L-Università ta' Malta

The potential of citizen science

Prof. Alan Deidun

Open Science: The Future of Scholarly Communication
Wednesday 24 February 2021
Online Seminar

organised by the University of Malta Library and OpenAIRE

Contents

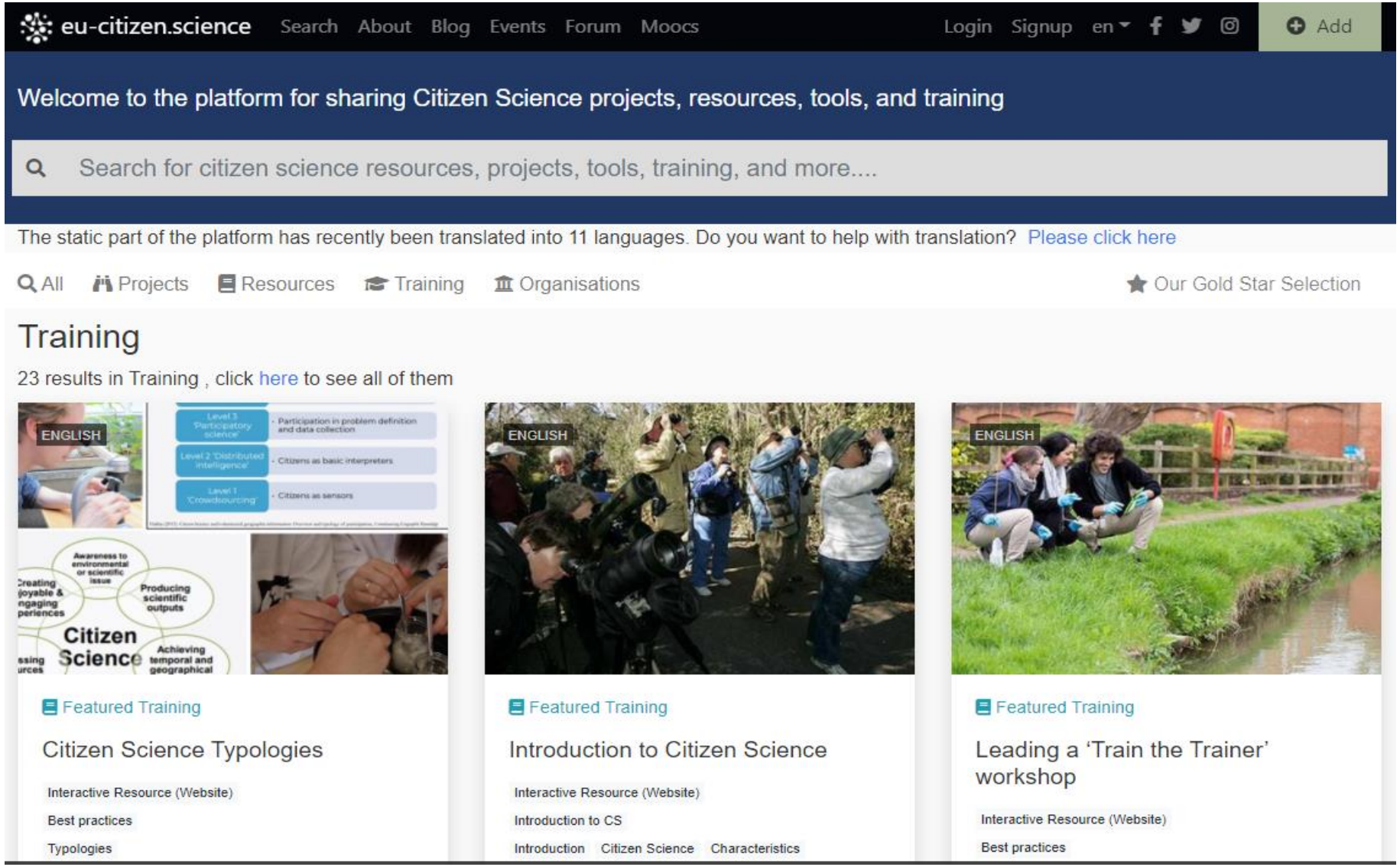
- What is citizen science?
- Citizen science has come of age…..
- A few applications of citizen science….
- How do you excite potential citizen scientists?
- The validation challenge
- The local citizen science experience

Citizen science defined…..

Citizen science *"covers a range of different levels of participation: from raising public knowledge about science, encouraging citizens to participate in the scientific process by observing, gathering and processing data, right up to setting scientific agenda and co-designing and implementing science-related policies".*

- Citizen science may be performed by individuals, teams, or networks of volunteers. Citizen scientists often partner with professional scientists to achieve common goals.
- Large volunteer networks often allow scientists to accomplish tasks that would be too expensive or time-consuming to accomplish through other means.
- Many citizen-science projects serve education and outreach goals.
- These projects may be designed for a formal classroom environment or an informal education environment such as museums.

Citizen science has come of age (finally)!



Citizen science has come of age (finally)!

European Commission

EN English

EU Funding Programmes promoting the development of citizen science programmes around Europe……

Home › H2020-SWAFS-2019 CITIZEN SCIENCE

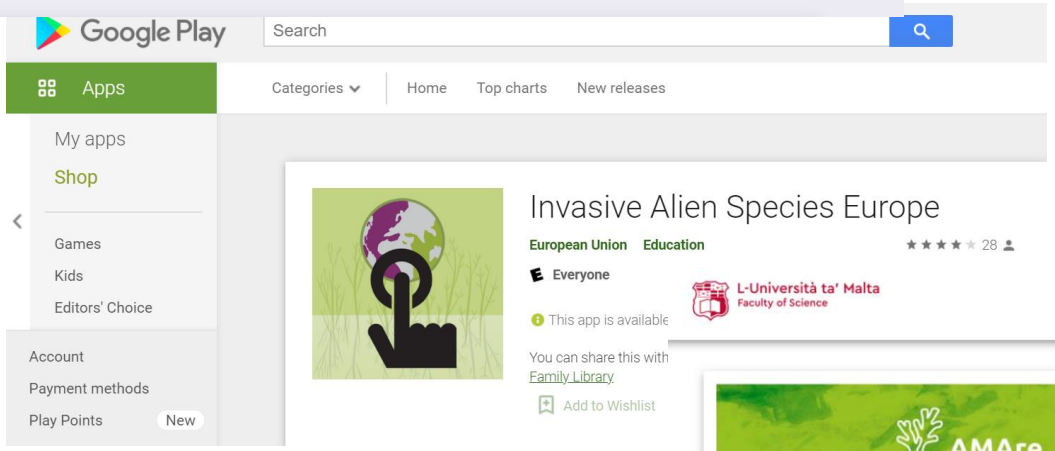
H2020-SWAFS-2019 CITIZEN SCIENCE

Our aim is therefore that **every European citizen becomes a citizen of our ocean and waters**. This, in itself, is an objective of the Mission: engaging, inspiring and motivating citizens to fully apprehend our ocean and waters as a common good. In other words, creating a community of citizens who value the ocean and waters as a common good and a natural capital to preserve, who want to engage in the Mission's goals to know, restore and protect the ocean and waters, as well as to enjoy them with sobriety and care for them collectively.

All channels should be used: education of all generations, citizen voluntary engagement such as beach clean-up initiatives, citizen science, and ocean-literacy initiatives for the public at large. This will be embodied in a European regeneration voluntary corps, a pan-European ocean literacy coalition of civil society organisations, schools, museums, aquaria, cultural centres and events, a pan-European "blue education" programme and a pan-European strategy for marine science.

The scale of citizen science campaigns…..

From the global scale….



To the regional/European scale….

To the local/national scale…..

