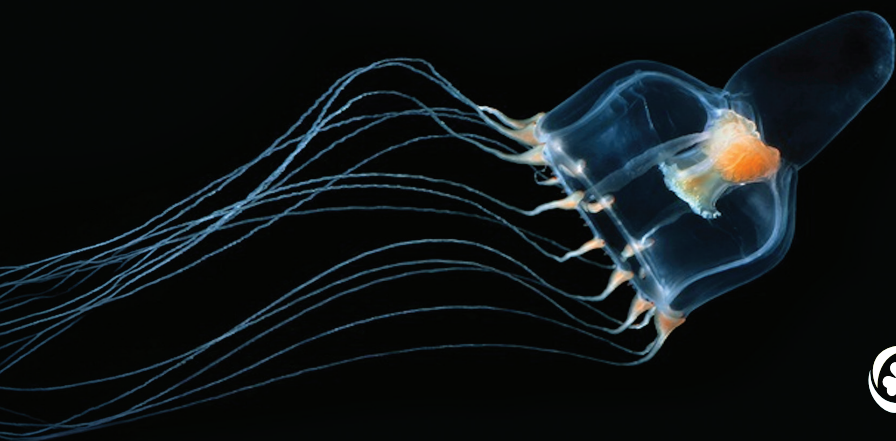
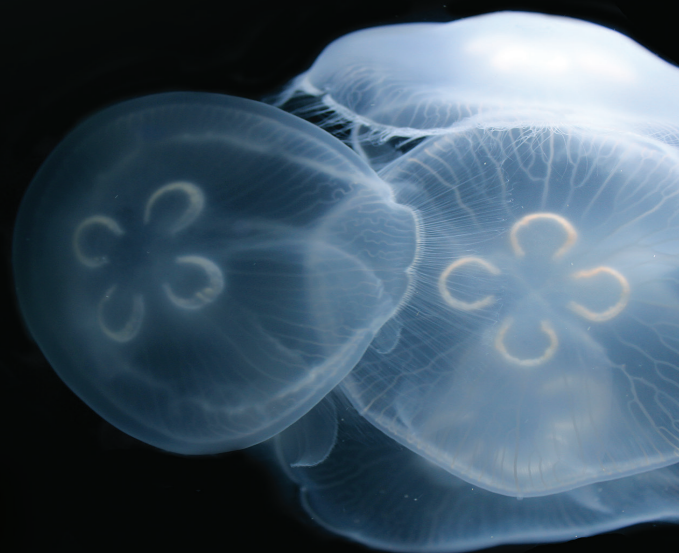
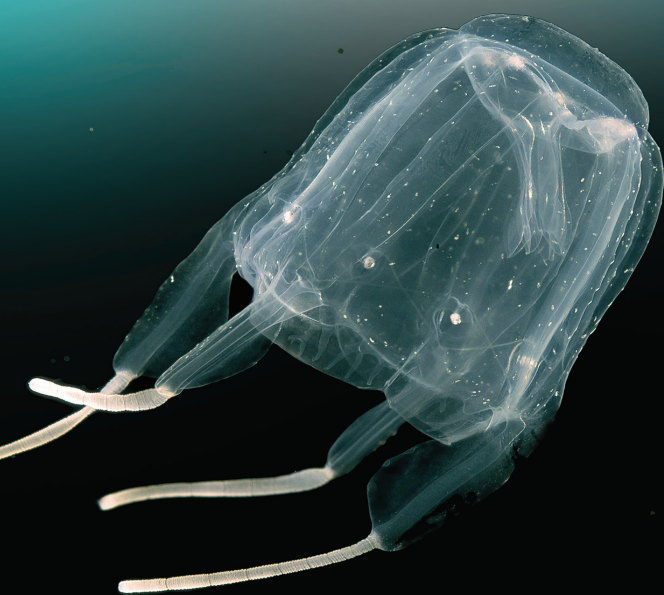
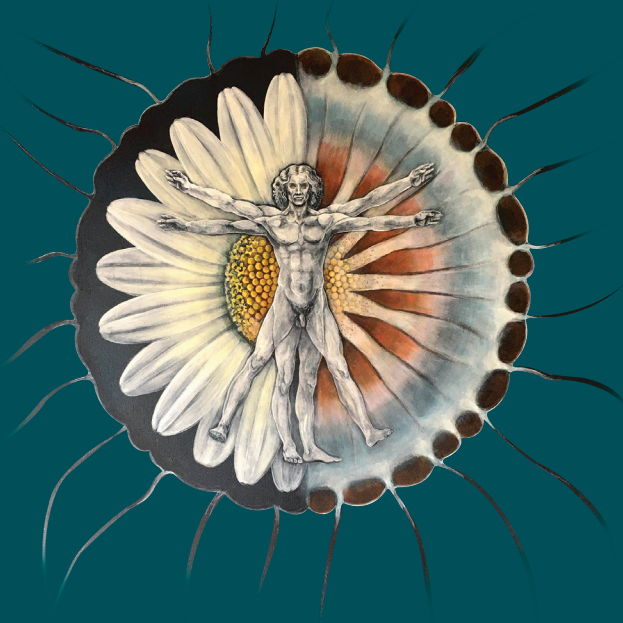




8th International
**Jellyfish
Blooms**
Symposium
Cork | Ireland
2026





Conference Organising Committee

Dr Tom Doyle (Cork, Ireland)

Dr Cathy Lucas (Southampton, UK)

Dr Valentina Leoni (Lecce, Italy)

Dr Mary Beth Decker (New Haven, Connecticut, USA)

Dr Delphine Thibault (Marseille, France)

Dr Andre Morandini (São Paulo, Brazil)

Thanks to our three sponsors



Foras na Mara
Marine Institute

MQWI[®]

Welcome Message

Fáilte and welcome to Cork for the 8th International Jellyfish Blooms Symposium. We are very excited to see you here in Cork and very much look forward to meeting everyone during the conference over coffee, lunch and hopefully for a pint in one of Cork's many heritage pubs. Please introduce yourself to any of the conference committee if you are new and this is your first JBS!

The number and quality of abstracts submitted has made our task of selecting oral talks extremely challenging. Hence this year, we have opted for 10 minutes talks (in line with many other international conferences) to squeeze more in. We also know that many of you are keen to present your research as posters, so we are very excited to have an excellent poster session on the Wednesday evening with plenty of finger food and wine to help with lively discussions. We have included plenty of coffee breaks and mini breaks in the timetable to make sure you are alert and keen to ask a question or two.

Our conference dinner will be on the Thursday in the Kingsley Hotel. We will have a BBQ with drinks and views of the River Lee. And on Tuesday night, some of our colleagues will participate in a 'Pint of Science' at Old Oak pub to engage with the public. Our cultural trip on Friday is another opportunity for you to mingle with your JBS colleagues and to learn about Irish history and heritage as we visit Blarney Castle, Cobh town and the Midleton Distillery.

After the conference, we hope you have a chance to visit some of the attractions in Cork city, or further afield. If you are looking for to see some jellyfish, we recommend heading to Glengarriff or Baltimore and go out on a wildlife boat tour. Now is a good time to see *Chrysaora hysoscella*, *Aurelia aurita*, and *Cyanea lamarckii*.

Finally, we would like to thank our sponsors (Failte Ireland, the Marine Institute, and MOWI Ireland) for supporting our conference and making it viable.

Is mise le meas (yours sincerely),

Tom & Cathy (JBS8 co-hosts)

Overview of symposium

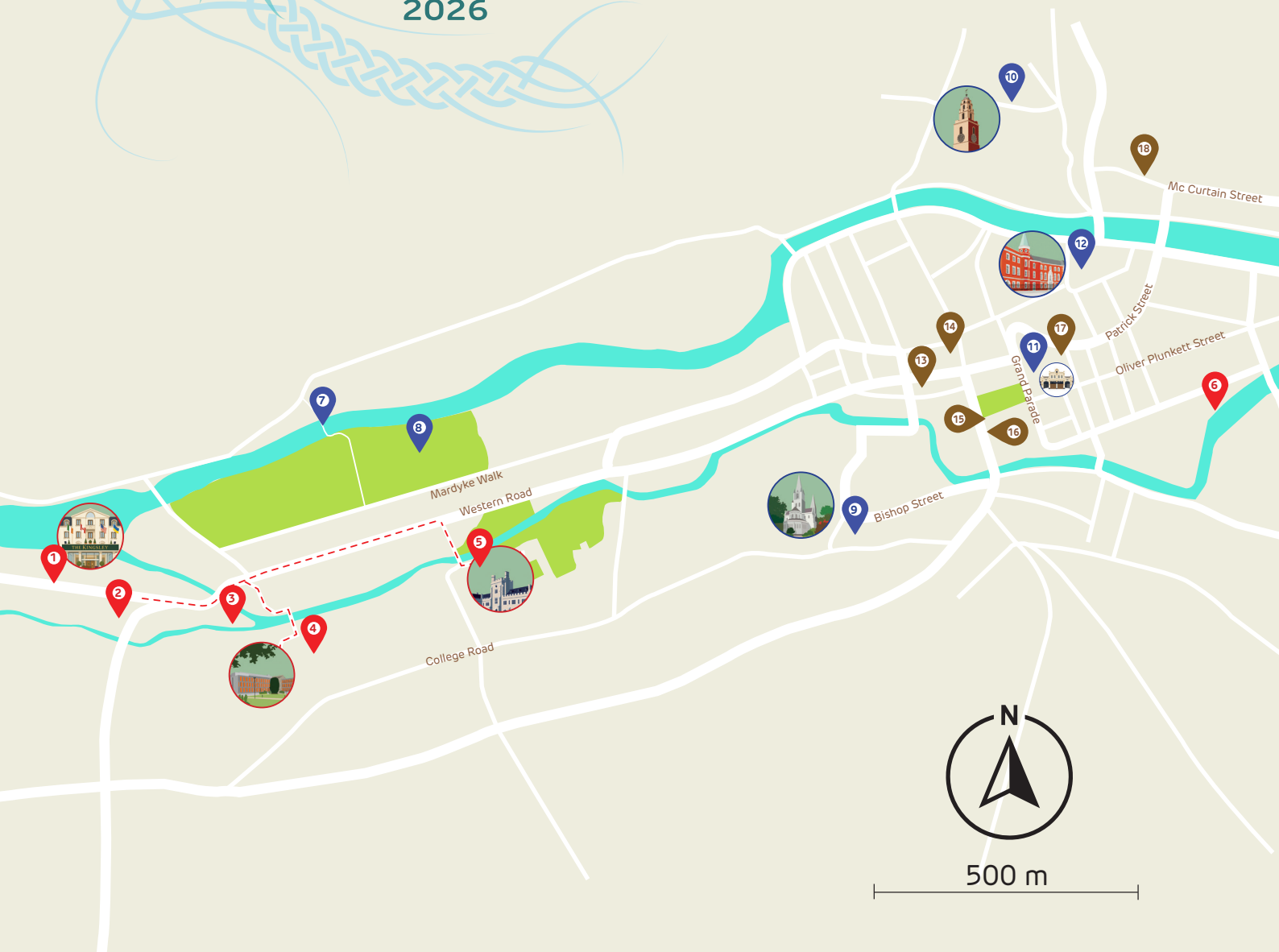
	29th June	30th June	1st July	2nd July	3rd July
08.00		WELCOME DESK	WELCOME DESK	WELCOME DESK	
09.00		PLENARY Prof. Kylie Pitt	PLENARY Prof. Aino Hosia	PLENARY Dr Rebecca Helm	
10.00		ORAL SESSION: Population dynamics	ORAL SESSION: Biodiversity and Applied	ORAL SESSION: Role of gelantionous zooplankton	
11.00					
12.00					
13.00		LUNCH	LUNCH	LUNCH	
14.00		ORAL SESSION Changing oceans	ORAL SESSION Monitoring gelantionous zooplankton	ORAL SESSION General	
15.00					
16.00		OPEN DISCUSSION		DISCUSSION & CLOSING	
17.00			POSTER SESSION (with finger food & drinks)		
18.00					
19.00	WELCOME RECEPTION Aula Maxima music and science/art talk by Prof. Alenka Malej	PINT OF SCIENCE public event 		CONFERENCE DINNER at Kingsley Hotel	
20.00					
21.00					

Cultural trip to Blarney Castle, Cobh (seaside town) and Midleton Distillery (optional)





8th International
**Jellyfish
Blooms**
Symposium
Cork | Ireland
2026



Symposium accomodation and venues

- 1 Kingsley Hotel
- 2 Crow's Nest accommodation
- 3 Victoria Mills accommodation
- 4 Brookfield Complex
- 5 The Quad (Aula Maxima)
- 6 Premier Inn

Local visitor attractions

- 7 Shakey Bridge
- 8 Fitzgerald Park
- 9 Saint Finbarre's Cathedral
- 10 Shandon Tower and Bells
- 11 English market
- 12 Crawford Art Gallery

Recommended pubs

- 13 Costigans
- 14 Castle Inn
- 15 The Oval
- 16 An Spailpín Fánach
- 17 Mutton Lane
- 18 Sin É

Conference information

VENUE

The conference is based in University College Cork, with all talks taking place in the Brookfield Complex. The poster session will also take place in this venue (upstairs). The welcome reception will take place in the *Aula Maxima* room (The Great Hall) of the Quadrangle Building. See map previous page.

CONFERENCE DINNER

The conference dinner (and celebration) will take place in the Kingsley Hotel from 7 pm on Thursday 2nd July. Tickets for the dinner must have been purchased in advance during registration. We very much look forward to seeing you at the conference dinner. The dinner will be a buffet style BBQ.

STUDENT PRIZES

There will be 5 prizes for the best oral presentations and 5 prizes for the best poster presentations.

SOCIAL MEDIA

We encourage you to share your thoughts, experiences, photos, questions and selfies over the week using

<https://www.instagram.com/jbs8.cork/#>

<https://www.facebook.com/p/8th-Jellyfish-Bloom-Symposium-61583962120251/>



Maude Delap was a self-taught Irish marine biologist that carried out pioneering research on jellyfish in the late 1800s & early 1900s. She cultured *Chrysaora hysoscella* and *Pelagia noctiluca* in her house to work out their life cycle. For more info: <https://www.discoveriveragh.ie/initiatives/finding-maude-delap>

Day 1 | Monday 29th June 2026

18:30 – 21:00 | WELCOME RECEPTION

Opening with traditional Irish music and dancers and general welcome by the Organising Committee. Food (hot and cold canapes) and drinks (red and white wine) will be served. The reception will take place in the *Aula Maxima* room - The Great Hall of the Quadrangle Building in UCC. (See map previous page).

PLENARY TALK

Reimagining Medusa: Myth, Metaphor, and the Role in Marine Systems - Prof. Alenka Malej, National Institute of Biology, Slovenia

Socialising with traditional music playing in the background



Day 2 | Tuesday 30th June 2026

08:00 – 09:00 | WELCOME DESK

09:00 – 09:30 | PLENARY:

Changing the narrative around gelatinous zooplankton population trends

Prof. Kylie Pitt, Griffith University, Australia

09:30 – 13:00 | Session 1:

Population dynamics including life histories and polyp biology

1 09:30 – 09:40 | PAKHOMOV:

Year-round reproduction and overwintering in *Salpa thompsoni* south of the Antarctic Polar Front

2 09:40 – 09:50 | MUELLER:

Overlapping sexual reproduction accelerates bloom formation in salps

3 09:50 – 10:00 | DA SILVA-RODRIGUES:

Oceanographic drivers and phytoplankton size structure shape thaliacean assemblages (Chordata, Thaliacea) in oceanic areas of the subtropical Southwestern Atlantic (22°S–33°S)

4 10:00 – 10:10 | LING:

Environmental drivers of jellyfish community patterns in the Singapore and Johor Straits

5 10:10 – 10:20 | DONG:

Blooming potential base on spatiotemporal distributional pattern and the contribution of sexual and asexual reproduction of the giant jellyfish *Nemopilema nomurai* in Bohai Sea

6 10:20 – 10:30 | MALONEY:

Strobilation after 10 years: uncovering the process initiating jellyfish metamorphosis from polyp to ephyra

10:30 – 11:00 BREAK: Tea and coffee

Day 2 continued

7 11:00 – 11:10 | VICENTE-RÍOS:

Life history of the thermophilic hydroid *Pennaria disticha* Goldfuss, 1820 (Cnidaria, Hydrozoa) in a Mediterranean coastal lagoon as a model scenario for global warming scenario

8 11:10 – 11:20 | ANGEL:

Statoliths of *Rhopilema nomadica* and estimation of medusan age

9 11:20 – 11:30 | DROR:

Chemical and physical interactions affecting swarm formation and coherence in the jellyfish *Rhopilema nomadica*

10 11:30 – 11:40 | SUZUKI:

Long-term population dynamics of *Aurelia coerulea* in Maizuru Bay: year-round persistence, collapse, and recovery

11 11:40 – 11:50 | BRANDWOOD:

Untangling and describing the life cycles of *Chrysaora quinquecirrha* and *Chrysaora chesapeakei*

12 11:50 – 12:00 | BOLOGNA:

Who needs sex? Clonal pathways in the clinging jellyfish, *Gonionemus vertens*

12:00 – 12:10 | MINI BREAK

13 12:10 – 12:20 | SUN:

The regulating role of benthic ecosystems in jellyfish outbreaks

14 12:20 – 12:30 | MEFFRE:

Divergent developmental strategies in jellyfish polyps exposed to seasonal temperature variability and marine heatwaves

15 12:30 – 12:40 | GESON:

Asexual reproduction and survival of *Aurelia* sp. polyps from the Philippines across a tropical thermal range

Day 2 continued

16 12:40 – 12:50 | TAKAUCHI:

Environmental adaptation and population formation history of *Aurelia coerulea* that produce large planulae

17 12:50 – 13:00 | GIMENEZ:

Caught in a risky choice: predator cues deter larval settlement in *Aurelia coerulea*

13:00 – 14:00 | LUNCH

14:00 – 16:20 | Session 2:

Gelatinous zooplankton in changing oceans

18 14:00 – 14:10 | GUY-HAIM:

Invasional meltdown: Invasive jellyfish may facilitate non-indigenous fish dominance

19 14:10 – 14:20 | TIRELLI:

Blooming in a new garden: the case of *Mnemiopsis* in the Northernmost Mediterranean lagoon.

20 14:20 – 14:30 | COLLAZO PAGÁN:

Jellyfish bloom events in the northern Gulf of Mexico: Hypoxia drivers under climate change

21 14:30 – 14:40 | ESKE:

Zooplankton distribution in a seasonal oxycline: Do certain hydromedusae fare better in hypoxia?

22 14:40 – 14:50 | VERHAEGEN:

The Pacific Gateway Paradox: Biogeographical contraction and niche restriction of Arctic soft-bodied zooplankton

14:50 – 15:20 | BREAK: Tea and coffee

Day 2 continued

23 15:20 – 15:30 | DETSCH:

16 years of Arctic gelatinous zooplankton seasonality

24 15:30 – 15:40 | IVÁN BARAGAÑO:

Seasonal and latitudinal dynamics of neuston in the Northeast Atlantic (2014-2025)

25 15:40 – 15:50 | SALVANES:

Periphylla periphylla in the mesopelagic ecosystem of deep west Norwegian fjords

26 15:50 – 16:00 | HOUGHTON:

From echoes to isotopes: Jellyfish and predators in the mesopelagic

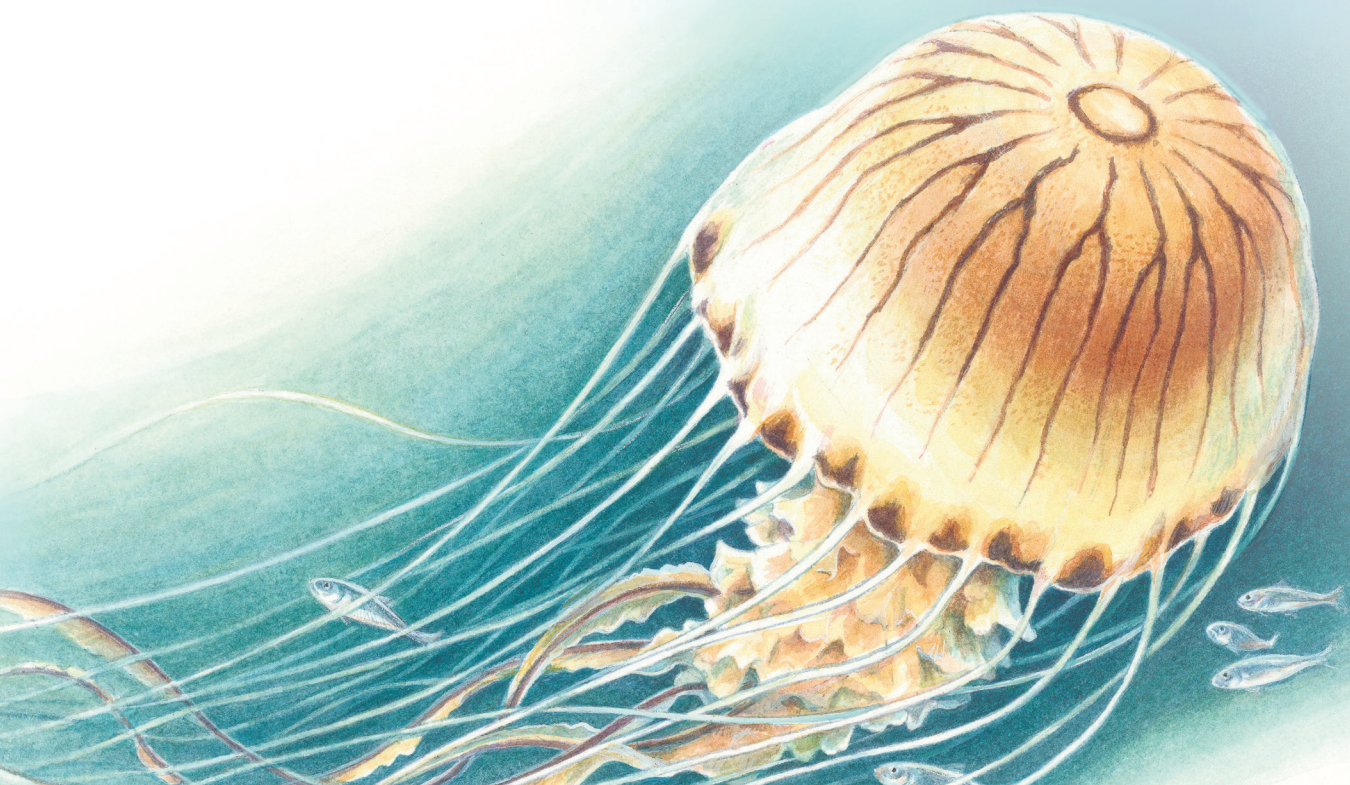
27 16:00 – 16:10 | FERNÁNDEZ-ALÍAS:

Revisiting scyphozoan jellyfish blooms: challenges and future of the topic

28 16:10 – 16:20 | FLEMING:

From nuisance to nexus: What twenty years of jellyfish research tells us and what it still can't

16:20 – 17:00 | DISCUSSION



Day 3 | Wednesday 1st July 2026

08:00 – 09:00 | **WELCOME DESK**

09:00 – 09:30 | **PLENARY:**

A decade of reference sequencing jellies

Prof. Aino Hosia, University of Bergen, Norway

09:30 – 13:00 | **Session 3:**

Advancements in studying biodiversity in all ecosystems and functional biology, using traditional and or molecular techniques

29 09:30 – 09:40 | **SOTO-ANGEL:**

Connecting life stages: revisiting life cycle, species diversity and phylogenetic position in understudied hydromedusae

30 09:40 – 09:50 | **FERNÁNDEZ-ZAPATA:**

Gelatinous zooplankton in oceanic regions of the Southeastern Pacific Ocean

31 09:50 – 10:00 | **EPINOUX:**

Structured reorganization of jellyfish communities: nestedness dominates assemblage shifts in a homogenizing Mediterranean Sea

32 10:00 – 10:10 | **TRABONI:**

Mediterranean gelatinous zooplankton: an updated snapshot of diversity, seasonality, and recent changes

33 10:10 – 10:20 | **TROCHANOWSKA:**

Blackwater diving illuminates biodiversity and ecology of siphonophores in the Gulf Stream

34 10:20 – 10:30 | **RAJ:**

Reevaluating bipolarity: *Dimophyes arctica* (Chun, 1897) as a case study

10:30 – 11:00 | **BREAK: Tea and coffee**

Day 3 continued

35 11:00 – 11:10 | MAÑKO:

Integrating mitogenomes, morphology, and ecology to resolve diversity in deep-sea *Bargmannia* siphonophores

36 11:10 – 11:20 | IAKOVLEVA:

Parasitism in gelatinous zooplankton across the Red Sea-Mediterranean region: first evidence and invasion-related patterns

37 11:20 – 11:30 | NAGATSUKA:

Simple population structure of *Aurelia* in oceanic island in contrast to higher diversity in island arc

38 11:30 – 11:40 | SUN:

Reproductive strategies and ecological adaptability of four scyphozoan species (*Rhopilema esculentum*, *Nemopilema nomurai*, *Aurelia coerulea* and *Cyanea nozakii*) in northern China

39 11:40 – 11:50 | STRAEHLER-POHL:

Chironex hemipristis sp. nov. (Cubomedusae, Chiropsopida, Chiropsopidae) and *Chiropsella bianchia* sp. nov. (Cubomedusae, Chiropsopida, Chiropsellidae) - two new, supposedly dangerous box jellyfish from Mozambique waters as part of the cubozoan collection of IIOE-2

40 11:50 – 12:00 | LICANDRO:

The importance of gelatinous zooplankton in the Canary Current Large Marine Ecosystem (CCLME) trophic web

12:00 – 12:10 | MINI BREAK



Day 3 continued

12:10 – 13:00 | Session 4:

Applied jellyfish research, including human interactions techniques

41 12:10 – 12:20 | HALLAREN:

Key identifiable characters of pelagic hydrozoans affecting aquaculture in the northeastern Atlantic: implications for microscopy- and image-based monitoring

42 12:20 – 12:30 | MARTELL:

Challenges to finfish aquaculture from *Apolemia* and other hydromedusae and siphonophores in the Northeastern Atlantic Ocean

43 12:30 – 12:40 | KIM:

Development and achievement of precautionary management of jellyfish blooms in Korea

44 12:40 – 12:50 | VANG:

The GLObecc Project: Jellyfish at a North Atlantic crossroad — Biodiversity baseline and reference database for Faroese waters

45 12:50 – 13:00 | FENG:

Photocatalytic degradation of jellyfish polyps: A sustainable approach to combat jellyfish blooms

13:00 – 14:00 | LUNCH



Day 3 continued

14:00 – 16:20 | **Session 5:**

Advances in monitoring, modelling and prediction

46 14:00 – 14:10 | MA:

An integrated monitoring–forecasting–mitigation framework for hazardous jellyfish in China’s coastal service zones

47 14:10 – 14:20 | PONZO:

Exploring *Rhizostoma pulmo* trajectories in a Mediterranean lagoon using electronic tagging

48 14:20 – 14:30 | LEÓN-COBO:

A modelling-based analysis of physical forcings influencing *Pelagia noctiluca* in the Balearic Archipelago

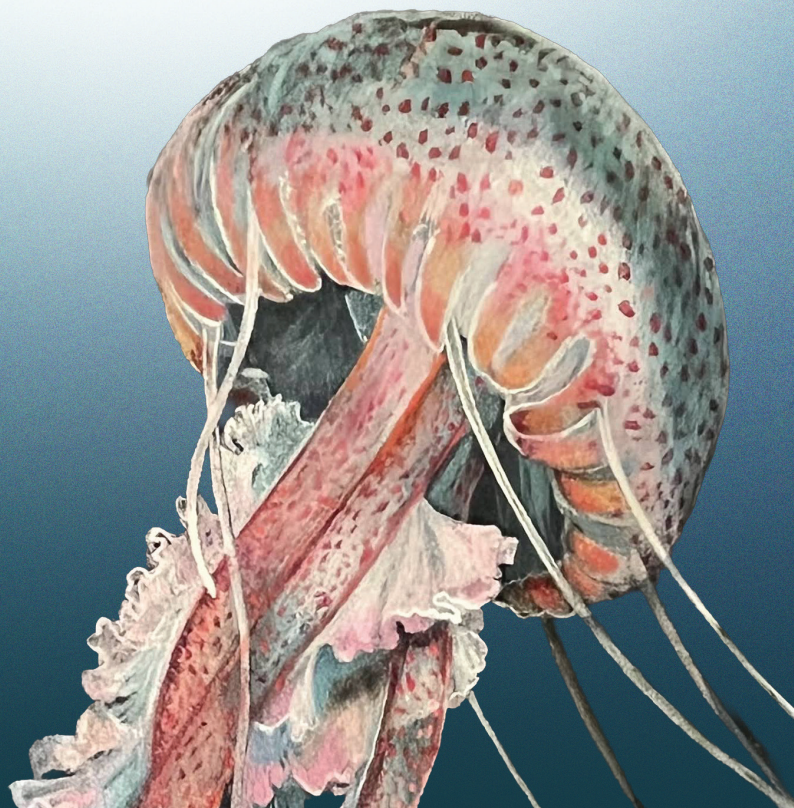
49 14:30 – 14:40 | CASTELBAJAC:

A flow map approach for visualizing uncertain jellyfish trajectories

50 14:40 – 14:50 | GUERCHON:

Testing behavioural plasticity of *Physalia utriculus* to key environmental drivers

14:50 – 15:20 | BREAK: Tea and coffee



Day 3 continued

51 15:20 – 15:30 | **DECKER:**

Tracing pathways: Understanding movement dynamics of the surface-dwelling siphonophore *Physalia physalis* in the northwest Atlantic Ocean

52 15:30 – 15:40 | **ACUÑA-FERNÁNDEZ:**

Physalia: A project on the evolution of biological sailing

53 15:40 – 15:50 | **CAPEÁNS GARCÍA:**

Environmental and geographic drivers of *Physalia physalis* strandings

54 15:50 – 16:00 | **ÁLVAREZ-TRASOBARES:**

Spatial and morphological drivers of *Physalia physalis* strandings on Spanish beaches

55 16:00 – 16:10 | **PRIETO:**

Atmospheric and oceanographic conditions during summer 2019 on the occurrence of Portuguese Man-o-War along the southern Iberian coasts

56 16:10 – 16:20 | **PEREZ:**

The dynamics of jellyfish swarms: from a Lagrangian to a mean-field kinetic model

16:20 – 16:30 MINI BREAK



Day 3 continued

57 16:30 – 16:40 | LEWIS AMES:

Introducing *Chironex blakangmati*, a new species of venomous box jellyfish from Singapore and the range extension of the Thai sea wasp *C. indrasaksajiae*

58 16:40 – 16:50 | VODOPIVEC:

PleagialBM: Uncovering the distribution of *Pelagia noctiluca* in the Mediterranean Sea with an individual-based model

59 16:50 – 17:00 | PERHARIČ BAILEY:

Coupling gelatinous zooplankton sinking speed to its surface-area based decay exposes overestimation in deep-sea particle-mediated carbon export

17:00 - 19:30 | POSTER SESSION

with finger food and wine



Day 4 | Thursday 2nd July 2026

08:00 – 09:00 | WELCOME DESK

09:00 – 09:30 | PLENARY:

Adrift on the high seas: the ecology and biology of cnidarians on the ocean's surface

Dr Rebecca Helm, Georgetown University, USA

09:30 – 13:00 | Session 6:

Role of gelatinous zooplankton in ecosystems, including trophic interactions, the biological carbon pump, and neuston

60 09:30 – 09:40 | DALY YAHIA:

Gelatinous zooplankton diversity, distribution patterns and ecological niches in Qatar's pelagic ecosystems

61 09:40 – 09:50 | VON MONTFORT:

Small jellyfish, large consequences: the overlooked predatory role of hydromedusae in subtropical estuarine ecosystems

62 09:50 – 10:00 | CAILLIER:

Feeding impacts and metabolic rates of the hydromedusae, *Bougainvillia carolinensis*, in the North Inlet Estuary

63 10:00 – 10:10 | HUNT:

Observation of unprecedented biomass of *Chrysaora melanaster* in the open ocean sub-Arctic northeast Pacific and its ecosystem effects

64 10:10 – 10:20 | JORDANO:

The role of epidermal cilia in fluid biomechanics and suspension feeding in scyphozoan medusae

65 10:20 – 10:30 | FUMAROLA:

Trophic role of the jellyfish *Rhizostoma pulmo* (Cnidaria: Scyphozoa) in the Gulf of Taranto (southern Italy)

10:30 – 11:00 | BREAK | Tea and coffee

Day 4 continued

66 11:00 – 11:10 | VONDERBANK:

Niche overlap of three sympatric jellyfish species in coastal Newfoundland, Canada

67 11:10 – 11:20 | LINCOLN:

Interactions between fishes and gelatinous zooplankton in the Irish Sea - exploring the “gingerbread house” hypothesis

68 11:20 – 11:30 | CHI:

Beyond quantity: Food quality links the causes and consequences of jellyfish blooms

69 11:30 – 11:40 | ASHPEL MANO:

Spatio-temporal assessment of jellyfish bloom assemblages and perception-based evaluation of gear-specific fisheries impacts along the Maharashtra coast, India

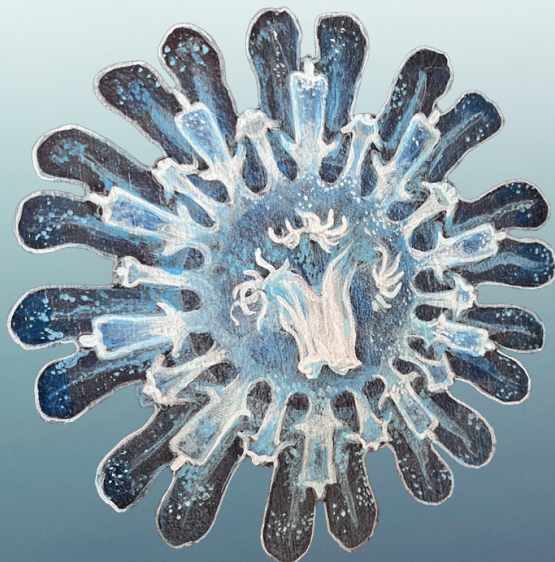
70 11:40 – 11:50 | MOREJÓN-ARROJO:

Jelly in the belly: A global network analysis of marine vertebrates as predators of gelatinous zooplankton

71 11:50 – 12:00 | SCHAUB:

Rapid gut evacuation offsets low nutritional content of jellyfish in medusivorous fish

12:00 – 12:10 | MINI BREAK



Day 4 continued

72 12:10 – 12:20 | MOTTA:

The Gulf of Trieste, a hotspot for gelatinous zooplankton and their digenean parasites?

73 12:20 – 12:30 | KOGOVSEK:

Metazoan associations of the invasive ctenophore *Mnemiopsis leidyi*: implication for reproduction and spillback potential

74 12:30 – 12:40 | YU:

Salinity and food selectivity regulate the survival and development of *Nemopilema nomurai* from fertilized eggs to polyps

75 12:40 – 12:50 | STEINWORTH:

Cellular immune responses at multiple scyphozoan life stages

76 12:50 – 13:00 | YANAGIHARA:

Beyond the Burn: identifying and resolving core controversies in jellyfish sting management

13:00 – 14:00 | LUNCH

14:00 – 16:20 | Session 7: General session

77 14:00 – 14:10 | IWANICKI:

Jelly or junk: neuston and sensory traps on the sea surface

78 14:10 – 14:20 | ZHANG:

Effects of temperature on the growth and biochemical composition of *Aurelia coerulea*

79 14:20 – 14:30 | BROTZ:

Jelly catches are fishy: Data gaps and imponderables in contemporary jellyfish fisheries

80 14:30 – 14:40 | MOSS:

Noncanonical structure of the adult *Mnemiopsis leidyi* tentacular apparatus

Day 4 continued

81 14:40 – 14:50 | BJÖRLING:

Who fried the cultured fish? Hidden diversity in Tubulariidae Goldfuss, 1818 (Hydrozoa) in Northeast Atlantic and Arctic waters

82 14:50 – 15:00 | AVIAN:

Rhizostomeae (Scyphozoa), a phylogenetic comparative analysis of their gastrovascular system

83 15:00 – 15:10 | GIBBONS:

Colonisation of Europe in the tailwinds of Mota, Magellan, Álvares, Fernandes, de Albuquerque, da Gama and Dias.

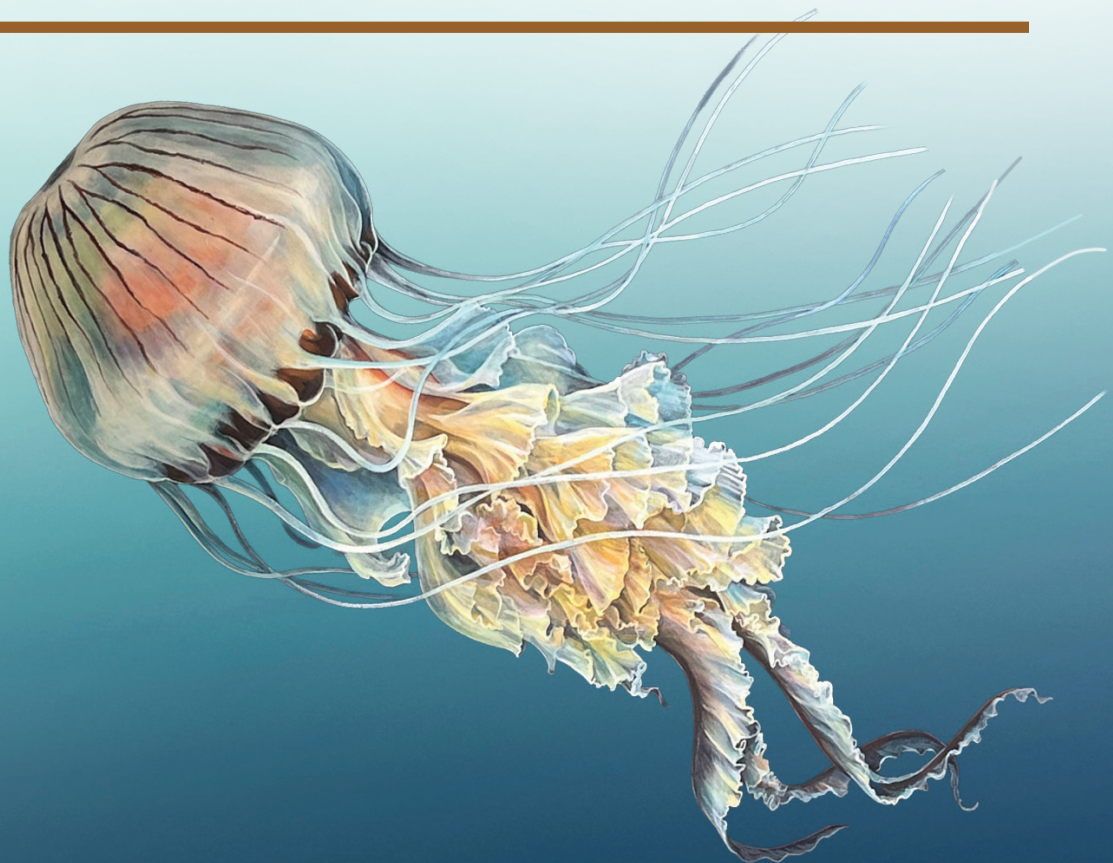
84 15:10 – 15:20 | DAWSON:

A Sea Change for Science: #BetterPublishing

15:20 – 16:00 | BREAK | Tea and coffee

16:00 – 17:00 |

DISCUSSION AND CLOSING



Day 5 | Friday 3rd July 2026

CULTURAL DAY TRIP

09:00: Depart UCC on bus

09:30: Tour of Blarney Castle & Gardens

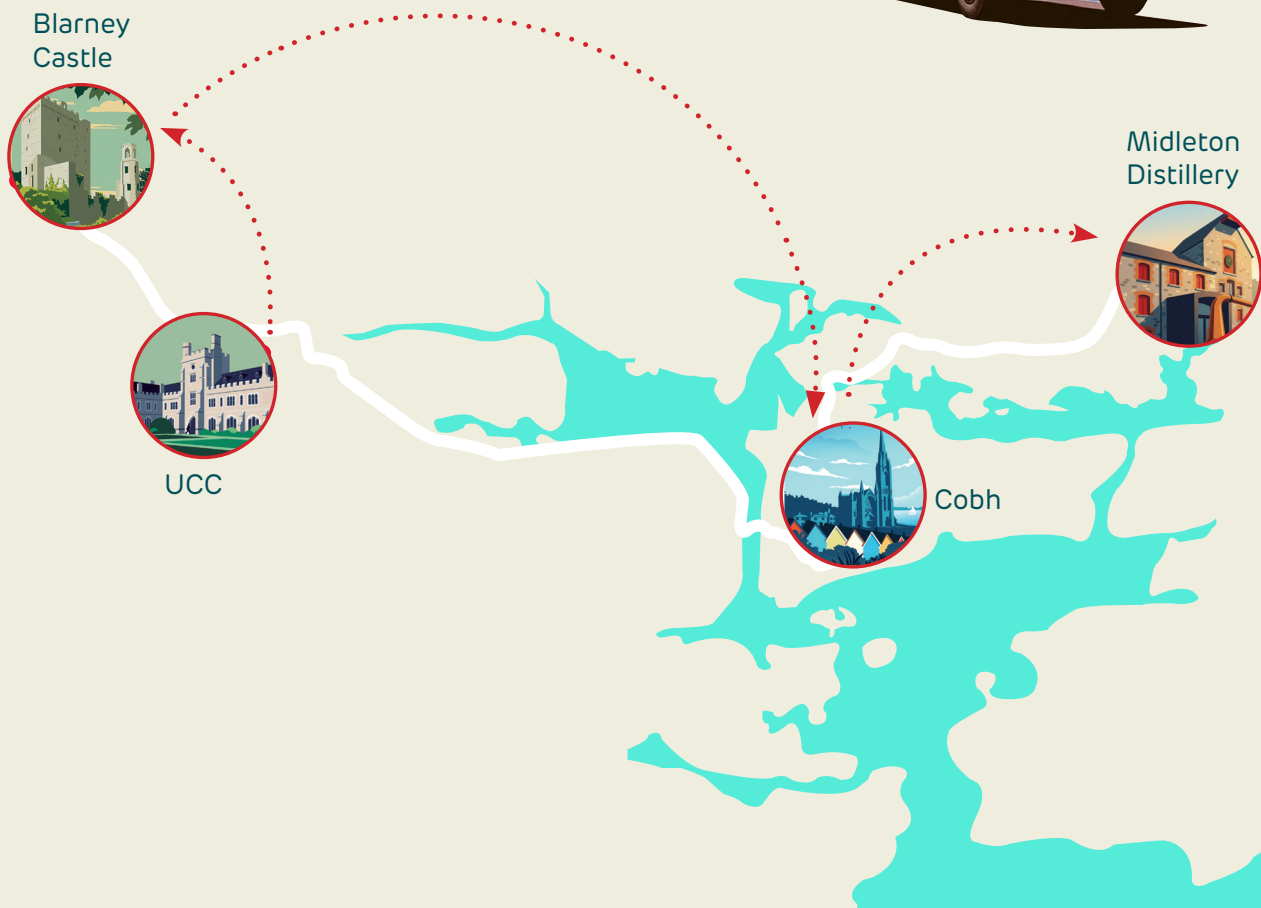
11:30: Depart Blarney on bus

12:15: Self-guided exploration of coastal town of Cobh (& get lunch)

15:00: Depart Cobh on bus

15:30: Tour of Midleton Distillery – home of Jameson whiskey. Tour includes whiskey tasting experience.

