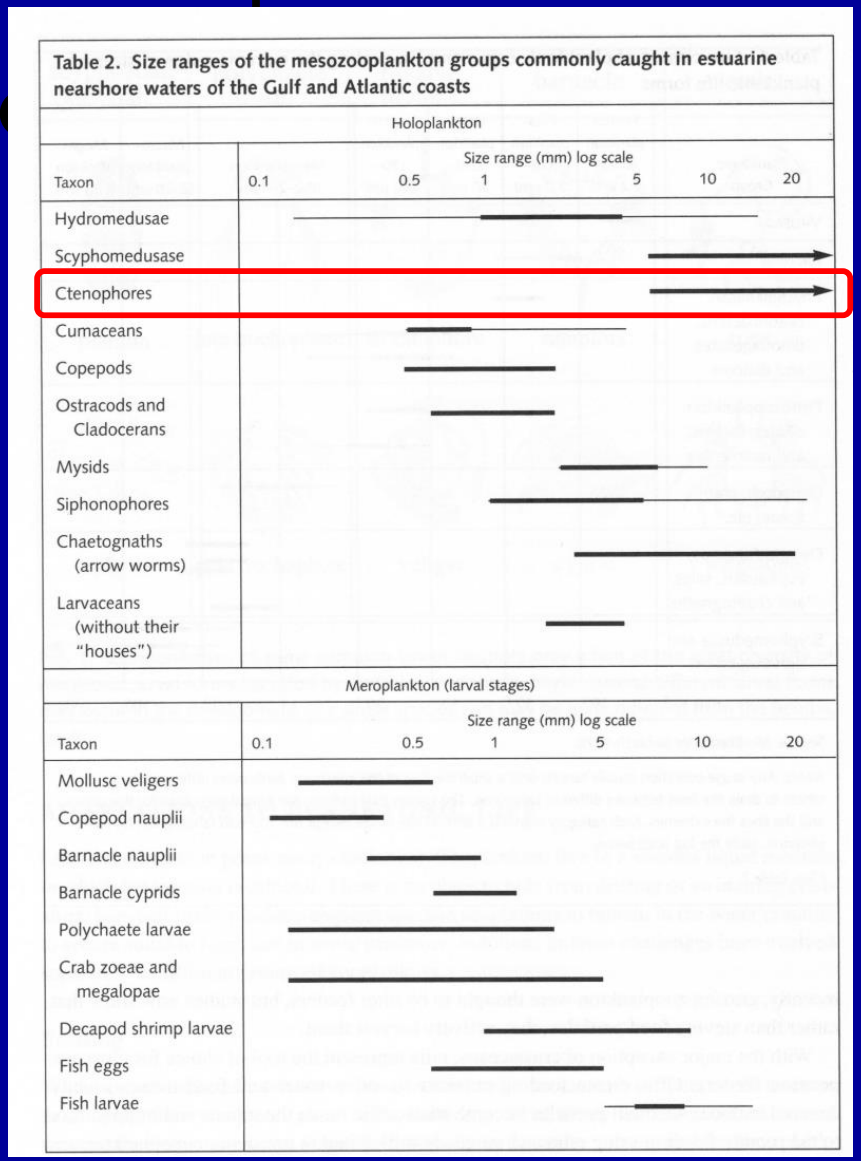
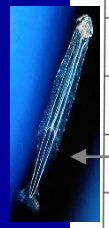


CTENOPHORA

CLASES DE TAMAÑO

CTENOPHORA

VELOCIDAD DE NADO



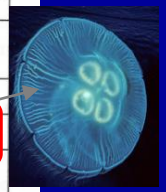


Table 3. Locomotion and swimming speeds of some common nearshore zooplankton with comparisons to fish and humans

Group	Means of locomotion	Characteristic movement	Swimming speed (cm/sec)	Body lengths/second
Ciliates	Cilia		0.001–0.06	1.5–10
Scyphomedusae	Rhythmic contractions of muscles around the bell	Distinctive pulsing motion	2–5	0.5–0.7 (dia/sec)
Hydromedusae	As above	As above	<0.2–1.0	1–5
Ctenophores	8 rows of long paddle cilia	Gliding motion		
Rotifers	Beating of cilia on the corona (wheel organ) at the anterior end	Gliding motion	0.05–0.15	3–14 3–8.6
Copepod nauplii (*Acartia, Oithona, Oncaea*[a])	Beating of appendages from the head region	Intermittent swimming or "jumps"	0.01–0.1 0.5 max	1–4
Copepods (adult calanoids, mean speed) (*Acartia, Temora*)	Primarily by beating of 2nd antennae and other cephalic appendages	Smooth steady swimming or halting, "sink and swim" motion	0.14	1–1.5
Adult calanoid escape responses (*Calanus*[a])	Primarily by vigorous beating of thoracic appendages		80	300
Mysids (opossum shrimps)	Beating of abdominal appendages (pleopods)	Smooth gliding even during directional changes	2–8	2–10
Shrimp and crab zoeae (blue crab, green shore crab, —Z1)	Beating of thoracic appendages, occasional abdominal flexions	Usually smooth, occasional pauses or jerks	2–3 0.067	about 1
American lobster (postlarva)	Beating of abdominal appendages		7–13	
Oyster (eyed veligers)	Cilia of the velar lobes	Smooth, steady swimming	0.08–0.24 0.1–0.3	about 1
Chaetognaths (arrow worms)	Dorsoventral flexions of longitudinal muscles	Rapid, darting motion	0.5–3	0.5–5
Fish larvae	Undulations of trunk and tail	Routine burst swimming	0.5–3	1–3 2–6
Barracuda	Undulations of trunk and tail	Bursts of up to a hundred meters	700+ (27 mph)	5–8
Human (Olympic swimmer)	Flailing of arms and legs	"Freestyle"	180	1

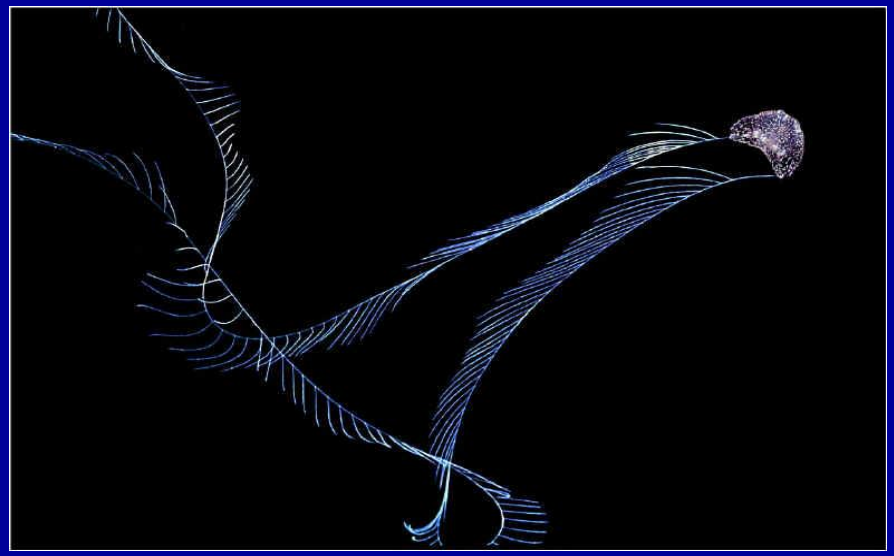
[a] See Paffenhöfer et al. 1996 and Lenz et al. 2004 for descriptions of swimming behavior.