Potential applications of citizen science campaigns

- Acquisition of observations of disparate phenomena possible (e.g. jellyfish blooms, arrival of alien species, passage of migratory species, presence of microplastics on beaches, etc)
- Collection of long-term monitoring data
- Means of informal education
- Means of fostering greater awareness about particular thematics
- Means for the general public to influence policy-making
- Overall, one of the key tools for **evidence-based policy-making!**

The scientific impact of citizen science campaigns

Examples of most recent peer-reviewed publications making use of local citizen science campaign data

BioInvasions Records (2020) Volume 9, Issue 4: 827–833

Rapid Communication

A bonanza of angelfish (Perciformes: Pomacanthidae) in the Mediterranean: the second documented record of *Holacanthus ciliaris* (Linnaeus, 1758)

Alan Deidun[1,*], Johann Galdies[1] and Bruno Zava[2,3]

BioInvasions Records (2020) Volume 9, Issue 2: 223–227

Rapid Communication

Far from home....the first documented capture of the genus *Elops* (Actinopterygii, Elopidae) from the Mediterranean

Alan Deidun[1,*] and Bruno Zava[2,3]

BioInvasions Records (2019) Volume 8, Issue 1: 108–112

Rapid Communication

Much can change in a year: the Massawan mantis shrimp, *Erugosquilla massavensis* (Kossmann, 1880) in Sicily, Italy

Paola Gianguzza[1], Gianni Insacco[2], Bruno Zava[2,3], Alan Deidun[4] and Bella S. Galil[5,*]

Aquatic Invasions (2020) Volume 15, Issue 1: 44–62

Special Issue: Proceedings of the 10th International Conference on Marine Bioinvasions
Guest editors: Amy Fowler, April Blakeslee, Carolyn Tepolt, Alejandro Bortolus, Evangelina Schwindt and Joana Dias

Research Article

***Symplegma* (Ascidiacea: Styelidae), a non-indigenous genus spreading within the Mediterranean Sea: taxonomy, routes and vectors**

Alfonso Ángel Ramos-Esplá[1], Ghazi Bitar[2], Yassine Ramzi Sghaier[3,4], Melih Ertan Çinar[5], Alan Deidun[6], Jasmine Ferrario[7,*] and Aylin Ulman[7]

The scientific impact of citizen science campaigns

Journal of Coastal Research	SI	85	316–320	Coconut Creek, Florida	2018

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†, Alan Deidun†*, Anthony Galea† and Adam Gauci†

†Department of Geosciences,
Faculty of Science, University of Malta, Msida, Malta.

www.cerf-jcr.org

Putting multi-annual citizen science data to good use!

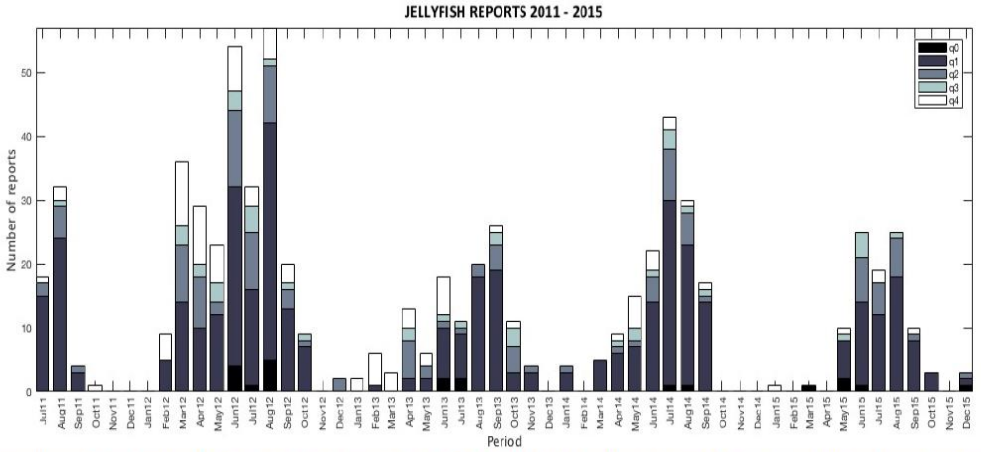


Figure 2. The number of monthly jellyfish reports received for the July 2011 – December 2015 period. T he legend represents the 5 abundance classes of jellyfish sighted, where Q0 (black) represents 0 jellyfish reports, Q1 represents 1-5 jellyfish reports, Q2 6-20 jellyfish reports, Q3 21-50 jellyfish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

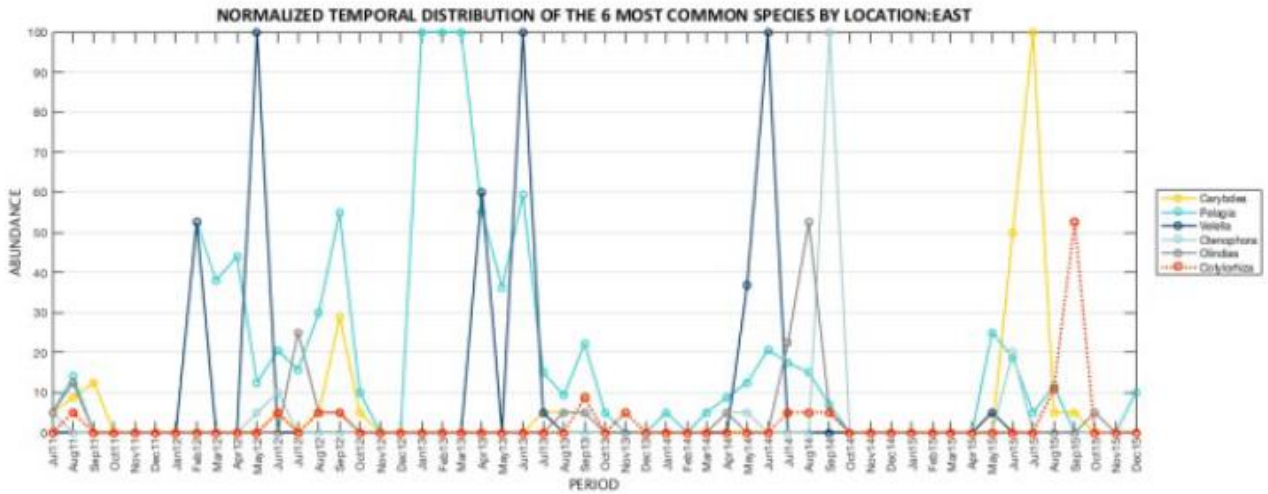
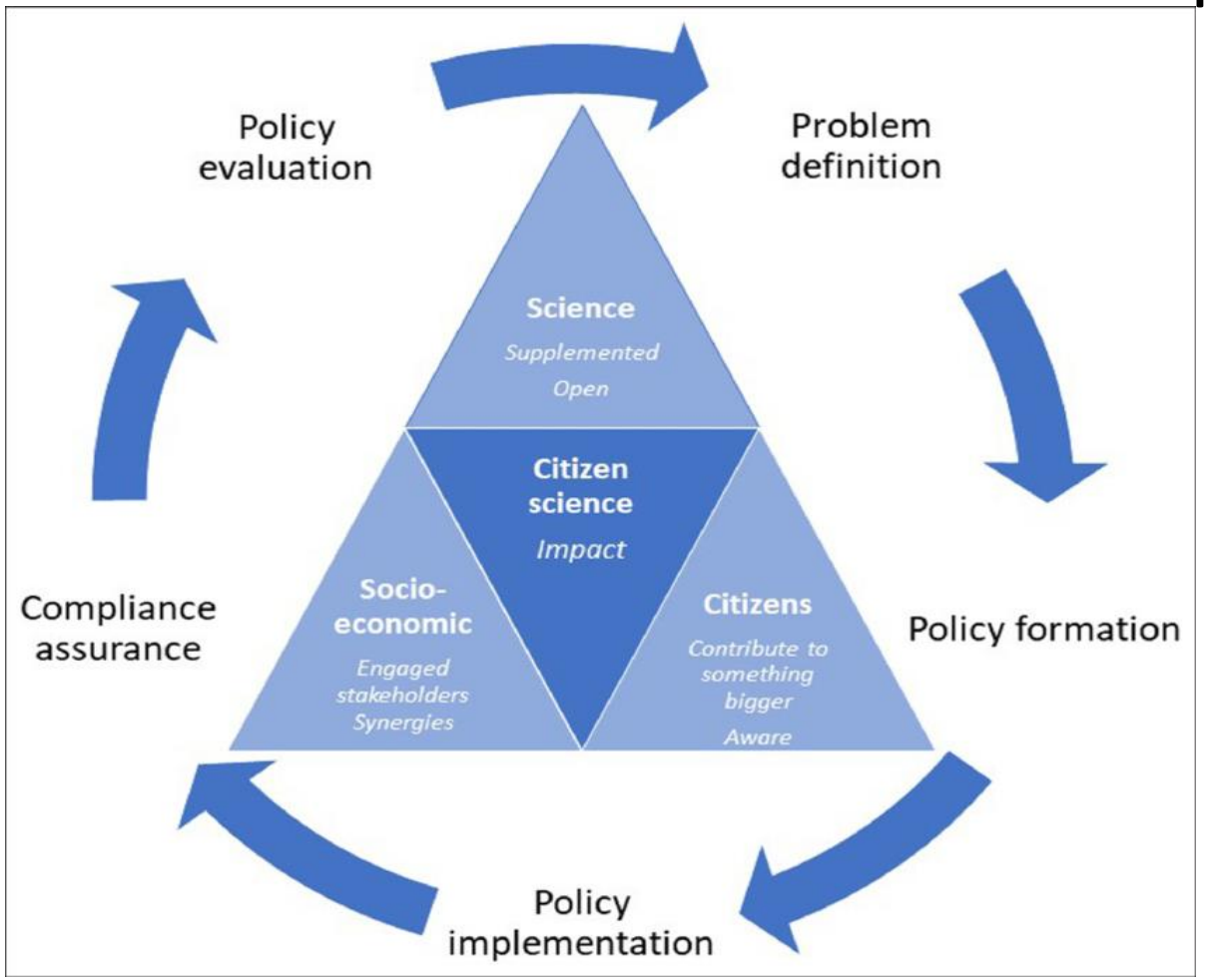