17:30: Depart Midleton Distillery on bus to return to Cork city (UCC)



Poster Session

Wednesday 1st July 2026



1 | BJÖRLING:

From noise to names: integrative taxonomy untangles public barcodes for genus *Euphysa*, Forbes 1848 (Hydrozoa: Corymorphidae)

2 | CANDELAS-PEREZ:

Deciphering the life cycle of *Aequorea forskalea*

3 | DETSCH:

High genetic connectivity and hidden diversity in Antarctic midwater Rhopalonematidae (Hydrozoa: Trachymedusae)

4 | HALAY:

Alternative stable states in a temperate freshwater ecosystem with *Craspedacusta sowerbii*

5 | MARTELL:

Hydrozoan jellyfish as intermediate hosts for baccigerid fish parasites (Digenea: Baccigeridae) in the North Sea

6 | COLIN:

Stunning secretions: incapacitating effects of ctenophore mucus across species and prey

7 | MUELLER:

Optimizing non-invasive methods to investigate salp behavior and physiology

8 | DE CASTELBAJAC:

Conformal taxonomic prediction for improving the validation of jellyfish citizen science records

9 | CHAE:

Quantification of the density of *Carybdea brevipedalia* (Cubozoa, Carybdeida) using a light-trap

10 | SUN:

Diel feeding patterns, prey selectivity, and predatory impact of the box jellyfish *Carybdea brevipedalia* (Cubozoa, Carybdeida)

11 | PARK:

Image-dataset construction of *Aurelia coerulea* polyps for object detection training: an Eda-based quality control strategy

12 | DUTRA-ALBUQUERQUE:

Citizen science reveals early life stages: proposing local reproduction of *Lychnorhiza lucerna* and *Chrysaora lactea* in the Uruguayan coast



13 | EISENBERG:

Float tank: a new research tool to observe gelatinous animal behavior

14 | PRIETO:

Engaging the public with jellyfish science: insights from multi-scale initiatives

15 | TERENCEZINI:

Searching for elusive non-indigenous freshwater jellyfish *Craspedacusta sowerbii* in the United Kingdom using citizen science

16 | TIRELLI:

How mobile phones can help monitor jellyfish: the case of avvistAPP

17 | BEACH:

Jellyfish silver gelatine photography: towards perceptual shifts through art-science collaboration and public engagement

18 | BONNET:

Cnidarian diversity revealed from environmental DNA biomonitoring in a mediterranean lagoon

19 | BONNET:

First steps towards jellyfish cryopreservation

20 | BONNET:

Scyphozoan cnidome: changes across ontogeny and diet

21 | REED:

Optimizing round fiberglass tanks for jelly grow-outs

22 | ANGEL:

Testing rinsing solutions to treat *Rhopilema nomadica* stings

23 | GIMENEZ:

Follow the crowd: conspecific cues enhance larval settlement in *Aurelia coerulea*

24 | GÓMEZ:

From polyp to medusa: compositional and metabolic evolution in *Aurelia aurita*

25 | GÓMEZ:

Physalia, how do you conduct yourself?

26 | ISHII:

Morphological characteristics of the gonads and reproductive ecology of subtropical jellyfish, *Aurelia malayensis*

27 | MOON (CHAE presenting):

Polyp elimination method to effective and inexpensive moon jellyfish bloom control

28 | IM:

Successful prevention cases by polyp eliminating in Korea's chronic jellyfish bloom repeated seas

29 | SATO:

Development of a craft beer utilizing moon jellyfish (*Aurelia coerulea*): a sustainable approach to jellyfish blooms

30 | TAKAUCHI:

Investigating the developmental potential of large planulae in *Aurelia coerulea*

31 | ÁLVAREZ-TRASOBARES:

When Portuguese Man-o'-War reach the coast: spatial and temporal distribution in Spain

32 | EPINOUX:

Climate-driven phenological shifts and biogeographical constraint of the hydrozoan *Velella velella* in Mediterranean coastal waters

33 | GESON (BARIA-RODRIGUEZ presenting):

Description of scyphozoan jellyfish assemblages in the Bolinao–Anda reef complex, northwestern Philippines

34 | LEÓN-COBO:

Modelling the coastal presence of *Pelagia noctiluca*: a comparative perspective

35 | LÜSKOW:

Shifting dominance in the Southern Ocean: ecological and societal implications of the Antarctic krill-salp dynamic under climate change

36 | OTTMAN:

Building a tool to predict the arrival of a dangerous jellyfish to coastal areas

37 | OTTMAN:

Sea-surface chlorophyll concentration determines abundance and distribution of *Pelagia noctiluca* ephyrae at the onset of summer

38 | ROSSI:

e-DNA metabarcoding of spring jellyfish communities in Irish coastal waters using Oxford Nanopore sequencing

39 | ROBINSON (CLARK presenting):

Estimating scyphozoan jellyfish abundance and size structure on a sub-mesoscale in the oceanic Gulf of Mexico using unmanned aerial vehicle imagery data and a convolutional neural network

40 | TIRELLI:

Exploring jellyfish (Cnidaria: Scyphozoa / Hydrozoa) as natural samplers of environmental DNA: a case study in the northern Adriatic Sea

41 | WANG:

Abundance and spatiotemporal dynamics of *Nemopilema nomurai* (Scyphozoa, Rhizostomeae) in waters nearby Hongyanhe nuclear power plant, Bohai Sea of China

42 | YAÑES-DOBSON:

Using fishery surveys for wide-scale jellyfish monitoring

43 | BORDEHORE (YAÑES-DOBSON presenting):

Can we alter the movement of jellyfish? Effects of electromagnetic fields (Patented)

44 | SALAZAR (FERNÁNDEZ-ALÍAS presenting):

Fishers' perceptions of jellyfish blooms and their economic impacts on fisheries in the Western Mediterranean Sea

45 | FIRTH:

Blueprints in the biofilms? Identifying species-dependent biofilm architecture and its potential role in determining jellyfish planula settlement and metamorphosis

46 | MAMMONE:

Exploring regeneration capabilities within Scyphozoa (Cnidaria)

47 | MACEDO (MORANDINI presenting):

Simulating climate change on the marine environment: The effects of higher water temperatures on the asexual reproduction of four scyphozoan species

48 | TISEO (MORANDINI presenting):

The evolution of gonads in coronate medusae (Scyphozoa, Cnidaria)

49 | MORANDINI:

Settlement and metamorphosis preference of planuloid buds of *Cassiopea andromeda* (Cnidaria, Scyphozoa) and a putative inhibitory effect from taurine

50 | MOREJÓN-ARROJO:

Same place, same niche: a fine-scale analysis of *Cassiopea* coexistence

51 | PITT:

Differing methods of photoprotection against ultraviolet b radiation in *Catostylus mosaicus* (Rhizostomeae) and *Aurelia coerulea* (Semaestomeae)

52 | PITT:

The *Cassiopea* conundrum: protecting a newly identified species of *Cassiopea* from the introduced *Cassiopea xamachana* in the Ningaloo coast, world heritage area, Western Australia

53 | TOSO:

Climate-driven spread of the upside-down jellyfish *Cassiopea andromeda* in a Mediterranean MPA

54 | TOSO:

Jelly Go-on s.r.l. advancing sustainable jellyfish research for novel food and blue biotechnology applications

55 | LEONE (TOSO presenting):

Non-native *Cassiopea andromeda* (Forsskål, 1775) as a bioreactor in the sustainable production of blue products

56 | CLAUS:

Investigating the nature and composition of egested material produced by gelatinous zooplankton using *Aurelia aurita* as a model organism

57 | LI (FENG presenting):

An introduction of a seedling factory on *Rhopilema esculentum* in China

58 | FENG:

Floating primary polyps of *Nemopilema nomurai* on detritus: effects of abiotic factors on their resettlement and subsequent growth

59 | GARCIA-RODRIGUEZ:

Thermal stress and jellyfish proliferation: do all species respond the same way?

60 | GUY-HAIM:

Climate change alters biogeochemical and microbial dynamics during jellyfish decomposition in a warm ultra-oligotrophic sea

61 | KIM:

Bioassay-guided isolation of a multi-toxin cardiorespiratory lethal fraction from giant jellyfish *Nemopilema nomurai*: a zebrafish model study

62 | MA:

Jellyfish-associated microbiomes differ from seawater communities

63 | MASAYA:

Estimation of the number of days required for the strobilation switch to be activated by low temperature in the giant jellyfish *Nemopilema nomurai*

64 | MIYAKE:

Life-history strategy of the edible jellyfish *Lobonemoides robustus* under strong salinity fluctuations in tropical estuaries

65 | RAJACK (LUCAS presenting):

The moon jellyfish *Aurelia aurita* as a model species in ecotoxicology: defining toxicity in unstable conditions

66 | MOTTA:

An unexpected morphotype of *Chrysaora hysoscella* in the Gulf of Trieste (north Adriatic Sea)

67 | DAWSON:

Peeer: publishing for an ethical and equitable environment in research

68 | DAWSON:

Symbioses in 3D: diversity and dynamics in pelagic symbioses across the tree of life

69 | FONFRIA:

Microfibres in jellyfish: low retention but species-dependent risk

70 | FONFRIA:

Choice of eDNA sampling matrix shapes biodiversity detection

71 | KUPLIK:

It's all about the polyps: insights into the proliferation of the rhizostome *Rhopilema nomadica* in the Mediterranean

72 | JOHNSON:

Strobilation of Pacific sea nettle (*Chrysaora fuscescens*) scyphistomae may be linked to seasonal upwelling

73 | KOGOVŠEK:

Extracting nutrients from jellyfish biomass for agriculture fertilizers

74 | KOGOVŠEK:

Can jellyfish act as bioindicators of trace metal(loid)s dynamics? – the northern Adriatic case study

75 | KOGOVŠEK:

An integrative approach to hydrozoan biodiversity assessment in the Adriatic Sea

76 | MARQUES:

When light matters: Tissue-level growth and biochemical shifts in jellyfish

77 | MARQUES:

Preliminary evaluation of the nutritional potential of cultured jellyfish as a novel food ingredient





Plenary speaker abstracts

Reimagining medusa: Myth, metaphor, and the role in marine systems

Alenka Malej¹ and Robertina Šebjanič²

¹National Institute of Biology, Marine Biology Station Piran, Slovenia, ²Freelance artist / Assoc. Prof., School of Arts, University of Nova Gorica, Slovenia.

Abstract

Jellyfish have traditionally been regarded as beautiful marine creatures yet are often portrayed as ecological stressors and nuisances to human activities. This ambivalent perception mirrors the mythological figure of Medusa, depicted as both beauty and monster, threat and protector. Her meaning has shifted across historical and cultural contexts, providing a compelling metaphor for interpreting the role of jellyfish in marine systems. Our contribution reframes medusae – both mythological and ecological – by integrating contemporary ecological data with artistic interpretations and historical narratives. We examine how evolving cultural perceptions and scientific understandings have transformed Medusa from monster to protector, and jellyfish from symbols of ecological imbalance into dynamic participants in ecosystem processes. Our interdisciplinary approach invites a reconsideration of jellyfish as functional ecological actors in changing marine environments and offers a more nuanced interpretation of how past Medusa narratives have evolved.

Changing the narrative around gelatinous zooplankton population trends

Kylie A. Pitt

Griffith University, Gold Coast, Australia

Abstract

Claims that gelatinous zooplankton are increasing globally persist in the scientific and public discourse. The two seminal studies that attempted to resolve this question, (Brotz et al. 2012; Condon et al. 2013) failed to reach consensus but were limited by the quality, quantity and spatial and taxonomic resolution of the data available at the time. More than a decade later, many more quantitative time series of gelatinous zooplankton have emerged enabling more rigorous and nuanced analyses of global population trends. Recent analyses of this expanded data set, compiled by a global consortium of jellyfish researchers, reveal that gelatinous zooplankton are highly variable, are not increasing globally and that medusae, ctenophores and pelagic thaliaceans exhibit disparate population trends, likely reflecting their differing ecologies and heterogeneous responses to environmental change. Perpetuating claims that gelatinous zooplankton populations are increasing globally could constrain scientific thinking and may channel resources towards unproductive research areas. Here I discuss the need to change the narrative around jellyfish to ensure that we direct resources towards the most pertinent research questions.

A decade of reference sequencing jellies

Aino L. J. Hosia¹, Luis Martell¹, Joan J. Soto-Angel¹, Elizaveta Ershova-Menze², Sanna Majaneva²

¹University of Bergen, Norway, ²Akvaplan-niva, Norway

Abstract

For over a decade, our team has been building DNA reference libraries for medusozoan cnidarians and ctenophores, particularly focusing on hydrozoans in the northeastern Atlantic, the Arctic, and the Antarctic. The accumulated vouchered sequence data not only facilitate the molecular identification of gelatinous predators but also provide an invaluable resource for taxonomic and ecological research, contributing to the identification of cryptic species complexes and resolution of complex life cycles, as well as the improved understanding of phylogenies, distribution patterns and trophic interactions. Despite the improved taxonomic coverage of reference libraries, systematic biases persist when applying molecular methods of diversity assessment to gelatinous predators. Systematic differences in taxonomic representation remain, due to limited access to specimens and difficulties in sequencing standard markers for selected taxa. Even when reference sequences are available, systematic primer-template mismatches can bias current metabarcoding results. To tackle these shortcomings, we are transitioning from Sanger sequencing to genomic approaches providing multiple markers and entire mitogenomes, as well as additional data at genomic scale. The data generated offer expanded opportunities for future applications, but are not without their challenges, particularly related to data management and sustainable bioinformatics pipelines. Joint efforts by the global community of gelatinous zooplankton researchers are encouraged as the key to continued accumulation and improved taxonomic, geographic and genomic coverage of openly available reference sequence data.

Adrift on the high seas: the ecology and biology of cnidarians on the ocean's surface

Rebecca R. Helm

Earth Commons Institute, Georgetown University, Washington DC, USA

Abstract

The air-sea interface is one of the largest contiguous habitats on Earth, covering over 70% of our planet's surface. This dynamic boundary layer is known as the neustonic zone, and its cnidarian residents sport a wide variety of remarkable adaptations, including living sails, waterproof tissues, and gas filled body cavities, which allow them to drift passively with prevailing winds and currents. Although neustonic cnidarians occasionally wash ashore, their primary habitat is the hard-to-access open ocean, rendering their biology and ecology largely understudied despite global advance in jelly biology generally. In this presentation, I will share our latest efforts to shed light on this ecosystem, including investigations into the environmental and biological drivers of species distribution, the ecological role these cnidarians play in shaping broader neustonic communities, and emerging approaches for detecting and monitoring neustonic cnidarians using Earth-observing satellite technologies.



Oral presentation abstracts

Year-round reproduction and overwintering in *Salpa thompsoni* south of the Antarctic Polar Front

Evgeny A. Pakhomov^{1,2}, Svenja J. Mueller^{3,4}

¹Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada. ²Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada. ³Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany. ⁴Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Abstract

Antarctic pelagic ecosystems are undergoing rapid change throughout the year, yet the overwintering strategies and reproductive dynamics of the most abundant tunicate in the Southern Ocean, *Salpa thompsoni*, remain poorly understood. Here we present year-round, multi-year observations conducted in the Atlantic sector of the Southern Ocean, encompassing the upper 500–3000 m of the water column. Salps were recorded exclusively between 50° and 62°S, with no records south of 62°20'S. During summer-fall (November–April), salps were abundant with a mean of 10.9 ind. m⁻² (max 81.7 ind. m⁻²) and a blastozoid-to-oozoid ratio of 27. Samples dominated by small- and medium-sized blastozoids clustered in one or two distinct modal groups. In contrast, mean winter-early spring (July–October) abundances declined by more than an order of magnitude, ranging from 0 to 2.1 ind. m⁻², with a seasonal average of 0.3 ind. m⁻². The winter population in the northern part of the survey area was overwhelmingly dominated by medium-sized oozoids, consistent with the classical annual salp life-cycle pattern described by Foxton (1966), involving a winter interruption in spawning. However, beneath seasonal sea ice in the southern part of the survey area, populations showed levels of development comparable to summer conditions and were dominated by young blastozoids. Although year-round spawning of *S. thompsoni* has been proposed in previous population modelling studies, our results provide the first direct empirical evidence that *S. thompsoni* can maintain active reproduction throughout the austral winter, challenging the traditional view of the seasonal life cycle in salps.

Keywords

Pelagic tunicates, Southern Ocean, Life-cycle

Overlapping sexual reproduction accelerates bloom formation in salps

Svenja J. Mueller^{1,2}, Evgeny A. Pakhomov^{3,4}, Kathrin Schierge², Morten Iversen^{1,5}, Bettina Meyer^{1,2,6}

¹Scientific Division Polar Biological Oceanography, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany. ²Institute for Chemistry and Biology of the Marine Environment, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany. ³Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada. ⁴Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada. ⁵MARUM and University of Bremen, Bremen, Germany. ⁶Helmholtz Institute for Functional Marine Biodiversity (HIFMB), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Abstract

Salps are increasingly recognized as important components of pelagic ecosystems, influencing trophic interactions and biogeochemical cycles. Their often-underappreciated ecological role arises from their ability to rapidly form dense aggregations, with significant consequences for carbon export and nutrient cycling. Despite this importance, many fundamental traits - particularly those related to life cycle, behavior, and physiology - remain poorly understood. To address these knowledge gaps, we conducted laboratory experiments with *Salpa fusiformis* using a kreisel tank system, examining functional traits such as swimming activity, growth, and reproductive development under controlled conditions. Continuous, non-invasive camera monitoring revealed that life span and development progression are tightly coupled to the offspring release. Moreover, salps exhibited overlapping protogynous hermaphroditism, completing the male phase prior to the embryo release. This reproductive strategy accelerates the life cycle and facilitates rapid population growth, with direct implications for bloom formation and ecosystem-level processes. Overall, our findings challenge traditional assumptions about the salp life cycle and provide critical insight for predicting the ecological and biogeochemical consequences of increasing salp abundance.

Keywords

Salps, Bloom formation, Life cycle, *Salpa fusiformis*

Oceanographic drivers and phytoplankton size structure shape thaliacean assemblages (Chordata, Thaliacea) in oceanic areas of the subtropical southwestern Atlantic (22°S–33°S)

Douglas da Silva-Rodrigues¹, Leticia Cazarin Baldoni¹, Erik Muxagata¹, Miodeli Nogueira-Júnior², Rafael Borges Mendes¹, Renato M. Nagata¹

¹Universidade Federal do Rio Grande, Rio Grande, Brazil. ²Universidade Federal da Paraíba, João Pessoa, Brazil

Abstract

Thaliaceans are key components of gelatinous zooplankton, capable of forming dense blooms that strongly influence pelagic food webs and biogeochemical fluxes. We analyzed seasonal and spatial responses of thaliacean across the continental shelf and slope of the southeast–south Brazilian during autumn and spring. Zooplankton samples were collected using oblique net tows and analyzed with hydrographic variables and phytoplankton pigments. A total of 61,366 individuals were recorded, comprising 16 species. Assemblage structure differed significantly between seasons and latitudinal sectors, with no shelf–slope differences. Spring assemblages were dominated by the salps *Thalia democratica* and *Salpa fusiformis*, which formed aggregations <6000 ind. 100 m⁻³. These blooms, mainly composed of blastozooids, occurred under warm, saline surface waters and low chlorophyll-a concentrations. Doliolids were also abundant in spring, with *Doliolum nationalis* reaching high densities on the southern shelf. In contrast, autumn assemblages were dominated by doliolids, with *D. nationalis* and *Doliolina krohni* as the main contributors, largely represented by nurses and gonozooids. Temperature and salinity were the primary drivers of the thaliacean assemblage, particularly during spring. Chlorophyll-a was relevant only in autumn, showing a positive association with *D. nationalis* gonozooids. Phytoplankton size structure further modulated species responses: picophytoplankton and nanophytoplankton were associated with lower abundances of doliolids, whereas *S. fusiformis* showed a positive relationship with nanophytoplankton. Together, these findings reveal that seasonal hydrography and phytoplankton size structure control thaliacean assemblages, underscoring their key ecological role in shaping trophic dynamics and carbon fluxes across the subtropical southwestern Atlantic margin.

Keywords

Bloom, Southwestern Atlantic, Gelatinous zooplankton, Tunicata

Environmental drivers of jellyfish community patterns in the Singapore and Johor Straits

Min Kang Ling¹, Hiroshi Miyake², Sho Toshino³, Nicholas Wei Liang Yap^{4,5}, Danwei Huang^{1,4,6,7}

¹Department of Biological Sciences, National University of Singapore, Singapore, Singapore.

²School of Marine Biosciences, Kitasato University, Sagami-hara, Japan. ³Kuroshio Biological Research Foundation, Otsuki, Japan. ⁴Tropical Marine Science Institute, National University of Singapore, Singapore, Singapore. ⁵St. John's Island National Marine Laboratory, c/o Tropical Marine Science Institute, National University of Singapore, Singapore, Singapore. ⁶Lee Kong Chian Natural History Museum, National University of Singapore, Singapore, Singapore.

⁷Centre for Nature-based Climate Solutions, National University of Singapore, Singapore, Singapore

Abstract

As an island state, Singapore frequently sees human-wildlife interactions involving medusozoan jellyfishes. While most interactions are harmless, recent high-profile stinging incidents have raised public concern. Besides their societal relevance, jellyfishes occupy important ecological positions in coastal ecosystems as predators of zooplankton and prey for higher trophic levels and facilitate energy transfer and nutrient cycling. Understanding jellyfish community composition and seasonality is therefore essential both for mitigating negative human–jellyfish interactions and for interpreting coastal ecosystem dynamics. However, Singapore's baseline records on jellyfish diversity and seasonal occurrences are deficient and inadequate. To establish baseline data, we surveyed six publicly accessible lagoons across Singapore (Changi, Eagle Bay, East Coast, Palawan, Siloso and St John's Island) once every two months, over two years, using a seine net. Where possible, medusozoans were imaged live before being preserved in 10% seawater formalin for morphological identification or molecular-grade ethanol for genetic analysis. While medusozoan communities in both straits were dominated by Leptothecata (Aequoreidae, Blackfordiidae, Eirenidae, Malagazziidae), each strait exhibited distinct diversity, with several families relegated to either Johor (Catostylidae) or Singapore Strait (including Tripedaliidae, Bougainvilliidae and Pelagiidae). Abundance and diversity trends were antagonistic between straits, peaking during the Southeast monsoon in Johor Strait, and at the start and end of the Northeast monsoon in Singapore Strait. These differences were driven by temperature and pH in Johor Strait, and temperature and salinity in Singapore Strait. Several new Medusozoa records were also reported for Singapore. Our findings improve understanding of Medusozoa diversity and help manage negative human-jellyfish interactions.

Keywords

Medusozoa, Lagoons, Ecology, Seine, Physiochemical

Blooming potential base on spatiotemporal distributional pattern and the contribution of sexual and asexual reproduction of the giant jellyfish *Nemopilema nomurai* in Bohai Sea

Jing Dong

Liaoning Ocean and Fisheries Science Research Institute; Key Laboratory of Protection and Utilization of Aquatic Germplasm Resource, Ministry of Agriculture and Rural Affairs; Key Laboratory of Marine Biological Resources and Ecology, Liaoning Province, Dalian 116023, PR China, Dalian, China

Abstract

Based on spatiotemporal distributional pattern from 2017 to 2024 *Nemopilema nomurai* and sexual and asexual reproduction, the population dynamics and blooming potential were explored: (1) Initial occurrence, distribution-shifts and advection in Liaodong Bay were reported. (2) The results on the environmental adaptability of planula have shown that their suitable survival range was not very strict. Based on the large number of eggs, they have sufficient ability to effectively supplement the polyp population through sexual reproduction. The optimum temperature, salinity and feed conditions for the metamorphosis attachment of jellyfish larvae were defined scientifically which have revealed the preference of attachment for planula. This paper demonstrated the capacity of sexual reproduction recruitment and interpreted that *N. nomurai* could accomplish their whole life cycle in LDB, and a few individuals could enter the Yellow Sea through the Bohai Strait. (3) Compare the capacity of sexual reproduction (mature medusa) and asexual reproduction (polyp) and estimate their relative contribution to the original polyp population through a two-year's synchronous observation on the annual life cycle of two generations of polyp from *N. nomurai* population, combining field experiment with polyps attached on hanging polyethylene plates and laboratory experiment simulating natural condition in terms of temperature, salinity and light intensity, etc.

Keywords

Abundance and distribution, Population recruitment, Jellyfish bloom, *Nemopilema nomurai*

Strobilation after 10 years: uncovering the process initiating jellyfish metamorphosis from polyp to ephyra

Megan Maloney¹, Vanessa L. Gonzalez², Allen G. Collins^{3,2}, Rebecca R. Helm¹

¹Georgetown University, DC, United States. ²Smithsonian Institution National Museum of Natural History, DC, United States. ³National Systematics Laboratory, National Oceanographic and Atmospheric Association, DC, United States

Abstract

Strobilation is a key developmental process driving the transition from polyp to jellyfish, yet the molecular mechanisms that initiate this metamorphosis remain largely unknown. Recent studies have identified signaling pathways and transcription factors involved in later stages of polyp-to-ephyra transformation; the regulatory events that initiate and mediate early strobilation are unresolved. Notably, although strobilation can be induced by environmental cues or chemical exposure to indole derivatives, morphological changes are not observed for several days, suggesting the presence of early, uncharacterized regulatory mechanisms. To identify molecular drivers of strobilation onset, we chemically induced strobilation in *Aurelia* and *Chrysaora* polyps and quantified transcriptomic changes at 2 and 6 hours post-induction. We detected significant upregulation of transcription factors associated with the Aryl Hydrocarbon Receptor (AHR) complex in both species. AHRs can modulate adaptation to the cellular environment through sensing oxygen levels, redox potential and changes in the circadian rhythm. Although AhR is classically associated with responses to environmental toxicants, recent evidence implicates it in cnidarian neural development, supporting a broader role in developmental regulation. Additional early-response genes included Krüppel-like factor 5, Wnt8, SOC3, and thyroxine 5-deiodinase. Together, these findings identify candidate regulators of the earliest stages of strobilation and represent the first targeted effort to resolve the molecular mechanisms underlying the initiation of scyphozoan metamorphosis from polyp to medusa.

Keywords

Strobilation, Transcriptomic changes, Aryl Hydrocarbon Receptor

Life history of the thermophilic hydroid *Pennaria disticha* Goldfuss, 1820 (Cnidaria, Hydrozoa) in a Mediterranean coastal lagoon as a model scenario for global warming scenario

Martín Vicente-Ríos^{1,2}, Alfredo Fernández-Alías^{1,3}, Manuel Rosendo Conde-Caño¹, Antonio Sala-Mirete¹, Borja Mercado-Casares⁴, Angel Pérez-Ruzafa¹

¹University of Murcia, Murcia, Spain. ²Spanish Institute of Oceanography, Murcia, Spain.

³University of Lille, Wimereux, Spain. ⁴European University of Valencia, Valencia, Spain

Abstract

Understanding the response of thermophilic marine organisms to temperature is crucial to predict climate change impacts on ecosystems. Mar Menor, a hypersaline coastal lagoon in the Western Mediterranean, exhibits thermal conditions resembling those projected for the Mediterranean Sea by 2050 under IPCC scenario 8.5, making it an ideal natural laboratory to study warming effects. This study aims to examine the *in-situ* ecology and phenology of the non-native hydrozoan *Pennaria disticha* in this lagoon to understand its potential behaviour under future Mediterranean warming scenarios. Over 16 months, a monthly monitoring of four populations with varying degrees of isolation from Mediterranean influence was conducted. Colony coverage, density, feather length, polyp and gonophore count, epibiont colonization, and environmental variables (temperature, salinity, dissolved oxygen, and chlorophyll-a) were measured. Results confirmed the species' thermophilic nature but also indicate that temperature is not the sole driver of its distribution, with other environmental factors playing a role, such as the degree of colonisation by epibionts. The species exhibited previously described thermal stress mitigation strategies, enabling an 11-month life cycle with two or more reproductive events. We recorded some of the highest feather lengths, feather density, polyp/gonophore densities reported to date. Our findings confirm that *P. disticha* could benefit from warming in shallow Mediterranean ecosystems and suggest that its active period might be even longer than currently predicted for the strongest global warming scenarios. Monitoring thermophilic benthic species in environments that approximate future warming scenarios provides a powerful tool for assessing ecological responses to climate-driven temperature increases.

Keywords

Thermophilic hydroid, Non-indigenous species, Coastal lagoons, Mediterranean Sea, Climate change, Thermal tolerance

Statoliths of *Rhopilema nomadica* and estimation of medusan age

Daniel Strul, Dror L. Angel

University of Haifa, Haifa, Israel

Abstract

Jellyfish swarms of the invasive scyphomedusa *Rhopilema nomadica* occur along Mediterranean Israeli coasts, in large summer swarms, but also in the winter. Impacts of this species on crucial ecosystem services underline the need to understand the formation of these swarms and their population dynamics. A key parameter needed to study the medusae is the age of the individuals, and their rate of growth. We examined jellyfish grown in the laboratory and sampled at sea in different seasons and examined their statocysts and statoliths. We employed light microscopy and image processing to count statoliths and to establish statolith sizes and morphological parameters and a scanning electron microscope to increase our resolution. Abundances of statoliths per statocyst, the distribution of shape parameters and statolith size distribution were all found to be good markers for characterization of jellyfish from different seasons. The results indicate that in each season there is a great similarity among jellyfish, but there is a clear difference between the populations sampled in different seasons. The morphological differences between statoliths in spring and those in summer, and the comparison to laboratory-grown jellyfish, suggests a relationship between environmental conditions and statolith morphology. The morphology of the statoliths in medusae collected in the winter leads us to propose that these individuals have survived from the previous summer, enabling us to estimate their age.

Keywords

Nomad jellyfish, Statoliths

Chemical and physical interactions affecting swarm formation and coherence in the jellyfish *Rhopilema nomadica*

Hila Dror¹, Ran Eisenberg², Ron Shnapp³, Eyal Heifetz¹, Zafir Kuplik²

¹School of the Environment and Earth Sciences Department of Geophysical, Atmospheric and Planetary Sciences Tel Aviv University, Tel-Aviv, Israel. ²The Steinhardt Museum of Natural History, Tel Aviv University, Tel-Aviv, Israel. ³Department of Mechanical Engineering Ben-Gurion University of the Negev, Beer-Sheva, Israel

Abstract

Rhopilema nomadica is the dominant jellyfish species in the eastern Mediterranean, forming massive summer swarms with substantial ecological and socioeconomic consequences. While environmental drivers of jellyfish blooms have been extensively studied, the mechanisms underlying swarm formation, coordinated swimming, and swarm cohesion remain poorly understood. Although often viewed as passive drifters, growing evidence suggests that jellyfish actively swim and coordinate their movements, shaping both vertical and horizontal distributions. We propose that swarm emergence and maintenance involve coupled physical and behavioral mechanisms that facilitate intraspecific communication, potentially mediated through chemical cues in mucus and hydrodynamic signals generated by bell pulsation. To test this, we combine proteomic analyses with controlled behavioral experiments. Mucus proteomics of solitary vs. swarming medusae aim to identify proteins involved in communication. Behavioral assays using wild and laboratory-reared individuals across pelagic life stages assess whether jellyfish actively aggregate in response to conspecifics, mucus, or prey. These experiments utilize Particle Image Velocimetry to quantify flow fields and changes in bellpulsation dynamics. Preliminary proteomic results revealed several proteins upregulated in mucus, including candidates associated with communication and cell-signaling pathways. Initial behavioral experiments indicate that individuals modify swimming patterns in response to mucus and prey cues. These analyses may provide new insight into the mechanisms enabling *R. nomadica* to form and maintain swarms. These data will further parameterize an Active Matter model constructed by our research group, incorporating orientation behavior, environmental coupling, and agent-to-agent interactions, advancing both ecological understanding and predictive capabilities for swarm dynamics.

Keywords

Proteomics, Communication, Mucus, Jellyfish swarms

Long-term population dynamics of *Aurelia coerulea* in Maizuru Bay: year-round persistence, collapse, and recovery

Kentaro S. Suzuki¹, Keita W. Suzuki², Emi Kumakura³, Yasuyuki Nogata¹

¹Central Research Institute of Electric Power Industry, Abiko, Japan. ²Kyoto University, Maizuru, Japan. ³CERES Inc., Abiko, Japan

Abstract

Outbreaks of moon jellyfish *Aurelia* have been reported from many coastal regions worldwide. Although polyps derived from planulae can rapidly increase through budding and strobilation, *Aurelia* also exhibits direct development without asexual reproduction, complicating the mechanisms underlying population outbreaks. To identify the key life-history processes driving inter-annual fluctuations in *Aurelia* populations, we conducted a nine-year field survey (2016–2024) in Maizuru Bay, Japan, where *Aurelia coerulea* shows both asexual (summer) and direct-developmental (winter) reproductive modes. Medusae showed a clear seasonal peak in June but persisted year-round, unlike in many regions where medusae typically disappear during summer. This year-round persistence continued until early 2021, when the population abruptly collapsed to extremely low levels, which lasted for the following three years before recovering in 2024. We tested the hypothesis that the abundance of ephyra originating from winter spawning influences the new recruitment of medusae. The abundance of overwintering medusae (>10 cm bell diameter in February–March) was positively correlated with ephyra abundance in March–April. Before the recovery, ephyra abundance in March–April was also positively related to the abundance of new-recruit medusae (<15 cm) during their June peak. In contrast, ephyra abundance in January–February were not significantly related to new-recruit abundance. Our previous studies indicated that ephyrae in January–February originated from both strobilation and direct development, while ephyrae in March–April originated mainly from direct development. Therefore, these findings suggest that winter-spawned cohorts produced through direct development contribute more strongly to recruitment than summer-spawned cohorts produced through strobilation.

Keywords

Direct development, Ephyra, Medusa, Overwintering

Untangling and describing the life cycles of *Chrysaora quinquecirrha* and *Chrysaora chesapeakei*

Travis Brandwood

The Jellyfish Compendium Project, Kannapolis, United States

Abstract

In 2017, Bayha et al. determined that the Atlantic sea nettle, *Chrysaora quinquecirrha* was actually comprised of two distinct species. The in-shore estuarine species was described as *C. chesapeakei*, while the offshore species retained *C. quinquecirrha*. While some literature on the life history of *C. quinquecirrha* does exist, it is unclear as to which species it truly applies to. In 2025, individuals of both *C. quinquecirrha* and *C. chesapeakei* were collected in Rodanthe, NC and Cedar Island, NC, respectively. Both species were maintained and spawned in captivity, with each of their life stages photographed and documented. Differences in spawning behavior were observed, and notable morphological differences were clear even in gamete stages but also present in scyphistoma, ephyra and young medusae. Clarifying and distinguishing the life stages of both species will help to solidify them as distinct species and allow a better understanding of where research is currently lacking. Observing the spawning behavior and development of each species has provided a glimpse at their ecology and may have implications in explaining their geographical range and population dynamics.

Keywords

Life cycles, *Chrysaora chesapeakei*, *Chrysaora quinquecirrha*, Sea nettle, Morphology, Spawning

Who needs sex? Clonal pathways in the clinging jellyfish, *Gonionemus vertens*

Paul A. X. Bologna

Montclair State University, Montclair, United States

Abstract

The clinging jellyfish, *Gonionemus vertens*, is a hydrozoan native to the Pacific Ocean, but has spread globally in temperate Atlantic and Mediterranean coastal waters. This species has a cryptic, benthic polyp stage that has the capacity to generate blooms of venomous medusae. Part of its success as an invader may relate to the numerous asexual pathways that generate more individuals. Laboratory investigations have identified multiple undescribed clonal pathways including budding, binary fission, and multiple polyps being generated from a single frustule. Additionally, this species generally produces a single medusa from the solitary polyp, but we have observed rare situations where multiple medusae are generated from a single polyp, which may help explain the development of medusae blooms in the field. Perhaps the most intriguing result we have seen relates to the potential development of larvae from polyps. It appears that polyps can generate auxiliary 'balloons' where larvae are packaged up for release, as well as the production of these within the extracellular matrix surrounding individual polyps. Additionally, undifferentiated tissue masses generate the same structures, which subsequently result in ciliated planulae larvae. This ability suggests that cellular material maintains totipotency capable of producing frustules, polyps, medusae, and larvae. The development of larvae has always been the hallmark of sexual reproduction, but this species appears to generate clonally derived larvae which may assist in multiple dispersal pathways for this invader.

Keywords

Asexual Reproduction, Hydrozoa, Anlage, Totipotency

The regulating role of benthic ecosystems in jellyfish outbreaks

Song Sun

Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China

Abstract

The occurrence of large numbers of jellyfish in seawater leads to serious ecological disasters. This phenomenon takes place in water bodies, but the key processes triggering jellyfish outbreaks may occur on the seabed. In Chinese waters, jellyfish species commonly associated with ecological disasters, such as the moon jellyfish (*Aurelia aurita*), sand jellyfish (*Nemopilema nomurai*), and lion's mane jellyfish (*Cyanea capillata*). These jellyfish have complex life cycles, spending most of their lives on the seabed and only a few months in the water column, exhibiting typical alternation of generations. Although extensive research has been conducted on the mechanisms of jellyfish outbreaks and prevention strategies, studies have often focused on the medusa stage. To date, we are unable to make cross-annual predictions of jellyfish abundance—that is, we cannot forecast the number of jellyfish in water bodies during spring and summer of the following year based on marine environmental conditions, particularly temperature changes, in the preceding autumn, winter, and early spring. A fundamental reason for this is our limited understanding of their polyp stage. Recently, through simulated experiments and field investigations on the seabed environmental characteristics of waters near Qingdao and the impact of environmental changes on the survival, growth, development, and reproduction of jellyfish polyps, we have analyzed the relationship between polyp reproductive strategies and seabed conditions. Our findings suggest that monitoring seabed environments holds promise for achieving cross-annual predictions of jellyfish outbreaks. Additionally, we have explored approaches and methods for assessing marine ecosystem health through monitoring jellyfish outbreaks.

Keywords

Jellyfish bloom, Benthos ecosystem, Population dynamics

Divergent developmental strategies in jellyfish polyps exposed to seasonal temperature variability and marine heatwaves

Marie Meffre^{1,2}, Maëlyss Dumont², Amelia Kaliszczak², Ameline Orts¹, Romain Gros¹, Anaïs Courtet², Etienne Bourgouin², Juan-Carlos Molinero³, Delphine Bonnet¹

¹MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France. ²Aquarium de Paris, Paris, France. ³MARBEC, IRD, CNRS, Ifremer, Univ. Montpellier, Sète, France

Abstract

Understanding how environmental variability regulates reproductive pathways in medusozoans is necessary under ongoing climate change. The Mediterranean Sea is a climate-change hotspot, where rising temperatures and increasingly frequent heatwaves provide a natural context to examine how seasonal and extreme thermal conditions shape life cycle regulation. A nine-month experiment rearing scyphistomae of both *Aurelia coerulea* and *Rhizostoma pulmo* was conducted under controlled conditions that reproduced weekly *in situ* temperature from a mediterranean lagoon, combined with two additional heatwaves (+5 °C for 6 days in December and +3.5 °C for 5 days in April). *A. coerulea* polyps exhibited strong developmental plasticity, proliferating through budding at low temperatures and rapidly colonizing the substrate (0.12 cm² day⁻¹), before a marked decline in propagation when temperatures persistently exceeded 15 °C. In contrast, *R. pulmo* almost exclusively produced podocysts, with minimal substrate colonization (<1.5 per 100 cm²), and summer temperatures acting as a trigger for excystment. Strobilation phenology and magnitude differed between species: *A. coerulea* strobilated mainly from mid-November to February (>200 ephyrae per 100 cm²), whereas *R. pulmo* showed an extended strobilation period from January to July, peaking in late March (>30 ephyrae per 100 cm²). Heatwave exposure did not alter polyps' phenology. Temperature significantly regulated both species' dynamics, but with contrasting thermal optima: cold conditions favored *A. coerulea*, whereas warming enhanced *R. pulmo*. Thus, co-occurring medusozoans can express different strategies under identical thermal regimes, highlighting how developmental pathways may mediate species-specific responses to climate warming.

Keywords

Medusozoa, Life-cycle transitions, Environmental triggers, Asexual reproduction, Scyphistome stage, Jellyfish blooms

Asexual reproduction and survival of *Aurelia* sp. polyps from the Philippines across a tropical thermal range

Serafin III Mendez Geson^{1,2}, André C. Morandini³, Maria Vanessa Baria-Rodriguez^{1,2}

¹The Marine Science Institute (MSI), College of Science, UP Diliman, Quezon City, Philippines.

²Bolinao Marine Laboratory (BML), UP MSI, Pangasinan, Philippines. ³Departamento de Zoologia, Instituto de Biociências & Centro de Biologia Marinha (CEBIMar), Universidade de São Paulo, São Paulo, Brazil

Abstract

The benthic polyp stage of the scyphozoan genus *Aurelia* is well-studied in temperate regions, yet data on tropical populations, particularly from Southeast Asia, remain sparse. This study investigated the survival and asexual dynamics of *Aurelia* sp. polyps from the Philippines under controlled temperature (27–33°C) and salinity (27 and 33 ppt) regimes. Polyps were subjected to incremental temperature shifts (increasing, decreasing, constant) and fed twice weekly. Following the experiment, surviving polyps were transferred to post-treatment conditions (27–28°C and 30°C) with reduced feeding to observe developmental shifts. Results showed high survival across all treatments, including at 33°C. Asexual budding increased significantly with temperature, while salinity had no significant effect. At the coolest experimental temperature (27°C), budding frequency was significantly reduced and polyp size increased, though no strobilation occurred during this phase. Strobilation was only successfully induced 30–35 days post-experiment after maintaining polyps at 27–28°C with reduced food supply; no strobilation occurred at 30°C. This study is among the few to examine polyp responses at these higher tropical temperature ranges. Our findings suggest that budding is the dominant reproductive mode under warm conditions and constant food supply, while strobilation is triggered by cooler temperature and nutrient limitation. We hypothesize that in the Philippines, strobilation for *Aurelia* sp. may occur during the cooler Northeast Monsoon (November–February), while warmer months drive polyp population growth. These results highlight distinct life-history cues in tropical *Aurelia*, providing critical insights into bloom dynamics in warming tropical seas.

Keywords

Aurelia sp., Polyps, Asexual reproduction, Monsoon, Southeast Asia

Environmental adaptation and population formation history of *Aurelia coerulea* that produce large planulae

Satsuki Takauchi¹, Hiroshi Miyake¹, Nobuo Suzuki², Shouzo Ogiso², Shinichiro Ikeguchi³, Naoya Hirata⁴, Momoka Nagai⁴, Yasuhide Nakamura⁵, Sarasa Nagatsuka⁵

¹School of Marine Biosciences, Kitasato University, Kanagawa, Japan. ²Noto Marine Laboratory, Kanazawa University, Ishikawa, Japan. ³Jyoetsu Aquarium, Niigata, Japan.

⁴Notojima Aquarium, Ishikawa, Japan. ⁵Estuary Research Center, Shimane University, Shimane, Japan

Abstract

In the general life cycle of *Aurelia coerulea*, planulae settle on a substrate and metamorphose into polyps. However, in Wakasa Bay and Noto region of Japan, medusae produce large planulae (> 400µm) during low water-temperature periods, and these planulae develop directly into ephyrae after settlement without passing through the polyp stage (Yasuda 1975). This study investigated the genetic and biological characteristics of *A. coerulea* in Japanese waters to clarify the life cycle strategy and population formation history of the “direct development type”. Samples were collected from coastal region around Japan, and population genetic structure was analyzed using the mitochondrial COI gene. In addition, medusae of both the direct development and normal types were reared from ephyrae under high (23°C) and low (13°C) temperature conditions until sexual maturity, and the sizes of oocytes and planulae were measured. Genetic analyses revealed two lineages of *A. coerulea* in Japanese waters: one expanded from southern regions and the other expanded from regions where the direct development type occurs. Rearing experiments showed that only the direct development type that experienced low temperatures produced large oocytes and large planulae. These results suggested that populations in the Sea of Japan were isolated during the Last Glacial Maximum and adapted to low water temperatures, leading to the production of large planula and direct ephyra development. After ephyra formation, their residual tissues can metamorphose into polyps. The asexual reproduction of polyps likely allows the direct development type to be maintained even after geographic isolation has ended.

Keywords

Life cycle, Adaptive strategy, Genetic differences, Direct development

Caught in a risky choice: predator cues deter larval settlement in *Aurelia coerulea*

Lucas H. Gimenez, Anthony R. Carroll, Kylie A. Pitt

School of Environment and Science, Griffith University, Southport, Australia

Abstract

Predators affect populations mainly through direct consumption, but also via non-consumptive effects that influence prey behaviour, morphology, and life history. Non-consumptive effects can be particularly important during early life stages, when settlement decisions determine recruitment success and population structure. Environmental factors and the presence of biofilms or conspecifics can regulate the larva–polyp transition in scyphozoan jellyfish. However, it remains unexplored whether larvae can assess predation risk when selecting settlement sites. We tested the hypothesis that chemical cues associated with predation risk by nudibranchs deter settlement of *Aurelia coerulea* larvae. Across four laboratory experiments, we examined larval settlement responses to live predators, predator kairomones, conspecific alarm cues, and predator dietary cues. Settlement was reduced in the presence of live predators and predator kairomones, revealing both consumptive and non-consumptive effects. Alarm cues associated with active predation on conspecific polyps deterred larval settlement. In contrast, larvae showed no response to chemical cues from conspecific polyps that were mechanically injured without predators. This indicates that alarm cues are released specifically during real attacks by nudibranchs, rather than as a general response to tissue damage. Similarly, larval attraction to conspecific cues, in the absence of predator kairomones, did not differ between cues originating from non-preyed polyps and those from polyps exposed to repeated predation. Finally, predator kairomones reduced settlement irrespective of whether nudibranchs fed on conspecific or heterospecific prey. Our findings demonstrate that immediate perceived predation risk can deter larval settlement, highlighting a non-consumptive mechanism by which benthic predators may influence jellyfish recruitment.