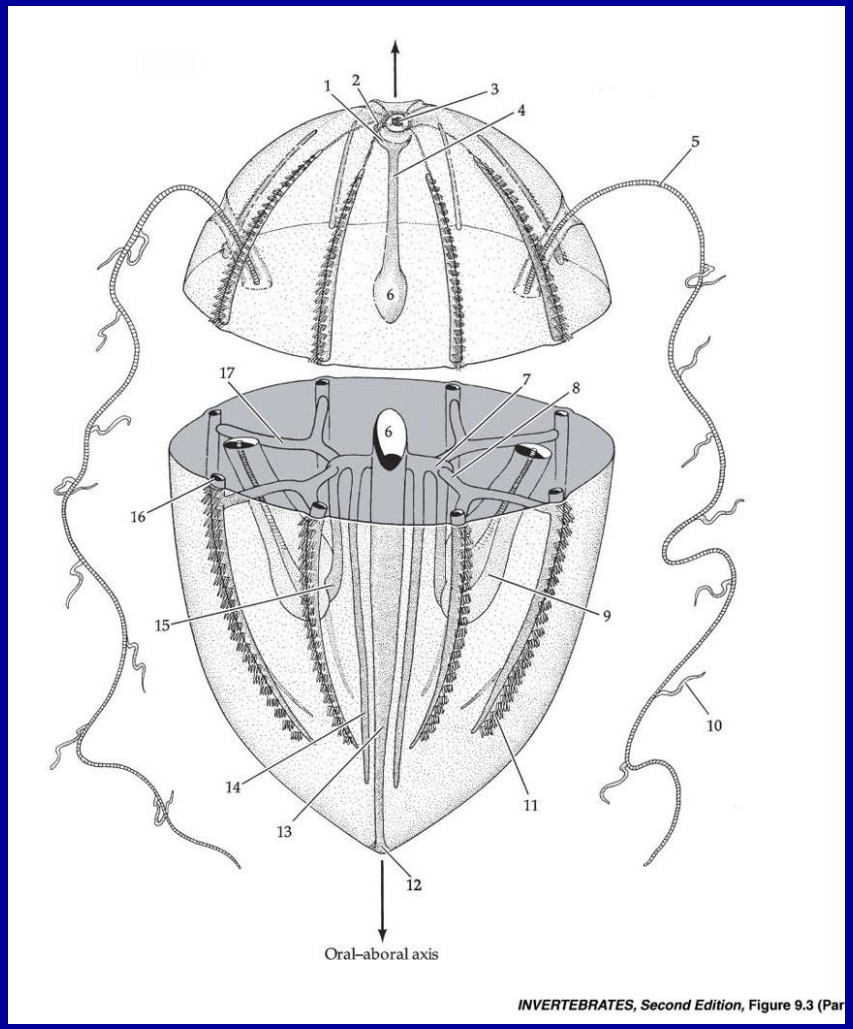
CTENOPHORA

- **BIRADIALES**
- 150 SP: exclusivamente marinos, planctónicos o bentónicos
- **CUERPO GELATINOSO**: solitarios
- **LOCMOCIÓN**: ctenas, fila de peines subtentaculares
- **ALIMENTACIÓN**: coloblastos
- **REPRODUCCIÓN**: muchos hermafroditas
- **BIOLUMINISCENCIA**
- **CARNÍVOROS**: copépodos, eufaúsidos, huevos y larvas de peces
- **PREDADORES**: peces
- **ALTAS ABUNDANCIAS** EN ZC Y ESTUARINAS