Figure 3. The normalized temporal distribution of the six most common species reported along the eastern flank of the island of Malta.

The policy impact of citizen science campaigns



PROJECT SUPPORTED BY:

International Ocean Institute

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Malta Tourism Authority

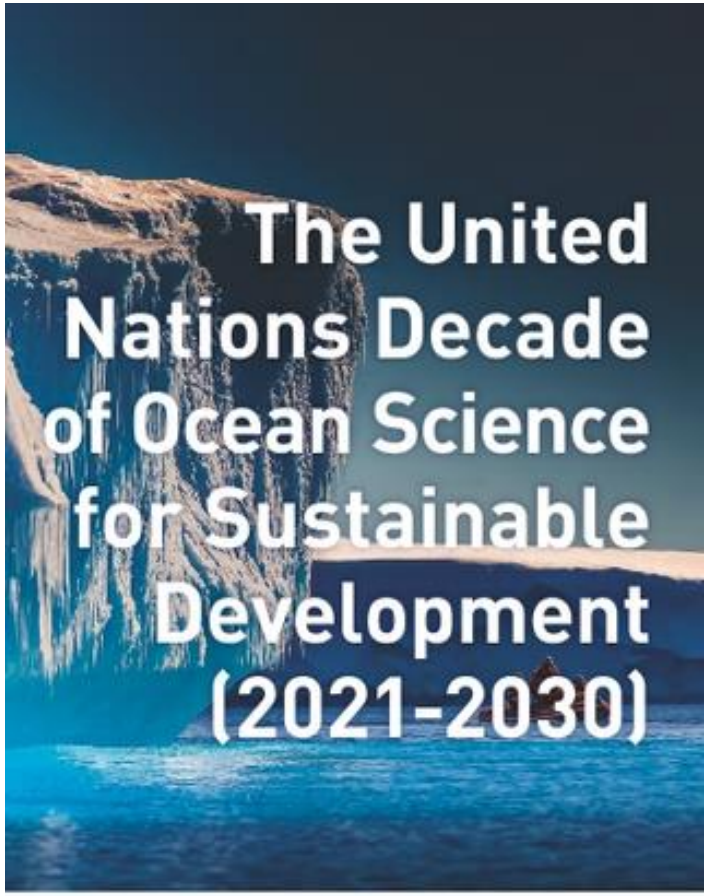
Friends of the Earth Malta

ERA

MINISTERU GĦALL-IŻVILUPP SOSTENIBBLI, L-AMBJENT U T-TIBDIL FIL-KLIMA

JUNE 2019

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.

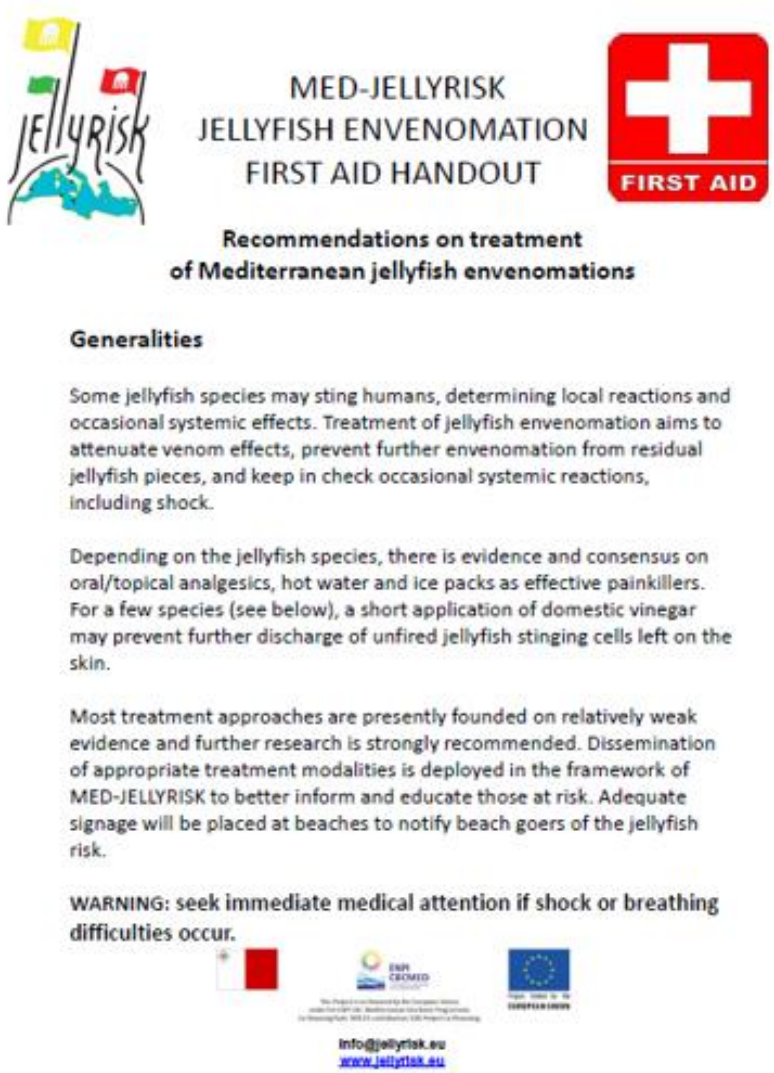
The Ocean We Need for the Future We Want

One Planet, One Ocean

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 community/societal impact of citizen science



MED-JELLYRISK
JELLYFISH ENVENOMATION
FIRST AID HANDOUT

FIRST AID

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.

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 (90-98%) 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 capillata) can reach a diameter of ~2 meters (~7 feet), with tentacles extending ~15 meters (50 feet); the Nomura's jellyfish (Nemopilema nomurai) can grow up to ~2 m in diameter and weigh over 220 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 bather is mistaken as a potential prey or predator, so stinging cells eventually discharge their venom into the bather's 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 angel – *Glaucus atlanticus* – 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 (*Cotylorhiza tuberculata*).

