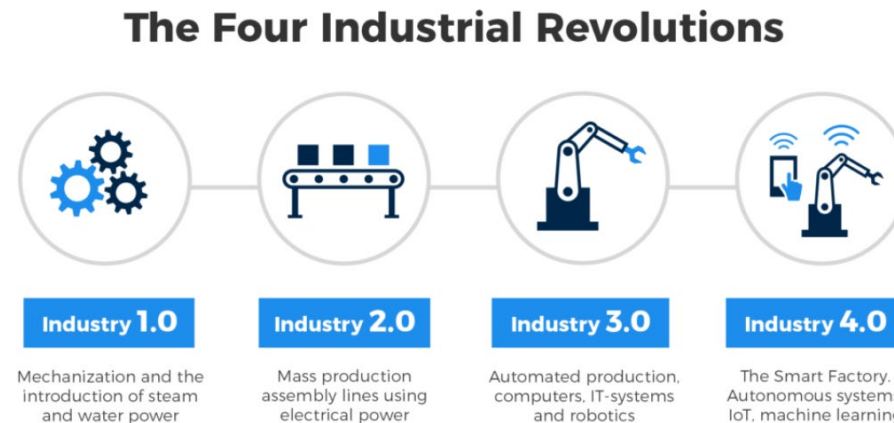


<2010



# The albatross around the neck of each CCC – VALIDATION! AI to the rescue!

- **Industry 4.0** is the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things and cloud computing. **Industry 4.0** creates what has been called a “smart factory”.
- Such protocols are increasingly being applied to the marine domain, promoting Blue Growth in the process





# AI to the rescue!

Article

## Automating Jellyfish Species Recognition through Faster Region-Based Convolution Neural Networks

Adam Gauci <sup>1,\*</sup>, Alan Deidun <sup>1</sup> and John Abela <sup>2</sup>

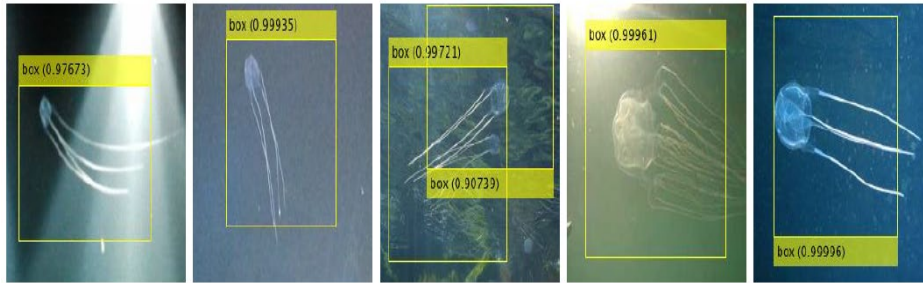


Figure 4. Output by classification model 5 for *Carybdea marsupialis* (box jellyfish).



Figure 5. Output by classification model 5 for *Cotylorhiza tuberculata* (friedegg jellyfish).

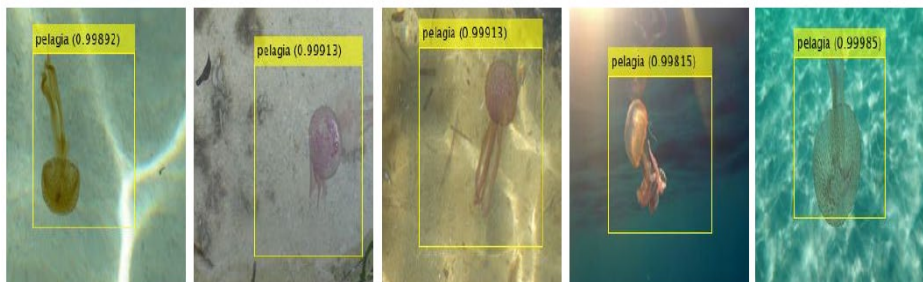


Table 4. Precision, recall,  $f_1$  score and  $\kappa$  metrics for predictions by the five classification models.