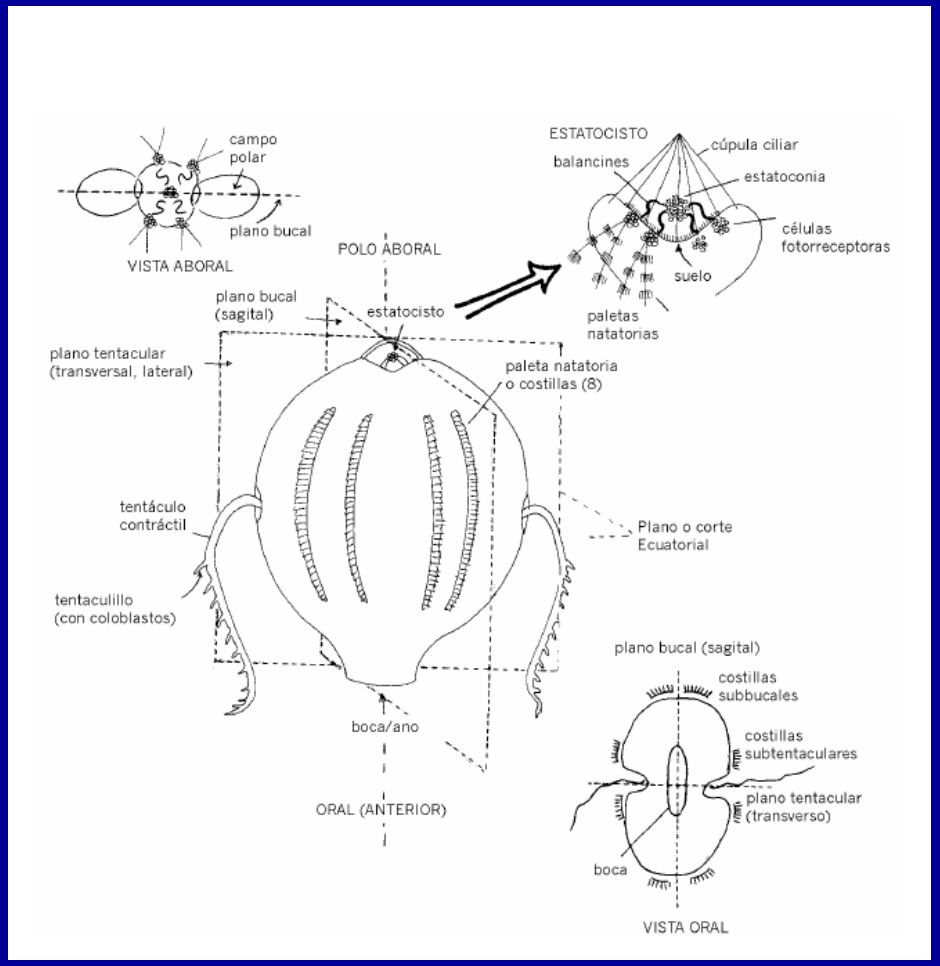
CARACTERÍSTICAS DISTINTIVAS

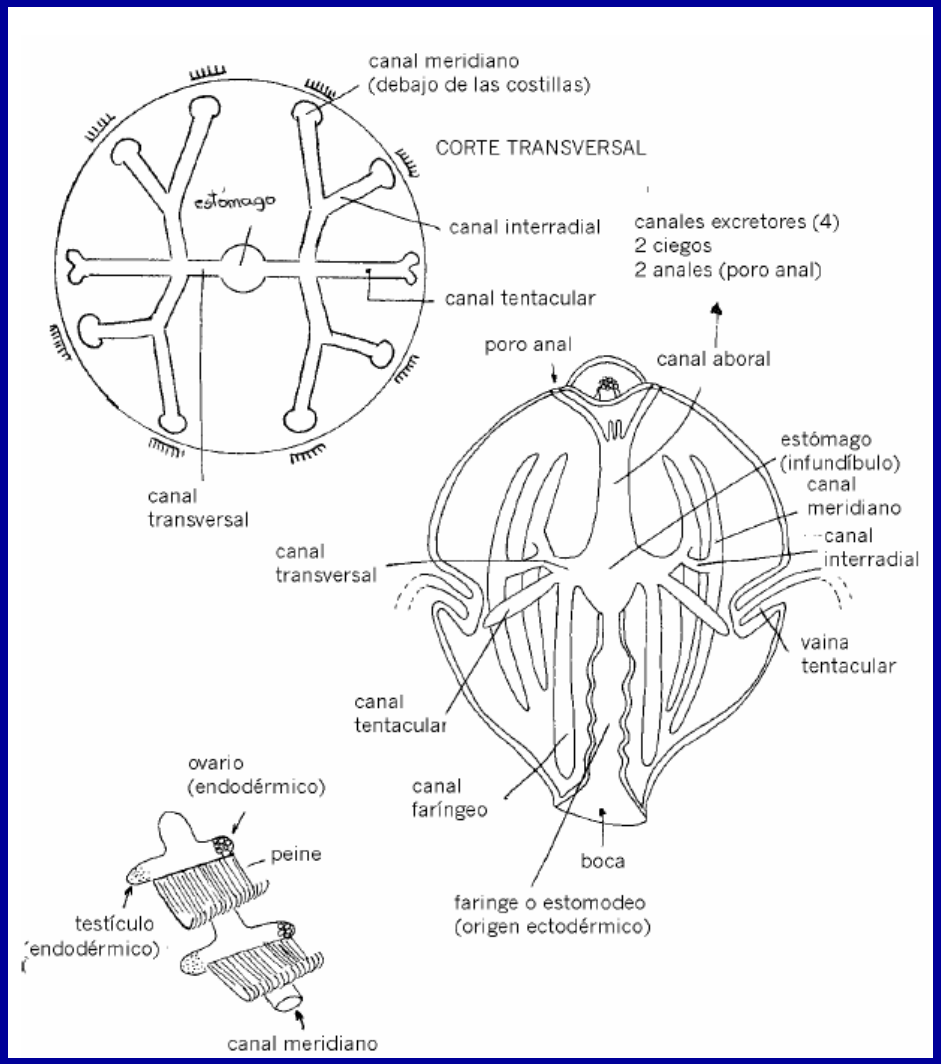
- Ocho filas de peines
- Órgano apical sensorial
- Tentáculos (algunos)
- Simetría biradial





