

Jelly

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

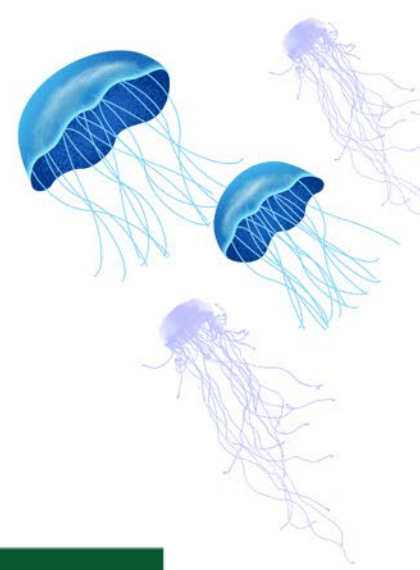


Hindcasting the occurrence and dispersal of Mediterranean jellyfish blooms via Citizen Science

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University of Haifa





Goal

Develop a jellyfish forecast system using citizen science reporting.

Rationale

Jellyfish swarms have been an increasing nuisance to various types of stakeholders.

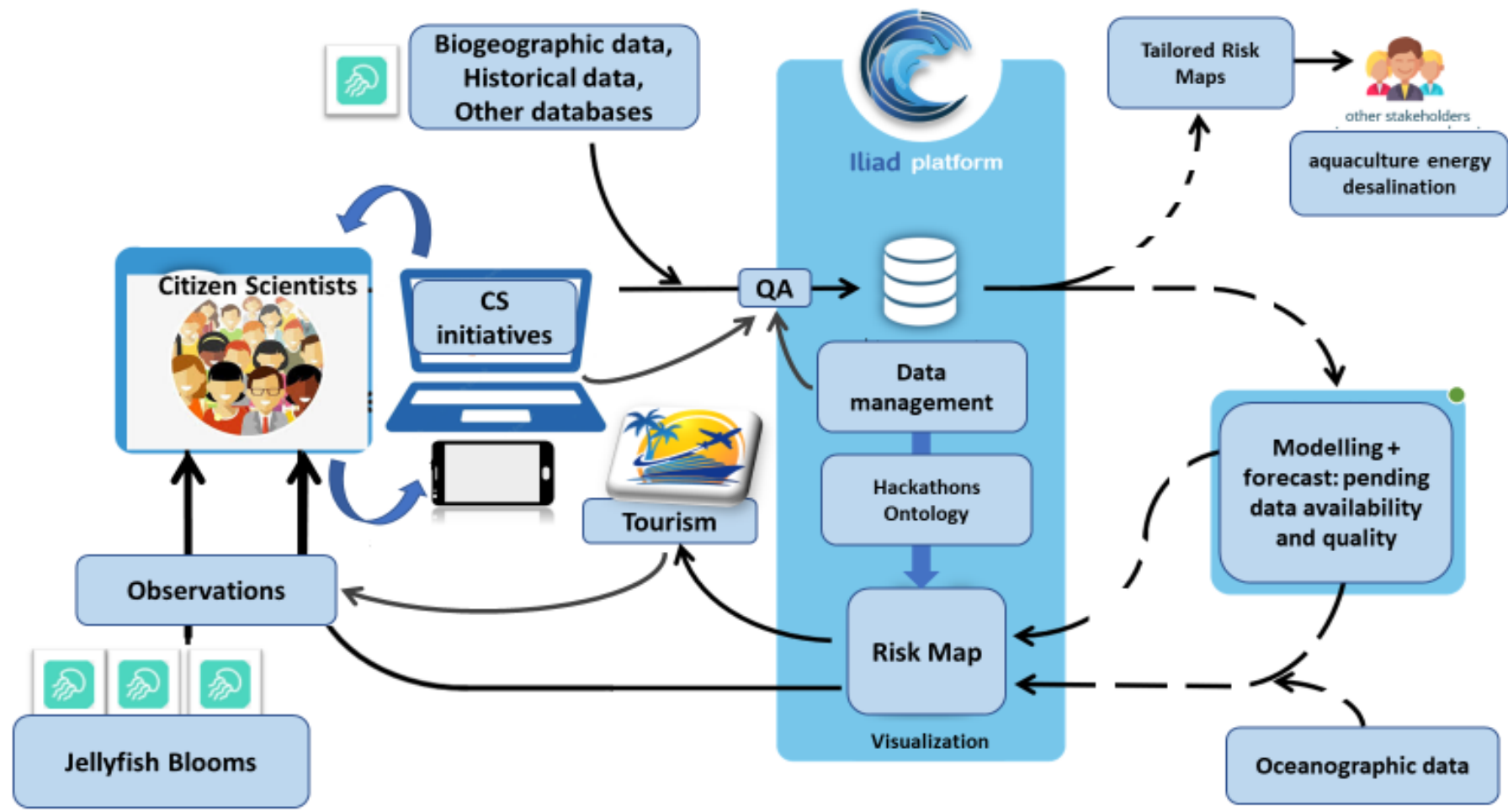
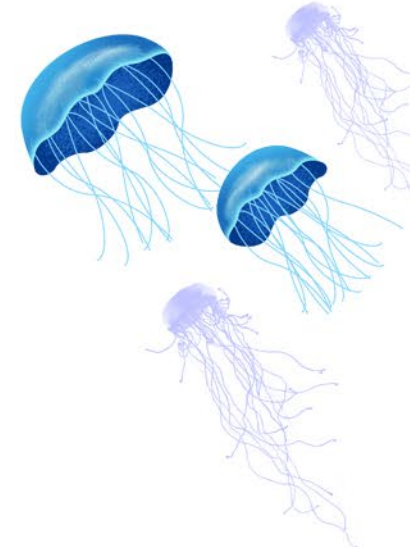
Approach

Collaborate with existing CS jellyfish projects to establish a "risk map" for jellyfish swarms.