Model	Species	Precision	Recall	$f_1$ Score	$\kappa$
1	<i>Carybdea marsupialis</i>	0.92	0.90	0.91	0.92
	<i>Cotylorhiza tuberculata</i>	1.00	0.95	0.97	
	<i>Pelagia noctiluca</i>	0.90	0.87	0.88	
	Salps	0.91	0.98	0.94	
	<i>Veleva veleva</i>	1.00	0.98	0.99	
2	<i>Carybdea marsupialis</i>	0.97	0.93	0.95	0.95
	<i>Cotylorhiza tuberculata</i>	1.00	0.95	0.97	
	<i>Pelagia noctiluca</i>	0.92	0.90	0.91	
	Salps	0.93	1.00	0.96	
	<i>Veleva veleva</i>	0.98	1.00	0.99	
3	<i>Carybdea marsupialis</i>	0.98	1.00	0.99	0.96
	<i>Cotylorhiza tuberculata</i>	0.95	0.98	0.96	
	<i>Pelagia noctiluca</i>	0.91	0.98	0.94	
	Salps	1.00	0.98	0.99	
	<i>Veleva veleva</i>	1.00	0.90	0.95	
4	<i>Carybdea marsupialis</i>	0.95	0.95	0.95	0.92
	<i>Cotylorhiza tuberculata</i>	1.00	0.85	0.92	
	<i>Pelagia noctiluca</i>	0.81	0.88	0.84	
	Salps	0.93	0.98	0.95	
	<i>Veleva veleva</i>	0.98	1.00	0.99	
5	<i>Carybdea marsupialis</i>	0.98	1.00	0.99	0.99
	<i>Cotylorhiza tuberculata</i>	1.00	1.00	1.00	
	<i>Pelagia noctiluca</i>	1.00	0.98	0.99	
	Salps	1.00	1.00	1.00	
	<i>Veleva veleva</i>	1.00	1.00	1.00	



**ENPI  
CBCMED**  
CROSS-BORDER COOPERATION  
IN THE MEDITERRANEAN



Project  
funded by the  
**EUROPEAN UNION**



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## INVOLVING STAKEHOLDERS

An essential feature of the MED-Jellyrisk project is the involvement of Mediterranean Sea stakeholders, including beach visitors, local authorities offices, beach resort centers, diving centers, fishery local associations, and Marine Protected Areas, who are likely benefit from, use or be affected by the findings of the project.

# MED-JELLYRISK

INTEGRATED MONITORING  
OF JELLYFISH OUTBREAKS  
UNDER ANTHROPOGENIC AND  
CLIMATIC IMPACTS IN THE  
MEDITERRANEAN SEA  
(Coastal Zones):

Trophic and Socio-economic Risks

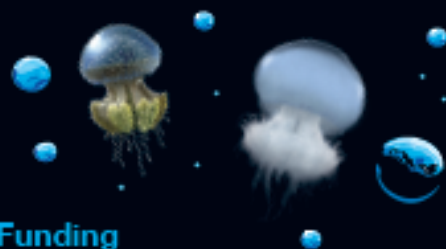


[www.jellyrisk.eu](http://www.jellyrisk.eu)



## Why MED-Jellyrisk is needed

Human problems with jellyfish have increased in the Mediterranean Sea causing economic losses to tourism and fisheries. Human pressures on coastal areas continue to expand from many sources (eutrophication, habitat modification, over-exploitation of living resources, shipping and climate change) and may have caused jellyfish increases. Jellyfish outbreaks represent a growing threat for humans and coastal activities. MED-Jellyrisk is the first OBO MED (Cross-Border Cooperation in the Mediterranean) project assessment of the socio-economic impacts of jellyfish blooms and the implementation of mitigation countermeasures.