Keywords

Chemical ecology, Cnidaria, Mollusca, Planula, Scyphistoma, Trophic interaction

Invasional meltdown: Invasive jellyfish may facilitate non-indigenous fish dominance

Tamar Guy-Haim

Israel Oceanographic and Limnological Research, Haifa, Israel. Ben-Gurion University, Beer Sheva, Israel

Abstract

Jellyfish are generally assumed as zooplanktivores, predating on fish eggs and larvae and competing with fish for zooplankton, significantly impacting pelagic food webs. The most prominent jellyfish in the Eastern Mediterranean Sea (EMS) is the invasive rhizostome *Rhopilema nomadica*, forming massive swarms. Previous study showed that the guts of *R. nomadica* medusae collected during summertime contain mostly microzooplankton. Here, we aimed to determine the trophic position and dietary sources of *R. nomadica* and co-occurring jellyfish species in the EMS using stable isotope analysis. Scyphomedusae, including *R. nomadica*, were collected in the EMS during summer and wintertime. Potential prey items, including phytoplankton, microzooplankton, copepods, and native and non-indigenous fish larvae, were collected seasonally. Mean $\delta^{15}\text{N}$ values of *R. nomadica* were $14.94 \pm 4.69\text{‰}$ and $7.43 \pm 1.89\text{‰}$ in the winter and summer, respectively, indicating seasonal succession and temporal dietary shift from high (winter) to low (summer) trophic levels. Bayesian mixing models showed a contribution of 34% of fish larvae to the diet of *R. nomadica* in the winter and <5% in the summer. Seasonal trophic shifts were previously shown in several jellyfish species and are considered an inherent scyphozoan ontogenetic trait. Nonetheless, such shifts in *R. nomadica* have far-reaching implications for the EMS biodiversity. During the winter, larvae and eggs of native fish only are present in the EMS waters, whereas non-indigenous fish reproduce during spring and summertime. Therefore, *R. nomadica* potentially exerts higher predatory pressure on native fish, facilitating the dominance of non-indigenous fish, through an invasional meltdown process.

Keywords

Food web, Predation, Trophic shift, Stable isotope analysis

Blooming in a new garden: the case of *Mnemiopsis* in the Northernmost Mediterranean lagoon

Valentina Tirelli¹, Alenka Goruppi¹, Alessandra de Olazabal¹, Diego Borme¹, Elisa Putelli¹, Nicola Bettoso², Lisa Faresi², Erica Caroline Becker¹

¹National Institute of Oceanography and Applied Geophysics-OGS, Trieste, Italy. ²Agenzia Regionale per la Protezione dell'Ambiente (Arpa FVG), Trieste, Italy

Abstract

In recent decades, the ctenophore *Mnemiopsis leidyi* has invaded and spread across many areas of the Mediterranean Sea basin, particularly in lagoon environments. Since 2016, large blooms have also been recorded in the Marano and Grado Lagoon (MGL) (Italy; northern Adriatic Sea) during the warmer months. Here, we present data on the presence and abundance of *Mnemiopsis* in the MGL, collected through monthly surveys conducted from March 2019 to November 2021, with interruptions in only three months: December 2019, and March and April 2020 as a consequence of the COVID-19 pandemic. Sampling was carried out at 9 stations with a bongo net: all collected ctenophores were counted and measured and mesozooplankton was also analyzed. Overall, ctenophores were almost absent during winter, while the highest abundance was recorded from July to September (maximum abundance: 817.2 ctenophores m⁻³), with individuals ranging in size from less than 0.2 cm to 10 cm in total length. *M. leidyi* was present across a wide range of temperatures (7.94–30°C) and salinities (4.74–36.82). In 2021 the diet was investigated through gut content analysis of 101 individuals: only 9 guts were empty and in the 'others' we found a total of 4271 prey (1 to 280 prey/ctenophore) belonging to 43 taxa. The predominant prey were copepods, copepod nauplii and bivalve larvae. Preliminary analysis indicated that optimal temperature and salinity alone are not sufficient to explain blooms of this species, and that the simultaneous availability of a suitable quantity of food is also necessary.

Keywords

Mnemiopsis, Invasive species, Lagoon, Zooplankton

Jellyfish bloom events in the northern Gulf of Mexico: Hypoxia drivers under climate change

Liz A. Collazo Pagán, Kelly L. Robinson

University of Louisiana at Lafayette, Lafayette, Louisiana, United States

Abstract

Large scyphozoan jellyfish move trophic energy in multiple pathways in northern Gulf of Mexico (nGoM) food webs during blooms; they predate on zooplankton, produce carbon-rich mucus consumed by microbes, and serve as prey for piscivorous fishes and marine turtles. One hypothesis for their high aggregations is that low oxygen conditions favor jellyfish as they can store oxygen in their bells. The nGoM seasonally experiences hypoxia driven by freshwater and nutrient loading from the Mississippi and Atchafalaya Rivers (MAR) in spring and temperature-driven water column stratification in late summer and fall. Increasing precipitation events in the MAR watershed and summer warming, amplified by long-term temperature trends, can favor *Aurelia* spp. and *Chrysaora* spp. by enhancing prey production and expanding hypoxic waters. We hypothesize that population densities of these genera increase when hypoxic waters cover a larger-than-average spatial extent along the nGoM. We quantified the temporal and spatial variability of nGoM jellyfish population density from 1982-2023 relative to hydroclimate drivers including SST, dissolved oxygen, river discharge, chlorophyll, and ocean-atmospheric oscillations. Using regression and correlation analyses, we assess relationships between oceanographic variables and bloom dynamics to estimate future patterns of jellyfish aggregation under climate drivers. Jellyfish population densities fluctuate over the years with extreme high and low outliers; identifying conditions during these years allows assessment of oceanographic variables impacting blooms. This study expands jellyfish abundance data from the GoM and furthermore combines analysis on oceanographic variables, giving us a better understanding on how climate variability modifies jellyfish ecology and ecosystem dynamics.

Keywords

Jellyfish, Hypoxia, Climate drivers, northern Gulf of Mexico

Zooplankton distribution in a seasonal oxycline: do certain hydromedusae fare better in hypoxia?

Annika Eske^{1,2}, Sean Colin³, Thomas K. Doyle¹

¹School of Biological, Earth and Environmental Sciences, University College Cork, Cork, Ireland. ²Flanders Marine Institute, Ostend, Belgium. ³Feinstein School of Social and Natural Sciences, Roger Williams University, Rhode Island, United States

Abstract

Gelatinous zooplankton are thought to tolerate hypoxia better than other zooplankton. However, limited studies connect *in situ* observations of species' oxycline depth preferences with laboratory findings. In Lough Hyne, a marine lake in southwest Ireland, a seasonal oxycline develops in May, reaching full hypoxia by August. To determine whether certain hydromedusae preferentially inhabit the hypoxic depths of the lough, vertical plankton net hauls (200 µm) between 15-42 m depth were conducted in May and June 2024. Depth bins (5 m) targeted normoxic (~8mg/L DO), transitional, and hypoxic (<2 mg/L DO) layers. The hydromedusa *Bougainvillia britannica* was significantly more abundant in low-oxygen layers compared to the normoxic layer. Additionally, mean copepod abundance in the transitional layer was three times that of the normoxic layer. To investigate the drivers of these distributions, we revisited Lough Hyne the following year and collected *Obelia* spp., *B. britannica*, and copepods for laboratory experiments examining anoxia survival and behavioural changes. These taxa were separately subjected to 24 hours of anoxic or normoxic conditions. The *B. britannica* survival rate was 100% for both treatments. Copepod and *Obelia* spp. survival rates in anoxia were reduced to 50% and 20%, respectively. Surviving copepods also displayed 50% slower cruising speed after exposure to anoxia. Together, field and laboratory data suggest that *B. britannica* are abundant in hypoxic waters and are physiologically resilient to it. While it is unclear why copepods were more abundant in low oxygen, unaffected *B. britannica* may benefit from increased predation rates in these layers.

Keywords

Jellyfish, Hydrozoa, Bougainvillidae, *Acartia*, Low oxygen environments

The Pacific Gateway Paradox: Biogeographical contraction and niche restriction of Arctic soft-bodied zooplankton

Gerlien Verhaegen¹, Wuju Son², Jee-Hoon Kim², Kyoung-Ho Cho², Eun Jin Yang², Dmitrii Pantiukhin³, Hyoung Sul La^{2,4}

¹Advanced Institute for Marine Ecosystem Change (WPI-AIMEC), JAMSTEC, Yokohama, Japan.

²Korea Polar Research Institute, Incheon, Korea, Republic of. ³Alfred Wegener Institute Helmholtz-Center for Polar and Marine Research, Bremerhaven, Germany. ⁴University of Science and Technology, Republic of Korea, Daejeon, Korea, Republic of

Abstract

The Arctic Ocean is undergoing rapid "Borealization", with poleward expansions of sub-Arctic species widely reported. While pan-Arctic projections often predict a future increase in gelatinous species occupancy, a trend linked to "jellification," we identified a regional paradox within the Pacific Gateway. We investigated the environmental drivers shaping epipelagic gelatinous and soft-bodied zooplankton communities in this narrow and shallow entrance to the Arctic. Community data from 54 vertical net casts collected in August 2024 were analyzed using a trait-based Joint Species Distribution Model. We integrated occurrence data for 17 taxa across five phyla including Cnidaria, Ctenophora, Tunicata, Chaetognatha, and Mollusca, with oceanographic and topographic covariates and life-cycle traits. Spatio-temporal projections to 2100 under the CMIP6 SSP245 scenario reveal a widespread biogeographical contraction of suitable habitat. Contrary to the expansion trends observed in the Atlantic Gateway, the majority of Pacific Gateway taxa, particularly meroplanktonic species, exhibited declining probabilities of presence over time. This niche restriction is driven by a unique synergy of salinity-induced freshening and strict topographic constraints. Our findings demonstrate that the Pacific Gateway acts as a selective environmental bottleneck that resists the uniform expansion of gelatinous zooplankton observed elsewhere. This regional "de-jellification" of the niche space suggests that the Pacific-Arctic transition may experience a loss of key predatory and prey species. Such shifts could potentially decouple traditional trophic pathways and reshape Arctic ecosystem services in the coming century.

Keywords

Jellyfish, Pteropod, Ctenophore, Joint species distribution modelling, Climate change, Gelatinous zooplankton, Spatio-temporal projections, Arctic Ocean

16 Years of Arctic gelatinous zooplankton seasonality

Christian W. G. Detsch^{1,2,3}, Thomas Juul-Pedersen³, Gerlien Verhaegen⁴, Charlotte Havermans^{2,1}, Doreen Kohlbach¹

¹Alfred Wegener Institute, Bremerhaven, Germany. ²University of Bremen, Bremen, Germany. ³Greenland Institute of Natural Resources, Nuuk, Greenland. ⁴Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

Abstract

Year-round long-term monitoring programs are essential for assessing ecosystem functioning and change. In the Arctic, however, continuous multi-year sampling covering all seasons remains scarce. Using monthly observations from the Greenland Ecosystem Monitoring program (2005–2021) in Nuup Kangerlua (SW Greenland), we characterized seasonal abundance patterns of major gelatinous zooplankton groups and assessed their responses to temperature, salinity, chlorophyll *a*, and prey availability (copepod biomass), a driver rarely included in long-term studies. All groups showed strong seasonality, with peak abundances in summer. Across taxa, prey availability showed correlations with gelatinous zooplankton abundance that were equal to or stronger than those of temperature. Chlorophyll *a* correlated weakly, while salinity showed mostly negative associations. These results highlight the importance of including both prey availability besides the common environmental variables and seasonal coverage when assessing changes in Arctic pelagic ecosystems.

Keywords

Abundances, Environmental drivers, GEM, Long-term monitoring, Climate change

Seasonal and latitudinal dynamics of neuston in the Northeast Atlantic (2014-2025)

Yago Iván-Baragaño¹, Gemma Capeáns-García¹, Nicolás Weidberg¹, Ángel López-Urrutia², Fernando G. Taboada², José L. Acuña¹

¹Departamento de Biología de Organismos y Sistemas, Universidad de Oviedo, Oviedo, Spain.

²Centro Oceanográfico de Gijón, Instituto Español de Oceanografía, Gijón, Spain

Abstract

The increasingly frequent occurrence of subtropical marine species in temperate regions, driven by global warming, is known as tropicalisation and reflects ongoing reorganisation of atmospheric circulation and ocean dynamics. These processes strongly affect the sea surface, the habitat of neustonic organisms. Characteristic members of this community include the hydrozoans *Velella velella* and *Physalia physalis*, a subtropical colonial siphonophore whose venomous tentacles pose a recognised socio-environmental concern in coastal areas. We characterised stranding patterns of these and other neuston species across the Northeast Atlantic using records from the citizen science platform iNaturalist. Data were standardised and filtered to minimise taxonomic, spatial and sampling-effort biases. Seasonal dynamics and long-term patterns were assessed using Quantile Generalised Additive Models (QGAMs), while regional trends were evaluated with Generalised Linear Models and post-hoc comparisons. Results reveal a strong and persistent seasonal signal across species, together with a significant increase in the relative occurrence of *P. physalis* in the Bay of Biscay compared to other areas of the Northeast Atlantic, from no recorded observations prior to 2019 to more than 9% of coastal records in 2025. These patterns align with recent changes in dominant atmospheric and oceanic drivers influencing the region, including the expansion of the Azores High. Overall, our findings suggest a northward shift in tropical neuston distributions, in agreement with trends reported for other marine taxa under ongoing climate change.

Keywords

Neuston, Tropicalisation, Northeast Atlantic, Global change, Citizen science

Periphylla periphylla in the mesopelagic ecosystem of deep west Norwegian fjords

Anne Gro V. Salvanes^{1,2}, Martine R. Solås^{1,2}, Pia A. B. Smit¹, Aino L. J. Hosia³

¹University of Bergen, Bergen, Norway. ²Bjerknes Centre for Climate Research, Bergen, Norway. ³University Museum Bergen, Bergen, Norway

Abstract

The near-cosmopolitan mesopelagic and long-lived coronate jellyfish *Periphylla periphylla* has increased in abundance in Norwegian coastal waters, and since the early 1970's become the dominant species in some west Norwegian fjords. *P. periphylla* is present in the deep fjords Fensfjorden and Masfjorden. Fensfjorden has a deep sill and a good connection to coastal and oceanic water masses. Masfjorden branch off from Fensfjorden over a shallow sill that restricts basin water renewal. Masfjorden is a fjord that was previously referred to as a typical "fish fjord", but recently *P. periphylla* abundance has increased. It is currently unknown whether this is part of a shorter natural variation or the onset of a long-term regime shift in the mesopelagic ecosystem. Previous work proposed that darkening (i.e., reduced light penetration) of the Norwegian Coastal Water has led to conditions that favor tactile predators, such as *P. periphylla* that do not need light for prey detection, and that darkening reduce habitats for visually feeding fish. We will present environmental data (including light) and biological data from our 15 year-long time series (2011 – 2025) collected during a field course in Ocean Science at the University of Bergen to Masfjorden and, for the last six years, to the neighbor fjord Fensfjorden (2020-2025). In 2023 - 2025 we measured coronal width, and sexed individuals and this allow comparisons of size distributions and sex ratio of *P. periphylla* between two neighbor fjords separated by a shallow sill. We will discuss the findings in view of environmental conditions of the two fjords.

Keywords

Periphylla abundance, west Norwegian fjords, Data time-series, Size distribution, Sex ratio

From echoes to isotopes: Jellyfish and predators in the mesopelagic

Jonathan D. R. Houghton¹, Paul J. Mensink², Célia A. J. Noël³, Alessandra T. N. Walsh⁴, Damien Haberlin⁵

¹Queen's University Belfast, Belfast, United Kingdom. ²Western University, London, Canada.

³Université du Littoral Côte d'Opale, Dunkerque, France. ⁴Western University, London, Canada. ⁵University College Cork, Cork, Ireland

Abstract

MOSAIC (Multi-disciplinary Ocean Sensing for Adaptive International Conservation) is a large-scale initiative linking Northern Ireland and Ireland with international partners to integrate ocean observation, ecology, and conservation science across connected pelagic systems. A core theme is pelagic ecosystem resilience, examined through the structure, stability, and connectivity of prey fields that support wide ranging top predators, including leatherback turtles, basking sharks, porbeagle sharks, and other highly mobile species that routinely occupy mesopelagic depth layers. This presentation marks the launch of this work and introduces its mesopelagic focus, using gelatinous taxa as entry points into vertically structured pelagic food webs. These organisms link surface productivity to deeper trophic pathways and form key components of prey field structure, shaping when, where, and how energy becomes available to higher predators across depth. Our approach combines physical oceanography, molecular ecology, biogeochemistry and telemetry. Observations of vertical structure and prey fields are integrated with dive and movement data from threatened top predators, allowing predator behaviour to be examined alongside the environments and prey landscapes they encounter. This is supported by molecular and biochemical tools that resolve community composition, physiological state, and trophic pathways across depth. By placing gelatinous taxa within a vertically integrated, cross jurisdictional framework, this contribution sets out a shared platform for linking mesopelagic prey fields to elasmobranch and sea turtle action plans and invites collaboration around how jellyfish and predators together can inform future assessments of pelagic ecosystem resilience in a rapidly changing ocean.

Keywords

Mesopelagic food webs, Gelatinous zooplankton, Prey field structure, Pelagic ecosystem resilience, Animal oceanography, Top predator foraging, Jellyfish

Revisiting scyphozoan jellyfish blooms: challenges and future of the topic

Alfredo Fernández-Alías^{1,2}, Concepción Marcos², Angel Pérez-Ruzafa²

¹University of Lille, Wimereux, France. ²University of Murcia, Murcia, Spain

Abstract

The 1990s marked the awakening of scientific interest in gelatinous zooplankton blooms. During the early years of research, it was widely believed that jellyfish blooms were globally increasing and a conceptual framework was developed linking it to ocean degradation factors such as climate change, eutrophication, habitat modification, overfishing and species translocation. However, the researchers who developed it also pointed out it was limited by the lack of a baseline to compare these observations against and the short duration of the time series. Original assumptions were also biased by an overrepresentation of the scyphozoan genus *Aurelia*, later confirmed as cryptic, and the ctenophore *Mnemiopsis leidyi*. Finally, within this group the mass proliferations are not homogeneously distributed but concentrated in the class Scyphozoa. The long-term monitoring system on the eutrophicated Mar Menor coastal lagoon (1997 – present) provides a unique *in situ* reference system. By tracking hydrographic, nutrient and scyphozoan abundance, we established a pre-bloom and pre-eutrophication baseline. This allowed to analyze how ocean degradation affects scyphozoan ecology, and their role in eutrophication processes. Observations revealed species-specific response to environmental stimuli and the maintenance of their phenology despite changes in thermal anomaly and ecological regimes. Our findings update the original framework by identifying detrimental factors that can significantly affect bloom intensity or even lead to jellyfish populations absence. These factors include the mortality of ephyra, planula, and scyphistoma (due to natural causes, predators, or fishing), and the performance of benthic populations, planula settlement, or the transition from ephyra to medusa under inappropriate conditions.

Keywords

Jellyfish bloom, Scyphozoan, Long-term monitoring, Limitations, Future research path

From nuisance to nexus: what twenty years of jellyfish research tells us and what it still can't

Nicholas E. C. Fleming¹, Dewi Ford^{1,2}

¹University of Chester, Chester, United Kingdom. ²University of Exeter, Exeter, United Kingdom

Abstract

Jellyfish have become one of the most visible symbols of change in the ocean. Over the past twenty years, research on gelatinous zooplankton has expanded rapidly, reshaping how these organisms are understood—not only ecologically, but socially and economically. Yet as jellyfish move from the margins of marine science into the centre of attention, a deeper question emerges: what does our growing body of knowledge actually prepare us for? In this talk, we step back from individual studies to reflect on two decades of scyphozoan jellyfish research and the patterns that emerge when viewed as a whole. Rather than cataloguing results, we consider how research focus, accessibility, and human priorities have shaped what we know, what we assume, and where uncertainty persists. By reframing jellyfish as part of shared human–ocean systems, we explore how ideas of risk, ecosystem services, and opportunity are evolving. The presentation looks forward, asking how future jellyfish research might move beyond managing impacts towards enabling coexistence in an ocean where jellyfish are not anomalies, but enduring and influential neighbours.

Keywords

Jellyfish, Gelatinous zooplankton, Global change, Ecosystem services, Marine ecosystems

Connecting life stages: revisiting life cycle, species diversity and phylogenetic position in understudied hydromedusae

Joan J. Soto-Angel¹, Luis Martell¹, Nicolas Straube¹, Marta Gil², Marta Ronowicz³, Charlotte Havermans^{4,5}, Allen Collins⁶, Dhugal Lindsay⁷, Praveen Raj¹, Sanna Majaneva⁸, Conxita Avila⁹, Francisco Ramil¹⁰, Aino L. J. Hosia¹

¹Department of Natural History, University Museum of Bergen, University of Bergen, Bergen, Norway. ²Benthic communities research group, Institute of Marine Research, Bergen, Norway. ³Department of Marine Ecology, Institute of Oceanology Polish Academy of Sciences, Sopot, Poland. ⁴HYIG ARJEL, Functional Ecology, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany. ⁵BREMARE, Bremen Marine Ecology, Centre for Research and Education, University of Bremen, Bremen, Germany. ⁶National Systematics Laboratory of NOAA's Fisheries Service, National Museum of Natural History, Smithsonian Institution, Washington, United States. ⁷Institute for Extra-cutting-edge Science and Technology Avant-garde Research (X-star), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Japan. ⁸Department of Ecosystem Understanding, Akvaplan-niva, Trondheim, Norway. ⁹Department of Evolutionary Biology, Ecology and Environmental Sciences, University of Barcelona, Barcelona, Spain. ¹⁰Centro de Investigación Marina (CIM-UVigo), Facultade de Ciencias do Mar, University of Vigo, Vigo, Spain

Abstract

Incomplete knowledge of the life cycle of metagenetic jellyfish is one of the major obstacles to progress in several fields. The true diversity and distribution of many hydromedusae is still highly uncertain due to the traditional separation between medusa and polyp-focused research. Parallel systematics (i.e. different life cycle stages classified as different species) not only preclude a good understanding of hydrozoan diversity but also lead to incongruent distribution ranges and obstruct ecological, biogeographical and monitoring advances relying on species occurrence data. To overcome these shortcomings, integrative approaches combining morphological, molecular, and life history traits are key. The present study alleviates the nomenclatural mismatch of selected hydrozoan species within the Tiarannidae and Laodiceidae. Material ascribed to several species within *Stegopoma* and *Ptychogena*, spanning a wide geographic range, have been sequenced for mitochondrial 16S, COI and nuclear 18S and 28S genes, including type material DNA accessed using a museomics approach. Species delimitation methods have allowed us to match several hydromedusae species to their corresponding hydroid stage. We show that both the Arctic *Ptychogena lactea* and the Antarctic *Ptychogena antarctica* have a *Stegopoma plicatile*-like polyp. However, *Ptychogena hyperborea* falls outside the Tiarannidae-Laodiceidae clade, with affinity to Hebellidae. Combined evidence falsifies the hypothesis that *S. plicatile* is a cosmopolitan species by showing that it is restricted to the North Atlantic. This study exemplifies the advantages of a holistic approach integrating molecular and morphological evidence derived from both life cycle stages, leading to a more accurate delineation of species diversity, distribution and ecology.

Keywords

Hydroid, Hydromedusae, Life cycle, *Ptychogena*, *Stegopoma*, Systematics

Gelatinous zooplankton in oceanic regions of the Southeastern Pacific Ocean

Braulio Fernández-Zapata¹, Tammy Horton², Cathy H. Lucas¹

¹Ocean and Earth Science, University of Southampton, National Oceanography Centre, Waterfront Campus, Southampton SO14 3ZH, UK, Southampton, United Kingdom. ²National Oceanography Centre, Southampton SO14 3ZH, UK, Southampton, United Kingdom

Abstract

Despite the worldwide distribution of gelatinous zooplankton (GZ), most studies are in the Northern Hemisphere, with areas of the Southern Hemisphere very understudied. Here, we study the GZ community structure and its size distribution in different marine regions of the Southeastern Pacific Ocean (SPO). We examined three stations along a coastal-ocean transect sampled in the north of Chile, from off the Antofagasta region (25°39.31'S, 71°32.20'W) to the Easter Island (26°25.65'S, 112°37.75'W). GZ were collected by an IONESS net from 7 depth strata, between 1600 m and the surface. Organisms were preserved in 4% formalin and identified under a dissecting microscope. Overall, taxonomic diversity was greatest in the epipelagic and mesopelagic zones, with the bathypelagic zone having fewer taxa. The most oceanic station (spg8) had a total of 6 GZ groups in the epipelagic zone. In general, chaetognaths dominate across all stations, followed by salps, contributing to both shallow and deep waters. In terms of biomass, station spg2 near the coast presented higher values compared to offshore stations, and vertically, peaks of biomass were observed below 1000m depth. This work contributes to the understanding of the GZ community and will help to elucidate their ecosystem role in the oceanic waters of the SPO.

Keywords

Gelatinous zooplankton, Community structure, Body size, Offshore, Southeastern Pacific Ocean

Structured reorganization of jellyfish communities: nestedness dominates assemblage shifts in a homogenizing Mediterranean Sea

Clémence Epinoux¹, Delphine Bonnet², Sandra Bringay^{3,4}, Matthieu de Castelbajac³, Arnaud Sallaberry^{3,4}, Maximilien Servajean^{3,4}, Juan-Carlos Molinero¹

¹MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Sète, France. ²MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France. ³LIRMM, Laboratory of Computer Science, Robotics and Microelectronics in Montpellier, CNRS, Montpellier University, Montpellier, France.

⁴AMIS, Univ. Montpellier Paul-Valéry, Montpellier, France

Abstract

The Mediterranean Sea, a semi-enclosed and rapidly warming basin, is undergoing unprecedented transformations under global change pressures. However, few ecological indicators effectively integrate these changes across broad spatial and temporal scales. Jellyfish, widely distributed and highly responsive to environmental change, present unique potential as ecological sentinels, but community-level reorganization has remained poorly explored beyond local bloom dynamics. Here, we leverage the most comprehensive dataset of Scyphozoan occurrences compiled for the Mediterranean Sea ($n = 108,113$; 2005–2024) to investigate long-term patterns of β -diversity – the community composition variation between sites within a geographic area – in a context of global change. Using a hierarchical Bayesian occupancy model accounting for imperfect detection and uneven sampling effort, we test whether recent warming has promoted directional community restructuring through environmental filtering at the basin scale. Our results reveal a consistent and basin-wide signal: jellyfish community reorganization over the past two decades has been dominated by nestedness rather than species turnover. This pattern indicates non-random, directional assemblage change, consistent with progressive species loss or gain without replacement. Mantel tests further identify sea surface temperature as a significant correlate of community restructuring. In parallel, we detect a sustained decline in overall β -diversity (posterior slope = -0.0012 yr^{-1} ; 95% credible interval: -0.0016 to -0.0008), supporting climate-driven biotic homogenization linked to Mediterranean meridionalization and tropicalization. These findings establish jellyfish as powerful early basin-scale indicators of ecosystem changes and provide a scalable framework to track climate-driven reorganization in marine ecosystems, assisting management and conservation plans.

Keywords

Beta diversity, Scyphozoan, Nestedness, Homogenization, Global change, Mediterranean Sea

Mediterranean gelatinous zooplankton: an updated snapshot of diversity, seasonality, and recent changes

Claudia Traboni^{1,2}, Roberto Gallia¹, Maja Trochanowska³, Priscilla Licandro^{1,2}

¹Stazione Zoologica Anton Dohrn, Naples, Italy. ²National Biodiversity Future Center, Università degli Studi di Palermo, Palermo, Italy. ³Institute of Oceanology Polish Academy of Sciences, Sopot, Poland

Abstract

In the Gulf of Naples (Western Mediterranean Sea), gelatinous zooplankton (GZ) represent a major component of the planktonic community and have increased in abundance in recent decades. However, available information on the GZ community composition is scant and limited to outdated studies or to metabarcoding-based surveys lacking taxonomic resolution. Here, we present updated information on the abundance and diversity of the main GZ taxa, particularly Hydrozoa and Thaliacea, observed at the long-term monitoring station MareChiara in the Gulf of Naples (40°48.500' N, 14°15.000' E). Our biannual (2023-2025) analysis integrates traditional net sampling (Jelly Net, 800 µm mesh; WP2 net, 200 µm mesh), microscopy, and molecular tools (DNA barcoding). In total, 48 taxa (17 Hydromedusae, 24 Siphonophora, 3 Salpida, 4 Doliolida) were identified and counted. Salpida and Siphonophora dominated the GZ community and persisted regularly over time, peaking during spring–summer with no differences in abundance between net types. Hydromedusae and Doliolida were relatively less abundant and occurred more frequently in colder seasons, even though their abundance differed between the two nets. The most recurring taxa of the GZ fauna included the siphonophores *Lensia subtilis*, *Muggiaea kochii*, and *Eudoxoides spiralis*, the hydromedusae *Liriope tetraphylla*, *Rhopalonema velatum*, and *Obelia* spp. Interestingly, the salp *Thalia orientalis* and the doliolid *Doliolum denticulatum* appeared to dominate the gelatinous filter-feeder community at present, having partially replaced the congeneric *T. democratica* and *D. nationalis*, endemic Gulf of Naples species.

Keywords

Gelatinous zooplankton diversity, Hydrozoa, Thaliacea, Long-term changes, Mediterranean Sea

Blackwater diving illuminates biodiversity and ecology of siphonophores in the Gulf Stream

Maja Trochanowska^{1,2}, Richard Collins³, Peter Schuchert⁴, Maciej K. Mańko¹

¹University of Gdańsk, Gdańsk, Poland. ²Institute of Oceanology Polish Academy of Sciences, Sopot, Poland. ³Florida Museum of Natural History, Gainesville, United States. ⁴Natural History Museum of Geneva, Geneva, Switzerland

Abstract

Siphonophores are gelatinous, colonial organisms composed of morphologically distinct units, called zooids. Traditional net-sampling methods damage siphonophore colonies, leading to the disintegration of colonies into individual zooids, which hampers species identification. Additionally, preserving the sample can further damage the specimens, making proper identification difficult. As a result, siphonophores remain understudied, with significant knowledge gaps concerning distribution, diversity, trophic ecology, and life cycles. To overcome these challenges, we employed here a novel approach in which intact colonies were photographed underwater by scuba divers during hundreds of night drift dives in the Gulf Stream waters off the Florida Coast. Additionally, species of interest were collected by divers for barcoding 16S rRNA gene. The morphological identification, corroborated by molecular data, allowed for the identification of 22 species, of which eight were not previously known in the study area, and one was new to science – *Lilyopsis problematica*. Moreover, our approach allowed us to identify novel larval stages, e.g., of poorly known *Rhizophysa* siphonophores, and to document new ecological associations between siphonophores and other marine taxa, such as the observation of larval *Physalia physalis* feeding on fish, justifying the broader application of blackwater diving in marine biodiversity research.

Keywords

Biogeography, Gelatinous zooplankton, Reproductive biology, Cnidaria, DNA barcoding, Atlantic Ocean

Reevaluating bipolarity: *Dimophyes arctica* (Chun, 1897) as a case study

Praveen Raj¹, Aino L. J. Hosia¹, Luis Martell¹, Charlotte Havermans^{2,3}, Sergi Taboada⁴, Maciej Mańko⁵, Gerlien Verhaegen⁶, Casey Dunn⁷, Micaela Ruiz⁸, Ana Riesgo⁴, Joan J. Soto-Angel¹

¹Department of Natural History, University Museum of Bergen, University of Bergen, Bergen, Norway. ²HYIG ARJEL, Functional Ecology, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany. ³FB2, BreMarE – Bremen Marine Ecology, University of Bremen, Bremen, Germany. ⁴National Museum of Natural Sciences (MNCN-CSIC), Spanish National Research Council, Madrid, Spain. ⁵Laboratory of Plankton Biology, Department of Marine Biology and Biotechnology, University of Gdańsk, Gdynia, Poland. ⁶Advanced Institute for Marine Ecosystem Change (WPI-AIMEC), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan. ⁷Department of Ecology and Evolutionary Biology, Yale University, Connecticut, United States. ⁸Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Instituto de Diversidad y Ecología Animal (IDEA), Av. Vélez Sarsfield 299 (X5000JJC), Córdoba, Argentina

Abstract

The concept of bipolarity describes the disjunct distribution of taxa across both hemispheres, where organisms share similar morphological traits and comparable cold-water environments. Cnidarians serve as excellent models for studying speciation by bipolarity due to their diverse life cycle strategies, broad depth ranges, environmental adaptability, and global distribution. One such cnidarian with a bipolar distribution is the calycophoran siphonophore *Dimophyes arctica* (Chun, 1897), a hydrozoan commonly recorded in polar and subpolar waters of both hemispheres. In this study, we generated genomic data (Illumina NovaSeq PE150) from 43 specimens collected from various locations across the North Atlantic, Arctic, and Antarctic waters. Thirteen mitochondrial genes were obtained, and phylogenetic relationships were reconstructed using maximum likelihood analyses. This work represents the first placement of *D. arctica* within a siphonophore phylogenetic framework. Our results revealed two well-supported, divergent clades corresponding to Arctic and Antarctic populations, suggesting potential distinct species in the Northern and Southern hemispheres. These findings challenge the morphology-based bipolarity of *D. arctica* at the species level. Furthermore, specimens from the South Atlantic, collected north of the polar front, formed a separate clade, sister to the Antarctic lineage. Our findings suggest the polar front may act as a dispersal barrier for some gelatinous zooplankton species. Ongoing work incorporating deeper genomic sequencing and population-level analyses will assess potential gene flow among these populations and further elucidate the evolutionary history and biogeographic patterns underlying the genetic divergence in this taxon.

Keywords

Cnidaria, Siphonophores, Bipolarity, Phylogenetics, Taxonomy

Integrating mitogenomes, morphology, and ecology to resolve diversity in deep-sea *Bargmannia* siphonophores

Maciej K. Mańko¹, Samuel H. Church^{2,3}, Diego A. Ramirez³, Steven H. D. Haddock⁴, Casey W. Dunn³

¹University of Gdańsk, Gdańsk, Poland. ²New York University, New York, United States. ³Yale University, New Haven, United States. ⁴Monterey Bay Aquarium Research Institute, Moss Landing, United States

Abstract

Deep-sea siphonophores remain among the least understood components of pelagic biodiversity, with species diversity, evolutionary relationships, and genomic architecture poorly resolved. Here, we present an integrative revision of the deep-sea genus *Bargmannia* Totton, 1954, combining morphological analyses, phylogenomics, mitochondrial genome reconstructions, and distributional data. Using museum specimens, genome-skimming data, and *in situ* observations and collections from remotely operated vehicles, we reevaluate species boundaries and describe two new *Bargmannia* species. Our phylogenetic analyses recovered two major lineages within *Bargmannia*, one of which exhibits pronounced acceleration of mitochondrial genome evolution. Interestingly, this genomic divergence coincided with a transition to monoecy, suggesting a potential link between mitochondrial evolution and sexual system shifts. Using geometric morphometrics, we show that nectophore shape variation is strongly structured by phylogeny and follows lineage-specific allometric trajectories. Comparative cnidome analyses revealed two distinct tentillum types associated with differences in nematocyst size and architecture. Finally, although *Bargmannia* species overlap horizontally, their distributions are clearly structured along depth gradients, supporting vertical niche partitioning as an important driver of speciation in the open ocean. Together, our results establish *Bargmannia* as a useful model for understanding evolution of deep-sea pelagic biodiversity.

Keywords

Biodiversity, Mitochondrial genome, Taxonomy, Sympatric speciation

Parasitism in gelatinous zooplankton across the Red Sea-Mediterranean region: first evidence and invasion-related patterns

Anastasiia Iakovleva^{1,2}, Dror L. Angel², Tamar Guy-Haim^{1,3}

¹National Institute of Oceanography, Israel Oceanographic and Limnological Research, Haifa, Israel. ²Department of Maritime Civilizations, University of Haifa, Haifa, Israel. ³Department of Life Sciences, Ben-Gurion University of the Negev, Beer Sheva, Israel

Abstract

Studies focusing on parasites of gelatinous zooplankton (GZ) have been scarce until recently, and the importance of GZ as hosts facilitating parasite transmission in marine food webs has only begun to be recognized. Investigating interactions between GZ and their parasites provides insight into host population dynamics, parasite spread during bloom events, and trophic interactions. Host-parasite relationships are particularly informative in regions undergoing bioinvasions, such as the Eastern Mediterranean Sea. In this study, we investigated host-parasite interactions in GZ from the Red Sea and the Mediterranean in the context of Lessepsian migration. Parasites were detected across all major GZ groups examined: medusae, siphonophores, ctenophores, chaetognaths, and, for the first time, salps. Here we present a wide range of helminths, including Anisakid nematodes, cestodes from the family Pseudotobothriidae, and digenean trematodes from four families (Accacoelidae, Didymozoidae, Lepocreadiidae, and the monotypic Pachypsolidae), with Pachypsolidae represented by species whose adults parasitize sea turtles, and which have not previously been reported from GZ. Additionally, we recorded the cnidarian planulae *Edwardsiella carnea* and documented their spillover from ctenophores onto two jellyfish species – *Rhopilema nomadica* and *Rhizostoma pulmo*. Parasite identities were determined using morphological and molecular genetic analyses (18S and 28S rRNA genes). Overall, parasite prevalence, abundance, and mean intensity were higher in the Red Sea, whereas parasite type diversity was greater in the Mediterranean, suggesting a potential enemy release process. Our findings underline the importance of GZ as an essential component in helminth life cycles and shed light on possible routes of parasite transmission pathways.

Keywords

Cnidaria, Ctenophores, Salps, Helminths, Chaetognaths, Planulae, Enemy release, Red Sea, Mediterranean Sea, Invasion

Simple population structure of *Aurelia* in oceanic island in contrast to higher diversity in island arc

Sarasa Nagatsuka¹, Naomi Tanaka², Miyako Tanimoto², Yasuhide Nakamura¹

¹Estuary Research Center, Shimane University, Matsue City, Japan. ²Okinawa Churaumi Aquarium, Motobu-cho, Japan

Abstract

Population structure of a species in isolated oceanic islands differs substantially from environments where new lineages often inflow from other regions (e.g., island arcs connected to a continent), and many studies were conducted in organisms with low dispersal ability. This information lacks in plankton with high dispersal ability such as *Aurelia* but clarifying this point could facilitate understanding the relationship between dispersal ability of marine organisms and population structure. This study focused on *Aurelia*, which has potential impact on coastal ecosystems and human society, inhabiting two contrasting environments: Okinawa Island, which is situated on a continental island arc, and the Ogasawara Islands, which are oceanic islands. To compare the population structure between these two regions, molecular analyses based on the mtCO1 and 16S rRNA genes were conducted. The Ogasawara population exhibited low genetic diversity, whereas the Okinawa population showed significantly higher genetic diversity. Moreover, an unknown lineage belonging to *Aurelia* was also discovered in Okinawa Island. Geographic isolation in the Ogasawara Islands may have resulted in a relatively simple population structure. In contrast, the population structure was suggested to be more complex for Okinawa Island, where new lineages often inflow through nearby strong warm currents (Kuroshio Current) and local genetic differentiation also occurs. This study provides the new knowledge that population structures could substantially differentiate between oceanic islands and island arcs facilitating recruitment despite the high dispersal ability and broad distribution of *Aurelia* in tropical and subtropical marine environments.

Keywords

Cryptic diversity

Reproductive strategies and ecological adaptability of four scyphozoan species (*Rhopilema esculentum*, *Nemopilema nomurai*, *Aurelia coerulea* and *Cyanea nozakii*) in northern China

Ming Sun^{1,2,3}, Jing Dong^{1,2,3}, Yan Duan^{1,2,3}, Fudi Chen^{1,2,3}, Yuwei Zhang⁴, Ying Li⁵, Yihao Zeng⁵

¹Liaoning Ocean and Fisheries Science Research Institute, Dalian, China. ²Key Laboratory of Protection and Utilization of Aquatic Germplasm Resource, Ministry of Agriculture and Rural Affairs, Dalian, China. ³Key Laboratory of Marine Biological Resources and Ecology, Liaoning Province, Dalian, China. ⁴South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China. ⁵Dalian Ocean University, Dalian, China

Abstract

Significant changes in the populations of scyphozoan jellyfish (*Rhopilema esculentum*, *Nemopilema nomurai*, *Aurelia coerulea*, and *Cyanea nozakii*) have a profound impact on coastal ecosystems and human activities in northern China. Compared with large medusae, there remain numerous unknown mysteries regarding small polyps. We continuously monitored the survival and asexual reproduction of polyps through microscopic observations in the laboratory and synchronous verification in situ. Monthly variations in polyp abundance, podocyst number, strobilation timing, and ephyra quantity were analyzed. The results indicated that temperature and food are key environmental factors regulating asexual reproduction, and significant differences exist in asexual reproductive characteristics among different species. All four polyp species exhibit a low-temperature dormancy period in winter, during which asexual reproduction ceases, with each species having a distinctly low-temperature range for dormancy. Strobilation occurred during the period of rising water temperature in spring. Under high-temperature stress in summer, habitat competition and predation pose significant challenges to benthic polyp populations. Differences in reproductive strategies and ecological adaptability among these species support their ability to coexist in the same habitat. The research findings are of great significance for further elucidating the coexistence mechanism of large jellyfish in the same area, effectively preventing the outbreak of harmful jellyfish blooms, and scientifically protecting and sustainably utilizing economic jellyfish resources.

Keywords

Scyphozoan, Polyps, Ecological environment, Asexual reproduction, Sexual reproduction

Chironex hemipristis sp. nov. (Cubomedusae, Chiropodida, Chiropodidae) and *Chiropsella bianchia* sp. nov. (Cubomedusae, Chiropodida, Chiropsellidae) – two new, supposedly dangerous box jellyfish from Mozambique waters as part of the cubozoan collection of IIOE-2

Ilka Straehler-Pohl¹, Michael K. Brown², Mark J. Gibbons²

¹Medusa's Nursery - Private Laboratory for Life cycle, Developmental, Evolutionary and Taxonomical Research, Haldensleben, Germany. ²Department of Biodiversity and Conservation Biology, University of the Western Cape, Bellville, South Africa

Abstract

The Southwestern Indian Ocean, spanning the coastlines of East Africa and associated islands, is, from the perspective of large jellyfish, poorly studied. Kramp's (1961) synopsis of global medusae reported only 15 species of Scyphozoa from the region and no Cubozoa. Cornelius (1997) suggested, without published evidence, that three genera of Cubozoa may be present in the area, while Bentlage (2013) described another. Following the inclusion of jellyfish as subjects of study in the FAO's EAF Nansen programme, samples were collected from Mozambique in 2018. Amongst captured material were four cubozoan species: one carybdeid and three chiropodids, the latter including specimens of *Chironex*. *Chironex* are known only from East Asian waters, where they are associated with coastal waters and mangroves. Mangroves too fringe some of the 9000 km of shoreline in Mozambique, Madagascar and Tanzania and more than 60 million people live, play and work around the coast. Given that some species of *Chironex* are deadly to humans, their accurate identification is important if we are to advise on the appropriate medical treatment of stung persons. Here we present two new species of potentially venomous chiropodid jellyfish, *Chironex hemipristis* sp. nov. and *Chiropsella bianchia* sp. nov., from the waters off Mozambique and discuss potential biogeography.

Keywords

Cubozoa, Chiropodida, Diversity, Southwest Indian Ocean, Biogeography

The importance of gelatinous zooplankton in the Canary Current Large Marine Ecosystem (CCLME) trophic web

Priscilla Licandro¹, Jemal El Abed², Bouya Mbengue², Beyah Meissa Habib², Abdellahi Samba², Raffaele Piscopo¹, Maja Trochanowska³

¹Stazione Zoologica Anton Dohrn, Naples, Italy. ²Institut Mauritanien de Recherches Océanographiques et de Pêches, Nouadhibou, Mauritania. ³Institute of Oceanology Polish Academy of Sciences, Sopot, Poland

Abstract

Mauritania is one of the main fishing grounds worldwide and a key component of the Canary Current Large Marine Ecosystem (CCLME). This is a highly productive sea area covering more than 5400 km of coastline under the influence of the NW African upwelling, that provides vital food and economic resources to an estimated population of 64 million people. In recent years the need of developing an ecosystem-based approach to the fishery in the GCLME has been highlighted. In this framework, baseline information on the first trophic levels of the GCLME food web were collected in Mauritania during autumn 2019 within the project DEMERSTEM. In situ data from 23 stations located between 21°LatN and 16°LatN highlighted the importance of gelatinous zooplankton, particularly in northern and central Mauritanian regions characterized by eddies and complex water-masses dynamics associated with the upwelling. Gelatinous filter-feeders, such as appendicularians and thaliaceans, and gelatinous carnivores, such as hydrozoan siphonophores, were particularly abundant off the Banque d'Arguin and Cap-Timeris. Large swarms of big scyphozoans were instead recorded across the whole Mauritanian continental shelf, with exceptional densities near the mouth of the river Senegal. Overall, main blooming scyphozoans were differently distributed, according to a latitudinal gradient. Environmental preferences of key gelatinous species were also identified, in order to improve our understanding of their distribution and population dynamics.