Jelly

SYSTEMS AND TOOLS FOR BLOOM OF JELLYFISH AND THEIR DISPLACEMENT TO THE COAST



Jellyfish Citizen Science Initiatives in Southern European Seas



International tourism receipts



<i>Aequorea sp.</i>	1	1	1	1	1	1	1	1	1	1	1
<i>Aurelia sp.</i>	1		1	1	1	1	1	1	1	1	1
<i>Beroe ovata</i>	1					1				1	
<i>Bolinopsis spp.</i>				1						1	
<i>Carybdea marsupialis</i>		1	1			1		1	1		
<i>Cassiopea andromeda</i>	1	1			1					1	
<i>Gastropylus tagi</i>		1			1			1	1		
<i>Gestum veneris</i>	1				1					1	
<i>Chrysaora hysoscella</i>		1			1	1	1	1	1	1	1

Zero jellyfish option	V	V	V	V	None	None	Via comments	V		V	V
					Less than 10/m2	1	None	0 individual s /10 m ²	<10 / <10 per m2 / 10-20 or >20 m between bells	None	0
0 - None	0	0	0	0				<10 / 1-10			

Size bins	11-30	10-15		None	None	None	None	None	None		
	31-60	15-25									
	60+	>25									
Beached jellyfish	Yes	None	None	Yes	None	Via comments	Yes				
Stinging	Yes	Online survey in app	None	None	None	Via comments	None				
Comments	Free text					Via comments	Free text				
Gold users	Yes - several hundred					None	None				
Photo/video	Photo - optional					Via comments	Photo - optional				
Transects	Optional	Optional				None	None				
Validation	Retroactive (real-time updates)	Retroactive		Approval	Scientific validation	Manual	None				
System/Platform	Android+Web	iOS+Android			Website	iOS+Android	Website-G				
Oil,Plastics, Debris	Oil	Oil,Plastics, Debris	None	None	None	Plastics, Debris	None				
Other animals	None	None	None	Yes	None	Yes - All marine life	None				
Map	Yes	Yes	Yes	Yes	Yes	Yes	Private				
Number of Downloads/users	4,600 users submitted reports	80,000+		1,000+			100,000+ downloads (users)				
Number of Reports/observations	22,000	5,500 Reports		>11000	300+	1,490 Reports	6 datasets (2010-2016)				
Years active	Since 2011	Since 2016	Since 2010	Since 2016	Since 2016 (obs. since 2010)	Since 2011	Since 2015				
New species discovered	Chrysaora pseudoocelata		9 species new to Maltese waters								

Size Bins

Photos, Training level, validation, platform, User uptake

<i>Pyrosoma atlanticum</i>				1							
<i>Rhizostoma luteum</i>		1		1		1	1		1		
<i>Rhizostoma pulmo</i>	1	1	1		1	1	1	1	<i>R. octopus?</i>	1	
<i>Rhopilema nomadica</i>	1	1	1		1			1	1		
<i>Salps</i>	1	1			1			1	1		1
<i>Siphonophora spp.</i>	1				1						
<i>Velella velella</i>		1	1		1	1	1	1	1		1

value option	11-99	>50	>50	1000/m2	51-100	Swarm		bells		
	100-999		>100		>100	retroactive expert decision	Main variable used is density			





Next - Data

Tracking Jellyfish Swarm Origins Using a Combined Oceanographic- Genetic-Citizen Science Approach

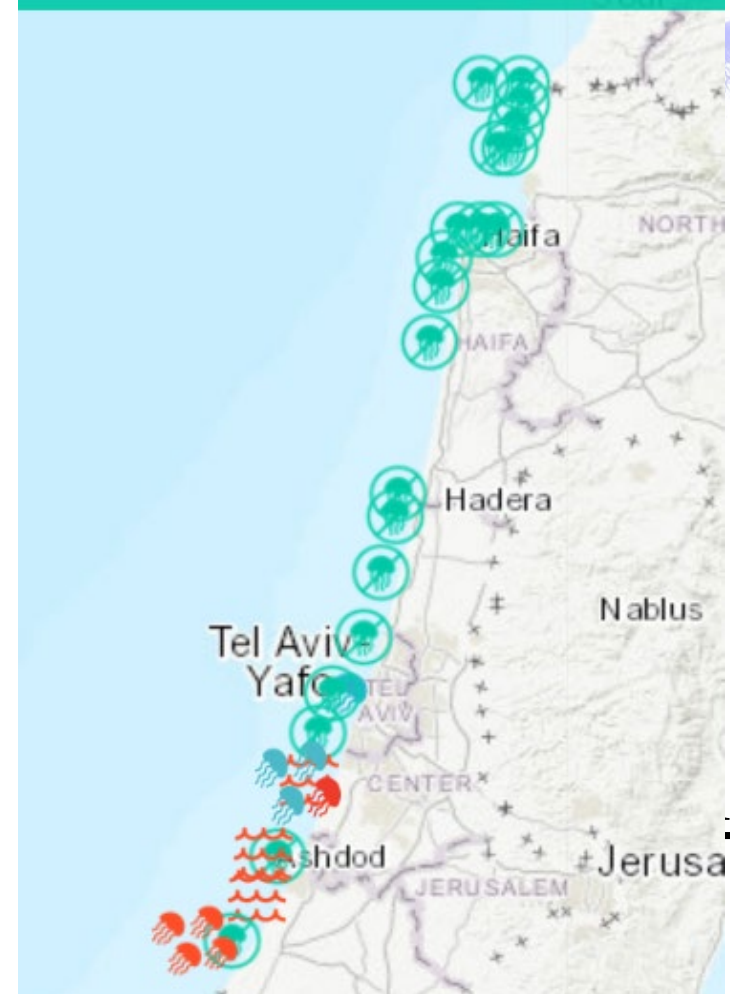
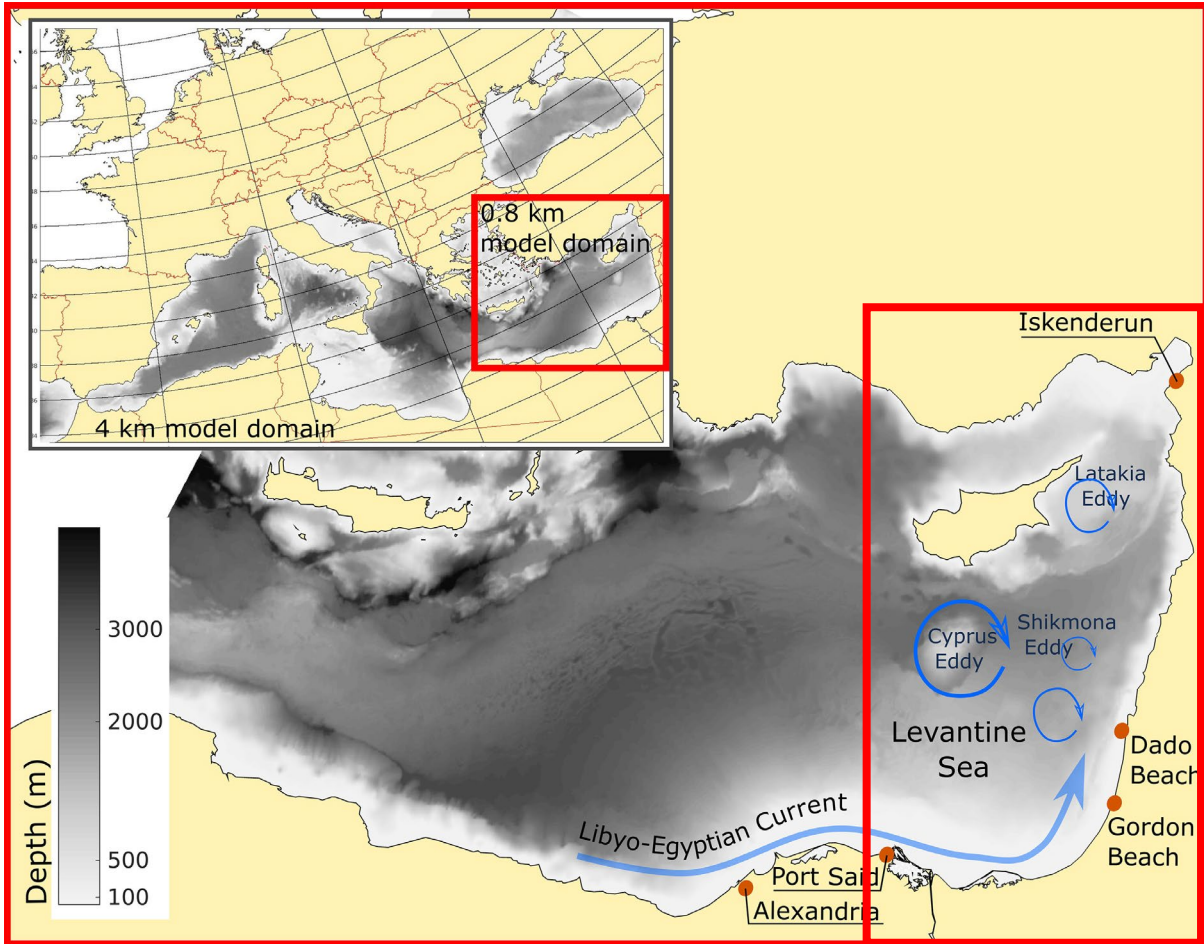
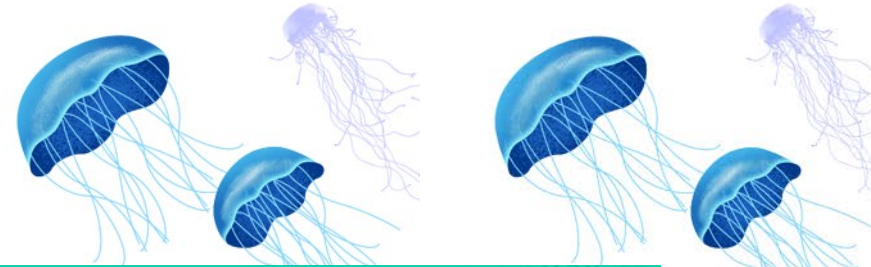
Dor Edelist , Øyvind Knutsen, Ingrid Ellingsen, Sanna Majaneva, Nicole Aberle, Hila Dror and Dror L. Angel

