JBS7
2023

7th International Jellyfish Blooms Symposium

JELLYFISH, ECOSYSTEMS AND HUMANS

21-25 November 2023

Thiruvananthapuram, Kerala, India

BOOK OF ABSTRACTS

Organized by

UNIVERSITY OF KERALA
Department of Aquatic Biology & Fisheries

ICAR-Central Marine
Fisheries Research Institute

7th International Jellyfish Blooms Symposium

(JBS7, 2023)

Jellyfish, Ecosystems and Humans

Book of Abstracts

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ICAR- CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

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Photo credit: **Daniela Munari**

Message from the Chairman and Organising Secretary

Dr A Gopalakrishnan and Prof A Biju Kumar

On behalf of the Local Organising Committee, we are pleased to welcome you all to Thiruvananthapuram and the 7th International Jellyfish Blooms Symposium (JBS7). The responsibility of organising JBS7 was given to Biju Kumar at the 6th JBS organised in Cape Town, South Africa, and the first suggestion came from Mike Dawson and was supported by Mark Gibbons and the majority of delegates at Cape Town. However, the onset of the COVID-19 pandemic and ensuing restrictions presented challenges that delayed initiating the organizing process in India.

One year ago, in a joint meeting of the University of Kerala and ICAR-Central Marine Research Institute, a decision was made to co-host JBS7. Renowned for its rich jellyfish diversity, India provides a fitting backdrop for this prestigious event. JBS7 is an opportunity for the global community to share and explore current and future research on jellyfish, fostering collaboration and innovation to address critical questions in the field.

The symposium's special theme, "Jellyfish Fisheries and Trade: Status, Trends, and Impacts on Livelihood," reflects the crucial role of jellyfish in marine ecosystems and their impact on the livelihoods of fishers in India. We anticipate that the discussions at JBS7 will guide researchers and policymakers in the coming years, particularly in ecosystem management, jellyfish fisheries, multi-omics studies, global ecology, biogeography, and medical and technological research.

We are delighted to report an overwhelming response to JBS7, with 192 abstracts received from 35 countries, highlighting the global interest and commitment to advancing jellyfish research. We extend our heartfelt thanks to the Ministry of External Affairs, Government of India, for their support and permissions, and to our sponsors for their timely contributions.

As you immerse yourselves in the symposium, we encourage you to explore the three 'C's – the Core of scientific inquiry, the rich Crafts and Culture of Thiruvananthapuram, and the Collaborative opportunities within the larger marine research network. May your stay be both intellectually rewarding and culturally enriching.

Welcome to JBS7!

Sincerely,

Dr A Gopalakrishnan
Chairman, JBS7

Prof A Biju Kumar
Organising Secretary, JBS7

21-25 November 2023
Thiruvananthapuram, Kerala, India
Kerala Arts and Crafts Village
Kovalam, Thiruvananthapuram, Kerala, India

Tuesday, 21 NOVEMBER 2023 **Venue: Uday Samudra Leisure Beach Hotel, Kovalam** https://www.udshotels.com/uday-samudra-leisure-beach-hotel-spa/	
15.00-17.00	WELCOME DESK AND REGISTRATION
17.00-18.00	**INAUGURAL SESSION** **Invocation song:** '*Lokah Samastah Sukinho Bhavantu'* (May All Beings Everywhere Be Happy and Free): Students of Dept of Music, University of Kerala **Welcome: Prof A Biju Kumar**, Organising Secretary, JBS7 **Symposium Overview: Prof Mike Dawson**, California State University and Chair, International Advisory Board **Speech by Guest of Honour: Dr B Meenakumari**, Former Chairperson of National Biodiversity Authority and Deputy Director General (Fisheries), Indian Council of Agricultural Research (ICAR), New Delhi **Inauguration: Prof Mohanan Kunnummal,** Vice-Chancellor, University of Kerala, and Kerala University of Health Sciences *Honouring the international committee members* **World Fisheries Day:** Honouring a representative of traditional fisherman of Kerala, followed by his perception on jellyfish in coastal waters of Kerala (the speech will be translated into English) **Felicitations:** **Prof Mark John Gibbons**, Department of Biodiversity and Conservation Biology, University of the Western Cape, Republic of South Africa **Prof PM Radhamany and Prof Gopchandran KG,** Members of Syndicate, University of Kerala

	Prof KS Anil Kumar, Registrar, University of Kerala **Dr JK Patterson Edward,** Director, Suganthi Devadason Marine Research Institute (SDMRI) **Vote of Thanks: Dr Grinson George**, Head, Marine Biodiversity & Environment Management Division, CMFRI, Kochi **NATIONAL ANTHEM** (Students of Dept of Music, University of Kerala)	
18.30 – 20.30	Welcome dinner (Uday Samudra Leisure Beach Hotel, Kovalam) **Fusion music by CLAP BOX BAND** (Violin: Neeraj Ram B; Guitar : Hrishikesh, P., Percussion: Dhanush JP; Bass Guitar: Harikrishnan; Keyboard: Induchoodan G.)	
Wednesday, 22 NOVEMBER 2023		
8.00-9.00	WELCOME DESK AND REGISTRATION	
09.00-9.15	Welcome Talk and Symposium Overview	Mike Dawson and Biju Kumar
JBS7- SESSION 1: Human-Jelly Interactions		
Chair: Sergio Stampar **Co-Chairs:** Grinson George; S M Raffi **Rapporteur:** A Riyas		
Time	Author	Abstract title
9.15-9.45	**PLENARY LECTURE Jamileh Javidpour**	Harmony Disrupted: The interplay of humans and jellyfish
9.45-10.00	Antonella Leone	Jellyfish blooms in the Mediterranean Sea: a potential source of functional novel food
10.00-10.15	Pralaya Ranjan Behera	Emerging commercial fisheries of catostylid jellyfish, *Crambionella annandalei* from Western Bay of Bengal
10.15-10.30	Hannah Brownlow	Developing a short-term harmful jellyfish forecast model for the salmon aquaculture industry
10.30-10.45	Sunwoo Kim	Precautionary management of jellyfish bloom by polyp elimination
10.45-11.00	Alexandre Jan	A versatile method to culture different ctenophore species
11.00-11.05	Subal Roul	Characterization of the small-scale jellyfish fishery and its economic efficiency along the Odisha coast, northwestern Bay of Bengal
11.05-11.10	Sergio Stampar	Jellyfish bloom of *Craspedacusta* in tilapia farms in Southern Brazil

11.10-11.15	Ramkumar Sugumar	Cubozoan blooms and its interaction with commercial fish production activity along the coastal region of Palghar district, Maharashtra, Northeastern Arabian Sea, India
11.15-11.20	Miriam Paul Sreeram	Stakeholders perception on jellyfish blooms and effects on marine fisheries in Kerala state, India
11.20-11.45	**TEA**	
JBS7- SESSION 2: Bio-inspiration / Envenomation		
Chair: Angel Yanagihara **Co-Chairs:** Miriam Paul Sreeram; Venmathi Maran **Rapporteur:** Kurian Mathew Abraham		
11.45-12.00	Angel Yanagihara	Cubozoan envenomation: mechanisms, models and management
12.00-12.15	Isam Sabbah	Mechanism of nano plastics capture by jellyfish mucin and its potential as a sustainable water treatment technology
12.15-12.30	Vasudevan Shankar	Dynamics of Jellyfish Swarms: Unraveling the Intricate Influence of Coastal Ocean Parameters in the South Eastern Arabian Sea
12.30-12.45	Krishan Karunarathne	Jellyfish fishery in Sri Lanka
12.45-13.00	Amit Lotan	A universal first aid Solution to eliminate continuous stinging of jellyfish at the beach
13.00.14.00	**LUNCH**	
JBS7- SESSION 3: Associations and Ecology		
Chair: Kylie Pitt **Co-Chairs:** Mark Gibbons; R Saravanan **Rapporteur:** Surya S		
14.00-14.30	**PLENARY LECTURE** Tinkara Tinta	The missing links between jellyfish and microbes in the ocean realm
14.30-14.45	Serafin III Geson	Thermal influences on the life cycle recruitment of the upside-down jellyfish, *Cassiopea* sp., in a tropical shallow embayment
14.45-15.00	Yoav Lehahn	Directional jellyfish swimming revealed from Lagrangian analysis of drone footage
15.00-15.15	Marta Mammone	The influence of photosymbiosis in *Cassiopea xamachana* regenerative success
15.15-15.30	Kentaro Suzuki	Environmental factors affecting the population dynamics of moon jellyfish *Aurelia coerulea* in Ise Bay, Japan

15.30-16.00	**TEA**	
16.00-16.15	Kylie Pitt	Parasites as trophic indicators of predation on gelatinous zooplankton
16.15-16.30	Riyas Abdul	Evaluating environmental influences *on Acromitus flagellatus* Maas, 1903 jellyfish blooms in southwest Indian backwaters and estuaries
16.30-16.45	Gregorio Motta	The hidden gastrovascular system of Rhizostomeae: innovative methods of study
16.45-17.00	Samir Aljbour	Differential effects of PAR and UVA on *Cassiopea andromeda* jellyfish respiration, oxidative stress, and photosynthesis
17.00-22.00: Tour (Delegates to give options at Registration desk)		
Thursday, 23 NOVEMBER 2023		
8.30-9.00	**Virtual Poster Presentations**	
JBS7- SESSION 4: Associations and Ecology		
Chair: Andre Morandini **Co-Chairs:** Macarena Campos; L Ranjith **Rapporteur:** Subal Kumar Roul		
9.00-9.30	**PLENARY LECTURE** Cornelia Jaspers	Do gelatinous zooplankton traits facilitate population outbursts under global change?
9.30-9.45	Ratheesh Kumar R	Spatio-temporal variations in jellyfish catch of bagnets in Maharashtra, India
9.45-10.00	Jessica Strickland	Convergent oceanographic slicks as potential habitat for jellyfishes
10.00-10.15	Macarena Marambio Campos	Jellyfish, the favored ones by climate change conditions in the Catalan coast, NW Mediterranean
10.15-10.30	Valentina Leoni	Trophic ecology of jellyfish in marine food webs
10.30-10.45	Fang Zhang	Monitoring of large jellyfish using low-altitude remote sensing by UAVs: A case study of *Acromitus flagellatus* in the seawater of Qinglan Port, Hainan, China
10.45-11.00	Jonathan Lawley	Differential expression of rhizostomin pigments leads to colour variation in a jellyfish
11.00-11.30	**TEA**	

11.30-11.45	Joshua Stone	Temporal and spatial distribution of the cannonball jellyfish (*Stomolophus meleagris*) in the South Atlantic Bight, USA
11.45-12.00	Xupeng Chi	Biochemical homeostasis through phytoplankton-zooplankton interface and mirrored in jellyfish polyps
12.00-12.15	Song Feng	Effects of salinity, light intensity and biofouling on planula settlement and subsequent development to polyps in *Cyanea nozakii* (Cnidaria: Scyphozoa)
12.15-12.30	Tamar Guy-Haim	Seasonal trophic shift of an invasive jellyfish facilitates non-indigenous fish dominance in a bioinvasion hotspot
12.30-12.45	Giacomo Milisenda	The role of fatty acids in the reproduction of *Pelagia noctiluca*
12.45-13.00	Scott Morrissey	Use of eDNA to test hypotheses on the ecology of *Chironex fleckeri*
13.00.14.00	**LUNCH**	
Chair: Rebecca Helm **Co-Chairs:** Jing Dong; Pralay Ranjan Behera **Rapporteur:** Mithun Sukumaran		
14.00-14.15	Mohamed Nejib Daly Yahia	Jellyfish populations in Qatar seawaters: the role of artificial shoreline development and recent hydro-climatic changes on scyphozoans blooms
14-15-14.30	Rebecca Helm	Distribution of left- and right-handed *Velella* in the global ocean
14.30-14.45	Kyoung Yeon Kim	Causes of the *Aurelia coerulea* outbreak on the southern coast of Korea
14.45-14.50	Marie Meffre	Unmanned aerial survey allows mapping *Rhizostoma pulmo* bloom dynamics in Bages-Sigean lagoon (Aude, France)
14.50-14.55	Mayara Jordano	The role of cilia in cnidarians, a brief review and new insights on the feeding mechanisms
14.55-15.00	Rithin Raj M	Studies on the dietary preferences of three scyphozoan jellyfish species in a tropical positive estuary, south India
15.00-15.05	Kavya Gokul	Association of jellyfish *Catostylus perezi* with crustaceans: A preliminary observation from Gulf of Kutch, Gujarat
15.05-15.10	Nicholas Wei Liang Yap	Marine stingers: effects of sea warming and food availability on a tropical jellyfish species
15.10-15.15	Clarissa Garbi Molinari	Molecular responses of cnidarians to environmental stress
15.15-15.20	Cesar Bordehore	Transforming Matrix Population Model into a Dynamic Size-Structured Model: A case study of *Carybdea marsupialis* population

15.20-15.25	Nicole Aberle-Malzahn	Long-term dynamics and population structure of the Helmet jellyfish *Periphylla periphylla* in a Norwegian fjord
15.25-15.30	Chaolun Li	Monthly dietary shifts in the jellyfish *Nemopilema nomurai* in Liaodong Bay, China
15.30-15.35	Jing Dong	Blooming potential base on spatiotemporal distributional pattern and dual-mode recruitment of polyp population of the giant jellyfish *Nemopilema nomurai* in Bohai Sea
15.35-15.40	Luis Martell	Worm-filled jellies: a multiapproach assessment of the dynamics of helminths parasitizing jellyfish hosts in two Norwegian fjords
15.40-16.00	**TEA**	
16.00-18.00	**POSTER EVALUATION Themes: Bioinspiration and Evenomation Associations and Ecology**	Participants to be near the poster for flash presentations in front of the affixed poster **Affix your poster in the two themes ONLY on 23rd November 2023 in the allotted spaces**
18.00-19.30	**CULTURAL EVENING Kathakali (Traditional Art form of Kerala)**	Story: Duryodhanavadham (Scene of killing Dussasana and Duryodhana- story from the epic Mahabharatham Lead: Dr Narayanan Namboothiri (Scientist, JNTBGRI)
HIGH TEA		
PARALLEL EVENT **Public Lecture (10.00-11.00) and PRESS MEET** **Venue: Press Club, Thiruvananthapuram** **Mark J Gibbons** (Jellyfish, People and the United Nations' Sustainable Development Goals)		
Friday, 24 NOVEMBER 2023		
JBS7- SESSION 5: Biodiversity		
Chair: Delphine Thibault **Co-Chairs:** Tamara Shiganova; S. Ramkumar **Rapporteur:** Pramod Kiran		
9.00-9.30	**PLENARY LECTURE Allen G. Collins**	Pace and scope in characterizing the diversity and distributions of jellyfishes – How are we doing as a community?
9.30-9.45	Michael Dawson	Scyphozoan systematics, genomics, and a new age of reason

9.45-10.00	Mehul Sangekar	New technologies for detecting blooms of mesozooplanktonic jellies
10.00-10.15	Joan J Soto-Angel	Bipolar jellyfish: evolutionary origin and diversification
10.15-10.30	Saravanan Raju	Mapping and monitoring recurrent jellyfish blooms in Indian coastal waters: known and unknown
10.30-10.45	Florian Lüskow	Freshwater jellyfish research – hidden gems, knowledge gaps, and current progress
10.45-11.00	Maciej Mańko	Gelatinous zooplankton as indicators of the Arctic Ocean Atlantification
11.00-11.30	**TEA**	
11.30-11.45	Verena Ras	Hiding in plain sight – hidden genetic diversity of west African jellyfish
11.45-12.00	Ramesh Chatragadda	Underexplored jellyfish blooms in some locations of India: Impacts, research gaps and future directions in sustainable utilization and management
12.00-12.15	Delphine Thibault	Siphonophore community along the Southeast Coast of South Africa (ACEP 2017 Summer and Winter cruises)
12.15-12.30	Maria McGuinness	The Irish seasonal coastal current – the source of *Muggaea atlantica* in Ireland?
12.30-12.45	Martin Vodopivec	Modelling the dispersal of *Pelagia noctiluca* in the Mediterranean Sea
12.45-13.00	Doris Björling	Anthoathecate jellyfish and their polyps in Swedish waters: An integrative taxonomy approach
13.00.14.00	**LUNCH**	
Chair: Mike Dawson **Co-Chairs:** Dhugal Lindsay; K V Jayachandran **Rapporteur:** Ramesh Chatragadda		
14.00-14.15	Michael Brown	Morphoplasticity and environment: Where the lines between taxonomy and ecology blur
14-15-14.30	Tamara Shiganova	Prediction of invading ctenophores *Mnemiopsis leidyi* Agassiz, 1865 and *Beroe ovata* Bruguiere, 1789 habitat expansion in the Ponto-Caspian seas associated with climate change
14.30-14.45	Gerlien Verhaegen	Drivers behind the diversity and distribution of a widespread midwater narcomedusa
14.45-15.00	Dhugal Lindsay	Hot bathtubs as proxies: jellyfish in a warming ocean
15.00-15.15	Pengpeng Wang	Trophic diversity of the bloom-forming jellyfish community in the coastal waters of China assessed by stable isotope analysis

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<tr><td>15.15-15.30</td><td>A.B. Kumar</td><td>Citizen Science illuminate the enigmatic realm of scyphozoans, including three new records to India</td></tr>
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<tr><td>16.00-16.30</td><td>TEA</td><td></td></tr>
<tr><td>16.30-18.00</td><td>POSTER EVALUATION
Themes: Human-Jelly Interactions
Biodiversity</td><td>Participants to be near the poster for flash presentations in front of the affixed poster
Affix your poster in the two themes ONLY on 24th November 2023 in the allotted spaces</td></tr>
<tr><td>18.30 - 21.00</td><td>VALEDICTORY DINNER
Coordinator:
Mike Dawson

Venue:
Amphitheatre, Arts and Crafts Village</td><td>In Honour & Memoriam Lectures
Memorials
<table>
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</table></td></tr>
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Padmasree M.C. Dathan, former director, Vikram Sarabhai Space Centre (VSSC) and Scientific Advisor to Chief Minister of Kerala</td></tr>
</table>

	Valedictory Address: **Dr A Gopalakrishanan**, Director, ICAR-Central Marine Research Institute, Kochi **REOPORT** **VOTE OF THANKS**

PARALLEL EVENT

Venue: Mini Conference Hall, Kerala Arts and Crafts Village

THEME: Jellyfish fisheries and Trade: Status, Trends and Impacts on Livelihood

Date & Time: November 24, 2023 | 10.00 to 12.00 hrs

Organised by CMFRI

Venue: Mini Conference Hall, Kerala Arts and Crafts Village

Chair: A. Gopalakrishnan, Director, ICAR-CMFRI

Chair: Dr Biju Kumar K., Head, Dept. of Aquatic Biology & Fisheries, University of Kerala

10.00 - 10.10

A. Gopalakrishnan, Director, ICAR-CMFRI

Introductory remarks: Jellyfish fisheries and Trade - Status, Trends and Impacts on Livelihood

10.10 - 10.30

Dr Biju Kumar A., Head, Dept. of Aquatic Biology & Fisheries, University of Kerala

Jellyfish and jellyfish fisheries in India: State of Knowledge and Knowledge Gaps

10.30 - 10.50

Dr Bindu J, Principal Scientist, ICAR-CIFT

Novel Processing Technologies for Jellyfish Products: Enhancing Quality, Safety, and Market Value

10.50 - 11.10

Dr Krishan Karunarathne

Jellyfish fishery in Sri Lanka

11.10 - 11.30

Dr Saravanan Raju, Senior Scientist, ICAR-CMFRI

Jellyfish Fisheries: Unveiling the Economic and Social Implications of a Rising Marine Resource

11.30 - 11.50

Dr Miriam Paul Sreeram, Principal Scientist, ICAR-CMFRI

From Nuisance to Economic Boon - The Emergence of Catosylids as a Commercial Fishery in India

DISCUSSION

PHOTO EXHIBITION: Venue- Art Centre, Kerala Arts and Crafts Village

22 to 24 November 2023

Saturday, 25 NOVEMBER 2023
Fieldwork and local tour
For tours contact our event management team for tours
Kerala Travels Interserve (https://keralatravels.in/)
Susan Mammen, Customer Happiness Officer
Mob : +91 96056 44000; email : susan.mammen@keralatravels.org; Ampili: +91 7907415031

JBS7 Workshop: INTEGRATIVE TAXONOMY
25–27 November, 2023
Venue: Dept. of Aquatic Biology & Fisheries, University of Kerala, Karyavattom Campus, Thiruvananthapuram
Contact Resource Persons: Dr Mike Dawson (mdawson@ucmerced.edu) or Liza Liza Gomez Daglio (liza.gomez-daglio@fresnocitycollege.edu)
Local Support: Dr Riyas (+91 9745771433); For transportation: Dr Mithun (+91 8075956015)

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Theme- 2: Bio-inspiration / Envenomation Poster Presentation

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Theme- 4: Biodiversity Poster Presentations

Theme 1:

Human-Jelly Interactions

ORAL PRESENTATIONS

Photo credit: **Biju Kumar**

Harmony disrupted: The interplay of humans and jellyfish

Jamileh Javidpour

Department of Biology,
University of Southern Denmark, Denmark
Email: jamileh@biology.sdu.dk

In this presentation, we delve into the intricate interplay between human activities and jellyfish in marine ecosystems, shedding light on the evolving dimensions of this coexistence. Over centuries, this relationship maintained a delicate equilibrium, with humans and jellyfish coexisting without significant disruption. However, the onset of industrialization and widespread alterations to marine habitats has precipitated a noticeable shift in this balance. The impacts of industrialization have manifested as shifts in water quality, overfishing of natural jellyfish predators, and the release of pollutants favoring the proliferation of select jellyfish species. These environmental changes have created ideal conditions for jellyfish blooms, resulting in a significant increase in their populations. Consequently, this surge in jellyfish populations has begun to encroach upon human activities and interactions. Simultaneously, inadequate protections and awareness regarding the vulnerability of certain jellyfish species have pushed them to the brink of endangerment. This situation calls for urgent action to prioritize jellyfish fishery regulations as a cornerstone of sustainable policymaking. By taking a proactive stance and implementing sustainable practices, we can ensure that this unique nexus remains balanced and beneficial for all parties involved.

Jellyfish blooms in the Mediterranean sea: A potential source of functional novel food

Antonella Leone[1*], Stefania De Domenico[1,2], Gianluca de Rinaldis[1], Stefano Piraino[2]

[1]*National Research Council, Lecce, Italy;*
[2]*University of Salento, Lecce, Italy*
*e-mail: antonella.leone@cnr.it

The waste-to-resource approach promotes a paradigm shift in the management of jellyfish in coastal zones, where the sustainable exploitation of jellyfish blooms can be regarded as valuable source of benefits for a range of actors. In this framework, we studied three rhizostomeae jellyfish occurring in the Mediterranean Sea, the native *Rhizostoma pulmo* and *Cotylorhiza tuberculata*, and the non-indigenous species *Cassiopea andromeda* for their biomass, potentially useful as human food, and their content of bioactive compounds, with antioxidant, immunomodulatory, and anti-proliferative activities on cancer cells. *R. pulmo* received growing interest in western Countries where it's non-traditional food. Its organic matter, mainly composed by protein (mostly collagen), demonstrated to be valuable source of bioactive peptides. We investigated the immunomodulatory potential of *R. pulmo* protein hydrolysates, focusing on low-molecular weight peptide fractions, produced by enzymatic hydrolysis, and tested on U937-derived-macrophage cell cultures for inflammation-related genes expression and cytokines quantification. Our analyses showed that at non-cytotoxic concentrations, pepsin-hydrolysates significantly reduced expression of the proinflammatory cytokine genes, IL-6 and TNFα, in a dose-response. The zooxanthellatae *C. tuberculata* and *C. andromeda* are both characterized of high amount of antioxidant compounds, partly due to the presence of endosymbiotic microalgae belonging to the family *Symbiodiniaceae*. Partially purified hydroalcoholic extracts of both jellyfish were tested for their anti-proliferative activity and pro-apoptotic effects on human cancer cells MCF7 and MB-MDA-231. These results suggest the biomass of outbreak-forming scyphozoans may represent a yet untapped resource, with potential use in food systems, in line with the goals of the blue-green growth economy.

Keywords: Human functional food; Bioprospecting; Zooxanthellae; Bioactive compounds

Emerging commercial fisheries of catostylid jellyfish, *Crambionella annandalei* from Western Bay of Bengal

Pralaya Ranjan Behera[*1], S.S.Raju[1], Shubhadeep Ghosh[1], Raju Saravanan[2], Ranjith L[3] and Ramkumar S[4]

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Crambionella annandalei, a catostylid jellyfish is native to the eastern Indian Ocean. The species is an important fishery. Processed body parts, mostly oral arms, have good export potential and market demand in Southeast Asian countries. However, there is a major gap in the development of the commercial exploitation of the species in India due to lack of knowledge on fishery methods, handling and first-stabilization protocols. An attempt was made to describe this jellyfish fishery and to evaluate the economic performance of harvesting the species by coastal fisher folk along Andhra Pradesh,Western Bay of Bengal during 2017–19. The study revealed that the species supports active commercial small-scale seasonal fishery. The fishing season was during March to July, with an estimated 55,181 metric tons of edible jellyfish caught by motorized crafts. The estimated value of oral arms at landing centres varied from Rs. 20 lakhs to Rs. 4013 lakhs. The gross revenue earned from each fishing trip was Rs. 6271, with a net operating income of Rs. 2744 per trip. Thus, jellyfish fishery can be of substantial economic benefit to fishermen, sea-food-processors and thus the local economy, making it a promising small-scale commercial fishery. The findings suggest jellyfish as a future food source and secondary raw material, with better harvesting and processing practices. This information will help establish proper harvesting mechanisms, handling, and first-stabilization protocols, as well as to promote edible jellyfish as a novel food in India.

Keywords: Rhizostomatid jellyfish, *Crambionella annandalei*, Small-scale fisheries, Processing

Developing a short-term harmful jellyfish forecast model for the salmon aquaculture industry

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The movement of jellyfish blooms into coastal areas can cause significant economic impacts to finfish aquaculture. Such blooms are well documented in the NE Atlantic, potentially driven by a combination of regional and/or local oceanography and weather. Here we present a short range (3-4 day) forecast model for harmful jellyfish based on an operational harmful algal bloom model. This model uses meteorological wind forecasts to predict changes in wind driven circulation in the seasonally stratified Bantry Bay (SW Ireland). These changes can be rapid and involve large exchanges between the bay and adjacent shelf water, a so called flipflop event. To test this, bi-weekly zooplankton samples and CTD profiles were collected at a salmon farm in the bay from July 2020 to December 2022 (n = 179 samples). The model hindcasted three flip flop events in 2020 and an increase in abundance of the harmful siphonophore *Muggiaea atlantica* was recorded following one of the events. Additionally, high densities (over 3,000 per m^3 at its peak) of *M. atlantica* were documented following another flip flop in 2022. To improve the model, outputs (bottom/surface current flow data) from an operational 3D primitive equation coastal ocean model were incorporated. Results suggest that harmful jellyfish blooms are linked to signals of downwelling. This demonstrates complex dynamics governing harmful jellyfish blooms can be hindcasted using wind and zooplankton densities. In order to potentially be useful as a management tool, we need to test this in forecast mode and track a flip flop event in real time.

Keywords: Modelling, Circulation, Prediction, Fish farming

Precautionary management of jellyfish bloom by polyp elimination

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Young polyps of jellyfish among its life cycle are important reservoir 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 hotspots, 2) eliminating of important polyp populations, and 3) verification of the effects. Ephyrae and medusea were significantly decreased after polyp-elimination in all area 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 first time since 2010, when the jellyfish warning system began operating in Korea, a Aurelia coerulea jellyfish warning was not issued nationwide in 2019. For the next five years from 2023, the "2nd Mid-term strategy" will be implemented. We are going to discuss effectiveness of direct elimination of polyp as a countermeasure of jellyfish bloom in several cases.

Keywords: Polyp elimination, Precautionary management, National project, Moon jellyfish

A versatile method to culture different ctenophore species

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Ctenophores are fascinating marine organisms that have gathered significant attention in ecological, evolutionary and molecular research. Here, we introduce a cost-effective and straightforward method for establishing and maintaining a sustainable ctenophore culture, mainly for *Mnemiopsis leidyi*. Ctenophores, with their delicate gelatinous bodies, pose challenges in laboratory cultivation. Our method places particular emphasis on monitoring water quality parameters, careful selection of nutrition sources, and the implementation of specialized handling and tank setups to the specific needs of these fragile organisms. By following this protocol, researchers can successfully establish and maintain stable laboratory populations of *Mnemiopsis leidyi*, or *Bolinopsis infundibulum*, ensuring a consistent supply of embryos, cydippids or adults for molecular biological and behavioral investigations. Moreover, this approach provides researchers with the independence to conduct experiments without being influenced by natural population dynamics and environmental fluctuations.Our culturing method simplifies research on ctenophores and provides a valuable resource to uncover the secrets of these mysterious marine predators. It expands our knowledge of the crucial roles of ctenophores in marine ecosystems and their relevance to different scientific fields.

Keywords: Ctenophore, Culture, Aquarium, Kreisel, Life cycle

Characterization of the small-scale jellyfish fishery and its economic efficiency along the Odisha coast, northwestern Bay of Bengal

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Globally, there has been an increasing demand and interest in consuming jellyfish as a potentially important marine resource. In India, harvesting of edible jellyfish started dating back to 1984, mainly for the purpose of exporting. Recently, only one catostylid jellyfish *Crambionella annadalei* contribute to a small-scale seasonal landing along the Odisha coast. Therefore, present study aimed to characterize the jellyfish fishery and its fishing activities together with economic efficiency along the coast during 2020-2021. The jellyfish are usually caught by single day motorized gillnetters (8.5-9.7 cm OAL, 9-10 H.P engine capacities) from December to April. The sizes of the sampled jellyfish ranged from 11 to 27 cm bell diameter (BD) with mean length 22.4 cm ± 0.14 BD and 100 to 1548 g total body weight (BW) with mean weight 879.7 g ± 15.8. The economic efficiency of the jellyfish fishery was estimated with an average operating cost per fishing trip Rs.7,936, catch rate 577 kg/trip, gross revenue earned from each fishing trip Rs.13,600, net operating income per trip Rs. 5,664, capital productivity 0.58 and a labour productivity of 96.2 kg per crew per trip. As global fish stocks are declining, judicious exploitation of these jellyfish can provide an additional income and alternate livelihood to small-scale fishers. The present study revealed that only oral arms of the jellyfish are processed using salt and alum, and traded and exported to South East Asian countries mostly China. This aforesaid baseline information will support the development of appropriate handling, initial stabilization, and harvesting techniques, as well as the promotion of edible jellyfish as a potential food item in the country.

Keywords: Catostylid Jellyfish, *Crambionella annandalei*, Small-scale fishery, Economics, Odisha

Jellyfish bloom of *Craspedacusta* in tilapia farms in Southern Brazil

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A rarity among cnidarian species due to its ability to inhabit freshwater environments, the jellyfish of the genus *Craspedacusta* has captured the attention of scientists and nature enthusiasts for its erratic appearance episodes. While its origin lies in Asia, *Craspedacusta* has found its way to various parts of the world, including South America. Its appearance is striking, boasting a translucent bell-shaped body adorned with tentacles that delicately extend into the water. *Craspedacusta sowerbii* was first documented in South America in 1930 with some other observations. However, many of these sporadic records do not have consistent data and thorough analyzes have not been carried out in South America. In April 2022, all tilapia specimens (*Oreochromis niloticus*) in a fish farm lake in the municipality of Ariranha do Ivaí, Paraná, Brazil, were completely exterminated (loss of US$200,000) by the appearance of thousands of jellyfish. Two dozen specimens were collected and brought to the laboratory for morphological and molecular analyses (mtDNA COI). Thus, we identified the animals as *Craspedacusta sowerbii*, but the molecular data indicated a close relationship with specimens sequenced from lakes in Canada, with no molecular variation related to the focus material of this study. These results are interesting as they may indicate recent connections arising from secondary carryover, probably due to the transfer of substrates such as aquatic plants. These data encourage further studies to understand how such distant areas maintain some kind of human-based connectivity. Understanding this dynamic is very important for avoiding new invasions and possible financial losses.

Keywords: Freshwater jellyfish, Invasive species, Ecology, Jellyfish bloom, Non-indigenous

Cubozoan blooms and its interaction with commercial fish production activity along the coastal region of Palghar district, Maharashtra, Northeastern Arabian Sea, India

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Cubozoan is a fast-swimming box jellyfish known for its deadliest venom that possesses worldwide through its species *Chironex fleckeri* (Seawasp). During the year 2022-2023, we recorded two species of cubozoan found to swarm in the coastal waters of the Palghar district, Maharashtra, Northeastern Arabian Sea. The species was identified as *Chiropsoides buitendijki* (van der Horst, 1907) and *Tripedalia cystophora* Conant, 1897. *C. buitendijki*, monotypic species belonging to the family Chiropsalmidae found to swarm at a depth range from 10 m to 40 m along the coast of the Palghar district from September to November and from April to May. We found that frequent interaction with the commercial Dolnet fishing operation on this coast leads to temporary fishing closures, clogging and damage to fishing net; and loss of fish catches back to the sea. *T. cystophora*, found to bloom in the creeks of this coast, has potentially affecting the extensive shrimp farms through inlet gates from October to December that leads to the stopping of stocking of seeds of *Penaeus vannamei.* This findings demands further investigation of factors responsible for these species blooms in these waters and eye opener to fishery managers to tackle this substantial economic loss to this highly valued fishery production coast that possesses fishery of high valued Penaeids, Non-penaeids, Silver and Black pomfret as well as Vannamei shrimp farms.

Keywords: Cubozoan blooms, Box jellyfish, Maharashtra, India, Arabian Sea, *Chiropsoides buitendijki*, *Tripedalia cystophora*

Stakeholders perception on jellyfish blooms and effects on marine fisheries in Kerala state, India

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Marine fisheries stakeholders, from active fishers to vendors, have consummate experience in encountering and dealing with jellyfishes. Perception analysis was performed on the data obtained through a structured interview-based survey of 360 respondents with 60 stakeholders each from six maritime districts of norther, central and southern Kerala, namely, Malappuram, Thrissur, Ernakulam, Alappuzha, Kollam and Thiruvananthapuram. A weighted questionnaire with objective and subjective questions on jellyfish blooms and deleterious effect on fishers livelihood was used. Perceptions on diversity, seasonality, intensity of swarms, disruption of fishery, spoilage of catch, avoidance of swarms, reasons for proliferation, intensity of jellyfish stings and remedies were gathered. It is concluded that while the stakeholders have vast experience dealing with jellyfish, interventions have to be designed for minimizing the effect on fisheries as well as introduction of first aid practices among fishers with increased awareness through public awareness campaigns as an immediate requirement.

Keywords: Perception analysis, jellyfish interactions, fishers, Kerala

Theme 1:

Human-Jelly Interactions

POSTER PRESENTATIONS

Photo credit: **Biju Kumar**

Perceptual analysis of commercial fishery during jellyfish bloom along Mandapam coast of the Gulf of Mannar, South east Coast of India

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Jellyfish have been considered as menace to fisheries since they known to have adverse affects on the fishing operations of both mechanised and motorised crafts in many parts of the world. Common hindrances due to jellyfish swarming in fishing ground are relocation to avoid blooms, loss of fishing time, extra hauls and sorting time, painful stings and gear damage. The frequency and severity of this phenomenon have increased several times over the past 50 years. Potential causes of jellyfish blooms include overfishing, global warming, eutrophication, transport of exotic species in ballast water in general, and the monsoon effects in particular in the Gulf of Mannar. However, trawl fishers in the Gulf of Mannar expressed their hope on better pelagic fishshoals especially bigeye scad *Selar crumenophthalmus*,sawtooth barracuda *Sphyraena putnamae*, obtuse barracuda *Sphyraena obtusata*, black pomfret *Parastromateus niger* etc. during the peak season of *Cyanea* spp. bloom in June to August. Personal enquires were conducted to gather perceptions of trawl fishers in the Pamban Therkuvadi Fish Landing Centre. They observed jellyfish swarms during the first few hauls, followed by a heavy catch of pelagics at 26-30m depth off Mandapam. They also cited the occurrence of foraging fish shoals in jellyfish swarms. The landings from mechanised fish trawls were dominated by bigeye scad (34%), barracudas (16%) round scads (12%) and, Indian mackerel (3%) during the bloom period. The catch composition of finfishes was entirely different during the non-bloom period, as silverbellies, goatfishes, other carangids, especially trevallies, and pompanos, snappers, and groupers lethrinids, occurred more in the trawl landings. Continuous field monitoring as well as gut content analysis coupled with DNA sequencing would help to shed more light into impacts of jellyfish bloom on the commercial fishery.