Keywords

Gelatinous zooplankton diversity, Mesoscale patterns, Ecosystem-based-approach to the fishery, CCLME, North Atlantic

Key identifiable characters of pelagic hydrozoans affecting aquaculture in the northeastern Atlantic: implications for microscopy- and image-based monitoring

Erlend A. Hallaren¹, Aino L. J. Hosia¹, Joan J Soto-Angel¹, Sanna Majaneva², Luis Martell¹

¹University of Bergen, Bergen, Norway. ²Akvaplan-Niva, Trondheim, Norway

Abstract

Pelagic hydrozoans are a growing concern for aquaculture, but they can be difficult to identify for non-specialists. Today, detection of these organisms is done primarily through morphological identification of plankton samples, and future monitoring will likely also be morphology-based. Therefore, identifying key characters for quick identification and creating resources for this is essential. Using museum collections and fresh samples, we characterized morphologically pelagic hydrozoans harmful to aquaculture in the NE Atlantic and identified key traits for rapid species identification. For *Apolemia uvaria*, the species most relevant to Norwegian aquaculture, we also analyzed the nematocyst complement. For *A. uvaria*, bracts and red palpons had the strongest diagnostic power for rapid detection and identification. Bracts are abundant, often retain their characteristic shape even in damaged samples, and display distinct morphological traits; while red palpons have a distinctive coloration and nematocyst distribution. These features make these two zooids suitable for image-based identification methods, such as Flow-cams, which can capture high-resolution images of planktonic organisms *in situ*. The cnidome of *A. uvaria* consists of four types of nematocysts (birhopaloids, isorhizas, stenoteles, and mastigophores), all of which (except mastigophores) occur in two size classes. Based on the cnidome, red palpons are the zooids most likely to cause damage due to the high abundance and distribution of isorhizas. We produced illustrated species identification (ID) sheets for all harmful species, useful for aquaculture professionals and other stakeholders outside academia. The ID guides present species in accessible language for use in science communication, capacity building, and risk mitigation.

Keywords

Identification, Plankton, Nematocysts, Cnidome, ID guides, Science communication, Management

Challenges to finfish aquaculture from *Apolesia* and other hydromedusae and siphonophores in the Northeastern Atlantic Ocean

Luis Martell¹, Erlend A. Hallaren¹, Joan J. Soto-Angel¹, Sanna Majaneva², Tone Falkenhaug³, Tina Oldham⁴, Ana Herrero⁵, Hamish Rodger⁵, Maciej K. Mańko⁶, Mari Kjønsstad⁷, Amanda Vang⁸, Trine Dale⁹, Aino L. J. Hosia¹

¹Department of Natural History, University Museum of Bergen, University of Bergen, Bergen, Norway. ²Akvaplan-niva, Trondheim, Norway. ³Flødevigen Research Station, Institute of Marine Research, Arendal, Norway. ⁴Research Group Animal Welfare, Institute of Marine Research, Bergen, Norway. ⁵PatoGen Fish Health Services Ltd, Kinvara, Ireland. ⁶Laboratory of Plankton Biology, Department of Marine Biology and Biotechnology, University of Gdańsk, Gdańsk, Poland. ⁷DNV Åkerblå AS, Sistranda, Norway. ⁸FIRUM, Tórshavn, Denmark. ⁹Norwegian Institute for Water Research (NIVA), Oslo, Norway

Abstract

Pelagic hydrozoans are increasingly recognized as a significant yet still overlooked threat to finfish aquaculture, particularly in the northeastern Atlantic, a region with intense jellyfish-aquaculture interactions. Research and mitigation efforts have focused mainly on large scyphozoan jellyfish, but growing evidence indicates that smaller and less conspicuous siphonophores and hydromedusae can cause equally severe biological and economic impacts. Based on an integrated synthesis combining peer-reviewed literature, government documentation, structured interviews with aquaculture producers, and media reports, we identified 28 independent and confirmed events in which pelagic hydrozoans affected farmed Atlantic salmon between 1984 and 2025. The frequency and spatial extent of these events increased sharply after 2021. Nine hydrozoan taxa were implicated, dominated by *Apolesia uvaria*, *Muggiaea atlantica*, *Solmaris corona*, and *Dipleurosoma typicum*. Molecular analyses resolve long standing taxonomic uncertainty by identifying *A. uvaria* as the species responsible for repeated large-scale events in Norwegian aquaculture. Consistent spatio-temporal patterns emerged, including strong autumn and winter seasonality, geographic clustering in western Ireland and northern and western Norway, and differences between countries in the dominance of single versus multispecies events. Consequences included mass mortality, gill pathology, secondary infections, and substantial economic losses, alongside clear gaps in monitoring, taxonomic resolution, and data availability. Our results emphasize the need for hydrozoan-focused monitoring approaches, improved species level identification, and stronger integration of regional knowledge. We provide a basis for targeted mitigation, early warning systems, and future research linking jellyfish ecology with aquaculture sustainability, to face the escalating applied challenge represented by pelagic hydrozoans.

Keywords

Pelagic hydrozoans, Farmed salmon, Jellyfish impacts, Monitoring gaps, *Muggiaea atlantica*

Development and achievement of precautionary management of jellyfish blooms in Korea

Sunwoo Kim¹, Bola Moon¹, Seongoh Im¹, Byungseol Koh¹, Jinho Chae²

¹Korea Marine Environment Management Corporation, Seoul, Korea, Republic of. ²Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of

Abstract

Young polyps of jellyfish among its life cycle are important reservoirs contributing to medusa blooms, because polyps can survive for many years, repeating asexual reproduction that leads to exponential growth of the population and production of numerous ephyrae. Population size of polyps is a crucial factor determining intensity of medusa blooms in the next seasons. Thus, we adopted the precautionary approach, based upon direct eliminating of polyps, for prevention in advance of medusa blooms by implementing “Jellyfish Polyp Management Program” since 2013. The program is composed of three major steps; 1) locating and quantifying polyp habitats, 2) eliminating important polyp populations, and 3) verification of the effects. Ephyrae and medusea were significantly decreased after polyp-elimination in all areas where we pinpointed exact locations of the polyp populations and calculated the amount before and after the elimination. In order to systematically operate jellyfish polyp removal, the ‘1st Mid-term strategy for systematic jellyfish polyp management’ was implemented in Korea from 2018 to 2022. As a result, jellyfish polyps across the country were reduced, and jellyfish warnings and damage were reduced. For the next five years, from 2023, the “2nd Mid-term strategy” is implemented. As part of these strategies, polyps were removed from Deukryang-Bay and Saemangeum-lake, Korea’s major jellyfish origins, effectively suppressing medusa massive bloom outbreak. We are going to discuss effectiveness of direct elimination of polyps as a countermeasure of jellyfish bloom in several cases.

Keywords

Polyp elimination, Precautionary management, National project, Moon jellyfish

The GLObecc Project: Jellyfish at a North Atlantic crossroad — Biodiversity baseline and reference database for Faroese waters

Amanda Vang^{1,2}, Luis Martell³, Ian Salter⁴, Tone Falkenhaus⁵, Petra E. Petersen⁶, Maria M. Dahl⁶, Debes H. Christiansen⁶, Sanna Majaneva⁷, Eiríkur Danielsen¹, Sissal V. Erenbjerg¹, Joan J. Soto-Angel³, Erlend A. Hallaren³, Lea S. Dober³, Aino L. J. Hosia³

¹Firum, Hvalvík, Faroe Islands. ²University of the Faroe Islands, Tórshavn, Faroe Islands.

³University Museum of Bergen, Bergen, Norway. ⁴Faroe Marine Research Institute, Tórshavn, Faroe Islands. ⁵Institute of Marine Research, His, Norway. ⁶Faroese Food and Veterinary Authority, Tórshavn, Faroe Islands. ⁷Akvaplan-niva, Trondheim, Norway

Abstract

The Faroe Islands represent a highly productive marine ecosystem at the intersection of Arctic and Atlantic water masses, yet jellyfish biodiversity in this region remains poorly documented. The GLObecc project provides the first comprehensive characterization of jellyfish biodiversity and seasonality in Faroese waters, an area of high ecological and economic importance in the North Atlantic. Coastal sampling was conducted fortnightly from July 2024 to November 2025, supplemented by opportunistic collections between March 2022 and November 2025 to improve seasonal coverage. Coastal blooms were dominated by Ctenophora (*Pleurobrachia* sp., *Bolinopsis* sp.), Scyphozoa (*Aurelia aurita*, *Cyanea capillata*, *C. lamarckii*), and Hydrozoa (*Hybocodon prolifer*), with an unusual aggregation of *Velella velella* recorded. Given the importance of salmon aquaculture in the country, GLObecc functioned as a risk assessment for harmful jellyfish species. *Apolemia uvaria* was documented in 2023 and 2024 but not in 2025, while several high-risk taxa (*Muggiaea atlantica*, *Solmaris corona*, *Lizzia blondina*, *Dipleurosoma typicum*) were not detected. No adverse health effects were reported. Offshore surveys across five hydrographic regions in September 2024, June 2025, and October 2025 recorded over 50 taxa, including species poorly represented in DNA reference databases (*Marrus orthocanna*, *Clausophyes moserae*, *Praya* sp., *Vogtia spinosa*). Notably, large aggregations of *A. uvaria* on the Faroe Bank in September 2024 support hypotheses of oceanic transport rather than local reproduction. Genome skimming is underway to establish a Faroese reference database, improving taxonomic resolution for the North Atlantic. Overall, GLObecc provides a critical baseline for investigating jellyfish bloom origin, advection, and distribution dynamics.

Keywords

Faroe Islands, Biodiversity, North Atlantic, Climate change, DNA reference database

Photocatalytic degradation of jellyfish polyps: A sustainable approach to combat jellyfish blooms

Song Feng¹, Jianing Lin², Wei Zhang², Jinzeng Gu², Ziwei Wang³

¹Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China. ²Shandong University, Qingdao, China. ³Liaoning University, Liaoning, China

Abstract

Jellyfish blooms have frequently occurred around the globe in recent decades, which have been extensively managed due to their serious ecological and socio-economic damage. However, the environment-friendly methods by eliminating polyps to early control the outbreaks of medusae from source had been rarely involved despite exhibiting some physical and chemical manners currently. A new approach to photo-catalytically inactivate polyps of *Aurelia coerulea*, was thus explored by synthesizing the P-g-C₃N₄ photocatalysts modified with trace Ag₂O in this study. During the photocatalytic reaction, up to 84.6% of polyps died under the weak visible light similar to their wild habitats by using the Ag₂O@P-g-C₃N₄ composite with the Ag content of 1.11%. This prepared photocatalyst exhibited the high electron density and photo-stability, which enhanced the harvest of visible light and decreased the recombination of photo-generated electrons and holes. The scavenger experiments and ESR results suggested that the •OH and •O₂⁻ were the major photo-generated reactive radicals causing the mortality of polyps. They could bring about some significant abnormal changes not only in the antioxidant enzyme activity, but also in transcriptional expression involved in permeability of the cell membrane, immune stress response and asexual reproduction for polyps. Under the attack of these radicals, polyps thus suffered severe tissue damage and eventually died. This study was the first to propose the application of photocatalytic reaction to control jellyfish blooms by inactivating their polyps and revealed the potential photocatalytic lethal mechanisms, providing new insights into solving marine ecological disasters.

Keywords

Jellyfish blooms, Polyps, Photocatalysis, Antioxidant enzyme, Transcriptome

An integrated monitoring–forecasting–mitigation framework for hazardous jellyfish in China’s coastal service zones

Chaolun Li, Xiao Ma

State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China

Abstract

Jellyfish blooms are increasingly disrupting coastal service zones, including nuclear power plant cooling-water intakes, aquaculture grounds, and bathing beaches. Here we present an end-to-end framework that links demand-driven risk management with ecosystem-based science, covering (i) population variability and ecological effects of key hazardous jellyfish, (ii) full-life-cycle three-dimensional monitoring, (iii) trend prediction and short-term path forecasting, and (iv) multi-technology mitigation and operational demonstration. Field investigations and historical-data synthesis across multiple representative coastal sites were combined with controlled experiments to quantify biological–ecological processes and identify dominant drivers, highlighting temperature as a critical regulator of seasonal dynamics and outbreak development. For monitoring, we developed a prototype *in situ* optical imaging sensor with image reconstruction and automated recognition/counting to detect early life stages in turbid waters and established an acoustic workflow for large-jellyfish identification and abundance estimation. For broad-scale surface surveillance, we built Unmanned Aerial Vehicles (UAV)-based low-altitude remote-sensing pipelines and evaluated UAV remote sensing for shallow-water applications. For forecasting, we set up a Regional Ocean Modeling System (ROMS) configuration, coupled with Lagrangian particle tracking and data-driven models, to support both long-term risk assessment and short-term trajectory prediction. Mitigation trials integrated ecological, physical, and chemical approaches, and were translated into a monitoring–warning–release–verification operational workflow in several coastal regions.

Keywords

Jellyfish bloom, Coastal hazard, Early warning, *in situ* imaging, Acoustic monitoring, UAV remote sensing, Mitigation technology

Exploring *Rhizostoma pulmo* trajectories in a Mediterranean lagoon using electronic tagging

Quentin Ponzo^{1,2}, Delphine Bonnet², Vincent Kerzérho¹

¹LIRMM - Univ. Montpellier, CNRS, Montpellier, France. ²MARBEC - Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France

Abstract

Jellyfish blooms are rapid and substantial increases in biomass with major ecological and socioeconomic impacts. While increasing attention has been paid to understanding drivers of bloom initiation and production, much less is known about jellyfish swimming behaviour and trajectories. Recent studies have shown that jellyfish are not always passive drifters and can actively adjust their displacement (e.g. searching for food or avoiding being stranded). Using a combination of observatory techniques such as real-time electronic tagging, control drifters and aerial drone footage, individual trajectories within a jellyfish patch were explored to better understand behaviour at small spatial and temporal scales. Bages-Sigean lagoon hosts a perennial population of the scyphozoan *Rhizostoma pulmo* blooming from June to October. Jellyfish were tagged using a floating electronic device equipped with a GPS that logs and transmits individual positions every 10 minutes. During summer 2025, five campaigns lasting between 24 and 48 h were conducted. Several individuals were tagged concurrently, for a total of 37 jellyfish tracked. Control tags, with and without a drogue, were simultaneously deployed to compare trajectories and assess the influence of environmental parameters (e.g. local winds and currents). Drone video footage was analysed using AI-based tracking methods to investigate the impact of the tag on the jellyfish's behaviour. Results show that across deployments, distances between individuals remain between 500 and 800 meters, indicating cohesive group-level organisation. Inter-individual analysis reveals the contribution of swimming behaviour to the trajectories, while the trajectory of the tagged-jellyfish positions' barycentre provides insights into environmental forcing.

Keywords

Biologging, Trajectory, Active displacement, *Rhizostoma pulmo*, Drone observations

A modelling-based analysis of physical forcings influencing *Pelagia noctiluca* in the Balearic Archipelago

Manuel Jesús León-Cobo¹, Daniel Ottman¹, Javier Ruiz¹, Juan Gabriel Fernández², Rebeca Álvarez², Eva Moragues³, Antoni María Grau³, Joaquín Tintoré⁴, Laura Prieto¹

¹Instituto de Ciencias Marinas de Andalucía, Puerto Real, Cádiz, Spain. ²Balearic Islands Coastal Observation and Forecasting System, Palma de Mallorca, Spain. ³Direcció General de Pesca, Conselleria d'Agricultura, Pesca i Medi Natural, Govern des Illes Balears, Palma de Mallorca, Spain. ⁴Instituto Mediterráneo de Estudios Avanzados, Esporles, Mallorca, Spain

Abstract

In recent years, massive jellyfish blooms have gained increasing attention due to their ecological and socio-economic impacts, particularly on health, fisheries and tourism. In the Mediterranean Sea, one of the most widespread species is *Pelagia noctiluca*, characterized by an entirely pelagic life cycle. The aim of this study is to assess, using Generalized Additive Models (GAMs), the influence of physical forcings on the coastal presence of these species in the Balearic archipelago. A comprehensive dataset of daily jellyfish observations spanning from 2014 to 2024 was assembled through collaboration with the Government of Balearic Islands, the CSIC (with its IMEDEA and ICMAN institutes) and the Balearic Islands Coastal Observation and Forecasting System (SOCIB). This dataset was integrated with oceanographic and biogeochemical model outputs to support the application of modelling approaches to identify environmental drivers of jellyfish occurrences. Results indicate that *P. noctiluca* presence is significantly related to current intensity, temperature, salinity, chlorophyll concentration and seasonal variability. These findings highlight the potential of the modelling framework to support the development of predictive tools for anticipating jellyfish arrivals, thereby supporting preventive management strategies and mitigating impacts on human health and coastal economic activities.

Keywords

Mauve stinger, Scyphozoa, Stochastic modeling, Coastal occurrence, Balearic Islands

A flow map approach for visualizing uncertain jellyfish trajectories

Matthieu de Castelbajac¹, Sandra Bringay^{1,2}, Arnaud Sallaberry^{1,2}, Maximilien Servajean^{1,2}, Clémence Epinoux³, Juan-Carlos Molinero⁴, Delphine Bonnet⁴

¹LIRMM, Univ. Montpellier, CNRS, Montpellier, France. ²AMIS, Univ. Montpellier Paul-Valéry, Montpellier, France. ³MARBEC, Univ. Montpellier, Ifremer, IRD, CNRS, Montpellier, France.

⁴MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France

Abstract

Accurately modeling jellyfish species distribution is crucial for better understanding jellyfish response to ongoing changes in marine ecosystems and its repercussions on these ecosystems and on human activities. Unlike other marine species, modeling jellyfish species distribution is particularly challenging as jellyfish presence are almost exclusively recorded on the shores, resulting in an important knowledge gap in their distribution at sea. Transport models have been proposed to simulate individual jellyfish trajectories for a few species. However, for many species, little is known regarding autonomous swimming behaviors or responses to environmental factors at sea, and existing approaches tend to omit or minimize these sources of uncertainty. To simulate this uncertainty, we propose a parametric transport model replicating several behaviors (such as vertical swimming, circadian rhythms or sailing), with injected noise. It produces sets of plausible trajectories in place of single trajectories. However, large sets of trajectories cannot be directly visually interpreted or interacted with, due to important overlap and visual clutter. Thus, we propose a new visualization that transforms sets of trajectories into legible flow maps using spatio-temporal clustering of intermediary jellyfish positions, where closely related trajectories are aggregated into flows. By this means, larger flows reflect more plausible routes. We validate our approach using real jellyfish presence records for several jellyfish species. We show how our method can highlight potential routes, reproduction sites, and connections between jellyfish blooms.

Keywords

Trajectory visualization, Uncertainty visualization, Trajectory modeling

Testing behavioural plasticity of *Physalia utriculus* to key environmental drivers

Jessica R. Guerchon¹, Alistair G. B. Poore¹, Amandine Schaeffer^{1,2}, Kylie A. Pitt³, Jasmin C. Lawes⁴

¹Centre for Marine Science and Innovation, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia. ²School of Mathematics and Statistics, University of New South Wales, Sydney, Australia. ³Coastal and Marine Research Centre, School of Environment and Science, Australian Rivers Institute, Griffith University, Southport, Australia. ⁴Surf Life Saving Australia, Sydney, Australia

Abstract

The pleustonic colonial hydrozoan *Physalia* spp. is widespread in world oceans and causes painful stings and beach disruptions when it strands in large numbers. Predicting coastal strandings has largely relied on wind and current transport models, assuming individuals behave passively and do not alter posture or sail exposure in response to changing surface conditions. However, near-surface behaviour remains poorly quantified for *Physalia* and has rarely been tested under controlled experimental conditions, limiting our ability to interpret how physical forcing influences drift patterns and stranding risk. Here, we test how wind forcing, UV-A irradiance, and seawater temperature shape relevant behaviours in *Physalia utriculus* that could modulate wind-driven drift and use these responses to define simple behavioural rules for transport models assessing stranding likelihood. Replicated single-factor trials are conducted on freshly collected colonies from the Sydney coast in 2 m cylindrical tanks at the Sydney Institute of Marine Science. Behaviour is captured on synchronised video and quantified using colony-level metrics including float orientation and posture, sail presentation, rolling events, and tentacle deployment dynamics. Preliminary observations suggest measurable behavioural shifts under changing wind strength, particularly in float posture and sail presentation, with formal analyses underway. By quantifying behavioural responses to realistic surface forcing, this work improves understanding of how *Physalia* responds to key surface triggers. The results inform models that aim to predict interannual variability in *Physalia* occurrence and strandings in New South Wales, Australia, including potential shifts under changing wind fields and ocean warming, and support improved stranding forecasting for beach management.

Keywords

Physalia, *P. utriculus*, Bluebottle, Pleuston, Gelatinous zooplankton, Behavioural plasticity, Wind, UV-A, Temperature, Transport processes, Coastal strandings, Forecasting, Beach management

Tracing pathways: understanding movement dynamics of the surface-dwelling siphonophore *Physalia physalis* in the northwest Atlantic Ocean

River B. Abedon¹, Mary Beth Decker¹, Casey W. Dunn¹, Samuel H. Church^{1,2}

¹Yale University, New Haven, United States. ²New York University, New York, United States

Abstract

The siphonophore *Physalia physalis* is frequently found stranded along the US East Coast, but the factors influencing its seasonal and geographic distribution are not well understood. Leveraging recent genomic insights into *Physalia* population structures, we combine observational data from iNaturalist with a biologically-informed particle-tracking model to explore the origins, dispersal, and stranding patterns of *P. physalis* in the northwest Atlantic. We identify observations of stranded adults and juveniles, using juvenile distributions for our model initialization. Our model incorporates updated data on *Physalia* drift hydrodynamics and high-resolution environmental factors to simulate a year-long dispersal. Our results reveal a peak in juvenile *P. physalis* during winter within a specific area encompassing the Straits of Florida and Gulf of Mexico. We find rapid transport via the Gulf Stream, with minimal recirculation, suggesting a source-sink dynamic. The large-scale distribution of *P. physalis* in this region is mainly dictated by current-driven flow, while winds are crucial for nearshore transport and strandings. We analyze the impact of the Gulf Stream and seasonal wind patterns on *P. physalis* strandings along different US East Coast regions. Mesoscale eddies appear to affect transport in offshore areas, and we propose that seasonal changes in Gulf Stream dynamics, such as eddy activity and shifts in current position and intensity, influence strandings north of Cape Hatteras. This study underscores the Gulf Stream's pivotal role in neuston distributions in the North Atlantic and the broader transport dynamics affecting global *Physalia* populations.

Keywords

Particle-tracking modeling, Neuston, Gulf Stream, Source-sink connectivity

PHYSALIA: a project on the evolution of biological sailing

Susana Acle¹, Itziar Álvarez-Trasobares², Leocadio Blanco-Bercial³, Jorge Cabrera Gámez⁴, Mario Cabrera Lavara⁵, Gemma Capeáns García⁵, Anna Cunill I Sáez⁶, Antonio Carlos Domínguez Brito⁴, May Gómez Cabrera⁶, Fernando González Taboada⁷, Carlos Guardado Fernández⁵, Alicia Herrera⁶, Juan Hofer⁸, Iñaki Huskin⁷, Alejandro Isla⁷, Yago Iván-Baragaño⁵, Melanie Juza⁹, Ángel López-Urrutia⁷, Diego Macias Moy¹⁰, Ico Martínez Sánchez⁶, Deva Menéndez Teleña⁵, Itziar Munuera⁷, Laura Prieto¹¹, José Manuel Rico Ordás⁵, Javier Ruiz¹¹, Verónica Soto López⁵, Álvaro Torres-Gómez⁶, Nicolás Felipe Weidberg López⁵, José Luis Acuña Fernández⁵

¹Bioparc Acuario de Gijón, Gijón, Spain. ²Instituto de Ciencias Marinas de Andalucía (ICMAN –CSIC), Puerto Real, Spain. ³Bermuda Institute of Ocean Sciences - Arizona State University, St Georges, United States. ⁴Instituto Universitario de Sistemas Inteligentes y Aplicaciones Numéricas en Ingeniería (I.U. SIANI), ULPGC, Las Palmas de Gran Canaria, Spain. ⁵Universidad de Oviedo, Oviedo, Spain. ⁶Universidad de Las Palmas de Gran Canaria (ULPGC), Las Palmas de Gran Canaria, Spain. ⁷Centro Oceanográfico de Gijón (IEO-CSIC), Gijón, Spain. ⁸Pontificia Universidad Católica de Valparaíso (PUCV), Valparaíso, Chile. ⁹SOCIB – Sistema de Observación y Predicción Costero de las Illes Balears, Palma, Spain. ¹⁰diego.macias-moy@ec.europa.eu, Ispra, Italy. ¹¹Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC), Puerto Real, Spain

Abstract

Much recent research focuses on the arrival of *Physalia physalis* to the coast, due to health concerns and negative impacts on beach economies. But we still lack basic knowledge about the biology and ecology of this species in the open ocean. Project PHYSALIA tries to fill this gap by looking at the evolution of *P. physalis* as a natural, biological sailor that harnesses ocean winds and currents using the pneumatophore, a specialized polyp that stands above the ocean surface and plays the role of sail. PHYSALIA uses open ocean experiments and observations to determine the sailing dynamics of these animals and will extrapolate those dynamics to the open ocean by means of agent-based models. Our observations represent the first *in situ* account of sailing behavior ever recorded and will provide a large-scale, coherent picture of these populations.

Keywords

Portuguese man o' war, Siphonophore, Navigation, Ecology, Dispersal, Population dynamics

Environmental and geographic drivers of *Physalia physalis* strandings

Gemma Capeáns-García¹, Yago Iván-Baragaño¹, Carlos Guardado Fernández¹, Leticia Viesca Lombardía¹, Iñaki Huskin Camino², Anna Cunil i Sàez³, Ángel López Urrutia², Itziar Munuera Fernández², Pili Fernández Martín², Alejandro Isla de la Roz², Susana Acle Olivo⁴, Ana Marrero Quevedo⁵, José Luis Acuña Fernández¹, Fernando González Taboada²

¹Departamento de Biología de Organismos y Sistemas, Universidad de Oviedo, Oviedo, Spain.

²Centro Oceanográfico de Gijón, Instituto Español de Oceanografía-CSIC, Gijón, Spain.

³Woods Hole Oceanographic Institution, Woods Hole, United States. ⁴BIOPARC Acuario de Gijón, Gijón, Spain. ⁵Protección Civil 112 Asturias, Lugo de Llanera, Spain

Abstract

Arrival of the colonial siphonophore *Physalia physalis* nearshore raises social concerns due to their highly toxic sting. Concerns are particularly marked in areas where *P. physalis* presence was previously sporadic but has become more common due to climate change. The characterization scattered distribution of *P. physalis* deters traditional sampling methods and limits the characterization of strandings. Here, we report the results of a *P. physalis* field monitoring network activated from July to September 2025 to cover more than 400km of the Asturian coast, in the southern Bay of Biscay. We coordinated reports from emergency services and leveraged citizen science platforms to detect *P. physalis* presence and quantify its abundance, and to collect colonies to characterize their morphology – pneumatophore length and chirality. We recorded the date, location, and colony abundance for 2,000 strandings, and characterized the morphology of over 1,000 specimens. The distribution of strandings was aggregated, with synchronous arrivals lasting for a few days that simultaneously affected tens of kilometers of the coast. The average number of colonies per day was 40 but peaked up to 300 during midsummer massive strandings. Pneumatophore length increased through summer and ranged from a few millimeters to 30 cm. The two chiral morphs were present, but right-handed colonies prevailed (90 %). We are analyzing meteorological data, coastal orientation and exposure to identify the drivers of strandings and map potential hotspots. Our findings pave the way toward the development of predictive models and early warning systems for a more anticipative management of jellyfish arrivals.

Keywords

Physalia physalis, Monitoring, Morphology, Stranding

Spatial and morphological drivers of *Physalia physalis* strandings on Spanish beaches

Itziar Álvarez-Trasobares¹, Pablo Almarez¹, Eduardo G. Torres-Conde², Laura Del-Río³, Manuel J. León-Cobo¹, Laura Prieto¹

¹Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC), Puerto Real (Cádiz), Spain.

²Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Puerto Morelos, Quintana Roo, Mexico. ³Universidad de Cádiz, Puerto Real (Cádiz), Spain

Abstract

The Portuguese man o'war (*Physalia physalis*) is a pleustonic species whose presence in coastal zones is strongly conditioned by the interaction between oceanic and atmospheric processes. Over the last decade, an increase in its arrival along several Spanish coasts, including archipelagos such as the Canary Islands and the Balearic Islands, has occurred, generating growing scientific and socio-environmental interest. Our study examines the arrival of *P. physalis* on Spanish beaches from a spatial and morphological perspective and analyzes how beach physical characteristics modulate stranding patterns. The analysis considers morphological variables such as shoreline orientation, degree of wave exposure and geometric configuration. Also, integrates them with regional-scale oceanographic and meteorological information. Our work is based on the compilation and analysis of records of *P. physalis* presence across different beach typologies, covering both continental and insular coasts. This approach aims to improve understanding of the variables that favor the accumulation of pleustonic organisms in specific areas, beyond large-scale forcing mechanisms. Finally, it provides a foundation for future research aimed at improving prediction of *P. physalis* arrival events and developing management and risk prevention tools for coastal zones, particularly in a context of increasing human pressure on the coastline.

Keywords

Portuguese man o'war, Coastal strandings, Pleustonic organisms, Beach morphology, Physical drivers

Atmospheric and oceanographic conditions during summer 2019 on the occurrence of Portuguese Man-o-War along the southern Iberian coasts.

Diego Macías-Moy¹, Lorea García-San Martín², Laura Prieto³

¹European Commission, Joint Research Centre (JRC), Ispra, Italy. ²Independent Researcher, Vitoria, Spain. ³Departamento de Gestión Costera, Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC), Puerto Real, Cádiz, Spain

Abstract

In early summer 2019, a number of *Physalia physalis* colonies arrived on the beaches of the southern Iberian Peninsula, causing closures, economic damage, and social concern. Different stakeholders wondered why this unusual event occurred and if it was a sign of change in these organisms' distribution areas as a consequence of climatic shifts. Usually, the advection of these pleustonic colonies happens during the winter months, when low-pressure atmospheric systems typically move from west to east accompanied by strong westerly winds. With the aim of elucidating the potential causes of the atypical arrival of *P. physalis* colonies during summer months to these important touristic destinations, several datasets of atmospheric and oceanographic variables were analyzed. This study reveals that summer 2019 presented particular atmospheric characteristics, with very low atmospheric pressure on both sides of the Iberian Peninsula and associated westerlies that drove a peculiar oceanographic setting with abnormal eastward currents and larger-than-average waves in the Gulf of Cádiz.

Keywords

Physalia physalis, Pleuston, Gulf of Cádiz, Northeast Atlantic Ocean

The dynamics of jellyfish swarms: from a Lagrangian to a mean-field kinetic model

Nicolas Perez¹, Erik Gengel², Zafrir Kuplik¹, Eyal Heifetz¹

¹Tel Aviv University, Tel Aviv, Israel. ²Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany

Abstract

Over the past decades, the scyphomedusa *Rhopilema nomadica* has become an invasive species in the eastern Mediterranean Sea, forming massive swarms that can extend over 100 km and comprise hundreds of thousands of individuals. These blooms appear annually along the Levantine coast. Despite their regularity and scale, the mechanisms underlying the formation, persistence, and coherent motion of these jellyfish swarms in the open sea remain poorly understood. Early studies largely treated jellyfish as passive tracers, attributing swarm formation and transport solely to advection by ocean currents. More recent observations, however, demonstrate that *R. nomadica* is an efficient swimmer that actively responds to environmental cues and can swim against prevailing currents, in some cases exceeding the flow speed. These findings call for a modeling framework that accounts for both passive transport and active behavior. Significant progress has recently been made toward a physical description of jellyfish motion. A state-of-the-art Lagrangian model represents individual jellyfish as active agents subject to current advection while swimming in response to environmental stimuli. By incorporating mechanisms such as signaling attraction and counter-current swimming, this approach successfully reproduces key features of observed swarm dynamics. Building on this agent-based description, we introduce a novel mean-field active-matter model aimed at capturing the collective behavior of jellyfish swarms and providing a macroscopic perspective on their large-scale organization and motion.

Keywords

Active matter modelling, Collective dynamics

Introducing *Chironex blakangmati*, a new species of venomous box jellyfish from Singapore and the range extension of the Thai sea wasp *C. indrasaksajiae*

Iffah Iesa^{1,4}, Cheryl Lewis Ames^{2,3}, Nicholas Wei Lang Yap^{4,5}, Danwei Huang^{1,4,6}

¹Lee Kong Chian Natural History Museum, National University of Singapore, Singapore.

²Graduate School of Agricultural Sciences and WPI-Advanced Institute for Marine Ecosystem Change, Tohoku University, Sendai, Japan. ³Department of Invertebrate Zoology, Smithsonian National Museum of Natural History (NMNH), Washington, DC, United States. ⁴Tropical Marine Science Institute, National University of Singapore, Singapore. ⁵St John's Island National Marine Laboratory c/o Tropical Marine Science Institute, National University of Singapore, Singapore. ⁶Department of Biological Sciences, National University of Singapore, Singapore

Abstract

Two venomous box jellyfish species of the genus *Chironex* are recently documented from Singapore's coastal waters: the Thai sea wasp *Chironex indrasaksajiae* and a newly described species, *Chironex blakangmati*. Specimens were collected from the Johor and Singapore Straits, with the new species recorded from Sentosa Island. *Chironex* species, which are exclusively Indo-Pacific in distribution, are not well understood due largely to inadequate sampling and difficulty in distinguishing species with few conspicuous morphological variations. Comparative examination of mature specimens in this study revealed diagnostic differences between *C. blakangmati* and related congeners, including the absence of velarial canals extending from the perradial lappet terminus in the new species. Cnidome analyses identified eight nematocyst types in *C. blakangmati*, compared to five types in both *C. indrasaksajiae* and the Okinawa sea wasp *C. yamaguchii*. Molecular phylogenetic analyses using 16S rRNA and COI markers support the placement of *C. blakangmati* as a distinct lineage closely related to *C. yamaguchii*. It has been 40 years since the last known fatal box jellyfish sting in Singapore, with *C. blakangmati* being the likely culprit, but a recent spike in reports of box jellyfish observations occurred from 2017 to 2022. These findings expand current knowledge of cubozoan biodiversity in Southeast Asia and contribute to understanding the taxonomy, evolution, and potential public health implications of venomous box jellyfish in tropical coastal ecosystems.

Keywords

Box jellyfish, *Chironex* spp., Singapore, Molecular

PleagialIBM: Uncovering the distribution of *Pelagia noctiluca* in the Mediterranean Sea with an individual-based model

Martin Vodopivec, Alenka Malej

Marine Biology Station Piran, National Institute of Biology, Piran, Slovenia

Abstract

Even though *Pelagia noctiluca* is one of the most abundant and economically important jellyfish species in the Mediterranean Sea, its spatial and temporal distribution is relatively poorly known due to scarcity of field observations. We developed a spatially explicit Individual Based Model (IBM) PleagialIBM and ran it for 21 years to produce a realistic distribution of *Pelagia noctiluca*. The model incorporates sun-synchronized vertical migrations, beaching, variable mortality and growth to mimic the behavior of jellyfish swarms. The environmental conditions are provided by Copernicus Marine Service - virtual particles are driven by currents derived from Mediterranean Sea Physical while food availability is provided by the biogeochemical reanalysis. The model produces a realistic distribution of *Pelagia noctiluca* that matches well with available observations. The core of the population resides in the western Mediterranean between the Catalan coast, Balearic Islands, Corsica and Gulf of Lions. However, its position and biomass are highly variable. PleagialIBM demonstrates how spatial IBMs can provide an unprecedented insight into spatial and temporal distribution of jellyfish species even when based on relatively simple assumptions. The model is freely available and can be used for any species or geographical setting.

Keywords

Pelagia noctiluca, Mediterranean Sea, Individual Based Model, Agent Based Model, OpenDrift

Coupling gelatinous zooplankton sinking speed to its surface-area based decay exposes overestimation in deep-sea particle-mediated carbon export

Črtomir Ernesto Perharič Bailey^{1,2}, Martin Vodopivec¹, Gerhard J Herndl^{3,4}, Tinkara Tinta¹, Matjaž Ličer^{5,1}

¹Marine Biology Station, National Institute of Biology, Ljubljana, Slovenia. ²Jožef Stefan International Postgraduate School, Ljubljana, Slovenia. ³Department of Functional and Evolutionary Ecology, Bio-Oceanography and Marine Biology Unit, University of Vienna, Vienna, Austria. ⁴Department of Marine Microbiology and Biogeochemistry, Royal Netherlands Institute for Sea Research, Den Burg, Netherlands. ⁵Office for Meteorology, Hydrology and Oceanography, Slovenian Environment Agency, Ljubljana, Slovenia

Abstract

Gelatinous zooplankton (GZ) has been proposed as a potentially important, but largely overlooked, contributor to the biological carbon pump. However, studies investigating GZ-derived carbon fluxes report a wide range of estimates for transfer efficiency, i.e. the fraction of biomass reaching the ocean floor, reflecting uncertainties in key parameters like sinking rates, degradation dynamics, and spatial–temporal variability of GZ populations. This study addresses two of these simplifications by introducing two modeling features: 1) vertical sinking that is dynamically coupled to GZ biomass loss due to microbial decay and 2) a novel formulation of biomass degradation that depends on the surface area of GZ, thereby exploring the potential influence of processes that were previously unaccounted for. We recompute global GZ particulate organic carbon (POC) exports under these new assumptions, using previous data-driven export production estimates. While GZ remains a major contributor to the total POC export from the euphotic zone, introducing mass-sinking speed coupling reduces GZ POC export to the seafloor by 14%. Additionally, in the surface-area based decay, it is reduced by 43%, due to the altered dependence on the particle's mass. This indicates that earlier models likely overestimated GZ's contribution to deep-ocean carbon sequestration. The modeling novelties of this study are generic and transferable beyond an idealized (spherical) GZ case presented here, to other classes of sinking and decaying particles with known decay rates and initial sinking velocities, thus advancing the understanding of the biological carbon pump's mechanical aspects.

Keywords

Gelatinous zooplankton, Modelling, Biological carbon pump, Particulate organic carbon export

Gelatinous zooplankton diversity, distribution patterns and ecological niches in Qatar's pelagic ecosystems

Mohamed Nejib Daly Yahia

Qatar University, Doha, Qatar

Abstract

Between June 2022 and October 2024, a gelatinous zooplankton monitoring program have been implemented along the coastal and offshore marine environment of Qatar in the Arabian-Persian Gulf. This extreme marine environment is considered as one of the harshest marine ecosystems on earth with very high salinities in the coastal environment ranging between 40 and 50 and between 39 and 41 in offshore waters in addition to oligotrophic conditions. Therefore, gelatinous zooplankton organisms are adapted to live to the margin of their physiological limit. The present study focuses on the diversity and distribution patterns of gelatinous zooplankton in the pelagic ecosystem of Qatar in relation to abiotic and biotic factors, with a description of the environmental niches for dominant species toward oceanographic (SST and SSS) and trophic conditions (Chlorophyll-a and Zooplankton DW). The gelatinous zooplankton diversity and phenology analysis reveals a relatively low species richness with 26 species belonging to 8 taxonomic groups such as chaetognaths, ctenophores, hydrozoans, siphonophores, scyphozoans, salps, doliolids and appendicularians and providing insights into potential functional roles. *Oikopleura dioica*, *Diphyes chamissonis*, *Sagitta bipunctata*, *Flaccisagitta enflata*, *Thalia democratica*, *Chrysaora caliparea* and *Catostylus perezii* were the dominant or blooming species during the study period. The Cumulative Frequency Method used to build the dominant species ecological niches through species cumulative frequency distribution (CFD) shows that relative tolerance of dominant species to environmental variables is very variable, ranging from species with a very broad ecological niche to species with a rather specialized one, toward the selected oceanographic and trophic parameter.

Keywords

Gelatinous Zooplankton, Diversity, Phenology, Environmental Niches

Small jellyfish, large consequences: the overlooked predatory role of hydromedusae in subtropical estuarine ecosystems

Guilherme M. Von Montfort¹, Kelly Sutherland², Sean Colin^{3,4}, John Costello^{5,4}, Renato M. Nagata¹

¹Universidade Federal do Rio Grande, Rio Grande, Brazil. ²Oregon University, Eugene, United States. ³Roger Williams University, Bristol, United States. ⁴Marine Biological Laboratory, Woods Hole, United States. ⁵Providence College, Providence, United States

Abstract

Hydromedusae are often overlooked in pelagic trophic ecology compared to large scyphozoans. We investigated the diet, prey selectivity, ingestion rates, digestion times, and predation impacts of the native *Liriope tetraphylla* and non-indigenous species *Cnidostoma fallax* and *Moerisia inkermanica* in a subtropical estuary of the southwestern Atlantic. While all three species predominantly consumed copepods, *L. tetraphylla* exhibited the broadest diet and highest number of preys in gut content (up to 13). Digestion time for *L. tetraphylla* decreased significantly with increasing temperature, from 94 min at 18°C to 64 min at 28°C, with Q_{10} values showing that digestion rates roughly double with a 10°C increase. *Cnidostoma fallax* exhibited longer digestion times (180 min at 23°C). Daily ingestion rations ranged from 16–212 copepods day⁻¹ for *L. tetraphylla*, 7–15 for *C. fallax*, and up to 48 for *M. inkermanica*. Predation impact (PI), the proportion of a prey stock consumed by *L. tetraphylla* population, averaged 38.1% and peaked at 103.5%, while *C. fallax* and *M. inkermanica* had lower impacts (~5%). Carbon intake analyses revealed that *L. tetraphylla* consumed up to 280 times its own carbon weight day⁻¹, far exceeding the non-indigenous species. These results highlight the critical role of hydromedusae in estuarine food webs, challenging the prevailing view that only large gelatinous predators exert top-down control. We demonstrate that small hydrozoans can be key agents shaping prey community structure and carbon flow in subtropical estuarine ecosystems.

Keywords

Gelatinous zooplankton, Hydrozoa, Non-indigenous species, Trophic ecology

Feeding impacts and metabolic rates of the Hydromedusae, *Bougainvillia carolinensis*, in the North Inlet Estuary

Jasmine Caillier, Josh Stone

University of South Carolina, Columbia, United States

Abstract

Hydromedusae are small planktonic jellyfish that occur worldwide and play an important role in our marine food webs. As predators of zooplankton, they have the potential to alter community structure and drive short-term changes in estuarine ecosystems. The North Inlet Estuary is a relatively pristine marsh-estuarine system where hydromedusae are the dominant jellyfish taxa; however, their ecological impacts remain poorly understood. Despite their high abundances, few studies have quantified the feeding impacts of hydromedusae in the North Inlet Estuary, limiting our understanding of their role in shaping zooplankton communities and potential competition with zooplanktivorous fish. This study examined the feeding impacts of *Bougainvillia carolinensis* on natural zooplankton assemblages. Additionally, respiration was measured at multiple temperatures to evaluate physiological responses to seasonal and interannual changes in water temperature, and how those responses might change with global warming. Clearance rate experiments revealed rapid declines in zooplankton abundance within one hour, indicating strong short term predation pressure on zooplankton. Together, both approaches will provide insight into how increasing temperatures may influence the trophic interactions of hydromedusae and their potential role in structuring planktonic estuarine communities.

Keywords

Hydromedusae, Respiration, Predatory feeding impact, Climate change, North Inlet Estuary

Observation of unprecedented biomass of *Chrysaora melanaster* in the open ocean sub-Arctic northeast Pacific and its ecosystem effects

Brian P. V. Hunt¹, Evgeny A. Pakhomov², Genyffer C. Troina¹, Vladimir Radchenko³, Aleksey Somov³

¹Institute for Oceans and Fisheries, University of British Columbia, Vancouver, Canada.

²Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, Vancouver, Canada. ³TINRO, Vladivostok, Russia

Abstract

The sub-Arctic northeast Pacific is the primary rearing and maturation habitat of Canadian and United States Pacific salmon stocks and is also used extensively by Russian and Japanese stocks. The food web dynamics of this ecosystem, including productivity and resource competition, are therefore of particular relevance as potential drivers of interannual fluctuations in salmon marine survival and recruitment. In February – March of 2019, an international expedition aboard the R/V Professor Kaganovsky conducted a gridded trawl survey of 58 stations, covering an area of approximately 697,500 km², to investigate ecosystem dynamics and salmon health at the end of winter, hypothesised to be a critical period for salmon survival. We observed the occurrence of an unprecedented bloom of the northern sea nettle *Chrysaora melanaster* in the northern half of the survey area (~ 300,000 km²) with abundance averaging 1,800 individuals per km² and total biomass estimated at 1.23 million tons wet weight. The dry weight of *C. melanaster* was 5 times the dry weight of salmon, and they were estimated to consume up to 35% of the mesozooplankton standing stock. We further assess the trophic role of *C. melanaster* using stable isotope data and present possible mechanisms driving their transport from the Alaskan shelf to the open ocean.

