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1. Offshore dispersion of ephyrae and medusae of *Aurelia aurita* s.l. (Cnidaria: Scyphozoa) from port enclosures: Physical and biological factors

海月水母 *aurita* s. l. (钵水母纲) 母体与幼体的离岸分布: 物理和生物因素

<http://www.sciencedirect.com/science/article/pii/S0924796315001438>

Recurrent outbreaks of the common jellyfish *Aurelia aurita* s.l. have been increasingly significant, particularly in human perturbed coastal waters, where numerous artificial constructions increase suitable habitat for polyp populations. We examined the spatiotemporal dispersion process in 6 ports of ephyrae of *A. aurita* after release from strobilating polyps, to offshore waters of northern Harima Nada (eutrophic eastern Inland Sea of Japan) from January to May 2010. Almost exclusive occurrence of the ephyra stage in the ports demonstrated that their seeding polyps reside in the port enclosures, and liberated ephyrae are rapidly exported offshore by tidal water exchange. Post-ephyra stages occurred primarily outside the ports, and their age increased gradually offshore, ca. up to 9 km off the ports, and the pattern of age increase could be simulated by a simple diffusion model. However, there was an abrupt decline in *A. aurita* density beyond ca. 3 km off the shore, where jellyfish-eating *Chrysaora pacifica* medusae were prevalent. We conclude that physical forces are primarily responsible for offshore dispersion of *A. aurita*, and a biological factor, i.e. predation by *C. pacifica*, jointly affects the distribution pattern of *A. aurita*.

2. Deterministic Factors Overwhelm Stochastic Environmental Fluctuations as Drivers of Jellyfish Outbreaks

随机环境波动作为水母暴发的驱动力

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0141060>

Jellyfish outbreaks are increasingly viewed as a deterministic response to escalating levels of environmental degradation and climate extremes. However, a comprehensive understanding of the influence of deterministic drivers and stochastic environmental variations favouring population renewal processes has remained elusive. This study quantifies the deterministic and stochastic components of environmental change that lead to outbreaks of the jellyfish *Pelagia noctiluca* in the Mediterranean Sea. Using data of jellyfish abundance collected at 241 sites along the Catalan coast from 2007 to 2010 we: (1) tested hypotheses about the influence of time-varying and spatial predictors of jellyfish outbreaks; (2) evaluated the relative importance of stochastic vs. deterministic forcing of outbreaks through the environmental bootstrap method; and (3) quantified return times of extreme events. Outbreaks were common in May and June and less likely in other summer months, which resulted in a negative relationship between outbreaks and SST. Cross- and along-shore advection by geostrophic flow were important concentrating forces of jellyfish, but most outbreaks occurred in the proximity of two canyons in the northern part of the study area. This result supported the recent hypothesis that canyons can funnel *P. noctiluca* blooms towards shore during upwelling. This can be a general, yet unappreciated mechanism leading to outbreaks of holoplanktonic jellyfish species. The environmental bootstrap indicated that stochastic environmental fluctuations have negligible effects on return times of outbreaks. Our analysis emphasized the importance of deterministic processes leading to jellyfish outbreaks compared to the stochastic component of environmental variation. A better understanding of how environmental drivers affect demographic and population processes in jellyfish species will increase the ability to

anticipate jellyfish outbreaks in the future.