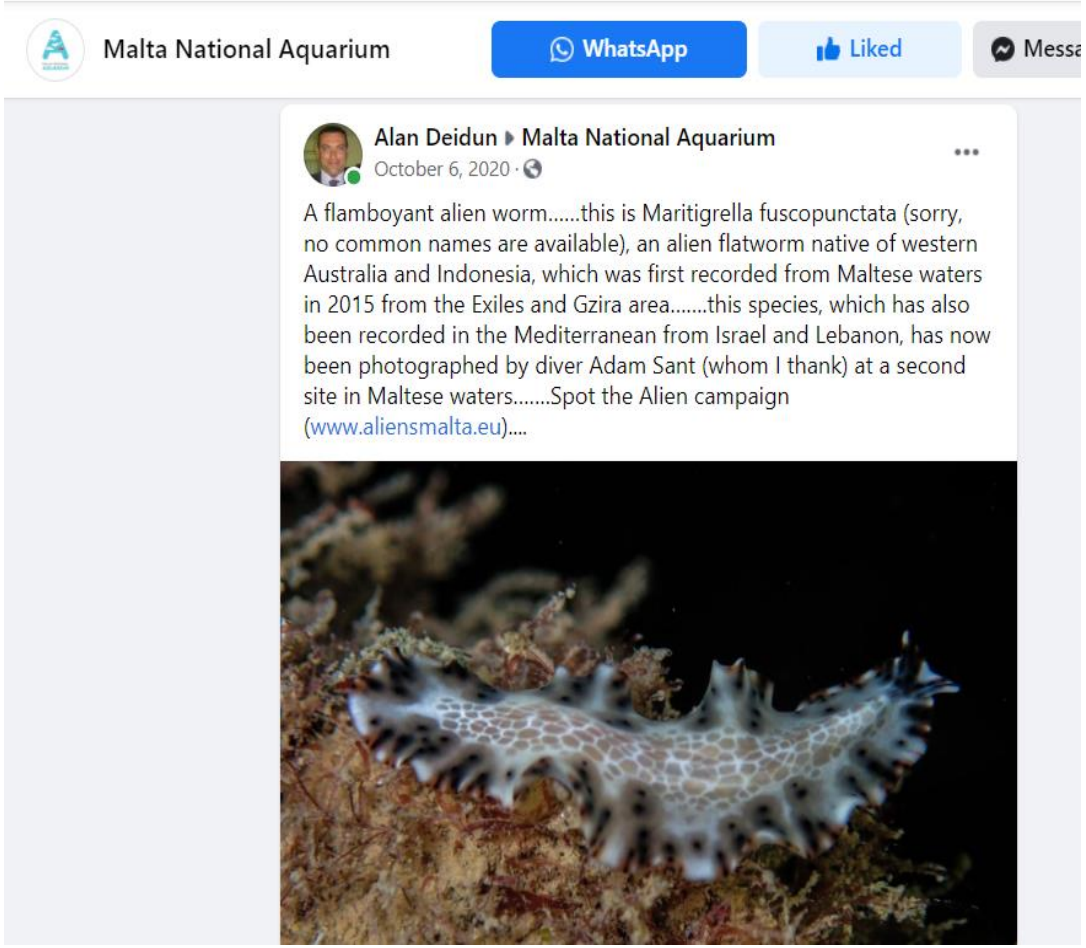
QUESTION: **What is a jellyfish bloom?**
ANSWER: Jellyfish populations may exhibit sudden outbreaks, resulting in huge numbers of individuals within restricted areas. These are usually referred to as blooms. Although different jellyfish species might bloom at the same time, blooms normally consist of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

Citizen science in environmental management

To solicit the control of marine IAS

As an early warning system….

How do you excite potential citizen scientists?



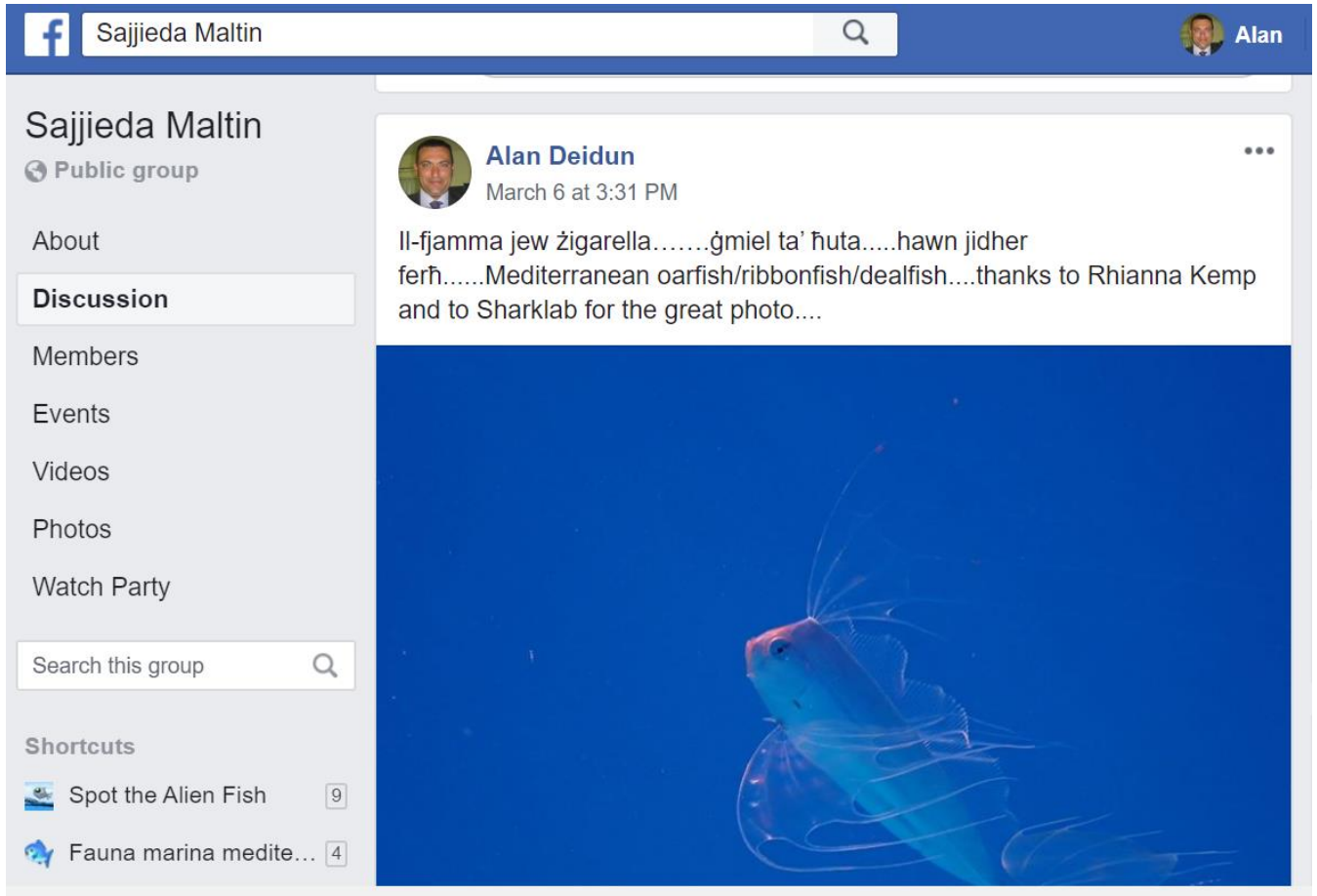
Provision of information and feedback on a continuous basis on **social media,** in both languages!

Through engagement and empowerment!