Keywords

Scyphozoan jellyfish, *Chrysaora melanaster*, Winter ecology, Food webs, Northeast Pacific, Pacific salmon

The role of epidermal cilia in fluid biomechanics and suspension feeding in scyphozoan medusae

Mayara A. Jordano¹, Guilherme M. Von Montfort², Renato M. Nagata², André C. Morandini³

¹Departamento de Oceanografia Biológica, Instituto Oceanográfico, Universidade de São Paulo, São Paulo, Brazil. ²Instituto de Oceanografia, Universidade Federal do Rio Grande, Rio Grande, Brazil. ³Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil

Abstract

Although the presence of motile cilia is widely recognized in Metazoa, their role in particle capture by medusae remains largely unexplored. Studies of the ciliary epidermis are also neglected in studies of medusae fluid biomechanics, which generally consider only bell pulsation. Therefore, the aim of this study was to investigate the performance and function of motile cilia, as well as to describe the interaction between the flows produced and the epidermis in scyphozoan ephyrae and medusae with different morphologies and behaviors, by analyzing high-speed video recordings and Particle Image Velocimetry (PIV). We observed ciliary flows that conduct suspended particles toward the mouth and oral arms, characterizing an active suspension-feeding mechanism. These flows also reduce boundary layer effects and increase the local Reynolds number, indicating that ciliation influences both the biomechanics and feeding ecology of these organisms. We propose a reinterpretation of the trophic niche of medusae, incorporating ciliary particle capture as a functional component of their feeding strategy.

Keywords

Biomechanics, Functional morphology, Fluid mechanics, Feeding, Oral arms

Trophic role of the jellyfish *Rhizostoma pulmo* (Cnidaria: Scyphozoa) in the Gulf of Taranto (southern Italy)

Lara M. Fumarola^{1,2}, Valentina Leoni², Giacomo Milisenda³, Mar Bosch-Belmar^{4,5,6}, Stefano Piraino^{1,2,6}

¹Dipartimento di Scienze e Tecnologie Biologiche e Ambientali (DiSTeBA), Università del Salento, Lecce, Italy. ²Consorzio Nazionale Interuniversitario per le Scienze del Mare, CoNISMa, Lecce, Italy. ³Stazione Zoologica Anton Dohrn, Department of Integrative Marine Ecology (EMI), Sicily Marine Centre, Palermo, Italy. ⁴Consorzio Nazionale Interuniversitario per le Scienze del Mare, CoNISMa, Palermo, Italy. ⁵Laboratory of Ecology, Department of Earth and Marine Science (DiSTeM), University of Palermo, Palermo, Italy. ⁶National Biodiversity Future Center, (NBFC), University of Palermo, Palermo, Italy

Abstract

Along the northern Mediterranean coast, *Rhizostoma pulmo* (Macri, 1778) is one of the largest and most abundant bloom-forming jellyfish. The recent increase in its bloom magnitude and frequency raised concerns about its potential effects on plankton communities and energy flow within the food web. This study investigates the trophic ecology of a *R. pulmo* population along the coastal area of the Gulf of Taranto using, for the first time, stable isotope and gut content analyses. Medusae (N = 86; bell diameter 1.5 - 43.0 cm), potential food resources and environmental conditions (chlorophyll a, temperature and salinity), were monthly monitored during 2023 - 2024 in a major bloom area. During summer (June to August), when juveniles (<15 cm) and adults (>15 cm) co-occurred, mixing models indicated that particulate organic matter (POM) contributed substantially to juvenile diets, while adults relied mainly on POM and microzooplankton, particularly ciliates. In subsequent seasons, mesozooplankton - predominantly copepods - became increasingly important, with gut content analyses showing the highest consumption in autumn (September to November). These results indicate that *R. pulmo* presents a diversified diet, and its blooms exert feeding pressure across multiple trophic levels of the planktonic food web. Moreover, jellyfish abundances (0.15 ± 0.10 to 7.29 ± 0.10 ind. 100 m^{-3}) were positively associated with chlorophyll a concentrations and plankton availability. Overall, our findings reveal pronounced ontogenetic and seasonal variability in jellyfish trophic roles, emphasizing the need for more realistic representations of jellyfish in coastal ecosystem models.

Keywords

Food web, Gut content, Medusa, Rhizostomeae, Stable isotopes, Trophic interactions

Niche overlap of three sympatric jellyfish species in coastal Newfoundland, Canada

Kate Vonderbank, Gail Davoren

Department of Biological Sciences, University of Manitoba, Winnipeg, Canada

Abstract

While jellyfish populations naturally have periods of high abundances ('bloom'), human-induced changes, such as climate change and overfishing, are causing blooms to increase in frequency. This can result in negative impacts on ecosystems, including a lack of recovery of overfished populations. Although jellyfish appear to occupy an intermediate position in marine food webs, their trophic roles are often unclear, and recent evidence suggests their roles are more complex than once thought. As the trophic ecology of jellyfish species is understudied, multiple species are often combined into one functional group, missing potential variation among and within species. We aimed to investigate the trophic ecology of three sympatric jellyfish species (*Cyanea capillata*, *Aurelia aurita*, *Beroe cucumis*) in coastal Newfoundland, Canada during the summer. All three species were sampled on the northeast Newfoundland coast July 16-August 3, 2025. Bell tissue from each individual was subsampled, processed (i.e., freeze dried, homogenized) and then stable isotope ratios of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) were quantified. Data analyses will determine whether all species consume similar prey types (isotopic niche overlap) or consume a similar variety of prey types (isotopic niche breadth) and whether these metrics vary with jellyfish size. Overall, obtaining species-specific information on jellyfish trophic ecology will aid in understanding the impacts of jellyfish blooms on ecosystem functioning.

Keywords

Cyanea capillata, *Aurelia aurita*, *Beroe cucumis*, Newfoundland, Canada, Stable isotope analysis, Trophic ecology, Species interactions

Interactions between fishes and gelatinous zooplankton in the Irish Sea - exploring the "gingerbread house" hypothesis

Oliver J. Lincoln^{1,2}, Donal C. Griffin^{1,2,3}, Chris Harrod⁴, Jonathan D. R. Houghton^{1,2}

¹School of Biological Sciences, Queen's University Belfast, Belfast, United Kingdom. ²Queen's University Belfast Marine Laboratory, Portaferry, United Kingdom. ³Fair Seas, Dublin, Ireland.

⁴Scottish Centre for Ecology and the Natural Environment, School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, Glasgow, United Kingdom

Abstract

Associations between gelatinous zooplankton and fishes have been documented previously, with observational and experimental studies suggesting that these interactions are more frequent in demersal fishes and may range from parasitic to mutualistic in nature. In this study, stable isotope analysis combined with Bayesian mixing models was used to test these existing hypotheses by quantitatively assessing trophic associations between gelatinous zooplankton and fishes in the Irish Sea. The results indicated that these interactions were predominantly unidirectional, with fishes deriving a greater dietary contribution from gelatinous zooplankton than vice versa. Such associations were most evident in demersal fishes within the study area. Several commercially important fishes in the Irish Sea were found to feed on gelatinous taxa, relationships that have not previously been quantified in this system. These findings provide empirical support for existing conceptual models and offer a more robust basis for incorporating gelatinous zooplankton into regional food-web and fisheries models.

Keywords

Stable isotope, Bayesian, Fish-jellyfish association, Demersal fish, Mixing models, Dietary contribution

Beyond quantity: Food quality links the causes and consequences of jellyfish blooms

Xupeng Chi¹, Fang Zhang¹, Jamileh Javidpour², Song Sun¹

¹Institute of Oceanology Chinese Academy of Sciences, Qingdao, China. ²University of Southern Denmark, Odense, Denmark

Abstract

Jellyfish bloom dynamics and their food-web consequences are often attributed to environmental forcing and prey abundance; however, prey biochemical quality provides a mechanistic bridge linking bloom formation to trophic impacts. Zooplankton quality regulates the benthic polyp “seed bank” that sets bloom potential, while predator benefits depend on jellyfish highly unsaturated fatty acid (HUFA) and taxon-specific lipid signatures. We pair experiments manipulating food quantity, prey HUFA quality, and temperature with a phytoplankton–copepod–polyp chain, and use diet-switch time series to quantify lipid turnover and lagged responses. Polyp performance (survival, growth, budding, strobilation) is not driven by prey quantity alone: HUFA-rich copepod diets increase outputs and partly buffer warming stress, whereas low-quality diets suppress reproduction and can underestimate reproductive capacity. Field surveys across gelatinous taxa show strong lipid fingerprints and wide HUFA variability; some taxa match key zooplankton prey in HUFA content, indicating blooms can be a context-dependent nutritional pulse rather than a universal trophic dead end. A key frontier remains: how gelatinous consumers filter, retain, and transform food quality across life stages, creating a “nutrient black-box” that can decouple environmental HUFA supply from consumer HUFA profiles and constrain predictability. We propose an Effective Nutritional Flux framework where bloom potential scales with zooplankton quantity × quality, trophic consequences scale with jellyfish HUFA content/composition from field surveys, and resolving the nutrient black-box via turnover and transformation pathways is critical for forecasting blooms and their impacts.

Keywords

Jellyfish bloom, Food quality, Food web, Fatty acid

Spatio-temporal assessment of jellyfish bloom assemblages and perception-based evaluation of gear-specific fisheries impacts along the Maharashtra Coast, India

M. R. Ashpel Mano¹, S. Abuthagir Iburahim¹, Asha T. Landge¹, S. Ramkumar², T. Velumani³, Sonam Angmo¹, Kottapalli Nikhil¹

¹ICAR- Central Institute of Fisheries Education, Mumbai, India. ²ICAR- Central Marine Fisheries Research Institute, Mumbai Centre, Mumbai, India. ³Bay of Bengal Programme - Inter-Governmental Organisation, Chennai, India

Abstract

Jellyfish blooms are increasingly reported along the west coast of India in the Eastern Arabian Sea and are emerging as a significant challenge to coastal fisheries, particularly in the state of Maharashtra. Despite recurring reports of economic losses, systematic information on the spatio-temporal occurrence of jellyfish blooms and their fisheries impacts remains limited. This study examined the distribution, seasonal dynamics, and fisheries-related impacts of jellyfish blooms along the Maharashtra coast between October 2023 to September 2024. Observations were made using SCUBA diving, experimental fishing, and fisher-assisted onboard surveys. Ten jellyfish taxa belonging to two phyla (Cnidaria and Ctenophora), four classes (Cubozoa, Hydrozoa, Scyphozoa, and Tentaculata), and nine orders were recorded. Seasonal bloom distributions were mapped, with higher species diversity observed during the pre-monsoon season (February–May). The study also assessed the negative effects of jellyfish blooms on fishing operations based on fishers' perceptions. Structured interviews were conducted with 140 fishers covering all major fishing gears using convenience and snowball sampling techniques. The major reported impacts included jellyfish stings (100%), reduction in fish catch (87%), increased catch sorting time (86%), clogging and breakage of fishing gear (55%), induced changes in fishing grounds (43%), and loss of fishing days (33%). Significant differences in impacts were observed among fishing gear types ($p < 0.05$), except for stings, which were uniform across all gears. The findings highlight the need for gear-specific management measures, improved bloom monitoring, and the sustainable utilisation of potential commercial species such as *Rhopilema hispidum* to mitigate its adverse effects.

Keywords

Bloom seasonality, Distribution, Ecosystem roles, Gear interference, Jellyfish diversity

Jelly in the belly: A global network analysis of marine vertebrates as predators of gelatinous zooplankton

Ramón D. Morejón-Arrojo¹, Florian Lüsckow², Jamileh Javidpour³, Valentina Leoni⁴, Evgeny A. Pakhomov^{5,6}, Déborah M. de Oliveira¹, Leandro Rodríguez-Viera⁷, André C. Morandini^{1,8}

¹Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil. ²Department of Earth Sciences, Uppsala University, Visby, Sweden. ³University of Southern Denmark, Odense, Denmark. ⁴Consorzio Nazionale Interuniversitario per le Scienze del Mare, Rome, Italy. ⁵Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada. ⁶Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada. ⁷Department of Biology, Faculty of Marine and Environmental Sciences, INMAR, University of, Cádiz, Spain. ⁸Centro de Biologia Marinha (CEBIMar), Universidade de São Paulo, São Paulo, Brazil

Abstract

Gelatinous zooplankton (GZ), including ctenophores, medusozoans, and thaliaceans, are key components of marine ecosystems, yet their role as prey for vertebrates remains poorly quantified globally. We compiled a global predator–prey network based on 1,114 documented feeding interactions involving 417 vertebrate species and 178 GZ taxa. At the species level (697 links), the network exhibited low connectance (0.012) and high modularity (0.735), indicating high degree of trophic specialization, with individual predator species consuming distinct subsets of GZ taxa. When aggregated to higher taxonomic levels, network connectance increased substantially (0.556), and the structure became moderately nested. Significant differences in connectivity were observed among major predator groups (birds, fish, mammals, and reptiles). Network nestedness was weak at the species level (NODF = 2.37) but increased markedly when interactions were considered among broader taxonomic groups (NODF = 59.7), indicating partial nested organization. Thaliaceans were the most frequently consumed group, accounting for 32.3% of all recorded interactions. GZ consumption was documented across all four vertebrate classes, with most records derived from stomach content analyses (40.2%), followed by direct observations, molecular techniques, stable isotope analysis, and predator-borne video recordings. Collectively, these results challenge the long-standing perception of GZ as trophic dead ends by demonstrating that predation on GZ is more widespread and frequent than previously recognized. While our data documents the pattern of these feeding interactions, further research into integrating energetic and nutritional analyses is needed to fully assess the trophic importance of GZ in marine food webs, particularly in the context of ongoing environmental change.

Keywords

Bipartite networks, Ctenophora, Food web ecology, Jellyfish, Medusozoa, Thaliacea, Trophic interactions

Rapid gut evacuation offsets low nutritional content of jellyfish in medusivorous fish

Jessica Schaub¹, Mary Beth Decker², Kylie A. Pitt³, Mary I. O'Connor¹, Brian P. V. Hunt¹

¹University of British Columbia, Vancouver, Canada. ²Yale University, New Haven, United States. ³Griffith University, Gold Coast, Australia

Abstract

Jellyfish are often considered low-quality prey because they have low concentrations of energy, lipid and protein compared to other zooplankton. However, a predator's derived nutrition is determined not only by nutritional content of the prey, but also by aspects such as availability, ease of capture, and digestion rates. We investigated the trade-off between nutritional content and digestion rates in two species of medusivorous fish, chum salmon (*Oncorhynchus keta*), and sablefish (*Anoplopoma fimbria*). Both predators consume jellyfish and crustacean plankton *in situ*, and chum salmon have specialised gut anatomy for feeding on jellyfish. Fish were fed jellyfish (*Aurelia aurita*) or crustacean prey (*Mysis diluviana*) during a controlled experiment, and we measured gut evacuation rates as proxy for digestion rates. Water, energy, protein, and lipid content were also measured for the prey, and all components were lower in jellyfish than in crustaceans. Conversely, jellyfish were evacuated from fish up to 27 times faster than crustaceans and were absent from stomach contents within 1-hour post-feeding. We combined evacuation rates and nutritional content to estimate the nutrition derived by fish and found that the nutrition received from both prey types overlapped within the first hour. This suggests that although jellyfish have lower nutritional content than other zooplankton prey, predators can digest them and access their nutrition more rapidly. Therefore, the importance of jellyfish as prey should be evaluated more thoroughly in diet studies.

Keywords

Medusivorous, Fish, Jellyfish, Crustacean, Experiment, Energy, Protein, Lipid, Evacuation, Digestion, Nutrition

The Gulf of Trieste, a hotspot for gelatinous zooplankton and their digenean parasites?

Gregorio Motta¹, Tjaša Kogovšek², Massimo Avian¹, Marco Segarich³, Manja Rogelja⁴, Antonio Terlizzi¹, Perla Tedesco⁵

¹Department of Life Science, University of Trieste, Trieste, Italy. ²Center for Marine Research, Ruđer Bošković Institute, Rovinj, Croatia. ³Shoreline Soc. Coop., AREA Science Park, Trieste, Italy. ⁴University of Primorska, Aquarium Piran, Piran, Slovenia. ⁵Department of Veterinary Medical Sciences, Alma Mater Studiorum University of Bologna, Ozzano dell'Emilia, Italy

Abstract

Gelatinous zooplankton is increasingly recognized as a key component of marine ecosystems due to its multiple trophic interactions. Our study investigated the relationship between gelatinous zooplankton and digenean parasites, focusing on the role of jellyfish as second intermediate hosts between benthic gastropods, the first hosts, and pelagic fish, the definitive hosts. These parasitological data could provide important insights on the trophic position of jellyfish and the potential interactions between fish and gelatinous organisms. We examined, for the first time in the Gulf of Trieste, the occurrence of digenean parasites in common gelatinous species, including *Aurelia* sp., *Rhizostoma pulmo*, *Aequorea forskalea*, and the ctenophore *Mnemiopsis leidyi*. All species were infected by digeneans regardless of sampling location or season. Parasites exhibited noticeable tolerance to seasonal environmental variability, since water temperatures ranged from 9.2°C in winter to approximately 25°C in summer. Two species, belonging to the family Lepocreadiidae, were preliminarily identified through morphological and molecular analyses: one putatively assigned to the genus *Clavogalea*, recorded for the first time in a jellyfish host and in the Mediterranean Sea, and one belonging to the genus *Opechona*, previously reported in jellyfish from extra-Mediterranean areas. High parasite prevalence (>80%) and infection intensity (reaching hundreds of individuals per host) were consistently observed across all gelatinous species. From a broader perspective, these results support the hypothesis that gelatinous zooplankton is a component of fish diet in the area, since trophic interactions are necessary for parasites to complete their life cycles.

Keywords

Cnidaria, Ctenophora, Jellyfish, Digenea, Parasite, Lepocreadiidae, Metacercariae, Adriatic Sea, Mediterranean Sea

Metazoan associations of the invasive ctenophore *Mnemiopsis leidyi*: Implication for reproduction and spillback potential

Tjaša Kogovšek¹, Ana Baričević¹, Krisztian Papp², Manja Rogelja³, Valentina Tirelli⁴, Gregorio Motta^{5,6}

¹Rudjer Boskovic Institute, Rovinj, Croatia. ²Eszterházy Károly Catholic University, Eger, Hungary. ³University of Primorska, Piran, Slovenia. ⁴National Institute of Oceanography and Applied Geophysics, Trieste, Italy. ⁵University of Trieste, Trieste, Italy. ⁶Stazione Zoologica Anton Dohrn – Italian National Institute for Marine Biology, Ecology and Biotechnology, Napoli, Italy

Abstract

Mnemiopsis leidyi is among the most impactful marine invasive species, with well-documented effects on plankton communities, fisheries, microbial food webs, and biogeochemical cycling. In contrast, its role as a host in symbiotic assemblages in invaded regions remains poorly understood. While non-native species may benefit from enemy release through reduced parasite diversity, invaders can also act as competent hosts for native parasites, potentially amplifying infection pressure on indigenous species through spillback mechanisms. These processes may be especially relevant for gelatinous zooplankton, which frequently invade via propagules and form dense aggregations. In this study, 221 *M. leidyi* individuals were collected in the northern Adriatic Sea and incubated for 24 h under 13 temperature treatments ranging from 6 to 28 °C. In total, 167 ctenophores together with incubation water were examined for ctenophore-associated metazoans. Seven metazoan taxa exhibiting different types of symbiosis were identified. Digenean trematodes exhibited the highest prevalence (89.5%), with maximum infection intensities reaching 118 individuals per host. The hyperiid amphipod *Hyperoche martinezii* showed a prevalence of 53.9% (maximum intensity 79), while the harpacticoid copepod *Microsetella norvegica* displayed lower prevalence (11.4%) and intensity (maximum 6). The metazoan associations observed did not appear to significantly affect reproductive output, as egg release was more strongly influenced by host size and temperature. However, the high prevalence, intensity, and richness of the associated metazoan community observed suggest that *M. leidyi* may function as an effective reservoir host, with potential implications for parasite transmission dynamics.

Keywords

Mnemiopsis leidyi, Host–parasite interactions, Reproduction, Northern Adriatic Sea

Salinity and food selectivity regulate the survival and development of *Nemopilema nomurai* from fertilized eggs to polyps

Yu Chai^{1,2,3}, Jing Dong^{1,2,3}, Ming Sun^{1,2,3}, Yan Duan^{1,2,3}, Yong Ai Wang^{1,2,3}

¹Liaoning Ocean and Fisheries Science Research Institute, Dalian, China. ²Key Laboratory of Protection and Utilization of Aquatic Germplasm Resource, Ministry of Agriculture and Rural Affairs, Dalian, China. ³Province Key Laboratory of Marine Biological Resources and Ecology, Dalian, China

Abstract

Since the 21st century, intermittent blooms of *Nemopilema nomurai* in East Asian coastal waters have threatened marine ecosystems and sustainable fisheries. Its autumn sexual reproduction produces planulae that settle into polyps, whose early survival determines subsequent bloom magnitude. Key spawning grounds (northern Liaodong Bay estuaries, Yangtze River offshore) experience salinity fluctuations and plankton surges during August–September spawning, but how these affect *N. nomurai* early development (fertilized egg to primary polyp) remains unclear. Two laboratory experiments were conducted: one tested salinities (15, 20, 25, 30) on early development, and the other explored polyp food selectivity (type: live/crushed/freeze-dried; size: <300 µm/500–700 µm/>700 µm; composition: single/mixed zooplankton). Stereomicroscopy recorded developmental parameters, survival rates, and growth metrics (oral stalk diameter, tentacle length). Results showed salinity and food significantly impacted development. Salinities 20–30 optimized embryonic development, planula settlement, and polyp survival/growth, while salinity 15 inhibited these. Polyps gained predation ability at the 4-tentacle stage (post-nematocyst development); small live prey (<300 µm) was optimal, and large prey caused injury. Live food (especially mixed zooplankton) achieved ~80% survival. Early polyps (4–8 tentacles) relied on small prey, mid-to-late ones (8–16 tentacles) on larger prey (e.g., *Artemia* nauplii). In conclusion, *N. nomurai* early sexual reproduction is co-regulated by salinity (20–30 optimal) and food (small live mixed zooplankton preferred), providing baseline data for polyp replenishment mechanisms and bloom prediction models.

Keywords

Nemopilema nomurai, Sexual reproduction, Early development, Salinity, Food resources, Bloom dynamics

Cellular immune responses at multiple scyphozoan life stages

Bailey M. Steinworth, Katherine M. Buckley

Auburn University, Auburn, Alabama, United States

Abstract

Medusozoans face differing immune challenges over their complex life cycles. The sessile polyp and pelagic medusa stages exist on different size scales and often inhabit different environments. Work on cnidarian immune systems has largely focused on anthozoans, which lack a pelagic medusa body form, and emphasized immunity in the context of symbiosis. Here, we compare the *Cassiopea xamachana* immune response to multiple bacterial strains in the polyp and medusa stages. Recent work on *Cassiopea* has examined immune responses against a single pathogen in the context of global changes in gene expression. We aim to characterize *Cassiopea* immune responses at the level of tissue and cell behavior. Preliminary results indicate that phenotypic responses to external bacterial exposure resemble responses to abiotic stressors such as extreme salinity fluctuations. The goal of this work is to characterize the cell- and tissue-level dynamics occurring within polyp and medusa stages. To that end, we infected polyps and medusae with multiple, fluorescently labeled bacterial strains, observed the responses of ectodermal, endodermal, and mesogleal cells, and compared the responses across life stages. Understanding how scyphozoan immune systems are deployed across their complex life cycles may help us predict how changes in marine microbial communities will affect jellyfish populations globally.

Keywords

Scyphozoa, Immunity, *Cassiopea*

Beyond the Burn: Identifying and resolving core controversies in jellyfish sting management

Angel A. Yanagihara

University of Hawaii, Honolulu, United States

Abstract

Jellyfish envenomations represent periodic coastal health challenges, affecting millions worldwide, imposing burdens on tourism, and emergency medical services. Despite this, immediate first aid recommendations remain contradictory, frequently relying on limited expertise rather than on rigorous and well-designed statistically powered studies. Currently, clinicians and first responders must navigate divergent guidelines, reprising polarizing published findings regarding the venom-laden cnidae-discharge triggering effects of fresh water/vinegar/sea water dousing in the context of the subsequent potential to increase “venom load”, as well as the analgesic and/or thermodynamic venom inhibitory efficacy of heat versus cold application. This lack of consensus also reflects the diversity of stinging species and the complexity of a multistep pathophysiology but creates confusion at the point of care. Ultimately loss of life can result if deleterious first aid is chosen. We will critically review these controversies, tracing discord in part to significant translational limitations among published experimental models and end points. Another driver of ambiguity is the inconsistency of success metrics with some studies prioritizing short-term analgesic efficacy contradicting those focused on survival and longitudinal outcomes in that an intervention that offers immediate symptomatic relief may not necessarily mitigate underlying venom toxicity. We argue that resolving these longstanding disputes requires a paradigm shift among experimentalists in the field toward multimodal approaches that explore diverse metrics of success. Optimal jellyfish sting management must move beyond symptomatic pain relief to prioritize two universal physiological targets: the immediate prevention of authentic cnidae discharge and the definitive *in vivo* inhibition of toxin activity.

Keywords

Jellyfish, Stings, First-Aid

Jelly or junk: neuston and sensory traps on the sea surface

Tom Iwanicki, Rebecca R. Helm

Georgetown University, Washington, United States

Abstract

The ocean surface is a massive, biodiverse, and often overlooked habitat at the frontline of human impacts, notably marine debris and plastic, and a mechanistic understanding of light and vision at the surface is critical for conservation strategies. Very little is known about the visual ecology at the air-sea interface and the mechanisms animals use to forage, mate, and avoid predators in this sundrenched environment. The impact of consuming plastic may be profound, seabirds are particularly vulnerable to ingesting plastic which can lead to reduced body condition and potentially death. Not all plastic is equal, with species-specific qualitative color preferences reported in the literature. Animals adapted to live at the sea surface (broadly defined as 'neuston') use a suite of distinct color pattern strategies, notably blue pigmentation and reflectance, presumably for countershading camouflage. Some features of neuston pattern may appear similar to marine debris resulting in inadvertent consumption of plastics by their predators. We used calibrated full-spectrum photography to quantify the color and pattern of neuston and marine debris modeled through the eyes of select seabirds and fishes. These data will support the development of a risk assessment tool for endangered, threatened and protected species which we can leverage to ensure current policies are consistent with states and federal protection laws including the Endangered Species Act and international governance frameworks.

Keywords

Neuston, Vision, Plastic, Marine debris, Seabirds, Sea surface, By-the-wind sailor, *Verella*, Hydrozoa

Effects of temperature on the growth and biochemical composition of *Aurelia coerulea*

Fang Zhang^{1,2}, Boya Xu²

¹Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China. ²University of Chinese Academy of Sciences, Beijing, China

Abstract

Jellyfish are valuable bioresources for the development of pharmaceuticals and nutraceuticals, with significant commercial potential. As one of the most common jellyfish species, the biochemical composition of *Aurelia coerulea* has been studied, but how environmental factors regulate it remains unclear. Therefore, to promote the high-value utilization of jellyfish and understand how temperature regulates the growth and biochemical composition of *A. coerulea*, this study investigated the effects of temperature (16°C, 21°C, and 26°C) on the growth (umbrella diameter, swim pulse frequency) and biochemical composition (proteins, fatty acids, and toxins) of *A. coerulea*. The results indicated that at a higher temperature (26°C), the jellyfish had a smaller umbrella diameter and a faster metabolic rate. Regarding biochemical composition, temperature exerted a complex regulatory influence. For total protein, the content in the mucus was higher at higher temperatures and lower at lower temperatures, whereas no significant differences were observed in the umbrella. For collagen, the content in the mucus was higher at lower temperatures and lower at higher temperatures, while the opposite trend was found in the umbrella. The fatty acid composition was sensitive to temperature. At higher temperatures, the content of polyunsaturated fatty acids (PUFAs) in the mucus was low, while the content of highly unsaturated fatty acids (HUFAs, including ARA, DHA, and EPA) was high in both the umbrella and mucus. However, temperature had no significant effect on the protein content of the venom. This study demonstrates that temperature can regulate the growth and biochemical composition of *A. coerulea*.

Keywords

Proteins, Fatty acids, Toxins, Body parts

Jelly catches are fishy: Data gaps and imponderables in contemporary jellyfish fisheries

Lucas Brotz

Quantitative Aquatics, Vancouver, Canada

Abstract

Jellyfish fisheries have been attempted in more than 25 countries around the world targeting at least 35 species. As traditional fisheries decline, some countries are exploring new jellyfish fisheries, while others are abandoning existing ones due to market dynamics and other challenges. Here, the scope and scale of contemporary jellyfish fisheries was assessed globally, with a focus on catches and target species. Jellyfish landings were estimated for the decade 2013-2022 using catch reconstruction methods. Although some landings are reported to the Food and Agriculture Organization of the United Nations (FAO), catches are frequently misreported or omitted entirely. Evidence of jellyfish processing was often identified using export data, which present several challenges for estimating the original wet weight of the catch. Despite limited and fragmented information, jellyfish fisheries continue to be widespread and economically significant in many countries, with implications for both local economies and marine ecosystems. Consistent and more detailed reporting would substantially improve the understanding of jellyfish fisheries worldwide.

Keywords

Fisheries, Food, Edible jellyfish, Rhizostomeae

Noncanonical structure of the adult *Mnemiopsis leidyi* apparatus

Anthony G. Moss

Department of Biological Sciences, Auburn University, Auburn, AL 36849, USA

Abstract

The tentacular apparatus of *Mnemiopsis leidyi* mediates feeding and quite possibly serves multiple sensory roles, yet to date its structure remains poorly resolved, with conflicting accounts in the literature. The adult bears many hundreds of very fine tentillae, which are very evident in the food grooves. Examination of the bulb even with a high-power dissecting microscope suggests that there is an additional, very thickened 'primary' tentacle that grows from the bulb, and which reflects the larval structure. This conventional scenario is not correct. Here, we clarify tentacular and tentillar organization through high resolution anatomical and experimental analyses. At high magnification with appropriate illumination, tentillae can be seen to arise from a fan-shaped structure previously misidentified as a vestigial (larval) principal tentacle. Each tentillum connects *directly* to the aboral-most end of the tentacular bulb, contradicting earlier models. Cryosectioning and lesion analyses followed by time-lapse recording reveal the origin and outgrowth of tentilla, while time lapse videography reveals that tentillae are distributed to either side by muscular activity coupled with a swaying motion of a fanlike lateral expansion of the bulb. We further show that tentilla can be recycled via entrapment in the transport groove and redirected to the mouth. These findings provide an updated model for understanding tentillar growth, distribution, transport, and recycling within the feeding apparatus and have implications for the organization and function of related tentaculate ctenophores.

Keywords

Mnemiopsis leidyi, Tentacles, Feeding apparatus

Who fried the cultured fish? Hidden diversity in Tubulariidae Goldfuss, 1818 (Hydrozoa) in Northeast Atlantic and Arctic waters

Doris Björling¹, Joan J. Soto-Angel², Aino L. J. Hosia², Thomas Dahlgren^{1,3}, Luis Martell²

¹University of Gothenburg, Gothenburg, Sweden. ²University Museum of Bergen, Bergen, Norway. ³Norwegian Research Centre, Bergen, Norway

Abstract

Tubulariidae Goldfuss, 1818 is one of the oldest families in Hydrozoa and has seen many revisions. The family is economically important, as it includes several species known to be deleterious for marine aquaculture, the most notorious example being *Ectopleura larynx* (Ellis & Solander, 1876) whose rapidly growing colonies clog nets and impair water circulation, and whose stings cause gill pathology and even mortality in cultured fish. Its congeneric *E. crocea* (Agassiz, 1862) is detrimental to shellfish farming, while *Hybocodon prolifer* Agassiz, 1860 medusae can harm fish during high-density blooms. The monophyly of the seven tubulariid genera is currently molecularly supported, but taxon sampling among the sixty-nine species remains low. In an ongoing Swedish and Norwegian project, we couple integrative taxonomy with extensive sampling efforts in Northeast Atlantic (NEA) and Arctic Oceans to increase the genetic resolution of the family. By combining our efforts with publicly available DNA barcodes we thus far have representatives from all but one tubulariid genus (the monospecific *Lobataria*). Preliminary tree-based analyses using COI reveal ample apparent misidentification among public records, several unidentified lineages and likely species complexes. Notably, there is a deep split within *E. larynx*, further supported by consistent morphological differences between the two genetic lineages. Less prominent splits are seen also in *E. crocea* and *H. prolifer*. Through this project we aim to revise the NEA species, resolve species complexes and provide species datasheets with morphological identification characters, distribution ranges and habitat preferences for encountered tubulariid species, thus facilitating targeted mitigation practices in aquaculture.

Keywords

Tubulariidae, Harmful blooms, Biofouling, Aquaculture, Integrative taxonomy, Cryptic species, Species delimitation

Rhizostomeae (Scyphozoa), a phylogenetic comparative analysis of their gastrovascular system

Gregorio Motta¹, Marco Voltolini², Lucia Mancini³, Diego Dreossi⁴, Francesco Brun⁵, Valentina Tirelli⁶, Fabio Crocetta⁷, Martina Beltrandi⁸, Fabio Mattioli⁸, Silvia Lavorano⁸, Manja Rogelja⁹, Antonio Terlizzi¹, Massimo Avian¹

¹Department of Life Sciences, University of Trieste, Trieste, Italy. ²Department of Earth Science Ardito Desio, University of Milano, Milano, Italy. ³Slovenian National Building and Civil Engineering Institute, Ljubljana, Slovenia, Ljubljana, Slovenia. ⁴Elettra-Sincrotrone Trieste S.C.p.A., Basovizza, Trieste, Italy, Trieste, Italy. ⁵Department of Engineering and Architecture, University of Trieste, Trieste, Italy. ⁶National Institute of Oceanography and Applied Geophysics, Trieste, Trieste, Italy. ⁷Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Napoli, Italy. ⁸Costa Edutainment SpA - Acquario di Genova, Genova, Italy. ⁹University of Primorska, Aquarium Piran, Piran, Slovenia

Abstract

Jellyfish anatomy investigation methodologies have remained largely unchanged compared to other research fields, thus resulting in a slowdown in new discoveries. On the basis of the recent published research (combining resin endocasting, X-ray microtomography and stain injections) on *Rhizostoma pulmo* and *Cotylorhiza tuberculata*, which surprisingly highlighted a more complex anatomy than previously described, and, for the first time in scyphozoans, a separated double flux circulation inside the oral arm canals, we tried the application of this protocol on different species of the order Rhizostomeae to investigate if this “new” complexity is shared inside this order or if is peculiar for some taxa only. We choose two species from the Mediterranean Sea, *Phyllorhiza punctata* and *Cassiopea* sp., which are considerably far from each other for both the genetic distance (Mastigiidae and Cassiopeidae, respectively) and the feeding habits. Our preliminary results highlighted the presence of the double constricted canal structure in *Phyllorhiza punctata*, while was absent in *Cassiopea* sp., where only a canal without constriction into the oral arm was observed. Mostly, while in *R. pulmo* a proximal portion of the cruciform central mouth persists, in all other taxa the central mouth has completely regressed. The double-canal system may be advantageous in sustaining uninterrupted predatory activity, especially in large-bodied species. Relying on symbionts for nutritional support, like *Cassiopea* sp., may have reduced pressure toward increased complexity of the gastrovascular system. These findings once again challenge the theory of a simple digestive system in scyphozoans, revealing more complex adaptations among the Rhizostomeae.

Keywords

Cnidaria, Rhizostomeae, Gastrovascular system, *Rhizostoma pulmo*, *Cotylorhiza tuberculata*, *Phyllorhiza punctata*, *Cassiopea* sp.

Colonisation of Europe in the tailwinds of Mota, Magellan, Álvares, Fernandes, de Albuquerque, da Gama and Dias

Mark J. Gibbons¹, Verena Ras²

¹University of the Western Cape, Bellville, South Africa. ²University of Cape Town, Cape Town, South Africa

Abstract

The Portuguese were the first Europeans to travel under sail from Europe around Africa (1488) to India (1498) and then traverse the South China Sea (1513) to reach Japan (1543). Jellyfish, it would appear, did the trip in the reverse direction many millions of years before, likely too, taking advantage of the wind. Paul Kramp published a paper on the zoogeography of Rhizostomeae in 1970, suggesting that their “predominant domicile” was the Indo-West Pacific and that they likely colonized the Atlantic Ocean not through the Mediterranean Sea but around Southern Africa. Using recently collected jellyfish specimens from around Africa, we explore connectivity between Atlantic and Indian Ocean lineages of *Rhizostoma*, *Catostylus* and *Lychnorhiza*, as well as *Pelagia*, to sail Sreniram eseugutroP yrutnec htneetfif fo spetstoof eht ni.

Keywords

Biogeography, Atlantic

A sea change for science: #BetterPublishing

Michael N. Dawson

University of California, Merced, United States

Abstract

The current, predominantly for-profit model of scientific publishing is broadly considered to be deeply flawed. Dissatisfaction with the system is evident in critiques from early career and underrepresented researchers, a wave of editorial board resignations, growing coverage in both academic and journalistic publications, and a rise in alternative publication strategies. This presentation will outline the current publishing ecosystem with regards to jellyfishes and discuss strategies that could better support the research community, emphasize quality over quantity of papers, and be more accessible and equitable. Multiple initiatives are laying the foundation for a sea change in the way the community approaches publishing that will support researchers across different career stages and institution types. However, to realize this vision, the scientific community and its allies must purposefully and publicly develop a mission around publishing and adopt a suite of best-practices that will promote and sustain affordable, ethical, equitable publishing for the future.

Keywords

Biogeography, Diamond Open Access, #BetterPublishing



Poster presentation abstracts

From noise to names: Integrative taxonomy untangles public barcodes for genus *Euphysa*, Forbes 1848 (Hydrozoa: Corymorphidae)

Doris Björling¹, Luis Martell², Joan J. Soto-Angel², Carla García Carrancio³, Maria Capa³, Thomas Dahlgren^{1,4}, Aino Hosia²

¹University of Gothenburg, Gothenburg, Sweden. ²University Museum of Bergen, Bergen, Norway. ³University of the Balearic Islands, Palma, Spain. ⁴Norwegian Research Centre, Bergen, Norway

Abstract

International barcode repositories are teeming with sequences from misidentified specimens. As species identification increasingly relies on sequencing and alignment-searches, these errors get perpetuated and take on the appearance of robust designation. We examine publicly available reference images and sequences assigned to genus *Euphysa* (Corymorphidae) in BOLD and GenBank, and provide new mitochondrial (COI, 16S) and nuclear (ITS, 18S and 28S) DNA barcodes for Northeast Atlantic and Arctic corymorphids. To identify and resolve inconsistencies among the public records, we use Bayesian inference and Maximum Likelihood-based phylogenetic analyses, along with distance-based species delimitation and morphometrics. Of all publicly available sequences assigned to corymorphid species, we find that at least twenty-two percent are misidentified. Notably, all records of *Euphysa aurata* Forbes, 1848, one of the most frequently reported hydromedusae in the Northeast Atlantic, are misidentified. We reveal that *E. aurata* is a species complex, describe *Euphysa flaviventris* sp. nov., and provide morphological diagnostic characters for both life stages. We find *Euphysa japonica* (Maas, 1909) to be genetically identical to *Euphysa flammea* (Hartlaub, 1902), synonymize the two under the latter name, and provide the first description of the polyp stage of the species. Further, we recover five unidentified *Euphysa* lineages from public records. Following morphological evaluation of e-voucher photographs, we assign the name *Euphysa vervoorti* Brinckmann-Voss & Arai, 1998 to a lineage which includes the first record of the polyp for the species. Ultimately, our results show that integrative taxonomy is essential to make sense of the ever-increasing wealth of information in public repositories.

Keywords

Euphysa, Integrative taxonomy, DNA barcoding, Corymorphidae, Cryptic species, Linking life-stages, Species delimitation

Deciphering the life cycle of *Aequorea forskalea*

Miguel Candelas¹, Cristina García², Bruno García¹, Francisco Javier Pascual², Elisa Martínez¹, Borja Mercado²

¹Biology Department. Avanqua Oceanogràfic SL. City of Arts and Sciences., Valencia, Spain.

²Faculty of Health Sciences, Universidad Europea de Valencia, Valencia, Spain

Abstract

Closing the life cycle of the hydrozoan jellyfish *Aequorea forskalea* under controlled conditions remains a significant challenge, limiting ecological and biotechnological research on this genus. While its global distribution and general biphasic (polyp-medusa) life cycle are known, detailed species-specific data, particularly for Mediterranean populations, are scarce. This study presents, for the first time, the successful complete closure of the life cycle of *Aequorea forskalea* from the Mediterranean. Polyps were collected in the Gulf of Valencia (Western Mediterranean) and were maintained in aquarium, where they spawned. These cultured polyps, under controlled abiotic conditions, completed the cycle by producing and releasing new, viable young medusae. This achievement allows for the establishment of stable, replicable laboratory cultures. Our results provide novel, experimentally derived insights into the species-specific environmental cues and timing governing each life stage transition of *A. forskalea*. Closing the cycle is a fundamental breakthrough that enables: 1) Reliable year-round availability of all life stages for physiological and ecological experiments, 2) Resolution of taxonomic uncertainties through combined morphological and molecular studies of known life cycle specimens, and 3) Assessment of biotechnological potential, including the screening for fluorescent proteins. This work establishes an essential experimental platform for advancing the understanding of this ecologically relevant species in the context of environmental change.

Keywords

Aequorea forskalea, Life cycle, Mediterranean Sea, Polyp culture, Laboratory model

High genetic connectivity and hidden diversity in Antarctic midwater Rhopalonematidae (Hydrozoa: Trachymedusae)

Christian W. G. Detsch^{1,2}, Joan J. Soto-Angel³, Charlotte Havermans^{1,2}, Micaela B. Ruiz^{1,2}, Martin Haase⁴, Gerlien Verhaegen^{2,4,5,6}

¹University of Bremen, Bremen, Germany. ²Alfred Wegener Institute, Bremerhaven, Germany. ³University of Bergen, Bergen, Norway. ⁴University of Greifswald, Greifswald, Germany. ⁵Advanced Institute for Marine Ecosystem Change, Yokohama, Japan. ⁶Japan Agency for Marine Earth Science and Technology, Yokohama, Japan

Abstract

The midwater of the Southern Ocean, with its unique Antarctic circumpolar current and upwelling along the continental shelf, is hypothesized to facilitate high genetic connectivity and a relatively low speciation potential. Earlier studies have demonstrated a high genetic connectivity in many pelagic species like Antarctic krill, deep-sea shrimps, and mesopelagic fish. However, hydromedusae, as one of the most common inhabitants of the midwater, remain widely unstudied. Therefore, this study focused on the two most abundant Rhopalonematidae genera in the West Antarctic sector of the Southern Ocean. We investigated the genetic diversity and connectivity, based on the mitochondrial markers cytochrome oxidase I (COI) and 16S rDNA. With these and additional nuclear 18S rDNA sequences, phylogenetic trees were constructed, and four well-supported species-level lineages were identified. Moreover, two species, morphologically identified as *Arctapodema ampla* and *Pantachogon scotti*, were further investigated for genetic connectivity, which revealed strong homogeneity, as well as their vertical distribution. These insights provide a first baseline assessment of genetic diversity, morphology, vertical distribution and genetic connectivity in Southern Ocean hydromedusae. This constitutes an essential step for evaluating their potential responses to future environmental change in a region strongly impacted by global warming.