## Funding

MED-Jellyrisk is a European Strategic Project supported by the ENPI-OBO MED Cooperation Programme. It has received € 2.33 million funding from the EC. The total cost of the project is € 2.6 million.

## Work Plan and Objectives

MED-Jellyrisk aims at trans-border cooperation in the Mediterranean basin against jellyfish impacts in 10 Marine Coastal Zones through common strategic work plans, education programmes, and funding schemes for all the partners and countries involved.

### The Work Plan

- Promotion of public awareness, citizen science (JellyWatch), and outreach initiatives to increase understanding of the risks of jellyfish impacts
- Training and data collection by the public and public service professionals
- Knowledge transfer and capitalization through tutoring of concerned stakeholders of the Marine Coastal Zones
- Building capacities to apply integrated monitoring protocols, including the creation of Local Emergency Task Forces, and formation of a Mediterranean Jellyfish Society
- Risk Assessment, socio-economic and epidemiological evaluation of jellyfish hazards and prevention plans



- Risk Mapping by predictive management tools and strategies. Development and application of probabilistic models of jellyfish blooms

- Development, Implementation, and assessment of mitigation countermeasures, including installation and evaluation of protective anti-medusa nets



## Expected Impacts

MED-Jellyrisk will contribute to

- Integrated Coastal Zone Management
- The socio-economic development and enhancement of territories, focusing on innovation and research, by strengthening synergies and strategies of territorial planning among the Mediterranean Countries
- The implementation of risk assessment, prevention and mitigation of negative impacts resulting from jellyfish proliferation
- The increase of public awareness

**Socio-  
economic  
survey in  
Malta,  
Tunisia, Italy  
and Spain**



# Ocean literacy and advocacy



UNIVERSITY OF MALTA  
L-Università ta' Malta

... dealing with  
jellyfish blooms & their impacts

<http://jellyrisk.eu>



This Project is co-financed by the European Union  
under the ENP CBC Mediterranean Sea Basin Programme  
Co-financing from ENP CBC contribution: 100% Project co-financing

MARINE LITERACY AND ADVOCACY FOR MASS DISSEMINATION

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Publication of informative and educational material for mass dissemination



# Ocean literacy and advocacy



MED-JELLYRISK  
JELLYFISH ENVENOMATION  
FIRST AID HANDOUT



Recommendations on treatment  
of Mediterranean jellyfish envenomations

## Generalities

Some jellyfish species may sting humans, determining local reactions and occasional systemic effects. Treatment of jellyfish envenomation aims to attenuate venom effects, prevent further envenomation from residual jellyfish pieces, and keep in check occasional systemic reactions, including shock.

Depending on the jellyfish species, there is evidence and consensus on oral/topical analgesics, hot water and ice packs as effective painkillers. For a few species (see below), a short application of domestic vinegar may prevent further discharge of unfired jellyfish stinging cells left on the skin.

Most treatment approaches are presently founded on relatively weak evidence and further research is strongly recommended. Dissemination of appropriate treatment modalities is deployed in the framework of MED-JELLYRISK to better inform and educate those at risk. Adequate signage will be placed at beaches to notify beach goers of the jellyfish risk.

**WARNING:** seek immediate medical attention if shock or breathing difficulties occur.



This Project is co-financed by the European Union under the ENPI CBC Mediterranean Sea Basin Programme. Co-financing from 2014 to 2020 under the EU Regional Development Programme.

info@jellyrisk.eu  
www.jellyrisk.eu



## MED-JELLYRISK FACTSHEET

...providing answers to the many questions about jellyfish  
Authors: Stefano Piraino, Jennifer Purcell, Alan Deidun



**QUESTION: Since when have jellyfish been around?**  
**ANSWER:** Jellyfish are among the oldest creatures on Earth oceans, and they have been around for at least 650 million years. This means they appeared about 400 million years before the dinosaurs did!