Tapping into Local Ecological Knowledge (LEK)

Engagement with SCUBA divers to unlock untapped knowledge

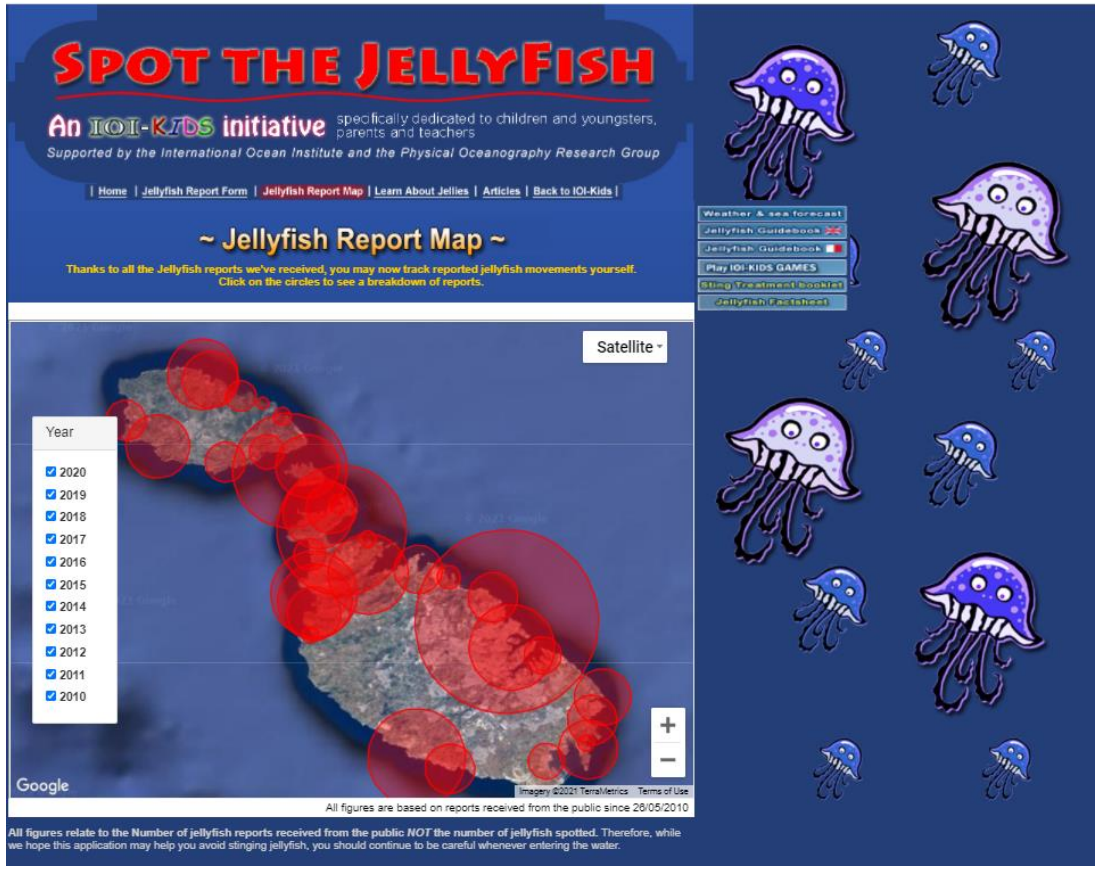
Engagement of fishermen through unexpected channels

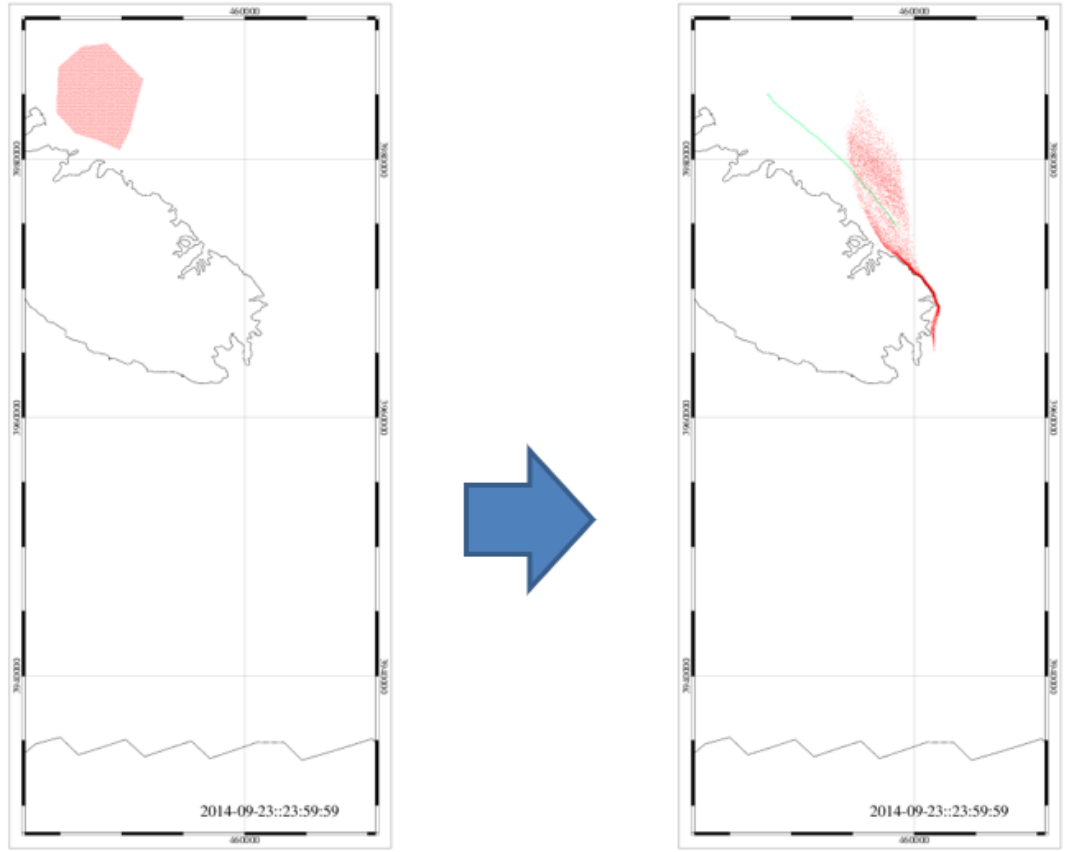


How do you excite potential citizen scientists?

Through engagement and empowerment!

How do you excite potential citizen scientists?