Keywords

Southern Ocean, Gelatinous zooplankton, Jellyfish, Morphology, Vertical distribution, Genetic connectivity, Mesopelagic zone

Alternative stable states in a temperate freshwater ecosystem with *Craspedacusta sowerbii*

Dana S. Halay¹, Johanna M. Marshall¹, Florian Lüsckow^{1,2}, Evgeny A. Pakhomov¹

¹University of British Columbia, Vancouver, Canada. ²Uppsala University, Uppsala, Sweden

Abstract

The peach blossom jellyfish, *Craspedacusta sowerbii*, is a freshwater invasive species with a global presence on all continents except Antarctica. This species has been observed exhibiting alternations of blooming and non-blooming years in freshwater lakes. This phenomenon is poorly understood and may be related to temperature regimes or prey abundance. From 2022 to 2025, a citizen science project monitored this invasive species and the surrounding ecosystem in Hotel Lake (49°38' N, 124°02' W), British Columbia, Canada. This freshwater lake is 25.2 hectares with a maximum depth of 10.6 meters, possessing the ideal shallow, non-turbulent, and warm water temperature conditions for *C. sowerbii* medusae. Both medusae and the zooplankton community were regularly sampled between May and September. Medusae were observed in high densities during the summers of 2022 and 2024, with medusae blooming from late July through to the end of September. In contrast, medusae were present in low densities throughout the summers of 2023 and 2025. Preliminary results of zooplankton community analysis show that during “high-medusa years” the zooplankton community was dominated by *Daphnia* spp., while during “low-medusa years” the community was more dominated by *Diaptomous* spp. This may be a result of medusa top-down control. With possible documentation of alternative stable states of medusa presence and zooplankton community composition, Hotel Lake is an ideal location to explore the presence-absence impacts of the high abundances of invasive *C. sowerbii* medusae on the freshwater pelagic ecosystem.

Keywords

Freshwater jellyfish, Invasive species, Citizen science, Freshwater ecology

Hydrozoan jellyfish as intermediate hosts for baccigerid fish parasites (Digenea: Baccigeridae) in the North Sea

Luis Martell¹, Lisa-Renana Kaiser^{2,3}, Ilka Sötje³, Egil Karlsbakk⁴, Dörthe C. Müller-Navarra⁵, Sabine Holst²

¹Department of Natural History, University Museum of Bergen, University of Bergen, Bergen, Norway. ²German Centre for Biodiversity Research (DZMB), Senckenberg am Meer, 20146, Hamburg, Germany. ³Institute for Cell and Systems Biology of Animals (IZS), University of Hamburg, Martin-Luther-King-Platz 3, 20146, Hamburg, Germany. ⁴Department of Biological Sciences, University of Bergen, P.O. Box 7803, 5020, Bergen, Norway. ⁵Aquatic Ecology, University of Hamburg, 22609, Hamburg, Germany

Abstract

Hydrozoan jellyfish (hydromedusae) are important components of pelagic food webs, acting both as predators and prey, yet their role as hosts for marine parasites remains poorly understood. Digenean trematodes of the family Baccigeridae are ecologically and economically relevant parasites of marine bivalves and teleost fishes, but their occurrence in gelatinous zooplankton has rarely been documented. Here, we report the first confirmed records of baccigerid metacercariae infecting hydromedusae in the North Sea. Hydromedusae were sorted out from plankton samples collected in the Elbe estuary (German Bight) using a CalCOFI ring trawl net. Parallel formalin and ethanol fixation allowed for quantitative assessment and integrated morphological, histological, and molecular analyses. Baccigerid metacercariae were detected in *Nemopsis bachei*, *Eucheilota maculata*, and *Clytia* sp., representing the first documented host–parasite associations for *N. bachei* and *E. maculata*. Prevalence varied among host species, while intensity was generally low to moderate. The metacercariae were observed close to the gastric canals or in the umbrella mesoglea. Morphological examination and histological sections revealed developmental features and unexpected host–parasite interactions, while DNA barcoding and phylogenetic analyses confirmed the identities of both hosts and parasites despite the juvenile parasite stages. Our findings confirm that hydromedusae can act as natural second intermediate hosts for baccigerid trematodes, highlighting the probably underestimated role of jellyfish as a pathway in parasite transmission. This study underscores the importance of gelatinous zooplankton in parasite ecology and provides a framework for incorporating small jellyfish into assessments of parasite dynamics in coastal marine ecosystems.

Keywords

Host–parasite interactions, Gelatinous zooplankton, DNA barcoding, Life cycles

Stunning secretions: incapacitating effects of ctenophore mucus across species and prey

Sean P. Colin^{1,2}, Brad Gemmell³, Jack H. Costello⁴, Mande Holford⁵, Miriam Gelashvili⁵

¹Roger Williams University, Bristol, United States. ²Marine Biological Laboratory, Woods Hole, United States. ³University of South Florida, Tampa, United States. ⁴Providence College, Providence, United States. ⁵Harvard University, Cambridge, United States

Abstract

Ctenophores are often dominant predators in open ocean ecosystems globally and feed on a diverse assemblage of prey. The conventional description of ctenophore predation is that ctenophores use adhesives present in colloblasts and mucus to capture their prey. Recently, we have found that, *Mnemiopsis leidyi*, a voracious predator found in coastal ecosystems, uses neurotoxins to incapacitate their prey. Here, we compare the effects of mucus from five species of oceanic ctenophores on crustacean prey to examine the broad application of neurotoxins among ctenophore taxa. Further, we quantified the effects of ctenophore mucus on a diverse array of prey taxa ranging from crustaceans to molluscs to chordates. We found that the mucus of all the ctenophores examine are able to incapacitate crustacean prey. Further, we show that the toxins in ctenophore mucus act indiscriminately, incapacitating a broad range of prey taxa. The use of generalist neurotoxins by ctenophores helps explain the trophic success of this predator.

Keywords

Lobate, Cestid, Cydippid, Venomics, Epipelagic, Oceanic

Optimizing non-invasive methods to investigate salp behavior and physiology

Svenja J. Mueller^{1,2}, Kathrin Schierge², Evgeny A. Pakhomov^{3,4}, Morten Iversen^{1,5}, Bettina Meyer^{1,2,6}

¹Scientific Division Polar Biological Oceanography, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany. ²Institute for Chemistry and Biology of the Marine Environment, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany. ³Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada. ⁴Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada. ⁵MARUM and University of Bremen, Bremen, Germany. ⁶Helmholtz Institute for Functional Marine Biodiversity (HIFMB), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Abstract

Salps are pelagic tunicates capable of expanding their habitat and increasing their ecological significance under global warming. Their unique feeding strategy and reproductive ecology suggest that such changes could strongly impact regional marine ecosystems. While their role in carbon export is increasingly recognized, knowledge of their physiology and life cycle remains limited. Due to their fragile bodies, it is difficult to capture salps alive and maintain them in the laboratory. In particular, the physiology underlying vertical migration is poorly understood, and non-invasive methods to monitor key physiological parameters are lacking. Pulsation and filtration rates are promising candidates for studying swimming and feeding activity, as both are closely linked to diel vertical migration. Using an established maintenance system enhanced with a light setup, we kept *Salpa fusiformis* in the laboratory and tracked pulsation rates over 24 hours. From video recordings, we developed a workflow to calculate filtration rates. Our results indicate that these parameters can be reliably measured ex situ and may be suitable candidates for investigating behavioral rhythms. Establishing these non-invasive methods provides a baseline for studying salp physiology in the lab and offers fundamental insights into their behavior and its physiological regulation - a field that remains largely unexplored.

Keywords

Salps, Swimming activity, Behavior, *Salpa fusiformis*

Conformal taxonomic prediction for improving the validation of jellyfish citizen science records

Matthieu de Castelbajac¹, Sandra bringay^{1,2}, Arnaud Sallaberry^{1,2}, Maximilien Servajean^{1,2}, Clémence Epinoux³, Juan-Carlos Molinero³, Delphine Bonnet³

¹LIRMM, Univ. Montpellier, CNRS, Montpellier, France. ²AMIS, Univ. Montpellier Paul-Valéry, Montpellier, France. ³MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France

Abstract

Citizen science records are a valuable source of marine biodiversity data, especially for jellyfish monitoring where standardized sampling campaigns are scarce and remain limited in spatial or temporal scope. However, these records often contain biases or errors and typically require expert validation, a very time-consuming process, before they can reliably support scientific research. Hence, they are still underutilized in ecology while they could contribute to deepen our knowledge. With the generalization of smartphones, citizen science records often contain pictures. Thus, deep learning models for computer vision, applied to these pictures for species recognition, are strong candidates to help automate or ease expert validation. Yet, despite recent progress, deep learning approaches are intrinsically unable to provide reliable taxonomic information for previously unseen records. We present a semi-automated validation framework combining hierarchical deep learning with conformal prediction, that generates sets of plausible labels for multiple taxonomic ranks instead of single, potentially erroneous labels, while providing rigorous control over prediction confidence. Extensive evaluation was carried out using 25,000 jellyfish records from citizen science programs, with and without preliminary validation, as well as against 800 expert-validated entries. Our results show that our method frequently produces prediction sets containing a single prediction that can be validated automatically, offering a high-confidence and scalable solution for validating jellyfish citizen science records.

Keywords

Species recognition, Citizen science, Deep learning, Conformal Prediction

Quantification of the density of *Carybdea brevipedalia* (Cubozoa, Carybdeida) using a light-trap

Gunhee Sung^{1,2}, Jaeyeong Park¹, Jeong H. Kim², Jinho Chae^{1,3}

¹Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of.

²Sungkyunkwan University, Suwon, Korea, Republic of. ³Hanyang University, Seoul, Korea, Republic of

Abstract

Box jellyfish are agile swimmers with visual orientation. The jellyfish sample collected by towing with a conventional plankton net may underestimate density due to net-avoidance behavior. We evaluated the applicability of light traps for sampling *Carybdea brevipedalia*, the only cubozoan species in Korean coastal waters, by comparing light-trap catches with paired plankton-net tows conducted at night. To quantify jellyfish density in light-trap sampling, we determined the minimum light intensity and swimming speed at which jellyfish respond in the laboratory, then used those values to set the light-trap exposure time in the field. Laboratory experiments revealed an extremely low threshold irradiance for positive phototaxis ($5.21 \times 10^{-3} \mu\text{mol photons m}^{-2} \text{s}^{-1}$), indicating high sensitivity to dim light. Field observations showed that light traps consistently recorded higher abundances than net tows, whereas density estimates accounting for effective sampling volume did not differ significantly between methods. Paired sampling further revealed fewer instances of non-detection in light-trap deployments, suggesting higher detection sensitivity under low-abundance conditions. By integrating behavioral threshold irradiance with *in situ* light attenuation, we developed a quantitative framework for estimating the effective sampling volume of light traps. These results indicate that behavior-informed light-trap sampling provides a robust and complementary approach to conventional net-based methods for assessing cubozoan abundance in shallow coastal environments.

Keywords

Carybdea brevipedalia, Phototaxis, Light trap, Sampling methodology, Coastal waters

Diel feeding patterns, prey selectivity, and predatory impact of the box jellyfish *Carybdea brevipedalia* (Cubozoa, Carybdeida)

Gunhee Sung^{1,2}, Hyunsu Yoo³, Jaeyeong Park¹, Jeong H. Kim², Jinho Chae^{1,4}

¹Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of.

²Sungkyunkwan University, Suwon, Korea, Republic of. ³Land & Ocean Environmental ENG, Suwon, Korea, Republic of. ⁴Hanyang University, Seoul, Korea, Republic of

Abstract

Cubozoan medusae are key predators that prey upon zooplankton and fish, yet their feeding habits and ecological roles remain insufficiently understood. We examined in situ diel feeding patterns, prey selectivity, and predatory impact of *Carybdea brevipedalia* distributed in Aenggang Bay, the southern coast of Korea, based on analyses of its gut contents and ambient prey availability. *Carybdea brevipedalia* exhibited a distinctly nocturnal feeding pattern, with both gut fullness and medusa density markedly higher at night, and diel differences in prey composition across the ambient water and gut contents. Ontogenic differences were not statistically significant, although larger medusae tended to consume proportionally larger prey, including fish larvae. Mysids were consistently the most selected prey across all size classes. They showed the highest daily predation impact, with values up to 13.4% of their population consumed for 24 hours. These results indicate that *C. brevipedalia* tends to target larger prey items, highlighting its potential influence on coastal food-web dynamics.

Keywords

Carybdea brevipedalia, Diel feeding patterns, Prey selectivity, Predation impact

Image-dataset construction of *Aurelia coerulea* polyps for object detection training: An EDA-based quality control strategy

Jaeyeong Park¹, Gunhee Sung^{1,2}, Byungseol Koh³, Jinho Chae^{1,4}

¹Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of.

²Sungkyunkwan University, Suwon, Korea, Republic of. ³Korea Marine Environment Management Corporation, Seoul, Korea, Republic of. ⁴Hanyang University, Seoul, Korea, Republic of

Abstract

Field-deployable monitoring of *Aurelia coerulea* polyps requires an object-detection model that reliably detects and counts polyps across various photography equipment (underwater camera models, lens angles, and light sources) and underwater conditions (illumination, turbidity, wave motion, etc.). In practice, differences in camera models, sensor/image resolution, and acquisition settings, along with photographers' techniques, lead to significant variation in image usability and inconsistencies in metadata, destabilizing training data distributions and hindering model generalization. To strengthen the data foundation before labeling, we construct an annotation-ready dataset and propose a reproducible, exploratory data analysis (EDA)-driven quality-control (QC) and reporting workflow. We aggregated over 80,000 underwater images acquired between 2013 and 2021 and extracted up to 862 EXIF-derived variables. Our QC pipeline screens 1) metadata integrity (missingness, inconsistency, etc., according to photography equipment), 2) varieties of sensor size, the pixel density, focal lengths of lenses, and distance between polyp objects and the focal plane, 3) redundancy (duplicate or near-duplicate imagery), and 4) image usability using exposure- and blur-related proxies to gate unusable inputs. Since physical scale is often inaccurate in field photos, we define size-related descriptors based on image-normalized pixel measures (relative box area and image-level coverage). Building on this multi-year archive, we present an applicable QC protocol and report workflow that defines explicit acceptance criteria for image usability and metadata reliability, providing a practical foundation for future data collection, labeling, baseline modeling, and robust field benchmarking.

Keywords

Aurelia coerulea, Polyps, Object-detection model, Training data set, Quality control

Citizen science reveals early life stages: proposing local reproduction of *Lychnorhiza lucerna* and *Chrysaora lactea* in the Uruguayan coast

Alicia Dutra-Alburquerque^{1,2}, Martín Laporta³, Ana Martínez³, Rafael Santana^{4,5}, Paula Sanchez⁶

¹Red de Avistamiento de Medusas., Montevideo, Uruguay. ²Museo de Historia Natural. Dr. Carlos Torres de la Llosa, Montevideo, Uruguay. ³Dirección Nacional de Recursos Acuáticos (MGAP), La Paloma, Rocha, Uruguay. ⁴Departamento de Ciencias de la Atmósfera y Física de los Océanos, Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay. ⁵Guardavidas, Seguridad de Playas, Secretaría de Deportes, Intendencia Municipal de Maldonado, Maldonado, Uruguay. ⁶Museo de Historia Natural Dr. Carlos Torres de la Llosa, Montevideo, Uruguay

Abstract

Lychnorhiza lucerna and *Chrysaora lactea* are the most abundant and most frequent jellyfish species along the Uruguayan coast (estuarine and South West Atlantic). Since 2012 a jellyfish sighting network (RAM in Spanish), has been monitoring the occurrence of these and other species. This has enabled the compilation of a comprehensive database, and significant advances in the knowledge of these species. The continuity of observations recorded over these 15 years has established a framework of skilled observers capable of detecting novel events. As a result, jellyfish in an early development stages of the two most common species have been documented. While the prevailing explanation for the presence of these species in the Uruguayan coasts is that they are transported from Brazil, these findings enable us to propose the hypothesis that they are born and develop in at least two coastal harbors. This has led us to develop a research project aimed to locate the respective polyp stages of these species. For these purposes we are working in collaboration with specialized divers within a citizen science framework.

Keywords

Citizen science, South Atlantic Ocean, Early development stages, *Lychnorhiza lucerna*, *Chrysaora lactea*

Float tank: a new research tool to observe gelatinous animal behavior

Ran Yithak Eisenberg, Zafrir Kuplick

Tel Aviv University, Tel Aviv, Israel

Abstract

Behavioral studies of gelatinous zooplankton, including medusae and ctenophores, under controlled laboratory conditions present substantial technical challenges. A primary difficulty in examining swimming behavior in captivity is the organisms' continuous requirement for water flow. Despite being efficient swimmers, gelatinous zooplankton depend on ambient currents to maintain suspension within the water column. This requirement is commonly met using Kreisel tanks, which generate a circular flow that prevents sinking and maintains continuous movement. Although Kreisel systems have proven effective, their circular flow regimes limit the range of observable swimming behaviors, thereby restricting the biological relevance of movement tracking and reducing the utility of such observations for quantitative behavioral analyses. To address these limitations, we developed a novel float tank design that enables gelatinous zooplankton to maintain neutral buoyancy without exposure to horizontal or circular currents. In this system, water is introduced from the bottom of the tank, generating a gentle, vertically oriented flow that supports the organisms in the water column while allowing unrestricted swimming in all directions. Neutral buoyancy is achieved through a double-layered tank floor that functions as a pressure chamber. Water enters the space between the two layers and is released through an array of fine perforations in the upper layer, producing a uniform upward flow. While preliminary results indicate that this design reduces hydrodynamic distortion and behavioral bias associated with forced circulation, further fine-tuning of flow characteristics and structural parameters is required. Nevertheless, the float tank represents a promising alternative to traditional Kreisel systems for laboratory-based behavioral and physiological studies of gelatinous zooplankton.

Keywords

Jellyfish, Behavior, Horizontal, Buoyancy, Current, Kreisel

Engaging the public with jellyfish science: insights from multi-scale initiatives

Itziar Álvarez-Trasobares, Manuel J. León-Cobo, Daniel Ottman, [Laura Prieto](#)

Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC), Puerto Real (Cádiz), Spain

Abstract

Jellyfish are often perceived as a growing problem in coastal ecosystems due to their ecological, social and economic impacts. However, public perception is frequently shaped by alarmist narratives, misinformation and limited understanding of their ecological roles. Effective science communication and outreach are therefore essential to bridge the gap between scientific knowledge and society. This work presents outreach initiatives aimed at disseminating knowledge on jellyfish and their blooms. Activities integrate scientific communication, education and participatory engagement focusing on bloom dynamics, the natural variability of populations and the complexity inherent in jellyfish ecology. Content and formats are adapted to diverse audiences, including the general public, students, and coastal stakeholders. Activities include educational programs, public talks, workshops at science events and the use of visual and digital materials. A participatory approach encourages dialogue rather than one-way information transfer. Emphasis is placed on the jellyfish species inhabiting the Spanish coasts, their distribution, potential risks to human health and appropriate responses in case of stings, while also presenting scientific advances and aspects of jellyfish ecology that continue to be investigated. These activities foster critical thinking, promote evidence-based understanding and build trust in marine science. Feedback from the audience suggests that interdisciplinary, multi-scale outreach enhances awareness of jellyfish as integral components of marine ecosystems and helps reduce common misconceptions. These insights highlight the importance of sustained, adaptive science communication efforts to support informed societal responses to jellyfish blooms in a changing ocean.

Fundings: PID2023-147159NB-C32, PIE-202530E251.

Keywords

Jellyfish, Bloom awareness, Science communication, Public outreach, Coastal management

Searching for elusive non-indigenous freshwater jellyfish *Craspedacusta sowerbii* in the United Kingdom using citizen science

John Terenzini¹, Matthew Faith¹, Maciej Mańko², Bruno Simões³, Florian Luskow⁴

¹University of Plymouth, Plymouth, United Kingdom. ²University of Gdańsk, Gdynia, Poland.

³Rewilding Portugal, Arrifana, Portugal. ⁴Uppsala University, Visby, Sweden

Abstract

The freshwater jellyfish *Craspedacusta sowerbii* is a widespread non-native species found in many locations globally. However, due to sporadic appearances of medusae and the cryptic nature of other life cycle stages, a complete picture of its distribution remains uncertain. Native to China, *C. sowerbii* was first reported in the United Kingdom (UK) in 1880 in an artificial tank in the Royal Botanic Garden, Regent's Park, London. Since then, there have been few reports of *C. sowerbii* in the UK over the past nearly 150 years. Although harmless to people, *C. sowerbii* may impact other local freshwater zooplankton and potentially fish recruitment, nutrient cycles, and ecosystem services, so understanding their abundance and distribution is valuable. This research is compiling reports on the currently known distribution of freshwater jellyfish in the UK by examining the historical literature, museum collections, and citizen science observations. Despite infrequent sightings, we predict via species distribution models that *C. sowerbii* is more widely distributed in the UK than is currently known and will expand in the coming decades with potential ramifications to related ecosystems.

Keywords

Hydrozoan, Medusa, Alien species, Limnic waterbody system, Species distribution

How mobile phones can help monitor jellyfish: the case of avvistAPP

Valentina Tirelli¹, Alenka Goruppi¹, Elisa Putelli¹, Alessio Mereu², Rodolfo Riccamboni², Milena Tempesta³

¹National Institute of Oceanography and Applied Geophysics-OGS, Trieste, Italy. ²Divulgando Srl, Trieste, Italy. ³DelTa-Delfini e Tartarughe in Golfo di Trieste, Gorizia, Italy

Abstract

Over the past 15 years, many citizen science jellyfish observation initiatives have been established, particularly taking advantage of new digital technologies and evolving in parallel in different locations, especially in the Mediterranean Sea. Here we present the results obtained with avvistAPP since its launch in July 2019. This app, freely available for iOS and Android phones, was designed to track the spread of the invasive ctenophore *Mnemiopsis leidyi* in the Adriatic Sea, but it was immediately used to collect observations on the presence of other jellyfish (mainly scyphomedusae) and few other marine animals as well. In 2020 avvistAPP was made available in English and currently 21 taxa can be reported worldwide. More than 3,000 sightings have been recorded, verified, and made freely available for download on the EMODnet Biology portal. The advantages and weaknesses of using mobile phones to collect data on jellyfish distribution are discussed.

Keywords

Citizen science, Invasive species, *Mnemiopsis*, Gelatinous zooplankton

Jellyfish silver gelatine photography: Towards perceptual shifts through art–science collaboration and public engagement

Matthew Beach

Queen Mary University of London, London, United Kingdom

Abstract

Photography has long supported jellyfish natural history because fragile gelatinous bodies often resist conventional sampling and preservation. Researchers now often use underwater imaging and image-based observations, including citizen photographs, to document distributions and bloom dynamics. At the same time, popular photographic media often frames jellyfish through hazard and “otherworldly” tropes, foregrounding stings, shutdowns, and disruptions, which can suggest a uniform, climate-driven global rise despite ongoing uncertainty and strong regional variability. I present an art–science collaboration with University of Georgia researchers who produced jellyfish-derived gelatine using Georgia-harvested cannonball jellyfish (*Stomolophus meleagris*) sourced via the state’s commercial fishery. Using their gelatine powder, I formulated a silver gelatine photographic emulsion by replacing mammalian gelatine in an established recipe with jellyfish-derived material. I then used the emulsion in two ways: (1) contact-printed photograms of beached cannonball jellyfish on Tybee Island; and (2) on-site portrait prints with attendees at Darien’s Blessing of the Fleet festival, which marks the opening of the shrimp fishing season. This project treats cannonball jellyfish as subject, photographic binder, and a public-facing material for science communication. Informal conversations at the festival suggested that attendees found jellyfish-based photography a compelling way to connect with coastal environments; they expressed fascination with cannonball jellyfish, support for the fishery, and curiosity about collagen applications. I argue that biologists, fishery managers, and biotechnology organisations can strengthen public understanding by building collaborations with artists, while acknowledging limits to transferability and the need for careful communication around extraction-to-product narratives.

Keywords

Photography, Art, Fishery, Public engagement, Collaboration

Cnidarian diversity revealed from environmental DNA biomonitoring in a Mediterranean lagoon

Ameline Orts¹, Alice Valentini², Carolane Giraud², Delphine Bonnet¹

¹Université de Montpellier, Montpellier, France. ²Spygen, Le Bourget du Lac, France

Abstract

Most cnidarians present a metagenetic cycle with developmental stages encompassing a large size range during ontogeny. Knowledge on medusae has drastically increased within the last decades, however, larval and benthic stages, while responsible for pelagic dynamics, are still poorly studied as they remain difficult to detect in the field. Jellyfish are known to drift with marine currents, shifting away medusae from their production area. As a result, identifying local sources remains a major challenge for understanding jellyfish population persistence and dynamics. In this context, environmental DNA (eDNA) may represent a powerful tool for specific diversity detection and monitoring. To test this, eDNA was combined with classical plankton sampling across space and season in Bages-Sigean lagoon harboring perennial cnidarians populations. Water samples were collected at five distinct stations at pre- or post-blooms periods for eDNA analysis, while plankton nets (200 µm mesh) were towed to identify cnidarian pelagic biodiversity. Using two 16S rRNA primer sets designed and validated for hydrozoans and scyphozoans species detection, 51 species were identified, revealing spatial diversity patterns contrasting sharply with classical plankton sampling, which captured only few pelagic cnidarian species. While pelagic individuals were absent from the water column, *Rhizostoma pulmo* occurrence was acknowledged, reporting for the first time, scyphistomae or podocysts presence within the lagoon. Confronting cnidarians biodiversity composition from molecular and classical microscopy approaches reveals the potential of eDNA metabarcoding as a powerful tool to detect cryptic cnidarian life stages, identify local population reservoirs, and improve understanding of jellyfish population dynamics in coastal ecosystems.

Keywords

Environmental DNA, Diversity, Monitoring

First steps towards jellyfish cryopreservation

Ameline Orts¹, Lila Belkaid², Margot Vergnet¹, Delphine Bonnet¹

¹University of Montpellier, Montpellier, France. ²Université du Littoral Côte d'Opale, Boulogne-sur-mer, France

Abstract

Cryopreservation is a promising strategy for the *ex-situ* conservation of species. While routine protocols have been set up for many exploited species, proofs of concept are still to be developed for jellyfish. Most of the Scyphozoa present a metagenetic life cycle, with a scyphistoma stage that can be maintained in culture for a long time. However, holopelagic species, like *Pelagia noctiluca*, without benthic stage, demand constant and delicate pelagic culture conditions, restraining exhibitions in aquariums but also scientific research. This raises the question of whether cryopreservation could provide an alternative strategy for the long-term conservation and experimental accessibility of holopelagic jellyfish species. One of the major factors that determines the success of a cryopreservation protocol is the type of cryoprotecting agents used to prevent damage to the cells from changes in osmotic pressure and intracellular ice crystal formation. In this study, various cryoprotectants concentration and toxicity effects were tested on the first developmental stages of *P. noctiluca* (planulae, cone larvae and ephyrae). Four criteria were measured to assess larval tolerance: survival, spontaneous mobility, morphological integrity and moving speed, using video analysis. Tolerance patterns differed among developmental stages, highlighting strong stage-specific sensitivity to cryoprotectant exposure. The combinations of 10% EG + 0.4 M trehalose allow the best results for planulae while 10% DMSO + 0.4 M trehalose were more suitable for ephyrae, providing a solid basis for initiating a cryopreservation protocol. This study represents a major step forward for jellyfish conservation, experimental reproducibility, and long-term biological archiving.

Keywords

Cryopreservation, *Pelagia noctiluca*, Toxicity, Cryoprotectants

Scyphozoan cnidome: changes across ontogeny and diet

Emma Le Roux¹, Marie Meffre^{1,2}, Maelyss Dumont², Anais Courtet², Etienne Bourgouin²,
Delphine Bonnet¹

¹University of Montpellier, Montpellier, France. ²Paris Aquarium, Paris, France

Abstract

Nematocysts are the only stinging organelles found in Scyphozoan. They aim to immobilize prey and discourage predators or competitors. Over 30 morphological types of nematocysts have been described in cnidarians based on morphology. This great diversity of morphology suggests that different types of nematocysts may fulfil different functions and may be specialized for capturing certain types of prey. Furthermore, nematocysts' composition might vary during ontogeny due to changes in organism size and diet. For most Scyphozoan species, a comprehensive description of the cnidome has not yet been done. In this study, we conducted an exhaustive determination of nematocysts typology and quantification in different stages of *Rhizostoma pulmo* (scyphistomae, ephyrae and juvenile and adult medusae) using light microscopy. Nematocyst types were determined and abundances expressed relatively to other categories. Measurements of capsule width and length were assessed from image analysis. In addition, a meta-analysis following a literature review was conducted on both Scyphozoan cnidome composition and diet, with the aim to identify patterns responsible for prey capture during ontogeny. Our results highlight 3 types of nematocysts in *R. pulmo* (a-isorhizae, euryteles and birhopaloids), with isorhizae being more abundant than rhopaloids in scyphistomae, and in oral arms rather than in umbrella edge in medusae, suggesting a key role in prey capture. The metanalysis indicates that some scyphozoan species show changes in nematocysts typology during development while others do not. Methods of analysis (e.g. light versus electronic microscopy) and targeted organs must be carefully considered when comparing cnidome description.

Keywords

Cnidome, Scyphozoan, Ontogeny, Diet, Meta-analysis

Optimizing round fiberglass tanks for jelly grow-outs

Jordan N. Reed

Georgia Aquarium, Atlanta, United States

Abstract

Fiberglass rounds are versatile tanks used for many different aquatic animals in quarantine, aquaculture, and long-term holding at public aquariums. Optimizing a fiberglass round to house *Aurelia* and Rhizostome jellies for both grow-out space and display holding eliminates the need for large pseudokreisels in behind-the-scenes areas. Biological and mechanical filtration are key components in maintaining aquarium water quality. However, flow is the most crucial element of a jelly tank. Altering the setup of spray bars allows for fine-tuning the jellies' movement around the tank, aiming to eliminate dead spots while checking the speed of incoming water. The more precise control of flow provides the means for smaller diameter jellies to thrive in the tank as well. Improving the components of filtration allows the system to efficiently process the nitrogen cycle and increased biological loads. These changes have resulted in water chemistry tests that sustain the ideal parameters even with supplemental feeds and increased population sizes. Fiberglass round tanks are a viable option for housing multiple jelly species with a suitable assembly of life support elements and simple modifications. Ideally, these combinations would broaden the variety of species that could thrive in rounds which would allow for a greater range of husbandry capabilities at aquariums. As our facility's culturing operations expand, we plan to continue to modify our jelly systems, and design future ones, based on what we have learned from altering the rounds for the *Aurelia* and Rhizostome species in our collection.

Keywords

Husbandry, System design, Fiberglass, Flow, Water quality, Biological filtration, Mechanical filtration, Holding, Display, Jelly tank

Testing rinsing solutions to treat *Rhopilema nomadica* stings

Carmel Danino-Gozlan¹, Ainara Ballesteros², Dror L Angel¹

¹University of Haifa, Haifa, Israel. ²Universidad Católica de Valencia, Valencia, Spain

Abstract

Rhopilema nomadica jellyfish stings are a common hazard in the eastern Mediterranean Sea, and despite their importance, there is no first-aid protocol based on solid scientific evidence. Current post-sting guidelines generally include four steps: mechanical removal of any visible tissue or tentacles from the skin, rinsing the stung area with a solution that does not trigger additional nematocyst discharge, application of cold or hot treatment, and seeking medical care if necessary. There are discrepancies and gaps in knowledge regarding how these solutions and treatments affect nematocyst discharge. The aim of this study was to evaluate the effect of commonly used solutions, such as seawater, vinegar, or sodium bicarbonate on nematocyst discharge using the Tentacle Solution Assay (TSA) methodology. While seawater was classified as a neutral solution, vinegar and ammonia triggered an immediate and massive nematocyst discharge after their application and were classified as activator solutions. This study represents the first evaluation of the effects of these substances on *R. nomadica* nematocysts. Moreover, it contributes to the development of a safe first-aid framework by discouraging the use of potentially inappropriate rinse solutions, while also providing evidence to support the harmonization of first-aid protocols for scyphomedusa stings across the Mediterranean basin.

Keywords

Nomad jellyfish, Nematocysts, Tentacle Solution Assay, Stinging

Follow the crowd: conspecific cues enhance larval settlement in *Aurelia coerulea*

Lucas H. Gimenez, Anthony R. Carroll, Kylie A. Pitt

School of Environment and Science, Griffith University, Southport, Australia

Abstract

Gregarious settlement contributes to the formation of jellyfish polyp aggregations, but the mechanism by which larvae detect habitats with conspecifics is poorly understood. Here, we tested the hypothesis that *Aurelia coerulea* larvae settle gregariously by detecting organic compounds released into the water by polyps. First, we conducted choice experiments to confirm the preference of larvae for substrate with conspecifics and assess whether larvae detect physical or chemical cues from polyps. Then, we conducted settlement induction experiments to explore the mechanism underlying the detection of conspecifics and the nature of the chemical cues involved. We exposed larvae to seawater that had been in contact with polyps, and to substrate from which polyps had been detached to assess whether the settlement cues were waterborne or surface-bound compounds. Finally, we measured whether settlement cues persisted after 18 h to determine their stability and evaluated their organic nature by testing whether larvae still settled when exposed to seawater from which dissolved organic compounds from polyps had been removed via filtration. Larvae actively selected substrate inhabited by polyps, and settlement was enhanced with seawater conditioned with a high-density of polyps. These settlement cues were organic and active for at least 18 h. Our results provide compelling evidence of a larva-polyp interaction in *A. coerulea* mediated by stable organic waterborne compounds that promote gregarious settlement. This chemical interaction may have unexplored ecological implications beyond habitat selection, potentially facilitating the invasive success of *A. coerulea* and the formation of jellyfish blooms.

Keywords

Chemical ecology, Cnidaria, Intraspecific interaction, Marine invertebrate, Planula, Scyphistoma

From polyp to medusa: compositional and metabolic evolution in *Aurelia aurita*

Vanesa Romero-Kutzner, Daniel R. Bondyale-Juez, Ico Martínez, Alicia Herrera, Theodore T. Packard, May Gómez

Marine Ecophysiology Group (EOMAR), IU-ECOQUA, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain

Abstract

Aurelia aurita exhibits a triphasic life cycle involving metamorphosis, transitioning from sessile polyps to free-swimming ephyrae and eventually maturing into medusae. This metamorphic process is triggered by a reduction in temperature. In this investigation, we delve into the intricate changes in protein, lipid, and carbohydrate content, and examine alterations in respiratory and excretory metabolisms using both physiological and enzymatic methodologies. This study provides the first monitoring of these parameters. Observations at compositional and metabolic levels were conducted over 108 days in triplicate, with three simultaneous cultures maintained under identical conditions throughout the experiment. The findings reveal compositional changes, particularly in lipid content, one of the main sources of biological energy during metamorphosis. Additionally, a 20-day increase in water content from 89 to 99% occurred during the transition from strobila to metaephyra. Respiratory activity reduced by 76% during strobilation, due to the necessary temperature drop. Concurrently, excretory activity showed a more gradual increase in ammonium excretion during the planktonic stages once feeding resumed. These findings highlight the role of temperature-dependent triggers and metabolic shifts in facilitating energy storage among other functions. This knowledge may provide insights into the potential impacts of future environmental change on the entire lifecycle.

Keywords

Excretion, Jellyfish, Lipid, Protein, Respiration, Strobilation

Physalia, how do you conduct yourself?

Ico Martínez¹, Anna Cunill¹, Sofía Huelbes¹, Álvaro Torres-Gómez², Alicia Herrera¹, Theodore T. Packard¹, May Gómez¹

¹Marine Ecophysiology Group (EOMAR), IU-ECOQUA, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain. ²Aquaculture Research Group (GIA), IU-ECOQUA, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain

Abstract

The aim of this work was to gain a deeper understanding of the physiology and biochemistry of the siphonophore *Physalia physalis*. We cultivated beached specimens in 1000L tanks with recirculating seawater, for 7-15 days. The *Physalia* were fed seabream (*Sparus aurata*) juveniles and were checked for their weight, pneumatophore and sail characteristics. At the end of this conditioning period, *Physalia physalis* were carefully transported to the laboratory, where their respiratory parameters (RO_2 , RCO_2) were measured. The specimens were then frozen ($-80^{\circ}C$) for further enzymatic and biochemical analysis. The results obtained were then compared to freshly collected (beached) specimens. No significant changes were observed in the pneumatophore or sail size during the monitoring period. The organisms evidenced good health in the indoor conditions. Weight gain, in terms of wet mass (g), was not uniform. All individuals showed comparable values both for respiratory status (RO_2 , RCO_2) and their related potential for O_2 consumption (ϕ) and CO_2 production (ψ), as well as for biochemical composition (protein, carbohydrates and lipid content). Values for RO_2 and RCO_2 were in the same range, while the ψ was an order of magnitude greater than the ϕ . Differences between cultivated and freshly collected organisms were observed for enzymatic activities related to stress (CAT, GST, SOD and LDH). The differences may be a sign of poor health when the samples are collected from the beach (metabolic stress). Longer term culture may decrease stress markers and offer a possibility for recovery.

Keywords

Physalia physalis, Growth, Metabolism, Biomarkers

Morphological characteristics of the gonads and reproductive ecology of subtropical jellyfish, *Aurelia malayensis*

Haruto Ishii¹, Kazusa Yamada¹, Yasuyuki Nogata², Tetsuro Sasaki³, Sarasa Nagatsuka⁴

¹Tokyo University of Marine Science and Technology, Tokyo, Japan. ²Central Research Institute of Electric Power Industry, Abiko, Japan. ³Institute of Boninology, Tokyo, Japan.

⁴Estuary Research Center, Shimane University, Matsue, Japan

Abstract

Aurelia malayensis was once considered the same species as moon jellyfish, *A. coerulea*, but is now recognized as a distinct species based on genetic and morphological characteristics, exhibiting significantly different ecological characteristics. In terms of distribution, while *A. coerulea* is primarily found in temperate bays and coastal waters, *A. malayensis* is mainly distributed in subtropical waters. One major morphological characteristic of *A. malayensis* is that its gonads are heart-shaped rather than horseshoe-shaped. One objective of this study is to clarify how such morphological changes relate to developmental stages. Another objective is to elucidate reproductive ecology by observing immature eggs within the gonads (ref. eggs) and measuring their growth and number of eggs. The morphology of the gonads was observed to be horseshoe-shaped during the young jellyfish stage, but as they grew, the shape gradually changed into heart-shaped. Diameter of eggs within the gonads increased with increasing the bell diameter of medusae, with the maximum egg diameter exceeding 140 micrometers. Total number of eggs also increased with increasing the bell diameter. Actually, *A. malayensis* is distributed in subtropical waters. However, as ocean warming progresses, its distribution range will be expected to expand. Therefore, their ecology particularly reproduction is one of the important research topics, as it is related to the population dynamics of the next medusae generations.

Keywords

Jellyfish, Reproduction, Subtropical, Gonads

Polyp elimination method to effective and inexpensive moon jellyfish bloom control

Bola Moon¹, Sunwoo Kim², Seongho Im¹, Byungseol Koh¹, Jinho Chae³

¹Korea Marine Environment Management Corporation, Seoul, Korea, Republic of. ²Korea Marine Environment Management Corporation, Seoul, Korea, Republic of. ³Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of

Abstract

Massive blooms of the moon jellyfish occurs various kinds of damages to fisheries, recreation as well as power plant operations. Moon jellyfish blooms increase every year in Korea, since the 90's. But recently, moon jellyfish blooms are effectively and inexpensively controlled in Korea. National organizations such as the KOEM, NIFS have collaborated to develop and act at various polyp elimination methods. Jellyfish polyp management program follows the order, hotspot search, test elimination, Actual elimination, monitoring, fundamentally. Representative polyp elimination method is water jet elimination method. And choose various different tools as occasion demands. As like as flat shovel, scraper, brush, etc. It also contributes to improving the efficiency of polyp removal by developing more efficient methods such as polyp inhalation devices, automatic brushes, and large squeeze and registering patents. In order to maximize the effectiveness of such a polyp removal method, a map of the distribution of polyps throughout Korea is prepared and updated every year, and polyps are removed by referring to this map.

Keywords

Polyp elimination, Precautionary management, Moon jellyfish

Successful prevention cases by polyp eliminating in Korea's chronic jellyfish bloom repeated seas

Seongho Im¹, Sunwoo Kim¹, Bola Moon¹, Byungseol Koh¹, Jinho Chae²

¹Korea Marine Environment Management Corporation, Seoul, Korea, Republic of. ²Marine Environmental Research and Information Laboratory, Gwacheon, Korea, Republic of

Abstract

The Korean government adopted the precautionary approach, based upon direct eliminating of polyps, for prevention in advance of medusa blooms by implementing "Jellyfish Polyp Management Program". This program was carried out in most of the sea areas where moon jellyfish blooms occur in Korea, and as a result, jellyfish blooms were prevented. But, in the water inside Deukryng Bay in southwest Korea, jellyfish bloom occurred even after the polyps were removed. Although the polyps were removed at the beginning of each year, jellyfish bloomed every summer, so we needed a new approach. The topography of Deukryang Bay is long in the northeast direction, and the depth of the entrance is relatively shallow. We explored polyp habitats in a wide range of waters, including both the inside and outside of Deukryang Bay, and surveyed Medusa. And, we comprehensively analyzed 1) jellyfish bloom area, 2) moving route of young medusa, 3) many ephyra appear area, and 4) the polyp habitats, and tracked the moving route according to the life cycle of jellyfish. So, we figure out where the origin polyp habitats, which is the source of jellyfish bloom occur. For the next step, the original habitats of the polyp was removed. As a result, there were no jellyfish blooms inside Deukryang Bay. The Korean government has applied this method to another special area, effectively preventing the moon jellyfish blooms.

Keywords

Polyp elimination, Precautionary management, Moon jellyfish

Development of a craft beer utilizing moon jellyfish (*Aurelia coerulea*): A sustainable approach to jellyfish blooms

Manami Sato

The University of Tokyo, Tokyo, Japan

Abstract

Jellyfish blooms cause severe damage to coastal industries, including fisheries and power plants, yet most countermeasures rely on physical removal and disposal, treating jellyfish as industrial waste. While some jellyfish species such as *Nemopilema nomurai* are traditionally consumed, species that most frequently cause industrial damage -particularly the moon jellyfish (*Aurelia coerulea*)- have seen little effective utilization despite their high biomass during blooms. To address this gap, we explored a utilization pathway for bloom-forming moon jellyfish: craft beer. Moon jellyfish, a dominant species in nuisance blooms, were used as the raw material. To ensure product quality and safety, mucus and gastric contents were removed to eliminate fishy odors. The jellyfish bodies were heated to extract collagen-rich liquid and internal fluids, while the membranes were filtered out. The resulting extract was added to wort prior to fermentation to produce a lager-style beer (5% ABV). The lager exhibited no fishy or salty odor. Sensory evaluation suggested that trace mineral components moderated malt-derived sweetness, resulting in a clean and refreshing finish. Food safety analysis confirmed that Total Viable Counts, Coliforms, and heavy metals (As, Pb, Cd, total Hg) were all within safe regulatory limits. Approximately ten jellyfish individuals were required per 200 L batch, indicating the potential to process large volumes of bloom-derived biomass. This study demonstrates a new utilization model targeting a high-impact species, reframing moon jellyfish from an industrial nuisance into a value-added consumer resource. Future work will evaluate consumer sensory perceptions, optimize large-scale production, and further analyze nutritional properties.

Keywords

Aurelia coerulea, Jellyfish utilization, Craft beer, Circular economy, Food safety

Investigating the developmental potential of large planulae in *Aurelia coerulea*

Satsuki Takauchi, Reiryu Cho, Hiroshi Miyake

School of Marine Biosciences, Kitasato University, Kanagawa, Japan

Abstract

Aurelia coerulea medusae in Wakasa Bay and Noto region of Japan produce unusually large planulae (> 400µm) that can develop directly into ephyrae. In these large planulae, almost all parts of planulae develop into ephyrae, whereas the aboral residues metamorphose into polyps. To clarify the developmental potential of large planulae, we investigated their developmental characteristics through cutting experiments. Large planulae were collected from medusae in Wakasa Bay, Fukui Prefecture, Japan. Planulae were bisected longitudinally along the long axis or transversely along the short axis (n = 100 for each treatment) using an insect pin. Fragments were incubated at 11 °C, and their survival, development process and morphology of the ephyrae were observed. The highest rate of ephyra formation was observed in longitudinal fragments (approximately 20%), whereas the highest polyp formation rate was observed in aboral fragments (approximately 90%), and high mortality was observed in oral fragments (approximately 80%). The ephyrae formed from longitudinal and oral fragments were mostly normal, while those from aboral fragments were abnormal with only two to four marginal lappets. These results suggested that the gradient of factors involved in ephyra formation is organized along oral-aboral axis. The capacity for ephyra formation is localized on the oral side and attachment of the aboral side is necessary for normal development. Furthermore, the fragments forming complete ephyrae lacked residual tissue, indicating that all available tissue were used for ephyra formation. These results demonstrate oral–aboral differentiation in large planulae and help explain direct development in *Aurelia*.