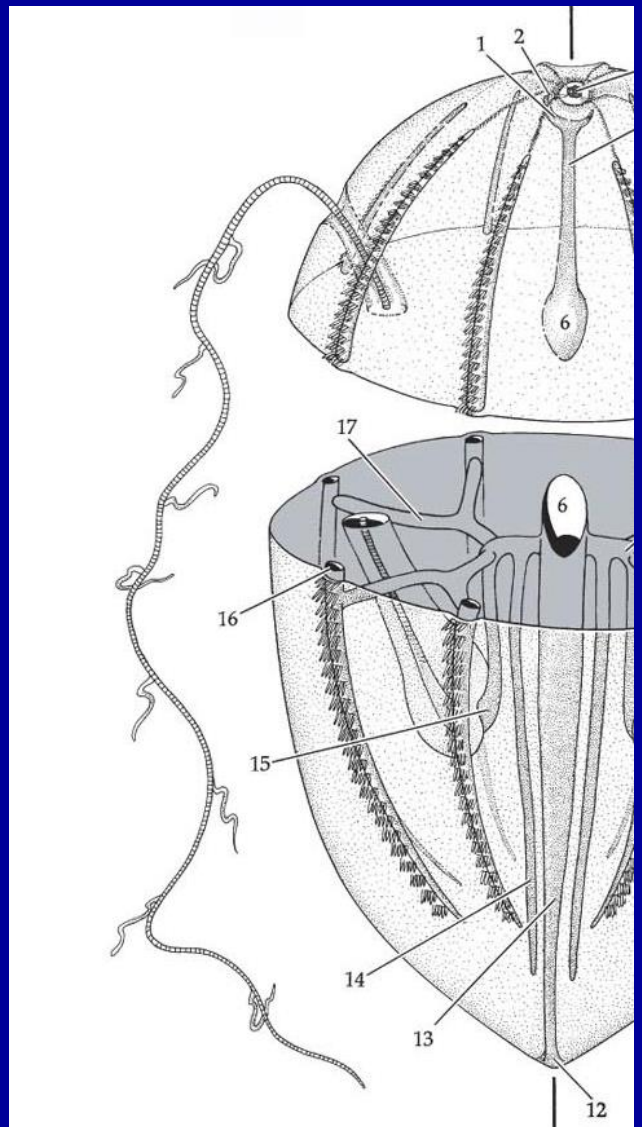
ANATOMÍA EXTERNA E INTERNA



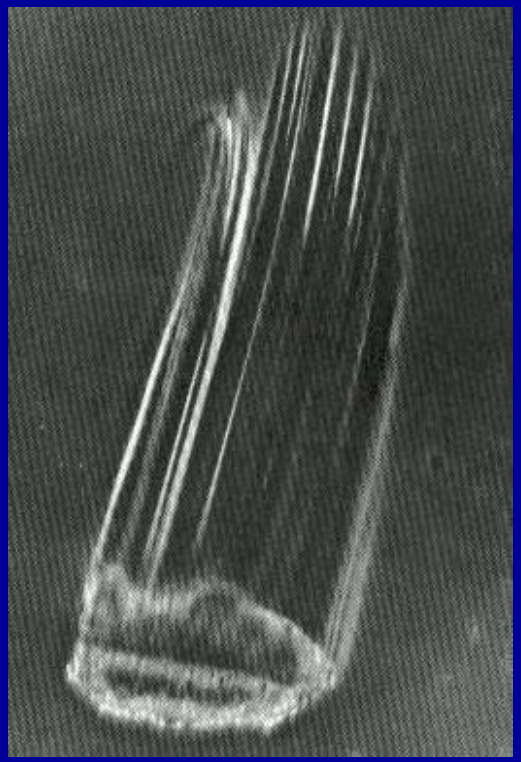


ALIMENTACIÓN

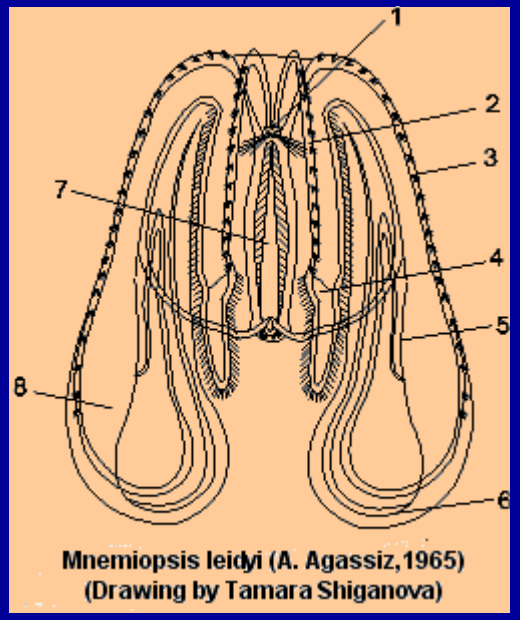
- Predadores
- Tentáculos:
  - Se extienden hasta 100 veces el largo del cuerpo
  - Se retractan dentro de vainas
  - El alimentlo se pega a sus paredes y luego se dirige a la boca
- Boca
- Faringe
  - Revestimiento epidérmico
- Canales gastrovasculares: 4-8 por debajo de las filas de peines
- Digestíon: intra y extracelular
- Excreción se efectúa por la boca y poros anales (mínimos, zona aboral)

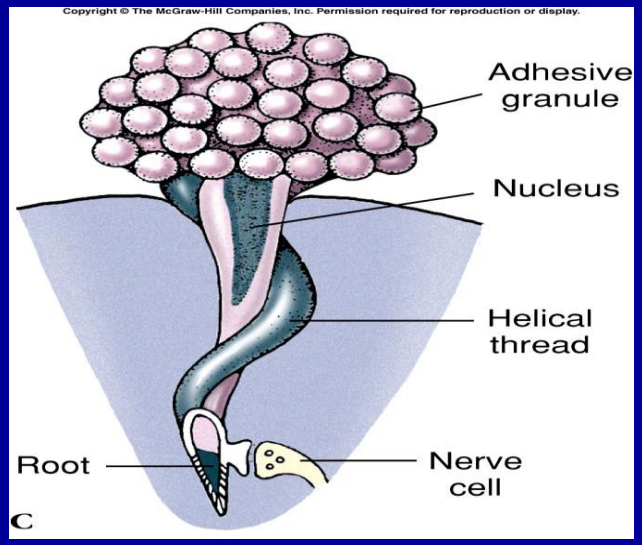


ALIMENTACIÓN



1.- Canal anal
2.- peine subtentacular
3.- peine subestomodeal
4.- canal perigastrico
5.- canal meridional
6.- lóibulo oral
7.- faringe