Frontiers in Marine Science 9: 869619. <https://doi.org/10.3389/fmars.2022.869619>



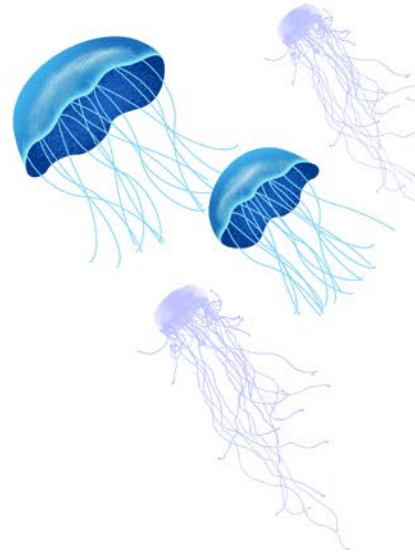
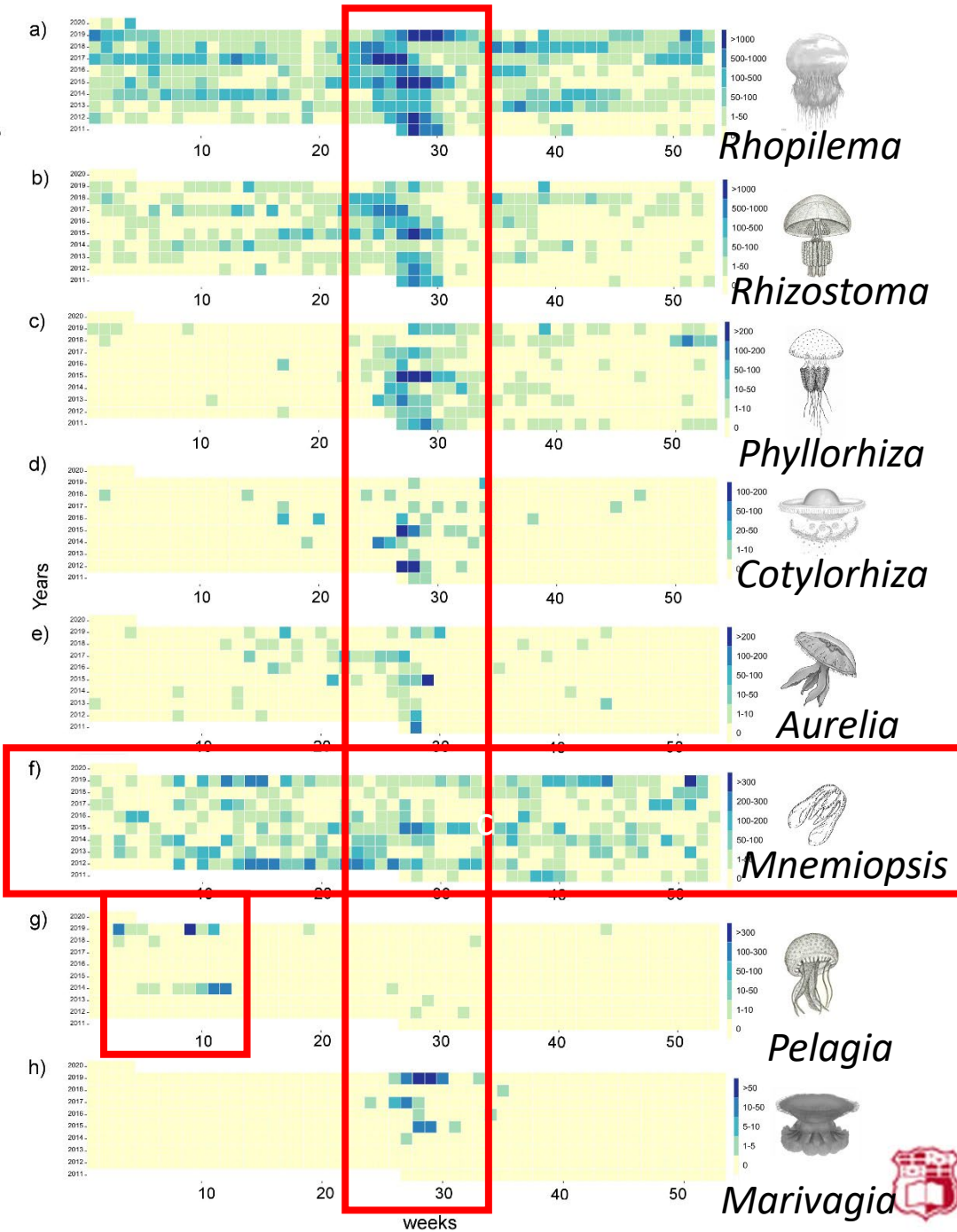
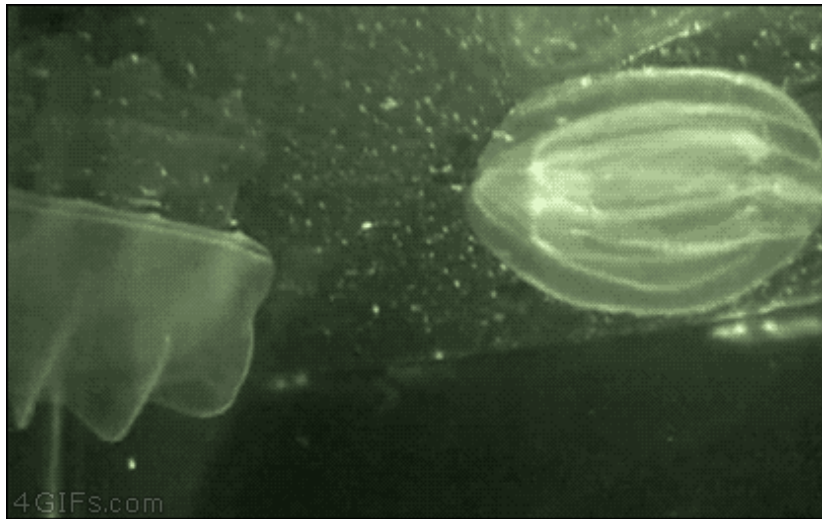
The Israeli
Experience – For
metagenic species
polyp beds are key

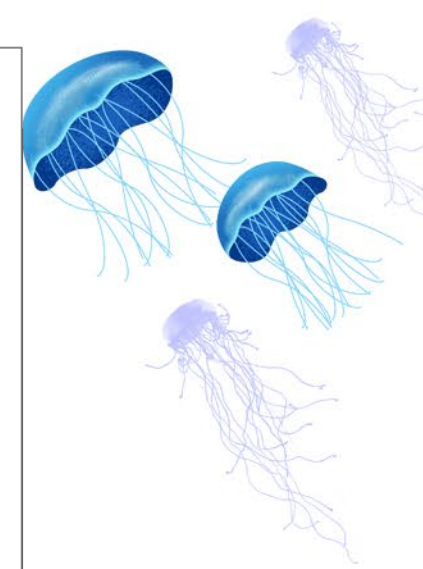
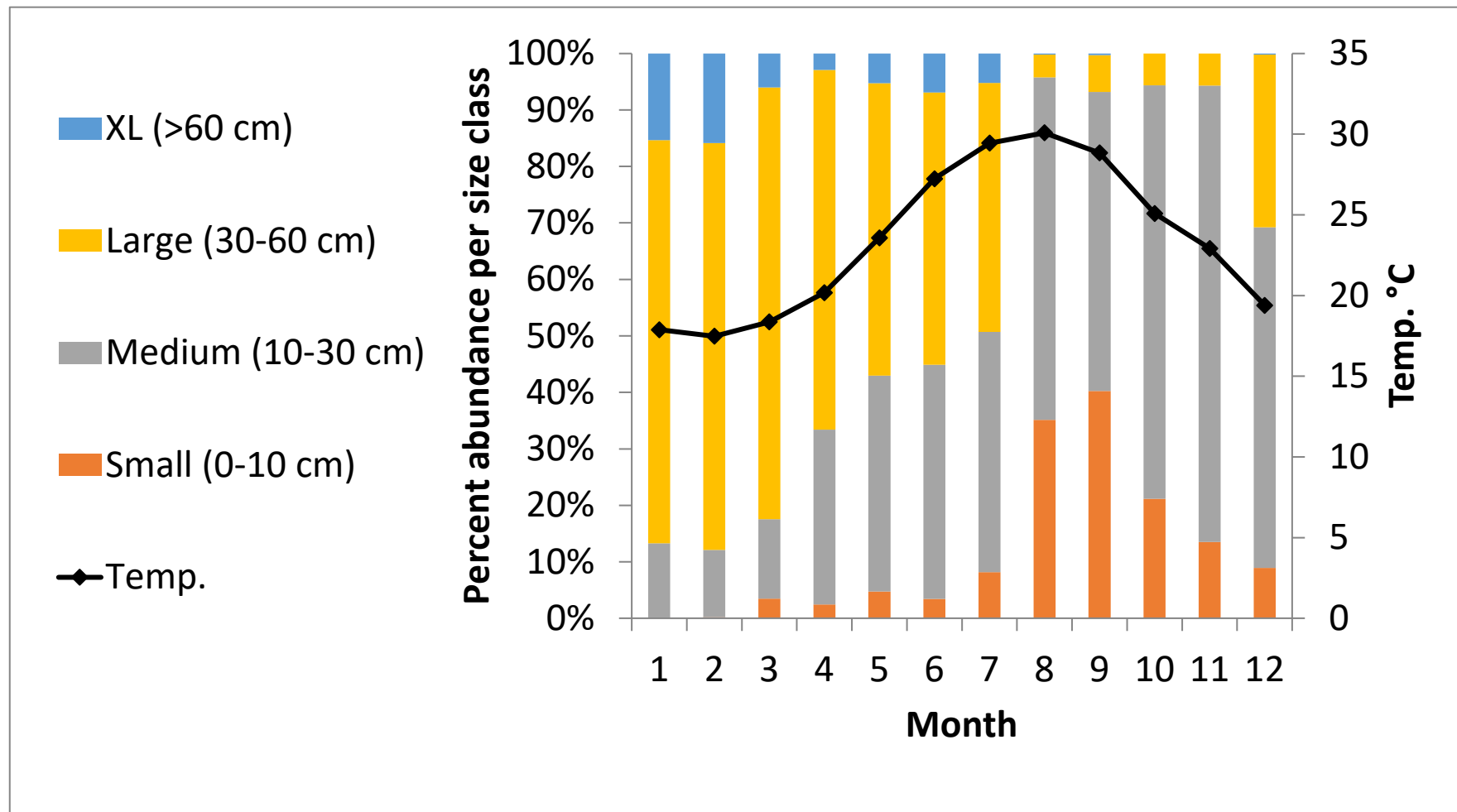
Amazing photo: Shevy Rothman