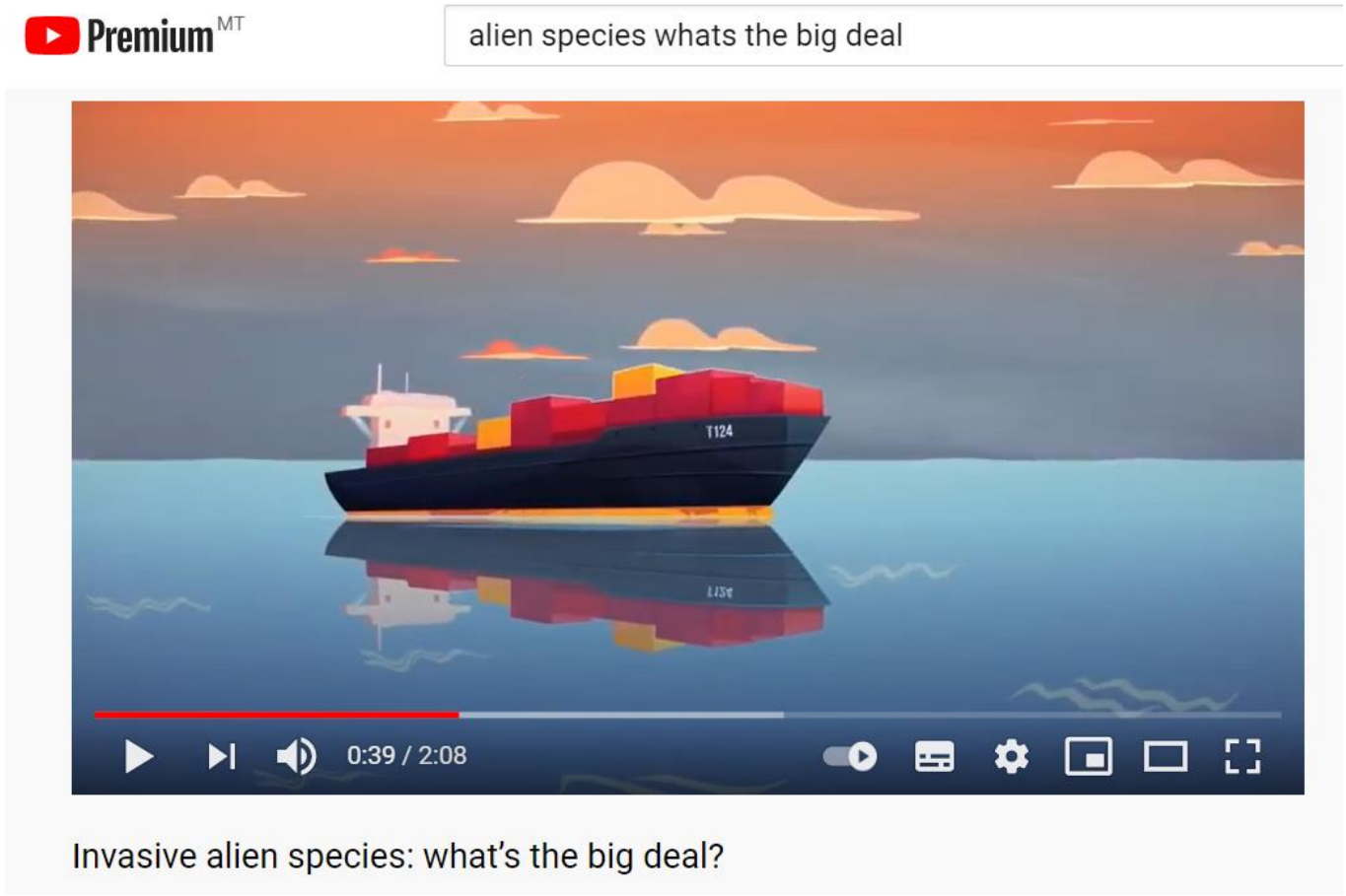


Visibility of report – recognition of contribution

Role in jellyfish dispersion model validation

Through engagement and empowerment!

How do you excite potential citizen scientists?



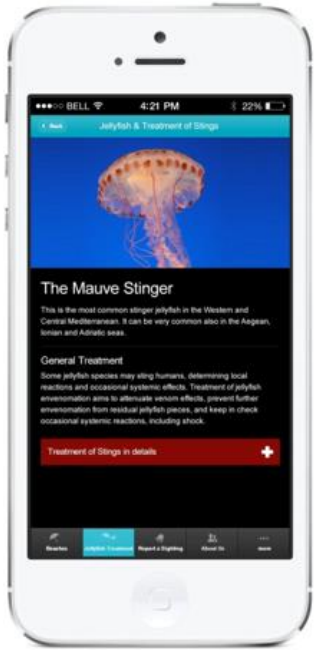
WATCH:

https://www.youtube.com/watch?v=7W00u_ugd2k

And also through innovative approaches!

How do you reach out to potential citizen scientists?

Seaside Boards
Social Media
Smart Phone Apps
Brochures
Websites



Advancing Citizen Science

for Coastal and Ocean Research

Position Paper 23

www.marineboard.eu

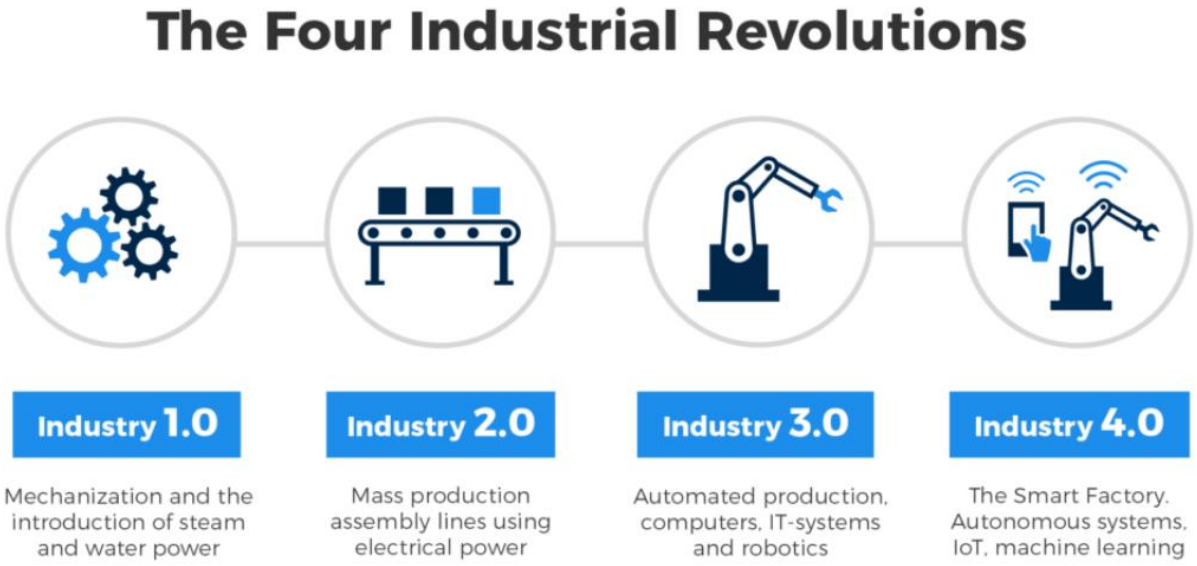
European MARINE BOARD
Advancing Seas & Ocean Science

The focus on citizen science

KEY CHALLENGES AND OPPORTUNITIES PROVIDED BY CITIZEN SCIENCE	
Challenges	**Opportunities**
Recognition of scientific value	Timely data from disperse sources
Maintaining scientific rigour and data quality	Power to address large knowledge and funding deficits
Involvement of Citizen Scientists representing a broad spectrum of society	Educating public about environmental policy issues such as biodiversity
Political and financial guarantees for action on findings	Participatory democracy

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!

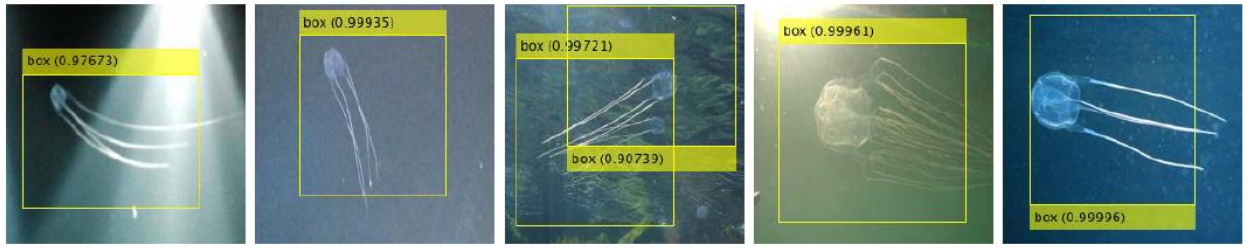


Figure 4. Output by classification model 5 for *Carybdea marsupialis* (box jellyfish).