**QUESTION: How many different species of jellyfish exist world-wide?**  
**ANSWER:** There are about 1000-1500 known species (or types) of jellyfish in oceans worldwide.

**QUESTION: What is the composition of a jellyfish?**  
**ANSWER:** Jellyfish, as their popular name implies, are mainly (90-95%) water in composition, with salts and proteins accounting for just 3-6% and 2-6% of their body mass, respectively.

**QUESTION: How long do jellyfish live?**  
**ANSWER:** Most species of jellyfish live for a maximum of a number of months to a few (2-3) years, but some are known to possess a wide potential for regeneration and rejuvenation, supporting a much longer life span as different life stages (resting cysts, polyps).

**QUESTION: Which are the largest jellyfish species in the world?**  
**ANSWER:** Among the largest species of jellyfish, the Lion's mane (*Cyanea capitata*) can reach a diameter of ~2 meters (~7 feet), with tentacles extending ~15 meters (50 feet); the Nomura's Jellyfish (*Nomophila nomura*) can grow up to ~2 m in diameter and weigh over 250 Kg (450 pounds), ranking as one of the heaviest invertebrate species worldwide.

**QUESTION: Do jellyfish have a role to play in marine ecosystems?**  
**ANSWER:** Jellyfish are top predators in the oceans. They prey on planktonic organisms like crustaceans, copepods, and fish larvae and eggs. Thus, jellyfish are both predators of fish and their competitors for food.

**QUESTION: Why and how do jellyfish sting?**  
**ANSWER:** Jellyfish use stinging cells (cnidocytes) to capture prey and discourage predators. Stinging cells fire a spiny filament and inject venom into prey or predator tissues. A bathers mistake as a potential prey or predator, so stinging cells eventually discharge their venom into the bathers skin. Some jellyfish have minor effects on human skin, but a few others may inflict painful stings or are even lethal (e.g., the Australian sea wasp, *Chironex fleckeri*) to humans.

**QUESTION: Can you treat all jellyfish stings in the same way?**  
**ANSWER:** No, there are different venom categories. Some are disarmed by heat, some are not. Stings of some species may require the application of cooling packs to affected body parts to reduce local effects of envenomation (pain, dermatitis, erythema).