Keywords: Bigeye scad, *Cyanea* spp., Mandapam, Pelagics, Trawl fishers

Jellyfish occurrences in the shrimp fishing grounds of Palk Bay and the Gulf of Mannar and their implications in the commercial fishery

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Swarms of jellyfish appeared in both Palk Bay and the Gulf of Mannar during the summer monsoon (April to June) in (mention year). Experimental bottom trawling was conducted in two locations: the Gulf of Mannar (9°05'47.1"N 79°11'51.7"; E9°05'45.5"N 79°06'25.4"E) on June 6, 2023, and Palk Bay (9°23'45.5"N 79°08'56.4"E; 9°28'33.5"N 79°10'07.9"E) on June 9, 2023, in the shrimp fishing grounds to assess the influence of jellyfish on fish and shrimp catches. The primary species targeted in both areas was the prawn, *Penaeus semisulcatus*. Each haul went on for 90 minutes in the Gulf of Mannar and 120 minutes in Palk Bay. The catches were segregated, and the species were identified. The jellyfish caught in the gear were measured and quantified. In both regions, silverbellies were more abundant in the catch. In Palk Bay, very minor quantities of shrimp (0.9 kg/ hour) and jellyfish were caught at 10 m depth. *Lobonemoides robustus* is an abundant jellyfish in this area, and the size ranges from 94 to 215 mm. In the Gulf of Mannar, the catch rate of *Penaeus semisulcatus* was 6.3 kg/h and three species of jellyfish, viz. *Cyanea lamarckii* (105-490 mm), *Rhopilema hispidum* (240-320 mm), and *Chrysaora chinensis* (46-112 mm), were found in the depth range of 22-24 m. Among these *Cyanea lamarckii,* was found to be the dominant and most abundant species in the Gulf of Mannar region. The SST and salinity recorded were in the range of 28.6-30.2º C and 33–34 ppt in the fishing grounds of Palk Bay and the Gulf of Mannar. In general, the perception of the fishermen is that there is less fish catch in the jellyfish areas, but in our experiment, the shrimp catch was observed to be normal in spite of the jellyfish abundance. The experimental trawling data shows that during the same period, the Palk Bay and Gulf of Mannar shrimp catches were very different. The shrimp catch in the Gulf of Mannar was 7 times higher than in Palk Bay for the same catch rate. This is contrary to the popular belief that the Palk Bay fishing ground is a shrimp ground; however, this scenario was observed during the changeover period of the monsoon, which is usually unpredictable. The long-term implications of jellyfish swarm in these two important ecosystems along the Tamil Nadu coastline can be understood through continuous monitoring which will help to formulate better management policy for the sustainable commercial fishing operations.

Keywords: Jellyfish, Fishing grounds, Shrimp fishery, Bottom trawl, Catch per hour

Policy perspectives on the present status and myriad challenges associated with the nascent jellyfish fisheries along India's Gujarat coast

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The study highlighted the present status of commercially harvested edible jellyfish species, their fishing operations, landings, economics, processing, and export in detail, evident from India's Gujarat coast. We discussed myriad challenges associated with nascent jellyfish fisheries from ecological, social, economic, technological and management perspectives. Previously underestimated jellyfish fisheries revealed huge potential in contemporary demand. The jellyfish fisheries along the Northwest coast of India were constituted by two edible emerging Scyphozoan species, *viz*., *Catostylus perezi* and *Rhopilema hispidum*. The fishing season fluctuated between March-May and October-December. Gujarat has become the primary jellyfish-producing state in India after Andhra Pradesh, followed by Kerala. The study provides baseline information and may further support the stakeholders engaged in decision-making. As landings were dynamic due to interannual variations, regular monitoring of the jellyfish fisheries was required to document the catch statistics as part of the national annual fisheries appraisal status. The study strongly recommends that India's jellyfish landings be incorporated into FAO's global catch statistics with the possible reconstruction of historical catches. This emergent fisheries study suggested jellyfish as future food and secondary raw material with the development of a better package of harvesting and processing practices. Creating consumer awareness about jellyfish with the development of local markets may enhance the jellyfish business in India. For the sustainability of the resource, co-management with a precautionary approach was suggested. The findings may help to improve our understanding of the jellyfish fisheries along the Northwest coast of India.

Keywords: Jellyfishing, Gujarat coast, Small-scale fisheries, Artisanal fisheries, Co-management

Impact of jellyfish bloom on trawl fishing sector: An Indian perspective

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Trawling is a major fishing method used in marine fisheries around the world, including India. In India, more than 50% of marine fish landing comes from the trawl fishing system. In recent years, there has been a steady rise of jellyfish blooms in estuarine and coastal waters of India. It is well known that jellyfish impact commercial fisheries which include the clogging, tearing and collapse of nets, loss of fishing days, physical injury to the fishermen and increased fuel consumption. However, quantitative information on the impact of jellyfish on the trawl fishing sector is lacking. To quantify the extent of damage caused by the jellyfish bloom in the trawling sector, a questionnaire has been prepared to assess the impact of jellyfish on the trawl fisheries of India. Information was collected from at least 30 trawl fishermen (15-single and 15-multiday trawlers) from major fisheries harbours (Okha, Porbandar, Veraval, Ratnagiri, Mangalore, Munambam, Kollam, Tuticorin, Chennai, Visakhapatnam, Paradeep, Jalada) of all maritime states of India. The questionnaire was set to collect details regarding the interaction of jellyfish and the associated loss. It was noticed that the jellyfish bloom peaks during the post-monsoon season, with a concurrent rise in fuel consumption (30 to 100 litres per day) due to increased drag caused by the capture of jellyfish. In the present study, the economic loss due to jellyfish blooms will be discussed as well as the strategies to mitigate their impacts on trawl fishing operations.

Key words: Jellyfish; Trawling; Economic loss; Marine fisheries; India

Diversity and abundance of jellyfish in Malaysia: Trends in a changing environment

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There is a strong consensus that a significant increase in jellyfish bloom incidents has been observed in marine ecosystems worldwide, which may indicate a state of environmental shift in the world's ocean. Despite being ubiquitous in the marine environment, studies on jellyfish taxonomy, biology and ecology are still considered new among countries in Southeast Asia. In Malaysia, there has been a rise in the reporting of jellyfish blooms, which are often associated with the decline of ocean health because of climate change and human driven factors. These jellyfish blooms cause undesirable impacts to some coastal anthropogenic activities, such as coastal tourisms due to fear of stinging threats, power plant operations as a result of blockage at cooling intakes, and commercial fisheries by damaging fishing nets and contaminating trawl catches. Here, studies and reports on jellyfish blooms in Malaysia will be reviewed, particularly in providing insights on their most recent updates on their diversity, abundance, and occurrence of blooms in relation to climate change and how the coastal environment of Malaysia has changed over the last two decades. Discussion will also highlight on problems of species identification and resolving taxonomic ambiguities, issues of harmful jellyfish stings and the sustainability jellyfish fisheries.

Keywords: Scyphozoa, Cubozoa, Blooms, Climate change, Fisheries

Interference of jellyfish in shrimp aquaculture in Palghar district

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Shrimp aquaculture plays a crucial role in the economy of the Palghar district, providing a sustainable source of income and employment to numerous farmers. However, the industry has been recently besieged by a concerning phenomenon - the invasion of jellyfish. During the winter seasons, farmers in the region have been grappling with significant challenges posed by the rapid multiplication and invasion of jellyfish within aquaculture facilities. This unforeseen and unexplained escalation of jellyfish presence has raised serious concerns, leading to substantial losses in shrimp culture productivity and profitability.

This abstract outlines the pressing issue of jellyfish interference in shrimp aquaculture in the Palghar district and aims to shed light on the potential causes and consequences. The study analyzes the factors contributing to the proliferation of jellyfish populations within aquaculture farms during the winter season, seeking to unravel the ecological and environmental triggers behind this unusual phenomenon. The impacts of jellyfish invasion on shrimp culture are multifaceted. First and foremost, the jellyfish pose a direct threat to shrimp populations, preying on juvenile and adult shrimp, thus hindering their growth and survival rates. This has resulted in diminished shrimp yields and reduced overall profitability for farmers. Moreover, jellyfish-related stings and injuries have been reported among aquaculture workers, further exacerbating the challenges faced by the industry. The present study also explores the potential ecological consequences of this imbalance in the marine ecosystem. The unchecked multiplication of jellyfish may disrupt the natural balance of marine organisms, affecting the overall biodiversity of the region. Understanding these complex ecological interactions is critical for devising effective mitigation strategies to safeguard both shrimp aquaculture and the surrounding marine environment. This study emphasizes the urgent need for comprehensive research and proactive measures to address the interference of jellyfish in shrimp aquaculture. Sustainable and environmentally friendly solutions must be developed in collaboration with local authorities, aquaculture farmers, and marine scientists. The findings of this research can serve as a foundation for the formulation of targeted policies and practices, mitigating the negative impacts of jellyfish invasion and ensuring the long-term viability of shrimp aquaculture in the Palghar district.

Keywords: Shrimp aquaculture, Jellyfish invasion, Ecological triggers, Environmental factors.

Polyp elimination method to effective and inexpensive jellyfish bloom control

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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

Impacts of citizen science on jellyfish-human interactions: A case study of Israel and Malta

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Engrained cultural values and behaviors influence how people interact with the sea and the animals within it, citizen science provides an avenue to change environmental based biases and attitudes. Jellyfish in the Mediterranean are viewed with numerous cultural perspectives, depending on species, geographical area, frequency, and severity of annual swarms. This research focused on understanding the social values and perceptions of Israeli and Maltese societies towards their gelatinous neighbors, and if citizen science as a form of environmental education can influence these social benchmarks. Theoretical frameworks from human-animal studies, animal studies and anthro-zoological research were employed to identify regional attitudes impacting the outcomes of these programs. Ethnographic methodologies of participant observation and interviews were used to identify relevant cultural characteristics. Ecological regulations, impacts of news media and historical environmental practices all impact the effect of citizen science on the populations. Both countries are impacted by jellyfish presence throughout the year, but the increased importance of summer recreation creates a human seasonal problem. Physical encounters with jellyfish in connection zones (i.e., beaches, aquaira and the open sea) influence the practices and behaviors of citizen scientists and lay member of society. The hypothesis is the use of citizen science can positively impact the perception of jellyfish within the marine ecosystem. The outcome of this study bear importance to the management of public mental and physical health and wellbeing, to decision-making processes in related industries such as coastal tourism, as well as raising awareness to cultural impacts of citizen science projects.

Keywords: Citizen Science, Cultural Values, Environmental Education, Physical Encounters, Jellyfish, Mediterranean

Jellyfish alert in Observadores del Mar: A citizen science initiative to expand jellyfish knowledge

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Observadores del Mar is the leading marine citizen science platform in Spain with more than 10 years promoting knowledge and understanding on the conservation and health status of marine ecosystems. Nowadays, Observadores del Mar has more than 5,000 volunteers, more than 450 organizations involved in different ways and more than 21,000 observations. The platform involves 17 different projects that gather information on different taxa being one of these the Jellyfish Alert project, which is focused on collecting observations about jellyfish presence mainly in the Spanish Mediterranean and Atlantic areas. The aim is to collect data that allow the analysis of temporal and spatial trends of the most common jellyfish species present in the study area. In addition, the platform works as an early detection and alert tool for the presence of exotic and invasive species and has received very interesting observations regarding jellyfish. Currently, the Jellyfish Alert project has received more than 2,000 observations of which 86% have been validated individually by the expert team, including 36 different species in more than 15 countries, mainly along the Mediterranean basin. Observadores del Mar is considered a valuable citizen science tool, providing reliable scientific information on jellyfish presence and other taxa, while allowing citizens to collaborate and get involve in marine sciences at the time of contributing to ocean literacy and jellyfish knowledge.

Keywords: citizen science, jellyfish blooms, Observadores del Mar, Jellyfish Alert

La Mar de Medusas: An educational and outreach project to expand ocean literacy through the world of jellyfish

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"La Mar de Medusas" is an educational and outreach project aiming to promote: a) scientific knowledge about jellyfish blooms and anthropogenic activities with consequences over marine ecosystems, and b) scientific vocations in girls and young women through the role model of women researchers. The methodology consisted in training actions for teachers of upper-primary cycle during the 2020-2021 school year, in two geographical Spanish areas: Asturias and Catalonia. The participants received 20-hour training and were provided with support materials. Then, they chose how to apply what they have learned to their class group. Various resources were developed: the table game "The Jellyfish Message", a species identification guide with first-aid protocols and support dossiers including theory on the entire world of jellyfish and various practical suggestions. The results included many proposals and experiences shared among 20 educational centers with more than 50 teachers directly involved and their social realities respectively. Moreover, actions through social networks, face-to-face and webinar-type workshops, and dissemination materials and questionnaires to contribute to the understanding and improvement of ocean literacy, helped reach in overall more than 10,000 people. Herein we present a successful case study of an ocean literacy approach for bringing marine scientific knowledge to the educational field. The resources developed have been openly distributed to help increase jellyfish knowledge and adopt responsible attitudes towards marine conservation. Nevertheless, we stress the importance of developing long-term ocean literacy strategies with enough resources that allow the integration in educational contexts and the continuity of this type of efforts.

Keywords: Ocean literacy, Scientific education, Jellyfish blooms, Scientific vocation

Targeting zero waste: when jellyfish become circular

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Human food security and the sustainability of food production systems are among the main concerns together with the consequences of climate change, pushing towards food systems based on the principles of the circular economy. An ideal circular food system uses neglected resources, implements processes with low environmental impact, and is able to use byproducts for further uses. In this framework, we suggest to use non-edible jellyfish or byproducts of jellyfish food processes, as sources of organic and inorganic components in regenerative agriculture. Indeed, marine-derived fertilizers can help to mitigate the negative impact of chemical fertilizers on the environment. To test jellyfish biomasses as potential organic fertilizer, we used *in vitro* cultures of *Arabidopsis thaliana* as a model plant grown under laboratory conditions. We tested seed germination and seedling growth in the presence of MS-medium or agar only, supplemented or not with different concentrations of dried *Rhizostoma pulmo* jellyfish. The jellyfish supplement was able in a dose-dependent manner, to improve performance (i.e., germination, Vigor Index) as compared to the controls. Interesting results were obtained in absence of MS-medium, in which the control seeds (agar and seawater) were not able to germinate and grow, while in presence of jellyfish supplement the seeds were able to germinate and the seedlings to develop almost normally. The supplement of jellyfish, directly or somehow processed, could replace traditional agricultural practices to protect and restore natural ecosystems, contributing to improving the edaphic quality of poor soils and fertilizing crops known for their tolerance/resistance to salt stress.

Keywords: Circular economy; Jellyfish-based fertilizers; Bioactive compounds

Better in captivity or wild? Upside-down jellyfish as potential biofactories

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The zooxanthellate jellyfish *Cassiopea andromeda* is among the first marine immigrant that over 100 years ago crossed the Suez Canal to become established in the Mediterranean Sea. We previously demonstrated that it contains valuable bioactive compounds such as fatty acids (mainly PUFAs as DHA, EPA, and oleic acid) and pigments produced by the photosyntethic dinoflagellates hosted as endosymbionts. Here we compared jellyfish cultured under laboratory conditions with wild specimens sampled in Sicily, Italy, for a) the hosted symbionts' molecular identity, number and density, and for b) their content of protein, phenols, lipids and pigments in the holobiont biomass. Using an established protocol, total extracts and their fractions were biochemically characterized and analyzed for their antioxidant activity. We found wild jellyfish showed a higher content of proteins, lipids and a richer composition of polyunsaturated fatty acids, whereas cultured jellyfish showed a higher content of phenols and antioxidant activity. We discuss the role of the endosymbiotic dinoflagellate metabolism in determining the *Cassiopea* holobiont biochemical composition, and the possible improvement of rearing conditions, also in light of their potential application as functional food, feed, and as source of bioactive compounds, in line with the goals of the blue-green economy.

Keywords: Bioprospecting; Zooxanthellae; bioactive compounds; jellyfish cultivation

Drones and artificial intelligence for jellyfish blooms monitoring

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Jellyfish blooms pose global challenges, demanding efficient monitoring. This abstract discusses the integration of drones and artificial intelligence (AI) for improved jellyfish bloom assessment. Drones provide a cost-effective, adaptable platform for extensive aquatic data collection, overcoming spatial and temporal limitations. Coupled with AI, this approach enables real-time image analysis, automating jellyfish detection, classification, and quantification. AI models, trained on diverse datasets, enhance accuracy in species differentiation and life stage identification. The benefits of this integration are threefold:

1. Real-time surveillance enables early bloom detection and prompt countermeasures.
2. Comprehensive spatial and temporal data offer insights into bloom dynamics and influential factors.
3. Reduced manual labour expedites data processing and decision-making.

Nevertheless, technical challenges need addressing, including drone stability, image processing complexity, and algorithm refinement. We must also consider Ethical concerns such as data privacy, regulatory compliance, and ecosystem impact. The synergy of drones and AI revolutionizing jellyfish bloom monitoring will lead to likely bloom prediction and increase the chances of well-managed mitigation measures in commercial fisheries and best management practices in coastal aquaculture farms. This innovation empowers stakeholders with timely, data-driven insights for sustainable marine ecosystem management. As technology advances and interdisciplinary collaboration grows, this integrated approach promises a pivotal role in understanding and mitigating jellyfish bloom impacts.

Keywords: Drones, Jellyfish, Image analysis, AI

Seasonal variation in jellyfish landing along the coast of Calicut, Kerala, southwest coast of India

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The jellyfish landing in single-day trawlers operated from Puthiyappa Fisheries Harbour, Calicut, India were observed during the period from January to December 2022. The estimated total landing of jellyfishes per day in September 2022 was 19,483 kg. The estimated total landings of jelly fishes was 15,052.80 kg/day in October 2022, 12,448.80 kg/day in November 2022 and 13,554.00 kg/day in December 2022. The landing of jellyfishes in single-day trawlers at Puthiyappa subsequently decreased during January and February 2023 (4,368 kg/day and 2,160 kg/day in January and February 2023 respectively). The number of trawlers operated in August 2022, just after the trawl ban period was less due to the abundance of jellyfishes in coastal waters and the fishers were reluctant to go for fishing. Among the jelly fishes, *Chrysaora* spp. was the predominant one in the landings of single-day trawlers. The diversity of jellyfish species along the coast of Calicut and the problems faced by the fishers during excess blooming of jellyfishes are discussed in this paper.

Keywords: Jellyfish, Trawl landings, Seasonal variation, Calicut coast

An update on the jellyfish swarming dynamics along the southern coast of Kerala

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Jellyfish is a common name given to the medusa phase of certain gelatinous members of the subphylum medusozoa, a major part of the phylum Cnidaria. The present investigation on Jellyfish diversity and distribution has recorded ten species of scyphozoans belonging to 7 families and one each in class Cubozoa and Hydrozoa during the observation period from 2017-2021. The entire coastline was surveyed to determine the extent of the scyphozoan jellyfish bloom and its dynamics. Collections were mostly from the fishing gears beach seine and ring seine. The recorded species are; *Acromitus flagellates, Crambionella* spp., *Chrysaora* spp. (4 different morphological types), *Marivagia* sp., *Cyanea* sp., *Cephea* sp., *Netrostoma* sp., *Thysanostoma* sp., *Lobonemoides* sp., *Rhopilema hispidium* (Class Scyphozoa), *Chridropoides buidjenki* (Class Cubozoa) and *Aqequora* spp. (Class Hydrozoa). Most common species encountered in the study was *Acromitus flagellates, Crambionella* sp. *Chrysaora* spp, *Netrosoma* sp. and *Cyanaea* spp. Occurrence of the genera *Cephea, Thysanostoma,* and *Rhopilema* was very rare and others were less frequent. During post-monsoon month's *Crambionella* sp. swarming recorded an average of 200-800nos/net which is mostly high in October and November. *Chrysaora* spp. may go up to thousands in each haul. Blue jelly, *Netrosoma* sp. swarming marked the start of the season in July- August followed by *Chrysaor*a spp and *Crambionella* sp. till December-January. The beach seine operation hauls in several tons of jellyfish during the season, creating a troublesome situation for the fishers. Swarming dynamics of scyphozoan jellyfishes have a great influence on the coastal ecosystem, as some are filter feeders and others are piscivores/carnivores. Global warming, decline in the population of predatory fish species and turtles due to overfishing can be a reason for the proliferation of jellyfish swarms. Although a number of environmental issues, such as climate change, pollution, overfishing of predatory fish, and an increase in artificial structures in the sea that support an increase in larval settlement, are associated with an increase in jellyfish blooming, an integrated approach to address all aspects of the concern is crucial.

Keywords: Scyphozoa, Swarming, Beach seine, Blue jelly

Exploring jellyfish movement and seasonality on the Spanish coast through public participation using *MedusApp*

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The Western Mediterranean (WM) Sea harbors diverse jellyfish species with significant ecological, economic, and social implications. Understanding the biogeographical patterns of these species is essential to manage fisheries, coastal industries, and marine ecosystems effectively. However, limited knowledge and measurement challenges hinder successful management strategies. Citizen science emerges as a valuable solution by engaging volunteers in data collection, contributing to research, raising awareness, and facilitating policy implementation. The present study utilized MedusApp, a citizen science app, to document the spatial and temporal distribution of jellyfish in the WM. MedusApp collected jellyfish data through user reports. Results showed an increase in sightings over the years, but the jellyfish intensity (JI) remained stable, indicating no significant rise in jellyfish abundance. Species-specific findings highlighted shifts in abundance and distribution. For instance, the spatial distribution of *P. noctiluca* exhibited a northward shift, while sightings of *R. luteum* around the Balearic Islands suggested potential geographic expansion, warranting further investigation. MedusApp's data facilitates socio-economic impact mitigation through species-specific measures. Overall, citizen science aids in effective jellyfish management, enabling predictive models for distribution and benefiting various stakeholders, including bathers, fishers, and aquaculture operators. Through citizen engagement, MedusApp stands as a valuable tool for advancing marine conservation and understanding jellyfish dynamics in the WM region.

Keywords: Jellyfish, Citizen science, Mediterranean Sea, *Pelagia noctiluca*, *Rhizostoma luteum*, Spatial and Temporal distribution

Harnessing the power of computer vision to provide early warning of gelatinous zooplankton in fish farms

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Incursions of gelatinous zooplankton into fish farms cost the global finfish aquaculture industry hundreds of millions of dollars annually via stock losses and increased production costs. Venomous medusae cause gill pathologies, skin lesions, and can kill farmed fish, and blooms of non-stinging gelatinous taxa (e.g. ctenophores and salps) can occlude nets and cause deoxygenation. Early detection is essential to enable managers to rapidly respond to and mitigate gelatinous zooplankton in fish pens. Fish pens are routinely monitored using underwater cameras and gelatinous zooplankton are often visible in the video footage. A convolutional neural network is being trained to detect and identify gelatinous zooplankton in videos streamed from inside the fish pens of Tasmania's salmon industry. The model is trained to identify different problematic taxa, including *Aurelia aurita* (Scyphozoa), ctenophores and salps by annotating gelatinous zooplankton in video frames. Establishing a video library of different gelatinous zooplankton, in a range of environmental conditions is essential to develop an accurate model. The computer vision monitoring system will be an essential decision-support tool to mitigate the impacts of gelatinous zooplankton on farmed fish in Tasmania and a vital tool to remotely monitor gelatinous zooplankton as fish farms move offshore.

Keywords: Artificial intelligence; Deep learning; Finfish aquaculture

Theme 2:

Bio-inspiration / Envenomation

ORAL PRESENTATIONS

Photo credit: **Joan J. Soto Angel**

The missing links between jellyfish and microbes in the ocean realm

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Due to their evolutionary age jellyfish (hereinafter cnidarian subphylum Medusozoans and phylum Ctenophores) are probably one of the first partners with which microbes established relationships. Due to their ubiquitous distribution, simple anatomy and alteration between different life stages, jellyfish might harbor and interact with taxonomically and metabolically diverse microorganisms throughout their life. Different life stages of jellyfish can serve as host for diverse microbial communities, with specific microbiota associated with different jellyfish body parts. Jellyfish can also exert top-down control over the ambient microbial populations. Via production and release of Dissolved Organic Matter (DOM) and inorganic nutrients, living jellyfish can induce bottom-up effects on the ambient microbial community. Finally, at the end of their life span, jellyfish can represent a source of Organic Matter (OM) for pelagic and/or benthic microbial communities. Yet, the link between jellyfish, jellyfish-derived OM and microbes remains largely underexplored. By merging the power of metagenomic and metaproteomic approaches we provided first insights into the metabolic network operated by jelly-OM degrading microbial consortia. We show that the ambient bacterial community needs to operate a complex metabolic network in a temporal cascade of biochemical reactions to degrade jellyfish-bloom-specific compounds. Our findings indicate that specific chemical and metabolic fingerprints associated with decaying jellyfish blooms potentially alter the functioning and biogeochemistry of marine systems. The jellyfish-microbe interactions must be further investigated to better understand the implications for the biogeochemical state and functioning of marine ecosystems and to constrain and balance the ocean-carbon budgets.

Keywords: Jellyfish, Microbes, Host-Microbiome interactions, Biodegradation, Metagenomics, Proteomics, Biogeochemical cycles

Cubozoan envenomation: Mechanisms, models and management

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Stings by certain species of box jellyfish (Cubozoan) are associated with a range of outcomes including life-threatening Irukandji syndrome and lethal acute cardiovascular collapse. The purpose of this study was to elucidate-, as well as to compare and contrast-critical mechanisms of action of specific species of carybdeid and chirodropid cubozoan venoms to inform first aid and clinical management. Venom dose-, and time-dependent pathologies were observed in mice and piglets after exposure to venom from a carybdeid cubozoan known to induce Irukandji syndrome, *Alatina alata*, and compared with venoms prepared from acutely lethal chirodropids of *Chironex* sp. Further, the topical and systemic effects subsequent to the application of live cubozoan tentacles were documented. Both live tentacle stings and intravenously injected venom, induced effects on cardiovascular and pulmonary function, as well as hematologic markers. Piglets showed a dose-dependent spectrum of responses ranging from metrics consistent with clinical Irukandji syndrome to acute lethal cardiovascular collapse from either carybdeid or chirodropid venom exposure. In both cases, acute cardiovascular collapse was associated with plasma potassium levels comprising lethal hyperkalemia. A lower dose range was determined at which animals consistently demonstrated transient elevations in heart rate, selected cytokines, catecholamines, and dopamine, all clinical markers of Irukandji syndrome. Finally, histological examination of venom exposed piglet tissues showed massive infiltration of alveolar tissue in lung as well kidney consistent with clinical case presentations in human sting cases. Taken together, these data demonstrate comparable dose-dependent outcomes comprising cubozoan envenomation syndromes and suggest highly conserved venom porin driven pathophysiology.

Keywords: Cubozoa, Box jellyfish, Irukandji syndrome, Chironex, Alatina alata

Good stings come in little packages: 3D imaging the nematocysts of the Australian big box jellyfish *Chironex fleckeri* and the Irukandji *Carukia barnesi*

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Cnidarians possess a unique arsenal of weaponry unlike any other creature in the animal kingdom. Their weapons of choice are microscopic stinging organelles called nematocysts, delivering venom through a combination of ballistics and barbed tubules. Here we take the two most venomous jellyfish on the planet, the Australian big box jellyfish *Chironex fleckeri* and the Irukandji *Carukia barnesi* and exhibit their nematocysts as 3D models accurate to the nanometer. This project scanned and 3D printed both the discharged and undischarged nematocysts in an effort to fully understand the ecological role of these organelles and further comprehend the role venom injection plays in sting victims. Traditional light microscopy is unsuitable as it does not have the resolving power to visualise the fine spiked structures of the injecting tubules, nor the internal structures, as the nematocysts are less than 100µm in length. Therefore, we used state of the art Serial Block Face Scanning Electron Microscopy to image the nematocysts, by which ultrathin (50nm) slices were cut from individual nematocysts, imaged and then digitally processed to generate authentically detailed, biologically accurate 3D models. By producing a 3D realisation of the nematocysts, we can determine the true venom delivery mechanism for each of these medically important species, providing significant advancement in the knowledge and understanding of not only the venom ecology of these animals, but potentially its direct action in human envenomation. Here we present the humble nematocyst as you've never seen it before.

Keywords: Nematocyst, Box jellyfish, Irukandji, 3D model, Microscopy, Sting

Dynamics of jellyfish swarms: Unraveling the ıntricate ınfluence of coastal ocean parameters in the south eastern arabian sea

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The dynamics of jellyfish aggregation are captivating ecological phenomena that bear significant ecological and socio-economic implications. This study aims to unravel the intricate relationships between key factors such as Ekman transport, Ekman pumping, wind stress curl, alongshore wind stress, chlorophyll concentration, temperature, and salinity distribution, and their collective impact on the patterns of jellyfish aggregation. Of particular significance is the role of upwelling and downwelling phenomena, which are vital mechanisms driving nutrient exchange and distribution. Upwelling events bring nutrient-rich waters to the surface, fostering conditions conducive to plankton growth, a crucial component of the jellyfish diet. Ekman transport and pumping, influenced by prevailing winds, contribute to the movement of nutrient-rich waters, affecting the availability of resources that sustain jellyfish populations. The interplay of wind stress curl and alongshore wind stress not only influences nutrient availability but also shapes the horizontal distribution and aggregation of jellyfish swarms. Chlorophyll concentration serves as an indicator of primary production, directly affecting jellyfish prey availability and, subsequently, their abundance and distribution. The vertical distribution of temperature and salinity, indicators of water column structure, plays a crucial role in determining the depth range at which jellyfish species thrive. These parameters influence behaviours such as vertical movement and diel migration, ultimately contributing to the spatial aggregation patterns of jellyfish. Through a comprehensive exploration of these coastal ocean parameters, this research enhances our understanding of the intricate dynamics governing jellyfish swarms in the South Eastern Arabian Sea. The insights gained have implications for marine ecosystem management, fisheries, and coastal communities, providing a foundation to address the potential impacts of changing oceanic conditions.

Keywords: Ekman transport; South-west coast of India; Upwelling; Downwelling; Jellyfish blooms

Jellyfish fishery in Sri Lanka

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Jellyfish are generally considered as trash in commercial fisheries but in certain areas of the world, especially in Asia, some of the jellyfish species are harvested for human consumption. Even a seasonal jellyfish fishery practices in Sri Lanka, it had not been studied. In this context, we surveyed the jellyfishes during 2016 to 2020 around the Sri Lankan coastal belt and found two occasionally harvested edible jellyfish species, namely 'ball-type' (*Crambionella orsini*) and 'white-type' (*Lobonemoides gracilis*). The fishing for the 'ball-type' is a group activity practised with mechanised boats in the sea off the southeast coast of Sri Lanka while the 'white-type' is mainly targeted by individual fishers by using non-mechanised canoes in lagoons of the northwest coast of Sri Lanka. Both the 'ball-type' and 'white-type' individuals are harvested during the southwest monsoon period which falls from June to September in the country. Of these catches, bells and arms of both the species are separated and processed with alum-salt mixture following five steps: (1) cleaning (soaking + washing); (2) first curing; (3) second curing; (4) sorting; and (5) packing. The average production quantities and export value of 'ball-type' jellies were estimated as 614.10 ± 584.77 tons and 0.92 ± 0.89 million USD, respectively per year. For the 'white-type' jelly, the average production quantity and value were found to be 10.98 ± 2.08 tons and 0.02 ± 0.00 million USD, respectively per year. China, Taiwan and Vietnam are the main buyers of processed jellyfish products in Sri Lanka.

Keywords: Edible jellyfish, Plankton fisheries, Processed seafood, South Asia

A universal first aid solution to eliminate continuous stinging of jellyfish at the beach

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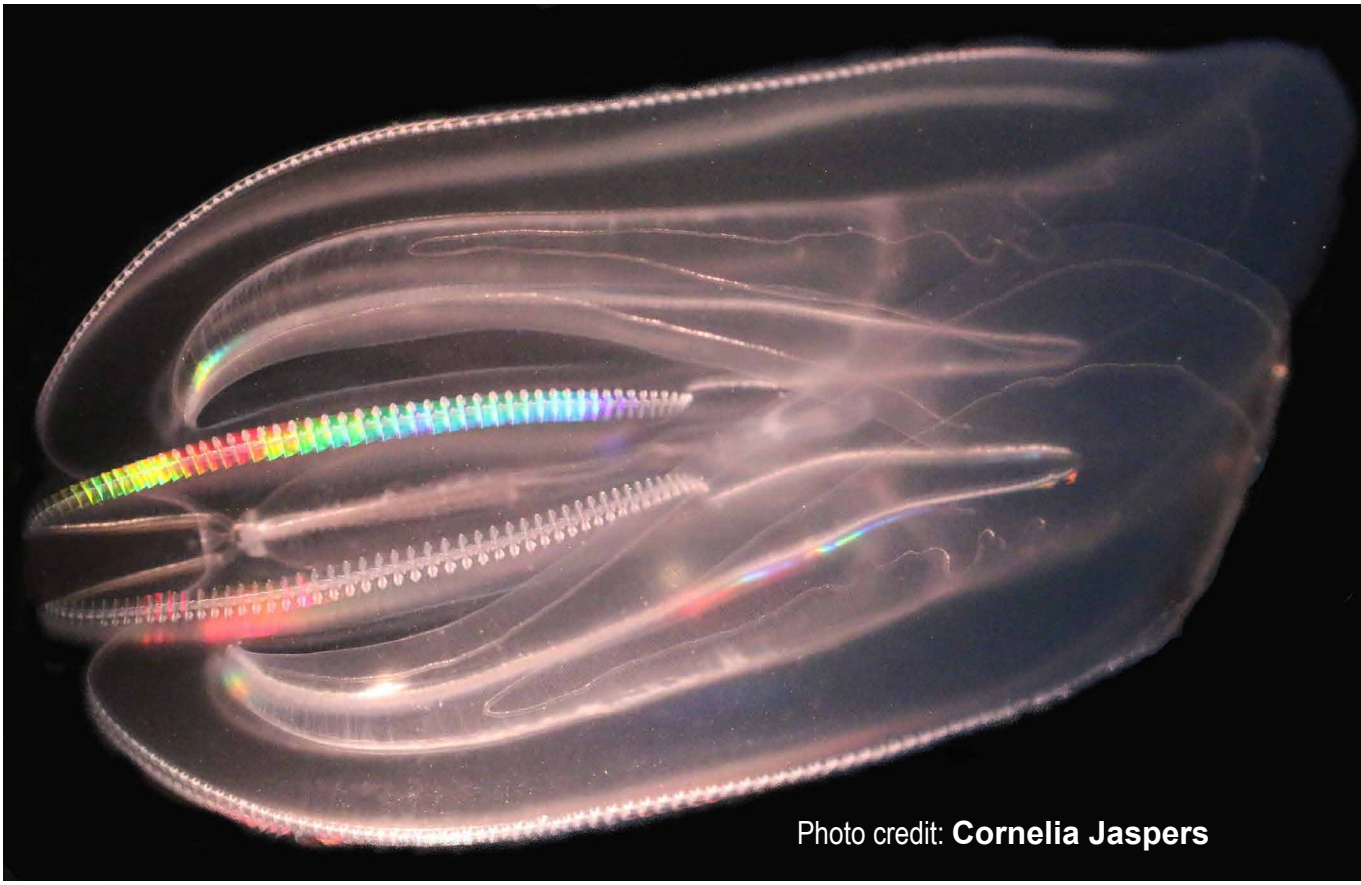
Nematocytes, the cnidarian stinging cells, pose a significant threat to public health, affecting millions of people and resulting in local and systemic reactions, including fatalities. Immediate first aid treatment can effectively inhibit ongoing stinging. First Aid treatments vary based on the jellyfish species are confusing. One controversial example is treating victims with vinegar, which inhibits many Cubomedusa stings but activates stings of Scyphomedusa. This research aims to develop a novel/single approach using inhibitors to block nematocyst discharge in Cnidaria. We identified three crucial events in the discharge cascade as potential targets for inactivation, aiming to prevent stings: A. Antagonists were employed to block nematocyte surface channel membranes, preventing the transduction signaling triggered by jellyfish prey or human skin. B. Inhibitors were utilized to modulate the action potential that activates nematocysts. C. Inhibitors were applied to reduce the high osmotic pressure (150 bar) within the nematocyst capsule. In this study, we explored the efficacy of potential inhibitors in blocking nematocyst discharge in two major classes of jellyfish species: Scyphomedusa and Cubomedusa. Our bioassay included tentacles containing batteries of nematocytes that were treated with the different inhibitors and than tested for activation. The potential of the inhibitors to prevent jellyfish stings was assessed by using an activator, such as Isopropanol. Our results demonstrate, for the first time, that the suggested inhibitors effectively hinder nematocyst discharge in both Cubomedusa and Scyphozoan species. This discovery represents a significant advancement towards developing a universal treatment approach for jellyfish stings encountered at the beach.

Keywords: Jellyfish sting, Nematocyst discharge, Inhibitors, First Aid

Theme 2:

Bio-inspiration / Envenomation

POSTER PRESENTATIONS



Physalia physalis in the Mediterranean Sea. A management tool to predict its spread

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The oceanic siphonophore *Physalia physalis* has repeatedly entered the Mediterranean Sea through the Strait of Gibraltar during recent years, being successively transported and distributed to different regions of that basin. When these floating colonies arrive at coastal areas during peak tourism periods there are large economic and health costs. In this work, advanced particle tracking Lagrangian models were applied to simulate the dispersion and beaching of *P. physalis* colonies within the Mediterranean. Observations from two high-presence years (2010 and 2013) were used as calibration dataset and an additional high-abundance record (2018) was employed as validation for the models. The calibrated and validated model set-up was used to construct a statistical inference dataset and extraction tool (Physalia-SIM) that allowed assessment of the likelihood of *P. physalis* arrival to any given coastal region of the Mediterranean Sea (with 97% accuracy) only by knowing their entrance time through the Strait of Gibraltar. The Physalia-SIM is a free-access, easily-useable tool by any stakeholder interested in knowing the probability for *P. physalis* presence in their particular region of interest. Moreover, this tool can help to provide warning as early as 3–4 months before the actual *P. physalis* presence is likely to occur. By making use of this prognosis tool, local and regional managers and stakeholders could take the necessary actions in order to minimize the economic and health impacts of the presence of these organisms in their coastlines.