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

applied sciences

MDPI

Article

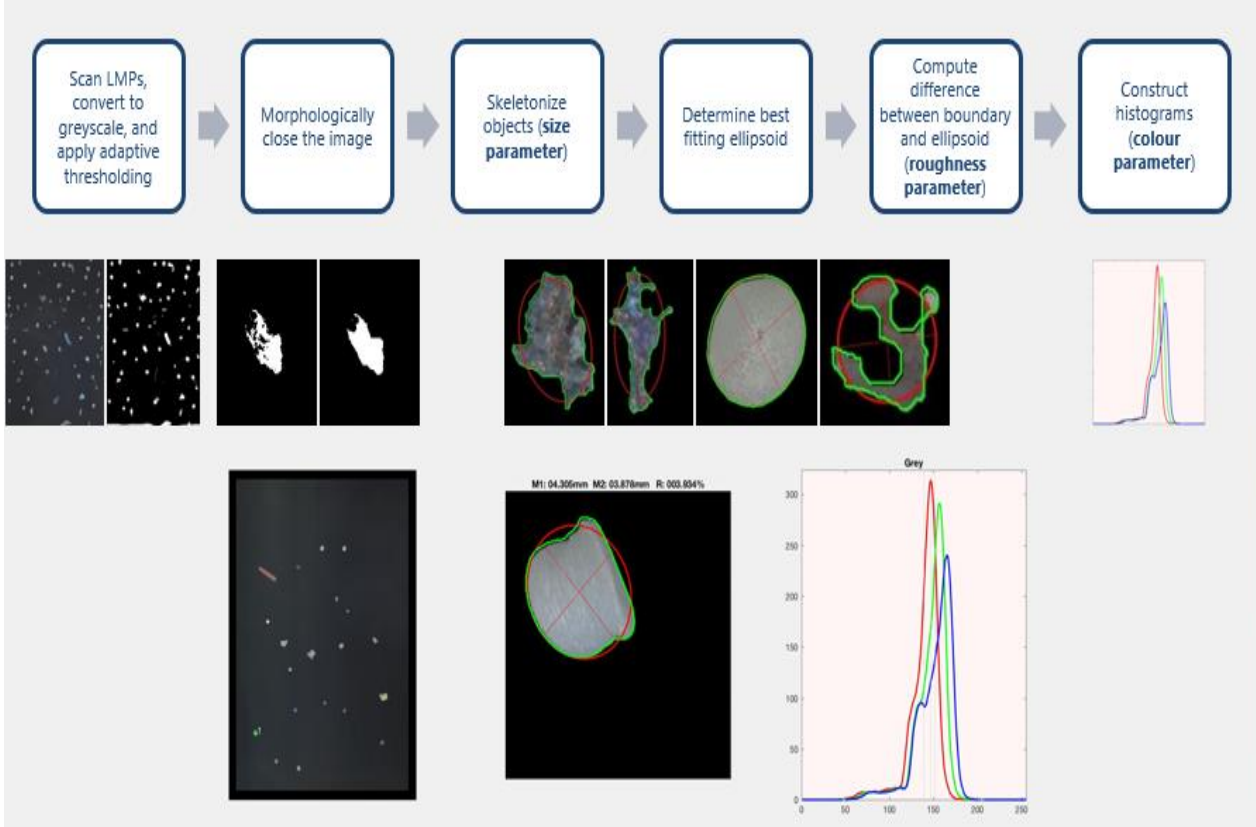
Automating Jellyfish Species Recognition through Faster Region-Based Convolution Neural Networks

Adam Gauci [1,*], Alan Deidun [1] and John Abela [2]

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

Model	Species	Precision	Recall	f_1 Score	*kappa*
1	*Carybdea marsupialis*	0.92	0.90	0.91	0.92
	Cotylorhiza tuberculata	1.00	0.95	0.97	
	Pelagia noctiluca	0.90	0.87	0.88	
	Salps	0.91	0.98	0.94	
	Velella velella	1.00	0.98	0.99	
2	*Carybdea marsupialis*	0.97	0.93	0.95	0.95
	Cotylorhiza tuberculata	1.00	0.95	0.97	
	Pelagia noctiluca	0.92	0.90	0.91	
	Salps	0.93	1.00	0.96	
	Velella velella	0.98	1.00	0.99	
3	*Carybdea marsupialis*	0.98	1.00	0.99	0.96
	Cotylorhiza tuberculata	0.95	0.98	0.96	
	Pelagia noctiluca	0.91	0.98	0.94	
	Salps	1.00	0.98	0.99	
	Velella velella	1.00	0.90	0.95	
4	*Carybdea marsupialis*	0.95	0.95	0.95	0.92
	Cotylorhiza tuberculata	1.00	0.85	0.92	
	Pelagia noctiluca	0.81	0.88	0.84	
	Salps	0.93	0.98	0.95	
	Velella velella	0.98	1.00	0.99	
5	*Carybdea marsupialis*	0.98	1.00	0.99	0.99
	Cotylorhiza tuberculata	1.00	1.00	1.00	
	Pelagia noctiluca	1.00	0.98	0.99	
	Salps	1.00	1.00	1.00	
	Velella velella	1.00	1.00	1.00	

AI to the rescue!



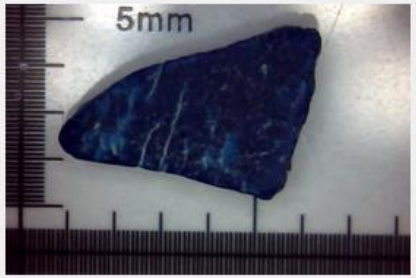
ELSEVIER

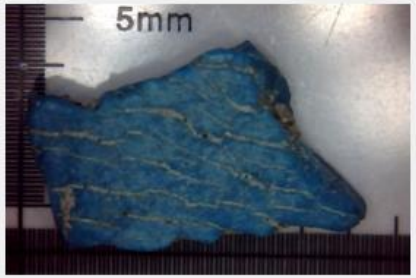
Ocean & Coastal Management

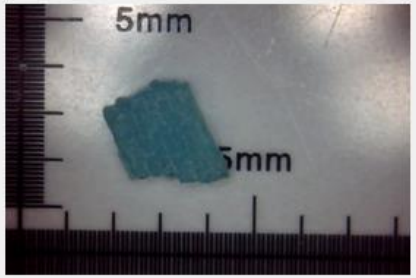
Volume 182, 1 December 2019, 104950

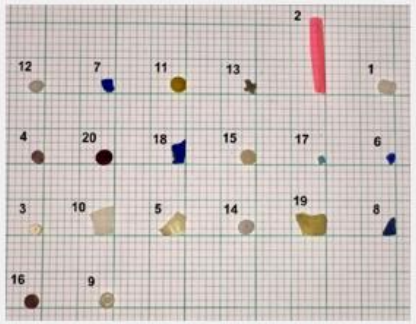
Automating the characterisation of beach microplastics through the application of image analyses

Adam Gauci [a], Alan Deidun [a], John Montebello [a], John Abela [b], Francois Galgani [c]







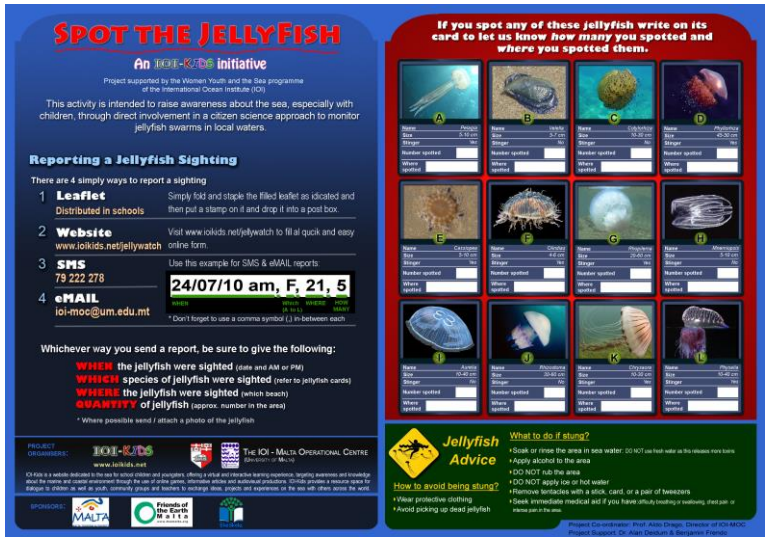


Sample	Manual grid measurement (mm)		Microscopic analyses (mm)		Algorithm output (no. of pixels)		Algorithm output (mm)		Max error (mm)	Max error (mm)
	major axis	minor axis	major axis	minor axis	major axis	minor axis	major axis	minor axis	major axis	minor axis
3	4.0	4.0	3.3	3.3	95.08	77.72	3.98	3.20	0.68	0.10
4	4.0	4.0	3.5	3.8	89.77	86.43	3.75	3.61	0.25	0.19
8	6.0	4.0	5.6	3.7	135.13	66.78	5.65	2.79	0.05	0.91
13	4.0	4.0	4.8	4.0	107.68	85.90	4.50	3.59	0.30	0.41
17	2.0	2.0	1.8	2.2	76.452	53.31	3.20	2.23	1.40	0.03
18	8.0	4.0	7.4	4.5	164.84	102.19	6.89	4.27	0.51	0.23