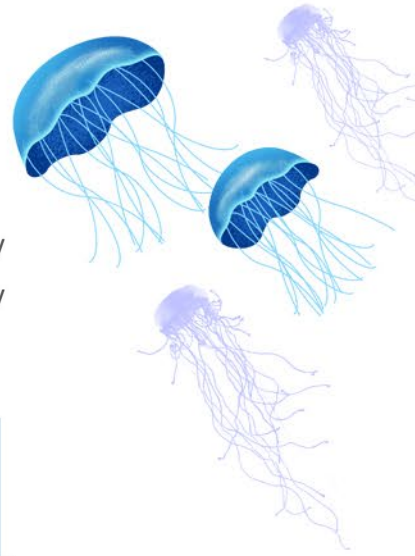


11 years
 >22,000 observations
 >4,600 observers





- Jellyfish Swarm Index – based on 20,000 observations
- July is Jellyfish month, but August is all but empty
- Large interannual differences
- Rhopilema are larger in winter

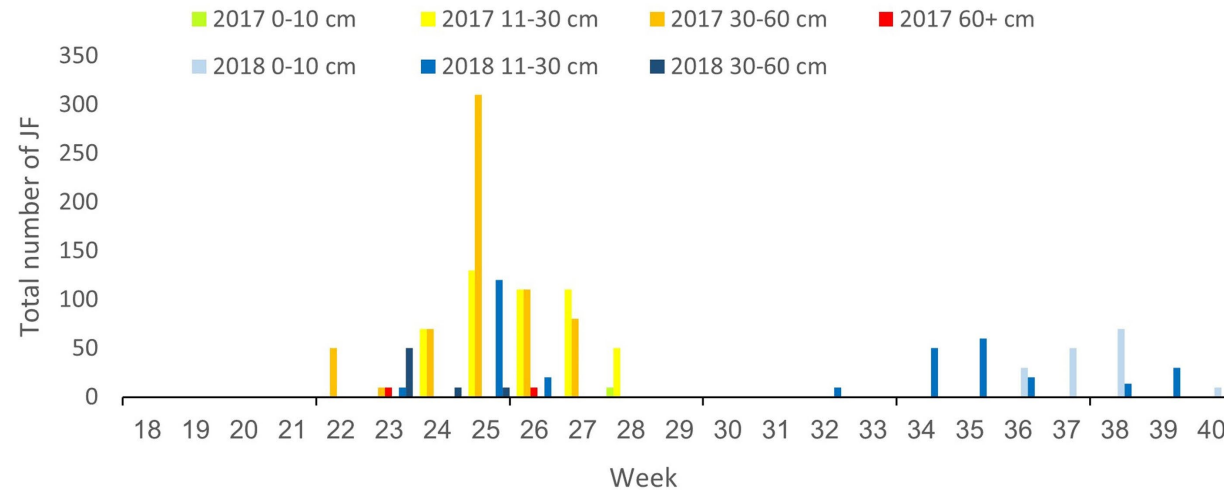
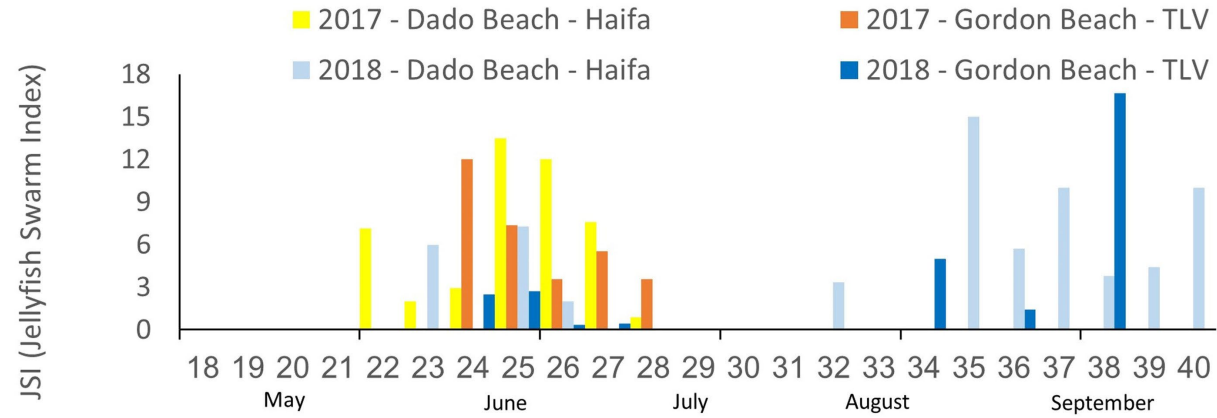