Keywords: Lagrangian modeling, Coastal management, Risk assessment

Management of jellyfish envenomation through *Jelly-Safe* First-aid kit – Lessons learnt and future directions

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In India, incidents of jellyfish envenomation are rarely recorded through any monitoring network. Since 2017, a network of scientists from the Central Marine Fisheries Research Institute (CMFRI) has been collecting details of jellyfish sting incidents and advocating for the usage of the *Jelly-Safe* first aid kit developed by CMFRI to alleviate the agony caused. *Jelly-Safe* is a first-aid kit made from commercially available components that has been refined for use in jellyfish sting care. The *Jelly-Safe* Kit includes seven items: gloves, vinegar, a jellycard, caladryl lotion, forceps, a JellyFish ID guide, and a user guide. The user guide instructs the sufferer on how to administer first aid in the event of a jellyfish sting, and the ID guide in local languages assists in identifying the type of jellyfish. This *Jelly-Safe* package is offered in nine different languages, catering to fishermen and tourists throughout India's coastal region. A three-pronged strategy for dealing with a jellyfish sting was used in the development of the *Jelly-Safe* kit. The nematocyst is first inactivated by the vinegar, which stops the release of more venom. The jellycard and forceps are useful for removing visible tentacles from the infected area, and the Calamine lotion helps to soothe burning and itching. The usage of *Jelly-Safe* in the field has resulted in a number of case reports, which are addressed in this study.

Keywords: Jelly Safe, First aid kit, Jellyfish sting, Envenomation, Vinegar

Distribution of jellyfishes and the proximate analysis of edible jellyfish *Crambionella annandalei* (Rao,1931) from Mudusalodai, Tamilnadu, South-East Coast of India

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The Jellyfish are commonly found in tropical sea waters. Jellyfish are coming under the Phylum: Cnidaria and are abundantly available in the Indo-Pacific region. This present study aimed to enumerate the species diversity from Mudusalodai Landing Centre (Lat: 11 29 29 N. Long: 79 56 2 E. Lan:), Tamilnadu, South-East Coast of India. We have recorded 4 species of Jellyfish-*Porpita porpita*(Linnaeus,1758),*Chrysaorahysoscella*(Linnaeus, 1767, *Crambionella annandalei*(Rao, 1931), and *Aurelia spp*. (Lamarck, 1816) based on their morphological features during the month of January– March 2023. We collected 32 numbers of Jellyfishes with four species the genus *Porpita* was more dominant. The *Crambionellaannandalei* and *Porpita porpita* were identified as blooming species. Besides, the physico-chemical parameters of water samples were also recorded during this study. Of course, no significant changes ($p>0.05$) were observed in the physicochemical parameters due to the pre-summer session. Further, the bell part of edible Jellyfish (*Crambionella Annandalei*) was used for preparing aqueous extraction to perform proximate analysis. The protein, carbohydrate, lipid, ash, moisture & salt content was estimated as 56±2.5%, 12.7±1.2%, 8.3±0.2%, 17%±0.5, 94.8%±1.3, 5±1.7%. This present study revealed that the moisture and the protein content were found as maximum among other components. Thus, the present study may create awareness among fishermen and the public to know their nutraceutical values as edible species. Thus, people can consume edible Jellyfishes with clean and care to avoid their sting.

Keywords: Diversity, Pre-monsoon, Edible jellyfish, Proximate analysis

Jellyfish : Bio inspiration and its application

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Jellyfish is a dome –shaped invertebrate with flexible motion ability, different from other fishes in anatomy and morphology. It is a simple yet complex organism with no brain bones or eyes and its unique mechanism to flow and catch prey, some have the ability to turn back their biological clock also , This unique ability has inspired scientists to research them because of possible ramification treatment of humans as well .There is a Jellyfish called as immortal jellyfish (Turritopsis dohrnii) which displays death-defying abilities which could spur discoveries about human aging.Jelly fish are a source of medical collagen which can be used in wound dressing and reconstructive surgery. All jellyfishes are not homogeneous as they posses different qualities such as freshwater jellyfish called hydra has tremendous survival extinct. It can survive despite being chopped to pieces in a blender,this property can be used in healing wounds. Comb jellies, the deadliest jellyfish, is being researched to make bio and other stranger weapon. Jellyfish have immense usage in the medical field as they produce protein called aequorin that has the power to scavenge calcium from nerve cells as we age. Jellyfish have green fluorescence protein which causes bio-luminescent used for gene insertion to other cells, bio sensing and drug delivery. Its application has immense use in numerous fields of sciences. Jellyfish fertilizer is used to improve soil conditions. Its principle of efficient swimming mechanism has motivated engineers to develop soft robots for observing climatic changes under sea. Soft robots can also be used in surgery and rehabilitation. Based on the food finding behavior of jellyfish JSO(Jelly fish search optimizer) has been developed which solves wide range of optimization problems while outperforming many meta heuristics in wide range of benchmark function. It can also be used in conjunction with other artificial intelligence related techniques. Jellyfish mucus has an absorbing property that can catch micro plastics that are present in water that makes it a great material for filtering micro plastic materials and a gelatinous solution to plastic waste. GFP(Green fluorescent protein) used by Jellyfish is another useful product for scientists through which scientist could study how neuron grow and connect,and to mark neuron affected by plaques that are hallmarks of Alzheimer disease. . A novel Undulatory propulsion strategy has been developed for underwater vehicles and robots which aims to use the stingray undulating mechanism more thoroughly. This structure is more efficient than the existing undulatory water robots. .In India soft robot concept and research is in its infancy , Jelly fish robots was developed by IIT Indore to monitor marine life.In other countries soft robots are used such as the remote controlled robot was launched in the waters of Sid Bou Said port (Tunisia) to clean the marine litter floating in the sea. Traditional Chinese medicine utilized jellyfish as a treatment for bronchitis, high blood pressure, asthma and gastric ulcer.Researchers at California Institute of Technology are using jellyfish to make discoveries in the areas of biology, deep sea dynamics and engineering. Jellyfish bio inspiration has immense potential and they remain a fascinating mystery to be discovered. It can be used to create cutting edge technology that offers a promise towards a sustainable and efficient future.

Keywords- Jellyfish , Bio inspiration , Robotics

Jellyfish-based smart wound dressing devices

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Although the negative consequences of the global phenomenon of jellyfish (JF) swarms are well recognized, the use of their biomass for practical applications is mostly limited to a niche in the Asian food industry. This fact is quite surprising since JF's biomass comprises useful biomaterials such as Q-mucin glycoprotein and collagen. In this work, the JF biomass, collected from two different species, is used to prepare electrospun scaffolds composed of nonmetric "core–shell"-type fibers, in which adjustment of the electrospinning process parameters can easily control their mechanical, morphological, and chemical properties. This nonwoven scaffold shows excellent biocompatibility and biodegradability, indicating suitability for biomedical research contexts. Performed cell proliferation assays show that the scaffold could support the growth of cardiac cells, fitting the requirement of tissue engineering. Additional incorporation of in situ-generated silver nanoparticles in these nanofibers produced mats with potent antibacterial properties. Preclinical trials with the resulted mats on porcine wound healing models exhibit fast and complete healing of wounds. In summary, we demonstrated the ease of use of JF's biomass as a biodegradable and biocompatible raw material for producing antibacterial mats. Our approach reflects a new paradigm, which suggests exploiting the JF as an accessible, cheap, and valuable renewable material that can be used in various applications, such as cosmetics, medical devices, and bioplastics. We strongly believe that further exploration of this route may help to reduce the negative consequences of JF bloom, reconstruct fishery-based economics, and contribute to maintaining the ecological balance in marine environments.

Keywords: Scaffold, Electrospun, Biomaterials, Biopolymers, Collagen, Q-Mucin.

The natural product chemistry of gelatinous zooplankton

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Natural products are secondary metabolites that serve ecological functions rather than maintenance of cellular functions. These compounds can be synthesised or sourced through diet or symbioses with algae, bacteria or fungi. Many chemical groups have been isolated from benthic marine invertebrates, but little to no research has been done on gelatinous zooplankton. Apart from cnidarians, which have cnidocytes, most gelatinous zooplankton lack structural defences, relyingon transparency to camouflage themselves in the pelagic environment. Gelatinous zooplankton, therefore, are prime candidates for producing natural products. Crude extractions were obtained from 14 Cnidaria, 3 Ctenophora, 2 Heteropoda and 4 Thaliacea, analysed using two different approaches: identifying compounds masses and comparing fragmentation data against a feature-based molecular-networking tool, and compound separation with subsequent structural elucidation. Relatively few natural products were found and only in very small concentrations, and future studies of a greater diversity of gelatinous zooplankton would provide a more comprehensive representation of the presence and diversity of marine natural products in gelatinous zooplankton. 1,2,3,4-tetrahydro-β-carboline-3-carboxylic acid and β-carboline, indole alkaloids with antitumour, antimicrobial and anti-inflammatory properties, were identified through compound separation and structural elucidation in the scyphozoan *Catostylus mosaicus*. More natural products were identified through compound mass and fragmentation data, including Norharman/β-carboline in the hydrozoan *Aldersladia magnificus*, but structural elucidation following compound separation is required to identify the compounds in conjunction with compound mass and a greater biomass of tissue is required. β-carbolines enhance the genotoxic and toxic effects of other compounds, which could be linked to potency of nematocysts in cnidarians.

Keywords: Gelatinous zooplankton, Natural products, Jellyfish, Chemistry

Feasibility of using *Rhizostoma pulmo* (Cnidaria, Scyphozoa) as bioindicator for marine plastic pollution

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Microplastics have emerged as a global concern due to their ubiquity, persistence and toxicity to both humans and wildlife. Hence, monitoring their distribution is a key step in risk assessment of marine environments. The aim of this study was to assess the effectiveness of the scyphozoan *Rhizostoma pulmo*, one of the most abundant and widely distributed jellyfish in the Mediterranean Sea, as a potential bioindicator for these pollutants. Jellyfish and seawater samples were collected from two distinct locations (Valencia and Dénia) on the Spanish coast, 100 km apart. After separating the umbrella from the tentacles and mucus, the microplastics found within the specimens and seawater were classified by size, shape and colour using a stereomicroscope. Microplastics (N=182) were detected in approximately 80% of the total analysed organisms (N=61), ranging from 1 to 11 particles/individual, with no significant differences between the parts examined, with black and transparent fibres predominating (about 60%). The average quantity of microplastics found in specimens from Valencia was statistically higher than those from Dénia (6.42 particles/individual compared to 2.57), but their abundance in the water samples was lower (0.15 particles/m^3 versus 0.43). In seawater, black and white fragments along with transparent and white pellets, were the most prevalent, accounting for 78% of the total. Conversely, black and transparent fibres constituted less than 7%. In summary, while microplastics were indeed confirmed in the gastrovascular cavity of *R. pulmo*, this species is unsuitable as a bioindicator because the microplastics found were not representative of those available in their environment.

Keywords: Microplastics, Bioindicator, Jellyfish, Mediterranean sea, Schyphozoa, Pollution

What is your favorite food? Growing the upside-down jellyfish *Cassiopea andromeda* under different laboratory diets

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The zooxanthellate *Cassiopea andromeda* (Forskål 1775) is native to tropical environments throughout the Red Sea and the Indian Ocean, recently it is arrived in the Eastern and Central Mediterranean Sea as a lessepsian immigrant. *C. andromeda* can be easily reared in aquaria with crustacean nauplii, making this species a model organism to the jellyfish research community. However, knowledge on its dietary plasticity and optimal nutrition is still scant. Here we report on growth rates of juvenile *C. andromeda* jellyfish upon different food items, over a nine-week exposure. Five aquaria were set up with 10 specimens for aquarium of *C. andromeda* juveniles each exposed to standard 12:12 light cycle, and heterotrophically fed to satiety respectively with the following prey items: a) the crustacean nauplii of *Artemia franciscana*, b) the green microalga *Spirulina maxima*, c) a lyophilized feed based on the tube worm *Sabella spallanzanii* d), a dense suspension of freshly squashed *Mytilus galloprovincialis*. A fifth aquarium was set with jellyfish were exposed to light, but no heterotrophic prey was added. Jellyfish fed with *A. franciscana* showed the highest growth (i.e., increase in bell diameter) up to 24.68 ±2.89 mm, followed by specimens fed with mussels, *Sabella* feed, *Spirulina*. Jellyfish without a heterotrophic input (light only) grew the least (3.37±1.47 mm), and five specimens died during the third week. These data corroborate the need for a heterotrophic input to the *Cassiopea* holobiont, calling for further investigation to diversifying the diet and identifying the best conditions to keep the upside-down jellyfish in captivity.

Keywords: Symbiotic, Heterotrophic, Upside-down jellyfish, Aquaculture, Holobiont.

First evidence of microplastics in the jellyfish along the North West coast of India

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The issue of plastic pollution in nearshore ecosystems has prompted a crucial exploration into the effects of microplastics (plastics <5 mm) on marine organisms, specifically the benthic scyphozoan jellyfish species Chrysaora caliparea and Cubozoan Box jellyfish Chiropsoides buitendijki along the North West coast of India. Through a comprehensive process involving 10% KOH digestion, filtration, density separation, microscopy-based enumeration, and micro Fourier-transform interferometer (μFTIR) analysis, we have discovered microplastics present in these jellyfish. Among the 120 specimens examined, 85.17% harbored microplastics. The abundance of MPs in Chrysaora caliparea and Chiropsoides buitendijki was 13.29 MPs items/individual and 9.14 MPs items/individual respectively, while in coastal waters it was 407.8 ± 105 items/L. Notably, the distribution of plastic densities and bell diameter exhibited significant variation among locations, with the highest values in individuals from Karanja, followed by Manori and Versova. Remarkably, μFTIR analysis confirmed the predominance of synthetic microfibers, primarily Polyethylene and polypropylene, across all three locations. Their presence was established in both the gastrovascular cavity and mucus of the jellyfish, potentially designating jellyfish as microplastic sinks and bioindicators for future assessments of microplastic contamination. These findings underscore the potential implications for jellyfish health, cascading effects on their predators, human consumption concerns, as well as implications for carbon and microplastic transport in the water column. Additionally, the prospect of exploiting jellyfish mucus as a novel bioflocculent material for microplastic sequestration in aquatic environments emerges as a noteworthy consideration.

Keywords: Jellyfish, Microplastics, Pollution, FTIR

Could jellyfish become another product/resource in Cameroon-Guinea Gulf and other African Coastal Countries?

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Jellyfish species are known for their socio-economic and environmental impacts worldwide. However, in the coastal region of Cameroon, there is limited information available on species diversity and impacts. Despite this, there have been numerous complaints about their proliferation, including mild to severe stinging events, competition and predation on fish, and increased labor during fishing due to their abundance. This study aimed to investigate the usefulness of jellyfish species found along the Kribi-coastal region in comparison to their negative impacts. A survey was conducted to assess the perception of jellyfish by local communities and to record the on-site impacts of their proliferation. Catostylus tagi, Catostylus sp2, and Catostylus sp3 were sampled from the by-catch products of beach-seine fishing, oven-dried at 60°C, and their proximate and mineral composition were analyzed. This poster presents the recorded impacts of jellyfish proliferation in Cameroon's coastal waters, the proximate and mineral composition of species from the genus Catostylus, as well as their potential utilization. Overall, the proximate composition showed higher nutrient and energy content than reported for species from the same genus. No heavy metals known to negatively affect human health were found. However, rare minerals were detected, including lanthanides (Terbium-Tb, Neodymium-Nd, Lutetium-Lu), uncommon transition metals (Rhodium-Rh, Chromium-Cr, Platinum-Pt, Palladium-Pd), a noble gas (Argon-Ar), a metalloid (Germanium-Ge), a halogen (Bromine-Br), as well as common macro- and microminerals found in foodstuffs (Fe, Cu, Zn, P, Ca, K, S). These results suggest that jellyfish species from Cameroon's coastal region can be used as a nutrient source for the well-being of coastal communities who depend on the sea for food and livelihoods.

Keywords: Jellyfish, Impacts, Proximate composition, Mineral

Effect of seed priming with jellyfish *Chiropsoides buitendijki* powder on seed germination and seedling establishment of maize and watermelon

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Jellyfish populations are increasing rapidly worldwide by making blooms. Despite their negative impacts, Jellyfish have potential benefits in many areas including agriculture. The potency of jellyfish *Chiropsoides buitendijki* in seed priming to enhance seed germination and seedling establishment of maize (*Zea mays*) and watermelon (*Citrullus lanatus)* was studied. Three concentrations (T1, T2, and T3) of Jellyfish liquids were prepared by dissolving oven dried Jellyfish powder (0.4g, 0.5g, and 0.6g per 40mL of DW) in distilled water. After 12 hours of soaking period of seeds (n=20) in each treatment and control, Petri plate method was conducted to determine seed germination. Seedling emergence and establishment were tested by sowing seeds on trays filled with sterilized sand. Appearance of sprout was counted for 14 days after initiation and seedlings were tested for vigor. Soaking maize seeds in Jellyfish liquid did not inhibit the normal seed germination confirming that *C. buitendijki* has no lethal effect on seeds when used as a seed primer. Seedling emergence of jellyfish-treated maize seeds were higher than the control experiment, and a significant increment in root length was recorded, ensuring better establishment. All Jellyfish-treated watermelon seeds had significantly higher maximum germination percentage, maximum emergence, and Seedling Vigor Index than the control group ($p<0.05$). However, there were no significant differences among treatments except seedling emergence percentage of T1 than T2 and T3 in watermelon. The treated watermelon seeds germinated and emerged three times more rapidly than the control group. *C. buitendijki* powder can be successfully used for seed priming to overcome the seed germination delays by enhancing seed germination, seedling emergence and establishment of maize and watermelon.

Keywords: Jellyfish, Maize, Watermelon, Seed priming, Germination, Emergence

Diversity, seasonality and impacts of jellyfish blooms in coastal waters of Sri Lanka

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The rapid increase in jellyfish blooms reported worldwide has posed a serious threat to marine ecosystem services. A survey was conducted along the north, west, and northwest coasts of Sri Lanka from January 2021 to June 2023 to identify the diversity and seasonality of jellyfish blooms. The impacts of jellyfish blooms were investigated using a semi-structured interview (n=50). A total of 12 jellyfish species belonging to 11 families were reported in this study. Seasonal and spatial variations in jellyfish blooms were identified. A mixed bloom of *Lynchnorhiza malayensis*, *Chrysaora* sp. and box jellyfish was reported in the southern part of the west coast from January to Mid-April and July to September. Huge blooms of *Acromitus flagellatus* and *Marivagia stellata* appeared from March-July and January-April, respectively in the northern part of the west coast. The northwest coast was dominated by *Phyllorhiza* sp. and *Rhopilem hispidum* blooms from January to April and an invasive bloom of *Cassiopea andromeda* was found in the north and northwest coasts throughout the study period. Jellyfish blooms reported some negative impacts on fisheries, tourism, and diving practices. Fishers (72%) complained about the reduced catch rates due to entangling of jellyfish and damages to fishing gear. Incidences of jellyfish stings and allergies were reported by 42 respondents. Bad smell (62%) and beach pollution (42%) impacting the the aesthetics value were mainly highlighted by the tourists. Effective utilization of these jellyfish blooms is one of the solutions to tackle growing jellyfish influx.

Keywords: Jellyfish blooms, Sri Lanka, Utilization

Jellyfish envenomation in Indian coastal waters: A case study and comprehensive review

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Envenomation due to jellyfish stings in Indian waters is a topic of significant concern for public health. However, a lack of comprehensive data on jellyfish stings in India makes it crucial to document such cases for better understanding and management. In this context, we present two case studies involving encounters with box jellyfish stings during fishing operations in the coastal area in Tamil Nadu (South India). The first case study, involving a 35-year-old male who encountered jellyfish sting by a box jellyfish during seine fishery at Tsunami Nagar, highlights the risk that fishermen face while pursuing their livelihoods. The second case study, involving three fishermen engaged in hand-picking of shrimps near Tuticorin Old Fishing Harbour, further emphasises the severity of box jellyfish stings. The unfortunate death of two of the fishermen serves as a tragic reminder of the potential lethal consequences of encountering certain species of jellyfish. The involvement of citizen science in the post-investigation of the survivors and in identification of the possible sting species are discussed in the paper. Through this study, we seek to underscore the dangers associated with jellyfish stings, particularly in coastal regions of India. We aim to contribute to the existing knowledge base by sharing these case studies and reviewing the current and recommended approaches for assessing and managing envenomation cases from Indian waters. By shedding light on this issue, we intend to raise awareness and improve the overall response to jellyfish stings in the coastal regions of India.

Keywords: Public health, Sting management, Box jellyfish, Southeast coast of India

Toxin metalloproteinases exert a dominant ınfluence on pro-inflammatory response and anti-inflammatory regulation in jellyfish sting dermatitis

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Toxin metalloproteinases are the primary component responsible for various toxicities in jellyfish venom, and there is still no effective specific therapy for jellyfish stings. The comprehension of the pathogenic mechanisms underlying toxin metalloproteinases necessitates further refinement. In this study, we conducted a differential analysis of dermatitis mouse model induced by jellyfish *Nemopilema nomurai* venom (NnNV) samples with varying levels of metalloproteinase activity. Through skin tissue proteomics and serum metabolomics, the predominant influence of toxin metalloproteinase activity on inflammatory response was revealed, and the signal pathway involved in its regulation was identified. In skin tissues, many membrane proteins were significantly down-regulated which might cause tissue damage. The expression of pro-inflammatory factors was mainly regulated by PI3K-Akt signaling pathway. In serum, many fatty acid metabolites were significantly down-regulated which might be the anti-inflammation feedback regulated by NF-κB p65 signaling pathway. These results reveal the dermatitis mechanism of toxin metalloproteinases and provide new therapeutic targets for further studies.

Keywords: Jellyfish sting, Metalloproteinase, Differential analysis, Signal pathway, Dermatitis mechanism

Temporal trends in jellyfish stings along the Spanish Coast: A 15-year analysis of the standardized *Sting index*

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This study analyzes marine incidents reported to lifeguard stations (LGS) on Spanish Mediterranean beaches over 15 years, building on the work of Bordehore et al. (2016). Central to our research is the Sting Index, which represents the ratio of jellyfish stings to other incidents, as a means to standardize the data by accounting for variations in beachgoer numbers. From 2008 to 2022, there were 366,685 jellyfish stings, constituting 59.12% of all incidents reported by LGS. This means that approximately 6 out of every 10 marine-related incidents were attributed to jellyfish stings, underscoring their significant role in marine safety. While the Sting Index showed a decline over the 15-year timeframe, peaking in 2012 and reaching its lowest in 2019, other injury incidents remained notably stable. The stability of other incidents over the years suggests uniform reporting and consistent risk factors for non-jellyfish-related incidents, coupled with a steady number of beachgoers. Interestingly, the years 2018 to 2022 saw significant fluctuations in the Sting Index, indicating variability in the relative frequency of jellyfish stings compared to other incidents. Ongoing research in this field offers invaluable insights into the temporal and spatial evolution of jellyfish populations. By discerning trends in the Sting Index and other incidents, beach authorities and local governments are better positioned to enhance safety measures, initiate public awareness campaigns, and optimize resource allocation.

Keywords: Jellyfish, Sting, Management, Lifeguard assistance, Mediterranean sea

Diet effect on the development of the ephyrae of the jellyfish *Cotylorhiza tuberculata* (Scyphozoa)

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The jellyfish *Cotylorhiza tuberculata* (Scyphozoa) inhabits the Mediterranean Sea and is very popular in European aquaria. It also abundant in some coastal areas and the species is commonly known as "fried egg jellyfish". Feeding is one of the most critical and major points for obtaining healthy populations in controlled environments. The present study explores the effect of five diets (nauplius, EVO, Easy Booster, and phytoplankton) on the growth and mortality of *C. tuberculata* ephyrae, with the aim of identifying the most suitable diet to guarantee their correct development. The results showed that a nauplius-based diet caused significant positive differences in the growth of the ephyrae compared to feeding the other diets. Mortality was minimal (<15%), except for the group fed phytoplankton diet, which showed a very high rate (95%). Our results may help to maintain, under better conditions, populations of *C. tuberculata* in aquaria controlled environments.

Keywords: Scyphozoa, Jellyfish, *Cotylorhiza tuberculata,* Ephyra, Feeding, Growth, Mortality

Theme 3:

Associatons & Ecology

ORAL PRESENTATIONS

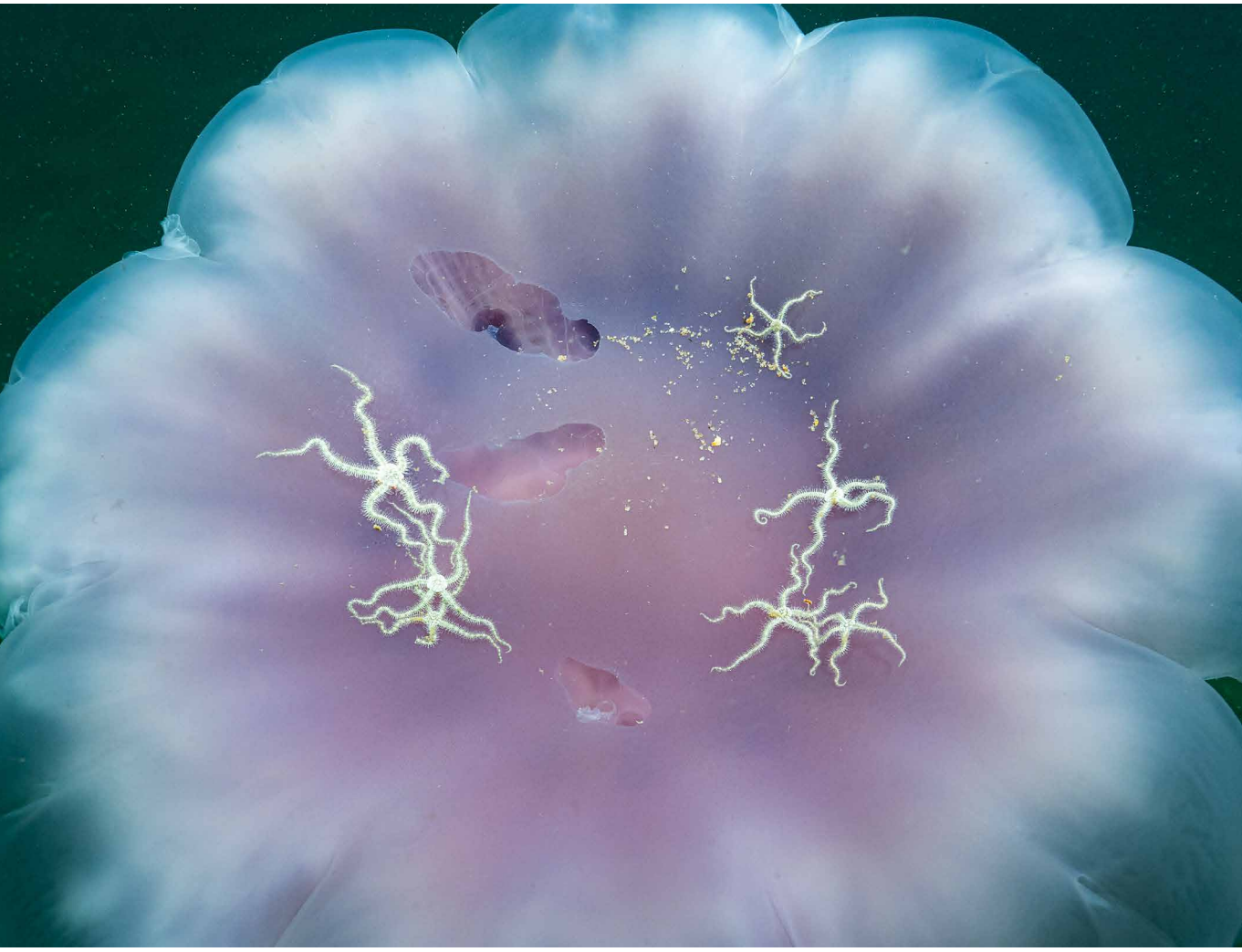

Photo credit: **Umeed Mistry**

Do gelatinous zooplankton traits facilitate population outbursts under global change?

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Lately, gelatinous zooplankton organisms, especially jellyfish, have raised large public attention as they are regarded to be 'winners' of global change, negatively impacting coastal ecosystems and human welfare while being deemed a dead end in the food chain. However, the scientific knowledge-base supporting these paradigms is weak and, in general, gelatinous zooplankton are disregarded in most marine food web studies. Gelatinous zooplankton span a wide range of taxonomic groups in the animal tree of life ranging from the most basal metazoans to higher evolved close relatives of vertebrates. They are often lumped under the term 'jellyfish' and share the trait of a mostly dilute carbon content, a soft, transparent body texture and the fact that they are severely understudied and even disregarded in most food-web models and biological oceanography investigations. Irrespectively, they can have important functions in marine food webs, contributing more to secondary production than classical crustacean zooplankton and are important food source for early life stages of commercially important fish species such as Bluefin Tuna and European Eel. Global change is expected to lead to wide ranging changes of the oceans, impacting food-web structure, carbon flow and secondary production, with consequences for the human exploitation of marine resources. In this talk I will outline some observed and anticipated changes of jellyfish and other gelatinous zooplankton groups. By presenting results from laboratory studies, experimental evolution investigations, field observations and whole genome re-sequencing analyses, I aim at outlining how species traits differ, how they can adapt to differing global change scenarios and what the consequences might be for the productivity of our future oceans.

Thermal influences on the life cycle recruitment of the upside-down jellyfish, *Cassiopea* sp., in a tropical shallow embayment

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Ocean warming is a growing concern for marine organisms as sea water temperatures rise, critically influencing jellyfish life cycle and population dynamics. Despite significant attention to temperate jellyfish, only a few studies have focused on tropical species, which experience narrower temperature ranges. In this study, two laboratory experiments were conducted to investigate the effects of warmer temperatures (27, 29, 31, 33, and 35°C) (1) on planular settlement (7 days) and (2) on polyp's reproductive responses (30 days) of the upside-down jellyfish, *Cassiopea* sp. Results showed that higher temperatures (33 and 35°C) significantly increased the percentage of planular settlement compared to the ambient temperature (31°C) and lower temperatures (27 and 29°C). The percentage of polyps that strobilated was significantly higher at 27°C as compared to 33°C, where budding was more predominant. Notably, at 35°C, no polyps strobilated or budded, and all died on the 15th day. This study suggests that warmer months (i.e. summer months) in the tropics strongly promotes polyp recruitment through enhanced larval settlement and asexual budding. In contrast, medusae recruitment through strobilation occurs during the relatively cooler months. These results highlight the sensitivity of *Cassiopea* sp. to narrow temperature variations, particularly in their reproductive behavior. As temperatures increase due to climate change, understanding how other tropical populations respond to such shifts can provide insights into their ecological resilience and adaptability in a changing environment.

Keywords: Jellyfish, Scyphozoan, Life cycle, Temperature, Tropics

Directional jellyfish swimming revealed from Lagrangian analysis of drone footage

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The predictability of outbreak and dispersion of jellyfish is limited by a gap in our understanding of their movement. Although there are evidences that jellyfish may actively affect their position, the role of active swimming in controlling jellyfish movement, and the characteristics of jellyfish swimming behavior, are not well resolved, largely due to the difficulty to collect the required observations over large numbers of individuals. Here we address this challenge through Lagrangian analysis of drone-based footage, which provides the time-varying synoptic perspective necessary for investigating collective movement of aggregated animals. Focusing on *Rhopilema nomadica* as a model organism, we show that the movement of jellyfish is controlled by distinctly directional swimming patterns, which are oriented against the direction of surface gravity waves. The behavior of the individual jellyfish translates into a synchronized directional swimming of the aggregation as a whole away from the coast, potentially reducing the risk of stranding and providing jellyfish with an adaptive advantage contributing to their survival. Our results emphasize the importance of active swimming in regulating jellyfish movement, and open the way for a more accurate representation of jellyfish movement in model studies, thus improving the predictability of jellyfish outbreak and dispersion.

Keywords: Jellyfish movement, directional swimming, Lagrangian analysis, drone-based remote sensing

The influence of photosymbiosis in *Cassiopea xamachana* regenerative success

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The regenerative capacity of Scyphozoans (Phylum Cnidaria) has been relatively understudied. The model organism *Cassiopea xamachana* hosts photosynthetic dinoflagellate symbionts in the host's motile amoebocyte cells. A handful of studies have reported regeneration in the polyps of C. xamachana, but the mechanisms underlying regeneration have not been fully explored. Despite undergoing drastic developmental changes when symbiotic, the effect of symbiont presence and species on host regeneration has never been explored. *C. xamachana* polyps were decapitated when aposymbiotic, and symbiotic with both a homologous and a heterologous symbiont species. Regeneration and asexual budding were observed, and EdU labeling was performed to observe patterns of cell proliferation in regenerating polyps. The presence of symbionts increased likelihood to regenerate, yet symbiont species did not affect success of regeneration. No blastema or dividing cells were observed, implying cell proliferation is not the primary mechanism behind regeneration in polyps of *C. xamachana*.

Keywords: Scyphozoa, Wound healing, Upside-down jellyfish, Cell proliferation, Regeneration, Symbiodiniaceae

Environmental factors affecting the population dynamics of moon jellyfish *Aurelia coerulea* in Ise Bay, Japan

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Outbreaks of moon jellyfish *Aurelia* are frequently reported from many parts of the world's coastal areas, and can have severe effects on coastal ecosystems and human enterprises, such as fisheries and coastal power plant operation. Therefore, mechanisms that cause the outbreaks are of ecological and scio-economic interest: however, the environmental factors, which affect their population dynamics, have been rarely investigated *in situ* mainly due to the lack of time-series data of *Aurelia* population dynamics. To clarify the environmental factors affecting *Aurelia coerulea* population dynamics, we analysed the relationship between *A. coerulea* population dynamics and possible environmental factors in Ise Bay, Japan. The nine-years (2003–2011) abundance data of the polyps and medusae were obtained from Hamada (2014). Medusa abundance was correlated with polyp abundance in the preceding winter ($r = 0.85$), and we treated the residuals of medusa abundance from the linear regression equation between medusa and polyp abundances as the index of mortality during ephyra stage. We also obtained data of river discharge, SST, SSS, phytoplankton abundance, and large-scale climate indices (ENSO, PDO, PNA, and AO) as potential environmental factors. Polyp abundance was correlated with PDO of the previous summer ($r = -0.75$). Ephyra mortality was correlated with the spring river discharge ($r = -0.78$), which could indicate high ephyra dispersal to offshore due to enhanced water exchange during high river discharge. Thus, the inter-annual fluctuation of medusa abundance is suggested to be explained by the combination of large- (PDO) and regional- (river discharge) scale climate indices.

Keywords: Climate, Polyp, Ephyra, Medusa

Evaluating environmental influences on *Acromitus flagellatus* Maas, 1903 jellyfish blooms in southwest Indian backwaters and estuaries

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Jellyfish blooms, caused by the intricate interplay between biological and environmental elements, have drawn much interest because of their effects on the environment, the economy, and society. Through extensive field surveys and visual counts conducted over 2016-2019, we collected data on the abundance of the estuarine jellyfish *Acromitus flagellatus* Maas, 1903 (Cnidaria: Scyphozoa). Statistical analyses were applied to establish correlations and potential causative relationships between environmental variables and jellyfish bloom occurrences in pre and post-monsoon seasons. The abundance of *A. flagellatus* recorded an increase from 2016 to 2019, and the abundance was higher during the post-monsoon season in the northern part of Kerala, while in the estuaries and backwaters of southern Kerala, it was higher in the pre-monsoon. There was a linear increase in jellyfish blooms in all four years under study. Principal Component Analysis revealed the relation between the abundance of *A. flagellatus* with the hydrographic parameters in the four years of pre- and post-monsoon seasons. Multiple regression analysis showed a positive correlation between *A. flagellatus* abundance and temperature, chlorophyll-*a*, pH, and $NO3^-$ content, while NO_2 and PO_4^{3-} did not affect the jellyfish abundance. The abundance of *A. flagellatus* increases with increasing temperature, chlorophyll-*a*, pH, and $NO3^-$. In India, the blooming of *Acromitus flagellatus* causes serious trouble for local fishers and mussel farming. Seasonal abundance of *A. flagellatus*, ecological changes, and impacts on the local estuarine fishery are discussed. By deciphering the triggers of *A. flagellatus* blooms, stakeholders can better predict and mitigate their impacts on local fisheries, tourism, and overall ecosystem health.

Keywords: Scyphozoa; Bloom; Estuary; Hydrography; Fishery

The hidden gastrovascular system of Rhizostomeae: Innovative methods of study

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Nowadays, it is evident how much jellyfish can interfere with human activities and the provision of ecosystem goods and services. Thus, a better knowledge of jellyfish anatomy and physiology could help to understand blooms presence, mechanisms, and impacts. However, few data about shape and function of rhizostomean gastrovascular system are available. The major issue is that gastrovascular systems are still studied on preserved specimens with traditional methods like stain injections, dissections, external observations, whose accuracy is limited by jellyfish thickness, opacity, and, moreover, they can't provide tridimensional information about their structure. So, we aimed at creating an innovative protocol for the investigation of jellyfish gastrovascular systems combining resin endocasts and X-ray computed microtomography to obtain a three-dimensional physical and digital reproduction of jellyfish inner structures which avoided the limitations of older techniques and allowed the analysis in a complete quantitative way. We tested our protocol on *Rhizostoma pulmo* and *Cotylorhiza tuberculata*, since the order Rhizostomeae possess a complex gastrovascular structure. Our results confirmed that making resin endocasts is cheap and feasible, while X-ray microtomography provides data like volume, length, thickness and connectivity of canals which were impossible to obtain with traditional methods. The 3D rendering of the imaged specimen also allows the observation of deep areas and the quantification of thinner/numerous features, such as the canal branching and terminal openings. Last, once a 3D volume reconstruction is made, it can be shared and analyzed everywhere, compared to sample delivery which is one of the most limiting factors in jellyfish field.