3. Population genetic analyses reveal distinct geographical blooms of the jellyfish *Rhizostoma octopus* (Scyphozoa)

种群遗传分析显示水母 *Rhizostoma octopus* 不同的地理性暴发

<http://onlinelibrary.wiley.com/doi/10.1111/bij.12614/full>

Understanding the spatial integrity and connectivity of jellyfish blooms is important for ecologists and coastal stakeholders alike. Previous studies have shown that the distribution of jellyfish blooms can display a marked consistency in space and time, suggesting that such patterns cannot be attributed to passive processes alone. In the present study, we used a combination of microsatellite markers and mitochondrial cytochrome oxidase I sequences to investigate genetic structuring of the scyphozoan jellyfish *Rhizostoma octopus* in the Irish and Celtic Seas. The mitochondrial data indicated far higher levels of population differentiation than the microsatellites: $\phi(ST[MT])=0.300$ vs. $\phi(ST[NUC])=0.013$. Simulation studies indicated that the low levels of nuclear differentiation were not the result of limited power because of low levels of polymorphism. These findings, supported by palaeodistribution modelling and mismatch distribution analysis, are consistent with expansion of *R. octopus* from a single, limited refugium after the Last Glacial Maximum, followed by subsequent isolation, and that the discrepancy between the mitochondrial and nuclear markers is a result of the nuclear loci taking longer to reach mutation-drift equilibrium following the expansion as a result of their four-fold larger effective population size. The populations studied are probably not well connected via gene flow, and thus genetically as well as geographically distinct, although our findings also highlight the need to use a combination of organellar and nuclear markers to enable a more complete understanding of population demography and structure, particularly for species with large effective population sizes.

4. CTENOPHORES FROM THE OAXACA COAST, INCLUDING A CHECKLIST OF SPECIES FROM THE PACIFIC COAST OF MEXICO (vol 3936, pg 435, 2015)

瓦哈卡海岸的栉水母门动物, 包括墨西哥太平洋沿岸的物种清单 (文章 pdf 见附件)

<https://www.researchgate.net/publication/273765359> Ctenophores from the Oaxaca coast including a checklist of species from the Pacific coast of Mexico

Ctenophores are poorly known in the tropical eastern Pacific, including the southern coast of Mexico. Previous records of ctenophores along the Pacific coast have been provided mainly from northern waters. For the coast of Oaxaca state, their occurrence has only been mentioned before at phylum level. In this paper, we provide the first three records of ctenophores for the Oaxacan coast, which represent new records of *Beroe forskalii* and *Bolinopsis vitrea* as well as the first record of *Ocyropsis maculata* in the tropical eastern Pacific. Descriptions of these three species, as well as a checklist of the ctenophores from the west coast of Mexico are provided.

5. Structural and physical properties of collagen extracted from moon jellyfish under neutral pH conditions

中性 pH 条件下从海月水母中提取的胶原蛋白的结构和物理特性

<http://www.tandfonline.com/doi/abs/10.1080/09168451.2015.1046367?journalCod>

[e=tbbb20](#)

We extracted collagen from moon jellyfish under neutral pH conditions and analyzed its amino acid composition, secondary structure, and thermal stability. The content of hydroxyproline was 4.3%, which is lower than that of other collagens. Secondary structure analysis using circular dichroism (CD) showed a typical collagen helix. The thermal stability of this collagen at pH 3.0 was lower than those from fish scale and pig skin, which also correlates closely with jellyfish collagen having lower hydroxyproline content. Because the solubility of jellyfish collagen used in this study at neutral pH was quite high, it was possible to analyze its structural and physical properties under physiological conditions. Thermodynamic analysis using CD and differential scanning calorimetry showed that the thermal stability at pH 7.5 was higher than at pH 3.0, possibly due to electrostatic interactions. During the process of unfolding, fibrillation would occur only at neutral pH.