Keywords

Life cycle, Direct development, Ephyra formation, Oral-aboral polarity

When Portuguese Man-o'-War reach the coast: spatial and temporal distribution in Spain

Itziar Álvarez-Trasobares, Laura Prieto

ICMAN-CSIC, Puerto Real (Cádiz), Spain

Abstract

Sightings of *Physalia physalis* along the Spanish coastline has aroused growing interest in understanding its distribution dynamics and coastal arrival patterns. In this study, we analyze records collected by the Andalusian Institute of Marine Sciences (ICMAN-CSIC) between 2005 and 2025 across the main Spanish coastal regions, aiming to identify recurring patterns, interannual variability, and potential regional differences. The results indicate that the Canary Islands maintain a relatively constant annual presence of *P. physalis* during the first months of the year (January–March), although the magnitude of the events fluctuates. In contrast, the Gulf of Cadiz coast and the Mediterranean shoreline show linked arrival events, with sightings in the Mediterranean occurring after those recorded in the Gulf of Cadiz. Shared atmospheric and oceanic patterns drive the episodes, while the specific conditions of the western Mediterranean modulate it. Finally, along the Cantabrian coast, the data reveal a clearly distinct pattern, with specimens arriving mainly during the second half of the year (June–December). Last decade this region experiences arrivals almost every year, although the intensity of the events varies interannually.

Fundings: PID2023-147159NB-C32, PIE-202530E251, Disp. 15052, BOE 310/2020.

Keywords

Physalia physalis, Spatiotemporal distribution, Coastal arrival patterns, Jellyfish blooms, Spanish coasts

Climate-driven phenological shifts and biogeographical constraint of the hydrozoan *Velella velella* in Mediterranean coastal waters

Clémence Epinoux¹, Sultana Zervoudaki², Maria Protopapa², Katerina Kikaki³, Juan Carlos Molinero¹, Delphine Bonnet⁴

¹MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Sète, France. ²Hellenic Center for Marine Research, Institute of Oceanography, Anavyssos Attiki, Greece. ³Hellenic Space Center, Athens, Greece. ⁴MARBEC, Univ. Montpellier, CNRS, Ifremer, IRD, Montpellier, France

Abstract

The hydrozoan *Velella velella* forms extensive surface swarms worldwide. Yet, its ecology and distribution in the Mediterranean Sea remain poorly documented despite its role in the pleustonic food-web. The most comprehensive database of *V. velella* for the Mediterranean (n = 11,742 records; 1841-2024) was compiled by integrating scientific literature, citizen science initiatives, social media, and press reports to investigate its biogeography and phenology, assessing its spatial distribution, seasonal dynamics, and phenological shifts linked to regional warming. We hypothesized that *V. velella* distribution is constrained by its thermal niche and that bloom timing has advanced following thermal niche tracking dynamics. Citizen science represents 72% of observations, highlighting its role in documenting widespread but irregular plankton events. Records exhibited a pronounced west–east gradient, with most occurrences in the Western Mediterranean. Seasonal patterns showed a dominant bloom from March to May, with regional variability and occasional autumn peaks. Bayesian analyses, including latent peak models and structural equation modeling, revealed an advancement of ~27 days in bloom timing between 2009 and 2024, closely linked to winter sea surface warming. They also identified indirect effect of winter NAO on bloom timing, mediated through SST. *V. velella*'s thermal niche spanned 13.0–24.5 °C, with an optimum near 14.5 °C, indicating tight coupling between seasonal dynamics and cooler winter-spring temperatures. These findings establish *V. velella* as an indicator of surface-ocean variability and demonstrate the potential of citizen science for detecting biogeographical and phenological responses of pleuston to climate change.

Keywords

Velella velella, Phenology, Biogeography, Citizen science, Climate change, Mediterranean Sea

Description of Scyphozoan jellyfish assemblages in the Bolinao–Anda Reef Complex, Northwestern Philippines

Serafin III Mendez Geson^{1,2}, André C. Morandini³, Maria Vanessa Baria-Rodriguez^{1,2}

¹The Marine Science Institute (MSI), College of Science, UP Diliman, Quezon City, Philippines.

²Bolinao Marine Laboratory (BML), UP MSI, Pangasinan, Philippines. ³Departamento de Zoologia, Instituto de Biociências & Centro de Biologia Marinha (CEBIMar), Universidade de São Paulo, São Paulo, Brazil

Abstract

Most existing knowledge of jellyfish population dynamics is derived from temperate systems, resulting in gaps in baseline data from tropical regions, particularly in Southeast Asia. This study provides the first description of scyphozoan jellyfish assemblages in the Bolinao–Anda Reef Complex (BARC), northwestern Philippines, and noting spatial and temporal patterns in species occurrence and abundance. Monthly plankton tow samplings were conducted at six sites within BARC from April 2024 to August 2025. Jellyfish were collected, counted, measured, and identified to tentative species based on morphological characters. A total of 246 individuals representing nine putative taxa were recorded. Assemblages were dominated by the genera *Mastigias*, *Linuche*, *Cassiopea*, and *Aurelia*, while the remaining taxa were represented by less than ten individuals each. Most taxa were first recorded in February and were observed in increasing numbers through the summer months, with the highest overall abundance recorded in May ($\sim 8.6 \times 10^{-4}$ ind m^{-3}). Spatial patterns varied among taxa, with higher occurrences around Anda Island for most species, whereas *Linuche* was restricted to sites near Lucero, Bolinao. Size composition differed among taxa, with *Mastigias* and *Cassiopea* largely represented by small juvenile individuals, while *Aurelia* and *Linuche* were primarily composed of mature adults. These findings provide baseline information on tropical scyphozoan assemblages in a reef-associated system and highlight the need for continued monitoring to resolve longer-term patterns and interannual variability and phenology.

Keywords

Jellyfish, Medusae, Population dynamics, Tropics, Southeast Asia

Modelling the coastal presence of *Pelagia noctiluca*: a comparative perspective

Manuel Jesús León-Cobo¹, Daniel Ottman¹, Javier Ruiz¹, Juan Gabriel Fernández², Rebeca Álvarez², Eva Moragues³, Antoni María Grau³, Joaquín Tintoré⁴, Laura Prieto¹

¹Instituto de Ciencias Marinas de Andalucía, Puerto Real, Cádiz, Spain. ²Balearic Islands Coastal Observation and Forecasting System, Palma de Mallorca, Spain. ³Direcció General de Pesca, Conselleria d'Agricultura, Pesca i Medi Natural, Govern des Illes Balears, Palma de Mallorca, Spain. ⁴Instituto Mediterráneo de Estudios Avanzados, Esporles, Mallorca, Spain

Abstract

Over the recent years, the increasing occurrence of large jellyfish aggregations has stimulated growing interest in modelling approaches as a valuable tool for characterizing jellyfish population dynamics and spatial patterns. Within this framework, species such as *Pelagia noctiluca*, which exhibit a fully pelagic life cycle, introduce additional complexity to the modelling of their coastal distribution. This study explores and compares the performance of different modelling approaches for explaining the coastal presence of *P. noctiluca* in the Balearic Archipelago. The analysis is based on a comprehensive database of daily jellyfish observations collected during 11 years. These biological observations are combined with oceanographic and biogeochemical model outputs. Several statistical modelling frameworks are evaluated, primarily Generalized Additive Models, with the potential inclusion of additional species distribution models for comparison. Model performance, variable selection, and the inferred relationships between environmental drivers and jellyfish presence are examined to assess the robustness and interpretability of each approach. By comparing alternative modelling strategies under a common data framework, this work aims to provide insights into the strengths and limitations of different approaches for characterizing *P. noctiluca* distribution patterns. The results contribute to improved modelling practices for jellyfish occurrence and to support future efforts towards predictive tools relevant for coastal management and impact mitigation.

Fundings: Disp. 15052, BOE 310/2020; PIE 202530E251.

Keywords

Mauve stinger, Stochastic modelling, Prediction, Coastal occurrence, Environmental forcing

Shifting dominance in the Southern Ocean: Ecological and societal implications of the Antarctic krill-salp dynamic under climate change

Florian Lüskow¹, Alexis A. Bahl², Evgeny A. Pakhomov², Lina Mtwana Nordlund¹

¹Uppsala University, Visby, Sweden. ²University of British Columbia, Vancouver, Canada

Abstract

The “gelatinous-crustacean bi-system” represents a key competitive dynamic in the Southern Ocean between two major metazoans: Antarctic krill (*Euphausia superba*) and salps (*Salpa thompsoni*). Here, we seek to improve our understanding of the diverse drivers shaping this system using an inclusive environmental framework. Climate change, manifested through rising ocean temperatures and declining sea ice extent, is a primary driver of change, facilitating a southward expansion of salp populations into regions historically dominated by krill. This shift in dominance has profound ecological consequences, as krill provide a high-energy food source for upper-trophic-level predators such as whales and penguins. In contrast, salps support alternative trophic pathways characterised by lower energy density and altered transfer efficiency. In addition, changes in species dominance affect biogeochemical cycling and the efficiency of the biological carbon pump, for example, through differences in faecal pellet production and sinking rates. Human activities in the Southern Ocean foster further interactions with these dynamics, including commercial krill fisheries that supply aquaculture feed and nutraceuticals, as well as tourism focussed on krill-dependent predators. In contrast, salps are unexploited and largely absent from management frameworks, despite their growing influence on food web structure, creating mismatches between ecosystem state, krill-focussed fisheries management, and the ecological conditions that support krill-dependent predators and tourism. Current regional management strategies are largely krill-centric, highlighting the need for more holistic and adaptive management approaches capable of responding to rapid and ongoing ecosystem and societal changes.

Keywords

Ecosystem services, Environmental frameworks, *Euphausia superba*, *Salpa thompsoni*

Building a tool to predict the arrival of a dangerous jellyfish to coastal areas

Daniel O. Ottmann¹, Manuel León-Cobo¹, Juan Gabriel Fernández², Rebeca Álvarez², Eva Moragues³, Antonio María Grau³, Joaquín Tintoré⁴, Laura Prieto¹

¹Institute of Marine Sciences of Andalusia (ICMAN-CSIC), Puerto Real, Spain. ²Balearic Islands Coastal Observing and Forecasting System, Palma, Spain. ³Direcció General de Pesca, Conselleria de Agricultura, Pesca i Medi Natural, Govern de les Illes Balears, Palma, Spain.

⁴Mediterranean Institute for Advanced Studies (IMEDEA-CSIC-UIB), Esporles, Spain

Abstract

The jellyfish *Pelagia noctiluca* poses a health and economic risk to coastal communities of the Mediterranean Sea. Here, we aim to develop and evaluate an operational tool capable of predicting the arrival of *P. noctiluca* to coastal areas of the Balearic Islands, Western Mediterranean. Using an 11-year database of scientific observations in coastal areas, we have developed a model that uses environmental variables to predict jellyfish occurrence up to two days in advance. The next step will be to implement this model into a publicly accessible mobile app, similar to weather apps, with interactive maps and automatically updated predictions. Model predictions will be tested with key user groups before releasing the app to the broader public.

Keywords

Jellyfish, Forecast, Mediterranean Sea, Health

Sea-surface chlorophyll concentration determines abundance and distribution of *Pelagia noctiluca* ephyrae at the onset of Summer

Daniel O. Ottmann¹, Patricia Reglero², Diego Álvarez-Berastegui², Joaquín Tintoré³, Laura Prieto¹

¹Institute of Marine Sciences of Andalusia (ICMAN-CSIC), Puerto Real, Spain. ²Spanish Institute of Oceanography (IEO-CSIC), Palma, Spain. ³Mediterranean Institute for Advanced Studies (IMEDEA-CSIC-UIB), Esporles, Spain

Abstract

Pelagia noctiluca is the most successful and well-studied jellyfish in the Mediterranean Sea. This species tolerates a wide range of water temperatures and succeeds in low to medium food regimes, but conditions driving its distribution and abundance remain uncertain. Here we applied a multiscale analytical approach using survey data and a physical–biochemical coupled model to assess how environmental factors affect the distribution and interannual abundance of *P. noctiluca* early life stages. The surveys took place after the spring bloom, when warm water favors fecundity and growth, but food shortage limits the reproductive investment and early survival. We found that most early life stages of *P. noctiluca* remained above the shallow thermocline. Their spatial distribution was positively correlated with surface chlorophyll concentration, and over 90% of the variation in interannual abundance was explained by basin-scale productivity in June.

Keywords

Jellyfish, Mediterranean Sea, Early life stages, Productivity

eDNA metabarcoding of spring jellyfish communities in Irish coastal waters using Oxford Nanopore sequencing

Giulia Maria Rossi¹, Roisin Nash², Fiona Kavanagh², Nicolas Touzet¹

¹Dept. of Environmental Science, Centre for Environmental Research, Innovation and Sustainability (CERIS), Atlantic Technological University, Sligo campus, Sligo, Ireland. ²Dept. of Natural Resources & the Environment, Marine and Freshwater Research Centre (MFRC), Atlantic Technological University, Galway campus, Galway, Ireland

Abstract

Jellyfish blooms, driven by global warming, coastal eutrophication and overfishing, have emerged as significant concerns in coastal environments. These dense aggregations have been occurring with increasing frequency and have caused significant biodiversity reduction, fish mortalities and economic losses, highlighting the urgent need for innovative management strategies. The gelatinous nature of the jellyfish makes it difficult to target them during routine monitoring campaigns. Consequently, environmental DNA (eDNA) coupled with metabarcoding offers a promising approach to assess medusozoan biodiversity in coastal environments and enable early detection of jellyfish aggregations. The portable Oxford Nanopore Technologies (ONT) MinION sequencer was employed to assess the community composition at 24 surface stations across four bays in North-West Ireland during May 2025, prior to the blooming season. Water samples were collected and filtered to extract eDNA. PCR amplification of both partial mitochondrial 16S and Cytochrome Oxidase 1 (CO1) genes was conducted using specific primer pairs prior to sequencing. To track the presence of scyphozoans, 1.2 Gb of data for 16S and 1.5 Gb for CO1 were analysed. Both *Aurelia aurita* and *Cyanea capillata*, which have caused blooms in the past, were successfully detected, more so in Donegal Bay. Phylogenetic trees were constructed to establish the identity of the *Cyanea* sequences that were not completely disentangled via BLAST analysis. This study is the first of its type conducted in Irish coastal waters. Findings demonstrate the potential of Nanopore-based metabarcoding as a monitoring tool for the conduct of biogeographical distribution studies of cnidarian species of concern.

Keywords

eDNA, Metabarcoding, Jellyfish blooms, Nanopore sequencing, Biodiversity

Estimating scyphozoan jellyfish abundance and size structure on a sub-mesoscale in the oceanic Gulf of Mexico using unmanned aerial vehicle imagery data and a convolutional neural network

Graeme Clark, Kelly L. Robinson

University of Louisiana at Lafayette, Lafayette, United States

Abstract

We tested if scyphozoan jellyfish population abundance and size structure in the surface layer of continental ocean could be quantified from video data captured via an unmanned aerial vehicle (UAV). Imagery data from UAV-mounted cameras have been used in other ecosystems to monitor the abundance and distribution of large jellyfish species in shallow and semi-enclosed ecosystems but never in the open ocean. Specifically, we generated sub-mesoscale (<1km) estimates of *Aurelia* spp. and *Chrysaora* spp. abundance (individuals m⁻³) and population size structure in the surface water of the oceanic, northern Gulf of Mexico using images from a high-resolution, 4K video camera mounted on a YUNEEC H520e. The UAV was flown along replicate transects over three sampling days in late summer 2022. In total, over 1.3 million images were collected. Among those images, we analyzed 3,009 frames, each of which imaged a unique 20,827 m² area of the ocean's surface. In each frame, *Aurelia* spp. and *Chrysaora* spp. individuals were identified using a YoloV8 convolutional neural network (CNN) and their bell diameter estimated with the software ImageJ. Results showed that the CNN identified jellyfish from non-jellyfish particles with an accuracy of 84%. *Aurelia* spp. densities ranged from 0.1 individuals 1000 m⁻³ to 50 individuals 1000 m⁻³. *Chrysaora* spp.'s densities ranged from 0.4 individuals 1000 m⁻³ to 20 individuals 1000 m⁻³. To evaluate possible top-down trophic effects of variations in scyphozoans on their plankton prey, genus-specific daily clearance rates (L individual⁻¹ d⁻¹) were derived from abundance and bell diameter estimates.

Keywords

Scyphozoan jellyfish, *Aurelia* spp., *Chrysaora* spp., Unmanned aerial vehicle, Drone, Convolutional neural network, Abundance, Size-structure, Clearance rate, Gulf of Mexico

Exploring jellyfish (Cnidaria; Scyphozoa/Hydrozoa) as natural samplers of environmental DNA: a case study in the Northern Adriatic Sea

Courtney May^{1,2}, Alice V. Cunningham¹, Peter Shum¹, Massimo Avian³, Valentina Tirelli⁴, Gregorio Motta³, Stefano Mariani¹, Craig S. Wilding^{5,1}

¹Liverpool John Moores University, Liverpool, United Kingdom. ²Queen Mary University of London, London, United Kingdom. ³University of Trieste, Trieste, Italy. ⁴National Institute of Oceanography and Applied Geophysics—OGS, Trieste, Italy. ⁵University College Dublin, Dublin, Ireland

Abstract

Conservation management, aimed at mitigating the ongoing biodiversity loss, critically relies on ecosystem monitoring to enable accurate estimates of species distributions and population sizes. Environmental DNA (eDNA) analysis has become increasingly popular for non-invasive and high-throughput species assessment, including fish species diversity. Beyond the established sample collection protocols, natural samplers of eDNA (nsDNA) – organisms that trap environmental genetic material in their tissues – show considerable promise, with recent work especially demonstrating the remarkable effectiveness of sea sponges. Here, the potential of jellyfish (phylum Cnidaria) to serve as motile, marine, pelagic natural samplers of eDNA was investigated through DNA metabarcoding using fish specific primers. Jellyfish are opportunistic marine predators known to consume fish eggs and larvae and their presence has been associated with certain fish species, making them potentially useful for open water fish assessment. Four species, the many-ribbed jellyfish (*Aequorea forskalea*, Class Hydrozoa), the moon jelly (*Aurelia solida*, Class Scyphozoa, Order Semaestomeae), the barrel jellyfish (*Rhizostoma pulmo*, Class Scyphozoa, Order Rhizostomeae) and the fried-egg jellyfish *Cotylorhiza tuberculata* (Class Scyphozoa, Order Rhizostomeae) were collected from the Italian waters of the Gulf of Trieste (northern Adriatic Sea) and nsDNA isolated, sequenced and analysed. Across all species, 28 fish Molecular Operational Taxonomic Units (MOTUs) were detected including pelagic species, benthic species likely spawning at the time of sampling, and species known to associate with the presence of jellyfish. We highlight the potential of jellyfish as tools for enhancing biodiversity monitoring, particularly in remote and inaccessible areas where conventional surveys may be difficult to employ.

Keywords

Biodiversity Monitoring, Metabarcoding, Fish, Mediterranean Sea

Abundance and spatiotemporal dynamics of *Nemopilema nomurai* (Scyphozoa, Rhizostomeae) in waters nearby Hongyanhe Nuclear Power Plant, Bohai Sea of China

Yantao Wang

Institute of Oceanology Chinese Academy of Sciences, Qingdao, China

Abstract

Large aggregations of *Nemopilema nomurai* have occurred in the northern East China Sea, Yellow Sea, Bohai Sea and East Sea/Japan Sea since the end of the 20th century, and the Changjiang River mouth adjacent sea and the northern inner coastal of Liaodong Bay (LDB) Bohai Sea have been suspected as the source of these jellyfish blooms. In coastal waters, jellyfish bloom often clogs water intakes of electricity power plants, imposing a potential threat to the safe operation of power plants. It is fundamental to determine the sources and population dynamics of jellyfish and control jellyfish bloom. In this paper, we present results of the spatiotemporal pattern of distribution and abundance of *N. nomurai* in waters nearby Hongyanhe Nuclear Power Plant LDB, Bohai Sea of China. The results showed that high abundance larvae of *N. nomurai* appeared in the north part of the survey area in May, indicating that the northern inner coastal areas of LDB is source of *N. nomurai* nearby Hongyanhe Nuclear Power Plant. Abundance of *N. nomurai* decreased from May to June, and abundance is higher in the south part than the north part of the area in June. Dead individual of *N. nomurai* was captured in September, and abundance decreased until September. The individual size increased from 3.94 ± 0.81 cm in May to 59.26 ± 18.68 cm in July. We present data on the temporal and spatial distribution of the species in relation to environmental variables (e.g., sea temperature, salinity, dissolved oxygen and Chlorophyll concentration).

Keywords

Nemopilema nomurai, Abundance, Spatiotemporal dynamics, Environmental factors, Hongyanhe Nuclear Power Plant

Using fishery surveys for wide-scale jellyfish monitoring

John Yañes Dobson¹, Eva S. Fonfría¹, Antonio Esteban², Jaime Fernandez¹, Encarnación García², Miguel Vivas², Cesar Bordehore²

¹University of Alicante, Alicante, Spain. ²CSIC-IEO, San Pedro del Pinatar, Spain

Abstract

The Mediterranean International Trawl Survey (MEDITS) is a long-term benthic trawl program conducted since 1994 to collect standardized information on demersal fisheries in support of sustainable management. Although MEDITS systematically samples and identifies most marine organisms, gelatinous zooplankton have traditionally been treated as bycatch and excluded from routine cataloguing, despite their key role in pelagic–benthic coupling and trophic web dynamics. Since 2023, MEDITS surveys conducted along the Spanish Mediterranean coast have systematically recorded the presence, abundance, biomass, and species composition of jellyfish, together with associated abiotic variables. This study presents results from three consecutive years (2023–2025), comprising 357 trawl hauls over a large spatial extent. Jellyfish presence was detected in 31% of hauls in 2023, increasing to 64% in 2024, and declining to 47% in 2025, indicating strong interannual variability. Mean abundance was highest in 2023 (184.4 ind·km⁻²), with extreme local maxima, while mean biomass remained comparatively low, highlighting the episodic and patchy nature of jellyfish aggregations. Although limited in temporal scope, these results demonstrate that meaningful jellyfish data can be obtained with minimal additional effort by integrating gelatinous organism recording into an already established monitoring framework. This Spanish initiative represents a first step toward basin-wide standardization. Expanding jellyfish sampling across MEDITS surveys in other Mediterranean countries (e.g. Italy, France, and beyond) would provide unprecedented large-scale data on jellyfish distribution and variability, at low economic cost, improving our understanding of their ecological role and contribution to Mediterranean marine ecosystems.

Keywords

MEDITS, Fishery survey, Benthic, Sampling

Can we alter the movement of jellyfish? Effects of electromagnetic fields (Patented)

Cesar Bordehore¹, Sandra Sendra-Compte², Eva S. Fonfria³, John Yañes Dobson³, Lorena Parra-Boronat⁴, Alberto Ivars-Palomares⁵, Jaime Lloret-Mauri⁵

¹Dep. Ecology & Research Institute "Ramon Margalef", University of Alicante, Alicante, Spain.

²Universitat Politècnica de València, Valencia, Spain. ³Research Institute "Ramon Margalef", University of Alicante, Alicante, Spain. ⁴Department of Agricultural Production, Dep. Universidad Politécnica de Madrid, Madrid, Spain. ⁵Dep. Communications, Universitat Politècnica de València, Valencia, Spain

Abstract

This system influences the swimming behaviour of jellyfish in marine environments by applying controlled electromagnetic fields. Two or more electromagnetic coils made of insulated copper wire are arranged at predefined intervals and configured to generate localised electromagnetic fields. The buoy houses an electronic control unit comprising an energy harvesting element, an energy storage unit, a voltage conversion module, a microcontroller, and a signal generation circuit. The circuit supplies the coils with an alternating electrical signal with a peak-to-peak voltage of at least 3.3 V and an operating frequency between 400 kHz and 800 kHz. When activated, the coils produce electromagnetic fields that interact with the sensory and neuromuscular mechanisms that govern jellyfish pulsation. Exposure to these fields temporarily reduces or inhibits bell contraction frequency, resulting in decreased active swimming performance. Consequently, affected jellyfish are unable to maintain their original position in the water column, descending or ascending depending on their density, and are passively advected by currents. Bottom and subsurface currents then transport the jellyfish away from the protected zone and beyond the effective range of the electromagnetic fields. Once they leave the field-influenced area, the jellyfish regain their natural pulsation rhythm with no observable physiological damage. This invention offers a non-invasive, reversible, energy-efficient method of managing the presence of jellyfish in ecologically and economically sensitive marine environments such as bathing waters, seawater intake systems, power plant cooling infrastructures, desalination facilities, and aquaculture environments. It does not rely on physical exclusion barriers, chemical treatments or lethal control strategies.

Keywords

Jellyfish, Clogging pipes, Electromagnetic fields, Modifying swimming patterns

Fishers' perceptions of jellyfish blooms and their economic impacts on fisheries in the Western Mediterranean Sea

Janire Salazar¹, Raquel Torres², Josep-Maria Gili¹, José Tena², Inmaculada Torres-Cano³, Ángel Pérez-Ruzafa³, Alfredo Fernández-Álias^{3,4}, Juan Antonio López-Jaime⁵, Tania Marín-Sánchez⁵, Juan Jesús Bellido-López⁵, Silvia Gómez⁶, Miroslav Pulgar⁶, Ainara Ballesteros²

¹ICM-CSIC- Institut de Ciències del Mar del Consejo Superior de Investigaciones Científicas, Barcelona, Spain. ²IMEDMAR-UCV-Institute of Environment and Marine Science Research, Universidad Católica de Valencia, Valencia, Spain. ³UMU-Universidad de Murcia, Murcia, Spain. ⁴University of Lille, Wimereux, France. ⁵FAMM-Fundación Aula del Mar Mediterráneo, Málaga, Spain. ⁶UAB-Universitat Autònoma de Barcelona, Bellaterra, Spain

Abstract

In recent decades, large proliferations of jellyfish have been reported in the northwestern Mediterranean Sea. It is widely acknowledged that these events may substantially disrupt fishing activities. However, to date, limited efforts have been made to systematically compile and compare this information across the region. To assess the economic implications of jellyfish blooms on fisheries in the NW Mediterranean, a structured survey was conducted among professional fishers operating from different harbours along the Spanish Mediterranean coast. The survey documented fishers' perceptions of jellyfish occurrence, evaluated the extent to which bloom events interfere with fishing operations, and assessed their interest in potential valorization options for jellyfish biomass. The survey was distributed and collected from at least 10 fishers in each region (Catalonia, Valencia Community, Region of Murcia, Andalusia, and the Balearic Islands). Responses revealed a widespread perception that jellyfish blooms have negatively affected fishing activities in recent decades. Fishers reported reduced catch efficiency, operational constraints, and increased effort during bloom periods. In addition to losses associated with diminished catches, respondents highlighted higher operational costs, including time devoted to the repair and cleaning of fishing gear damaged or clogged by jellyfish. Results also showed a high level of interest in valorization options such as collagen, suggesting that jellyfish blooms may represent not only a challenge for fisheries but also a promising opportunity for future blue biotechnology applications in the NW Mediterranean.

Keywords

Bloom impacts, Fishers, Scyphozoa, Blue technology

Blueprints in the biofilms? Identifying species-dependent biofilm architecture and its potential role in determining jellyfish planula settlement and metamorphosis

Isabelle E. Firth, Alex J. Dumbrell

University of Essex, Colchester, United Kingdom

Abstract

Many medusozoans exhibit polyphasic life histories, with planktonic planula larvae settling and metamorphosing into benthic polyps, a transition crucial for species persistence. Bacterial biofilms are recognised as biological drivers influencing this transition, through the emission of recruitment cues, therefore determining the ecological and spatial distribution of polyp populations which play a role in biofouling communities and jellyfish blooms. Previous studies examine the settlement response to natural or species-specific bacterial biofilms, however, the morphological characteristics, architecture and spatial patterning of biofilms, which may underpin localised recruitment cues remains unexplored. Here, we characterised the architectural development and spatial design of assembled bacterial biofilm assemblages, using isolates obtained from fouled marine substrata. Bacterial monocultures of *Alteromonas* sp., *Marinobacter* sp., *Maribacter* sp. and *Psychrobacter* sp. were assembled into all possible biofilm community permutations across diversity levels. Biofilms were visualised through confocal scanning laser microscopy, following fluorescent labelling of nucleic acids. Image acquisition revealed all biofilms were established after 24 hours of incubation, with species-specific structures suggesting unique biofilm development profiles. In multispecies assemblages, characteristic structures persisted in certain combinations, suggesting architectural dominance of specific bacteria. Although biofilm diversity levels did not influence overall morphological metrics, spatial analysis revealed clustered distribution patterns across all assemblages, with lower-diversity biofilms reflecting greater heterogeneity in clustering. These findings demonstrate biofilm architecture is shaped by bacterial composition and may differentially influence planulae settlement behaviours. These biofilms are now implemented in settlement experiments with moon jellyfish (*Aurelia* sp.) planula to investigate relationships between biofilm morphology and planula settlement and metamorphosis.

Keywords

Biofilm, Bacteria, Fluorescence, Settlement, Metamorphosis

Exploring regeneration capabilities within Scyphozoa (Cnidaria)

Marta Mammone^{1,2}, Victoria Sharp³, Travis Brandwood⁴, Monica Medina^{5,3}, Maria Pia Miglietta¹

¹Texas A&M University, Galveston, United States. ²University of Galway, Galway, Ireland.

³Pennsylvania State University, State College, United States. ⁴Jellyfish Compendium Project, Kannapolis, United States. ⁵University of California Los Angeles, Los Angeles, United States

Abstract

Cnidaria are early-branching metazoans with remarkable regeneration capabilities, which have been explored mostly in model organisms such as *Hydra*, *Hydractinia* (Class Hydrozoa), and *Nematostella* (Subphylum Anthozoa). Regeneration studies on the true jellyfish (Class Scyphozoa) have focused mainly on two taxa, *Aurelia* and *Cassiopea*, which show a wide range of whole-body and tissue regeneration. However, the extent to which regeneration is widespread among the Class is unknown. In this study, we explore and assess the regenerative capabilities of the polyp stage (i.e., benthic stage) of 19 scyphozoan species and one Class Cubozoa species by dissecting heads from stalks. After decapitation, stalks and heads were monitored for 22 days or until regeneration. Stalks were photographed and scored daily as: regenerated (head regrown from the stalk), no change (without signs of regeneration), or dying/dead (degrading tissue). Eighteen out of nineteen scyphozoan species and the cubozoan outgroup exhibited head regeneration. All 19 scyphozoan species showed capability to survive the decapitation with limited mortality. No dissected heads were able to regenerate their stalk however, in 17 out of 19 species, the heads reproduced asexually. We will use the data acquired through these experiments to score regenerative capabilities and map them onto the Scyphozoan phylogenetic tree to gain insight into the evolution of regeneration in this group.

Keywords

Jellyfish, Stolons, Budding, Polyps, Wound healing

Simulating climate change on the marine environment: The effects of higher water temperatures on the asexual reproduction of four scyphozoan species

Karina Lima Siqueira de Macedo, André C. Morandini, Mayara A. Jordano

University of São Paulo, São Paulo, Brazil

Abstract

Climate change is a relevant phenomenon due to its socioeconomic and environmental consequences. In this context, one of the most affected environments are the oceans. The phenomenon of blooms has become more widespread in recent years and may be correlated with changes in water temperature. Given the different forms of clonal reproduction of scyphozoan polyps, this life cycle stage is crucial for understanding the blooms. Therefore, this project aimed to verify and understand the possible correlation between temperature increase in the oceans and population variations of species of the class Scyphozoa, focusing on the polyp stage and its asexual reproduction by strobilation. To achieve this goal, four species were subjected to six different temperatures (simulating heatwaves), which increased gradually: *Aurelia coerulea*, *Chrysaora colorata*, *Lychnorhiza lucerna*, and *Nausithoe maculata*. The polyps were placed individually in 6-plate wells and separated in different incubators at a specific temperature. The temperatures were intermediates between the control (15°C for *A. coerulea* and *C. colorata* and 20°C for *L. lucerna* and *N. maculata*) and the highest temperature, ten degrees above the control. Each species contained six individuals for each of the six temperatures sampled, and the experiment lasted about three months. Data collection was performed every two days. The data collected were strobilation events in the different sample units and the number of ephyrae produced by each polyp. Trends toward lower strobilation rates at higher temperatures were observed, as well as a lower number of ephyra produced.

Keywords

Scyphozoa, Temperature, Climate change, Asexual reproduction

The evolution of gonads in coronate medusae (Scyphozoa, Cnidaria)

Gisele R. Tiseo^{1,2}, André C. Morandini²

¹Universidade Estadual Paulista “Julião de Mesquita Filho” - UNESP-FCAV, Jaboticabal, Brazil.

²Universidade de São Paulo, São Paulo, Brazil

Abstract

The first coronate jellyfish description appeared 237 years ago. Since that time, no study reviewed the sexual reproduction considering the different gonadal morphologies, reproductive strategies, types of life cycle and embryonic development. This paper summarizes the state of knowledge on coronates sexual reproduction based on original descriptions and literature data answering the question “Does the sexual reproduction features and reproductive strategies seen in coronatae medusae brings us insights to try to better understand the evolution of different lineages of the group?”. The majority of coronates seems to be gonochoric but the hermaphroditic and parthenogenic conditions are seen in Nausithoid family. The new histologic evidence described for *Nausithoe eumedusoides* corroborates the reduction of the male sex trend for Coronatae medusae. The holopelagic life cycle and the direct development can be recovered supporting the clade Atollidae (Paraphyllinidae, Periphyllidae). Likewise, the W-shaped gonads are exclusive of Paraphyllinidae, the J and U-shaped gonads and the presence of accessory cells are seen only in Periphyllidae. Our review provides a comparative evolutionary scenario about sexual reproduction in this group with the results indicating that closely related species share important and significant series of morphological reproductive characteristics.

Keywords

Reproduction, Gametogenesis, Jellyfish, Histology, TEM

Settlement and metamorphosis preference of planuloid buds of *Cassiopea andromeda* (Cnidaria, Scyphozoa) and a putative inhibitory effect from taurine

Tárik M. Rocha, André C. Morandini

Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil

Abstract

Asexually-produced swimming buds, planuloids, are a remarkable strategy throughout the life cycle of different jellyfish species. *Cassiopea andromeda* (Forskal, 1775) is an epibenthic medusa that inhabits shallow waters in tropical and subtropical areas and is considered an invasive species in Brazil. Understanding the life cycle of invasive species is fundamental for elucidating population dynamics and for developing effective control measures. Planuloid buds may represent a key point in the life cycle of these medusae, as they can define their potential for dispersal and invasion events. Settlement of planuloid buds is mediated by environmental cues, and although there is consistent literature addressing this process in planula larvae, information on planuloid buds remains limited. Our study aimed to evaluate the ability of natural and artificial substrates to induce settlement and metamorphosis, as well as the inhibitory effects of exogenous substances such as antibiotics and taurine, in planuloid buds of *C. andromeda* polyps collected from Cabo Frio, Rio de Janeiro (SE Brazil). The results showed that only natural substrates, such as *Rhizophora mangle* L. leaves and sand, were capable of inducing settlement and metamorphosis. The presence of antibiotics or taurine resulted in reduced settlement. These results, in addition to describing substrate preferences in *C. andromeda* planuloids, highlight a putative inhibitory effect mediated by taurine, which has only been reported for planula larvae of some cnidarian species. The similarity between the effects observed in planulae and planuloids suggests that some of the signaling mechanisms modulating settlement may be shared between these distinct life stages.

Keywords

Upside-down jellyfish, Substrate preference, Asexual reproduction, Taurine

Same place, same niche: A fine-scale analysis of *Cassiopea* coexistence

Ramón D. Morejón-Arrojo¹, Edgar Gamero-Mora², Marta Mammone³, Antonio C. Marques¹, André C. Morandini^{1,4}

¹Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil. ²Department of Biological Sciences, University of Texas at El Paso, Texas, United States. ³Centre for Chromosome Biology, School of Biological and Chemical Sciences, University of Galway, Galway, Ireland. ⁴Centro de Biologia Marinha (CEBIMar), Universidade de São Paulo, São Paulo, Brazil

Abstract

Elucidating mechanisms of coexistence among sympatric species is a central challenge in ecology. Upside-down jellyfish (*Cassiopea* spp.) provide a suitable model to test whether co-occurring species partition environmental niches in marine systems. Here, we examine global spatial distribution patterns and environmental niche segregation in *Cassiopea* to determine whether coexistence is mediated by differentiation along oceanographic gradients or fine-scale habitat partitioning. We compiled the first global, spatially explicit dataset for the genus, comprising 391 georeferenced records representing 10 *Cassiopea* species. Fine-scale spatial clustering (DBSCAN, 5 km resolution) was applied to distinguish true local sympatry from regional-scale co-occurrence. Environmental variables (temperature, salinity, nutrients, chlorophyll-a, dissolved oxygen) were extracted from Bio-ORACLE and analyzed using Principal Component Analysis. We identified 71 geographic clusters, of which 48% exhibited local-scale multispecies coexistence. Major coexistence hotspots occurred in the Caribbean (Florida Keys, Panama, Belize) and western Indo-Pacific (Palau, Philippines), with up to three species co-occurring. Only 36% of all records represented true sympatry, indicating that apparent large-scale co-occurrence often reflects spatially aggregated allopatric populations. Temperature and salinity accounted for 69.1% of the environmental variance, but no significant differences were detected between sympatric and allopatric populations. Environmental niche distances between co-occurring and non-co-occurring species pairs were statistically indistinguishable. These results suggest *Cassiopea* coexistence is not driven by differentiation along the analyzed oceanographic gradients. Alternative mechanisms, including fine-scale habitat partitioning, ecological plasticity, or historical biogeographic processes, likely contribute to coexistence patterns. Integrating meter-scale field surveys with molecular identification will be essential to resolve coexistence mechanisms in this widespread genus.

Keywords

Sympatry, Niche partitioning, Spatial ecology, Biogeography, Jellyfish, Literature synthesis

Differing methods of photoprotection against ultraviolet B radiation in *Catostylus mosaicus* (Rhizostomeae) and *Aurelia coerulea* (Semaestomeae)

Tanisha McBratney, Vincent Raoult, Steven Melvin, Kylie A. Pitt

Griffith University, Gold Coast, Australia

Abstract

Ultraviolet B radiation (UV-B) damages DNA and penetrates up to 30 meters into the water column in tropical and subtropical latitudes. Scyphozoan medusae are often exposed to high levels of UV-B, which can induce genomic instability, increase aerobic respiration, inhibit growth, and generally hinder survival. Medusae must have photoprotective mechanisms to avoid injury; however, these mechanisms are poorly understood. Some rhizostome jellyfishes produce a novel pigment protein (Rhizostomin) hypothesised to be photoprotective. In contrast, Semaestomeae jellyfishes have no known methods of photoprotection, but may use mycosporine-like amino acids (MAAs) acquired via their diet for photoprotection. To investigate the responses of jellyfish to environmentally relevant levels of UV-B, we exposed medusae of *Aurelia coerulea* (Semaestomeae) and *Catostylus mosaicus* (Rhizostomeae) to 0.52Wm⁻² of UV-B on a 12:12 light/dark cycle for 28 days. Average swimming depth, metabolomic profiles, and CuZn-SOD gene expression were measured to assess sub-lethal responses to UVB. Pigments were quantified using spectrophotometry, and qPCR and liquid chromatography-mass spectrometry were used to identify photoprotective pigments. This study underscores the diverse photoprotection strategies among jellyfish species and provides insight into the less-studied effects of UV-B radiation on jellyfish behaviour and physiology.

Keywords

Rhizostomin, Pigments, Experiment, Gene expression

The *Cassiopea* Conundrum: Protecting a newly identified species of *Cassiopea* from the introduced *Cassiopea xamachana* in the Ningaloo Coast, World Heritage Area, Western Australia

Kylie A. Pitt¹, Jessica Strickland-Coe¹, Zoe Richards², Joseph DiBattista¹, Vincent Raoult¹, Emily Bourke¹

¹Griffith University, Gold Coast, Australia. ²Curtin University, Perth, Australia

Abstract

The remote Ningaloo (Nyinggulu) Coast in Western Australia is renowned for its rich biodiversity, unique habitats and pristine natural beauty. This region was designated a World Heritage Area in 2011 and remains largely free from invasive species. In 2023, we discovered two species of *Cassiopea* co-occurring in Mandu Lagoon, a small, shallow coastal lagoon that is isolated from the ocean by a natural rocky berm. Phylogenetic analyses confirmed that one species is undescribed (*Cassiopea* sp. nov.) and possibly endemic to the region, and that the second species is *Cassiopea xamachana*, a native species in the Atlantic Ocean that is now widespread in the Pacific Ocean and often referred to as invasive. Surveys in Mandu Lagoon indicate a decline in the abundance of mature *Cassiopea* sp. nov. concurrent with an increase in mature *Cassiopea xamachana*. The presence and abundance of polyps of both species have not been determined. To prevent the non-native *Cassiopea xamachana* from potentially contributing to the extirpation of *Cassiopea* sp. nov., we are working with Traditional Owners and resource managers to manually remove *C. xamachana* from Mandu Lagoon. In addition, we are developing eDNA assays to detect both species. We will use these eDNA assays, in combination with visual surveys, to assess the broader distributions of both species within the Ningaloo Coast World Heritage Area and Exmouth Gulf. To our knowledge, this is the first intervention undertaken to conserve a jellyfish.

Keywords

Introduced species, Competition, Coastal lagoon, Conservation

Climate-driven spread of the upside-down jellyfish *Cassiopea andromeda* in a Mediterranean MPA

Andrea Toso^{1,2,3}, Francesca Necci^{1,2}, Antonella Leone⁴, Lara M. Fumarola^{3,5}, Stefano Piraino^{1,3,2}

¹Department of Biological and Environmental Sciences and Technologies (DiSTeBA), Lecce, Italy. ²National Biodiversity Future Center (NBFC), Palermo, Italy. ³Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa), Rome, Italy. ⁴Consiglio Nazionale delle Ricerche, Istituto di Scienze delle Produzioni Alimentari, (CNR-ISPA, Lecce, Italy. ⁵University of Salento, Lecce, Italy

Abstract

In October 2025, the first occurrence of *C. andromeda* was recorded in a semi-enclosed basin within the Marine Protected Area of Porto Cesareo (Italy). representing the northernmost record of the species in the Mediterranean basin to date. The population was monitored from October to December 2025 to assess density, size structure, and environmental conditions. Two sampling methodologies were compared: (i) an invasive approach based on the complete removal of individuals within fixed quadrats for measurements of bell diameter, and (ii) a non-invasive photographic survey using 50 × 50 cm quadrats, validated through specimen removal (i). Environmental parameters, including seawater temperature, salinity, dissolved oxygen and chlorophyll-a, were measured during the survey. In addition, the abundance of zooxanthellae in jellyfish tissues was quantified across different size classes. Mean jellyfish density in October was 108.8 ± 106.7 ind m⁻² (mean $\pm$ SD; n = 41). Individuals ranged from 0.5 to 20 cm in bell diameter (mean 2.82 ± 0.34 cm). Seawater temperature ranged from 17 to 21 °C (mean 19.9 ± 1.7 °C), salinity averaged 33.4 ± 1.2 psu, and dissolved oxygen 7.5 ± 1.3 mg L⁻¹ and chlorophyll-a 4.5 ± 2.3 µg L⁻¹. No statistically significant differences were detected between the two methods. Photographic sampling proved more efficient, allowing wider spatial coverage with reduced effort and minimal disturbance. Zooxanthellae abundance in jellyfish tissues decreased with increasing bell diameter. These results highlight the suitability of shallow, confined Mediterranean habitats for the establishment of *Cassiopea* and emphasize the importance of early detection and efficient monitoring strategies under ongoing climate warming.

Keywords

Invasive species, Non-indigenous species

Jelly Go-oN s.r.l. advancing sustainable jellyfish research for novel food and blue biotechnology applications

Andrea Toso¹, Stefano Piraino¹, Antonella Leone²

¹Department of Biological and Environmental Sciences and Technologies (DiSTeBA),, Lecce, Italy. ²Consiglio Nazionale delle Ricerche, Istituto di Scienze delle Produzioni Alimentari, (CNR-ISPA), Lecce, Italy

Abstract

Within the framework of the national project National Biodiversity Future Center, funded by PNRR resources, it was possible to take part in a six-month Upskilling training course, which enabled the development of an innovative idea aimed at establishing an innovative start-up entirely focused on jellyfish and sustainability, supported by € 60,000 in funding. Accordingly, in November 2025, Jelly Go-oN s.r.l. was founded as an innovative start-up, originating from the European project GoJelly, promoted by the National Research Council (Lecce) and the University of Salento. Jelly Go-oN aims to consolidate and further develop research on *Rhizostoma pulmo*, with the goal of proposing it as a novel food at the European level. In parallel, the company will focus on *Cassiopea andromeda*, investigating the species both in the wild and under controlled laboratory conditions. Field activities will be aimed at assessing the environmental and ecological drivers that support its proliferation in confined Mediterranean habitats, including key. Laboratory activities will be designed to reproduce the physico-chemical conditions observed in nature, to optimize cultivation protocols and ensure reproducibility of growth performance and biomass quality. In addition, Jelly Go-oN will investigate the full range of bioactive compounds and biochemical traits associated with this species, with the objective of identifying potential applications in the food, feed, nutraceutical, and cosmetic sectors. This is the first attempt at a fully integrated production system with environmental impact assessment. Continuous monitoring of environmental and technological parameters, including through digital systems, will create a pilot technosystem, paving the way for future scalable applications.