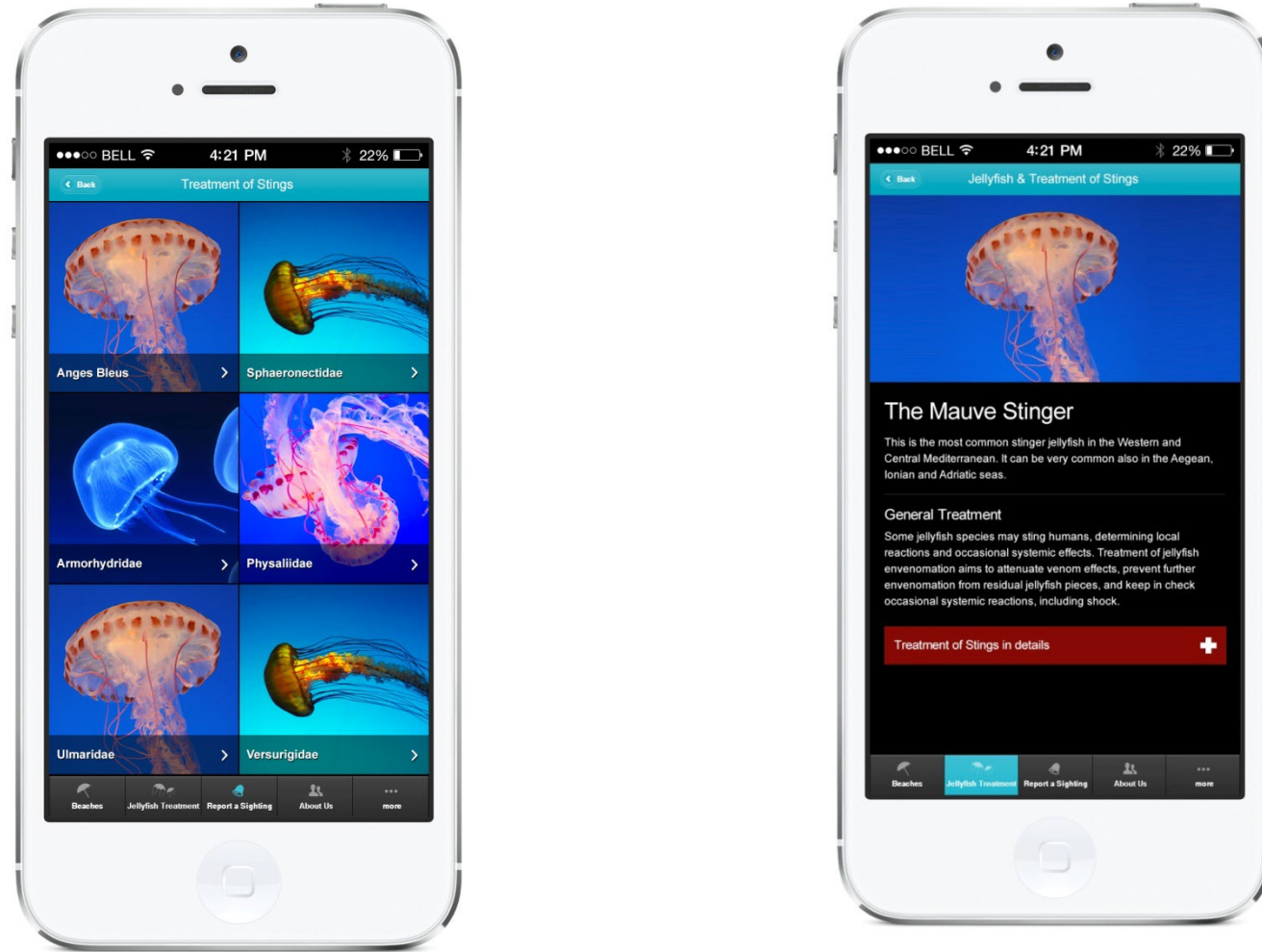
**QUESTION: Do any marine species consume jellyfish?**  
**ANSWER:** Jellyfish are a resource for many marine species: some pelagic molluscs (e.g., the blue argoï – *Glaucus atlanticum*) feeds on *Velella velella* fish, sea turtles, and sea birds feed on jellyfish. Juvenile fish can seek refuge from predators, using jellyfish tentacles as a shield, such as the juveniles of mackerel which use the tentacles of the lined egg jellyfish (*Cotyphocheilus tuberculatus*).

**QUESTION: What is a jellyfish bloom?**  
**ANSWER:** Jellyfish populations may exhibit sudden outbreaks, resulting in huge numbers of individuals within restricted areas. These are usually referred to as blooms. Although different jellyfish species might bloom at the same time, blooms normally consist of a single jellyfish species.