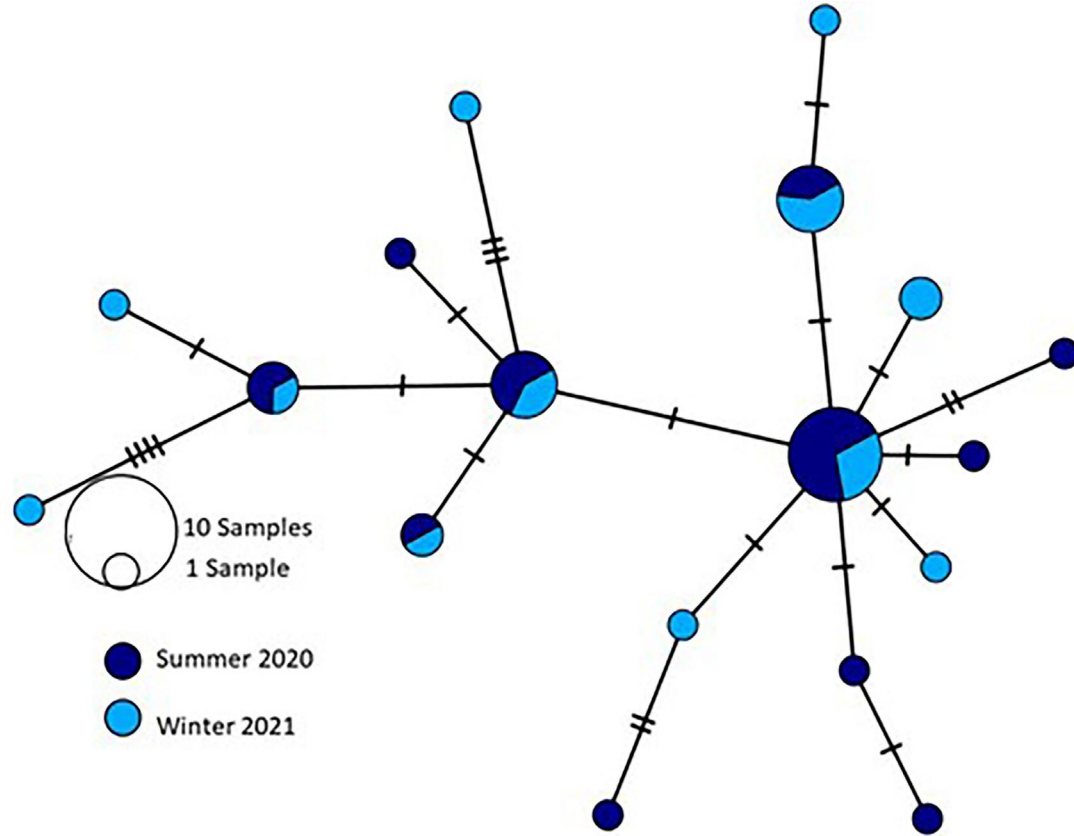
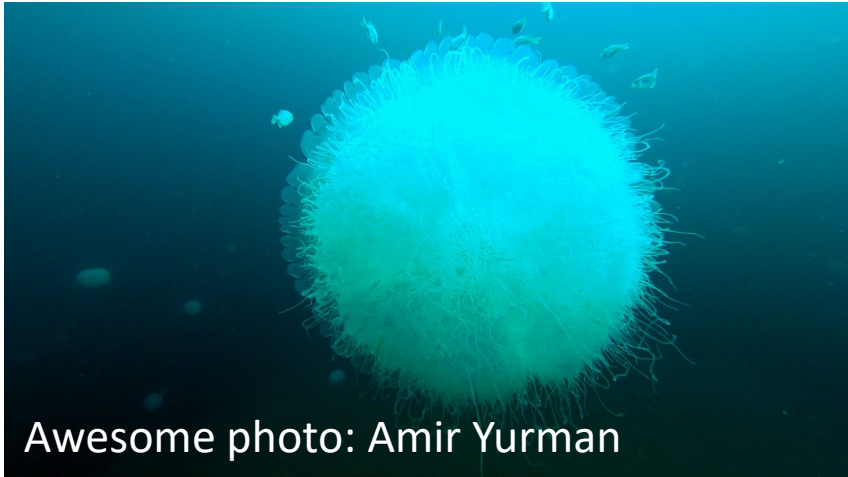
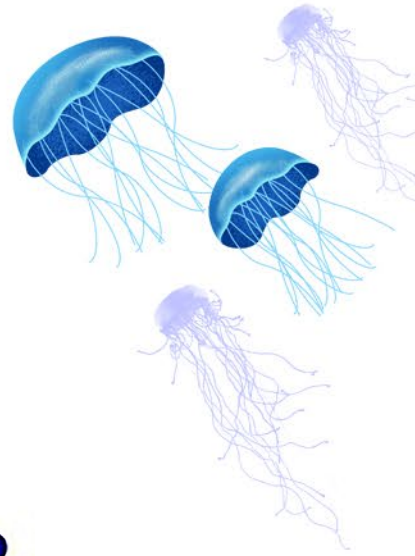
Two beaches