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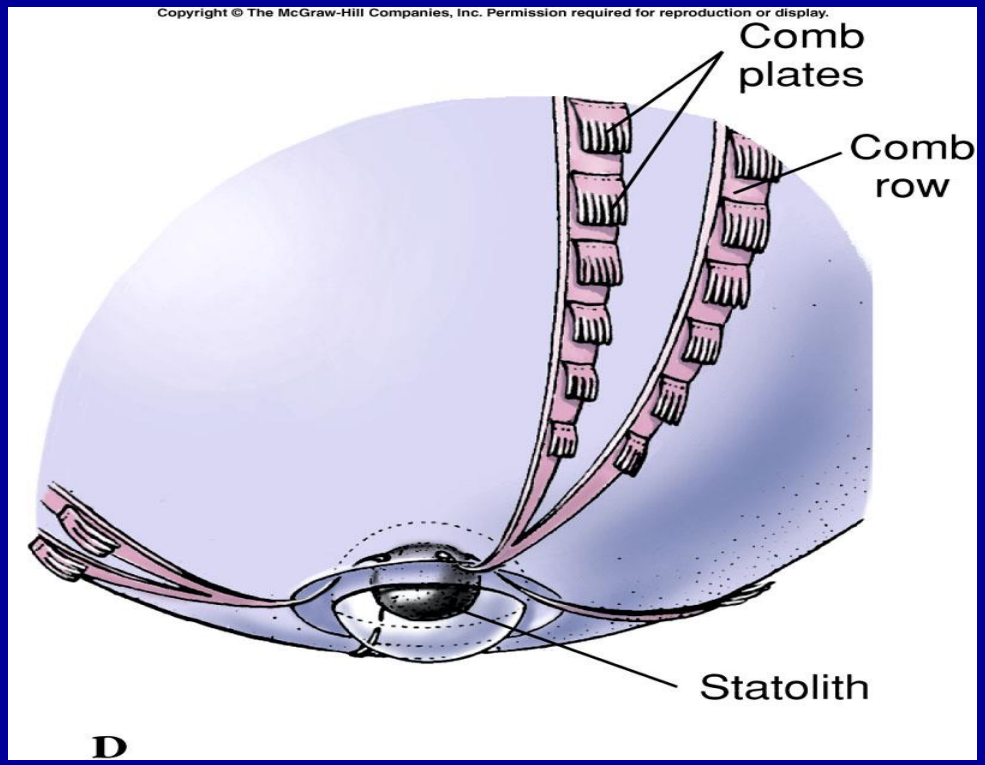
Adhesive granule
Nucleus
Helical thread
Root
Nerve cell
C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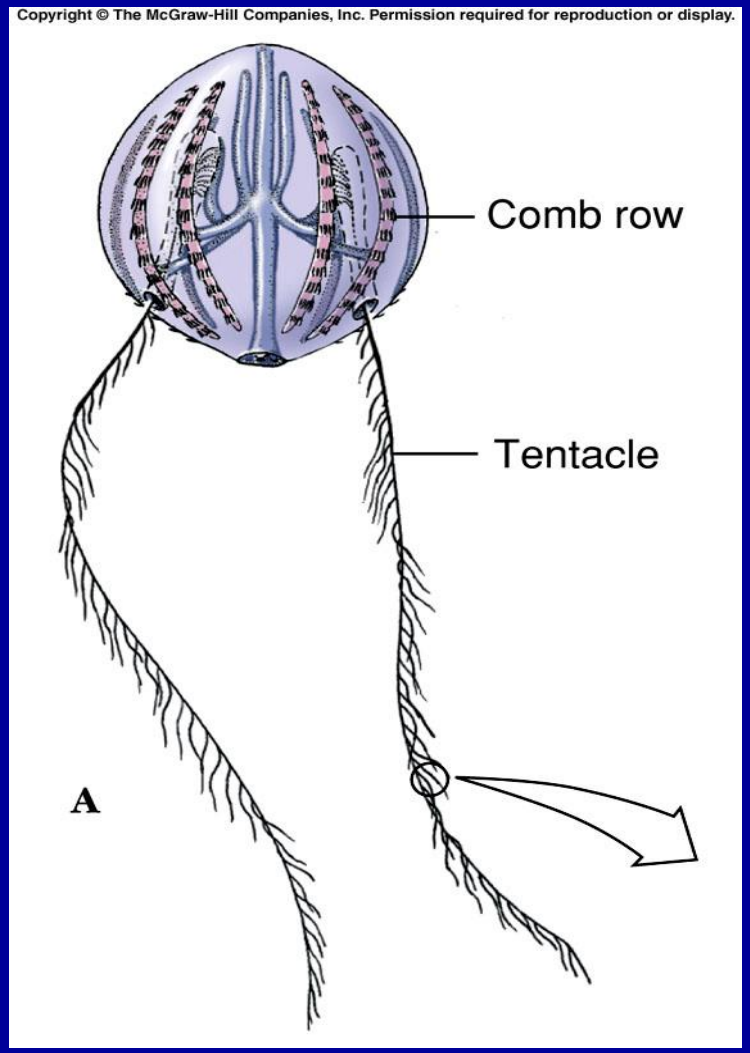
Comb plates
Comb row
Statolith
D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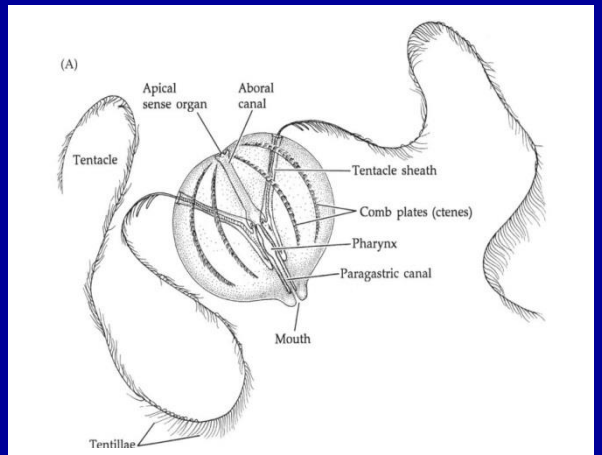
Tentacle
A

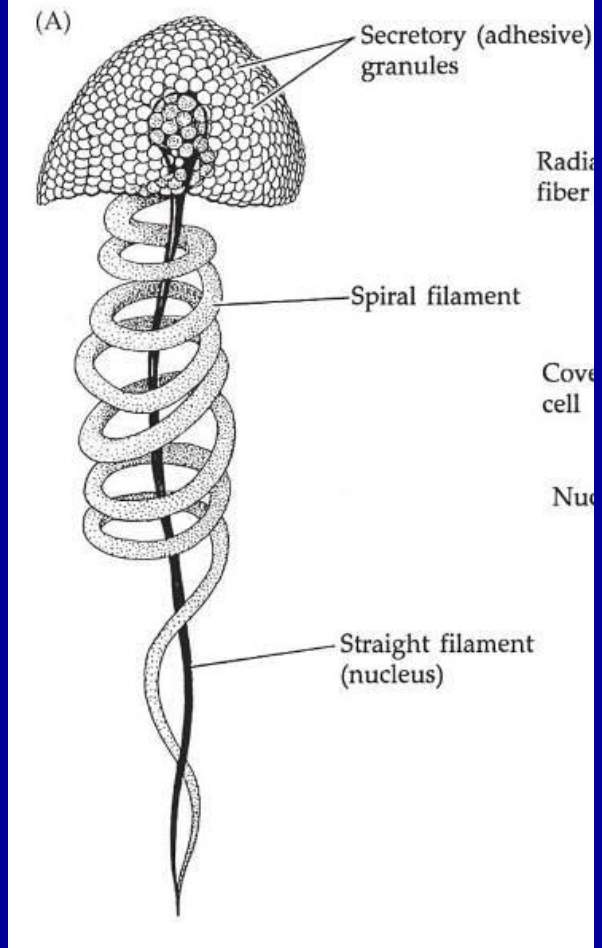
ALIMENTACIÓN

Pleurobrachia

COLOBLASTOS

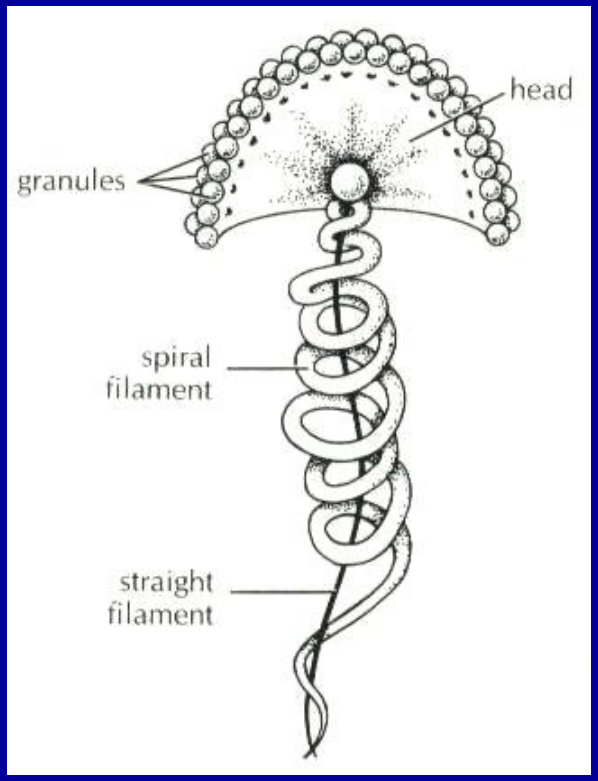
- Se encuentran sobre los tentáculos
- Cercanos o sobre la boca
- Anclados en la musculatura
- Estructura
  - Filamento recto
  - Filamento en espiral
  - Cabeza con glándulas adhesivas
  - Neurona asociada
- Los gránulos son reemplazados