6. Ecology and behavior of *Bolinopsis infundibulum* (Ctenophora; Lobata) in the Northeast Atlantic

东北大西洋 *Bolinopsis infundibulum* (栉水母类; 兜水母目) 的生态学和行为研究

<http://link.springer.com/article/10.1007%2Fs10750-015-2180-x>

Results from field surveys with net sampling and video profiling, combined with laboratory experiments on feeding and growth, revealed the ecological function of *Bolinopsis infundibulum* in northern temperate coastal waters. *B. infundibulum* reaching a peak abundance of around 250 ctenophores m^{-2} , in mid-May, followed by a dramatic reduction over the next few weeks, presumably explained by predation from the ctenophore *Beroe cucumis*. The field data on maximum individual body height in the population indicated an instantaneous growth rate of 0.129 d^{-1} . Newly hatched cydippid larvae showed an average instantaneous growth rate of 0.240 d^{-1} over 4 weeks, whereas ctenophores in the size range of 4.4–9.8 mm height gave instantaneous growth rates between 0.10 and 0.20 d^{-1} . *B. infundibulum* disappeared from surface water in mid-June, but big individuals were found in deeper water, where they preyed on copepods. The results indicate that the new generation of the year was recruited from February onwards. Laboratory predation and digestion experiments showed a continuous increase in predation rate with increased prey abundance, throughout the tested range of 5–400 copepods l^{-1} , and a digestion time increasing from 39 min with a single copepod ingested to 73 min with 8 copepods ingested.

7. Significance of different microalgal species for growth of moon jellyfish ephyrae, *Aurelia* sp.1

不同的微藻种类对海月水母 (*Aurelia* sp. 1) 生长的重要性

<http://link.springer.com/article/10.1007%2Fs11802-015-2775-x>

The scyphozoan *Aurelia aurita* (Linnaeus) sp. 1., is a cosmopolitan species-complex which blooms seasonally in a variety of coastal and shelf sea environments around the world. The effects of different microalgal species on the growth of newly-released *Aurelia* sp.1 ephyrae were studied under laboratory conditions. We fed ephyrae with four different microalgal species (diatom, autotrophic dinoflagellate, heterotrophic dinoflagellate, and chlorophyta) plus *Artemia nauplii* for 12–24 d at 18 °C. Results showed that the growth rate

diverged significantly for *Artemia nauplii* compared to other food types. In addition, there was no significant variation between the growth rates for *Skeletonema costatum* and *Prorocentrum donghaiense*, and no significant variation was found in the growth rates for *N. scintillans* and *P. subcordiformis*. *Artemia nauplii* could support the energy requirement for the newly-released ephyrae to develop to medusae, and the ephyrae with *Artemia nauplii* showed a significant average growth rate of 25.85% d⁻¹. Newly-released ephyrae could grow slightly with some species of microalgae in the earliest development stage. Chain diatom *Skeletonema costatum* and autotrophic dinoflagellate *Prorocentrum donghaiense*, could not support the growth of the ephyrae, while heterotrophic dinoflagellate *Noctiluca scintillans* and chlorophyta *Platymonas subcordiformis* could support the growth of the ephyrae. However, none of the ephyrae fed with the tested phytoplankton could mature to medusae.

8. Use of an Inverse Method for Time Series to Estimate the Dynamics of and Management Strategies for the Box Jellyfish *Carybdea marsupialis*

使用时间序列逆方法评估箱形水母 *Carybdea marsupialis* 的动力学和管理策略
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0137272>

Frequently, population ecology of marine organisms uses a descriptive approach in which their sizes and densities are plotted over time. This approach has limited usefulness for design strategies in management or modelling different scenarios. Population projection matrix models are among the most widely used tools in ecology. Unfortunately, for the majority of pelagic marine organisms, it is difficult to mark individuals and follow them over time to determine their vital rates and build a population projection matrix model. Nevertheless, it is possible to get time-series data to calculate size structure and densities of each size, in order to determine the matrix parameters. This approach is known as a “demographic inverse problem” and it is based on quadratic programming methods, but it has rarely been used on aquatic organisms. We used unpublished field data of a population of cubomedusae *Carybdea marsupialis* to construct a population projection matrix model and compare two different management strategies to lower population to values before year 2008 when there was no significant interaction with bathers. Those strategies were by direct removal of medusae and by reducing prey. Our results showed that removal of jellyfish from all size classes was more effective than removing only juveniles or adults. When reducing prey, the highest efficiency to lower the *C. marsupialis* population occurred when prey depletion affected prey of all medusae sizes. Our model fit well with the field data and may serve to design an efficient management strategy or build hypothetical scenarios such as removal of individuals or reducing prey. This method is applicable to other marine or terrestrial species, for which density and population structure over time are available.