Keywords: Rhizostomeae, Gastrovascular System, Circulation, Endocast, X-ray computed tomography, 3D imaging.

Differential effects of PAR and UVA on *Cassiopea andromeda* jellyfish respiration, oxidative stress, and photosynthesis

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Sunlight is essential for cnidarians with symbiotic zooxanthellae. In contrast to ultraviolet-B (UVB) and photosynthetic active radiation (PAR) effects on symbiotic cnidarians, the effects of ultraviolet-A (UVA) remains poorly understood. Therefore, we investigated the impacts of UVA on metabolic, oxidative, and photosynthetic responses of *Cassiopea* jellyfish under different PAR intensities. For eighteen days, twenty-four jellyfish were equally distributed into four exposure-groups (i.e., low PAR (±UVA), high PAR (±UVA). All groups exhibited statistically significant, however comparable, increases in mass and bell diameter. Irrespective of UVA, the intensity of PAR (*per se*) significantly affected photosynthesis and cellular respiration rate parameters, with higher chlorophyll-a concentrations ([chlorophyll-a]) and activity of the mitochondrial electron transport system (ETS) under low PAR. Furthermore, ETS correlated positively with [chlorophyll-a] but negatively with jellyfish mass. In contrast, both PAR and UVA had significant effects on lipid peroxidation (LPO), and their interaction resulted in increased LPO ($P < .05$), particularly under high PAR, where it was 69% higher than under low PAR. Nonetheless, the substantial rise in oxidative stress under high PAR suggests a synergistic interactive effect with UVA radiation. In all groups, jellyfish growth remained consistent, but variations in coloration, driven by varying PAR intensities, suggested changes in algal symbiont density. This demonstrates the robust adaptability of Cassiopea jellyfish to varying light conditions, and their resilience to cope with environmental changes. The study highlights the pivotal role of light, especially PAR, in influencing physiology and ecology of marine invertebrates like jellyfish, unveiling their complex responses to environmental radiation.

Parasites as trophic indicators of predation on gelatinous zooplankton

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The significance of gelatinous zooplankton as prey in marine food webs is underestimated because gelatinous zooplankton have low calorific value and are difficult to identify in predators' guts. Trematode parasites may be useful for identifying predators of gelatinous zooplankton because they infect multiple hosts in their life cycles and are transferred from intermediate hosts (including gelatinous zooplankton) to definitive hosts (usually vertebrates) via predation. Host specificity of trematodes is usually conserved, and these life cycles only develop from long-term associations between predator and prey. We tested the utility of trematodes as trophic tracers by extracting metacercariae (the second intermediate stage of the trematode life cycle) from 384 gelatinous zooplankters, including medusae, ctenophores, salps and heteropods collected from southeast Queensland waters and oceanographic voyages along Australia's east coast. ITS2 rDNA and *cox*1 mtDNA data were generated for all host/parasite combinations. Sequence data for trematode metacercariae extracted from gelatinous hosts were compared to published and unpublished databases of sequences of adult trematodes from fishes. Sequences for multiple species of metacercariae infecting gelatinous zooplankton matched those of adult trematodes infecting pelagic, coral reef, and inshore teleost fishes. Some fishes were known predators of gelatinous zooplankton but some novel predators, including several tropical pomacentrid fish were identified, revealing those fish may prey opportunistically on gelatinous zooplankton. Our results highlight that gelatinous zooplankton are a major food source for some fish, that gelatinous zooplankton are important vectors of parasites to fishes, and that parasites are novel and useful trophic tracers of predators of gelatinous zooplankton.

Keywords: Trophic ecology; endoparasites; digeneans

Spatio-temporal variations in jellyfish catch of bagnets in Maharashtra, India.

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A study was carried out to understand the spatio-temporal variations in the jellyfish catch of coastal bagnets in Maharashtra and the influence of environmental variables. Fishing experiments and evaluation of environmental parameters were conducted monthly at four stations for two years, and the data were divided into four pre-determined seasons *viz.,* winter monsoon (WM), spring inter-monsoon (SI), summer monsoon (SM) and fall inter-monsoon (FI). Study observed a 5.69% average annual contribution by jellyfishes in bagnets, with maximum occurrence during FI and minimum during SM. *Chrysaora* and *Chiropsoides* were the two major genus recorded during the study. The average catch of jellyfish during different seasons from the stations ranged from 0 to 9.68 kg/haul and the percentage composition varied from 0 to 15.97 ± 1.76. No significant spatial variation was observed in the percentage composition of jellyfishes, however, there was a significant ($P<0.05$) seasonal variation. Among the seasons, significantly higher percentage composition of jellyfishes was observed during FI period and significantly lower percentage composition was observed during SM. During the summer monsoon season, heavy rain and runoff reduce the salinity and temperature in coastal water bodies. The sudden rise in temperature and salinity during the subsequent season might have favoured the bloom of jellyfishes during FI. During FI, zooplankton density was also found to be comparatively high at all the studied stations favouring the bloom of Jellyfishes. After the monsoon fishing ban for 61 days along the northwest coast of India, fishing pressure may suddenly increase. This leads to the over-exploitation of fishery resources creating a vacant ecological space for the jellyfishes to propagate. Thus, heavy fishing after the fishing ban period might have positively affected the jelly populations by increasing the zooplankton available to them due to the depletion of forage fishes (mackerels, sardines, anchovies etc) that primarily feed on zooplankton. The information from the study could be used as baseline data for framing management measures for a sustainable bagnet fishery along Maharashtra Coast.

Keywords: Bagnet, Temporal variation, Fall Inter-monsoon, Bloom

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Convergent oceanographic slicks as potential habitat for jellyfishes

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Jellyfishes, especially dangerous 'Irukandji' species, impact Ningaloo Reef's significant tourism industry in Western Australia. Dozens of people are hospitalised every year but the distribution of Irukandji and other jellyfishes at Ningaloo Reef is poorly known. Oceanographic slicks, which are convergent features that accumulate organic matter and host high pelagic biodiversity, may also provide habitat for jellyfishes, including Irukandji species. We tested the hypothesis that jellyfishes were more abundant inside than outside slicks. Twenty-four slicks were sampled over three 'jellyfish seasons,' in offshore waters using 100 metre video transects to detect multiple jellyfish taxa, and water samples for environmental DNA analysis. Three video transects and three water samples were collected inside and outside each slick. The environmental DNA samples were used to detect the presence of the Irukandji species, *Malo bella,* with a species-specific PCR assay. When jellyfish were present in the region, they were more abundant inside than outside slicks. This suggests that slicks are important habitat for jellyfishes, including Irukandji species. This information will help tourism operators and authorities reduce the risk of jellyfish stings by ensuring swimmers are not placed in slicks. The next stages of this project will investigate the effectiveness of environmental DNA methods for providing data on the distribution of dangerous jellyfishes and will inform jellyfish management strategies at Ningaloo Reef.

Keywords: Jellyfish ecology, Indian Ocean, Pelagic habitats, Cubozoans, eDNA.

Jellyfish, the favored ones by climate change conditions in the Catalan coast, NW Mediterranean.

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Current climate change conditions alter biodiversity and marine ecosystems. Such is the case of jellyfish, which show increasingly frequent and intense blooms, as well as changes in distribution patterns from different places around the globe. On the Catalan coast, an established Jellyfish Observation Network formed mainly by trained personnel from rescue services has been monitoring jellyfish daily for more than 15 years during the summer season from more than 200 sites. The data obtained has contributed to a database with more than 20,000 validated observations of the presence and absence of jellyfish and allowed the temporal and spatial trend analysis of the populations of two jellyfish species: *Pelagia noctiluca* and *Rhizostoma pulmo*. In addition, the most important environmental variables were considered within the gamlss model with a zero adjusted gamma error distribution. To cope with the temporal correlation of the data, a first-order moving average autoregressive structure was added to the model. Preliminary results indicate that temperature, salinity, and chlorophyll are the three environmental variables related to jellyfish increase. Depending on the species, we conclude that the environmental conditions influenced by climate change, such as increasing sea temperature, changes in the rainfall and seasonal temperature regimes with increasingly longer summers, and changes in the primary production of the marine trophic web, favor one or more stages of the jellyfish life cycle, with a consequent increase in the jellyfish blooms.

Keywords: Jellyfish blooms, climate change, Catalan coast, sea temperature, temporal trend, spatial trend.

Trophic ecology of jellyfish in marine food webs

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There is concern that climate change coupled with human activities may lead to a proliferation of jellyfish populations in coastal waters. Due to their high growth rate, carbon uptake, and opportunistic voracious behavior, the increase of these populations is expected to disrupt the trophic links in the marine environment. Jellyfish diets have been understudied in comparison with other marine taxa, and our knowledge is limited to a few well-known species. In order to determine present and future trends in marine food webs, a global synthesis of jellyfish trophic roles remains an important step. We performed (1) a global systematic review of the trophic ecology of Medusozoa (Scyphozoa, Cubozoa and Hydrozoa), *i.e.*, the most conspicuous, diverse and abundant gelatinous zooplankton in both coastal and deep-water environment and (2) a meta-analysis on the relative abundance of prey by taxonomic groups. Further, we identified (3) current gaps of knowledge and (4) a road map to move forward on this important ecological question. A total of 170 articles were obtained, spanning the years 1955–2022 with notable taxonomic bias towards the species of the genus *Aurelia*, and spatial bias towards the northern hemisphere. 40% of studies were performed exclusively on species of the order Semaeostomeae, whilst 80% of Scyphozoa and Cubozoa species' diet remains unknown. This work is an effort to unify all the existing information and identify uncertainties on jellyfish trophic ecology, and how this knowledge changes in space, time and across taxa.

Keywords: Medusozoa, Diet, Predator-prey relationship, Trophic web

Monitoring of large jellyfish using low-altitude remote sensing by UAVs: A case study of *Acromitus flagellatus* in the seawater of Qinglan Port, Hainan, China

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Unmanned aerial vehicles (UAVs) remote sensing technology holds great potential for monitoring jellyfish outbreaks by capturing images on a large scale. To better quantify the population characteristics of jellyfish, we developed an "umbrella diameter estimation model" to calculate the diameter length of jellyfish in aerial images. We also used the Mask RCNN algorithm to develop software that can automatically identify and count the number of jellyfish in images. Using these techniques, we assessed the population characteristics of *Acromitus flagellatus* in the Qinglan Harbor from mid-April to mid-May 2021. The abundance of *A. flagellatus* in the surface waters of Qinglan Harbor showed an upward trend from mid-April to mid-May, followed by a downward trend, and exhibited obvious patchiness in space. This study provides a new method for quantitatively monitoring the population characteristics (abundance and umbrella diameter condition) of large jellyfish in the ocean surface based on low-altitude aerial photographs taken by UAVs. The method is efficient, low-cost, and has a practical workflow, with obvious advantages and potential for application, also provided basic data for better elucidating the mechanisms of jellyfish outbreaks.

Keywords: Image processing; large jellyfish; AI; Acromitus flagellatus

Differential expression of rhizostomin pigments leads to colour variation in a jellyfish

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Rhizostomins are a pigment family exclusive to rhizostome jellyfish that often appear blue, but may also be red or brown. Some species have multiple rhizostomin genes and it is unknown if they have functionally diversified, for example, to generate different colours. Furthermore, it is unknown how rhizostomin expression is regulated and if this is associated with intraspecific colour variation. We combined transcriptomics with protein characterisation and sequencing to investigate colour variation in *Catostylus mosaicus*, a rhizostome jellyfish that varies in colour from blue, to white and brown. Each of these colour morphs may also display a blue band around the bell margin and/or the oral arm margin. Three rhizostomin candidates were differentially expressed among colour morphs. Rhizostomin-64636 was associated with the blue band around the bell margin, while Rhizostomin-45872 was linked to the blue body pigment. Rhizostomin-62488 was upregulated in non-blue jellyfish and was potentially associated with the brown pigment. Differential gene expression analysis between blue and non-blue jellyfish revealed differences in extracellular matrix proteins and signalling pathways, particularly wingless/integrated (Wnt) and transforming growth factor beta (TGFβ), which are conserved developmental pathways that regulate morphogenesis. Rhizostomins have been hypothesised to have photoprotective functions, and stress-related genes were among the top differentially expressed genes, yet further studies are needed to elucidate the link between rhizostomin expression and stress response. This study provides the first in-depth exploration of color variation in jellyfish and serves as a foundation for future investigations into rhizostomin function and conserved signalling pathways involved in their expression.

Keywords: Rhizostome jellyfish, Colour variation, Signalling pathways, Gene expression

Temporal and spatial distribution of the cannonball jellyfish (*Stomolophus meleagris)* in the South Atlantic Bight, USA

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The cannonball jellyfish, *Stomolophus meleagris*, is one of the most abundant scyphozoan jellyfish in the South Atlantic Bight (SAB) of the southeastern USA. Like many scyphozoan jellyfish, cannonball jellies have high interannual variability and little is known about the environmental drivers of their distribution and phenology. To better understand the ecology of this species, we used fisheries-independent abundance and biomass data of *S. meleagris* from 2001 to 2019 collected by the Southeast Area Monitoring and Assessment Program (SEAMAP) throughout the coastal zone of the SAB. Average biomass of *S. meleagris* is highest in the spring in the central SAB, and on average, the largest jellyfish were collected during the spring months. The lowest biomass was observed in the summer months when smaller jellyfish were caught at lower abundances in the coastal zone. These patterns suggest that mature *S. meleagris* medusae occur in the offshore area in the spring and move inshore toward estuarine habitats to sexually reproduce in the summer. The seasonal and spatial variability across the region is not correlated with local differences in temperature, salinity, chlorophyll-a concentration, or river discharge, but is perhaps influenced by distance from the presumed source estuarine habitats and prevailing currents. While interannual variability in jellyfish biomass is high, no long-term trends or strong correlations with the tested environmental parameters were detected. Due to their high biomass, they potentially exert high grazing on the plankton community, with an estimated average spring grazing of ~10% of the mesozooplankton standing stock per day in the region.

Keywords: Jellyfish Blooms, Time Series, Fishery, Life History

Biochemical homeostasis through phytoplankton-zooplankton interface and mirrored in jellyfish polyps

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Essential biomolecules have been recognized to determine the food quality for predators and regulate their fitness. However, a general comprehension of the biomolecule transfer process and efficiencies along the food chain is still lacking to date. We conducted a diet-switch experiment on jellyfish polyps using natural food sources *Artemia sinica* nauplii and the calanoid copepod *Pseudodiaptomus annandalei* manipulated by feeding three different microalgae in various fatty acid (FA) compositions. The results show that the *Artemia* used in this experiment contained a high level of 20:5n3 (EPA) and was further transferred up to polyps which are significantly different from previous studies that used EPA-poor *Artemia*. In addition, the copepod has a strong tendency to biosynthesize long-chain polyunsaturated fatty acids (LC-PUFA) such as EPA and 22:6n3 (DHA) from their precursor fatty acids ALA, and this pattern was further mirrored in their predator polyps. On the contrary, polyps only had a low EPA and DHA content, but had a notable high level of 20:4n6 (ARA) compared to their zooplankton and phytoplankton food sources. However, data on FA metabolism in polyp are very limited, pathway of ARA biosynthesis is need further to be investigated. Moreover, 18:1n9 as a biomarker of *Artemia* reveals the turnover time is about 19 days when polyps encounter diet-shift. Thus, the progress of metabolism and anabolism of fatty acids through the "phytoplankton-zooplankton" interface, as well as the turnover time provide critical information for modeling jellyfish population dynamics considering both food quantity and quality 'match-mismatch' in a complex multi-factor fluctuant ecosystem.

Keywords: Jellyfish, Food quality, Fatty acid, Copepod

Effects of salinity, light intensity and biofouling on planula settlement and subsequent development to polyps in *Cyanea nozakii* (Cnidaria: Scyphozoa)

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Cyanea nozakii is a scyphozoan jellyfish that causes problematic blooms in Chinese coastal waters, whilst its polyps have never been found in the field. This study examined the effects of salinity, light intensity and biofouling on planula settlement and subsequent development to polyps for narrowing the potential polyp habitat with regard to these factors. Planulae of *C. nozakii* could complete settlement, metamorphosis through planulocysts and development into 4-tentacle polyps within 5 days over a broad salinity range from 13 to 32. The planulae were photonegative with significantly lower settlement success at 1700 lx compared to 80 lx and darkness. The settlement was severely inhibited by the exacerbation of biofoulings mainly consisted of ascidians and bryozoans; it was blocked completely on substrates with heavy biofouling and substantially on those with light biofouling. The settled polyps were outcompeted by the biofouling proliferation and finally eliminated. These imply that neither salinity nor light intensity is a limiting factor but the availability of proper hard substrates with no or scarce biofouling is a bottleneck for *C. nozakii* polyps to establish the population in Chinese coastal waters.

Keywords: Jellyfish blooms, Life cycle, Macrofauna invasion, Polyp refuges

The role of fatty acids in the reproduction of *Pelagia noctiluca*

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Pelagia noctiluca is a non-selective, opportunistic planktonic predator that plays a crucial, top-down control on North Atlantic and Mediterranean pelagic food webs. Its outbreak-forming potential is influenced by the complex interplay between favorable (or unfavorable) environmental conditions and the quality and quantity of available food, eventually driving its overall reproductive fitness. In this sense, fatty acids (FAs) are fundamental building blocks of biological membranes, also serving as energy sources during reproduction, development, and growth. In *P. noctiluca,* omega-3 and omega-6 polyunsaturated fatty acids (PUFAs) are required for reproductive physiological processes. The present work delves into the significance of FAs in the reproduction of Mediterranean *P. noctiluca*, examining the role of diet into FAs storage, and the variations in FAs composition and concentration in the gonads before and after major spawning events. These results show that FAs are primarily acquired from planktonic prey, demonstrating a major and direct link between food availability and reproductive performance. Further, available data shows that the concentrations and relative proportions of FAs in the gonads significantly change during the reproductive events of *P. noctiluca* jellyfish. Throughout gonadal maturation, female jellyfish actively accumulate FAs, particularly long-chain PUFAs, to support oocyte production and differentiation. At spawning, a large amount of stored FAs are released, representing essential energy sources sustaining embryonic development, larval recruitment, and survival. These results highlight the importance of the dietary intake of FAs and the essential role of FAs to secure the reproductive outcome of the mauve stinger jellyfish.

Keywords: bloom, biochemistry, life cycle, biology

Use of eDNA to test hypotheses on the ecology of *Chironex fleckeri*

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Chironex fleckeri is the most notorious cubozoan species and poses a considerable risk to both human health and enterprise. Despite this, considerable knowledge gaps surrounding the ecology of this species exists. These gaps exist due to the challenges associated with their detection resulting from their transparency, spatial dispersion, and overall elusive nature. Environmental DNA (eDNA), as it removes the need to physically locate and morphologically identify individuals, offers a new approach to detect and study the ecology of this deadly taxon. As a result, we developed a TaqMan based species-specific detection assay, multiplexed with an endogenous control to ensure accuracy and confidence in detections. With this, we aimed to utilise the genetic detection technique as an ecological tool to test hypotheses surrounding the ecology of *C. fleckeri*. Specifically, we examined; 1) eDNA's use to detect both medusae and polyp life history stages of *C. fleckeri*, 2) identified habitats in which polyps were detected to test hypotheses surrounding the locality of this life history stage, 3) compared the distribution of both medusae and polyps, based on eDNA, to examine potential stock boundaries of the species, and 4) tested predictions from biophysical models on the dispersal and likely stock boundaries of *C. fleckeri*. From this, we conclude that eDNA has the potential to significantly advance research and knowledge surrounding cubozoan ecology which, in turn, will allow for greater management of the risk they pose to both human health and enterprise.

Keywords: Environmental DNA, Detection, Life History, Ecology, Polyps, Population Structure

Jellyfish populations in Qatar seawaters: The role of artificial shoreline development and recent hydro-climatic changes on scyphozoans blooms

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Despite an extreme marine environment, the Arabian Gulf is characterized by a very diverse pelagic ecosystem and hosts a variety of jellyfish species. Among the Cnidarians, Medusozoans of Qatar seawaters have been recently investigated through a dedicated monitoring program started in 2018 where 14 species of Hydrozoans and 5 species of Scyphozoans have been identified. Among the jellyfish community we examine the spatial distribution and phenology of two dominant scyphozoans, *Chrysaora cf. caliparea* and *Catostylus perezi* in order to highlight the role of artificial shoreline development and recent hydro-climatic changes on their recurrent blooms. To reach our objectives, abundance data from field surveys and historical records from literature and citizen science from 2012 to 2022 have been standardized, transformed and ordinated through non-metric Multi-Dimensional Scaling (nMDS) analysis using Primer 7, versus a set of environmental variables such as the length of the artificial shoreline and hydro-climatic parameters like Sea Surface Temperature (SST), Wind Direction, Wind Speed, Geopotential Height and Chlorophyll *a*. Our results shows that total scyphozoans' abundance during the last decade was significantly correlated to the increase of Chlorophyll *a*, Wind Speed, Sea Surface Temperature and artificial shoreline length in the eastern coast of Qatar.

Keywords: Medusozoans, Diversity, Phenology, Artificial Shoreline, Hydro-Climate, Arabian Gulf.

Distribution of Left- and Right-handed *Velella* in the global ocean

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For centuries scientists have puzzled at the chirality of species like by-the-wind sailor *Velella velella*. These animals float on the ocean's surface and move by harnessing wind using a sturdy chitinous sail. This sail does not cut down the middle of the *V. velella* body, but rather, grows at a slight angel to the left or the right, breaking the typical cnidarian radial symmetry. These left- and right-handed animals sometimes wash ashore in similar locations, and other times, only left- or right-handed animals will strand on beaches and coastlines. Scientists have long hypothesized that certain geographic, climactic, and oceanographic conditions favor either left- or right-handed sailors, and shifting conditions and locations maintain a balance of left- and right-handed individuals within the global populations. The purpose of this study is to examine the global distribution of left- and right-handed *V. velella* and determine which abiotic factors are associated with their distribution. To conduct this work, we analyzed thousands of images of *V. velella* submitted by participatory scientists from around the world. We find a strong relationship between handedness and geographic location. These results suggest that sailing morphology may be an adaptive strategy that is regionally specific.

Causes of the *Aurelia coerulea* outbreak on the southern coast of Korea

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The *Aurelia coerulea* is a cosmopolitan species found worldwide. *A. coerulea* has occurred abundantly in Korea since the late 1990s, causing damage to fisheries and industry. This species is an endemic in Korea, and it is abundant in eutrophic coastal waters and artificial lake such as Sihwa and Semangeum. In particular, jellyfish outbreaks have been occurring in the southeastern coastal waters of the Korea for more than a decade. The aim of the study was to understand the causes of jellyfish blooms in the southeastern coastal waters through the characteristic analysis of jellyfish populations and polyp habitats, as well as environmental factors. As a result, the main habitat of *Aurelia coerulea* polyps was oyster farms, and the populations could be divided into winter and summer population in study area. In additional, *A. coerulea* had year-round eggs, the size of planula was the largest in March with an average of 400 ㎛, and planula formed year-round polyps.

Keyworks: Polyp, Dynamics, Habitat, Planula, Jellyfish, Population, *Aurelia coerulea*

Unmanned aerial survey allows mapping *Rhizostoma pulmo* bloom dynamics in Bages-Sigean lagoon (Aude, France)

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Jellyfish blooms are a rapid production of huge biomass with many ecological and economic consequences. These phenomena are hard to predict and elusive due to the scarcity of field observations at adequate scales to capture the magnitude of blooms. Lately, non-invasive biomass estimations based on unmanned aerial surveys of jellyfish distribution have been implemented. However, the generally used low altitudes appear not adequate to assess the entire spatial dimension of jellyfish blooms. In this study, we used a small plane that flew at 300m altitude to map an entire Mediterranean lagoon (55 km²), at the beginning (July), the middle (August), and the end (October) of the 2022 bloom of *Rhizostoma pulmo* (Cnidaria; Rhizostomae). Data treatment was done by means of an image analysis algorithm trained with images with manually counted jellyfish individuals. The jellyfish densities obtained were then mapped for each flight. This approach provides novel insights of the *R. pulmo* bloom's spatial dimension and further provided details of the jellyfish patchy distribution and temporal changes in population size structure, thus allowing detecting the occurrence of different cohorts. The unmanned aerial survey at high altitude (i.e., 300m) proves to be an efficient method to monitor jellyfish blooms dynamics at coarse scale, although abundance and therefore biomass are underestimated due to the individuals size detection limits.

Keywords: *Rhizostoma pulmo*, Image processing, Aerial survey, Jellyfish bloom, Population dynamics, Mediterranean lagoon.

The role of cilia in cnidarians, a brief review and new insights on the feeding mechanisms

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Cilia are sensory and motor structures found in metazoans, playing a crucial role in the collection of particles through feeding currents in suspensivorous animals. Suspended particles are too small to be captured individually, requiring concentration. This concentration occurs by different food mechanisms that are characterized in three phases: (1) encounter, (2) capture, and (3) particle handling. Some cnidarians, like other suspensivorous animals, utilize cilia in their feeding mechanisms. However, few studies consider ciliary flow in biomechanics of cnidarian feeding. Traditional views suggest that jellyfishes capture prey only by nematocysts and mucus, and do not possess cilia that collect suspended particles (i.e., phase 2). Thus, we aim to present a critical analysis of the presence, distribution, and ciliary function in Cnidaria (mainly Medusozoa) with a focus on particle collection, with an overview of suspension feeding in invertebrates. We analysed different mechanisms of suspension feeding and presented a scheme with phases of pelagic jellyfish suspension feeding based on a classification that we proposed for invertebrates. We found in the literature that cilia create currents only in phases 1 and 3 of suspension feeding. However, there are indications that some scyphomedusae have another nutritional source, besides prey captured by nematocysts and mucus, as resources are insufficient to supply the energetic demands of jellyfish. Therefore, we suggest that jellyfish also capture small particles by cilia (i.e., phase 2), expanding their trophic niche, and making it possible to reinterpret the trophic role of medusoid cnidarians on plankton.

Keywords: suspension feeding, niche amplification, fluid biomechanics, particle collecting

Studies on the dietary preferences of three scyphozoan jellyfish species in a tropical positive estuary, south India

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Jellyfishes are important components of aquatic ecosystems; however, their ecological roles and impacts on food webs remain enigmatic. This study investigates on the stomach contents of three scyphozoan jellyfish species, *Acromitus flagellatus* (Maas, 1903), *Lychnorhiza malayensis* Stiasny, 1920 and *Chrysaora caliparea* (Reynaud, 1830) collected from an ecologically important tropical positive estuary, the Vembanad lake. A total of 243 jellyfish samples were collected from stake net and scoop net catches during 2015-18 period to delineate their dietary preferences and potential interactions with fishery resources and planktonic communities. Among the three species, *A. flagellates* recorded the highest preponderance (67.5%), followed by *L. malayensis* (25.5%) and *C. caliparea* (7%). The stomach contents examined comprised zooplankton, larvae and adults of fishes and shrimps, and other small invertebrates. It could be noted that *A. flagellates* followed a generalised feeding strategy, consuming a wide range of zooplankton taxa, with a distinct preference for shrimps. In contrast, *C. caliparea* displayed a more selective feeding behaviour and a pronounced preference for larval fish. The stomach content analysis of *L. malayensis* suggested a diversified diet encompassing copepods, crab larvae, and shrimps. Furthermore, temporal variations were observed in the diets, indicating potential shifts in prey selection and foraging patterns that could affect energy transfer and trophic interactions within the lake food web. The study provides valuable insights into the trophic roles of three jellyfish species within the Vembanad Lake ecosystem, aiding predictions on their effects on fishery resources and ecosystem dynamics. This research contributes to a broader understanding of jellyfish ecology and its significance in maintaining the ecological balance of sensitive aquatic habitats such as Vembanad Lake.

Keywords: Gelatinous plankton, Predation, Gut content, Feeding behaviour, Stake net

Association of jellyfish *Catostylus perezi* with crustaceans: A preliminary observation from Gulf of Kutch, Gujarat

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Jellyfish are gelatinous zooplankton that drift through the water column of seas around the world. Scyphozoan in the Phylum Cnidaria have at least 220 species globally, with 35 from Indian waters. Moreover, there exists a targeted jellyfish fisheries along India's Northwest coast for the two edible Rhizostome Jellyfish *Catostylus perezi* and *Rhopilema hispidum*, which swarmed in and around the Gulf of Kutch during the winter season. Around 13569.95 metric tonnes of jellyfish landed between November 2017 and February 2020. The review of the literature shows that, despite there have been numerous studies on jellyfish taxonomy, distribution and fishery, studies on jellyfish and their associated fauna are lacking in India. Jellyfish and crustaceans can often have interesting associations within marine ecosystems. These associations can be either symbiotic or predatory in nature. Generally, jellyfish are predatory in nature, supported by a network of nerve cells, however, some crustaceans, ophiuroids and fishes reported association with these scyphomedusae ranging from parasitism to mutualism. To fill the knowledge gap, special onboard observation programs on jellyfish *Catosylus perezi* and associated animals have been started since November-2022. Interestingly, we found that *C. perezi* with crustaceans was noted and will be discussed in the study. Also, the morphometric measurements *viz:* umbrella diameter, oral arm length, oral arm weight and the total weight of the jellyfish were measured and correlated for the associations with crustaceans. Studying jellyfish and associated fauna is important for understanding their ecological roles, their responses to environmental changes, and their impacts on ecosystems and human activities. Such knowledge is essential for informed conservation, management, and sustainable use of marine resources.

Keywords- Associations, Crustacean, Jellyfish association, Jellyfish fishery, Scyphozoa, Winter season

Marine stingers: effects of sea warming and food availability on a tropical jellyfish species

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Increasing blooms of jellyfishes have been observed in tropical Southeast Asia, compromising both human health and economy. While rising sea temperatures and shifts in food-webs have been implicated as causes for such blooms in temperate habitats, it is unclear if these apply to the tropics. Wide knowledge gaps concerning the biology of many local jellyfish species still persist. We hypothesised that rising sea temperatures and shifts in food-web structure will affect the reproductive phenology and output for species in the tropics. To test this, we used *Cassiopea* sp. polyps (n > 120 polyps) cultured from larvae harvested from wild populations established in Singapore, and subjected them to the following treatments over four-weeks: i) differing seawater temperatures (i.e., 28°C, 30°C and 32°C), and ii) frequency of food availability (i.e., twice versus six times a week). Polyps were observed for their maturation in development, asexual fecundity, and mortality. We found that when exposed to high, stressful temperatures (i.e., 32°C), survivorship of *Cassiopea* sp. polyps dwindled, regardless of food availability. In contrast, at a moderate, stressful temperature (i.e., 30°C), these polyps thrived well only when food availability was frequent. This suggests that for species acclimatised to the tropics, food availability plays a greater role in instigating rapid maturation, asexual fecundity and survivorship, rather than increasing sea temperatures. Our findings highlights the need to continually fill knowledge gaps pertaining to the biology of tropical jellyfish species, which will help prime the synthesis of future marine management strategies to mitigate unexpected blooms.

Keywords: Climate Change, Life cycle, Planuloid, Rhizostomae, Strobilation

Molecular responses of cnidarians to environmental stress

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The effects of environmental stressors on cnidarians are traditionally observed by changes in physiology and behaviour. Although studying those parameters is still fundamental, gene and protein expression analyses can also be powerful tools to investigate the responses of cnidarians to stress. These molecular tools provide information on both genetic and functional variation and capture dynamic shifts in organismal physiology. As the use of high throughput sequencing to understand responses of cnidarians to stressors is still relatively new, standard experimental protocols have not yet been established, which limits the ability to compare studies. We systematically reviewed the literature published prior to December 2022 of cnidarian gene and protein expression studies related to environmental stressors. Our goals were to determine the type of environmental stressors studied, which species and clades were represented, and how laboratory and field stress experiments were conducted. Around fifty percent of the articles investigated the responses of cnidarians to variations in temperature and only 1% of studies addressed jellyfish species. Duration of exposure to the stressor, sampling frequency and intervals, and acclimation periods varied greatly among lab-based experiments, and only 8% of the studies sampled after a recovery period. Nevertheless, to correctly interpretate these pathways it is essential the experimental design incorporates appropriate sampling interval and frequency and includes adequate acclimation periods for each species/population studied. To develop those designs, we suggest focussing on plasticity and resilience to stressors, by analysing molecular patterns during acclimation and recovery after stress.

Keywords: transcriptomics, proteomics, Cnidaria, stressor, environment.

Transforming matrix population model into a dynamic size-structured model: A case study of *Carybdea marsupialis* population

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Population projection matrix models have been extensively used in ecological studies. However, for many pelagic marine organisms, obtaining vital rate data to construct such models remains challenging. Here, we present a novel approach utilizing time-series data, referred to as the "demographic inverse problem", to estimate matrix parameters, including size structure and densities, rarely applied in marine organisms. Drawing from the matrix parameters calculated in Bordehore et al.'s 2015 study of *Carybdea marsupialis* (L. 1758), a Mediterranean box jellyfish known for blooming under specific ecological conditions, we transformed the matrix approach into a size-structured dynamic model using STELLA Architect©. Incorporating a benthic polyp stage, our model accommodates six age classes and enables simulation of a stable population over time. Model parameters were carefully calibrated to minimize residuals between model simulations and real life data. With calibration achieved, the dynamic model becomes a powerful tool for comparing scenarios and conducting sensitivity analyses on various variables, including food availability, advection, growth rates, predation, and fertility. Our findings demonstrate that dynamic models offer a valid and flexible alternative to matrix projection models. By adapting to different testing scenarios, dynamic models provide several advantages, including enhanced flexibility and applicability. This approach significantly contributes to the understanding of *C. marsupialis* population dynamics and may extend to other marine species, fostering broader ecological insights.

Keywords: Cubozoa, Modeling, Mediterranean Sea, Ecology, Jellyfish, Population dynamics

Long-term dynamics and population structure of the Helmet jellyfish *Periphylla periphylla* in a Norwegian fjord

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Mass occurrences of *Periphylla periphylla* in Norwegian fjords cause major concerns related to potential regime shifts that could affect ecosystem stability. 15-years of trawl data (2006-2015), complemented with comprehensive sampling in different areas and seasons (2018-2021) allowed new insights on the dynamics and population structure of *P. periphylla* populations within and beyond Trondheimsfjorden. Despite assumed population bursts, no clear trend on *P. periphylla* population size in Trondheimsfjorden were identified. Sampling frequency and population size suggest a local reproduction of *P. periphylla*, especially in the inner part of the fjord where young-of-the year (YOY) individuals occur. Size variations occurred in relation to sampling month and point at seasonal patterns in growth and reproduction. Further, a strong dispersal of *P. periphylla* within Trondheimsfjorden and into adjacent waters is suggested and supported by its overall low geographic population structure. Data on *P. periphylla* long-term dynamics and population structure can contribute to a better understanding of jellyfish bloom dynamics and advance ecosystem state assessment and management approaches.

Keywords: Jellyfish bloom, Scyphozoa, zooplankton, Coronatae, fjord ecosystem

Monthly dietary shifts in the jellyfish *Nemopilema nomurai* in Liaodong Bay, China

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Nemopilema nomurai is a frequently bloomed species in the China seas. Their feeding organ has an ontogenetic change when they grow up, but whether their diet changes along with it is unclear. A 5-month study on *N. nomurai* was conducted in Liaodong Bay, China to clarify the dietary shift and feeding effect of *N. nomurai*. Fatty acid biomarkers revealed the proportion of carnivorous food in the diet of *N. nomurai* decreased when their bell diameter increased. The isotope data revealed a similar story with δ15N dropping which indicated a decreased trophic level. The diet composition was dominated (74 %) by zooplankton >200 μm in May and then decreased to <32 % in July. In contrast, the proportion of particulate organic matter increased from <35 % to 68 %. This study revealed a monthly shift in the diet of *N. nomurai* and contributed to knowledge of trophic interactions between plankton and *N. nomurai*.

Keywords: *Nemopilema nomurai*, Diet, Distribution, Stable isotopes, Fatty acids

Blooming potential base on spatiotemporal distributional pattern and dual-mode recruitment of polyp population of the giant jellyfish *Nemopilema nomurai* in Bohai Sea

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Base on spatiotemporal distributional pattern from 2017 to 2022 *Nemopilema nomurai* and dual-mode recruitment of polyp population, the population dynamics and blooming potential were explored: (1) Initial occurrence, distribution-shifts and advection in Liaodong Bay were reported. (2) Find out the favorable conditions of metamorphosis for planula produced by sexual reproduction through experiments on settlement preferences, and on the effects of temperature, salinity and light on survival rate and adhesion rate. (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*

Worm-filled jellies: a multiapproach assessment of the dynamics of helminths parasitizing jellyfish hosts in two Norwegian fjords

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Jellyfish parasites are an important but often neglected component of pelagic ecosystems. In particular, the diversity of helminths (nematodes, trematodes, cestodes) parasitizing cnidarians and ctenophores is poorly understood despite the impact that these organisms have in the regulation of the populations of their hosts and of commercially important fish. These parasites are mostly present as larvae, and therefore identifying them to species is challenging based on morphology alone. To assess the extent of these associations in two Norwegian fjords, we conducted a year-long monthly survey and monitored the identity, host range, prevalence, and intensity of these parasites within the jellyfish community. The specimens collected were analyzed via an integrative approach including both morphological identification and DNA-barcoding, with the additional goal of producing DNA reference libraries for the parasites. In addition, a trial for eDNA monitoring of the parasitic component was implemented. Both the hosts and parasites belonged to phylogenetically diverse sets of organisms, including >17 species of hydromedusae, siphonophores, scyphomedusae, and ctenophores parasitized with members of at least 7 different families of helminths, several of which are parasites of commercially relevant fish (e.g. the nematode *Hysterothylacium aduncum*, and the trematode *Derogenes varicus*). By far the most common interaction recorded was that of metacercaria-stage trematodes parasitizing hydromedusae (>90% of the interactions). Individual jellyfish were found on occasion to harbour extremely high parasitic loads, with intensity values of >2300 metacercariae/individual. The potential contribution of these massive infections to the decline of jellyfish blooms is discussed.

