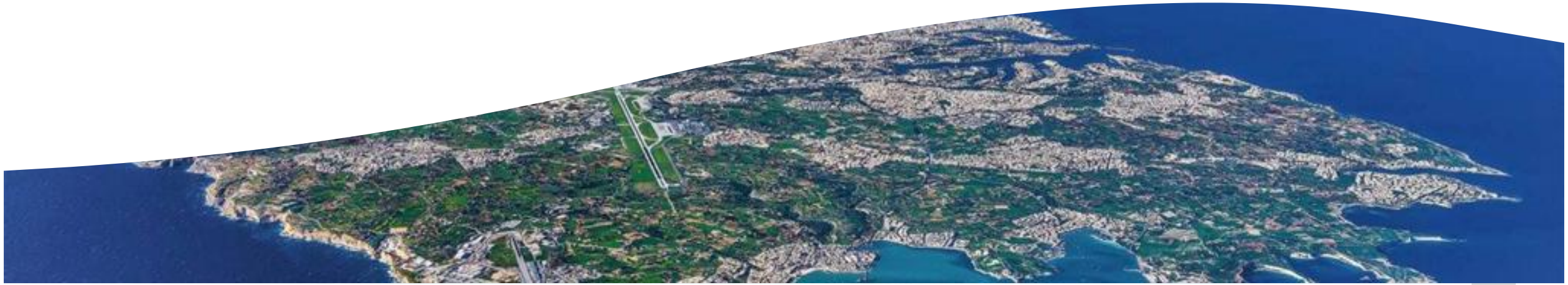
Early warning system for the Maltese tuna farms

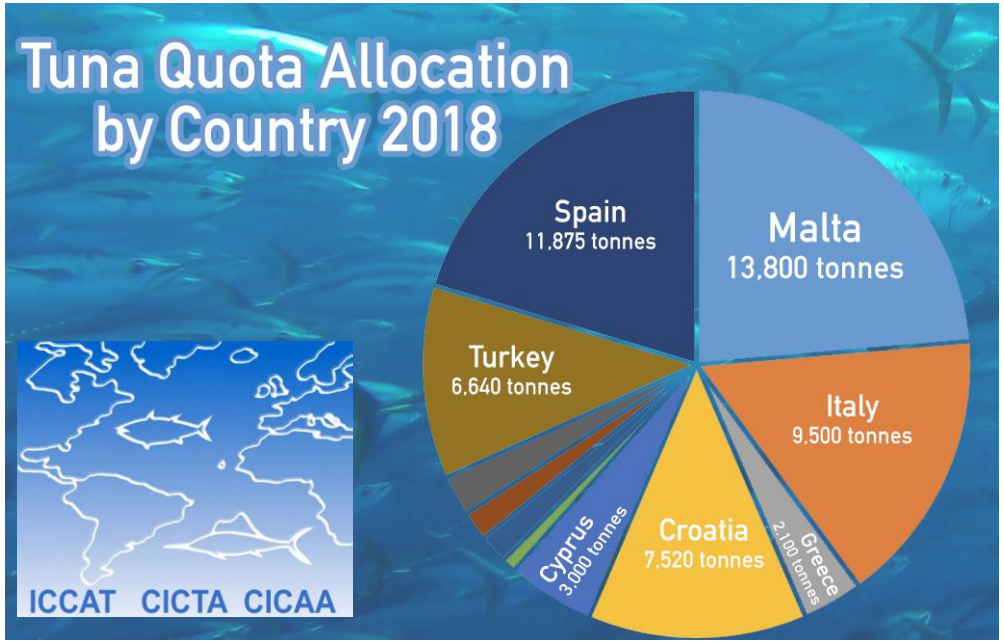
The Corto Maltese Inc. – Innovative forecast solution for your business