Publication of informative and educational material for mass dissemination

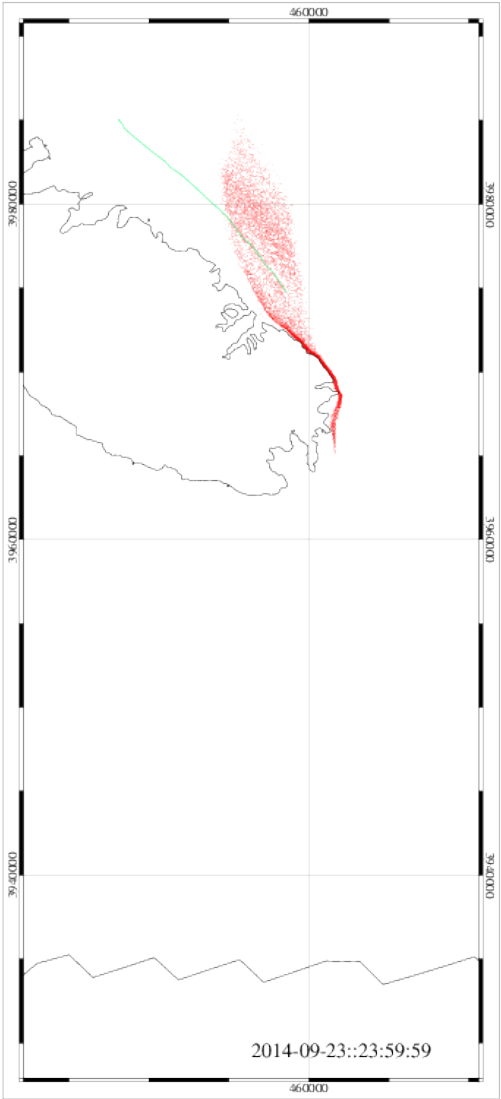
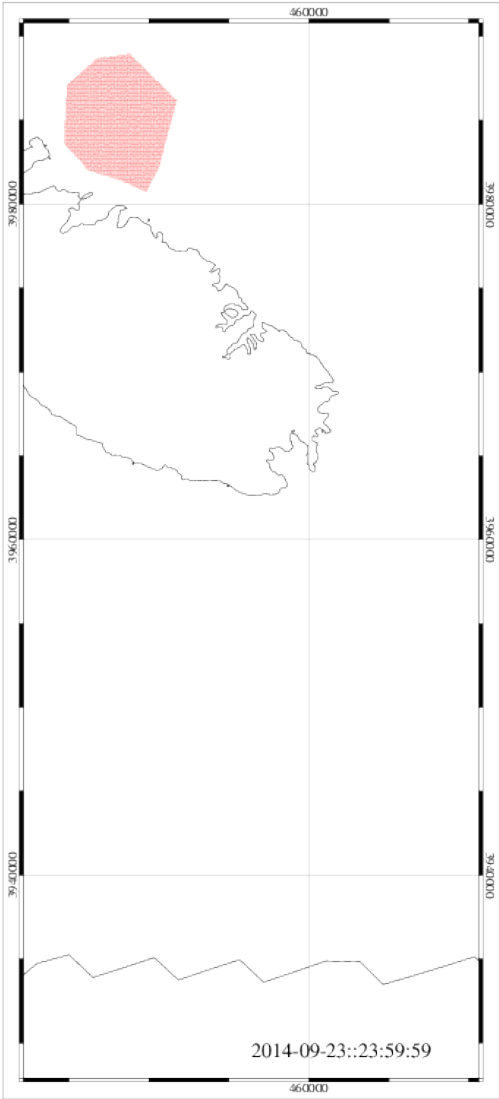
# SMART PHONE APP