Keywords

Novel food, Bioactive compounds, Non-indigenous species

Non-native *Cassiopea andromeda* (Forsskål, 1775) as a bioreactor in the sustainable production of blue products

Antonella Leone^{1,2,3}, Andrea Toso^{4,2}

¹Consiglio Nazionale delle Ricerche (CNR-ISPA), Lecce, Italy. ²Consorzio Nazionale Universitario per le Scienze del Mare (CoNISMa), Rome, Italy. ³National Biodiversity Future Center (NBFC), Palermo, Italy. ⁴Department of Biological and Environmental Sciences and Technologies (DiSTeBA), University of Salento, Lecce, Italy

Abstract

Cassiopeia andromeda, a zooxanthellate jellyfish, was among the first marine species to migrate through the Suez Canal over a century ago and establish itself in the Mediterranean Sea. After a few sporadic records, *C. andromeda* now appears to be widely distributed across the southern Mediterranean. *C. andromeda* hosts zooxanthellae, forming a semi-autotrophic holobiont that is a rich source of valuable bioactive compounds, including fatty acids, primarily polyunsaturated fatty acids (PUFAs) such as DHA, EPA, antioxidant pigments produced by its photosynthetic dinoflagellate symbionts, photoprotective molecules, peptides, and other compounds of interest for bioprospecting. Although it can be cultured with relative ease, indoor farming requires complex and energy-intensive infrastructure. By contrast, natural populations in Italy are flourishing, resilient, and capable of producing and accumulating biocompounds. Under these optimal environmental conditions, *C. andromeda* populations can yield substantial biomass. Nearly 40-50% of the dry biomass of *Cassiopea andromeda* consists of compounds that can be extracted using green solvents, including a high quantity and diversity of antioxidant molecules. Moreover, some compounds isolated from *C. andromeda* extracts have shown promising biological activity and cytotoxicity pattern in Caco2 cell culture assays, highlighting the potential of this species as a source of nutraceutical ingredients. We are currently monitoring the physicochemical parameters and compositional features of natural *C. andromeda* populations in Italy to evaluate the feasibility of establishing nearshore jellyfish aquaculture. The biomass shows strong potential as a sustainable source of bioactive compounds for nutraceutical, pharmaceutical, and/or cosmeceutical applications within a circular-economy framework.

Keywords

Alien species, Jellyfish extracts, Zooxanthellae, Cytotoxicity, Antioxidant activity, CaCo2

Investigating the nature and composition of egested material produced by gelatinous zooplankton using *Aurelia aurita* as a model organism

Maximilian Claus¹, Cathy H. Lucas¹, Sari Giering², Chelsey Baker²

¹University of Southampton, Southampton, United Kingdom. ²National Oceanography Centre, Southampton, United Kingdom

Abstract

The biological carbon pump (BCP) is an important contributor to the regulation of our climate, exporting between 5 and 16 Gt carbon from the surface to the deep ocean per year. Without the BCP, atmospheric CO₂ concentrations would be 140-200 ppm higher. Gelatinous zooplankton may be responsible for 2.5-42% of the BCP's carbon export, based on the findings of a recent carbon cycle model. The global distribution of *Aurelia* spp. and the high recorded densities of *Aurelia aurita* suggest that this model species may be of global importance in carbon export, primarily via the release of mucus. However, direct metabolic and egestion rate measurements of gelatinous zooplankton are rare, leading to large uncertainties in current estimates. Here we aim to improve the present understanding of the role of gelatinous zooplankton – and cnidarians in particular – in carbon export by quantifying the capacity of model species *A. aurita* for carbon transport via egestion and the production of mucus. We will measure the egestion and mucus release rate, obtain a sinking rate for egesta and mucus, and characterise all egested material. By determining this species' mucus composition, we will evaluate its effectiveness as an aggregator of particulate organic carbon. These results would provide foundational information on the role of cnidarians in the BCP, which would be particularly valuable in light of the pelagic cnidarian tendency to form blooms and the possible growth of their populations under climate change conditions.

Keywords

Biological carbon pump, DOC, POC, Jellyfish, Mucus, Egestion, Gelatinous zooplankton, Metabolic rates

An introduction of a seedling factory on *Rhopilema esculentum* in China

Daoping Li¹, Song Feng²

¹Sheyang Shenghai jellyfish seedling company, Sheyang, China. ²Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China

Abstract

Rhopilema esculentum is one of the most important fishery resources in China. Huge number of *R. esculentum* young medusae were artificially released in some coastal waters of China. They also were bought in abundance to culture in many coastal ponds by farmers every year. Here, a famous breeding factory on *R. esculentum* named "Sheyang Shenghai jellyfish seedling company" were introduced, which is the largest and most capable *R. esculentum* seedling enterprise in China. The company has a 10,000-square-meter factory-style seedling workshop and 270 mu of natural feed (rotifers) cultivation ponds. The annual production capacity is 100,000 polyp settlement plates, 600 million *R. esculentum* young medusae, and 500 million shrimp larvae. The *R. esculentum* seedlings under the trademark "Jiangshuhong" are popular in the coastal areas of Jiangsu, Shandong, Zhejiang, Fujian, Guangdong, Guangxi and other parts of the country, and are also exported to the coastal areas of Vietnam. The "Jiangshuhong" *R. esculentum* produced by the company is a unique variety along the coast of Jiangsu Province. It has a bright red color and high nutritional value. This variety is mainly produced in the near sea and is an important species for autumn fishing by fishermen. All the parents used in the company's seedling production are sourced from marine fishing, ensuring pure quality. The young medusae produced have a high survival rate and fast growth rate. The polyps could be preserved at low temperatures for a long time. Therefore, the company has received high praise from the industry.

Keywords

Rhopilema esculentum, Medusae, Polyps, Shenghai seedling, Jiangshuhong

Floating primary polyps of *Nemopilema nomurai* on detritus: effects of abiotic factors on their resettlement and subsequent growth

Song Feng¹, Xueting Xu¹, Shiyu Mo¹, Yaran Xu¹, Jianing Lin², Song Sun¹

¹Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China. ²Shandong University, Qingdao, China

Abstract

Studies on the formation process and physio-ecological characteristics of primary polyps would help understand the causes of giant jellyfish *Nemopilema nomurai* blooms in the coastal sea of East Asia. A new mode of settlement and metamorphosis from planulae into primary polyps was observed in this study by artificially breeding *N. nomurai* polyps in a large tank. *N. nomurai* planulae could successfully metamorphose into primary polyps with ≤ 4 tentacles in the seawater, even though they did not initially colonize the hard substrates as previously reported. The developed primary polyps were then able to hang upside down on detritus via the mucus secreted by planulae and float on the seawater surface. Their resettlement on the large, hard substrates showed significant preference to plastic materials (e.g., polyethylene plates); however, the resettlement density was significantly reduced owing to the increase of age. The resettlement of primary polyps was also affected by the combination of salinity and age. The survival of primary polyps increased, but their resettlement percentage significantly decreased at hyposalinity of 10–23 and older age. This study also found that primary polyps on the detritus could normally develop into individuals with 16 tentacles. There was no significant difference in their survival, development of 14–16 tentacles, and calyx growth at salinities of 15–33, indicating their euryhalinity adaptability. This study suggested that floating in the seawater by attaching to detritus was a possible living mode of *N. nomurai* polyps inhabiting the estuaries surroundings, which may favor polyp population recruitment and maintenance.

Keywords

Primary polyps, *Nemopilema nomurai*, Planulae, Detritus, Resettlement

Thermal stress and jellyfish proliferation: Do all species respond the same way?

Jimena Garcia-Rodriguez^{1,2}, Kei Chloe Tan¹, Chanikarn Yongstar¹, Adrian Jaimes-Becerra¹, Miguel Candelas³, Agustin Camacho⁴, Eva S. Fonfría⁵, Allen C. Collins⁶, Antonio C. Marques⁷, Cheryl Lewis Ames^{1,2}

¹Tohoku University, Sendai, Japan. ²WPI-AIMEC, Sendai, Japan. ³Avanqua Oceanogràfic SL, Ciudad de las Artes y las Ciencias, Valencia, Spain. ⁴University Autonoma, Madrid, Spain. ⁵University of Alicante, Alicante, Spain. ⁶Smithsonian Institution, Washington DC, United States. ⁷University of Sao Paulo, Sao Paulo, Brazil

Abstract

More than a dozen jellyfish species are known to produce large-scale blooms, and each species has a unique life cycle involving both sexual (medusa) and asexual (polyp) phases. Importantly, the occurrence of medusa-stage blooms is dependent on the successful survival and transition of ephyrae —juvenile jellyfish—from the benthic polyp stage, which reproduces asexually (strobilation in Scyphozoa; metamorphosis in Cubozoa). Jellyfish blooms are increasingly reported in coastal waters worldwide, raising ecological and economic concerns, particularly for fisheries and coastal industries. Despite public fears and media reports suggesting a global takeover by jellyfish, current scientific data remain insufficient to confirm whether blooms are truly increasing at global or even local scales. To better understand the drivers of bloom formation, it is essential to investigate how environmental factors affect polyp survival and strobilation/metamorphosis success across species. This study aims to explore whether warmer water temperatures promote jellyfish proliferation similarly across multiple species with different geographic and ecological backgrounds.

Keywords

Jellyfish bloom, Asexual reproduction, Polyp, Scyphozoa, Cubozoa

Climate change alters biogeochemical and microbial dynamics during jellyfish decomposition in a warm ultra-oligotrophic sea

Tamar Guy-Haim^{1,2}, Eyal Rahav^{1,2}, Guy Sisma-Ventura¹, Ximena Velasquez¹, Arseniy R. Morov^{1,3}, Maxim Rubin-Blum^{1,4}

¹Israel Oceanographic and Limnological Research, Haifa, Israel. ²Ben-Gurion University, Beer Sheva, Israel. ³Memorial University of Newfoundland, St. John's, Canada. ⁴University of Haifa, Haifa, Israel

Abstract

In the rapidly warming ultra-oligotrophic Levantine Sea, the invasive scyphozoan *Rhopilema nomadica* forms massive seasonal blooms whose collapse generates substantial necromass. Here, we used large-scale flow-through outdoor mesocosms to examine (1) the thermal dependency of jellyfish biomass decay in shallow coastal waters and (2) the ecosystem-level biogeochemical and microbial responses to jellyfish decomposition under present-day and future warming conditions. Whole dead *R. nomadica* individuals were incubated at realistic densities across a natural temperature gradient (19–31°C). Jellyfish biomass decay was strongly temperature-dependent, decreasing from six days at 19°C to 36h at ≥25°C. Jellyfish decomposition caused rapid oxygen depletion and a pronounced drop in pH during the first 24h, followed by elevated oxygen and pH relative to controls, indicating a transient fertilization effect. Ammonium and phosphate concentrations peaked sharply within the first 24h in jellyfish treatments, while experimental warming reduced overall nutrient release. Jellyfish necromass stimulated heterotrophic bacterial abundance and production, followed by declining microbial α -diversity and a rapid shift toward Alpha- and Gammaproteobacteria, including carbon degradation associated taxa. After 40h, heterotrophic bacterial activity declined, coinciding with increases in eukaryotic algae, chlorophyll, and primary production. After six days, microbial communities converged toward ambient conditions. Overall, jellyfish decomposition induces short-lived hypoxia and acidification, rapid nutrient release, and pronounced microbial succession, reinforcing heterotrophic pathways before fueling autotrophic growth. As climate warming accelerates jellyfish decay rates, jellyfish necromass is likely to become an increasingly important driver of coastal biogeochemical cycling and microbial dynamics in the Levantine Sea and other oligotrophic regions.

Keywords

Post-bloom dynamics, Necromass, Decomposition, Nutrient cycling, Microbial productivity and diversity

Bioassay-guided isolation of a multi-toxin cardiorespiratory lethal fraction from giant jellyfish *Nemopilema nomurai*: A zebrafish model study

Ramachandran Loganathan Mohan Prakash, Du Hyeon Hwang, Ravi Deva Asirvatham, Il-Hwa Hong, Changkeun Kang, Euikyung Kim

Laboratory of Toxicology and Pharmacology, School of Veterinary Medicine, Gyeongsang National University, Jinju, 52828, Republic of Korea

Abstract

Nemopilema nomurai envenomations cause severe cardiorespiratory complications in thousands of victims annually along East Asian coasts, yet the molecular toxin components remain poorly characterized. We employed bioassay-guided sequential chromatography to isolate and identify the lethal cardiotoxic fraction. Crude venom underwent DEAE Sepharose ion exchange chromatography followed by Superdex-200 FPLC. Toxicity screening utilized H9c2 cardiomyocytes and adult zebrafish bioassays evaluating survival, swimming behavior, hemorrhage, and histopathology. The toxic fraction was analyzed by LC-MS/MS. Sequential purification yielded Peak 4 (NnTP: *N. nomurai* toxic peak) as the principal lethal component, showing 30.89% H9c2 viability (10 µg/mL). In zebrafish, NnTP (100 µg/g) induced 60% mortality, severely impaired swimming (score: 1.2 vs. 4.4 control), and extensive cardiorespiratory hemorrhage. Histopathology revealed severe lesions (3+) in heart, gills, and brain. LC-MS/MS identified 23 toxin homologs: metalloproteinases (24%), neurotoxins (14%), ion channel toxins (14%), and hemorrhagic factors (14%). Gelatinase assays confirmed metalloproteinase-mediated hemorrhage, while potassium channel toxins contributed to neurological impairment. *N. nomurai* cardiorespiratory toxicity results from synergistic action of multiple toxin classes. These findings provide molecular targets for antivenom development and establish a zebrafish-based framework for cnidarian toxin discovery.

Keywords

Giant jellyfish, Cardiotoxin, Proteomic profiling, Zebrafish toxicology, Metalloproteinases

Jellyfish-associated microbiomes differ from seawater communities

Xiao Ma, Chaolun Li

State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology,
Chinese Academy of Sciences, Guangzhou, China

Abstract

Jellyfish blooms provide extensive biological surfaces that can harbor distinct microbial assemblages, yet the degree of separation between tissue-associated microbes and surrounding seawater bacteria remains insufficiently characterized across regions and body parts. Here, we investigated bloom events in two coastal regions (Yantai and Qinhuangdao) by sampling jellyfish umbrella and oral arms together with adjacent seawater. Seawater microbes were size-fractionated into free-living (0.2–3 μm) and particle-attached (>3 μm) fractions, and bacterial communities were profiled using 16S rRNA amplicon sequencing. Across both regions, bacterial community composition differed markedly between jellyfish tissues and seawater, indicating strong habitat filtering on jellyfish surfaces relative to the ambient microbial pool. Tissue-associated communities generally exhibited lower diversity and were dominated by a limited set of taxa, whereas seawater communities were more diverse and compositionally distinct. Moreover, tissue microbiomes showed clear body-part and site specificity: in Yantai, jellyfish-associated bacteria were characterized by enrichment of Vibrionaceae and Mycoplasmataceae, while in Qinhuangdao umbrellas contained higher contributions from *Vibrio* and Endozoicomonadaceae and oral arms were dominated by Bacillota-related lineages. These results demonstrate pronounced differentiation between jellyfish-associated and planktonic bacterial communities.

Keywords

Jellyfish microbiome, Particle-attached bacteria, Free-living bacteria, Bloom ecology

Estimation of the number of days required for the strobilation switch to be activated by low temperature in the giant jellyfish *Nemopilema nomurai*

Toyokawa Masaya¹, Ikeda Shuhei²

¹Japan Fisheries Research and Education Agency, Niigata, Japan. ²Tsuruoka City Kamo Aquarium, Tsuruoka, Japan

Abstract

The Nomura's jellyfish (*Nemopilema nomurai*, Kishinouye) is primarily distributed along the coast of China from the Yellow Sea to the northern East China Sea, where it is targeted for fishery. Some individuals are transported by ocean currents to the coasts of South Korea and Japan, but in some years, large numbers are swept out, causing significant damage to coastal fisheries in both countries. For this phenomenon to occur, two conditions must coincide: high production number along the Chinese coast and the emergence of physical conditions conducive to the mass outflow of individuals from the Chinese coast. However, the spatiotemporal distribution of the species prior to the fishery season across the vast Chinese waters remains unknown. The production of medusae in the class Scyphozoa is highly dependent on water temperature. If the timing of production can be estimated using water temperature distributions, combined with physical conditions, it may contribute to predict the volume of outflow. To estimate how many days of low-temperature exposure are required for the Nomura's jellyfish polyps to initiate metamorphosis, we first experimentally determined how many days after the metamorphosis switch is activated morphological changes appear and ephyra are released. Next, we investigated the number of days required for morphological changes to appear under low-temperature conditions. From chemical induction until visible morphological change, it took 21 to 31 days at 6°C and 2 to 3 days at 22°C. The number of days required to initiate metamorphosis required fewer days at lower temperatures.

Keywords

Chemical induction, Life cycle, Metamorphosis, Polyp, Timer hypothesis

Life-history strategy of the edible jellyfish *Lobonemoides robustus* under strong salinity fluctuations in tropical estuaries

Takeru Sugaya¹, Hiroshi Miyake¹, Satsuki Takauchi¹, Mai Watabe², Aya Adachi², Tadao Sakiyama², Aileen Tan Shau Hwai³, Sim Yee Kwang³, Muhammad Lutfi Haron³, Vivian Cavan Jia Wen Lee⁴, Ellycia Maimunah Lasarus⁴, Khwanruan Srinui⁵, Supattra Taleb⁵, Nattawut Luangoon⁵

¹School of Marine Biosciences, Kitasato University, Sagamihara, Kanagawa, Japan. ²Enoshima Aquarium, Fujisawa, Kanagawa, Japan. ³Centre for Marine and Coastal Studies, Universiti Sains Malaysia, Penang, Malaysia. ⁴Singapore Oceanarium, Sentosa Island, Singapore.

⁵Institute of Marine Science, Burapha University, Chon Buri, Thailand

Abstract

Edible jellyfishes support important coastal fisheries in Southeast Asia, yet basic information on their life cycles remains limited, constraining science-based resource management. The life history of the highly harvested rhizostome *Lobonemoides robustus* was investigated by conducting salinity-manipulation rearing experiments across key developmental stages. Mature medusae were collected from Penang, Malaysia and Cha-am, Thailand. No brood pouches were observed around oral arms of the mature medusae, and planulae appeared in holding tanks of mature medusae on the morning after collection. This suggested that fertilization occurs externally in this species. Planulae showed the highest settlement at salinity 22.5 (80% within 48–72h), whereas settlement was markedly reduced at salinity 30. Many planulae completed settlement and metamorphosis into polyps within 24h under salinities ranging at 10–30, indicating rapid settlement as an adaptive strategy for unstable estuarine conditions. Polyp proliferated and formed colony best at salinities 15–20, producing both lateral budding and stolonal budding. Notably, podocyst formation, that is common in many rhizostomes, was never observed even under multiple stressors, implying reliance on budding for rapid population increase. Because podocyst-based proliferation is generally slower, budding-only reproduction may be advantageous in highly variable estuaries. Ephyrae exhibited a contrasting salinity niche: survival and feeding required higher salinities 20–30, with maximum growth and feeding at salinity 25. Based on these findings, a stage-specific habitat shift is suggested in which low-salinity estuaries favor settlement and polyp amplification, whereas higher-salinity waters support ephyra growth and subsequent medusa recruitment, consistent with synchronization to monsoon-driven salinity cycles.

Keywords

Lobonemoides robustus, Life history strategy, Salinity tolerance, Stage-specific habitat shift, Estuarine adaptation

The moon jellyfish *Aurelia aurita* as a model species in ecotoxicology: defining toxicity in unstable conditions

Jack E. Rajack, Cathy H. Lucas, Nic Bury

University of Southampton, Southampton, United Kingdom

Abstract

Anthropogenic contamination is a significant concern in both freshwater and marine systems due to an ever expanding range of contaminant inputs, including pharmaceuticals, personal care products, petroleum derived chemicals and heavy metal contamination among other sources. Model species are often selected and used as reference points to define the potential consequences of contamination on the organisms present in these systems, as well as providing a framework by which to compare the impacts of different sources of contamination. There are relatively few marine model species which have been developed, particularly in temperate marine environments. Due to its benthic-pelagic life history, and tolerance to a range of temperature and salinity conditions in a variety of habitats, the moon jellyfish *Aurelia aurita* represents a strong potential focal point for ecotoxicological research. Such focus is supported by initial success in model development with several behavioural, lethal and molecular endpoints already established. The current study expands on this research to build *A. aurita* into a more developed model species by applying an energy budget model alongside a wider range of molecular endpoints, using a variety of life stages to facilitate the assessment of contaminants in both benthic and pelagic habitats creating a model which can be used to assess both independent and synergistic stressors using a wide range of metrics, increasing both the current viability and future scope for the use of *A. aurita* as a model species in ecotoxicology.

Keywords

Ecotoxicology, Contaminants, Model systems, Physiology, Synergistic stressors

An unexpected morphotype of *Chrysaora hysoscella* in the Gulf of Trieste (North Adriatic Sea)

Gregorio Motta¹, Chiara Manfrin¹, Alberto Pallavicini¹, Tjaša Kogovšek², Manja Rogelja³,
Valentina Tirelli⁴, Massimo Avian¹

¹Department of Life Sciences, University of Trieste, Trieste, Italy. ²Center for Marine Research, Ruder Boskovich Institute, Rovinji, Rovinj, Croatia. ³University of Primorska, Aquarium Piran, Piran, Slovenia. ⁴National Institute of Oceanography and Applied Geophysics, Trieste, Trieste, Italy

Abstract

The genus *Chrysaora* (Semaestomeae: Pelagiidae) comprises 16 species distributed worldwide, yet its taxonomy remains under continuous revision. *Chrysaora hysoscella* (the compass jellyfish) is common in the Mediterranean Sea, including the Adriatic Sea. In the Gulf of Trieste, its presence has been documented since 1874, with an increase in abundance and frequency reported since the 1980s. In 2025, several “unusual” *Chrysaora*-like jellyfish were observed in the Gulf of Trieste, with reports from both the Italian and Slovenian coasts. All individuals displayed striking morphological traits, in particular extremely elongated oral arms measuring 2 to more than 3 m, far exceeding those typically described for *C. hysoscella*. In contrast, the umbrellas, which showed different pigmentations, ranging from traditional compass patterns to whitish or pale coloration, were relatively small (≤ 20 cm in diameter), resulting in a marked disproportion between umbrella size and oral arm length. To determine whether these specimens represent a novel morphotype of *C. hysoscella* or an undescribed species, molecular analyses were conducted. DNA was extracted from umbrella margins, oral arms, and gonadal tissues, and a fragment of the mitochondrial Cytochrome Oxidase I (COI) gene was amplified following Folmer et al. (1993). Molecular identification confirmed all individuals as *Chrysaora hysoscella*, with the highest BLASTn similarity to specimens from Cork (Ireland). These findings suggest that the observed morphological divergence likely reflects a high degree of phenotypic plasticity within *C. hysoscella*. To further assess intraspecific variability and regional patterns, genetic analyses are currently being expanded with additional samples from across the Mediterranean basin.

Keywords

Cnidaria, *Chrysaora hysoscella*, Morphotype

PEER: Publishing for an ethical and equitable environment in research

Michael N. Dawson

University of California, Merced, United States

Abstract

Current changes in scientific publishing are among the most radical in >350 years and the range of publishing options expanding. Publisher-owned journals often dominate and increasing Article Processing Charges and surging Open Access threaten to leave authors and institutions with few affordable options. These changes increase inequity – among more- versus less-wealthy researchers, institutions, and countries; they also particularly penalize early career researchers who are more dependent on high profile – typically more expensive – journals for establishing careers. PEEER’s mission is to foster a culture in which authors, editors, and reviewers choose publication venues that support affordable and equitable access plus a healthy scientific and research community. Our goal is to channel the community’s shared frustrations with the current predominantly for-profit scientific publishing ecosystem, into joint action, to move the community toward a more affordable, equitable, and inclusive publishing ecosystem.

Keywords

Open access, Open science, Scientific publishing, Research

Symbioses in 3D: diversity and dynamics in pelagic symbioses across the tree of life

Michael N. Dawson

University of California, Merced, United States

Abstract

The coastal and open oceans present numerous physiological and biological challenges to which animals exhibit various adaptations. These adaptations give pelagic fauna powerful ecosystem roles as predators and prey, capable of altering ecosystem structures. For some animals, symbiosis is a crucial adaptation to occupying this niche, with various biological implications including nutrition, communication, and development. However, much is still unknown about the role of symbiosis in the evolution, ecology, and biology of pelagic animals. Our international collaboration studied four major lineages of pelagic animals (pyrosomes, medusozoans, ctenophores, acoels) and their symbionts (proteobacteria, zooxanthellae, flagellates, green algae). The goal was to generate high-quality chromosome-scale reference genomes for up to 50 gelatinous zooplankton and their metazoan symbionts, and microbial cobiotes. Such data can reveal the eco-evolutionary assembly and disassembly of host-specific symbioses from a diverse pool of pelagic microbes, specificity and plasticity to changing environments, how symbioses influence ecosystem dynamics, and how these organisms inform evolution and development of metazoans, including bilaterians and vertebrates. Consequently, they can accelerate understanding of contemporary ecological phenomena and dynamics.

Keywords

Behavior, Ecology, Evolution, Genomics, Symbiosis

Microfibres in jellyfish: low retention but species-dependent risk

María Cañadilla¹, Paula Poveda¹, Eva S. Fonfría², John Yañez Dobson², Miguel Candelas³, Cesar Bordehore⁴

¹Dpt. Ecology, University of Alicante, Alicante, Spain. ²IMEM Ramón Margalef, University of Alicante, Alicante, Spain. ³Dpt. Biology, Avanqua Oceanogràfic SL, Valencia, Spain. ⁴Dpt. Ecology & IMEM Ramón Margalef, University of Alicante, Alicante, Spain

Abstract

Microfibres are ubiquitous emerging pollutants in marine environments. Those made of polyester and cellulosic materials are currently the most abundant and widely distributed. Despite their distinct chemical nature (plastic versus natural), both types can adsorb contaminants harmful to humans, such as heavy metals, polychlorinated biphenyls, and hydrocarbons. Jellyfish, on the other hand, play a pivotal role in marine trophic webs, serving as prey for fish, turtles, seabirds, other cnidarian, and even humans. Used as food for centuries in Asian countries, their consumption is increasingly expanding into Western markets. To evaluate whether jellyfish may act as vectors for the trophic transfer of microfibres, we investigated in aquaria the palatability and retention time of polyester and cotton fibres, both virgin and diesel-contaminated (simulating an accidental oil spill), in the scyphozoan species *Rhopilema esculentum* (edible) and *Aurelia solida* (potentially edible). The results obtained indicate that, although palatability did not differ significantly among fibre types or treatments in either species, *A. solida* retained fibres for a significantly longer time than *R. esculentum*. *A. solida* also significantly discriminate between composition (cotton vs polyester) in virgin fibres, retaining the latter for a longer duration. Diesel contamination, however, had no remarkable effects in any case. Overall, the temporal availability of the retained fibres to predators appears to be low; however, it largely depends on the species and composition. Further studies on different jellyfish species intended for human consumption are recommended to adequately assess potential food safety risks.

Keywords

Microfibres, Polyester, Microplastic, Edible jellyfish, Cnidarian, Food chain, Diesel, Trophic web

Choice of eDNA sampling matrix shapes biodiversity detection

Cesar Bordehore¹, Sofia Duarte², John Yañez Dobson³, Noemí M. Guzmán⁴, Susana Benlloch⁴, Laura Matarredona⁴, Jesús García-Martínez⁴, Aida Mora⁵, Rafael Company⁵, [Eva S. Fonfría](#)³

¹Dpt. Ecology & IMEM Ramón Margalef, University of Alicante, Alicante, Spain. ²Centre of Molecular and Environmental Biology (CBMA) and Aquatic research Network (ARNET) & Institute of Science and Innovation for Bio-Sustainability (IB-S), University of Minho, Braga, Portugal. ³IMEM Ramón Margalef, University of Alicante, Alicante, Spain. ⁴Dpt. Physiology, Genetics and Microbiology, University of Alicante, Alicante, Spain. ⁵Fundación Valencia Port, Valencia, Spain

Abstract

Over the past few years, eDNA metabarcoding, a molecular technique that combines amplicon barcoding with high-throughput sequencing, has been increasingly applied for the detection and monitoring of multiple taxa in marine environments. However, to reduce costs and minimize processing time, sampling and analysis are often limited to seawater. This study aimed to assess whether reliance on this single sampling matrix is sufficient to detect fouling organisms, including cnidarians belonging to different classes (e.g. Staurozoa, Hydrozoa, etc.). To address this question, we collected surface seawater and conducted scrape sampling at different depths (1 m, 3 m, and 7 m) on existing hard substrates (pillars, walls, and breakwaters) in the Port of Sagunto. Sampling was carried out in collaboration with the Port Authority of Valencia within the framework of the Horizon 2020 ILIAD project. Genomic DNA was extracted from both matrices using Qiagen DNeasy kits (Blood & Tissue kit and PowerSoil Pro kit, respectively) and species identification was performed using the mitochondrial cytochrome c oxidase subunit I (COI) gene as the molecular marker. Although dozens of species from different phyla were detected at each site and in each matrix, results showed that fewer than 15% of the species identified in scrape samples were also detected in the seawater samples collected at the same locations. Based on these findings, we recommend the combined use of benthic and pelagic sampling matrices in marine monitoring surveys to achieve a more comprehensive assessment of the organisms present.

Keywords

eDNA, Metabarcoding, COI, Cnidarian, Matrix, Port monitoring, Fouling organisms, Hydrozoa

It's all about the polyps: insights into the proliferation of the rhizostome *Rhopilema nomadica* in the Mediterranean

Zafirir Kuplik¹, Hila Dror^{1,2}, Karin Tamar¹, Alan Sutton³, James Lusana⁴, Blandina Lugendo⁴, Dror L. Angel²

¹Tel Aviv University, Tel Aviv, Israel. ²University of Haifa, Haifa, Israel. ³Independent Researcher, Dar es Salaam, Tanzania, United Republic of. ⁴University of Dar es Salaam, Dar es Salaam, Tanzania, United Republic of

Abstract

The nomad jellyfish *Rhopilema nomadica* is among the most impactful invasive scyphozoans in the eastern Mediterranean Sea, forming dense seasonal swarms that affect fisheries, coastal infrastructure, and tourism. However, more than 35 years after it was first described as a Lessepsian migrant, no verified records from its putative source region exist, and the mechanisms underlying its proliferation remain unresolved. Using mitochondrial COI sequences, we provide the first molecular confirmation of *R. nomadica* in the western Indian Ocean, using samples collected from stranded specimens near Dar es Salaam, Tanzania. Phylogenetic analyses reveal strong genetic similarity between Indo-Pacific and Mediterranean populations, supporting an Indo-Pacific origin and suggesting anthropogenic introduction, most likely via shipping. Historical evidence suggests that *R. nomadica* was present in the eastern Mediterranean decades before the onset of recurrent mass blooms in the 1980s, implying a prolonged period of cryptic persistence. We propose that this lag reflects the ecology of its metagenic life cycle, with benthic scyphistomae persisting at low densities until environmental conditions favoured enhanced population amplification. In particular, large-scale alterations to the eastern Mediterranean trophic structure following construction of the Aswan High Dam, combined with rising sea surface temperatures, may have boosted polyp survival, asexual reproduction, and strobilation success. These findings emphasize the critical role of cryptic benthic stages in jellyfish invasions and demonstrate how delayed ecological responses to environmental changes can obscure invasion histories. Improved understanding of polyp ecology is essential for predicting and managing future jellyfish outbreaks in warming and altered marine ecosystems.

Keywords

Scyphomedusa, Cryptic, Food web, Life cycle

Strobilation of Pacific sea nettle (*Chrysaora fuscescens*) scyphistomae may be linked to seasonal upwelling

Sarah H. Johnson, Amanda S. Kahn

Moss Landing Marine Labs, San Jose State University, Moss Landing, United States

Abstract

Seasonal abundance of the Pacific sea nettle (*Chrysaora fuscescens*) has become more variable in the last three decades along the central California coast; it is unknown why this greater variability has occurred but a prevailing hypothesis is that blooms are tied to seasonal coastal upwelling. Previous studies demonstrate that strobilation, and thus subsequent blooms, is induced by changes in physical factors such as temperature, salinity, and light intensity. This study aims to understand how temperatures, and temperature variability such as that associated with upwelling, may impact strobilation timing and ephyra production of *C. fuscescens*. Scyphistomae were reared in an incubator or flow-through system and exposed to three temperatures—low temperature associated with strong upwelling (8-10°C), ambient Monterey Bay temperature (14-15°C), and high temperature (18°C)—under constant conditions, and for different durations at those temperatures. I hypothesized the coldest temperature would induce strobilation earlier and would result in more ephyrae produced than the high and mid temperatures, and that scyphistomae would require exposure to cold upwelling conditions for at least two weeks to induce strobilation. Preliminary results support this hypothesis: scyphistomae in the low temperature began strobilating earlier and strobilation occurred in more polyps than in the warm and ambient temperatures. The polyps in the warm treatment overall produced more podocysts and new polyps than both the ambient and cold treatments. Results from this research will inform understanding of the drivers of jellyfish blooms in changing oceans, as upwelling patterns are predicted to shift.

Keywords

Pacific sea nettle, Upwelling, Strobilation

Extracting nutrients from jellyfish biomass for agriculture fertilizers

Tjaša Kogovšek, Mirta Smodlaka Tanković, Ana Baričević, Daniela Maric Pfannkuchen, Mia Knjaz, Ivan Vlašicek, Lana Grižančić, Ivan Podolsak, Ariana Turković, Martin Pfannkuchen

Rudjer Boskovic Institute, Rovinj, Croatia

Abstract

Global agricultural production is projected to double over the next century, creating significant challenges for food security and environmental sustainability. The efficient and responsible use of fertilizers is therefore critical to maintain crop productivity while minimizing ecological impacts. Current research increasingly targets non-synthetic and non-fossil-based alternatives that pose lower risks to ecosystems and human health. In this context, jellyfish have recently emerged as a promising marine biomass with diverse biotechnological applications. Despite their low organic content in wet mass, jellyfish exhibit a low carbon-to-nitrogen (C:N) ratio (4–5), indicative of a nitrogen-rich substrate. Previous studies have highlighted their potential as an agricultural fertilizer; however, practical constraints persist, notably the high salt content and challenges associated with its removal. Here, we report preliminary findings from the NutriGel project on laboratory-scale extraction of P and N from selected jellyfish species (Scyphozoa and Ctenophora). Two bloom-forming species were investigated: *Rhizostoma pulmo*, with the highest N (2.5% of dry mass) and P (0.19% of dry mass) content, and the invasive ctenophore *Mnemiopsis leidyi*, characterized by low organic content (0.4% N and 0.03% P in dry mass). Approximately 50% of P, measured as orthophosphate, was successfully recovered via precipitation from the initial jellyfish homogenate. These results demonstrate the potential of jellyfish-derived biomass as a sustainable source of nutrients for fertilizer development, offering an innovative approach that contributes to both sustainable agriculture and the blue economy.

Keywords

Nitrogen and phosphorus recovery, Jellyfish biomass, Sustainable fertilizers, Agriculture, Biotechnology

Can jellyfish act as bioindicators of trace metal(loid)s dynamics? – The northern Adriatic case study

Tjaša Kogovšek¹, Darja Mazej², Marta Jagodic Hudobivnik², Alenka Malej³, Ingrid Falnoga², Jadran Faganeli³

¹Rudjer Bošković Institute, Center for Marine Research, Rovinj, Croatia. ²Jožef Stefan Institute, Department of Environmental Sciences, Ljubljana, Slovenia. ³National Institute of Biology, Marine Biology Station, Piran, Slovenia

Abstract

Marine environments have been increasingly threatened by both local and global stressors, particularly in coastal areas where multiple pressures converge. Among these stressors, potentially toxic metals and metalloids (TMs) pose a significant concern due to their persistence, bioaccumulation, and potential for biomagnification. Aquatic invertebrates uptake TMs from water and, predominately, from food, with significant variability of accumulation patterns across TMs and taxa. In this study, six bloom-forming species: the scyphozoans *Aurelia solida*, *Chrysaora hysoscella*, *Cotylorhiza tuberculata*, *Rhizostoma pulmo*, hydrozoan *Aequorea forskalea* and the invasive ctenophore *Mnemiopsis leidyi* were collected between 2017 and 2019 in the northern Adriatic Sea to quantify TM concentrations, evaluate their bioaccumulation potential, and explore the implications for trophic transfer and contaminant cycling. The studied species significantly concentrated TMs well above the dissolved seawater levels in the generalised order $Sr > Zn, Fe > As > Cu > Mn > Se > Ni > Pb > Cd > Mo > Cr > Co > Hg$. Analysis of TM composition and TM/ C_{org} ratios revealed significant interspecies differences. Species with lower C_{org} content tend to have lower concentrations of several metal(loid)s compared to the species with higher C_{org} content. In addition, when normalised to C_{org} , essential elements were more variable among species than potentially toxic elements. Generally, TM were bioconcentrated (mostly $\log BCF$ 3-4) and bioaccumulated (mostly $\log BAF < 3-4$) in jellyfish, and thus, gelatinous organisms have the potential to serve as bioindicators or biomonitors for TMs in seawater.

Keywords

Jellyfish, Metal(oids), Bioaccumulation, Bioindicator, Adriatic Sea

An integrative approach to hydrozoan biodiversity assessment in the Adriatic Sea

Tjaša Kogovšek, Ana Baričević, Mirta Smodlaka Tanković, Daniela Maric Pfannkuchen, Mia Knjaz, Ivan Vlašicek, Lana Grižančić, Ivan Podolsak, Ariana Turković, Martin Pfannkuchen

Rudjer Bošković Institute, Center for Marine Research, Rovinj, Croatia

Abstract

The Mediterranean Sea is a biodiversity hotspot, with Hydrozoa (excluding Siphonophora) accounting for approximately 10% of known marine species. This diversity is increasingly threatened by anthropogenic pressures, climate change, and species translocation, highlighting the need for continuous and standardized monitoring. In the Adriatic Sea, particularly its northern and central regions, hydrozoan research was historically intensive; however, systematic observations have been largely absent for the past two decades, resulting in a significant gap in baseline biodiversity data. Hydromedusae are a highly diverse and ecologically important component of hydrozoan communities, yet their monitoring is challenged by fragile morphologies, cryptic species, and complex life cycles. To overcome these limitations and update historical records, we applied an integrative framework combining conventional net sampling, metabarcoding and citizen science observations. Net sampling and metabarcoding revealed comparable levels of species richness, although the detected assemblages only partially overlapped, particularly when benthic samples were included. Molecular identification was further constrained by gaps and inconsistencies in available reference sequence databases and limiting taxonomic resolution. Citizen science contributed additional records not detected by traditional or molecular approaches, including large medusae such as *Aequorea forskalea* and *Neotima lucullana*, extensive aggregations of *Obelia* spp., and the first records of previously undescribed species. Our results demonstrate that no single method is sufficient to comprehensively assess hydrozoan biodiversity. Integrating traditional, molecular, and participatory approaches is essential for effective monitoring, while the development of a curated, taxonomically validated reference database of barcodes represents a critical next step to fully realize the potential of molecular tools.

Keywords

Hydrozoa, Biodiversity, Monitoring, Metabarcoding, Citizen science, Northern Adriatic Sea

When light matters: Tissue-level growth and biochemical shifts in jellyfish

Raissa C. F. C. Cerqueira, Marta Neves, Joana Figueira, Sérgio Miguel Leandro, Sonia Cotrim Marques

MAREMARE / ARNET, School of Tourism and Maritime Technology, Polytechnic of Leiria, Peniche, Portugal

Abstract

Jellyfish exhibit high physiological plasticity that can be shaped by environmental drivers such as light regime. Understanding how environmental conditions influence jellyfish biochemical quality is essential for assessing their nutritional value and trophic role in marine food webs. Here, we investigated how contrasting light regimes (12 h light : 12 h dark vs. continuous light, 24 h) affect jellyfish growth and tissue-specific biochemical organization. We quantified biometric traits together with biochemical composition across distinct body fractions (bell, arms, and mucus), including protein, collagen, ash content, and fatty acid profiles. At the whole-organism level, biometric traits and most bulk biochemical parameters showed limited responses to light regime. However, clear tissue-specific patterns emerged. Protein content differed significantly among body fractions, with arms consistently exhibiting higher protein levels than the bell under both light regimes, while collagen and ash content varied primarily among tissues rather than between treatments. In contrast, fatty acid composition displayed strong multivariate differentiation driven by both body fraction and light regime, as revealed by Bray–Curtis distances, PERMANOVA, and principal coordinates analysis. SIMPER analyses indicated that polyunsaturated fatty acids, particularly n-3 and n-6 compounds, contributed most to biochemical differentiation among tissues, whereas fewer fatty acids explained differences between light regimes. Overall, our results show that jellyfish responses to light regime are subtle at the bulk level but become evident when growth and biochemical traits are examined at the tissue scale, highlighting the ecological relevance of tissue-level plasticity for jellyfish trophic functioning under changing light environments.

Keywords

Gelatinous zooplankton, Light regime, Biochemical traits, Fatty acids, Trophic role

Preliminary evaluation of the nutritional potential of cultured jellyfish as a novel food ingredient

Joana P. C. Figueira, Filipa R. Pinto, Sónia Barroso, Sónia Cotrim Marques, Maria Manuel Gil

MAREMARE / ARNET, School of Tourism and Maritime Technology, Polytechnic of Leiria,
2520-630 Peniche, Portugal

Abstract

The search for alternative food ingredients is becoming increasingly urgent in order to reduce pressure on natural resources, including arable land, freshwater, and conventional animal stocks. Jellyfish blooms occurring in the Tagus estuary may represent a valuable and underexploited biological resource. While jellyfish are traditionally consumed in several Asian countries, their use in European diets remains negligible. This study provides a preliminary evaluation of the nutritional potential of jellyfish for human consumption. Jellyfish were cultured for 66 days and subsequently analysed to assess growth performance, protein and lipid content, as well as lipid and mineral profiles in juvenile specimens. The results demonstrated a high protein content ($43.23 \pm 0.66\%$ DW), with marked differences among jellyfish components, and about 10% DW total lipids, characterised by the presence of compounds of nutritional relevance. The mineral composition revealed elevated Na concentrations, suggesting the potential applicability of jellyfish biomass as a functional food ingredient, including its use as a partial salt substitute while simultaneously contributing other essential nutrients. Although these findings are promising, further studies are required to evaluate variability across life stages, processing methods, sensory attributes, and potential food safety considerations before jellyfish can be fully considered a novel food ingredient. Overall, these results highlight the potential of jellyfish as a sustainable alternative food resource and support their inclusion in strategies aimed at diversifying protein sources and promoting more resilient food systems.

Keywords

Jellyfish food, Biochemistry, Nutritional content, Human food

Something Is Wrong! Why are local *Aurelia aurita* populations collapsing every year?

Christin Appelqvist

University of Gothenburg, Department of Marine Sciences -Tjörnö 452 96 Strömstad, Sweden

Abstract

Local populations of *Aurelia aurita* along the northern Swedish west coast have experienced recurring seasonal mortality events during the past five years. Affected individuals display abnormal swimming behaviour and progressive tissue degradation prior to disintegration and death. Remarkably, these events occur during the same seasonal period each year, suggesting the presence of a recurring environmental or biological trigger. However, the underlying mechanisms remain unknown. Although jellyfish populations are naturally variable, the repeated and highly synchronized nature of these mortality events raises concerns regarding both the timing and rapid progression of mortality. Under normal conditions, the medusa of *Aurelia aurita* typically senesce during autumn following reproduction. In contrast, the observed mortality occurs already in May–June, before reproductive activity has been completed, with local populations collapsing within only a few days. These observations highlight the need for long-term monitoring of *Aurelia aurita* populations in Swedish and adjacent waters. As an initial step, a citizen science project was initiated at the University of Gothenburg in 2025 to document the spatial and temporal extent of these mortality events. Whether the Swedish observations represent a localized phenomenon or part of a broader global pattern affecting gelatinous zooplankton remains unclear. However, the timing is predictable. The mechanism is not. Have similar *Aurelia* mortality events been observed in other marine ecosystems worldwide?

Keywords

Aurelia aurita, Mortality events, Citizen science, Population dynamics



8th International
**Jellyfish
Blooms**
Symposium
Cork | Ireland
2026

FRONT COVER IMAGE CREDITS

Leuckartiara octona © Joan Josep Soto-Angel

Carybdea prototypus © Alvaro E. Migotto

Aurelia aurita © Andre Morandini

ILLUSTRATIONS © Shevaun Doherty