9. Population ecology of *Muggiaea atlantica* (Cnidaria, Siphonophora) in the Western English Channel

西英吉利海峡 *Muggiaea atlantica* (Cnidaria, Siphonophora) 的种群生态学
<http://www.int-res.com/abstracts/meps/v535/p129-144/>

Recent observations suggest that the siphonophore *Muggiaea atlantica* is expanding its geographical distribution. The mechanisms behind this expansion remain unclear due to our limited knowledge of the species' ecology. We modelled the functional relationship

between the 2 main life-cycle stages of *M. atlantica* over a 5 yr period (2009-2013) in the Western English Channel. Our aims were to determine the key features of the species' population dynamics and the influence of local environmental conditions on its population development. Our results highlighted a strong coupling between the timing of specific environmental conditions and the development of the *M. atlantica* population, thereby explaining interannual differences in the phenology of its blooms. Population development commenced with the initiation of eudoxid production by the overwintering polygastric stages. This reproductive event was linked to the onset of a spring temperature threshold, suggesting a critical basal limit of 10 °C for eudoxid production. Interannual variability in the timing of this threshold modulated the degree of mismatch between the developing *M. atlantica* population and the availability of copepod prey. Unusually cold conditions in the spring of 2010 and 2013 limited the capacity for *M. atlantica* to initiate eudoxid production leading to poor trophic phasing and the production of single autumn cohorts. In contrast, warmer conditions during spring 2009, 2011, and 2012 facilitated earlier population development, optimal trophic phasing and the production of both summer and autumn cohorts. These findings represent an important addition to our understanding of the ecology of *M. atlantica* in the Northeast Atlantic.

10. Multi-jet propulsion organized by clonal development in a colonial siphonophore

[http://www.nature.com/ncomms/2015/150901/ncomms9158/full/ncomms9158.htm](http://www.nature.com/ncomms/2015/150901/ncomms9158/full/ncomms9158.html)

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Physonect siphonophores are colonial cnidarians that are pervasive predators in many neritic and oceanic ecosystems. Physonects employ multiple, clonal medusan individuals, termed nectophores, to propel an aggregate colony. Here we show that developmental differences between clonal nectophores of the physonect *Nanomia bijuga* produce a division of labour in thrust and torque production that controls direction and magnitude of whole-colony swimming. Although smaller and less powerful, the position of young nectophores near the apex of the nectosome allows them to dominate torque production for turning, whereas older, larger and more powerful individuals near the base of the nectosome contribute predominantly to forward thrust production. The patterns we describe offer insight into the biomechanical success of an ecologically important and widespread colonial animal group, but, more broadly, provide basic physical understanding of a natural solution to multi-engine organization that may contribute to the expanding field of underwater-distributed propulsion vehicle design.

11. Trophic relationships between the large scyphomedusa *Chrysaora plocamia* and the parasitic amphipod *Hyperia curti-cephala*

大型钵水母 *Chrysaora plocamia* 和寄生动物 *Hyperia curti-cephala* 之间的营养关系

<http://link.springer.com/article/10.1007%2Fs00227-015-2716-7>

Scyphozoan jellyfish develop dramatic population blooms, which may significantly alter marine food webs. In turn, hyperiid amphipods parasitising jellyfish can occur in such great numbers that they represent an important trophic link to diverse species of fish, and may contribute to the decline of their host populations. Therefore, there is an urgent need to assess the trophic function and energy transfer through jellyfish and their parasites. We studied the isotopic composition (i.e. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) of *Chrysaora plocamia*, the largest

and most abundant scyphozoan jellyfish in the Humboldt Current System of Chile and Peru, and of its associated hyperiid parasite *Hyperia curticephala*. The isotopic composition of *C. plocamia* changed with body size, suggesting that the diet of this species may include both pelagic and benthic prey as a consequence of the vertical distribution patterns observed. Although the density and intensity of infection of the parasite *H. curticephala* changed with the size of the host, their isotopic composition showed little variation, suggesting no shifts in the use of resources by the parasite. In contrast to other hyperiid parasites, reported to shift to a benthic mode of life when their hosts are lacking or in low abundance, the isotopic composition of *H. curticephala* revealed that their food source is mainly pelagic.