Keywords: Cnidaria, Ctenophora, parasites, DNA barcoding, eDNA

Theme 3:

Associatons & Ecology

POSTER PRESENTATIONS

Photo credit: **Umeed Mistry**

Population structure and seasonal reproductive pattern of the scyphozoan jellyfish *Phyllorhiza punctata* in the Klang Strait, Malaysia

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Population blooms of scyphozoan jellyfish are often linked with seasonal reproduction and reproductive strategies, although in-depth understandings of these biological aspects are relatively limited for tropical jellyfish. Thus, this study aims to investigate the population structure and sexual reproductive pattern of *Phyllorhiza punctata* von Lendenfeld, 1884 in the Klang Strait, Malaysia, where their bloom events have been frequently reported. A total of 1,123 individuals were collected and measured, and their sexual maturation stages were identified over a 19-month sampling period. The species population comprised typical medusa ontogenetic phases, which were empty juveniles (U), immature (M1), mature (M2), and spawning (M3) stages. The immature (U, M1) and mature (M2, M3) groups contributed equally to the population size, indicating active spawning and juvenile medusa recruitment. Sex ratio analysis showed that the number of females was generally equivalent to or higher than males. There was no sexual dimorphism in relation to size (bell diameter), and early maturation occurred at the minimum size of 140 mm. The species performed continuous spawning and juvenile medusae recruitment throughout the year, attributed to the relatively stable water temperature and year-long primary production. However, monsoon-related physicochemical effects and food availability might regulate the timing of strobilation and spawning, thus the major periods of juvenile recruitment for this species. These reproductive strategies have resulted in the massive and perennial occurrences of *P. punctata* medusa in the area, supporting the hypothesis that Klang Strait serves as a nursery, maturation, and spawning ground for scyphozoan jellyfish.

Keywords: Abundance, Ontogenetic, Scyphozoa, Sex ratio, Sexual maturity

Exploring planula settlement, encystment and excystment of the scyphozoan *Cyanea lamarckii* (Péron and Lesueur, 1810) in a multi-methodological approach

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The development of jellyfish populations is linked to planula survival, settlement success and subsequent polyp metamorphosis. A particular periderm covered stage formed by the newly settled planula – the planulocyst – has been reported for the scyphozoan *Cyanea lamarckii* (Péron and Lesueur, 1810), a bloom forming species in the northeast Atlantic. Only a few planulocysts develop into polyps directly after settlement and the excystment process has not been understood in detail. By combining live observations with histological sections and scanning electron microscopy, present results clarify that the excysting *C. lamarckii* planula secretes a thin periderm stalk within the planulocyst and subsequently the polyp develops at the tip of the stalk. Experiments with combined temperature (10, 15, 20 °C) and salinity (32, 25) treatments revealed significant effects of temperature on *C. lamarckii* planula settlement success and planulocyst excystment but no significant effects of salinity. These results indicate that early *C. lamarckii* life stages are well adapted to environmental salinity changes and that increasing temperature due to global warming can be beneficial for their development which may support their northward distribution and increasing jellyfish populations in the northeast Atlantic area.

Keywords: Planula, Planulocyst, Polyp metamorphosis, Histology, SEM, Ecology

Polyps of congeneric scyphozoan jellyfish species respond differently to future warmer and acidified scenarios.

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Ocean acidification (OA) and warming are challenging marine organisms and ecosystems around the world. The effects of these two climate change drivers on scyphozoan jellyfish are still understudied. Here, we examine the independent and combined effects of both stressors on polyp population dynamics of the scyphozoans *Rhizostoma pulmo* and *Rhizostoma luteum*. An experiment was conducted to examine asexual reproduction of polyps considering current and ca. 2100 winter and summer conditions under projected future climate change scenarios (SSP5-8.5, IPCC, 2021). The first part of the experiment (32 days) was conducted at 18ºC and two pH levels (ambient: 8.0 and future: 7.7). In the second part (32 days), temperatures of 24 and 30ºC were tested in combination with ambient and acidified pH (8.0 and 7.7, respectively). In *R. luteum*, warming and acidification had no significant effects on podocysts formation and excystment ($p > 0.05$). However, temperatures of 24 and 30ºC produced mortality of scyphistomae and loss of podocysts under both pH conditions. Furthermore, no strobilation occurred at 30ºC. *R. pulmo* podocyst formation and excystment was higher at warming conditions and no effects of low pH were found. Our results show that *R. pulmo* scyphistomae would thrive in the Mediterranean Sea under future scenarios and generate healthy ephyrae at every tested conditions. The fate of *R. luteum* scyphistomae will, however, be less prosperous under future scenarios, as the capacity of this species to undergo strobilation will cease at warmer temperatures, thereby affecting medusae recruitment and population dynamics.

Keywords: pCO_2, pH, temperature, scyphistomae, podocysts, strobilation.

The post-sexual reproduction development of *Nemopilema nomurai*

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Nemopilema nomurai is the largest Jellyfish species in the East Asian Sea, with the significant biomass and the wide-ranging influence. The immense number of eggs in an adult makes sexual reproduction an important way to regulate its population. However, compared to asexual reproduction, literature on sexual reproduction is often scattered. We obtained fertilized *N.n* eggs through artificial breeding and observed their development into polyps. At 22.0~ 23.5℃ and 30.0~ 31.0 salinity, it took four hours for the eggs to develop into larvae that swim clockwise before becoming primary polyps two hours later. After 20 days, the four-tentacle polyps had grown into mature polyps with sixteen tentacles each. This paper describes the biological development of sexual reproduction and explore the effects of salinity and dried food on this stage: (a) Fertilized eggs are suitable for low-salt environments, with a suitable range that increases as they develop; (b) Four-tentacle polyps are weak predators without subjective selection of food; (c) Proper size of dried food is crucial for newborn polyp growth and survival. Finally, this paper summarizes current understanding of *N.n*' s biology and ecology during sexual reproduction while proposing ideas for future research.

Keywords: *Nemopilema nomurai*, Sexual reproduction, Biology, Ecology

Abundance and co-occurrence of jellyfish in the coastal waters off Cochin

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Jellyfish are a significant taxonomic group of marine organisms that exhibit a wide distribution throughout various coastal and pelagic regions. The proliferation of jellyfish populations in coastal seas has become a prevalent occurrence in recent years, resulting in significant effects on ecosystem services. A study was carried out during July 2022 to November 2022, along the coastal waters of Cochin, in the traditional fishing grounds. Catch data collected using two shrimp trawls (with head ropes lengths of 36m and 41m, were used for the study). Catch rates, composition and seasonal trend in the abundance of jellyfish and other species were studied. The highest catch was observed in the month of October, (368.9 tonnes per square km.). The lowest overall catches were observed in the month of July (9.5 tonnes per square km.). However, when analysis was carried out after removing jellyfish, the highest catches were observed in November (265.5 tonnes per square km), followed by catches in October (226.6 tonnes). It was observed that the contribution of species other than jellyfishes ranged from 51.1% to 70.0% during the months from July to September, however the percentage contribution of commercial fishes to the total catches were only 38.6 and 25.9 percentage respectively during the months of October and November. To understand the species that cooccur along with jellyfish in the fishing ground, a co-occurrence analysis was carried out using the same dataset, by including all species encountered in the catches, with a total of 337 pairs. Probabilistic co-occurrence model showed no significant association of jellyfish with any of the species encountered in the catches. However, there were significant correlations between the other species like *Leiognatus* sp. and *R. kanagurta* were the species which showed maximum association with other species occurring in the catches/region. The results of the study and the implications of high abundance of jellyfishes in the catches are discussed in the paper.

Keywords: Jellyfish, Shrimp trawl, Coastal waters, Co-occurrence.

Correlating jellyfish abundance with environmental factors in the waters off Cochin

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Jellyfish aggregations often exert significant adverse impacts on fishing operations, either through inflicting damage to fishing gear during retrieval or by inducing ecological repercussions by preying upon the larvae or eggs of economically important species and possibly by many other ways, for which there is no sufficient information. Jellyfish growth and reproduction vary greatly when environmental conditions change, which results in sudden jellyfish blooms, that sometimes persist for considerable time, significantly affecting the fishing activities in the region. The understanding of the initiation and proliferation of jellyfish blooms in coastal waters is currently limited. Given the substantial adverse effects on fishing activities and other coastal water uses, it is crucial to establish a comprehensive framework for understanding the contributing factors to jellyfish blooms. This study reports the use of jellyfish abundance data collected during experimental trawl operations along the coastal waters off Cochin, which is a traditional fishing ground. To determine the most important factor affecting jellyfish abundance, satellite-derived data on Sea Surface Temperature (SST), Sea Surface Salinity (SSS), and Chlorophyll were correlated with jellyfish abundance data collected during experimental fishing operations. No significant changes in the mean salinity were observed, whereas the mean SST was lowest in the month of August (26.54^{0}C) and September (27.52^{0}C), and highest during October (28.31^{0}C) and November (28.84^{0}C). The mean chlorophyll varied significantly among the months (mean of 9.1 mg.m^3 in the month of July to a concentration of 2.28 mg.m^3 in the month of November) and was found to be the main factor that correlated with the changes in the jellyfish abundance. The paper provides a description of the findings and the potential implications they carry.

Keywords: jellyfish swarms, SST, chlorophyll

Marine heatwaves on blooms and populations of jellies: What do we currently know?

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Marine heatwaves (MHWs) are anomalously warm water events that have become increasingly stronger and more frequent over recent years. Aside from its mechanisms and trends, research on the biological responses to MHWs has also gained more attention, including their putative effects on jellyfish distribution. To provide a consolidated understanding of the progress of studies between the two events, we review the published literature that investigates MHWs with jellyfish blooms and populations. Studies note two scenarios that potentially link MHWs with occurrences of more jellies: (1) certain species thrive or bloom during MHWs and (2) pre-bloom MHWs may have provided jellies with ideal conditions for development (e.g., more food, suitable temperatures). Contrastingly, populations of other species either have (1) less presence during MHWs compared to pre-MHW states or (2) noticeable declines due to MHWs preventing the usual conditions conducive to jellyfish growth. However, there are also species noted to have unclear responses to MHWs. Since there are differences in each species, more investigations into how various jellyfish respond to MHWs are strongly suggested to determine which kinds can (or cannot) more likely persist with the current and future trends of warm marine extremes. We then present the potential applications of analysing MHW-jellyfish bloom co-occurrences in which certain sectors such as marine fisheries and aquaculture, human services, tourism, and human safety (e.g., against jellyfish envenomation) can prospectively benefit. The analyses between MHWs and jellyfish can raise scientific attention to the public, especially in areas where both events are still understudied.

Keywords: Marine heatwaves, Jellyfish blooms, Extreme events, Sea surface temperatures, Population ecology, Biological oceanography

Towards predicting *Cassiopea xamachana* blooming in Indian waters - Insights into metagenesis and metamorphosis

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Metagenesis in the life cycle of *Cassiopea xamachana* Bigelow, 1892, plays a vital role in the potential blooms occurrence in marine and coastal ecosystems. To better understand the ecological functioning, bloom potential, and implications of the life history features of *C. xamachana*, this study examined the early life cycles in conjunction with critical environmental factors, including temperature, salinity, and light availability. The study documented the sexual/asexual reproduction and the meta-genetic life cycle stages, such as planula larva, benthic polyp, juvenile ephyra, and adult medusa under controlled Cnidarian laboratory conditions of ICAR-CMFRI. Successful sexual reproduction was achieved outdoors, while asexual reproduction was frequently observed in indoor glass and FRP tanks. In addition to brooding, parental dependency was found to be higher in sexual reproduction, with females caring for young ephyrae in the oral arm region. The ability of polyps to reproduce and generate ephyra through budding and further development into asexual planuloids plays a crucial role in the population demography. The study revealed that higher temperature and salinity regimes induced the asexual phase *via* planuloid buds, while the lower regimes resulted in regular strobilation. Furthermore, the study identified the larval stages with reproductive potential that can regulate natural population abundances and fluctuations. The study provides information on potential environmental cues that influence the reproductive strategies of this species that contribute to its blooming potential. Developing mathematical models integrating the knowledge of metagenesis, metamorphosis, and environmental influences that can predict jellyfish blooming events of India is the need of the hour. .

Keywords: Cassiopeidae, Environmental conditions, Gulf of Mannar, Zooxanthellae, Scyphozoa, Upside-down jellyfish

Modeling the population dynamics of *Mastigias papua* in Jellyfish Lake, Palau, to explain past disappearances and identify future risks

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Jellyfish Lake, a marine lake in Palau, is renowned for its typically perennial population of golden jellyfish, *Mastigias papua etpisoni*. This ecosystem is a significant source of biodiversity and a major tourist attraction. However, in 1999 and 2016, and most recently in 2022, the *Mastigias* medusa population collapsed, provoking questions about the sustainability of this intricate ecosystem. In response, we are developing a dynamic model to understand the potential causes and consequences of the medusa disappearances. Our model aims to simulate the dynamics of the *Mastigias* population over time and under varying conditions, thereby providing insights into the potential drivers of the 2016 and 2022 disappearance events, for which we have detailed data. Our preliminary analysis indicates that environmental factors, such as temperature variation, significantly influence the rates of survival and growth of *Mastigias*. These observations highlight the delicate balance of this unique ecosystem and the potential vulnerability of *Mastigias* to further climate-driven environmental changes. The model can serve as a tool for marine lake management, aiding in the conservation of *Mastigias* in the face of pressures such as tourism and extreme weather events. The outcomes of this study will not only help us better understand the complex dynamics of the *Mastigias* population but also provide us with a framework to anticipate future declines.

Keywords: Jellyfish Lake, *Mastigias*, Life cycle, Modeling, Palau, Population dynamics

Mass rearing techniques of *Cassiopea xamachana* young medusa for marine aquarium trade

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The upside-down jellyfish *Cassiopea xamachana* reared in captivity at the Cnidarian Laboratory is used to mass produce young Medusa (10±2.0 mm). The rearing technique is optimised for the mass production of young Medusa in marine research aquariums and outdoor tanks. The aquarium rearing facility consists of a series of glass tanks (45 x 30 x 45 cm) connected with a recirculation unit and illuminated with a 4 W blue LED tube light. The concrete tank (2 x 2 x 0.8 m) in triplicate was used for outdoor mass production of young Medusa. The study revealed that young Medusa tends to occupy the bottom of the tank showing positive geotactic and thigmotactic behaviour. The maximum and minimum ranges of salinity and temperature tolerance of *C. xamachana* young medusa were 40˚C & 20˚C; 20 ppt & 55 ppt, respectively. The optimum water quality parameters in the rearing systems were Salinity (34±2 ppt), Temperature (28±2.0˚C), pH (8.3±2.0), DO (5.0±1.0 mg/L), Light (12L: 12D) and water depth (0.50±0.20m) for the mass rearing. The feeding trial was conducted using *Artemia* nauplii and selected marine calanoid copepods for the young Medusa in both systems. Newly hatched nauplii were fed @ 200±50 nos/ young medusa/day, whereas the mixed marine calanoid copepods *Acartia southwelli* and *Parvocalanus crassirostris* were fed @ 1000±75 nos/young medusa/day. Among the two live feeds studied, the young Medusa prefers Artemia nauplii to copepods. The ideal stocking density of young Medusa is 5 nos/L in aquariums, whereas 12 nos/L in outdoor systems. The late Medusa (55±5.0 mm) growth was achieved in 50±10 days of rearing and was found suitable for retail marine aquarium trade.

Keywords: *Cassiopea* spp, Medusa, Stocking density, Live-feeds, Salinity

How Individual Based Models help us to understand what we cannot see in the sea: The case of *Chrysaora fulgida* off Namibia

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Our knowledge of jellyfish populations is constrained by the samples we collect to study them, and if there are gaps or biases in our sampling regimen, there are corresponding holes in our understanding. Computer simulations of populations provide an opportunity to fill some of the gaps, and here we use a series of individual based models (IBMs) in an effort to understand the year-round presence of *Chrysaora fulgida* (Discomedusae: Pelagiidae) off central Namibia. The demography of this species is unusual for a jellyfish living in a temperate environment, as a variety of size classes can be found in the population throughout the year and reproduction by adults may occur at any time. Models were run under scenarios of different growth and mortality rates (sourced from the literature), in which individuals randomly recruit to the population on dates that reflect one or/and two geographically distant polyp populations, each with different release dates. Given that year-round sexual reproduction may be the product of reproductive heterogeneity, we additionally allowed individuals to follow a particular life path terminating in reproduction and immediate death or gradual senescence. Our results, which will be presented, are perhaps not surprising but the thought processes undertaken have served to strengthen our understanding of the species in this system and have provided a suite of hypotheses to be tested in the future.

Keywords: Benguela ecosystem, eastern boundary current, population biology, Scyphozoa

Jellyfish as Vital Food Sources for Marine Animals?

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Despite being regarded as nuisances to humans, jellyfish hold a crucial place in marine ecosystems due to their significant ecological roles. As opportunistic feeders, they consume plankton and small marine organisms, becoming vital links in the transfer of energy and nutrients through the marine food web. Moreover, jellyfish also act as predators, effectively controlling populations of small marine organisms like zooplankton and small fish. This predator-prey relationship indirectly influences the abundance and distribution of other marine species, maintaining a delicate balance in marine ecosystems. In addition, jellyfish serve as a critical food source for various marine animals, including species of fish, sea turtles, seabirds, and marine mammals. The absence of jellyfish as a food source could pose challenges for these marine species in finding suitable alternatives. Although the role of jellyfish as prey supporting many marine food webs is widely acknowledged, the specifics of this interaction remain a relatively unexplored frontier. In this article, we aim to explore the incredible diversity of species that consume jellyfish. Through a comprehensive review of scientific literature and observations, we seek to answer the intriguing yet unanswered question: How many species of marine animals consume jellyfish?

Keywords: Predation, Scyphozoa, Cubozoa, Food webs

Reproductive strategies of the scyphozoans in northern China

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The species of the scyphozoans in northern China include *Rhopilema esculentum*, *Nemopilema nomurai*, *Aurelia coerulea*, and *Cyanea nozakii*. The life cycle of these species consists of alternating generations of planktonic jellyfish reproducing sexually and benthic polyps reproducing asexually. Compare to the large medusae, there are still many unknowable mysteries of the small polyps. So we followed survival and asexual reproduction of the polyps both by observing microscopically in the lab and verifying synchronously in situ in different environmental conditions for more than two years. We found that (1) There are low-temperature dormancy periods for polyps of the four species without asexual reproduction in different suitable low-temperature ranges in winter. (2) Strobilation occurred during the rise in water temperature in spring. Temperature and food are key environmental control factors to asexual reproduction. (3) The differences in contribution via asexual reproduction to polyps population replenishment between the different species are significant.

Keywords: Scyphozoan, Polyps, Asexual reproduction, Strobilation, Ecological Environmental factors

Food ecology of two species of macromedusae (*Rhizostoma lutem* and *Pelagia noctulica*) frequently observed of the Canary Current upwelling ecosystem (Morocco region)

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A series of episodic proliferation and sudden disappearance of the jellyfish specie's on the continental shelf of the northern sub-region of the Canary Current upwelling ecosystem, has been observed for years since the nineties. The phenomenon was particularly accentuated during the during the last five years. These species, which inhabit large parts of the pelagic ecosystem, constitute competitive organisms for the other indigenous small pelagic resources in terms of distribution areas and food and affect their dynamics. Eight species are the most abundant and frequent in scientific observations in both the Atlantic and the Mediterranean, two of which are monitored biologically and ecologically; *Rhizostoma luteum and Pelagia noctiluca.* The dynamics and the occurrence frequency of the macromedusae seems to be partly governed by its oceanographic parameters and food ethology that represents a crucial factor in the stock development. This work aims to deepen the understanding of the biological parameters and trophic behavior of the macromedusae through an analysis of its diet in relation to the pelagic ecosystem's parameters. The specimens of *R. luteum* and *P. noctulica* were collected during scientific sea surveys carried out during the period 2017 – 2022 in two regions: Mediterranean area between Saïdia and Ceuta and the Atlantic Region Cap Blanc - Cap Boujdor are analyzed to estimate their biological parameters and trophic indices. The results obtained reveal a significant correlation between the macromedusea abundance and some environmental parameters computed locally in the same zone. The occurrence seems attesting to a case of a species responding to a marine ecosystem subject to hydrological disturbances generated by the level of the upwelling's intensity.

Keywords: Macromedusea, Upwelling, Moroccan Atlantic and Mediterranean continental shelf.

Jellyfish: Organism biology and ecology

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Jellyfish, belonging to the class Scyphozoa, are fascinating marine invertebrates that have captured the attention of scientists, researchers, and the public alike due to their unique characteristics and important ecological roles. This abstract provides an overview of jellyfish organismal biology and ecology, highlighting their anatomical adaptations, life cycle, reproductive strategies, feeding mechanisms, and ecological significance. Understanding the organismal biology of jellyfish begins with their anatomy. These gelatinous creatures possess a simple body structure, typically consisting of an umbrella-shaped bell and trailing tentacles. The umbrella facilitates swimming, which are generated by contracting muscular cells. The tentacles are armed with stinging cells known as nematocysts, which aid in prey capture and defense against predators. Jellyfish also feature a decentralized nervous system and lack centralized organs, a characteristic trait of most cnidarians. The life cycle of jellyfish comprises both asexual and sexual reproduction, with most species exhibiting a medusoid body form during their adult stage. Asexual reproduction occurs through budding or strobilation, where small polyps or segments develop into free-swimming medusae. Sexual reproduction involves the release of gametes, with fertilization taking place either internally or externally. Following successful fertilization, larvae are formed, which subsequently grow into medusae, completing the life cycle. Feeding mechanisms of jellyfish revolve around their predatory nature as they primarily subsist on planktonic organisms. Using their tentacles, jellyfish employ both passive and active capture methods. The sticky nematocysts and mucus present on their tentacles aid in trapping prey, which is subsequently immobilized, consumed, and transported to their gastric cavity for digestion. Jellyfish have been known to exhibit opportunistic feeding behaviors, adapting their diet based on the availability of prey and the surrounding ecological conditions. Jellyfish play significant ecological roles as both consumers and prey within marine ecosystems. They are efficient filter feeders, capable of large-scale filtration and impacting plankton community dynamics. Additionally, they act as a food source for various marine organisms such as fish, turtles, and birds. The population dynamics of jellyfish are closely tied to environmental factors such as temperature, salinity, nutrient availability, and climate change. Blooms or outbreaks of jellyfish populations can have cascading effects on marine food webs and ecosystem equilibrium. In conclusion, jellyfish organismal biology and ecology encompass various intriguing aspects, including their unique adaptations, life cycle, reproductive strategies, feeding mechanisms, and ecological interactions. A comprehensive understanding of jellyfish biology not only contributes to our knowledge of marine ecosystems but also aids in the management and conservation efforts required to sustain these crucial organisms and their habitats.

Effect of Climate Change in tropical Zooplankton, west coast of India

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Aquatic biodiversity has vast economic value and is mainly responsible for sustaining and supporting overall ecological health. Plankton symbolize life in the water column which control the basic energy source at lower trophic levels and hence form an integral issue the world is currently facing. Climate change and global warming are potential threats to humanity.The importance of zooplankton in ocean ecosystems and traits that make them climate change-sensitive beacons. Global warming may have greater implications for marine ecosystems than on terrestrial ecosystems, as temperature affects the stability of water poles, nutrient enrichment, new production, and thus the abundance, composition, size, diversity and nutritional efficiency of zooplankton. The relevant descriptions of physical changes in the oceans in response to climate change are presented as a prelude to a detailed discussion of the perceived effects of global warming on zooplankton. Zooplankton is an important part of the pelagic community since it includes the major consumers of primary production. The present study carried out from west coast showed zooplankton biomass ranging between 19.13 and 87.28ml/100m giving an average of 40.08ml/100m.In most of the creek system the zooplankton population showed wide fluctuation in high saline water and low saline condition, however in west coast maximum zooplankton population was observed in post monsoon period (November to January). The present research work constitutes the ecological study and impact of climate change on tropical zooplankton from west coast of India.

Keywords: ecosystem, climate change, distribution, global warming, zooplankton.

What a 13-year long time series tells us about a Scyphozoan jellyfish

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In a climate change context, it is important to know what drives jellyfish population dynamics. As their life cycle is linked to temperature, global warming may affect their abundance, seasonality, and biometrics. To study the phenological changes a population undergoes, time series are essential. However, long-term time series on gelatinous organisms are rare. Here, we sampled zooplankton bimonthly since 2010, at a fixed station in Thau, a French Mediterranean lagoon, using 200 and 700µm mesh nets. *Aurelia coerulea* abundance was calculated for each sample and maximum bell diameter was measured on ephyra and medusa stages. *Aurelia coerulea* develops one cohort: ephyrae are released from November to May, and the medusa stage occurs until June. There is a large interannual variability in stages occurrence, with ephyrae and medusae appearance ranging from 33 to 199 days and from 0 to 112 days respectively. Jellyfish maximum abundance reached up to 1474 individuals. $100m^{-3}$ in 2014 and only 14 individuals. $100m^{-3}$ in 2018. The relationships between phenological (start, duration and end of the bloom, growth rate, individual maximum size) and environmental parameters (sea surface temperature, salinity, and chlorophyll a concentration) were investigated. Our results suggest that maximum abundance of ephyrae and medusae are correlated, respectively, with winter temperature of the previous year, and spring temperature. Medusae growth rate is correlated with spring temperature. Overall, we found that temperature plays a key role in *Aurelia coerulea*'s phenology.

Keywords: Phenology, Temperature, *Aurelia coerulea*, Abundance, Population dynamics

Community composition and seasonal dynamics of the *Aurelia labiata* polyp microbiome

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The jellyfish polyp microbiome has been demonstrated to be important to their fitness and ability to strobilate under laboratory conditions. To date, however, the seasonal dynamics of the *Aurelia* spp. polyp microbiome has yet to be studied *in situ.* Seasonal dynamics are important for understanding how changes in the polyp microbiome relate to strobilation. In this study, *Aurelia labiata* polyps were collected from pre-settled plates suspended at 1 m depth. Jellyfish polyp and seawater samples were collected monthly between February and July 2019. DNA was extracted from individual polyps and the V4 region of the 16S rRNA gene was amplified and sequenced on an Illumina MiSeq. The resulting amplicon sequence variants (ASVs) were used to resolve the polyp and seawater microbial communities. Both the polyp microbiome and seawater community composition changed seasonally, but remained distinct across all months. Changes in the polyp microbiome were primarily driven by a decrease in *Endozoicomonas* and an increase in *Rubritaleaceae*, *Haliecae*, *Cyclobacteriaceae*, *Flavobacteria*, *Pirellulaceae* and *Saprospiraceae* from February to July. Given the synchrony of these compositional changes with strobilation, we propose that these microbial taxa may play key roles in the life history of *A. labiata* polyps. Specifically, these taxa should be investigated for their ability to induce strobilation on the molecular level, and their potential role in seasonal bloom formation of *A. labiata* medusae.

Keywords: Microbiome, *Aurelia labiata*, Polyp, Seasonal dynamics, Strobilation

Kleptoparasitism and nursery habitats: An ıntriguing symbiotic association between cyaneid jellyfish and ophiocnemis brittle stars

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Symbiotic relationships in marine habitats are diverse and intriguing, with commensalism being a common phenomenon where one organism benefits without harming the other. Cyaneid jellyfish, such as *Cyanea nozakii* Kishinouye, 1891, act as ideal hosts for smaller organisms seeking transportation or protection. Among these hitchhikers is the brittle star, *Ophiocnemis marmorata* (Lamarck, 1816), a benthic organism, which is found associated with jellyfish species. In this study, we document the first recorded association between *O. marmorata* and *C. nozakii,* highlighting an intriguing case of probable kleptoparasitism. Three specimens of *C. nozakii* were collected from the coast of Mandapam, Tamil Nadu, India, along with juvenile carangids in the month of August 2022. The water temperature, salinity, and pH at the location were recorded. Twenty-four ophiuroids were found attached to the jellyfish, with larger ones on the exumbrellar portion and smaller ones inside the gastrovascular cavity. The bell diameter of *C. nozakii* was measured at 38 cm, while ophiuroids had disc diameters ranging from 2.5 mm to 5 mm, and carangids varied in total length from 3 cm to 10 cm. Morphological identification confirmed *C. nozakii* as a member of the Cyaneidae family and *O. marmorata* as a representative of Ophiocnemis genus. While previous researchers hypothesized *O. marmorata* to be a suspension feeder, our study supported the hypothesis of kleptoparasitism, indicating that the ophiuroids feed on micro and mesozooplankton captured by the jellyfish, as the majority of the juvenile brittle stars were found in the gastrovascular cavity of the jellyfish. Additionally, our findings propose that scyphozoans, like C. nozakii, may serve as nursery habitats for *O. marmorata*, where larvae feed in the gut cavity and later migrate to the apex of the jellyfish as they mature. This study provides compelling evidence for the kleptoparasitism theory and introduces a novel hypothesis of scyphozoans serving as nurseries for *O. marmorata*. Understanding such symbiotic relationships enriches our knowledge of marine ecology and the intricate strategies organisms employ to enhance their survival and resource utilization.

Keywords: Symbiosis, Commensalism, Hitchhikers, *Cyanea nozakii, Ophiocnemis marmorata*, Marine ecology

Co-occurrence patterns: Invertebrate associates of jellyfish *Cyanea nozakii*, *Lychnorhiza malayensis*, and *Netrostoma coerulescens* along the Indian southwest coast

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Jellyfish are known to harbour diverse assemblages of associated invertebrates, forming intricate ecological interactions that contribute to the overall biodiversity of marine ecosystems. This study investigates the biological associations between three jellyfish species, *Cyanea nozakii*, *Lychnorhiza malayensis*, and *Netrostoma coerulescens*, and their associated invertebrate communities along the southwest coast of India. Out of 60 samples of *Cyanea nozakii* collected, four specimens harboured the cirripede *Alepas pacifica;* they were found attached to the radial muscle fold in the subumbrella. Out of 120 samples of *Lychnorhiza malayensis* collected, portunid crab *Charybdis feriata* (82 numbers) and brittle star *Ophiocnemis marmorata* (24 numbers) were noticed in the exumbrella. The Brittle star *Ophiocnemis marmorata* (36 numbers) were noticed in the exumbrella of 40 samples of *Netrostoma coerulescens* collected. We consider the observation on the association of *Alepas pacifica* with jellyfish as parasitic, as the barnacle penetrates deep in the subumbrella. Gut content analysis of the crabs associated with jellyfish showed the presence of mucus and nematocysts, revealing the possible jellyfish mucus feeding by the crab. The association of brittle stars *O. marmorata* with *N. coerulescens* is probably commensalistic, as the latter can lead an independent life, though the strong degree of host-specificity exhibited by brittle stars could be explained only with further studies. Understanding the intricate jellyfish-invertebrate associations may help recognize the broader comprehension of marine food webs and provide valuable insights into the dynamics in such associations.

Keywords: Commensalism, Parasitism, Gut content analysis, *Alepas pacifica*

An investigation on the gelativores food chain: A case examines *Caranx heberi* from the Gulf of Mannar

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Gelativores play an integral part in marine ecosystems. Several marine organisms have been observed ingesting living gelatinous materials. Except for a few sparse reports, studies on gelativores have not been conducted in Indian waters. More than 36 fish families have been identified as gelativores on a global scale, with Stromateidae (3 species) and Balistidae (1 species) being the only ones with a documented ability to consume *Chrysoara* jellyfish. A study was conducted from January 2020 to December 2020 at the Pamban Therkuvadi Fish Landing Centre (9°16' 45.683"N, 79°12'19.298"E) on the Gulf of Mannar coast to record the diet of gelativores landings of trawls operated at a depth of 60 m. The Index of Relative Importance (IRI) reveals that between April and September, *Chrysaora* sp. (IRI value of 0.04) was found in the diet of adult *Caranx heberi* (Total length-17.8 to 46.6 cm). While the predominant prey of *C. heberi's* included *Decapterus* spp, and sardines. However, the presence of *Chrysoara* in certain months indicates the seasonal abundance of jellyfish in the Gulf of Mannar, and its role in the diet of *C. heberi*. There is a lack of information about the diet of juveniles of *Caranx* spp.; juveniles have often found to be associated with jellyfish. Hence, there is a need to document the diet preference in different phases of the life history of the fish to arrive at a concrete conclusion about the opportunistic feeding nature on gelatinous prey, and to document the diet, behaviour and ecology of gelativore predators.

Keywords: Marine ecosystems, *Chrysoara*, Seasonal abundance, Diet, Gulf of Mannar

Microbial degradation of carcass of jellyfish and other gelatinous zooplankton in seawater

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Not only living jellyfish, the significant importance of jellyfish carcass in biogeochemical cycles is also pointed out and some intensive studies have been conducted. However, information of microbial processes on carcass is still not enough. Here we report the results of microcosm experiments with carcass of jellyfish, *Aurelia coerulea* (Cnidaria), and other gelatinous zooplankton, *Beroe cucumis* s.l. (Ctenophora), *Ocyropsis* sp. (Ctenophora), and *Pegea confoederata* (Tunicata), to investigate the microbial degradation process of these carcasses and their effects to microbial community in seawater. The microcosms were prepared with each carcass and freshly collected seawater (including natural microbial community) or autoclaved seawater (only carcass-associated microbes), and incubated. During the experiments, water samples were subtracted from each microcosm to measure the concentrations of organic carbon (OC) and inorganic nutrients, abundance and community structure of prokaryotes. In the jellyfish carcass microcosm, much OC was in the water at the beginning. During the 19 days, 83% of the additional OC in water was degraded by microbes from the natural seawater, while 34% was degraded in autoclaved seawater microcosms. Inorganic nutrients were increased with decreasing of OC. Prokaryotes increased drastically during the first several days. Gammaproteobacteria were dominant on the Day4, similar as reported in previous studies. Succession of microbial community was observed, including Alphaproteobacteria and Flavobacteriia (Day9), and Verrucomicrobiae and Planctomycetia (Day20). The dominant microbes were different from the jellyfish-associated bacteria. Among the different carcasses, different community succession was observed. We will discuss the differences/similarities in degradation process and contributing microbes among the carcasses.

Keywords: Carcass, Bacteria, Organic matter, Nutrient, Microbial community, Biogeochemical cycles

Medusozoan dormancies: A review

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Dormancy is a crucial part of the life cycle of Medusozoa, but the morphological and ecophysiological properties of the different dormant stages have not been comprehensively studied. Here, we review all "dormancies" so far reported for 71 species (32% of 219 species with described life cycles) and categorize them into seven types based on ontogeny and morphology. These are 1) resting eggs in Cubozoa (C) and Hydrozoa (H); 2) planulocysts in Staurozoa (St), Scyphozoa (Sc) and H; 3) tubular cysts in Sc and H; 4) podocysts in Sc and H; 5) polypocysts in C and H; 6) dormant frustules in H; and 7) medusocysts in H. Dormant stages are basically small (ca. 100–1,000 µm diameter) and consist of an undifferentiated monoblastic, or poorly differentiated diploblastic, cell mass encased in a chitinous, gelatinous or mucus periderm. The dormancies are confined to those orders with benthic egg and polyp stages, suggesting that they have evolved to allow these to survive adverse conditions. Seasonal variation in temperature is important in inducing both encystment and excystment, though hypoxia, starvation, salinity change or mechanical damage may also trigger encystment. Compared to the dormant stages represented by other aquatic invertebrates, such as Rotifera, Bryozoa, Tardigrada and Crustacea, those of Medusozoa are less tolerant of various environmental stress. It is argued that the dormancy strategies employed by Medusozoa have evolved over the last 725 million years in order to sustain populations exposed to fluctuating environment and also to expand their geographical distribution.

Keywords: Dormancy, Encystent, Excystment, Life cycle, Medusozoa

The post-sexual reproduction development of *Nemopilema nomurai*

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Nemopilema nomurai is the largest Jellyfish species in the East Asian Sea, with the significant biomass and the wide-ranging influence. The immense number of eggs in an adult makes sexual reproduction an important way to regulate its population. However, compared to asexual reproduction, literature on sexual reproduction is often scattered. We obtained fertilized *N.n* eggs through artificial breeding and observed their development into polyps. At 22.0~ 23.5℃ and 30.0~ 31.0 salinity, it took four hours for the eggs to develop into larvae that swim clockwise before becoming primary polyps two hours later. After 20 days, the four-tentacle polyps had grown into mature polyps with sixteen tentacles each. This paper describes the biological development of sexual reproduction and explore the effects of salinity and dried food on this stage: (a) Fertilized eggs are suitable for low-salt environments, with a suitable range that increases as they develop; (b) Four-tentacle polyps are weak predators without subjective selection of food; (c) Proper size of dried food is crucial for newborn polyp growth and survival. Finally, this paper summarizes current understanding of *N.n*' s biology and ecology during sexual reproduction while proposing ideas for future research.