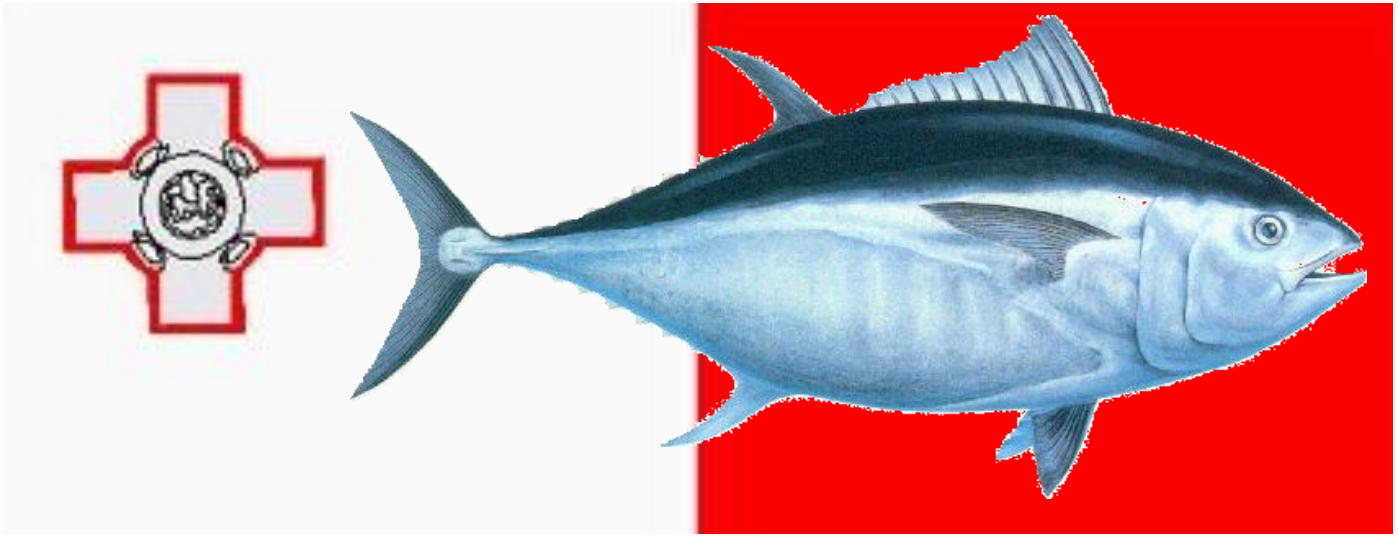
Tuna Aquaculture in Malta

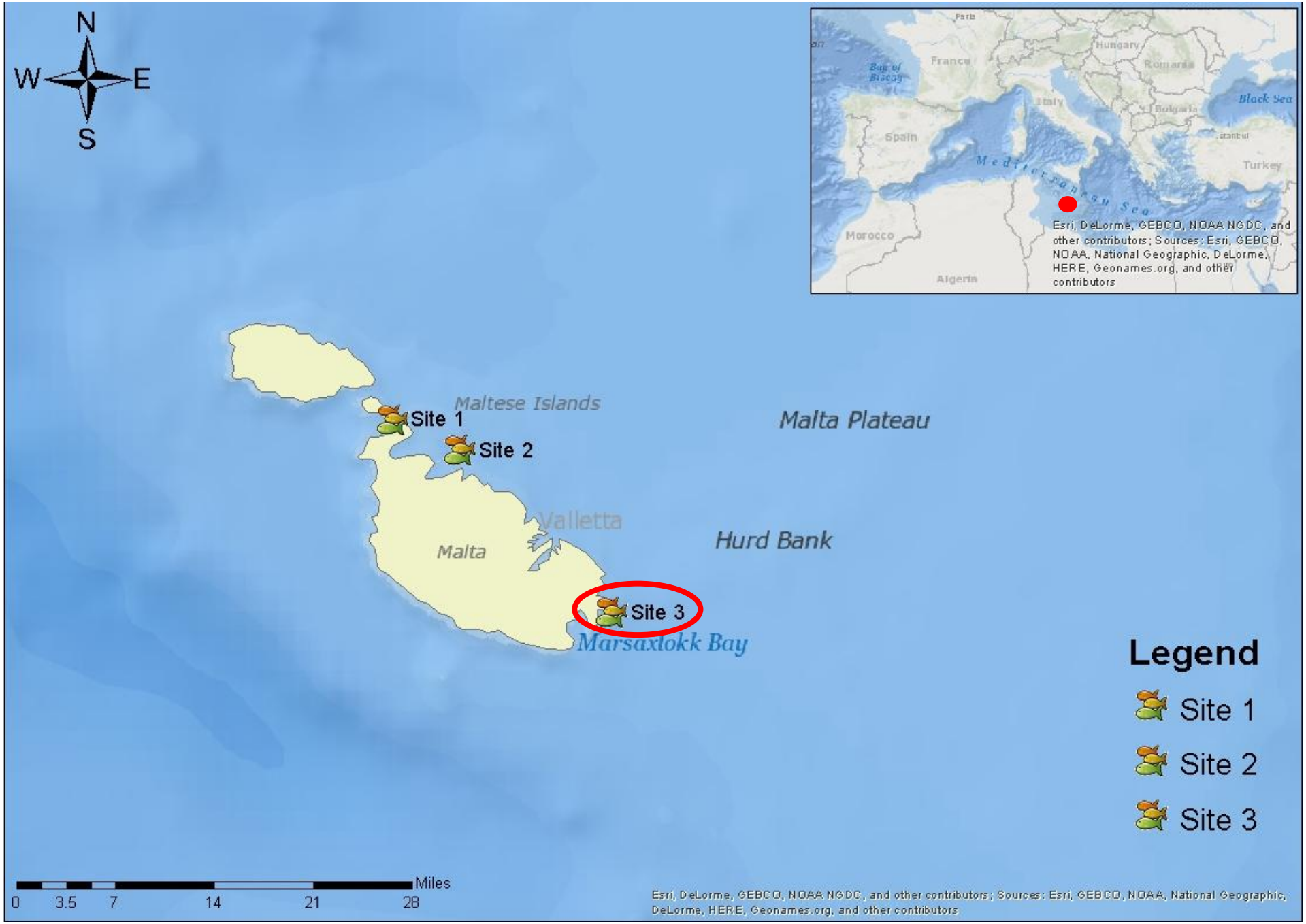
Why is it important?