12. On the distribution and population dynamics of the ctenophore *Mnemiopsis leidyi* in the Belgian part of the North Sea and Westerschelde estuary

北海比利时部分和 Westerschelde 河口的栉水母 *Mnemiopsis leidyi* 的分布和种群动力学

<http://www.sciencedirect.com/science/article/pii/S0141113615300180>

The spatio-temporal distribution and population dynamics of the non-indigenous ctenophore *Mnemiopsis leidyi* A. Agassiz 1865 were investigated through monthly and quarterly surveys in 2011–2012 at several locations in the Belgian part of the North Sea, the main coastal ports and the adjacent Westerschelde estuary. *M. leidyi* occurred from August to December, but was never found more than 30 km offshore. Densities were generally low (average $0.8 \pm \text{SD } 2.8 \text{ ind m}^{-3}$) compared to other invaded European systems. Highest densities of *M. leidyi* were found in the semi-enclosed basin (port of Oostende; 18.4 ind m^{-3}) and Westerschelde estuary (1.9 ind m^{-3}). The presence of larvae and sudden appearance of high numbers across the size distribution in August indicated that ports and estuaries may act as sources, populating the adjacent coastal area. The zero-inflated logistic regression model showed that there is a higher chance of finding *M. leidyi* (presence) when temperature declines from late summer onwards. Combined with a negative binomial regression, our model suggests that increasing *M. leidyi* densities are associated with decreasing autumn temperatures, low wave height (low energetic systems) and low dissolved oxygen concentrations. Although densities remained relatively low since its first appearance in 2007, a permanent population seems to be established in Belgian waters. As population outbursts may occur with only a small change in environmental parameters, further monitoring of this notorious invasive species is recommended.

13. Effects of temperature on the feeding and growth of the larvae of the invasive ctenophore *Mnemiopsis leidyi*

温度对入侵性栉水母 *Mnemiopsis leidyi* 幼体取食和生长的影响

<http://plankt.oxfordjournals.org/content/37/5/1001>

Carbon-specific prey clearance and ingestion rates of 1.5-mm tentaculate larvae of the ctenophore *Mnemiopsis leidyi* increased linearly between 6 and 25 °C but declined between 25 and 30 °C. Both absolute (length) and carbon-specific growth rate increased linearly with increasing temperature. The latter was 0.87 d^{-1} at 25 °C. Extremely low or negative growth rates observed at 6 and 30 °C help define the thermal limits to population growth of this successful biological invader.

14. Feeding and starvation in the native ctenophore *Bolinopsis infundibulum* and the introduced *Mnemiopsis leidyi* in the North Sea: implications for ctenophore transport in ships' ballast water

北海本土型栉水母 *Bolinopsis infundibulum* 和引入型 *Mnemiopsis leidyi* 的喂养

<http://plankt.oxfordjournals.org/content/37/5/1006>

Two lobate ctenophores, *Bolinopsis infundibulum* and *Mnemiopsis leidyi*, occur in the North Sea. Stomach contents of field-collected *B. infundibulum* were recorded and clearance rates for cladocerans and copepods calculated. In starvation experiments, daily body carbon losses of 2.2 and 1.2% and total carbon content losses of 76 and 63% were observed for *B. infundibulum* (after 68 days) and *M. leidyi* (after 67 days), respectively.

15. Reproduction rates under variable food conditions and starvation in *Mnemiopsis leidyi*: significance for the invasion success of a ctenophore