Keywords: *Nemopilema nomurai*, Sexual reproduction, Biology, Ecology

Responses of *Aurelia coerulea* and *Catostylus mosaicus* polyps to a simulated marine heatwave

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Marine heatwaves (MHWs) are natural phenomena characterized by extreme ocean-temperature events. With global warming, intensity, frequency, and duration of MHWs have been increasing across the oceans, and they are expected to continue increasing under future emissions scenarios. Although there are several studies on the responses of jellyfish to anthropogenic stressors, most have aimed to assess long-term climate change scenarios, and the impacts of MHWs on jellyfish has been poorly studied. Our goal is to analyze the response of *Aurelia coerulea* and *Catostylus mosaicus* polyps cultured at the Griffith Sea Jellies Research Laboratory to a simulated MHW. This response will be evaluated by changes in reproductive (*i.e.*, strobilation, budding) and mortality rates and molecular (transcriptome) parameters. We hypothesize that that *Aurelia coerulea*, which appears robust to a variety of anthropogenic stressors (i.e., *Aurelia coerulea*) will have a higher threshold of resistance to high temperatures than *Catostylus mosaicus*. To simulate the MHW, water temperature will be increased from 20.5^{o}C to 24.6^{o}C at a rate of 0.5^{o}C per day and kept at 24.6^{o}C for 5 days. Strobilation, budding, and mortality will be recorded every three days and polyps will be sampled at the beginning and end of the treatment for transcriptomic analysis.

Keywords: Scyphozoa, Moon jellyfish, Jelly blubber, Gene expression, Temperature, Stress

Hydrozoan jellyfish and Mesozooplankton inter-relationship in the coastal waters of Kochi

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Hydrozoan jellyfishes are widespread in all marine habitats. Recently, recurrent jellyfish blooms in the coastal waters of India have greatly affected the fisheries sector. The present work was carried out to study the temporal distribution of hydrozoan jellyfishes in the coastal waters of Kochi. For this, seasonal (pre-monsoon, monsoon, and post-monsoon) sampling was carried out in the years 2021 and 2022. Hydrozoan jellyfish exhibited seasonal variations in their distribution and abundance. Higher hydrozoan jellyfish abundance was observed during the post-monsoon of 2021 and the monsoon of 2022, while it was lowest during pre-monsoon of 2021 and post-monsoon of 2022. An inter-relationship between mesozooplankton abundance and hydrozoan jellyfish was also observed in both the years. The hydrozoan jellyfish followed a peak in the mesozooplankton abundance. In 2021, mesozooplankton was relatively high during the monsoon, and was subsequently followed by an increase in hydrozoan jellyfish during the post-monsoon. Similarly, in 2022, higher mesozooplankton abundance of pre-monsoon was followed by an increase in jellyfish abundance during monsoon. The present study reveals that the mesozooplankton abundance have a prominent influence on the distribution and abundance of hydrozoan jellyfishes in the coastal waters of Kochi.

Keywords: Jellyfish, Hydrozoa, Mesozooplankton, Coastal waters, Kochi

Combined and independent effects of ocean acidification and warming on *Rhizostoma pulmo* (Macri, 1778) ephyrae

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Climate change affects marine organisms and ecosystems through a combination of different stressors such as warming and ocean acidification (OA). Our understanding of the effects of increasing temperatures and reduced pH on scyphozoan jellyfish is still poor. Here, we investigated the independent and combined effects of OA and warming on swimming activity and morphological aspects of the ephyrae stage of the barrel jellyfish *Rhizostoma pulmo*. A full-factorial experiment was designed with eight experimental treatments. One-day-old ephyrae were exposed for 7 days to four different temperatures (15, 18, 24, and 30ºC), and two P_{CO2} levels corresponding to current (P_{CO2} = ~ 500 ppm) and projected levels (P_{CO2} = ~ 1000 ppm). General linearized models revealed the combined and independent effects of both stressors on swimming activity and ephyrae size. Swimming activity was lower under projected P_{CO2} conditions, and in combination with elevated temperatures of 30ºC significantly reduced ephyrae mobility at both ambient and projected P_{CO2} levels. Ephyrae exposed to reduced pH had significantly smaller body size, specially at 15 and 30ºC, indicating that optimal growth occurs at mild temperatures of 18 and 24ºC. In summary, elevated temperatures and reduced pH simulating projected Ocean Acidification conditions had significant effects on swimming activity and size of *R. pulmo* ephyrae, which may have consequences on the survival and population dynamics of wild populations.

Keywords: pCO_2, pH, Temperature, Scyphozoan, Swimming activity, Body growth

Exploring the potential ecological niche of *Pelagia noctiluca* in Mediterranean ecoregions

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The marine pelagic ecosystem of the Mediterranean Sea hosts a variety of species, each with its own ecological niche. Among these inhabitants, the holoplanktonic scyphozoan *Pelagia noctiluca*, has attracted attention due to its recurrent bloom events and significant ecological and economic impacts. Holoplanktonic medusozoans are thought to have evolved greater tolerance to various environmental factors, allowing them to thrive in open ocean and nearshore environments. By examining the spatial distribution, phenology, demography and environmental characteristics in different ecoregions of the Mediterranean Sea, this study aims to shed light on the ecological niche of *P. noctiluca*. To achieve this goal, a comprehensive analysis is conducted utilizing data from extensive field surveys (the 1990s to 2023) from the Adriatic Sea (northern, middle, and southern), the Balearic Sea, the Southern Tyrrhenian Sea, and the North of Tunisia, as well as data from the literature. These data are complemented by a set of environmental variables such as oceanographic data derived from CMEMS model reanalysis (Copernicus Marine Environment Monitoring Service) to define the niche features in the different regions in terms of T/S ranges, thickness and duration of the surface mixing layer, wind/wave regimes and food availability. By integrating these diverse datasets, we intend to gain insights into the spatial distribution, population dynamics, and niche ecology of *Pelagia noctiluca* across different Mediterranean ecoregions. Moreover, we will evaluate/test the hypothesis that the different ecoregions could provide complementary habitats allowing the maintenance of sink populations with locally-observed pattern of presence.

Keywords: *Pelagia noctiluca*, spatial distribution, oceanography, phenology, Mediterranean Sea.

Tolerance of *Cassiopea andromeda* (Forskål, 1775) to warming scenarios of the Mediterranean Sea

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Responses of marine organisms to warming oceans are driven by multiple factors, with temperature being a crucial one. In turn, this may also impact tolerance to changes in other factors, such as dissolved oxygen concentration and salinity. The upside-down jellyfish *Cassiopea andromeda* (Forskål, 1775) in the Mediterranean Sea is a Lessepsian immigrant, whose scyphistoma stage plays a key role in determining the reproductive success, long-term survival and dispersal of the species across multiple habitats and geographic regions. Thus, predicting *C. andromeda* tolerance and adaptability to future climate change scenarios relies also on clarifying how the scyphistoma stage may react and adapt to varying environmental conditions. Here, we used oxygen consumption rate as a proxy of metabolism to investigate two basal functional traits: temperature and salinity tolerance range and thresholds. Under controlled conditions, 15 experimental temperatures - from 12°C to 40 °C - and 12 salinities - from 24 to 46 ppm - were tested. Two performance curves were constructed for temperature and salinity with the obtained data set, showing that the scyphistoma polyps of *C. andromeda* presents wide tolerance ranges for both temperature and salinity, which may allow adaptation even under extreme environmental conditions. In future scenarios of climate change, a mechanistic trait-based approach may significantly contribute to forecast the ecological success and distribution of *C. andromeda* in the warming Mediterranean Sea.

Keywords: Lessepsian species, Functional traits, Metabolism, Climate Change, Upside-down jellyfish, Scyphistoma

Evaluation of the induction of asexual reproduction in *Cassiopea andromeda* (Cnidaria, Scyphozoa) through feeding stimuli

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Variations in food availability may induce reproductive processes that can cause "jellyfish blooms". One potential food source is the organic material dissolved (DOM), which could be linked to domestic sewage discharge. However, the impact of DOM on jellyfish asexual reproduction remains unclear. Here we aimed to check the influence of different types of food on the asexual reproduction in polyps of *Cassiopea andromeda* from Cabo Frio, Brazil. We test the impact of different food sources (*Artemia salina* or *Dallocardia muricata*) and DOM (Marine Snow - Barrak) on asexual reproduction. Three types of feeding protocols (N=10) were conducted, with each group separated into triplicates, and a control group with no food. Experiment (A) with marine snow, which mimics the pathway of DOM at the manufacturer's recommended concentration. Experiment (B) macerated mussel (*Dallocardia muricata*) was utilized as food, and experiment (C), *Artemia salina* nauplii were employed as the food source. The polyp specimens were fed for 5 days and observed for 10 days, while the control group was kept without any food (starvation). The group C (*Artemia salina*) demonstrated the highest number of asexual products with 2 budding polyps, 25 planuloid buds, 2 new polyps, and a only 3 deaths. Conversely, groups A and B did not exhibit a higher reproduction rate and had 2 and 15 deaths, respectively. Interestingly, both groups A and B had worse results than the control group kept in starvation. Our findings provide unexpected results which should be further tested and discussed; apparently, *Cassiopea andromeda* polyps can absorb more nutrients from crustacean food sources compared to mollusks or marine snow.

Keywords: Polyps, Invasive species, Pollution, Upside down jellyfish, Non-indigenous

Gelatinous zooplankton: Exploring diversity and seasonality in a Subtropical Eastern Atlantic Oceanic Island System

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As the effects of climate change and human activities continue to reshape marine environments, acquiring a profound understanding of ecosystems' structure and functioning becomes imperative. This entails focusing on biodiversity, monitoring the possible influx of non-indigenous species, and observing community phenology. Within this context, gelatinous zooplankton (GZ), comprising a taxonomically and functionally diverse group of marine organisms, emerge as a pivotal player in oceanic ecosystems. However, despite their ecological significance, these organisms remain insufficiently explored regarding their biodiversity, phenology, and distribution, particularly within regions like the Eastern Subtropical Atlantic. This study presents a comprehensive synthesis of the existing knowledge regarding GZ biodiversity (here Cnidaria, Ctenophora, Chaetognatha, Appendicularia, Heteropoda, Pteropoda and Thaliacea) within the Madeira archipelago in the eastern subtropical Atlantic Oceanic Island system. Drawing upon an exhaustive review of literature, historical records, and contemporary news sources, we offer an overview of the subject. Moreover, extensive fieldwork expeditions were performed, covering various seasons (autumn and summer), depths (subsurface up to -300m) and geographical areas with 12 stations deployed around the island from coastal to the open ocean. The primary objective was to capture gelatinous communities' spatial and temporal dynamics. Results showed 1) a higher GZ abundance in the island's southern waters, 2) different community composition, with chaetognaths and Appendicularia dominance in the westernmost and easternmost stations, respectively, and 3) a seasonal variation in the GZ dynamics. In doing so, we seek a contemporary outlook on their distribution and potential change over time.

Keywords: Gelatinous, Oceanic ecosystems, dynamic, spatial distribution, Madeira Archipelago

Massive stranding of sea jellies on the West coast of India

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A rare event of massive stranding of few gelatinous organisms were observed in September 2022 off the Mangrol coast, Gujarat, west coast of India. Four gelatinous species, Three Cnidarians and one Chordate (Tunicate) were found in the accumulation. A few Cnidarians such as *Porpita porpita* and *Physalia physalis* were reported to be stranded in the Indian waters during post monsoon. However, it was a rare event of mass stranding of the moon jelly *Aurelia* sp. and with the tunicate *Salpa* sp. being a prime component. The blooming of planktons during the post monsoon season due to the mixture of fresh water nutritive components from the rivers may be one of the reasons for this stranding. The over exploitation of the fishes might indirectly facilitate the blooming of jellies because most of the fishes shares a common feeding habit by praying upon the planktonic species. Further, possible causes of mass stranding along the coastal areas may be in response to different abiotic processes such as sea surface temperature, stronger wind speed and currents.

Keywords: Mass stranding, Sea jelly, Cnidarians, Tunicate, Gujarat coast, Plankton bloom.

Exumbrellar surface of jellyfish: The presence of microvillar array in some species and their possible functions

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The exumbrellar surfaces of jellyfish were ultrastructurally examined to reveal their structural diversity. Including six species previously reported (Hirose et al., 2021), we compared the exumbrellar structures in 12 species covering 5 hydrozoans, 2 cubozoan, and 5 scyphozoans. A simple epidermis entirely covers the exumbrellar surface in 10 species. The epidermis was lost in two mesopelagic species probably due to disturbance during collection, but it partly remained in the other two mesopelagic species. Epidermal structures considerably varied among species: the epidermis is composed of squamous, cuboidal or columnar cells, and its surface structure was broadly classified into flat (e.g., a siphonophoran *Agalma okenii*), irregular (containing cellular bulges, microvillus, and cilium: e.g., a scyphozoan *Aurelia coerulea*), and microvillus-arrayed (e.g., a hydrozoan *Spirocodon saltatrix*). The microvillar surface forms a surface structure similar to the nano-scale nipple arrays on the cuticular surface in some insects and tunicates. These nipple arrays in insects and tunicates are supposed to be a functional nano-structure that reduces light reflection, adhesion, and etc. We will discuss possible function of the microvillar array found on the exumbrellar surface in some jellyfish.

Keywords: Epidermal morphology, Nano-structure, Transmission electron microscopy, Medusozoa

A citizen science approach to explore spatio-temporal patterns of jellyfish in Uruguay (Southwestern Atlantic coast)

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In Uruguay, oceanic and estuarine coastal areas support important economic activities such as tourism and fishing. These activities can be directly affected by jellyfish blooms, contaminating fish catch or stinging bathers. Despite the socio-economical importance of studying this ecosystem component, jellyfish has been historically understudied in the Uruguayan coasts. Here we present the citizen science jellyfish monitoring initiative "Sightings Net of Jellyfish" (R.A.M.). The project started in 2012 and includes volunteers -mostly lifeguards- predominantly during summer months. Since 2015, a mobile app "Veomedusas" has been implemented, which allows species identification and data recording in real time, replacing the original printed forms. The project achieved the participation of 160 volunteers, with 52 annual observers in the last years, covering a coastal daily extension of 500m. We compiled a total of 9300 presence-absence records during 12 years. As a result at least 13 species have been identified, including scyphomedusae, hydromedusae, cubomedusae, ctenophores and siphonophores. *Lychnoriza lucerna* and *Chrysaora lactea* are among the most frequent bloom-forming species, whilst *Tamoya haplonema*, *Olindias sambaquiensis* and *Physalia physalis* are the species causing most accidents with bathers. With the collected information, we have filled knowledge gaps concerning inter- and intra-annual fluctuations of these populations, bringing this knowledge to all coastal users. The continuation of this project is paramount to provide responses to future scenarios that could arise if jellyfish blooms become more frequent and intense as a consequence of climate change.

Keywords: Medusae, Río de la Plata estuary, South America, Monitoring, Cnidaria, Ctenophora

The feeding ecology of the *Chrysaora* sp (Scyphozoa, Cnidaria) indicates the coastal community structure and trophic level interactions in the South Eastern Arabian Sea

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The feeding ecology of Jellyfish is crucial in understanding the ecological roles and interactions of coastal organisms as they play a critical role in coastal food web dynamics and trophic level organisms. The primary focus of the study was the analysis of gut contents collected from Chrysaora sp., with an aggregate number of samples (n=252) gathered from coastal regions of northern Kerala (Southeastern Arabian Sea) between September 2022(post monsoon) and May 2023(pre monsoon). Throughout the study period, the abundance of Chrysaora sp. in the region ranged from 80±12 per 100m² during the pre-monsoon period to 130±15 per 100m² during the post- monsoon period. Gut content was analyzed from samples collected at a single net haul, revealing variations in contents, including empty stomachs, partially digested items, and undigested elements of the diet. The predominant contents of the jellyfish guts were fish larvae, followed by crustaceans, particularly prawn larvae and copepods. Among copepods, cyclopoida and calanoida were more prevalent than harpacticoida and other orders. Additionally, other zooplanktons, such as chaetognatha and fish eggs, were found, although in lower abundance. The stomach content analysis also showed representation of phytoplanktons. Significantly, through the study it could be understood that there is a strong correlation between the size of the jellyfish umbrella (diameter) and the quantity of diet contents it could support. Larger umbrella diameters are associated with a greater abundance of prey consumed; highlighting the importance of size in determining the jellyfish's feeding intensity. The study provides new insights that Chrysaora sp. has significant ecological impacts on coastal ecosystems. They are voracious predators of tiny organisms and can exert top-down regulation on planktonic populations, affecting the food web dynamics. Additionally, their predation on fish larvae and other juveniles may have influence on the recruitment of specific fish populations.

Keywords: Jellyfish; Coastal ecology; Feeding behavior; Prey selection; Food web dynamics

Microplastic intrusion in pelagic jellyfish *Netrosoma coerulescens* Maas, 1903 in the eastern Arabian Sea

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Microplastic (MP) pollution has become a significant environmental concern worldwide, with potential implications for marine ecosystems and species, including jellyfish. The potential of jellyfish mucus to adsorb the micro and nanoplastics has also been realized recently. MPs reach aquatic organisms directly by ingesting them or via trophic transfer by consuming contaminated prey. This research paper investigates microplastic intrusion in the pelagic blooming jellyfish species *Netrosoma coerulescens* collected from the eastern Arabian Sea, west coast of India. From the *Netrosoma coerulescens* blooms, 94 jellyfish were collected randomly. Mucus, bell and oral arms were tested for microplastics by acid digestion. Out of 94 specimens analyzed, 58 (61%) were contaminated with MPs; the number of plastics per individual was 2.08±0.15 (±SE), and they measured 0.317 mm (mucus) to 4.89 mm (bell). MPs were recovered highest from mucus (58.67%), bell (25.61%) and least in the oral arm (15.70%). The polymers were identified using ATR-FTIR and micro Raman spectroscopy. The number of MPs retrieved was in the order: mucus>bell>oral arm with fibres (95.04 %) and fragments (4.95 %). Black (36.36%) was the predominant colour of the MPs, followed by dark blue (23.96%), red (21.48%), light blue (11.57%) and pink (6.61%). ATR-FTIR revealed polymers such as polyurethane (PU) and polyvinyl acetate (PVA), and Raman spectroscopy confirmed PTFE, PP, Nylon and PET. Comprehensive research on MP contents on jellyfish would reveal the extent of pollution in various marine realms and the possible trophic transfer of pollutants and understand the potential of jellyfish mucus in trapping micro and nano plastics.

Keywords: Plastic pollution; Jelly fish bloom; ATR-FTIR, micro-Raman

Annual evaluation of zooplanton and jellyfish in the Golden Horn Estuary, Istanbul, Türkiye

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Zooplankton species may be objectively measured and play a significant role in influencing the quality of an ecosystem. Estuaries are regarded as very productive ecosystems because they serve as transitional areas between riverine and coastal environments. The current study's objective is to investigate the Golden Horn Estuary's zooplankton yearly cycle. At the sample station throughout the year, September had the highest concentration of all zooplankton species. The most common zooplankton groups are Clodecera (949,717 ind/m^{-3}), Copepoda (731,892 ind/m^{-3}) and Meroplankton (731,892 ind/m^{-3}). The most abundant species belonging to the Clodecera group is *Penillia avirostris*, this species is most abundant in September (949,717 ind/m^{-3}) .The most abundant month of the jellyfish species *Aurelia aurita* found at the sampling station throughout the year was July, while the smallest individual (2 cm) was found in this month, and the largest individual (23.5 cm) in April. Bivalve larvae were the most common zooplankton species found in the stomach of *Aurelia aurita* throughout the year. Then the most common species in stomach contents throughout the year are copepod species *Acartia clausi* and *Paracalanus parvus*, cladoceran species *Pleopis polyphemoides* and rotifera respectively. Throughout the year, the zooplankton species in the stomach of *Aurelia aurita* and the zooplankton species in the seawater were parallel.

Spermatogenesis and sperm release in *Aurelia cebimarensis* (Semaeostomeae, Scyphozoa)

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There are only a few studies describing in detail the histology and histochemistry of scyphozoan spermatogenesis. Here we analyze and describe the spermatogenesis and sperm release in the species *Aurelia cebimarensis*, a common semaeostome found in waters of SE Brazil. Like other species of the genus, *A. cebimarensis* is dioicous and gonochoric in which the gonad has an external columnar epithelium, an inner genital cuboidal epithelium and between them lays the spermatogenic cells immersed in the acidophil mesoglea. The external genital epithelium has large vesicles with basophil, mucopolysaccharide secretion indicating the production of an apparent seminal fluid. The spermatogonia and spermatocytes are seen in the follicular periphery while the spermatid and sperm are found in the basal-central part of the follicle. The final sperm have elongated basophil head positive to proteins and acid compounds with a long acidophil flagellum. Differently of other semaeostomes with internal fertilization, *A. cebimarensis* do not releases the sperm in clumps, being the sperm released in the genital sinus through a rupture in the follicular wall near the inner genital epithelium. We presume that the sperm immersed in a seminal fluid could be an intermediate strategy of sperm release among other scyphozoans (e.g. free gametes or packed in *spermatozeugmata*). The presence of sperm immersed in an acid mucopolysaccharide seminal fluid may minimize bacterial infection and could indicate an advantage in the mechanism of sperm transfer in this species.

Keywords: Jellyfish, Reproduction, Gametogenesis, Histology, Histochemistry

Exploring biotechnological potential of gelatinous biomass in the northern Adriatic

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The northern Adriaitc Sea has been facing extensive jellyfish blooms over the last decades. In particular, the year 2022 was an extremely "gelatinous". Four Scyphomedusae (*Rhizostoma pulmo*, *Aurelia* sp., *Chrysaora hysoscella* and *Cotylorhiza tubeculata*), two Hydromedusae (*Aequorea forskalia*, *Aequorea* sp.), a pelagic tunicate (Salpa fusiformis) and a ctenophore species (*Mnemiopsis leidyi*) formed extensive aggregations over approximately three months each, causing nuisance for local tourism and fisheries, and affected human health. On the other hand, recurring high gelatinous biomass over the last decades raised discussion about exploitation possibilities of the most frequently blooming species. Here, we reviewed the variety of potential use of gelatinous biomass and discussed the possible local implementation. Further, we compiled the information on elemental composition (C, N, P), fatty and amino acid content, and metal(oid)s content in jellyfish dry mass, and discussed the implications of high salt content. Finally, we performed a survey among local commercial and artisanal fishermen to determine their perception of the impact of jellyfish blooms on their activities and their willingness to adjust fishing gears and operations to catch gelatinous plankton if any of the jellyfish become a targeted species.

Keywords: biochemical composition, biotechnological applications, jellyfish fishery

Monthly dietary shifts in the jellyfish *Nemopilema nomurai* in Liaodong Bay, China

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Nemopilema nomurai is a frequently bloomed species in the China seas. Their feeding organ has an ontogenetic change when they grow up, but whether their diet changes along with it is unclear. A 5-month study on *N. nomurai* was conducted in Liaodong Bay, China to clarify the dietary shift and feeding effect of *N. nomurai*. Fatty acid biomarkers revealed the proportion of carnivorous food in the diet of *N. nomurai* decreased when their bell diameter increased. The isotope data revealed a similar story with $\delta^{15}N$ dropping which indicated a decreased trophic level. The diet composition was dominated (74 %) by zooplankton >200 μm in May and then decreased to <32 % in July. In contrast, the proportion of particulate organic matter increased from <35 % to 68%. This study revealed a monthly shift in the diet of *N. nomurai* and contributed to knowledge of trophic interactions between plankton and *N. nomurai*.

Keywords: *Nemopilema nomurai*, Diet, Distribution, Stable isotopes, Fatty acids

Palatability and ingestion-egestion times of virgin and aged microplastics in polyps and medusae of three schyphozoan species: *Aurelia sp.*, *Rhizostoma pulmo* and *Cotylorhiza tuberculata*

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Microplastics are pollutants of global environmental and public health concern due to their potential for biomagnification in high-level predators once they enter the food chain. Their ubiquity and small size allow them to be ingested by a diverse range of marine organisms, including cnidarians. To assess the ingestion-egestion times and palatability of various types of microplastics (polyethylene microspheres and polyester microfibers), both virgin and aged, in the polyp and medusa stages of three scyphozoan species (*Aurelia sp*., *Cotylorhiza tuberculata* and *Rhizostoma pulmo*), we conducted experiments in aquaria. The obtained results were mixed. While the presence of biofilm did not influence the uptake of microspheres or microfibers into tentacles in any species or stage, ingestion and egestion times of virgin microfibers were significantly higher than aged ones in the medusa stage of *Aurelia sp.* Comparing polyps and medusa stages in *Aurelia sp*. we also observed significant differences in ingestion and egestion times, with polyps being faster at incorporating microplastics, but slower at expelling them. However, the average residence time of the microplastics in organisms of both stages (N=147) did not exceed 2.5 hours. For *C. tuberculata* and *R. pulmo*, the number of particles ingested was insufficient for any statistical analysis at the medusa phase, while for polyps, no significant differences were found between their ingestion and egestion times and those of *Aurelia sp.* polyps. In summary, the time window in which microplastics would be available in these species for transfer to a predator is small, thus limiting the risk of biomagnification.

Keywords: Scyphozoa, Ingestion time, Jellyfish, Microplastics, Food chain, Biofilm

Swimming behaviour in ontogenic stages of *Carybdea marsupialis* (Cnidaria: Cubozoa) and its implications for their spatial distribution

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Carybdea marsupialis is a box jellyfish endemic to the Mediterranean Sea, abundantly detected in some of its shallow waters. The goal of this study was to determine the influence of their swimming behaviour on the spatial distribution of a well-studied population off the coast of Dénia (NW Mediterranean), where adults and juveniles do not coincide geographically. To achieve it, we analysed the swimming speed, effective velocity, and effective displacement index (EDI) of 27 individuals with diagonal bell widths (DBW) ranging from 1.1 to 36 mm in aquaria using conventional video recordings and the video analysis tool Tracker. Mean swimming speed for small juveniles (DBW≤5 mm), medium juveniles (5 mm <DBW<15 mm) and adults (DBW≥15 mm) was 9.65 ± 0.76 mm s^{-1}, 21.91 ± 2.29 mm s^{-1} and 43.10 ± 1.78 mm s^{-1} (mean ± SE), respectively. Effective velocity was lower than speed in all categories, particularly in the smaller ones. EDI values indicated that small juveniles had trajectories with more twists and turns than the other classes. When comparing these results with local currents obtained from drifting buoys, only adults would be able to swim strongly enough to overcome almost 70% of the currents and select their habitat, while small juveniles would be dependent on advection. Although experiments adding currents in aquaria would be necessary to confirm these theoretical results, such information would be useful in improving jellyfish bloom forecasting models, since, although mild in intensity, the sting of *C. marsupialis* may produce severe systemic effects in sensitive swimmers.

Keywords: Box jellyfish, Carybdeidae, Swimming speed, Surface currents, Advection, Video analysis

Tracking jelly populations by combining genetics and oceanographic dispersal models

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Understanding the population structure, connectivity and dispersal are universally considered important for biodiversity conservation. For gelatinous zooplankton taxa this is particularly challenging. For example, jellyfish blooms are highly variable in their temporal and spatial scales and can result from reproduction and growth of new individuals in a given location, from redistribution of existing individuals to a given location from another location, or a combination of these factors and their dispersal paths are often untraceable. However, dispersal can contribute significantly to population structure with implication on reproduction, growth rates, gene flow and, ultimately, species persistence. Here we use *Aurelia aurita, Cyanea capillata and Periphylla periphylla* as model organisms to show how coupling the population genetic analysis together with Lagrangian dispersal simulations can provide crucial information on their population structure. This unique dataset includes several hundreds of specimens with detailed metadata on the life stage, the geographic position of the specimens together with abiotic information which are often missing from the publicly available sequence data. With this data, we could, for instance, identify two distinct populations of *C. capillata* in the Baltic Sea/North Sea region and solve a long-standing riddle regarding local reproduction in the Baltic Sea. This knowledge is an important aspect when linked together with the environmental factors as different populations may present local adaptations to certain environmental conditions. Such local adaptations are key when for instance modeling bloom events and predicting the future scenarios.

Keywords: Adult, Connectivity, Dispersal, Polyp, Population, Ecosystem-based management

Can different temperatures and food availability influence jellyfish blooms (Cnidaria, Discomedusae)?

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Cnidaria is a phylum in which 1/3 of the species have a metagenetic life cycle (medusozoans). Strobilation is the asexual reproduction by which scyphozoan species produce young medusae (ephyrae) from polyps. Thus, the polyp stage is intimately related to the phenomena known as jellyfish blooms. Under favorable conditions, polyps can spend more energy increasing their numbers through asexual methods, consequently increasing the number of jellyfish in the environment afterward (possibly causing blooms). The main goal of this work was to identify the influence of temperature and feeding on strobilation and other asexual reproduction types of four scyphozoans species: *Lychnorhiza lucerna*, *Cotylorhiza tuberculata*, *Sanderia malayensis,* and *Aurelia coerulea*. Our experiments consisted of varying the temperature and food supply. The results indicate that higher temperatures influence positively the polyps' production in *Aurelia coerulea*, *Cotylorhiza tuberculata*, and *Sanderia malayensis*, and also in *Lychnorhiza lucerna*'s polyps that remained starved. Considering stolon production, the absence of food is significant in *Aurelia coerulea* and *Sanderia malayensis*. There was no influence on the podocysts production for the species studied. Finally, both temperature and absence of food influenced the strobilation of *Aurelia coerulea*, *Lychnorhiza lucerna,* and *Sanderia malayensis*, being higher in the first species than the other two. *Cotylorhiza tuberculata* did not strobilate during the course of the experiments and had 100% mortality at lower temperature (10ºC). The increase in the number of polyps for the species studied indicates that understanding the reproduction in the benthic stage is essential to comprehend scyphozoan population dynamics with metagenetic life cycles, and thus being able to precisely understand the jellyfish blooms.

Keywords: Blooms, Temperature, Strobilation, Asexual, Reproduction, Scyphozoa

The levels and composition of cultivable bacteria associated with the jellyfish *Aurelia aurita* in the Golden Horn Estuary, Istanbul, Türkiye

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Estuaries are dynamic ecosystems that maintain high productivity and intense flow of organic and inorganic nutrients and jellyfish blooms are known to affect the composition and abundance of marine bacteria. In this study, it was aimed to determine the total heterotrophic aerobic bacteria (THAB) levels and to determine the culturable bacterial diversity in seawater and *Aurelia aurita* samples taken from three stations in the Golden Horn Estuary. THAB was determined using spread plate technique on Marine Agar in both seawater samples taken from 0-30 cm surface and jellyfish samples by monthly sampling under aseptic conditions between January 2022 and June 2023. The bacterial isolates were identified using an automated, VITEK2 Compact30 micro-identification system. The highest THAB values were recorded as $38x10^{12}$ (H1, June 2023) and the lowest $51x10^{6}$ cfu/ml (H2, January 2023) during the sampling period. THAB levels were recorded on the *A. aurita* umbrella outer surface to be $19x10^{9}$ - $18x10^{4}$ cfu/g; $17x10^{8}$ - $16x10^{4}$ cfu/g in oral arm and $27x10^{10}$-$40x10^{4}$ in mucus samples. 14 bacteria species belonging to three classes; Alphaproteobacteria (17.64 %), Gammaproteobacteria (79.42 %), Betaproteobacteria (2.94 %), were recorded. It was determined that the bacterial levels were higher in seawater samples than jellyfish samples. *Enterobacter cloacae* and *Sphingomonas paucimobilis* species were isolated from both seawater and *A. aurita* samples. In this study, the first data on the levels of jellyfish-associated bacteria and free living bacteria in the surrounding water, bacterial compositions were recorded in the Golden Horn Estuary.

Keywords: Heterotrophic aerobic bacteria, Bacterial composition, *Aurelia aurita*, Golden Horn

The impact of differing plankton diet on the growth, development and mortality of *Mastigias papua* (Lesson, 1830)

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Mastigias papua, popularly referred to as White-spotted Sea Jellies in the aquarium trade, are known for their symbiotic association with photosynthetic dinoflagellates. In the wild, these medusae pulsate near water surfaces during daylight, allowing the symbionts that they harbour to photosynthesise; the latter providing nutrients to its medusa host. However, *M. papua* also consume a variety of plankton, such as both zooplankton and phytoplankton, to sustain themselves. It is unclear how the growth of *M. papua* may be impacted by the variety of its plankton diet, at present, there are knowledge gaps pertaining to this. In this study, we investigated how the growth of *M. papua* is impacted by the variety of its plankton diet. We hypothesized that for *M. papua* to be grow and be healthy, it must consume both zoo- and phytoplankton. We subjected 180 *M. papua* ephyrae to three different diet treatments: i) phytoplankton only (i.e., *Nannochloropsis* sp.), ii) zooplankton only (i.e. *Artemia* sp.), and iii) a mixture of equal parts phytoplankton and zooplankton. Ephyrae were fed daily for over a month, we assessed their growth rate, size and mortalities. We found that ephyrae fed with a mixture of both zoo-and phytoplankton, had the least mortalities and had the best growth. When fed only with a diet of phytoplankton, *M. papua* ephyrae did not thrive well. Our findings build towards further understanding the biology of tropical jellyfish, and provides useful insights to culturing species, both for the aquarium trade and as a food source for sustainable proteins.

Keywords: Symbiotic, Photosynthetic, Phytoplankton, Zooplankton, Mortality

Pigments in Medusozoa (Cnidaria)

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Animal pigments play crucial roles in survival and reproduction, and may also have industrial and biomedical applications. The green fluorescent protein (GFP), for example, first identified from the jellyfish *Aequorea victoria*, is widely used as a fluorescent tag in biomedical research. Despite GFP's importance, information about the origin and function of medusozoan pigments is limited. We conducted a systematic review of the literature on pigments in Medusozoa using the PRISMA method. We identified eight pigment classes from 76 species across the four medusozoan classes. Pigment classes include yellow-orange carotenoids and flavonoids, dark melanins and ommochromes, red-brown tetrapyrroles, blue-green bioluminescent luciferins, GFPs, and blue rhizostomins. Carotenoids, tetrapyrroles, and GFPs were the most commonly reported pigments, and carotenoids were also the most widespread across medusozoan classes. Since the turn of the century, three-quarters of the research focused on GFPs and luciferins, and three-quarters of the species studied were hydrozoans. Pigments acquired through diet showed a broader distribution across medusozoan classes compared to synthesised pigments, potentially influencing their phylogenetic distribution. Camouflage constituted over 50% of the hypothesised functions for medusozoans, followed by active defence, vision, and photoprotection, often associated with the pigment's location in the body. To validate these hypotheses, the next crucial step involves conducting ecological experiments, while omics technologies offer opportunities to expand knowledge on the distribution of medusozoan pigments. Despite the potential oversight of medusozoans due to the transparency of many species, brightly coloured ones like many scyphozoans present exciting prospects for pigment research.

Keywords: Colouration, Jellyfish pigments, Chemical diversity, Carotenoids, Camouflage, Bioluminescence

Public Lecture

Mark J. Gibbons

Jellyfish, People and the United Nations' Sustainable Development Goals

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The long-term survival of Earth's rich biodiversity is increasingly threatened by humanity's rapacious consumption of resources, with seemingly scant regard for rates of renewal. Although the imbalance between resource use and replenishment has long been recognised, the concept of sustainability was only mainstreamed globally by the United Nations in 2015, when it adopted the 17 Sustainable Development Goals (SDGs). In essence, the SDGs recognise that ending poverty cannot be achieved by countries, even working together, without also addressing *inter alia* health, education, inequality and economic growth: while at the same time tackling climate change and preserving life and life processes on both land and in the sea. In the context of the present symposium, the SDG of interest is Goal 14: Life Under Water, which aims to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development". The management of sustainable capture fisheries in the 21st Century is built around balancing human needs with those of the wider ecosystem, and the concept of the Ecosystem Approach to Fisheries (EAF) forms the foundation on which more recent iterations of thinking are based.

In this presentation, I explore the value of EAF, with a focus on jellyfish. This exploration is done with the benefit of hindsight, because it is only after we have made mistakes that we are in a position to learn. I also look at some of the science that is needed to provide good input data to EAF management, and I make some personal observations on the issue of harvesting jellyfish. It turns out that jellyfish satisfy the great majority of the goals of SDG 14, in a way that many capture fisheries do not.

Theme 4:

Biodiversity

ORAL PRESENTATIONS

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Pace and scope in characterizing the diversity and distributions of jellyfishes – How are we doing as a community?

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Two overriding challenges to achieving a full understanding of the diversity of jellyfishes on this planet are the magnitude of richness and complexity of species. One count of known, accepted species (=hypotheses that have not been refuted) of Medusozoa is presently 4238, but there are likely two to five times (perhaps more) that number of extant medusozoan species in total. Given the relatively small number of researchers conducting taxonomic studies and the fact that most species are only described many years after they were first collected and preserved, indicates that having viable hypotheses for all or nearly all medusozoan species will likely take many decades of work. Further, the high complexity of species, as evolutionary collectives of variable individuals propagated by both sexual and asexual reproduction, makes them challenging to characterize. If an ideal characterization were envisioned as a complete statement necessary to describe a species, one can see that no species description has been or ever will be complete. This perspective breaks down the false dichotomy of molecules versus morphology. Instead, the question becomes: How do we best fall short of ideal species descriptions in the face of the ongoing biodiversity crisis? The past few decades have seen the development of numerous technologies – the deployment of remotely operated and autonomous underwater vehicles, imaging techniques, genomics, eDNA, community science portals, etc. – that enhance species characterization. As a community we should support and increase all efforts to aggregate and integrate information that informs humanity about species diversity and distributions.