- Marine-based aquaculture
- Atlantic bluefin tuna (*Thunnus thynnus thynnus*)
- Five farms in 2015 to fatten captured tunas
- 8,051 tonnes produced in 2015 (four times more than sea bass and sea bream)
- AJD Tuna company - one of the top three Mediterranean producers - generates **1% of Malta's GDP**






N
W
E
S
Maltese Islands
Site 1
Site 2
Malta Plateau
Valletta
Malta
Hurd Bank
Site 3
Marsaxlokk Bay
Legend
Site 1
Site 2
Site 3
Miles
0
3.5
7
14
21
28
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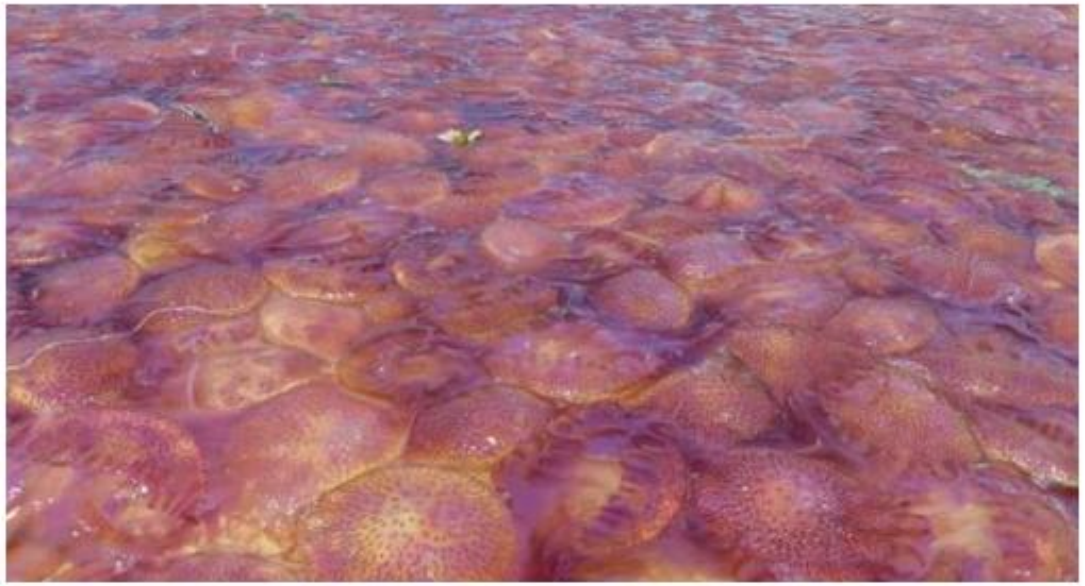
Hungary
France
Romania
Bay of Biscay
Black Sea
Italy
Bulgaria
Spain
Turkey
Morocco
Algeria

Tuna vs Jellyfish

The problem

Millions of jellyfish seen along Malta's east coast

Saturday, 5 May 2018, 13:55 Last update: about 3 months ago



Millions of jellyfish were seen today along the entire east coast of Malta, in what marine biologist Alan Deidun yesterday described as "purple carpets of mauve stingers (*Pelagia noctiluca*) in Birzebbuga, St Thomas Bay, Xghajra, Msida and Bahar ic-Caghaq.