Ocean literacy through unconventional means – smart phone apps – **MED-JELLY**

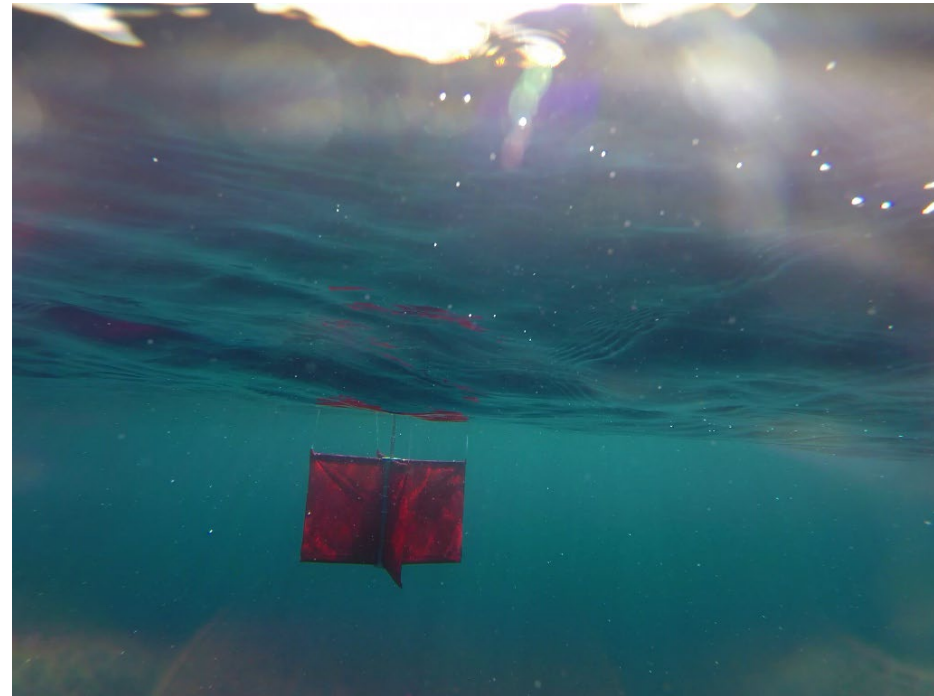
Available for both Android and iPhone platforms – almost 2000  
downloads to date

# JELLYFISH DISPERSION MODEL





# Validation of the model



03/03/2015

PERSEUS International Jellyfish Workshop  
Spain

Cadiz,

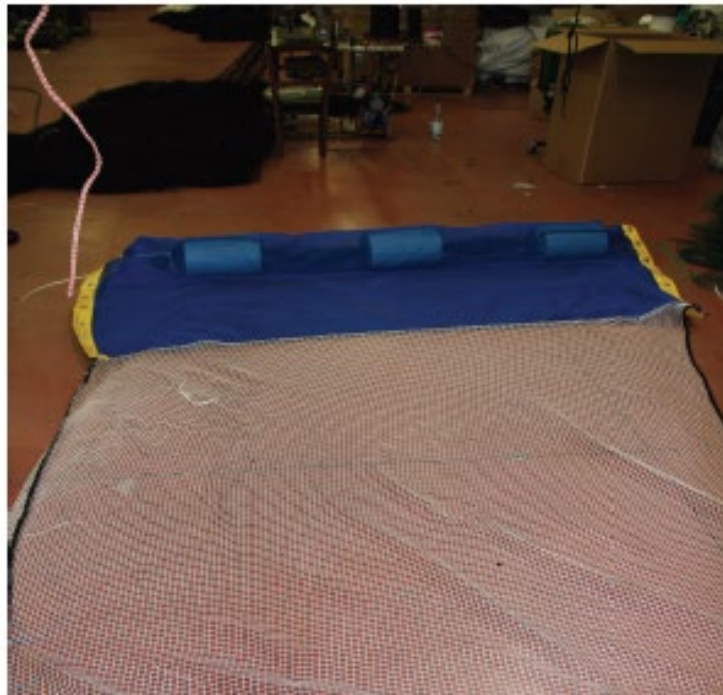
**Coastal drifters**



Fig.

Fig.1. A) Parte emersa della rete antimедуsa. B) Visibilità della parte sommersa della rete antimедуsa.