Keywords: Integrative taxonomy, Participatory science, Systematics, Species descriptions

Scyphozoan systematics, genomics and a new age of reason

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In the early 2000's, scyphozoan systematics underwent a renaissance. Before this time, taxonomy and systematics of jellyfishes were often confounded by incomplete and overly inclusive hypotheses of species delimitation. The problem lay largely with unstable inferences from few qualitative morphological features. The adoption of DNA-based methods provided more robust results from many independent characters and more stable inferences about species boundaries. That stability, coupled with development of relatively data-rich quantitative morphometric approaches, allowed identification of phylogenetically informative (and uninformative) morphological differences among species. The pairing brought a richer understanding of the genetic and phenotypic diversity and distributions of scyphozoans, approximately doubling estimates of species richness, and laid the foundations for integrative analyses of, among other things, diversification, functional morphology, and macroecology, and a synthetic understanding of plankton ecology. As we enter a new genomic age for scyphozoans, we now stand on the brink of further enlightenment of the relationships between genotype and phenotype, determinants of functional ecology, epigenetics and plasticity, and their interactions guiding responses to global change. In particular, We will present challenges and achievements emerging from analyses at the intersection of pelagic symbioses and scyphozoan behavior. These examples illustrate that data rich, synthetic, team science, occasionally coupled with serendipitous observations, may usher in a new age of reason and understanding.

Keywords: Behavior, Ecological genetics, Functional biology, Phylogenomics, Symbioses

New technologies for detecting blooms of mesozooplanktonic jellies

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Occurrence of jellyfish blooms has been known to affect fish populations, making them an important study subject. *Solmaris*, *Phialella* and *Muggiaea* blooms have shown to cause mass mortality of salmon. Observing jellyfish blooms in-situ as they interact with fish is essential for both science and fisheries stakeholders. However, since the exact timing of blooms cannot be predicted we need a long-term monitoring system to visualize these events at different resolutions. As a solution to this, we have developed a shadowgraph imaging system that uses a collimated light beam to image animals at their actual size. The system can be configured to look at different size ranges based on the target jellyfish. High-speed videos are recorded and passed to our automated data processing pipeline, which uses machine learning (YOLO5, Morphocluster) to identify animals. Environmental CTD parameters, simultaneously recorded, are combined with identifications and tools for automated analysis, such as size and density estimation, have been made. Identifications can also be shared with other databases like EcoTaxa for validation. We are currently recording data from this system at different locations in Japan, including Suruga Bay. During automated onshore processing, the system was able to detect pycnoclines and also identify jellyfish such as *Solmaris*. The imaging system, automated pipeline and preliminary results from surveys will be presented here. In the future we aim to connect this system with moorings and aquaculture cages so jellyfish bloom events can be automatically detected and alerts can be provided to scientists and the fishing community.

Keywords: Mass mortality, Shadowgraph, Machine learning, Community composition, TaxonomyTaxonomy

Bipolar jellyfish: Evolutionary origin and diversification

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Polar regions host a considerable high diversity of jellyfish and their polyps. Among the species found in these extreme environments, a few are present in both the Arctic and the Antarctic. This phenomenon, known as Bipolarity, has attracted the interest of the scientific community for over a century. Despite being considered as the greatest disjunct distribution on Earth and being widespread through the whole tree of life, bipolarity has rarely been evaluated in an evolutionary context. Our knowledge on the origin and consequences of bipolarity is still incomplete: How and when did bipolar distributions arise? The ongoing project POLE2POLE aims to study the origin and diversification of bipolar biota by focusing on Hydrozoa as a model group. Hydrozoans show contrasting life cycles: hydromedusae and siphonophores are key players in planktonic communities, while benthic hydroids are important habitat formers as part of the so-called marine animal forests. This wide array of ecological strategies makes Hydrozoa a promising candidate to evaluate how life history – and the corresponding dispersal capabilities – have shaped diversification by bipolarity. Therefore, and for comparative purposes, selected taxa include strictly holoplanktonic, strictly benthic and meroplanktonic species. The project combines integrative species delimitation methods with High Throughput Sequencing techniques to resolve species identity, their evolutionary history and origin. First results show that most taxa previously considered as a single species in both poles actually constitute cryptic species complexes, including several previously undetected evolutionary lineages. Our findings highlight the urgent need for in-depth studies of polar marine biodiversity under integrative approaches.

Keywords: Life cycle, bipolarity, Hydrozoa, integrative taxonomy, biogeography, speciation

Mapping and monitoring recurrent jellyfish blooms in Indian coastal waters: known and unknown

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The Central Marine Fisheries Research Institute (CMFRI) embarked on a study on demarcating the jellyfish blooming areas around the Indian coastal waters in 2017. The advantage of CMFRI's location on the Indian coast allowed scientists to observe and evaluate jelly bloom episodes along the peninsula's coastline. The Jellyfish Focal Areas (JFA) are areas in the coastal water where recurrent jellyfish blooming incidents are observed with varied intensity. There are ten maritime states in India, viz., Gujarat, Maharashtra, Goa, Karnataka, and Kerala on the west coast; Tamil Nadu, Pondicherry, Andhra Pradesh, Orissa, and West Bengal on the east coast. This study has identified 74 spots throughout the Indian coast as jellyfish focus areas. The work provided insight into the diversity of jellyfish bloom in these locations and discussed the dispersion pattern of these jellyfish. *Chrysaora* appears to be the most prevalent jellyfish genus in terms of numbers in Indian coastal waters, but when biomass is taken into account, Genus *Cyanea* takes its place. This study clearly distinguished across different species that bloom on India's east and west coasts. The spread of different jellyfish species and their aggregation in coastal waters are significantly influenced by the boundary currents along India's coastline. According study results, jellyfish species are dispersed from India's west coast to its east coast. After 2020, the Genera *Cephea*, *Netrostoma*, and *Marivagia*, which were largely absent earlier, are progressively appearing along the coastal waters of India's east coast, which were dominant along the west coast during 2017 to 2020. For a long-term dataset to comprehend jellyfish blooming dynamics and their impact on the marine food chain in Indian coastal waters, constant monitoring of the jellyfish focal areas identified in this study is crucial.

Keywords: Jellyfish Focal areas, Bloom, *Chrysaora*, *Cyanea*

Freshwater jellyfish research – Hidden gems, knowledge gaps, and current progress

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Freshwater jellyfish (= limnic medusa-budding hydrozoans) are a small group of cnidarians found on all continents except Antarctica in temperate to tropical latitudes. Members of this group belong primarily to three genera: *Astrohydra*, *Craspedacusta*, and *Limnocnida*. Other, less-studied and spatially confined genera like *Keralica* and *Mansariella* are not considered. While *Astrohydra* and *Limnocnida* are typically restricted to the islands of Japan, Africa, and the Indian subcontinent, one species or potential species complex, *Craspedacusta sowerbii*, became globally invasive. Despite research going back about one-and-a-half centuries, little is known about their phylogeny and ecology compared to marine jellyfish. Recent species distribution modelling, however, showed that by 2050 freshwater jellyfish will potentially extend their distribution ranges due to global warming to high-latitude ecosystems and be present (medusa stage) for an extended time in the seasonal limnic production cycle. An increase in their relative ecological importance with temporal and spatial spreading is hypothesised. Only recently, it has been shown that trophic roles of polyps and medusae and their prey overlap with other ecosystem members. In addition, medusa behaviour may cause trophic cascades and alter vertical nutrient distributions. However, polyps and other benthic life cycle stages are understudied. This talk aims to overview the global information on freshwater jellyfish since 1880, and to identify knowledge gaps and potential reasons for their 'underdog role'. In changing freshwater ecosystems that may become more accommodating for freshwater jellyfish, an improved understanding of their population biology and ecosystem ecology is urgently needed.

Keywords: Cnidaria, *Craspedacusta*, Hydrozoa, Interdisciplinary research, limnology

Gelatinous zooplankton as indicators of the Arctic ocean Atlantification

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The warming of the Arctic Ocean has accelerated in recent decades, with the European Arctic warming at the globally unparalleled pace. The warming is fueled by the increasing temperature, salinity, and the volume of Atlantic water reaching the Arctic through the Fram Strait, in a process called Atlantification. The inflow alters physical environment and delivers boreal biota northward, thus contributing to polar ecosystems transition into boreal state. As more indicators are needed to estimate and monitor the pace of pelagic ecosystems evolution, we sought to verify if the gelatinous zooplankton (GZ; pelagic cnidarians and ctenophores) could serve as such. For that purpose, we analyzed zooplankton samples from a globally unique 12-years-long time series from the area spanning c. 300 000 km^2 of the European Arctic. First, we uncovered large-scale patterns of the GZ diversity across the European Arctic. Then, using various statistical methods we looked into their associations with particular water masses, additionally testing if GZ communities can mix across fronts that separate adjacent water masses. Finally, we assessed whether the population structure dynamics of the key GZ locally, *Aglantha digitale*, follows the interannual variation in the Atlantic water inflow. Overall, our results indicate that the abundance, diversity and population structure of GZ are all good indicators of the progressing Atlantification. Given that we have found a more abundant and less speciose community of GZ in the Atlantic water, we predict that the progressing Atlantification could lead to a more gelatinous future of the pelagic ecosystems of the European Arctic.

Key words: Climate change, Biodiversity, Arctic ocean, Distribution modelling

Hiding in plain sight – Hidden genetic diversity of west African jellyfish

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Africa as a whole has often been excluded from global studies investigating patterns of jellyfish diversity and abundance. This is largely due to a dearth of data from the region, reflecting low collection efforts. With several species along the African coast known to bloom extensively e.g., *Pelagia noctiluca* and *Chrysaora fulgida*, this lack of data (particularly the lack of long-term baseline data) constrains our understanding of the potential drivers of blooms along these coastlines, as well as our ability to effectively manage these species within the ecosystems in which they occur. Recent surveys conducted by the Dr Fridtjof Nansen between 2017-2019, allowed a continent-wide collection of specimens from both West and East Africa, presenting a unique opportunity to perform the first large-scale investigation into species diversity and structuring across the region – specifically along West Africa which forms the focus of this work. The African dataset is incorporated into a global dataset (that of Abboud et al. 2018) and patterns of diversity compared. Though major global patterns remained unchanged, when African data were analysed in isolation or, when global data were analysed at finer geographical scales, several African species showed patterns of gene flow that differed to patterns seen across other studies/regions. We begin to tease apart these patterns with this work.

Keywords: Africa, DNA barcoding, population structure, Scyphozoa, species diversity

Underexplored jellyfish blooms in some locations of India: Impacts, research gaps and future directions in sustainable utilization and management

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Among numerous known marine faunal blooms and strandings along the coastal waters of India, jellyfish blooms and strandings are gaining significant attention in recent times due to their impacts and recurrent occurrence in coastal waters. This study reports the blooms of jellyfish *Aurelia aurita*, C*hrysaora fuscescens*, *Crambionella stuhlmanni*, *Chrysaora caliparea*, *Pelagia noctiluca*, *Physalia physalis*, *Porpita porpita*, and *Cassiopea andromeda*, *Rhopilema* cf. *hispidum*, recorded for the first time from unnoticed locations of India. Special emphasis is given to jellyfish blooms found in the coral reef environments. These blooms pose negative impacts on research activities like plankton studies (net operations), coral reef monitoring (diving), fishing activities, coastal economy, and coastal water health. Conversely, these blooms also offer beneficial biomaterials such as mucus, collagen, and other products like fluorescent compounds, food, for biomedical applications. The present study infers that spatiotemporal studies on blooms of these jellyfish species need to be conducted using repmote sensing techniques to quantify and utilize these bioresources for biomedical applications. This helps researchers to study the spatiotemporal origins, dispersal, and diminution of blooms under local hydrodynamics and geographical factors as well as their impact on coastal biodiversity and biogeochemical cycles. Additionally, coastal communities would benefit from this information by withdrawing fishing activities to avoid loss of gear during trawling and stings from some jellyfish blooms.

Keywords: Jellyfish blooms; Fishing nets; Climate change; Anthropocene; Coastal pollution.

Siphonophore community along the southeast coast of South Africa (ACEP 2017 summer and winter cruises)

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The Transkei shelf is the least studied continental shelf system in southern Africa, but it plays an important role in connecting the semi sheltered KwaZulu Natal Bight on the east coast with the Agulhas Bank. Information on the ecology and distribution of zooplankton in these sensitive ecosystems is in dire need. Among zooplankton, knowledge on the holoplanktonic Siphonophorae (Cnidaria, Hydrozoa) community structure is weak. Like every other planktonic organisms, siphonophores drift with the current and have very limited swimming capacity, therefore they can be usefully employed as indicators of water masses and water mass movement. As part of the ACEP cruises conducted during two contrasting seasons, in January/February (summer) and July/August (winter) 2017, diversity and abundance of siphonophores was assessed at in relation with the hydrographic drivers. Overall, 55 species of siphonophores were recorded with 1 species of cystonect (*Physalia physalis*), 11 Physonects and 43 Calycophorans; 15 species were recorded only during one cruise. Highest richness was observed offshore in the southern sector of the transect. Abundance reached ~6022 ind $100m^{-3}$ in summer, while in winter only reached ~480 ind $100m^{-3}$. *Muggiaea atlantica* was the most abundant and common species representing between 0-100% of the community and showing an affinity for the coldest waters. Data were compared to those collected in 1999 and give insight in the potential jellification of the region.

Keywords: Siphonophores, Agulhas current, Diversity, Dsitribution, Water masses

The Irish seasonal coastal current – the source of *Muggaea atlantica* in Ireland?

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Small coastal currents that occur in shelf waters are thought to play a role in shaping plankton communities. The Irish seasonal coastal current has been identified as a mechanism of transport for large quantities of harmful phytoplankton around the south Irish coast. Given that phytoplankton and zooplankton are governed by similar physical processes, we hypothesise it is also a pathway for the transport of harmful zooplankton such as *Muggaea atlantica*, whose origin in Irish waters is unknown. To investigate this, we carried out a 7-day research survey where we looked at the vertical and horizontal distribution of gelatinous zooplankton, including the harmful *M. atlantica* in the coastal current and surrounding water bodies. On board CTD measurements were used to identify the coastal current and a multinet with mesh size 300 µm and 1 m opening diameter was used to collect zooplankton samples. Mean densities of *M. atlantica* were low at 0.332 ± 0.482 ind.m^{-3} with highest densities found in inshore waters at 15-30 m depth interval (2.091 ind.m^{-3}). *Aglantha digitale* was the most abundant gelatinous organism with a mean density of 4.067 ± 7.389 ind.m^{-3}. Highest densities were observed in offshore waters below the thermocline (27.451 ind.m^{-3}). *Pleurobrachia pileus* had a mean density of 0.880 ± 0.797 ind.m^{-3} and highest densities in inshore waters (2.914 ind.m^{-3}). There is clear evidence for the partitioning of these organisms between water bodies with a highly significant difference in densities of *M. atlantica* between inshore, offshore and coastal current waters ($p<0.001$). *M. atlantica* was virtually absent from offshore waters which provides evidence for the coastal current as a transport mechanism from a source elsewhere, seeding inshore populations of *M. atlantica* in Ireland.

Keywords: Coastal current; Thermocline; Gelatinous zooplankton; *Muggaea atlantica*; Community assemblages

Modelling the dispersal of *Pelagia noctiluca* in the Mediterranean Sea

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The mauve stinger *Pelagia noctiluca* is a holoplanktonic oceanic jellyfish known for its large outbreaks at irregular intervals. In the northern Adriatic, large blooms have occurred sporadically in recent decades. However, they are sighted more frequently in some other Mediterranean regions. We study the dispersal of *Pelagia noctiluca* in the Adriatic and Mediterranean Sea using an individual-based model (IBM) based on the OpenDrift Lagrangian particle tracking tool. The model accounts for diel vertical migrations and was run backward in time to explain sightings of *Pelagia noctiluca* in the northern Adriatic. The modelling period spans from 1987 to 2020, and the currents used to drive the particles were obtained from the Copernicus Med MFC physical reanalysis. We identify two prominent pathways into the northern Adriatic. One comes from the southern part of the western Mediterranean and surprisingly another, less pronounced, from the Aegean Sea in the eastern Mediterranean. We examine the travel time and also the likelihood that these two locations serve as sources of northern Adriatic blooms. We present preliminary results of additional experiments in which mortality and reproduction of particles (superindividuals) are modulated by temperature and food availability. We explore the parameter space of the resulting non-linear differential equation looking for a combination that would ensure a stable *Pelagia noctiluca* population in the western Mediterranean Sea.

Keywords: *Pelagia noctiluca*, model, Adiatic Sea, Mediterranean Sea, currents, Lagrangian particle tracking

Anthoathecate jellyfish and their polyps in Swedish waters: An integrative taxonomy approach

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Hydrozoan jellyfish and polyp taxonomy was an active field in Sweden during the 1700s and 1800s with seminal work by e.g. Linnaeus, Forsskål, Lovén, and Segerstedt. However, as we entered the 1900s the activity came to a halt. During the last 120 years, there has been only one inventory targeting Hydrozoa in Sweden, which excluded the jellyfish stage and represented the large order Anthoathecata with a mere 14 species. Here we present HYDROINS (Hydrozoa In Sweden), a PhD project (2023–2027) funded by the Swedish Taxonomy Initiative, aimed at addressing the outdated knowledge of Swedish hydrozoan diversity through an inventory focusing on Anthoathecata. To date, 72 anthoathecate species from 18 families have been reported in Sweden, but while many are common and easily found, e.g. some species in Hydridae, Tubulariidae, Hydractiniidae, Corynidae, Bougainvilliidae and Pandeidae, over 20 percent of the listed species have not been seen since their first report or description. Additionally, as phylogenetic work elsewhere has identified cryptic species and matched previously unlinked life stages, inconsistencies in Swedish national records have accumulated. HYDROINS uses an integrative morphological and molecular approach to evaluate the status of currently listed species, and together with its sister projects in Norwegian waters, it has already identified discrepancies in genera *Euphysa*, *Cordylophora*, and *Tubularia*. HYDROIN's work is producing an updated list of molecularly confirmed species, descriptions of new species, a geo-tagged reference collection stored at the Natural History Museum in Gothenburg, and an improved barcode coverage for Swedish anthoathecates.

Keywords: Hydrozoa, Anthoathecata, Diversity, Integrative taxonomy, Barcoding

Morphoplasticity and environment: Where the lines between taxonomy and ecology blur

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For decades we have been using morphology (more recently integrating it with other traits) to define boundaries between species. For good reason too. There certainly must be a level at which species are notably not the same thing as others. Few people would argue, for example, that a llama and a camel are the same thing, yet they both fall within the family Camelidae. The next logical step from visually comparing morphological traits is to try statistically to delimit species based on the dissimilarities of morphometric traits. However, in doing so, one often runs into another, perhaps expected, issue of differences in morphology of the same species from different ecological areas. This is a rather frustrating point when we often also grapple with cryptic speciation. This talk will explore the effects of ecotypes on our understanding of morphological taxonomic delimitation. While highlighting the value of integrative taxonomy, this talk will also focus on the possibilities of utilising these resultant integrative findings to better understand species' adaptation to environment.

Keywords: Integrative taxonomy, ecology, morphoplastcicity, ecotypes.

Prediction of invading ctenophores *Mnemiopsis leidyi* Agassiz, 1865 and *Beroe ovata* Bruguiere, 1789 habitat expansion in the Ponto-Caspian seas associated with climate change

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The seas of Ponto-Caspian basin (Black, Azov and Caspian) are exposed to species invasions, including harmful ctenophore *Mnemiopsis leidyi* and its predator *Beroe ovata*. Their current conditions of occurrence and development have been compiled, based on own field observations and published data. Analysis of climatological data on basic environmental parameters (water temperature, salinity, chlorophyll) and modeling approach were used to predict favorable for both ctenophores conditions, and changes of those conditions, associated with the climate variations. Role of *B. ovata* in *M. leidyi* biocontrol has been assessed. Several climate change scenarios have been considered. The most sensitive to SST increases areas of *M. leidyi* reproduction duration are the western coast of the Black Sea and the Southern and Middle Caspian, while *B. ovata* reproduction duration should increase in the northern Black Sea and the Southern and Middle Caspian. The coastal areas of the Black Sea and regions between the Southern and Middle Caspian are susceptible to an earlier start of *M. leidyi* reproduction during warmer springs. Regarding *B. ovata*, the whole Black Sea is vulnerable to spring SST changes, but in the Caspian *B. ovata* extends its reproduction duration only in the Middle Caspian during warm seasons. Since *B. ovata* consumes mostly *M. leidyi,* it is an important biocontrolling agent of *M. leidyi*, harmless for the ecosystem. After *B. ovata* invasion in the Black Sea, it took control over *M. leidyi* population, which resulted in the Black Sea ecosystem gradual recovering. We expect the similar effect in the Caspian in future.

Keywords: non-native species, *Mnemiopsis leidyi*, *Beroe ovata*, climatology, climate change, Ponto-Caspian basin

Drivers behind the diversity and distribution of a widespread midwater narcomedusa

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Narcomedusae play a key role as top down-regulators in the midwater, the largest and most understudied biome on Earth. Here, we used ecological niche modelling in 3D, ecomorphology, and phylogeny, to answer evolutionary and ecological questions about the widespread narcomedusan genus *Solmissus*. Our phylogenetic analyses confirmed that *S. incisa* represents a complex of several cryptic species. Both the different genetic clades and tentacle morphotypes were widespread and often overlapped geographically, the main difference in their distribution and ecological niche being depth. This demonstrated the importance of including the third dimension when modelling the distribution of pelagic species. Contrary to our hypothesis, we found the modelled distribution of the *Solmissus* genus (N = 1444) and both tentacle morphotypes to be mostly driven by low dissolved oxygen values and a salinity of 34, and slightly by depth and temperature. *Solmissus* spp. were reproducing all year-round, with specimens reproducing in slightly warmer waters (up to 1.25°C warmer). Our results suggest that *Solmissus* spp. will likely come out as climate change winners by expanding their distribution when facing ocean deoxygenation and by increasing their reproduction due to global warming. However, because most available midwater data comes from the northern Pacific, this sampling bias was undoubtedly reflected in the output of our ecological niche models, which should be assessed carefully. Our study illustrated the value of online databases including imagery and videography records for studying midwater organisms, and to treat midwater biogeographic regions as 3D spaces.

Keywords: Ecological niche modelling, Species distribution modelling, Deep-sea, *Solmissus*

Hot bathtubs as proxies: Jellyfish in a warming ocean

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Proxy systems can inform us of the mechanisms involved in determining the possible gelatinous "winners" and "losers" in a warming ocean, allowing modelling of future scenarios. Two submarine volcanic calderas in the Izu-Ogasawara Island chain, enclose anomalously warm water masses. Temperatures within the Kurose Hole (rim 250 m, floor 790 m) have increased from 11.2˚C (salinity 33.41) in 2000 to 17.8˚C (salinity 34.73) in 2020 and the midwater community composition has changed from one dominated by the leptomedusa *Earleria bruuni*, the only previous records being from the type locality in the Bay of Bengal, to one dominated by the viperfish *Chauliodus sloani*. As with the Kurose Hole, *E. bruuni* was also the dominant faunal component in the Sumisu Caldera (rim 490 m, surveyed to 913 m, 10˚C, salinity 34.31), which is an actively venting caldera, in contrast to the "dormant" Kurose Hole. Ctenophore abundances were also heightened within the caldera compared to abundances outside. In the Sulu Sea (rim 400 m), the enclosed water is ca. 10˚c at 1000 m depth but, in contrast to the Mediterranean and Red Seas, and similarly to the Japanese calderas, salinity is low (34.55). Many taxa were effectively absent from all three systems. Information exists for the Mediterranean, but the Red Sea deepwater gelatinous fauna is still largely unstudied, apart from recent surveys by KAUST and JAMSTEC. Finally, a new subfamily of ulmarid scyphomedusa has been described from inside the Sumisu Caldera, this being the only location at which it has ever been observed.

Keywords: Ocean warming, Proxies, Modelling, Community Composition, Taxonomy

Trophic diversity of the bloom-forming jellyfish community in the coastal waters of China assessed by stable isotope analysis

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A growing realization indicates that the trophic ecology of jellyfish is more diverse than once thought; yet a holistic view reflecting the trophic structure and trophodynamics in bloom-forming jellyfish community remains rare. Based on stable isotope $\delta^{13}C$ and $\delta^{15}N$ analysis, we estimated the trophic characteristics of common blooms jellyfish *Nemopilema nomurai*, *Cyanea* spp., *Aurelia coerulea* and *Aequorea* spp. in the coastal waters of China (CWC). Our data indicated that most of the isotopic niche space in the overall planktonic food web was occupied by the bloom-forming jellyfish community. The large spectrum of isotopic niche highlights the diverse ecological roles and potentially broad trophic relevance of these jellyfish in the food web. The substantial trophic diversity of these jellyfish resulted from the difference in trophic positions occupied by different taxa, complicated niche differentiation and overlap patterns, inconsistent size-based trophic variation, and spatial and temporal variation patterns. Isotopic niche comparisons indicated the presence of niche differentiation, reflecting the difference and individual-specific characteristic in resource exploitation and feeding preference among different jellyfish. Additionally, the inconsistent size-based trophic variation among groups derived from an increase in trophic level with size for *Cyanea* spp., *A. coerulea* and *Aequorea* spp. medusae to no change for *N. nomurai* medusae, which suggests the complexity in size-related trophic shift patterns within the jellyfish community. Additional diversity also arose from variation in the spatiotemporal structuring of jellyfish trophic ecology, which might be caused by the occurrence of trophic heterogeneity at the base of the planktonic food web. In conclusion, our study characterized the trophic structures of the bloom-forming jellyfish community in the CWC, and revealed their trophic diversity resulting from interspecific, intraspecific (ontogenetic), and spatiotemporal variation. These results hold strong potential to further improve the understanding of the trophic ecologies and functional roles of the jellyfish community.

Keywords: Jellyfish bloom, Zooplankton, Planktonic food web, Trophic ecology

Citizen Science illuminate the enigmatic realm of scyphozoans, including three new records to India

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Citizen science is a powerful tool in marine biodiversity documentation, enabling broader data collection, encouraging public engagement, and advancing our understanding of dynamic marine ecosystems. This research paper presents analysis of the underwater photographs of a citizen scientist of Earth CoLab in India and the second author of this paper in various marine biomes of India. The species identified from the natural underwater photography included *Mastigias papua, Lobonema smithii, Rhopilema hispidum, Crambione mastigophora, Aurelia* sp, *Cyanea nozakii* and *Catostylus* sp. *Crambione mastigophora, Aurelia* sp. and *Catostylus* sp. are reported for the first time from the Indian waters; the genus *Crambione* Maas, 1903 is reported for the first time from India, and all these species were photographed from the Andaman islands. The analysis also reveals the blooming patterns of *Aurelia* blooms in the Andaman waters, and the geo-coordinates and data inscribed in the photographs helped realise the seasonality and patterns of blooms. Further, the professional underwater photography of *Aurelia* sp. with detailed morphological characters showed significant variations with *Aurelia aurita* and *Aurelia solida* previously recorded from the region, warranting further integrative taxonomic studies. The underwater photographs further helped document the association of invertebrates and fish with jellyfish. This collaborative approach not only allowed for the collection of a substantial dataset but also facilitated the engagement of the citizen scientists in documenting life below water.

Keywords: Underwater photography, Scyphozoa, citizen science, life below water

Jellyfish Biodiversity in Sabah, Malaysia

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Medusozoan jellyfish (Cnidaria) represent an important part of the ocean's ecosystem, and despite their wide-ranging impacts to human activities, relatively little knowledge is currently present on their population within the state of Sabah. In order to determine the species biodiversity and the impact that these jellyfish have to human health in the state, an assessment of jellyfish biodiversity was carried out. Historical records from 1870-1970 show that more than 150 species of were previously recorded in Sabah, Malaysia. The large difference between the number of jellyfish species recorded in the present day compared to that in historical records suggest that the current records of jellyfish biodiversity in the state is highly underestimated, especially in the classes Hydrozoa and Cubozoa. Since 1991, there have been about 36 cases of serious jellyfish envenomation in the state, with six resulting in fatality of the sting victim. Children are most at risk of developing serious symptoms. Cases of jellyfish stings were reported from all parts of the state. Sting events are more common from November to January; however, stings were reported year-round. Among the species known to occur in the state is the deadly box jellyfish *Chironex yamaguchii* Lewis & Bentlage, 2009, which has been implicated in multiple serious jellyfish stings and fatalities. Through this study, a list of jellyfish species which could occur in the state has been produced, as well as a checklist of jellyfish species currently known to occur within the state, with physical samples collected deposited for future reference. It was also found that harmful jellyfish pose a threat to coastal human populations throughout the state. More research on jellyfish needs to be prioritized, not only to determine the true biodiversity of jellyfish in the region and to identify and prepare for harmful jellyfish species, but also to raise public awareness of jellyfish-related risks and proper safety seeking attitude in order to reduce the risk of jellyfish-human conflicts.

Cubozoan and scyphozoan jellyfish from Carigara Bay, Leyte, Philippines

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Jellyfish or gelatinous zooplankton play a significant role in our marine ecosystem by providing ecological and societal benefits such as climate regulation through carbon sequestration and transport through the water column, as a food source, as hosts for algal symbiotic associations, and as habitats and nurseries of other marine organisms. Studies of jellyfish in the Philippines are few and focus only on specific groups and locations. Hence, this study aims to determine the species of the scyphozoan and cubozoan jellyfish found in Carigara Bay, Leyte, Philippines. The sampling areas were along the coastal municipalities of Carigara Bay, namely: Capoocan, Carigara, Barugo, San Miguel, and Babatngon. An opportunistic sampling method was employed to have a higher chance of encountering jellyfish medusae. Using a boat at a maximum speed of one meter per second, the identified sampling areas were traversed, and the shallow water portions, specifically the mangrove zones, were waded. All sighted jellyfish were collected using a wide-mouthed plastic dipper and scoop nets (50 cm diameter, 2 mm mesh size), bucket, and basin while ensuring the collected specimens were not exposed to air and were in good condition. Dr. André C. Morandini of the Laboratory for Cnidarian Studies and Cultivation, University of Sao Paulo, Brazil verified the pre-identified jellyfish samples for scyphozoans, and Dr. Ilka Straehler-Pohl of the Quality Assurance Unit, Eurofins Agroscience and of Research, Freelancing Biologist @ Medusa(‘)s Nursery for the cubozoans. In this study, a total of seven species have been identified and reported herein, two are cubozoans, namely, *Chironex yamaguchii* and the *Chironex indrasaksajiae,* and five are scyphozoans; *Mastigias papua, Catostylus mosaicus, Acromitoides purpurus, Versuriga anadyomene,* and *Rhopilema hispidum*. Of note, *Chironex indrasaksajiae* is a new record for the Philippines.

Keywords: Species composition, *Chironex,* Jellyfish record

Theme 4:

Biodiversity

POSTER PRESENTATIONS

Photo credit: **Umeed Mistry**

Inconspicuous but important: Periderm formation in Scyphozoa

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Chitinous periderm tubes are known as typical exoskeletons widespread in benthic polyp colonies of Hydrozoa, while the polyp stages of most scyphozoan taxa are usually not protected by exoskeletons. However, periderm formation is also important in Scyphozoa: planula larvae attach themselves to the substrate by periderm secretion and in some species thin periderm layers protect the basal parts of scyphozoan polyps. In addition, encysted stages enclosed by periderm, namely planulocysts and podocysts, occur in some scyphozoan taxa. Evidence compiled from the literature indicates several gaps in knowledge regarding periderm structures in Scyphozoa. We present observations on these inconspicuous and understudied structures to discuss taxon-specific differences as well as potential effects of environmental factors on their development. A better understanding of periderm structures in Scyphozoa may help to detect species-specific differences between polyp stages which lack other distinct morphological characters and to expand our knowledge on the distribution range of benthic scyphozoan life-stages.

Keywords: Periderm secretion, Polyp morphology, Resting stage, Reproduction, Taxonomy

Medusae (Scyphozoa, Cubozoa and hydrozoa) from the Southern Cameroonian Atlantic coast: Abundance, temporal dynamics and socio-economic impact

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Given the scanty information on marine invasive species in Cameroon, jellyfish research was initiated in Kribi coastal region of Cameroon to assess their taxonomy, ecology, abundance and size variation. Jellyfish were sampled as b-catch products of the beach seine between June 2017 and December 2022. Here are presented the temporal distribution of species in relation to environmental variables including seas surface salinity, temperature, pH, dissolved oxygen, total dissolved solids, turbidity and conductivity, as well as water physicochemical parameters variation. Seven species that represented six Scyphozoans and one Cubozoa were frequently observed: *Cyanea spp*., *Chrysaora spp*., *Catostylus sp1*, *Catostylus sp2*, *Catostylus sp3*, *Catostylus tagi*, and *Chimaerus palmatus*. One Hydrozoans was also sampled during sampling. Identified species shaped different patterns in their abundance and seasonal variation: (1) *Chimaerus palmatus* appearing throughout the year, but with a higher frequency from December to June, (2) *Cyanea spp*. appearing during the short rainy season and short dry season, (3) *Chrysaora spp*. appearing throughout the year, but with high occurrences during the large rainy season (September to early December), (4) *Catostylus tagi* appearing throughout the year with higher abundance recorded in March and from August to January, (5) *Catostylus sp1* and *Catostylus sp2* display sporadic occurrence withing Catostylus catches in March and during the large rainy season, (6) Catostylus sp3 appearing mostly during the large rainy season and between December and January, but in small number. The impact of jellyfish proliferation on sea-related activities is also presented as well as the proximate composition of species from the genus Catostylus. These results showed that jellyfish species from the coastal region of Cameroon are not only a nuisance but also a resource that can serve many purposes. However, a long term monitoring is required for a comprehensive understanding of jellyfish population dynamics along this coastal zone.

Keywords: Jellyfish, Cameroon, Kribi, impact, abundance

Symbiosis drives diversification in cnidarians

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Understanding what types of traits drive variation in species richness and diversification rates (speciation-extinction) among clades is an ongoing challenge. In this study we test the importance of diverse ecological, developmental, morphological, and reproductive traits in Cnidaria (*e.g.*, corals, sea anemones, jellyfishes). We used phylogenetic approaches to test which traits explain variation in richness and diversification among major cnidarian clades. Differences in richness were explained primarily by variation in diversification rates. Diversification rates were most strongly related to the presence of an endosymbiotic dinoflagellate (*Symbiodinium*) in some clades. Surprisingly this mutualism increased both speciation and extinction rates, despite increasing diversification rates overall. Other traits generally had little impact on diversification. Our study uniquely demonstrates the importance of mutualistic interactions for accelerating diversification rates in large, ancient animal clades. Our results also help resolve the debate about whether mutualisms increase extinction or diversification: we show that they can simultaneously increase both in the same clade. We also illustrate how the current susceptibility of cnidarians with *Symbiodinium* to extinction (*i.e.*, from climate-related bleaching) is paralleled by their deep-time extinction rates over hundreds of millions of years.

Keywords: Endosymbiosis, Macroevolution, Phylogeny, *Symbiodinium*, Zooxanthellae

Morphological characterization of Discomedusae jellyfish (Scyphozoan) along the coast of Andhra Pradesh, Western Bay of Bengal

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Discomedusae jellyfish proliferations cause swarms that have harmful impacts on human activities, industries (fisheries, aquaculture, and tourism), and ecosystems. Identifying species is crucial for forecasting and managing these impacts. High degree of morphological variation among and within species remains a challenge. Research on jellyfish has increased in recent years in Indian waters, but knowledge of accurate taxonomic identification of scyphozoans, mostly Discomedusae groups, is still lacking. A survey was conducted in coastal and estuarine waters of Andhra Pradesh, Western Bay of Bengal during January 2017 to April 2023. We identified and described eleven Discomedusae species (*Crambionella annandalei, Marivagia stellata, Catostylus* sp., *Rhopilema hispidum*, *Cyanea nozakii, Chrysaora chinensis*, *Chrysaora* sp., *Netrostoma coerulescens*, *Acromitus flagellates*, *Lychnorhiza malayensis*, and *Lobonemoides robustus*) by using the morphological and meristics taxonomic approach. This study documents the first record of eight species of Discomedusae from the coast. Here, we present a detailed taxonomic account with colourful visual documentation of morphological characteristics that could be utilized as a stand-alone identification guide for different species. This basic taxonomic information will enhance the understanding of the population dynamics and their consequences in the fisheries.

Keywords: Taxonomy, Rhizostomeae, Semaeostomeae

Nematocyst types of *Chrysaora caliparea* and *Crambionella orsini* from Muthalapozhi at Thiruvananthapuram, Kerala

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The nematocyst of a cnidarian is not just a weapon for its defence and predation but also have an importance from the taxonomical view. The shape, structure, and size along with the presence of specific nematocyst classes in particular orders and families can be utilised to form a comprehensive taxonomic data. For this study, the morphology and occurrence of nematocysts in two jellyfish species observed at the Thiruvananthapuram coast were analysed. The jellyfish, *Chrysaora caliparea and Crambionella orsini, are marine in nature that bloom during the months from October to January.* The specimens were sampled from Muthalapuzhi in Thiruvananthapuram along the Southeastern coast of India. Three nematocyst types (A-isorhiza, eurytele, and birophaloid) having different sizes, were observed in *C. orsini*. Three types of nematocysts (O-isorhiza, eurytele as well as a- and A-isorhiza) were observed in *C. caliparea*. There are two types of nematocysts with divergent tubule patterns, and they could possibly be new nematocyst types: warranting further analysis and study.