Two bathing seasons

Interannual differences

Temporal > Spatial

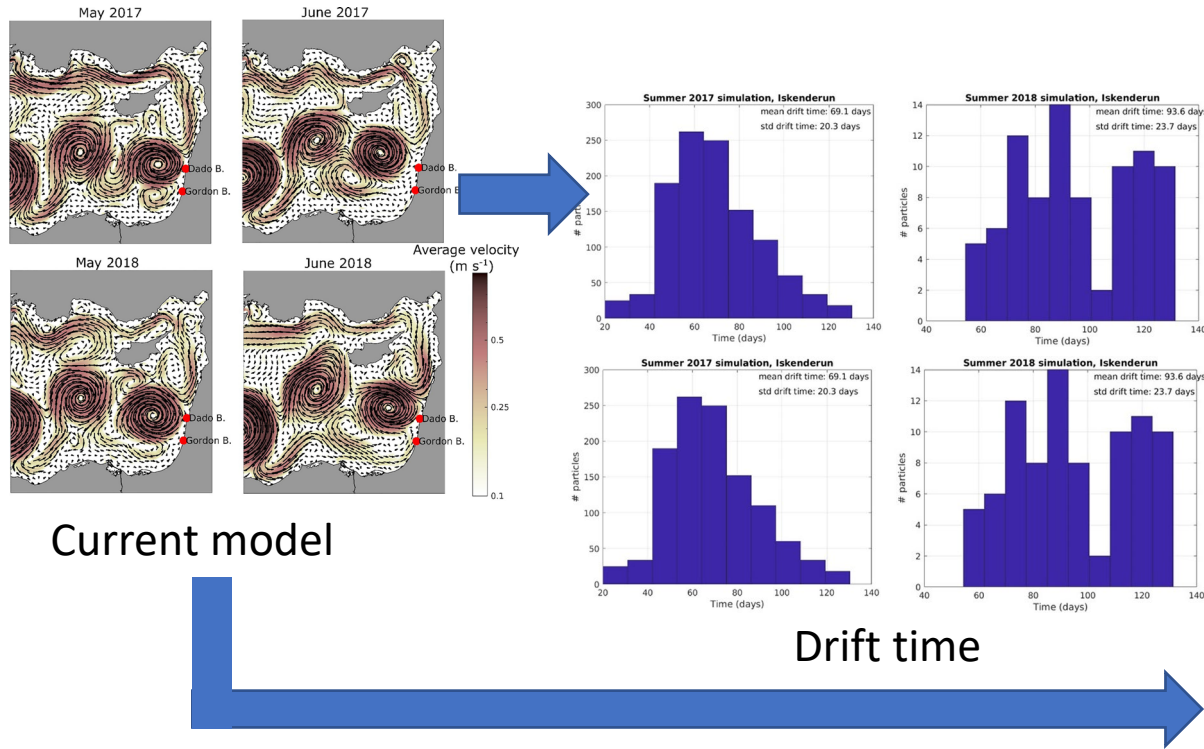




R. nomadica populations exhibited **little temporal or spatial genetic differentiation**, a typical feature of a species that has recently undergone rapid population expansion.