Alan Deidun, who coordinates the Spot the Jellyfish citizen science campaign, said the bloom consisted of just the one species which normally bloom in Maltese waters in late May and early June.

maltaINDEPENDENT

SCIENTIFIC REPORTS

OPEN

Concurrent environmental stressors and jellyfish stings impair caged European sea bass (*Dicentrarchus labrax*) physiological performances

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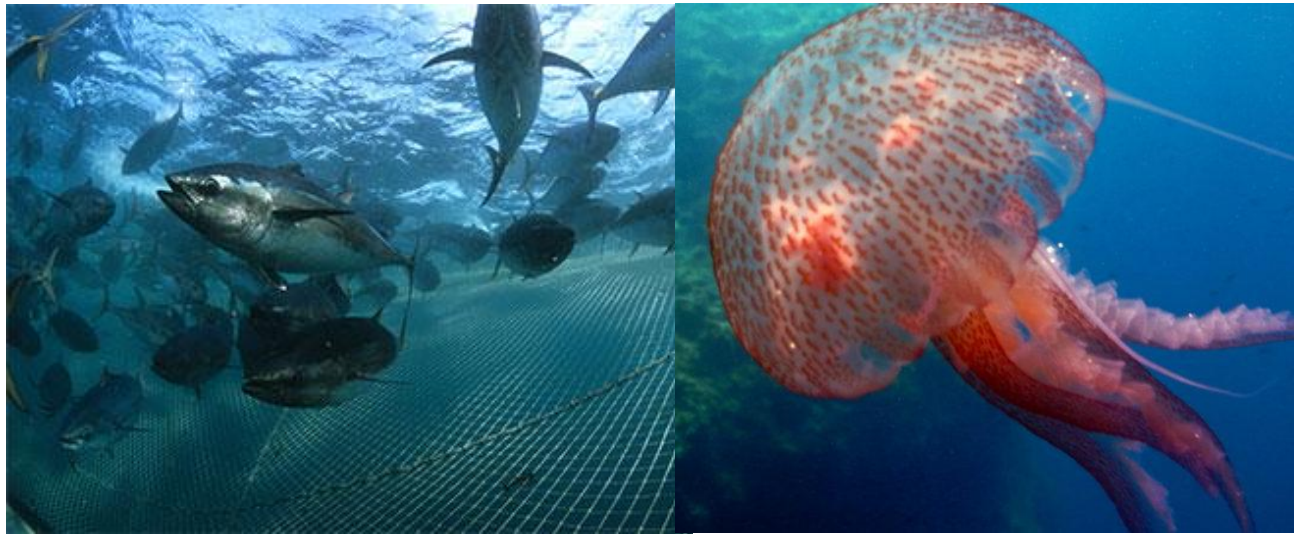
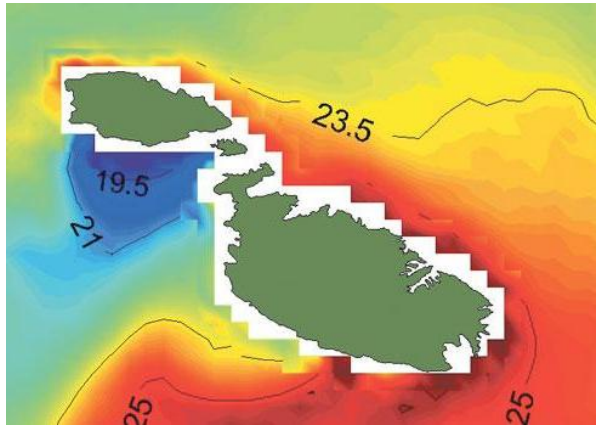
Mar Bosch-Belmar[1,2], Folco Giomi[3], Alessandro Rinaldi[3,4], Alberta Mandich[5], Verónica Fuentes[6], Simone Mirto[4], Gianluca Sarà[3,*] & Stefano Piraino[1,2,*]