Keywords: Cnidocysts, Isorhizas, Haplonemes, Scyphozoan,

Exploring jellyfish diversity and blooms in the South-Eastern Arabian Sea: Implications for coastal management

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Jellyfish play a vital role in marine ecosystems, impacting fisheries and tourism. However, their global diversity remains poorly understood and often underestimated due to taxonomic confusion. In India, jellyfish diversity has been overlooked, but recent studies indicate increasing blooms attributed to climatic factors. The jellyfish faunal diversity in the south-eastern Arabian Sea is largely unexplored despite its importance in ecosystem functioning and services. To fill this knowledge gap, our study conducted from 2017 to 2022 investigated jellyfish diversity in both in-shore and off-shore waters along the Karnataka coast. We documented 16 jellyfish species in the region, mainly during the post-monsoon period from September to January, with a minor bloom during the pre-monsoon phase from February to May. Among the recorded species, *Chrysaora, Lychnorhiza, Aequorea, Acromitus*, and *Pelagia* dominated the Karnataka waters. Jellyfish blooms in estuarine and coastal areas posed challenges to coastal fishers and tourists alike. The study emphasizes the spatial and temporal variations in jellyfish blooms across different coastal ecosystems. Understanding these patterns is crucial for managing potential ecological and social impacts associated with jellyfish blooms. Insights from our research can aid in developing effective measures to address jellyfish blooms in near shore open seas and estuarine areas, promoting the sustainable coexistence of marine ecosystems and human activities. By addressing jellyfish bloom dynamics and their ecological significance, we can make informed decisions to mitigate their potential adverse effects on local communities, fishing industries, and tourism sectors.

Keywords: Marine ecosystems, Ecological impacts

Composition of zooplanktonic jellyfish (Cnidaria: Medusozoa) in Bahía de Acapulco during the dry season

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Planktonic jellyfish are invertebrate organisms that, due to their predatory nature, can affect other zooplanktonic groups. Therefore, knowing the diversity, abundance and distribution of jellyfish in Bahía de Acapulco, Guerrero is relevant to determine their influence on zooplankton composition. The composition of zooplanktonic jellyfish was determined during the dry season in February 2018 and 2020. Surface trawls were carried out in three different zones, two in the internal part of the bay (Caleta and Naval) and one outside the bay (Oceanica) with conical net with a mesh size of 250 µm. Zooplankton were fixed in formalin 4%. Jellyfish were sorted, counted and identified to species level. A total of 834 individuals were sampled, corresponding to 29 taxa of the Hydrozoa and Scyphozoa classes, the first being the most diverse. In 2018, 21 species were reported, while in 2020, 22 species were obtained. Even though the sampling corresponds to the same climatic season, differences in diversity and abundance were found between the two years studied. The most abundant species were *Aglaura hemistoma* (n=155), *Clytia simplex* (n=110*)* y *Obelia* sp. (n=187). The species *Amphogona apicata, Bougainvillia niobe, Bougainvillia pagesi, Bougainvillia superciliaris, Clytia noliformis, Eucheilota duodecimalis, Merga* sp., *Phialella* sp*., Solmaris flavescens* are new distribution records for Bahía de Acapulco.

Keywords: Medusozoa, diversity, Mexican Pacific

Jellyfish bloom occurrences off central Kerala, south-west coast of India: Exploring the diversity and taxonomy through an integrative approach

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The study investigated the occurrence and swarming of jellyfishes off central Kerala, south-west coast of India, during the period from 2017-2022. Through a comprehensive approach encompassing both assessment of diversity and integrative taxonomy, we attempted to elucidate the dynamics of these jellyfish proliferations. Jellyfish diversity was assessed through collection, identification and morphometric analysis across a diverse range of fishing gears. The study also documented the distribution and seasonal occurrences, as well as their impacts on the local fishing activities, facilitated by interactions with fisher folk communities. Diverse species of scyphozoan/hydrozoan jellyfishes spanning the genera, *Chrysaora, Cyanea, Acromitus, Lychnorhiza, Catostylus, Netrostoma, Cephea, Crambionella, Pelagia*, and *Aequorea* were encountered across various locations and time frames in the study region. The major bloom forming species along the region were found to be *Chrysaora, Acromitus, Lychnorhiza*, and *Netrostoma,* throughout the study period, whereas other genera formed minor blooms during specific seasons. Our study systematically examined the composition, distribution, and temporal patterns of jellyfish blooms, shedding light on the ecological factors that contribute to their emergence. Use of integrative taxonomy techniques, facilitated a holistic understanding of the diverse jellyfish species present in these blooms, emphasizing the importance of accurate species identification and classification. Integrating ecological data with taxonomic insights, the study provides a comprehensive framework that enhances our understanding of the complex interactions that drive jellyfish bloom occurrences.

Keywords: Classification, Fisher folk, Jellyfish swarming, Integrative taxonomy, Marine ecosystems, Morphometry

Non-indigenous hydrozoans, *Blackfordia virginica* and *B. polytentaculata* in Shihwa Lake and the Seomjingang River estuary in Korea

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Tiny hydrozoans of the genus *Blackfordia* have invaded worldwide estuaries and harbors. Medusae of *B. virginica* were first found at Shihwa Lake in 2013, while the polyps from an abandoned fishing net were photographed in 2004, which we later recognized. *Blackfordia virginica* blooms yearly in 2013-2023 except for 2017 in Shihwa Lake, recording the highest mean density above 800 ind.m^{-3}. The species was euryhaline (16-32 psu), distributed mainly in the inner area near the mouth of the Ansan Stream. Stable isotope-ratio analysis showed copepods and barnacle larvae are the primary food sources. Copepods, the dominant prey, were exhausted soon after the hydrozoan's blooming, then bell shrinkage of the jellyfish individuals occurred consecutively. Dispersion or new invading of *Blackordia* was not found in other river mouths until 2021. However, we again observed blooms of *B. virginica* and first found *B. polytentaculata* at the Seomjingang estuary in 2021. Before this study, *Blackfordia polytentaculata* had been recorded only from its type location, Jiulong River, Fujian province in China. We assumed their occurrence in the Seomjingang estuary is due to novel introduction rather than dispersion from Shihwa Lake since populations in these two areas are geographically isolated, and the Seomjingang estuary is adjacent to Gwangyang Port, one of the largest international trading ports in Korea.

Keywords: Population dynamics

20 years later: Revisiting the gelatinous zooplankton communities of Korsfjord and Fanafjord using integrative methods

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A comprehensive seasonal study of the gelatinous zooplankton communities of Korsfjord and Fanafjord was conducted in 2003 using morphological methods only (Hosia and Båmstedt 2007). In 2023, the study was repeated in a simplified form, but also including trials for eDNA monitoring of the gelatinous fauna. Morphological samples comparable to those from 2003 were collected monthly in Korsfjord and Fanafjord using a vertical net tow (WP3, 780 µm) from above bottom to surface, while eDNA was collected in each season from above bottom, middle of the water column, and below surface (3*2L replicates, 0.22 µm Sterivex filters, immediately fixed with ATL buffer). In the meanwhile, Norwegian Taxonomy Initiative projects HYPNO, NorHydro and GooseAlien have focused on DNA barcoding and integrative taxonomy of the hydrozoan and ctenophoran fauna of Norway, successfully barcoding (COI, 16S and/or 18S) most of the species observed in 2003, as well as >25 additional pelagic or benthopelagic species of hydrozoans and ctenophores from the vicinity of the study area. Combining morphological and molecular methods has contributed to resolving several taxonomic issues regarding the observed taxa, as well as revealed cryptic diversity in several of the genera, improving our knowledge of the diversity in the region. The resulting comprehensive database of reliable DNA barcodes from the study area also facilitates the annotation of species from eDNA.

Keywords: hydromedusa, siphonophore, monitoring, diversity, metabarcoding

Journey from the East: Geographical range expansion and first record of the euryhaline epibenthic hydromedusa *Vallentinia gabriellae* Vannucci Mendes, 1948 (Hydrozoa: Limnomedusae) to Indian waters

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The epibenthic euryhaline hydromedusa *Vallentinia gabriellae* Vannucci Mendes, 1948 is an olindiid species native to tropical Atlantic waters. Here we describe the cryptic introduction of this species in an estuary along the coast of Kerala, in southwestern India. This study records the existence of *V. gabriellae* outside of Atlantic waters for the first time and document its geographical range expansion. Our identification was based on a combined morphological and DNA barcoding assessment using the COI and 28S markers. Although we noted some morphological differences between our specimens and those from their native range, our findings were conclusive. We suggest that phenotypic plasticity may result from differences such as prey availability between the native and introduced habitats. So, this study highlight the need of studying hydrozoans with integrative morphological and molecular approaches. *V. gabriellae* medusae are epibenthic and cling to a variety of hard and soft substrates, including bivalves. Our specimens were associated with the invasive fouling mussel *Mytella strigata*, and we suggest that *V. gabriellae* could have been transported along with these mussels to the Kerala coast. We propose that *V. gabriellae* might be underestimated in various regions, especially in non-native environments, due to its morphological differences across regions. Future research should prioritize investigating its polyp stage and its potential for spreading to new areas by hitchhiking on the shells of *M. strigata* and other bivalves.

Keywords: *Vallentinia gabriellae*, non-indigenous, hydrozoa, medusa, Cochin Estuary, Indian Ocean.

Half a century of Rhizostomeae research – A review since 1970, inspired by Max Egon Thiel and his unpublished manuscript

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Max Egon Thiel (1898-1979) published eight extensive volumes of reviews about most of the scyphozoan taxa (Stauromedusae, Cubomedusae, Coronatae, and Semaeostomeae) between 1936 and 1977 (interrupted by World War II, ~1,400 printed pages). The final volume on Rhizostomeae did not make it to the printer; however, the family saved an unpublished typescript. Due to the scientific historical relevance and completeness of the series, an international group of jellyfish scientists envisioned organizing a review edition entitled "Half a century of Advances in Rhizostomeae Jellyfish Research", with Thiel's final volume as an appendix. Review chapters will cover the spectrum of recent research on the taxon, including Morphology, Histology, Life Cycle, Physiology, Species Associations, Ecology, Phylogeny, and Anthropogenic use of rhizostome jellyfish. A review of Thiel's earlier volumes will cover digital supplements containing his leftover manuscript on the Rhizostomeae (translated into English language), and the Bibliography (Thiel 1977) about the earlier works. Further, an extensive literature search about the rhizostome research during 1970-2022 will complete the project package as another digital supplement. Over 30 collaborators (Angel, Brotz, Brown, Castilho, Colin, Costello, D'Ambra, Djeghri, Doyle, Enrique-Navarro, Fischer, Fitt, Gamero-Mora, Gibbons, Holst, Jordano, Kondo, Kuplik, Lauritano, Maronna, Miyake, Morandini, von Montfort, Nagata, Nogueira Jr, Pitt, Prieto, Reinicke, Schiariti, Sötje, Stampar, Straehler-Pohl, Thibault, Thiel, Tiseo, Uye, Wiesenthal) from more than 10 different countries are lending their expertise to produce this special volume, edited by Morandini, Holst, and Reinicke. The work will be published within the Elsevier's series *Advances in Marine Biology*, early in 2024.

Keywords: Rhizostome, History, Collaboration, Review volume, Jellyfish

Quality parameters of archived DNA samples of scyphozoans and their usefulness for downstream manipulations

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Modern approaches to biological research require more molecular analyses (e.g. omics studies), including proper collection, storage and preservation of biological material. Given the current accelerated rate of biodiversity loss and environmental degradation, *ex situ* conservation and archiving of molecular samples is of immense importance as they represent important resources for future research and open science, especially for the study of species with unpredictable occurrence or endangered species. They need to ensure integrity, authenticity and availability together with the associated data to describe the stored samples in detail. Quality tests were conducted on archived tissue and DNA samples of several scyphozoan species to meet the above criteria and to provide guidelines for the maintenance and preservation of the biorepository. Several parameters describing the quality of the samples were investigated and evaluated (concentration, fragmentation, purity, integrity of DNA) by spectrophotometric measurements (Nanodrop) and automated microfluidic-based electrophoresis (TapeStation System Agilent). The results and implications will be discussed, particularly with regard to the storage of samples in sufficient numbers for population and demographic studies and as reference material for barcoding, voucher specimens, genome sequencing and many other applications. To meet all the requirements for successful sample storage, researchers need to be well informed and follow best practises to ensure sample quality and reproducibility of molecular analyses. This contribution is part of the LIFEWATCH-SI initiative to promote the digitisation of biodiversity and the principles of open science.

Keywords: Cnidaria, Biorepository, Quality control, Barcoding

Delineating swarming of scyphomedusae along India's Gujarat coast: Dynamics and calendar

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The information on the swarming dynamics of jellyfish has yet to be paid much attention despite sporadic swarming and landings along the Gujarat coast, India. The present study exemplified the swarming dynamics of six scyphomedusae by observing the variation in aggregation over a spatiotemporal scale. The broadest swarms observed were of *Catostylus perezi*, followed by *Rhopilema hispidum* in the Gulf of Kutch, whereas the other scyphomedusae viz., *Cassiopea andromeda, Cyanea nozakii*, *Chrysaora chinensis*, and *Chrysaora* cf. *caliparea* delineated isolated swarms. The collective temporal variation of the scyphomedusae with low to high swarm abundance was illustrated through a swarming calendar. Future jellyfish blooms are brought on by biogeographical and phenological changes that may be predicted using the present swarm behaviour and existing situations. The work could serve as a starting point for further research into potential shifts in the swarming of the scyphomedusae. The results of the current study may also assist the stakeholders in the decision-making processes for managing regional fisheries and other coast-based sectors in dealing with emerging jellyfishes.

Keywords: Jellyfish blooms, Spatiotemporal changes, Biogeography, Phenology

Observations and aggregations of the jellyfish *Pelagia noctiluca* in the waters of the Caribbean and the Pacific Ocean of Colombia

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Although the presence of the jellyfish *Pelagia noctiluca* (Forsskål, 1775) was already known from citizen science sightings in the Caribbean (Magdalena) and the Colombian Pacific (Choco), this is the first time that data on the abundance of the jellyfish in the Colombian Pacific are available. An assessment of the plankton biomass in the epipelagic zone of the newly created MPA - DNMI Colinas y Lomas del Pacífico Norte - was carried out at 10 stations between the 27th and 31st of March 2022. Mesozooplankton (200 microns) and macrozooplankton (500 microns) were collected with a bongo net with a Hydrobios flowmeter attached to the mouth to calculate the volume of filtered water, using oblique trawls nets from 200 to 0 m. The specimens were anaesthetized with 10% magnesium chloride and fixed with 4% normalized formalin, and taken to the laboratory of the Museum of the Natural History of the Marina de Colombia (MHMNC). *Pelagia noctiluca* was found abundant in five stations, coinciding with the highest planktonic biomass recorded in the area studied. This finding indicates that jellyfish are concentrated in a highly productive and food rich system, serving as a resource available to large predators that inhabit and pass through this ecosystem, such as the turtles *Lepidochelys olivacea*, *Eretmochelys imbricata*, and *Dermochelys coriacea* which have nesting populations in Tribugá Bay.

Keywords: Semaeostomeae, New record, Distribution, Tropical Eastern Pacific.

Taxonomic position of the species of *Aurelia* around the Ogasawara Islands

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Aurelia is distributed in coastal areas throughout the world and is known as a species that sometimes occurs in large numbers. However, no phylogenetic or ecological researches have been studied for *Aurelia* distributed around the Ogasawara Islands. In this study, molecular phylogenetic and morphological analyses were conducted to clarify the taxonomic position of *Aurelia* species distributed around the Ogasawara Islands. For the molecular phylogenetic analysis, we analyzed mitochondrial cytochrome *c* oxidase subunit I, nuclear 16S ribosomal RNA and internal transcribed spacer 1 region sequences extracted from medusae collected around the Ogasawara Islands, and created a phylogenetic tree. Morphological analysis was performed for the polyps, ephyrae and medusae of *Aurelia* species. The results showed that this species is most closely related to *Aurelia malayensis* and differs from the two *Aurelia* species (*Aurelia coerulea* von Lendenfeld, 1884 and *Aurelia limbata* Brandt, 1835) whose distribution has been reported in Japan. *Aurelia malayensis* has once been reported as *Aurelia* sp. 4. Although the current system around the Ogasawara Islands is largely unknown, other than *A. malayensis*, there are several reports of common species with southern areas such as Hawaii and Micronesia for fish, indicating an interesting geographical distribution. It is suggested that *A. malayensis* may have expanded its distribution range due to the influence of ocean currents. The Ogasawara Islands, an oceanic island, are genetically isolated from other coastal areas of Japan, even for *Aurelia*, and thus different species may have been observed.

Keywords: Integrative taxonomy

Detailed taxonomic description of a newly occurring jellyfish species *Netrostoma coerulescens* Maas, 1903 from Odisha coast of India

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The study presents a detailed taxonomic description of the crowned jellyfish, *Netrostoma coerulescens,* which is lately exhibiting a swarming phenomenon in the northwestern Bay of Bengal. In May 2021, consequent to a very severe cyclonic storm "Yaas" (IMD, 2021), thousands of this unique jellyfish species were observed to be stranded on the Puri coast of Odisha (India). A subsample of stranded jellyfish (n = 10) was collected for further study. After a detailed scrutiny of the available literature, it was found that the available scientific information on this species is very scarce. Therefore, a detailed taxonomic study was carried out for the correct identification of the species. A combination of morphological features was used to distinguish *Netrostoma coerulescens* from its congeneric species. These include the presence of short, laterally compressed, distally bifurcated mouth arms with numerous short, spindle-shaped appendages. The umbrella margin did not have any tentacles. Every octant had a company of six to seven round-edged velar lappets and two small, pointed rhopaliar lappets. The rhophalial lappets were small and pointed. The exumbrella had a low central dome with a distinct furrow around it. The dome was completely ornated with about eight to twenty-five warts or papillae. The present detailed taxonomic description with colourful visual documentation of morphological characteristics could be used as a stand-alone identification guide for the identification of this species.

Keywords: Identification, Puri coast

Occurrence of Box jellyfish *Chiropsoides buitendijiki* and *Alatina alata* from Palk Bay

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Jelly plankton catch was periodically observed in beach seine and wind-driven mini trawl operations (Thallumadi) from January 2022 to June 2023 along the Dhanuskodi and Pamban seas of the Palk Bay, respectively. Box jellyfish swarms were discovered in Palk Bay's Dhanuskodi waters between May and June 2023. These swarms were later identified as belonging to the box jellyfish species *Chiropsoides buitendijiki* (van der Horst, 1907) of the family Chiropsalmidae, order Chirodropida, class Cubozoa, and phylum Cnidaria. This species is distributed In the Indo-Pacific region, specifically in India, Malaysia, Indonesia, the Philippines, and Australia. They are inhabitants of coastal habitats like mangroves. *C. buitendijiki* has an umbrella-shaped fleshy body, a flexible and smooth texture, and tubule-shaped stinging cells called nematocysts that coil within a capsule structure. The other single specimen of box jellyfish was collected in April 2022 from a wind-driven mini trawl operation along the Pamban waters of Palk Bay and was identified as a four-arm box jellyfish (*Nallu mukku sori* in Tamil) species called *Alatina alata* (Reynaud, 1830), which belongs to the family Alatinidae, order Carybdeida, class Cubozoa, under the phylum Cnidaria. *A. alata*, often called the sea wasp, is found in the Pacific, Indian, Atlantic, Caribbean, and Arabian seas, including Pakistan. It is mainly observed in shallow waters near the coast in tropical and subtropical regions, but it also occurs offshore in deep water. It is a transparent box jellyfish with a narrow, transparent central eyeball, a smooth outer cap, and a rounded pyramidal cap on top. On the umbrella, there are four lengthy periradial rhopalia. It features a band of nematocysts running the length of its four long, wing-like pedalia, each equipped with tentacles. This study demonstrated the summertime presence of Cubozoan box jellyfish in the Palk Bay coastal waters.

Keywords: Palk Bay, Box Jellyfish, Shore seine, Wind-driven mini trawl, Stinging, Nematocysts.

Diversity, distribution, and connectivity of Antarctic gelatinous zooplankton revealed with state-of-the-art molecular tools

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Gelatinous zooplankton is a taxonomically and ecologically diverse planktonic assemblage of cnidarians, ctenophores, and tunicates. Some gelatinous zooplankton are notorious for their detrimental impacts on pelagic ecosystems and human activities. However, a recent paradigm shift has shown their widespread importance and benefits, including their key role in trophic webs and their contribution to the carbon pump through "jelly-falls". In the Southern Ocean, besides the extensively studied salps, a considerable knowledge gap on other gelatinous zooplankton taxa persists since classic net sampling appears inefficient for studying these fragile organisms. Therefore, the main goal of this project is to combine molecular methodologies with environmental data to characterize the species diversity, distribution, connectivity, and ecology. First, we will apply phylogeographic analyses to test whether populations are circumpolar and assess to which extent the Antarctic Polar Front limits gene flow. Second, analyses of environmental DNA sampled from the water column will be used to characterize the Antarctic gelatinous zooplankton species composition and link distributional patterns to hydrography. Environmental DNA from marine sediments will be compared with that of the overlaying water column, providing first insights on the role of gelatinous zooplankton in the carbon pump. Establishing this baseline information will be crucial to predict how environmental change will affect the gelatinous zooplankton community composition and distribution, and by consequence, how it will impact regional trophic networks and carbon fluxes in the future.

Keywords: Environmental DNA, Southern Ocean, Carbon pump, Antarctica

Seasonal dynamics and environmental influences on planktonic hydrozoan populations in the Northern Bay of Bengal

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This study investigated the seasonal diversity and abundance of hydrozoan populations in the northern Bay of Bengal, focusing on the impact of various environmental factors. Plankton samples were collected during both the summer and winter monsoons from five transects with six stations each. A total of 39 hydrozoan species were identified, with 29 species recorded during the summer monsoon and 21 during the winter monsoon. Dominant species were identified as five siphonophore species (*Lensia* sp., *L. subtiloides, Diphyes* sp., *D. chamissonis,* and *D. bojani*) and one hydromedusa (*Liriope tetraphylla*). The influence of seasonal variability and environmental factors on hydrozoan abundance and composition was examined. Canonical Correspondence Analysis (CCA) revealed that salinity was the primary factor influencing hydrozoan abundance during the summer monsoon, while temperature played a more significant role during the winter monsoon. Regression analysis further indicated weak positive correlations between hydrozoan abundance and salinity during the summer monsoon, and with temperature during the winter monsoon. Moreover, the CCA results suggested that siphonophore species were more influenced by salinity and dissolved oxygen concentrations, while hydromedusae species were more impacted by nutrient concentrations and temperature. *Liriope tetraphylla* and *Diphyes* sp. were found to thrive consistently in both the estuarine and coastal waters of the Bay of Bengal and the Sundarban during both seasons. This study sheds light on the previously overlooked diversity and abundance of hydrozoans in the Bay of Bengal, emphasizing the importance of regular and frequent sampling to understand the dynamics of this taxa. The findings underscore the critical role of environmental factors in shaping hydrozoan populations and their potential influence on secondary production within the ecosystem. These results advocate for further research efforts to comprehensively study the ecology and distribution of hydrozoans in this region, ultimately contributing to a better understanding of the intricate marine biodiversity in the Bay of Bengal.

Keywords: Cnidaria, Hydromedusa, Siphonophore, Mesozooplankton, Gelatinous Zooplankton

Spatio-temporal distribution of the salps and doliolids in Korean waters

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Thaliacea (Tunicata) is a gelatinous zooplankton, occasionally occurring in massive blooms around Korean waters. These species utilize phytoplankton and microzooplankton as prey sources. Previous studies noticed that the massive occurrence of thaliaceans could influenced the biomass of prey in the fields, which might be a principal component to fluctuate the trophodynamics in marine ecosystem. This study was carried out to elucidate the spatio-temporal distribution of salps and doliolids around Korean waters during 2018 and 2022. Seasonal distribution of salps and doliolids showed the highest abundance in summer (Aug., max: 1,064 inds.m^{-3}), and occurred abundantly in East China Sea, which is spatially influenced by warm current. Exceptionally, salps sometimes appeared intensively in South Sea of Korea during the cold season. Dense swarm of *Salpa fusiformis* appeared along the east coast of Korea and invaded a nuclear power plant in March 2021. Due to the accident, 2 radioactive reactors were shut down. Rising sea water temperature caused by climate change is likely to expand the growth and distribution of salps and doliolids. In addition, their mass occurrence would not only reduce the standing stock of phytoplankton, but also decrease the biomass of zooplankton using the same prey sources. Therefore, we will discuss the environmental factors that influence the distribution of thaliaceans and consider their impact to pelagic ecosystem including phyto and zooplankton during the bloom periods.

Keyworks: Mass occurrence

Morphological and molecular characterisation of swarm forming ghost jellyfish *Cyanea nozakii* Kishinouye, 1891 (Cnidaria: Scyphozoa)

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The swarm of Scyphozoa, *Cyanea nozakii* is considered as a nuisance since it causes ecological catastrophe and dangerous stings to humans. This species is distributed in the Pacific and Indian Ocean. The present study reports the first swarm of *C. nozakii* Kishinouye, 1891 from the coastal waters of Northwestern Bay of Bengal during winter monsoon, 2021. The species was identified by using integrated tools of morphometry and molecular taxonomy. DNA barcoding of mitochondrial Cytochrome c Oxidase subunit I (COI) was used to confirm the species identity after taxonomic identification. Our sample clustered closely with previously published sequences of *C. nozakii* from the coastal waters of China. The COI sequence alignment translated into 242 amino acid residues, comprising of 36 variable sites, 199 conserved sites and 15 parsimony informative sites. *C. nozakii* was present with a mean abundance of 270±50 ind. m^{-3} in the study area. This study was undertaken to monitor the geospatial spread of jellyfish species diversity and to document the recent increase in jellyfish swarms from Indian waters.

Keywords: Bloom; Cnidaria; DNA barcoding; Gelatinous zooplankton, Integrative taxonomy

Report on blooms of C*raspedacusta sowerbii* Lankester 1880 in Ernakulam and Kollam districts of Kerala, India post flooding

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Reports of blooms of freshwater jellyfish *Craspedacusta sowerbii* Lankester, 1880 are rare in Kerala. Invasion of these hydrozoans have been attributed to translocation in association with water hyacinth *Eichhornia crassipes*, migratory birds and inundation during monsoon. The current report is of large blooms of *C. sowerbii* occurring in shrimp farms near Kuzhupilly, Vypeen Island, Ernakulam district in August 2018 immediately after the catastrophic floods. The floods inundated the shrimp farms during the deluge and waters receded to normal levels within two weeks following which the blooms were noted. A second record of a bloom is made of an occurrence in a landlocked freshwater pond in Karurkadavu, Allurkavu village, Karunagapally, Kollam district in April 2019. The intense bloom was of a density of 144 individuals/litre. Plankton bloom was noticed along with the *C. sowerbii* bloom. Although the pond was a stand-alone water body, it was inundated with water from nearby paddy fields during the 2018 floods. Podocysts or sessile polyps may have survived in this pond post flooding to multiply under favourable conditions later. The hydrozoan *C. sowerbii* can be considered for addition to the list of 32 aquatic invasive species reported from Kerala water bodies following the 2018 floods.

Keywords: Freshwater jellyfish, *Craspedacusta sowerbii*, Bloom, Invasive, Floods, Kerala

Studies on the marine hydrozoan diversity along the coastal waters of Palk Bay and Gulf of Mannar

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The phylum Cnidaria includes the tiny, most diverse, and sparsely studied hydrozoan jellyfish, which occur in Indian coastal waters. There are about 2000 species worldwide. In general, hydrozoan jellyfish exhibit diploblastic layers and radial symmetry. A sessile polyp and a free-swimming medusa are two of the distinctive morphologies found in many types of hydrozoan jellyfish. Sessile polyps reproduce asexually, but free-swimming medusae reproduce sexually by developing eggs and sperm. A swarm of various hydrozoans were collected and brought to the laboratory of ICAR-CMFRI, Mandapam, during the routine jelly plankton survey in the Mandapam and Pamban coastal waters of Palk Bay and the Gulf of Mannar during January 2022 to June 2023. The hydrozoan *Turritopsis* cf. *dohrnii*, which range in size from 2-3 mm, were discovered in the coastal waters around Mandapam and is a first report of its occurrence. These jellyfish are known as immortal jellyfish owing to their ability to reverse their life stages. Other hydrozoans identified were *Aequorea* sp., *Corymorpha* sp., *Bougainvillia* sp., *Blackfordia* sp. *and Euphysa* sp. based on their morphological traits. The study indicates that there could be many species of hydrozoan medusae in the coastal waters of Palk Bay and Gulf of Mannar which necessitates dedicated study on these smaller but abundant group jellyfish in the Indian coastal waters.

Keywords: Hydrozoan, Medusae, Diversity, Immortal jellyfish, Polyps, Coastal water

Assessing the suitability of molecular markers cytochrome opxidase I and 16S ribosomal RNA for medusozoan identification

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Successful identification of species critically depends on the DNA region which is used as the barcode. Although several regions have been proposed as standard DNA barcodes for different taxonomic groups, efficiency of these barcodes for medusozoans still needs to be evaluated. 3,369 partial sequences of the mitochondrial genes for large (16S) ribosomal subunits and Cytochrome C Oxidase subunit I (COI) of the orders Carybdeida, Rhizostomeae, Semaeostomeae and Stauromedusae were downloaded from GenBank and carefully curated for length, directionality, coverage, and potential contaminations. Orders and genes were selected based on the abundance of global dataset in the GenBank. The final dataset comprises 2,787 sequences & 108 species for COI and 582 sequences and 60 species for 16S. Simple distance using PAUP*, DNA barcoding gap using Abgd and tree-based evaluations tests using SPIDER and BarcodingR packages in R were performed for all sequences of each gene and for the same species present in both the genes. Clearly COI had a better discriminatory capacity than 16S RNA based evaluations. 16S had no barcode gap whereas COI had 8 – 11 % gap, which may or may not be sufficient for cryptic species identification. Therefore, Combination of two or more molecular markers is preferred for species identification.

Keywords: DNA barcoding, Identification capacity, Mitochondrial genes, Molecular identification, Jellyfishes

Two new deep sea species of *Bargmannia* siphonophores

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Siphonophores are primarily pelagic, colonial hydrozoans that play pivotal roles in oceanic trophic web, particularly in the deep sea. They are characterized by an unparalleled zooid functional specialization reflected in their complex morphology. This, together with the fragility of their colonies, renders their taxonomic identification particularly difficult, especially when working with the net-collected material. However, the recent technological advancement in the deep sea exploration now allows to collect intact siphonophore specimens furthering our understanding of their biodiversity. Here, using ROV-collected specimens, we provide formal description of the two new *Bargmannia* species supplemented with an overview of *Bargmannia* diversity and a key to all valid species.

Keywords: Taxonomy, Diversity

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Gelatinous zooplankton diversity, distribution and seasonality in the Barents Sea

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Gelatinous zooplankton are important components of marine ecosystems. In the Barents Sea, gelatinous zooplankton diversity, distribution and seasonality have been heavily understudied. Thus, the aim of this study was to (1) investigate gelatinous zooplankton diversity and distribution patterns between the different water masses and (2) investigate the gelatinous zooplankton seasonality in this productive region. For this purpose, in the Nansen Legacy project, four seasonal field campaigns were conducted covering the full seasonal cycle, along a transect from the central Barents Sea to the Nansen Basin and collecting both biological and physical data. In total 31 gelatinous zooplankton taxa were identified: seven Ctenophora, eighteen Hydrozoa, four Scyphozoa and two Appendicularia. Gelatinous zooplankton communities and seasonal dynamics in Atlantic Water and Polar Water influenced areas were different and significantly influenced by the primary production, the zooplankton biomass, the inflow of Atlantic Water and the geographical location. For example, in warmer and more saline Atlantic Water influenced areas, the gelatinous zooplankton communities were dominated by the Appendicularia *Fritillaria borealis* whose abundance peaked in August simultaneously to the peak in phytoplankton and zooplankton biomasses. While, in colder and fresher Polar Water influenced regions, the gelatinous zooplankton communities were dominated by the Appendicularia *Oikopleura* sp. which peaked in December coinciding with the peak in macrozooplankton biomass. As a result, the predicted future higher inflow of Atlantic Waters into the Barents Sea may promote more abundant gelatinous communities that rely on the summer seasonal peak in production, hence directly competing with other key taxa.

Keywords: Barents Sea, Seasonality, Distribution, Atlantic waters, Polar waters, Nansen legacy

Diversity and inter-annual variation of jellyfish abundance along the southeast Arabian Sea, India: An analysis from trawl catch

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Scyphozoa are the most common jellyfish and are called “true jellyfish”. There are at least 220 valid species of Scyphozoan, recorded the world over, of which 35 species have been reported from Indian waters so far. Despite the long history of jellyfish fisheries and their commercial exploitation, the study on scyphozoan jellyfish has been neglected in India. Scyphozoan medusa are captured as a by-catch in different fishing gears viz. gillnet, purse seine, ring seine, and trawls. Mostly, the jellyfish caught in the fishing gear are thrown out in the sea, since they have no market value. It is widely recognized that catch statistics are crucial for fisheries management. With the above background, the present study was conducted on-board research vessel M. F. B. Matsyakumari-II (L_{OA} 17.7m and engine horsepower 325 hp) using trawl nets operated along the coastal waters of off-Cochin between 8m and 35 m depth during the years 2016 to 2019 to study the diversity and inter annual variation of jellyfish abundance along the coast. The diversity and catch composition of 410 fishing tows were analysed and 10 species of jellyfishes were recorded and quantified. *Rhizostoma pulmo*, *Chrysaora hysoscella, Lychnorhiza malayensis and Cephea cephea* were the most abundant and widely distributed species. The biomass of jellyfishes during this period was quantified using swept area method. Jellyfish showed high annual variability probably due to its various forms of life cycle and occupying different niches (pelagic, demersal, or benthic). Jellyfish biomass was minimum during the pre-monsoon season, which gradually increased during the monsoon and post-monsoon seasons. Since the rhizostome jellyfish are edible and having very good demand in overseas, effective techniques to harvest and utilize this unconventional resource would help to improve the income of fishermen.

Keywords: Trawl catch; Jellyfish; Diversity; Fisheries; Arabian Sea

La Guajira platform, Colombian Caribbean, as a substrate for polyps of the Nausithoidae family

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Polyps of the family Nausithoidae can be distinguished from other scyphozoan polyps by their hard periderm, which is conical, dark brown and transparent. They are often found in benthic samples and the jellyfishes are found in plankton samples. It is a biological group that has not yet been much studied in Colombia. In a recent survey carried out in December, following an agreement with the National Hydrocarbons Agency (ANH), benthic and planktonic samples were collected at ten stations on the continental platform in the department of La Guajira, Colombia. The samples of benthos were anaesthetized with magnesium chloride 10% and fixed with standard formalin 12% (benthos) and standard formalin 4% (plankton), then they were sent to the laboratory of the Museum of Natural History Marina de Colombia (MHMNC) - MAKURIWA of INVEMAR. In five stations (E712, E715, E 717, E718 and E720) Nausithoidae polyps were identified and in two plankton stations (E718 and E719) jellyfish were identified. Due to the fact that the project area is relatively shallow (10 to 500 meters depth), it was possible to collect both life stages. It is possible that with a more rigorous collection methodology it will be possible to identify more of these specimens in the area, since it is a site characterized by the presence of macroalgae meadows, rhodoliths and composite gravel on which polyps can settle.

Keywords: Jellyfish, Coronatae, Life cycle, Identification

Reduction of medusa and speciation in Hydroidolina (Cnidaria, Hydrozoa): Two cases from the White Sea

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Hydrozoans are widely known for a variety of life cycles. While some species produce free-swimming medusa, in other species the medusa stage remains attached to the parent colony or parent specimen (reduced medusa). I found two cases of reduction of the medusa stage in the shallow-water hydrozoans belonging to the genera *Sarsia* and *Bougainvillia* from the White Sea. I have studied the genetic and morphological diversity of about 200 specimens of *Sarsia* and about 50 specimens of *Bougainvillia* from the White Sea. In the first case, specimens *Sarsia* producing free-swimming medusae and attached eumedusoids were assigned to the same species *Sarsia lovenii* due to small genetic distances and hybridization between different haplotypes. The periods of spawning in specimens *Sarsia lovenii* with different morphotypes of gonophores are similar. This ensures the exchange of genes between the populations. In the second case, we found two closely related but genetically isolated species: hydrozoan with a free-swimming medusa (*Bougainvillia superciliaris*) and a new undescribed species (*Bougainvillia* sp.), producing attached eumedusoids. The isolation between the two species *Bougainvillia* is due to differences in the periods of reproduction: one species spawns in winter, and the second in summer. We assume that the mechanisms of speciation are similar for these two cases which demonstrate different stages of the evolutionary process.

Keywords: Biodiversity, Integrative taxonomy

Investigating jellyfish swarming and stranding dynamics along the Indian Coast from 1980 to 2023

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India's extensive coastline and vast Exclusive Economic Zone provide a multitude of marine ecosystem services, including tourism, fisheries, and more. However, these activities face challenges due to occurrences of jellyfish swarming and beach stranding events. To understand these occurrences, a comprehensive study was caried out analyzing reported jellyfish nuisance events along the Indian coast from 1980 to June 2023, drawing from available literature and print media. The data analysis revealed a total of 103 events at different times and locations, with 74 identified as swarming events and 29 as beach strandings. The east coast, west coast, and islands accounted for 52, 49, and 2 events, respectively, with Tamil Nadu coast observing the highest number of events followed by Kerala. In 17 cases, the jellyfish species remained unidentified. Throughout the study, 25 jellyfish species were reported, with *Crambionella stuhlmanni* being the most frequently recorded (15 times), followed by *Netrostoma coerulescens* and *Chrysaora quinquecirrha* (11 times each), among others. Notably, the maximum number of events occurred in May (26), followed by October (24), July, August (23 each). Conversely, January and February recorded the relatively less events (15 each). Year-wise analysis revealed that 2018 experienced the highest number of jellyfish events, followed by 2021. Furthermore, this study showed an increasing trend of jellyfish nuisance events over the years during the study period induced by both natural and anthropogenic factors.

Keywords: Bay of Bengal; Arabian Sea; Tourism; Pollution; Ocean warming

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