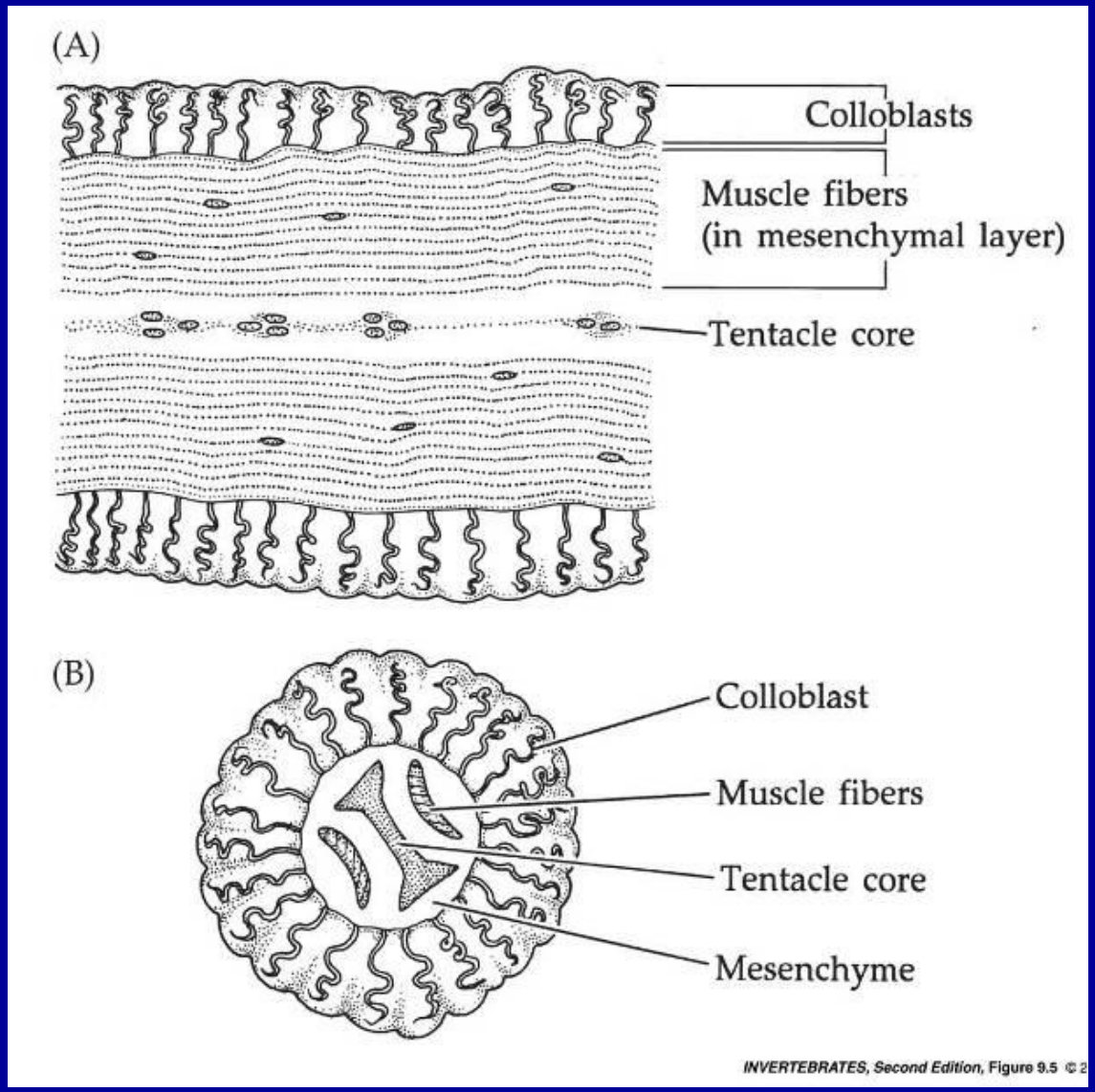




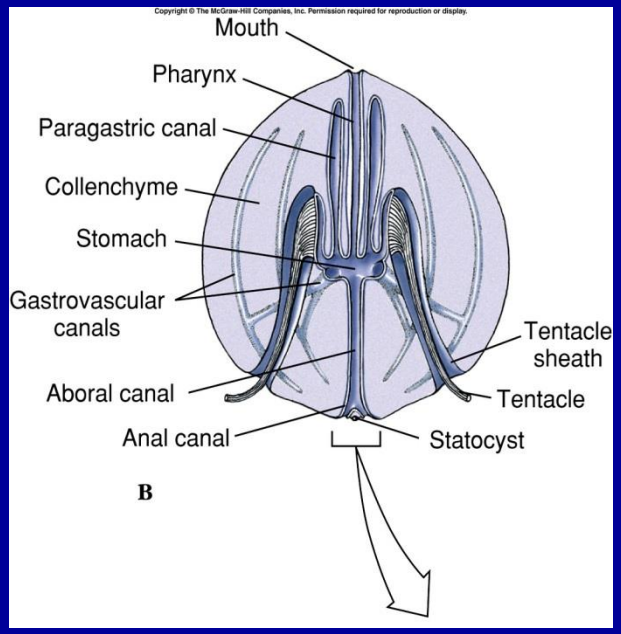
ALIMENTACIÓN

Pleurobrachia



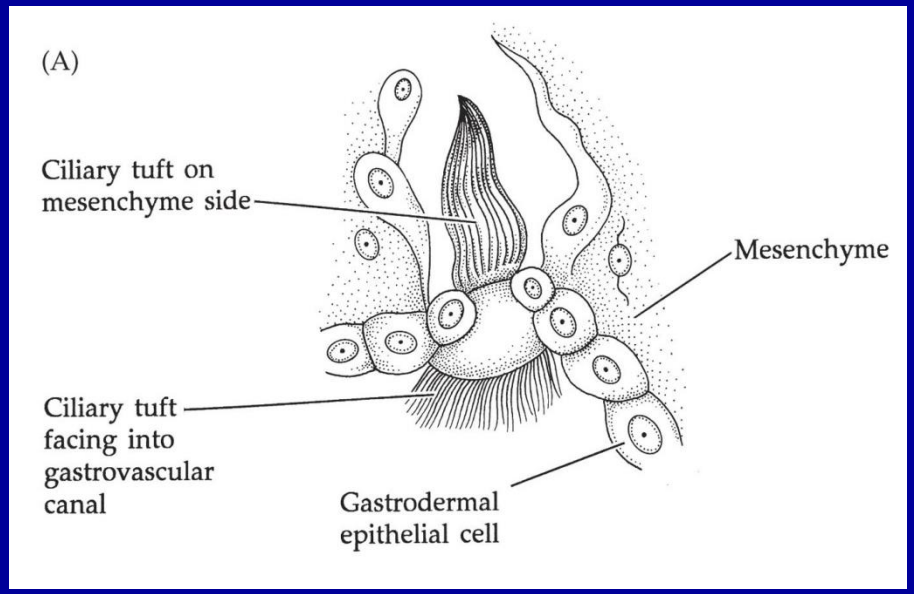


RESPIRACIÓN EXCRECIÓN



Respiración y excreción a través de la superficie del cuerpo

Rosetas celulares se asemejan a "bulbos de llama" de Platyhelminthes



OSMORREGULACIÓN: Por difusión. Amoniotelicos.

HISTOLOGÍA

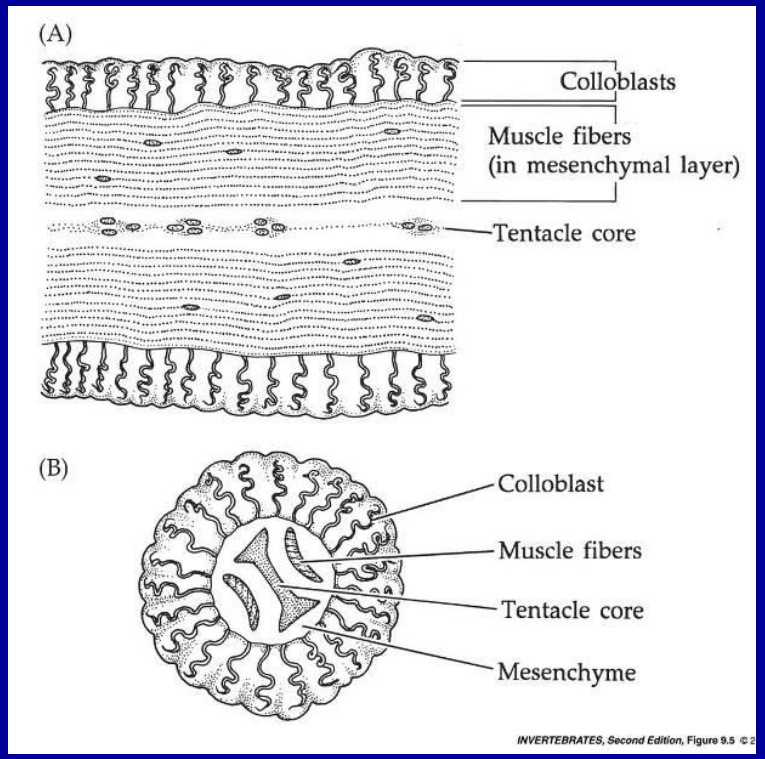
ECTODERMO:

- Células epiteliales: células de soporte.
- Células glandulares: producen mucus. Protectoras, venenosas: defensivas y captura del alimento.
- Células ciliadas: forman las paletas natatorias.
- Células sensoriales.
- Células nerviosas: en la base de la epidermis formando un plexo nervioso.
- Células musculares.