Proof of concept achieved – next step is the incorporation of algorithm within smart phone app for citizen science implementation

A sampling of local citizen science campaigns

<2010



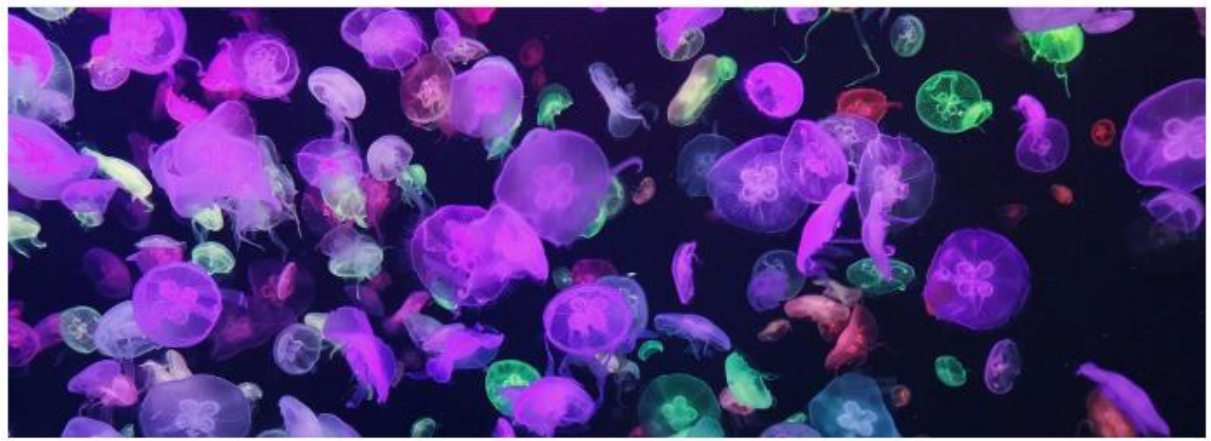
Spot the Jellyfish – kicked off in June 2010 – recognised as an example of citizen science good practice!

The evolution of seaside boards

The Spot the Jellyfish campaign turns 10!

In Projects 13:13, 28 Jan 2020

Share:



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,

See More

Horizon 2020: Video campaign

PROJECTS 08:45, 11 Mar

UM academics develop first-ever made-in-Malta hip joint replacement

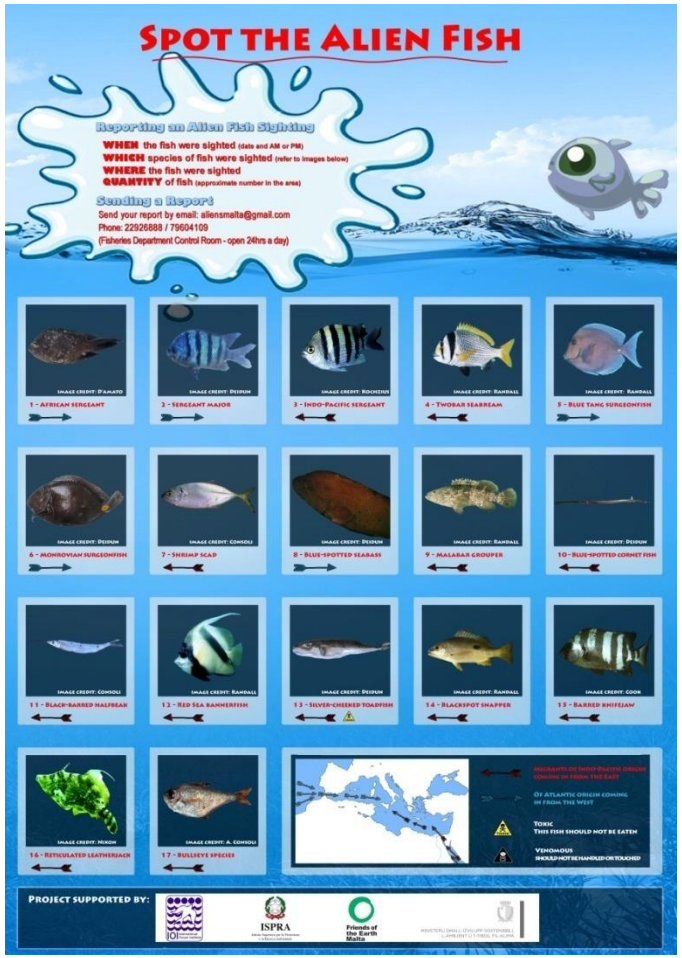
PROJECTS 10:41, 10 Mar

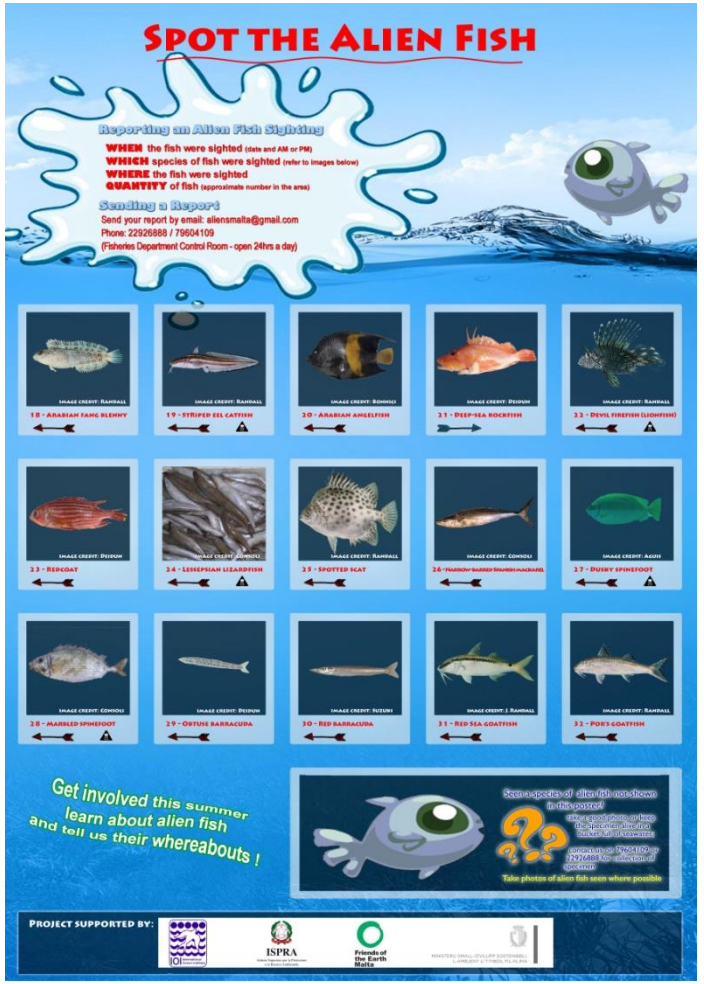
UM's Quality Assurance Committee undertaking mock audit exercises

PROJECTS 08:01, 10 Mar

Categories

A sampling of local citizen science campaigns





Citizen science – design of user-friendly brochures is crucial!

A sampling of local citizen science campaigns

Citizen science – design of user-friendly brochures is crucial!

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