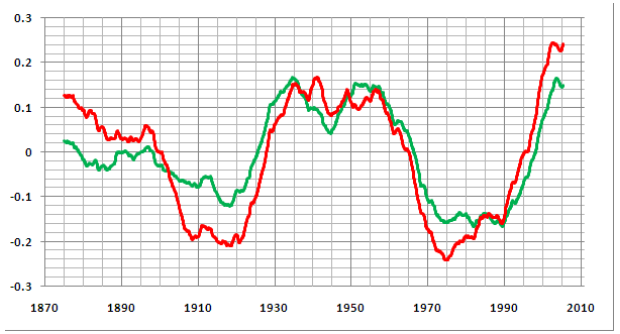


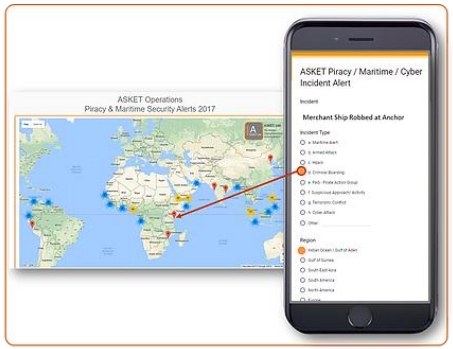
Conceptual model

The Corto Maltese approach

Early warning system for the Maltese tuna farmers







Module 1: environmental parameters

- Currents and Temperatures
- Rosario model (Univ. of Malta)

Module 2: risk assessment

- Monthly vulnerability
- 48 hours forecasts

Module 3: validation

- Hindcast with historical data
- Occurrences in news
- Jellyfish dispersion model (Univ. Malta)

Module 4: outputs

- Online portal
- Alarm via sms/email to users

	INPUT PARAMETERS		RELEVANCE
ρ	Speed	0 - 2 m/s	20%
θ	Direction	0 – 360 degrees	40%
	Seawater Temperature	10- 30 Celsius	40%

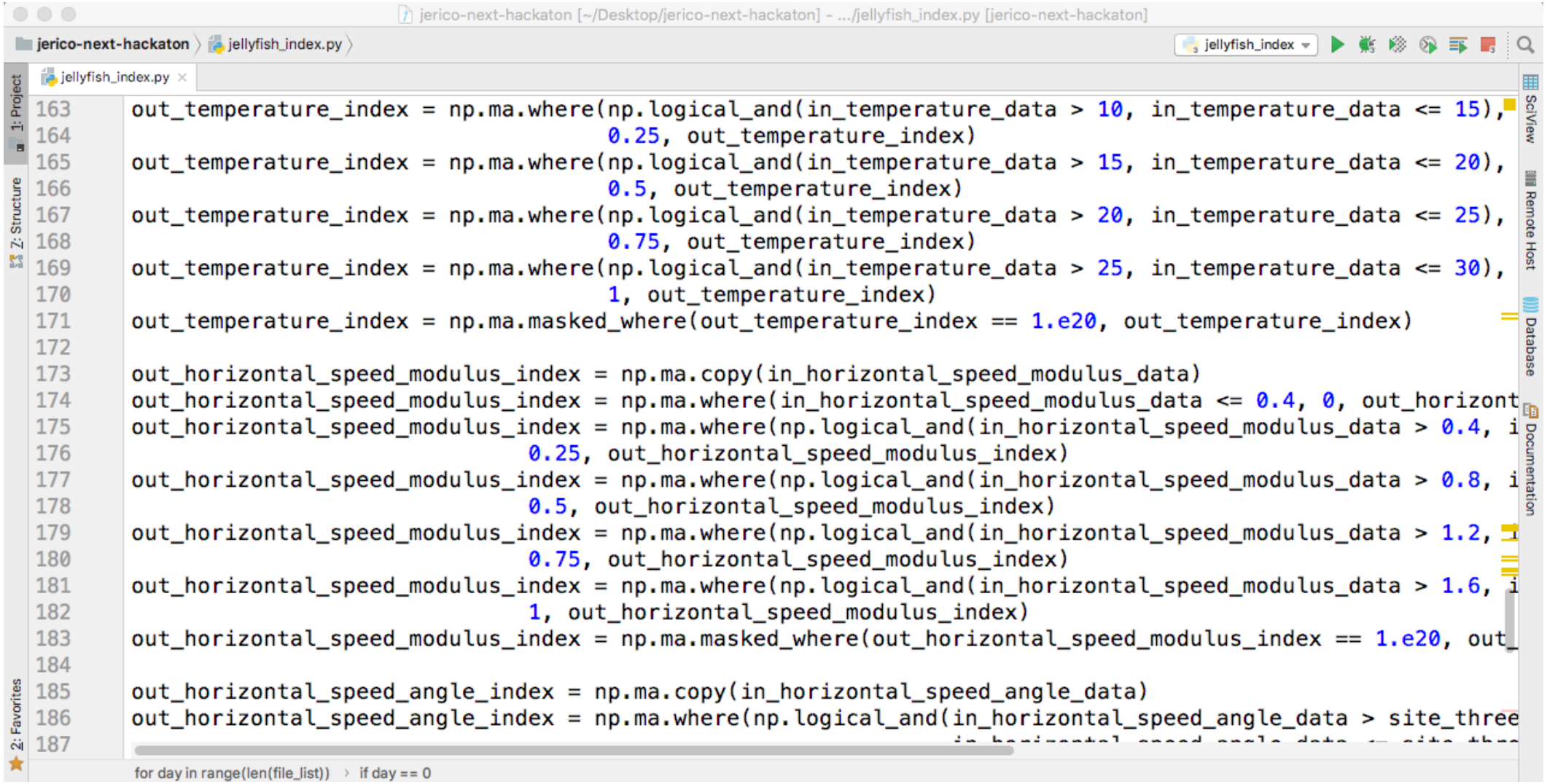
Risk	No Risk	Low	Medium	High	Extreme
Speed	0.4	0.8	1.2	1.6	2
Direction	0	0.25	0.5	0.75	1
Temperature	10	15	20	25	30