Hindcasting the occurrence and dispersal of *Rhopilema nomadica*



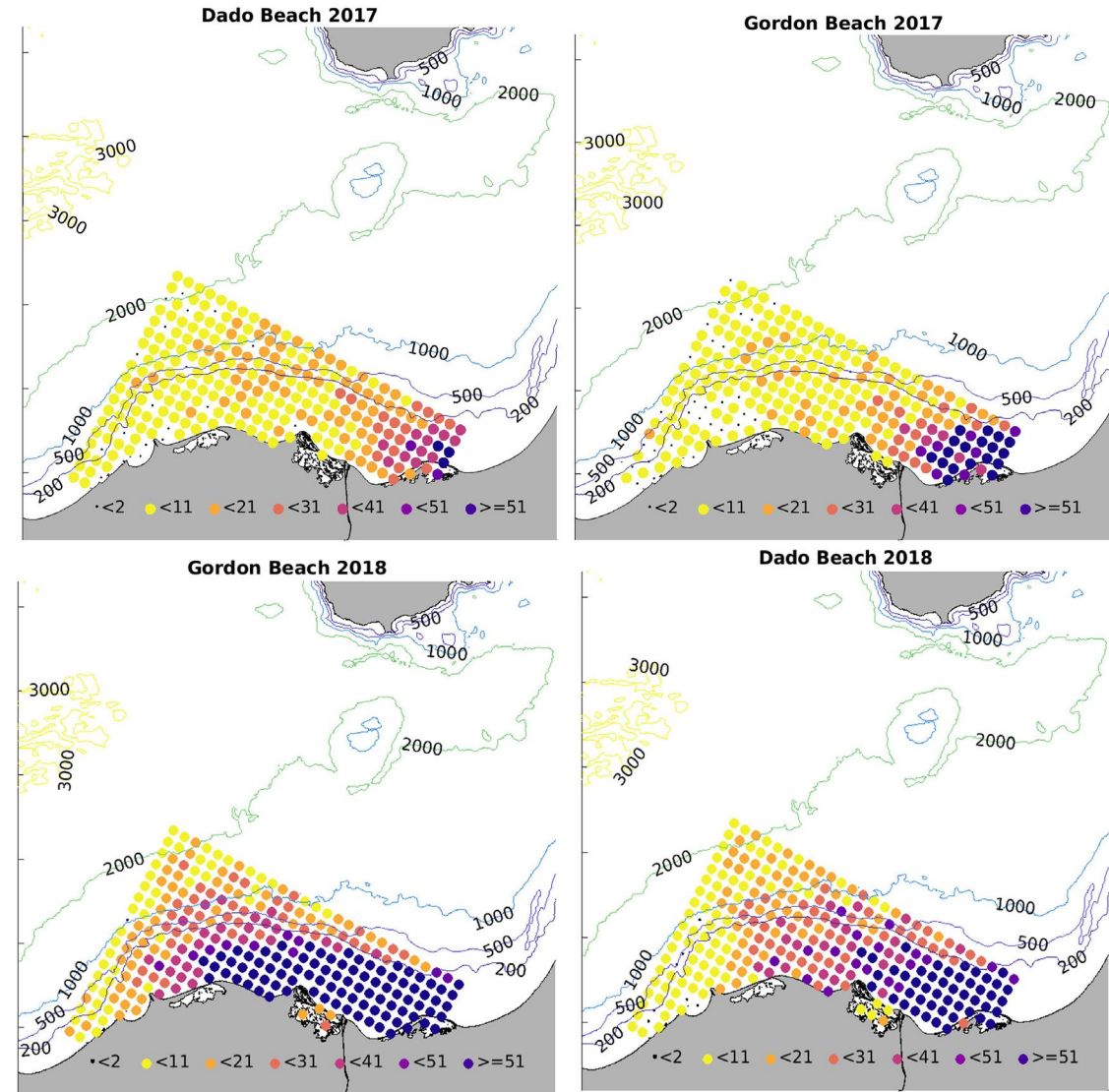
Current model

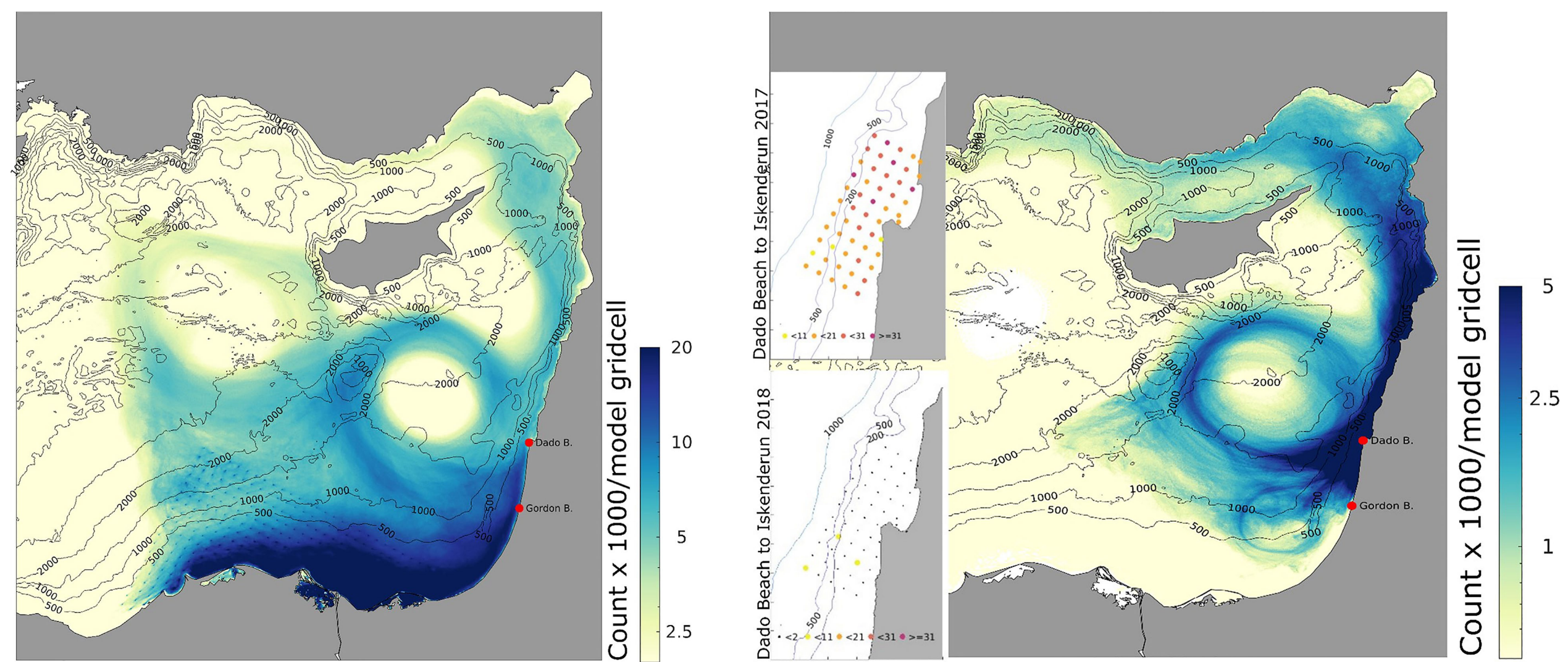
Drift time

the SINMOD model framework has been used to track the movement of passive tracers Released from 8m and 15m depth to the Israeli shores.

SINMOD is a coupled 3D model simulating hydrodynamic and biological processes (see Wassmann et al., 2010).

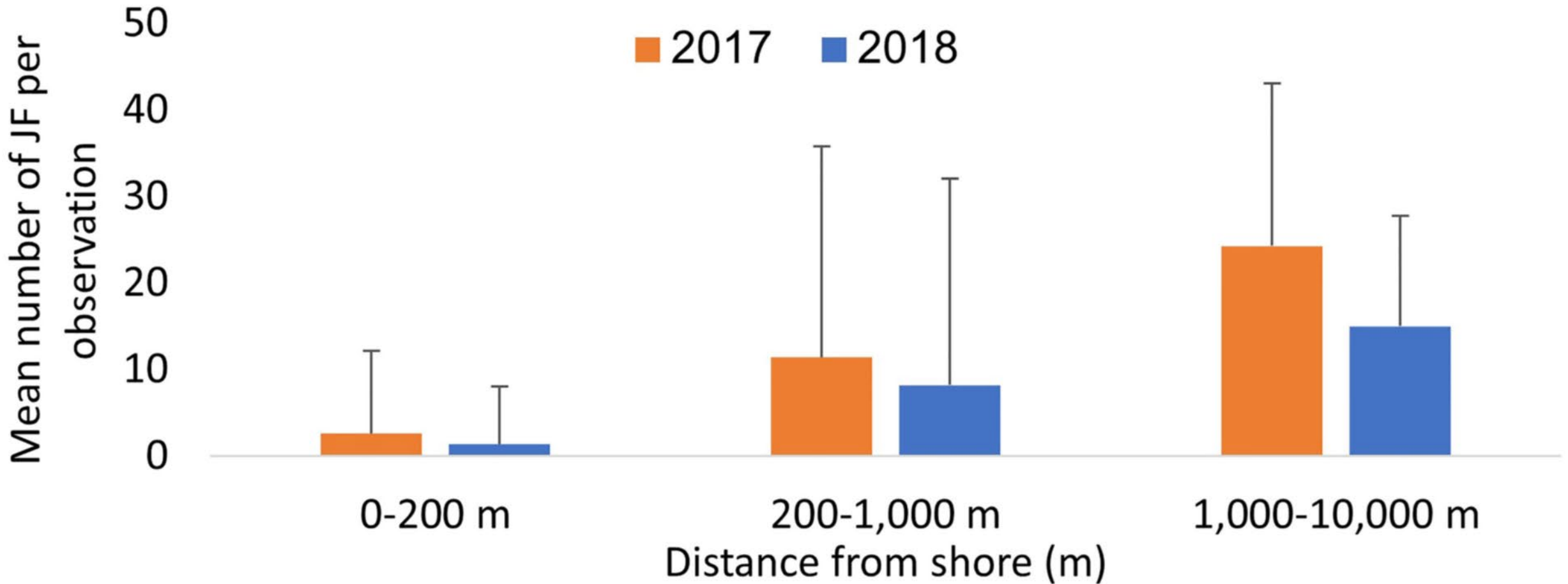
Probable polyp beds





R. nomadica released as ephyrae in early spring were likely to reach target beaches 200-300 km down current within two to three months. Swarms of young adults arrive in the early summer bathing season. They are also likely to enter the gyres, returning as adults in the winter.

Nearshore polyp beds, but offshore transport



The offshore transport, the lack of genetic structure, and the interannual differences in both hydrodynamics and citizen scientist observations, all indicate **decentralized swarm origins**.



R. nomadica swarms take several months to develop and traverse hundreds of kilometers to do so.

Interdisciplinary approaches that incorporate Citizen Science can **provide viable tools to track jellyfish bloom origins.**

Understanding the complexity of jellyfish swarm dynamics supports future management strategies such as **forecasting, preparedness and public education.**

Cool Photo: Shai Agam