Mnemiopsis leidyi 在变化食物条件下的生殖率

<http://plankt.oxfordjournals.org/content/37/5/1011>

The ctenophore *Mnemiopsis leidyi* is characterized by high growth rates and a large reproductive capacity. However, reproductive dynamics are not yet well understood. Here, we present laboratory data on food-dependent egg production in *M. leidyi* and egg hatching time and success. Further, we report on the reproduction of laboratory-reared and field-caught animals during starvation. Our results show that the half-saturation zooplankton prey concentration for egg production is reached at food levels of 12–23 $\mu\text{gC L}^{-1}$, which is below the average summer food concentration encountered in invaded areas of northern Europe. Furthermore, starved animals continue to produce eggs for up to 12 days after cessation of feeding with high overall hatching success of 65–90%. These life history traits allow *M. leidyi* to thrive and reproduce in environments with varying food conditions and give it a competitive advantage under unfavourable conditions. This may explain why recurrent population blooms are observed and sustained in localized areas in invaded northern Europe, where water exchange is limited and zooplankton food resources are quickly depleted by *M. leidyi*. We suggest that these reproductive life history traits are key to its invasion success.

16. Understanding winter distribution and transport pathways of the invasive ctenophore *Mnemiopsis leidyi* in the North Sea: coupling habitat and dispersal modelling approaches

了解入侵性栉水母 *Mnemiopsis leidyi* 在北海的冬季分布和运输途径:耦合生境与传播建模方法

<http://link.springer.com/article/10.1007%2Fs10530-015-0899-y>

The invasive ctenophore *Mnemiopsis leidyi* has been reported in various coastal locations in the southern North Sea in the past years. Since 2009, International Bottom Trawl Surveys have recorded this species each winter in open waters. As this species, well-known for its dramatic disturbance of ecosystems, was expected not to be able to overwinter offshore it is crucial to understand its distribution dynamics. Two modelling methods, a quantile regression and a particle tracking model, were used (1) to identify habitats where the invasive ctenophore *M. leidyi* could survive the North Sea cold winters and (2) to investigate the dispersal of individuals between these different habitats,

emphasizing favorable areas where sustainable populations could have been established. Temperature was found to be the crucial factor controlling the winter distribution of *M. leidyi* in the North Sea. High abundance predictions in winter were associated with low values of temperature, which characterise south-eastern coastal areas and estuaries influenced by riverine runoff. A retention-based *M. leidyi* population was indicated along the northern Dutch coast and German Bight and a transport-based population offshore from the western Danish coast. Individuals found in the open waters were transported from southern coasts of the North Sea, thus the open water population densities depend on the flux of offspring from these areas. This study provides the first estimates of the overwinter areas of this invasive species over the cold winters in the North Sea. Based on the agreement of habitat and dispersal model results, we conclude that *M. leidyi* has become established along south-eastern coasts of the North Sea where the environment conditions allows overwintering and it can be retained for later blooms.

17. A new species of *Cyanea* jellyfish sympatric to *C. capillata* in the White Sea

一种新的 *Cyanea* 水母与 *C. capillata* 在白海的分布区重叠

<http://link.springer.com/article/10.1007%2Fs00300-015-1707-y>

Cyanea is a genus of large bloom-forming scyphozoans, including some of the most conspicuous representatives of megaplankton. Its taxonomy has been revised repeatedly throughout the last century due to the fact that most of the morphological characteristics of *Cyanea* species, such as color, structure of gastrovascular system and number of tentacles, may overlap greatly in different populations. Here, we report a new species of *Cyanea*, *Cyanea tzetlinii* sp. nov., from the White Sea, which is distinguishable from all previously described *Cyanea* species by an eye-spot-bearing bulb formed at the base of each rhopalium. This well-recognizable morphological characteristic is supported at the molecular level by a substantial genetic distance in mitochondrial (CO1: 9.6–10.6 %, 16S RNA: 3.1–3.5 %) as well as nuclear (ITS: 5.0 %, 18S RNA: 0.1 %) loci, making it the sister species to *Cyanea capillata*. Taking into account the young geological age of the White Sea and a substantial genetic divergence between *C. tzetlinii* sp. nov. and the nearest sister species, we suppose that *C. tzetlinii* sp. nov. has been advected to the White Sea from elsewhere and may also inhabit other Arctic seas. Past ecological studies in the White Sea and possibly in other Arctic Seas could have conflated *C. tzetlinii* sp. nov. with other species, which likely affected the analyses.

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