$$\text{JELLYFISH RISK} = P \times 0.2 + \Phi \times 0.4 + T \times 0.4$$

Numerical model

The Corto Maltese solution

Python code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jerico-next-hackaton
jellyfish_index.py
jellyfish_index
1: Project
2: Favorites
7: Structure
SciView
Remote Host
Database
Documentation
163 out_temperature_index = np.ma.where(np.logical_and(in_temperature_data > 10, in_temperature_data <= 15),
164 0.25, out_temperature_index)
165 out_temperature_index = np.ma.where(np.logical_and(in_temperature_data > 15, in_temperature_data <= 20),
166 0.5, out_temperature_index)
167 out_temperature_index = np.ma.where(np.logical_and(in_temperature_data > 20, in_temperature_data <= 25),
168 0.75, out_temperature_index)
169 out_temperature_index = np.ma.where(np.logical_and(in_temperature_data > 25, in_temperature_data <= 30),
170 1, out_temperature_index)
171 out_temperature_index = np.ma.masked_where(out_temperature_index == 1.e20, out_temperature_index)
172
173 out_horizontal_speed_modulus_index = np.ma.copy(in_horizontal_speed_modulus_data)
174 out_horizontal_speed_modulus_index = np.ma.where(in_horizontal_speed_modulus_data <= 0.4, 0, out_horizont
175 out_horizontal_speed_modulus_index = np.ma.where(np.logical_and(in_horizontal_speed_modulus_data > 0.4, i
176 0.25, out_horizontal_speed_modulus_index)
177 out_horizontal_speed_modulus_index = np.ma.where(np.logical_and(in_horizontal_speed_modulus_data > 0.8, i
178 0.5, out_horizontal_speed_modulus_index)
179 out_horizontal_speed_modulus_index = np.ma.where(np.logical_and(in_horizontal_speed_modulus_data > 1.2,
180 0.75, out_horizontal_speed_modulus_index)
181 out_horizontal_speed_modulus_index = np.ma.where(np.logical_and(in_horizontal_speed_modulus_data > 1.6, i
182 1, out_horizontal_speed_modulus_index)
183 out_horizontal_speed_modulus_index = np.ma.masked_where(out_horizontal_speed_modulus_index == 1.e20, out_
184
185 out_horizontal_speed_angle_index = np.ma.copy(in_horizontal_speed_angle_data)
186 out_horizontal_speed_angle_index = np.ma.where(np.logical_and(in_horizontal_speed_angle_data > site_three
187
for day in range(len(file_list)) › if day == 0

Output

You will have 48 hours to act and save your business

WORK
IN PROGRESS