**Anti-  
jellyfish  
nets**





# Anti-jellyfish nets

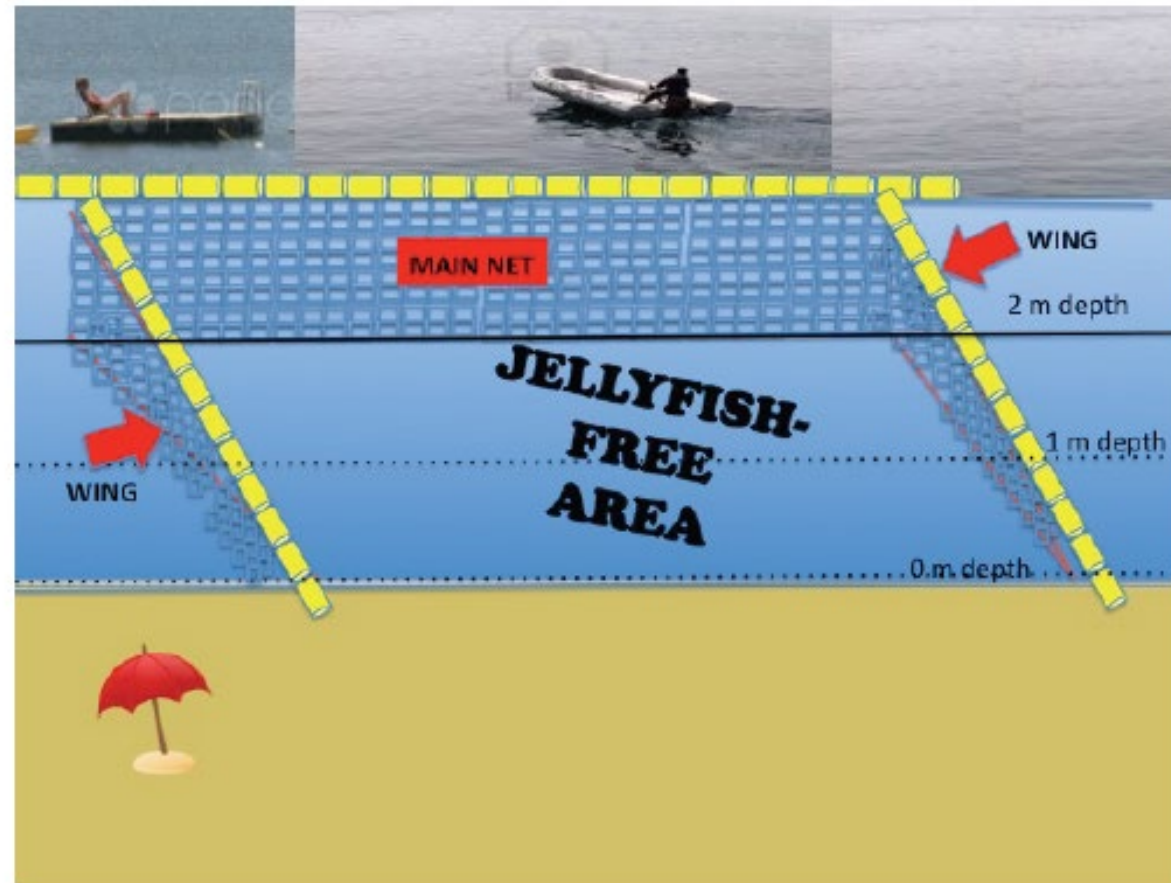






Fig.

Fig.1. A) Parte emersa della rete antimedusa. B) Visibilità della parte sommersa della rete antimedusa.

## Anti-jellyfish nets



# Deployment of anti-jellyfish net



Figure 9 – deployed MED-JELLYRISK anti-jellyfish net at Pretty Bay (summer 2015)

DANKSCHEEN  
TASHAKKUR ATU  
GRACIAS  
ARIGATO  
SHUKURIA  
JUSPAXAR  
KOMAPSUNIDA  
MAAKE  
GRAZIE  
MEHRBANI  
PALDIES  
BOLZİN  
MERCİ  
TINGKI  
BIYAN  
SHUKRIA  
YAQHANYELAY  
SUKSAMA  
EKHMET  
GOZAIMASHITA  
EFCHARISTO  
TASHAKKUR ATU  
SUKSAMA  
EKHMET  
GOZAIMASHITA  
EFCHARISTO  
YAQHANYELAY  
SUKSAMA  
EKHMET  
GOZAIMASHITA  
EFCHARISTO

# THANK YOU