- Coloblastos: células adhesivas para la captura de las presas; parece que también tienen toxinas.

ENDODERMO:

- Células epiteliales: células de soporte.
- Células glandulares enzimáticas.
- Cromatóforos.
- Células nerviosas: en la base de la gastrodermis formando un plexo nervioso.

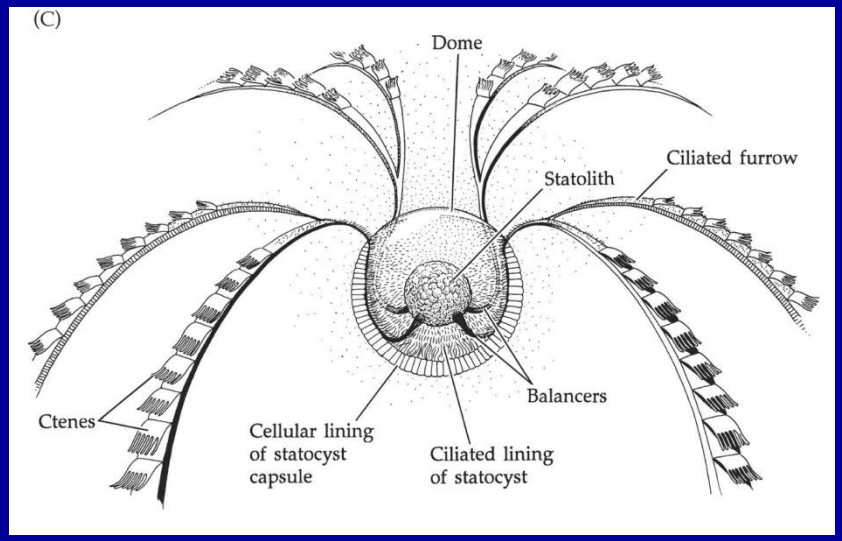
MESOGLEA: Es un colénquima que contiene la matriz gelatinosa, células mesenquimáticas y fibras musculares.



SISTEMA NERVIOSO

MOVIMIENTO GENERAL

- Boca (final oral) adelante
- Movimiento de las filas del peine
- La contracción muscular es más importante en algunas especies



El control de las filas de peines: órgano sensor apical

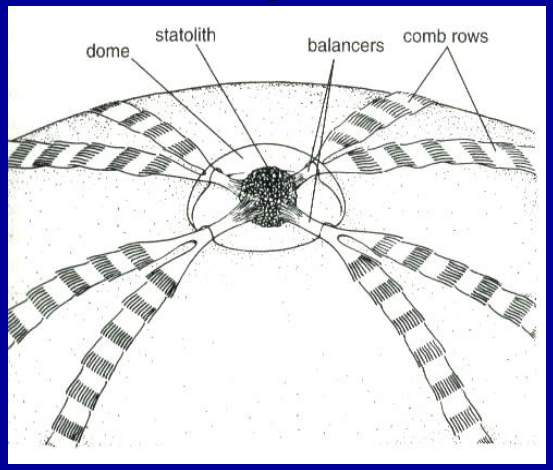
Estatocisto modificado:

- Domo
- Estatolito
- Surcos ciliados modificados: uno por cada peine

El estatolito empuja contra los balnaceadores → batiendo las cilias dentro de los surcos → batido del 1º peine →los peines transmiten las ondas mecánicamente

Inclinación: golpes más vigorosos en las filas inferiores

SISTEMA NERVIOSO



RED NEURONAL

- Proporciona retroalimentación al órgano de los sentidos apicales
- Ayuda a coordinar el batido entre filas adyacentes
- Controla los músculos

Cuerpo receptivo al tacto, a la luz, a la vibración, a la temperatura, a ciertos productos químicos

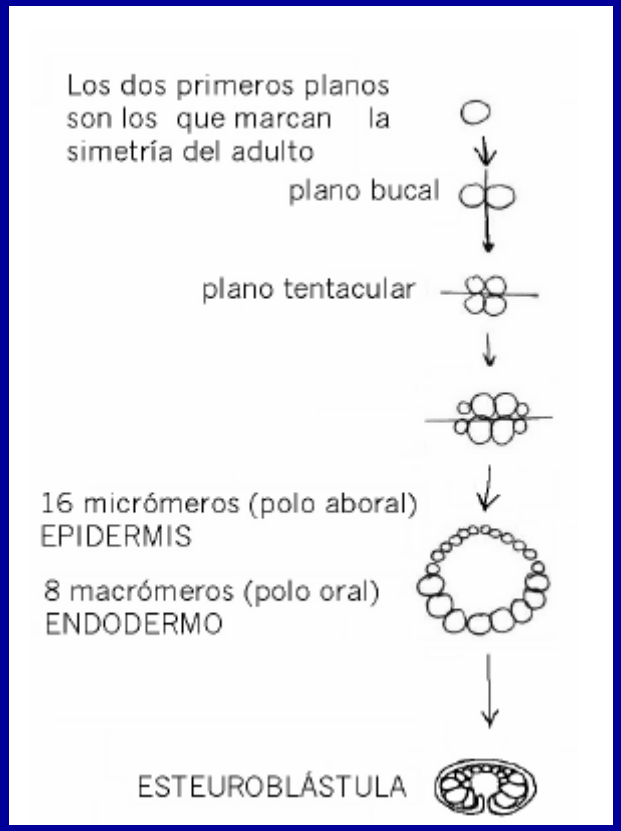
Los campos polares (regiones ciliadas) pueden ser sensitivos

Músculos

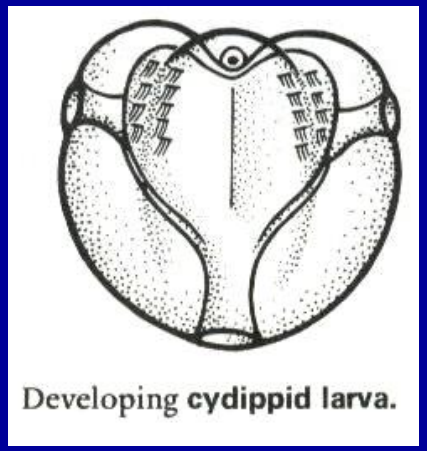
Respuestas de escape

Forma clave del movimiento en algunos

REPRODUCCIÓN



- Hermafroditas simultáneos; Puede autofertilizarse
- Las gónadas dentro del canales
- Huevos y espermatozoides generados por los poros
- Los adultos generalmente mueren después del desove
- Poliespermia y elección femenina
- El núcleo del huevo elige el núcleo del esperma
- Rápidamente puede regenerar partes dañadas del organismo
- Larva: Cydippid

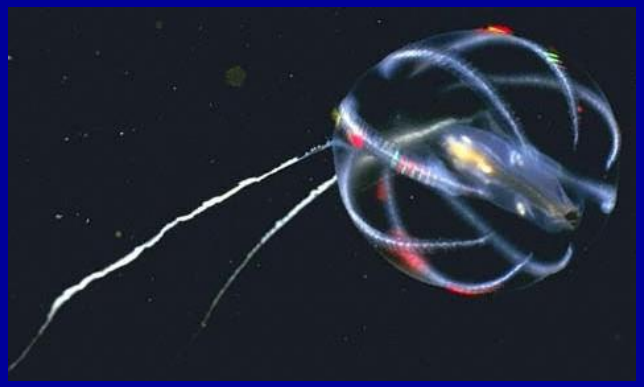


HISTORIA EVOLUTIVA

Characteristic	Ctenophores	Cnidarians
Developmental Stage	Cydippid	Planula
Digestive System	Gastrovascular canals	Gastrovascular canals
Nematocysts	None	Present
Colloblast	Present	None
Sexuality	Hermaphroditic	Gonochoristic
Musculature	Within Mesoglea	Within Gastrodermis
Ciliation	Multiciliated cells	Monociliated cells

ECOLOGÍA

- MARINOS
- DESDE LA SUPERFICIE HASTA EL OCEÁNO PROFUNDO
- HOLOPLANCTÓNICO
- SE ALIMENTA DE LARVAS DE PECES Y ZOOPLANCTON
- ***Mnemiopsis leidyi***, puede ser responsable del colapso en las poblaciones de anchoa
- CASI TODOS SON BIOLUMINISCENTE



DIVERSIDAD

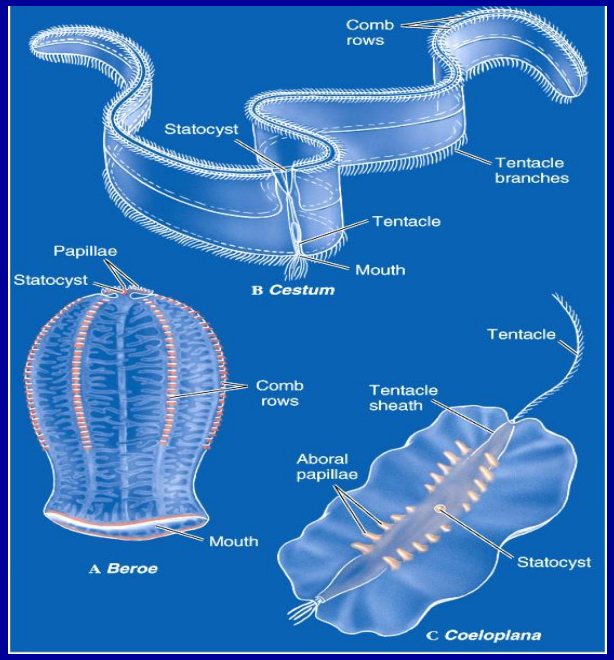
Muchas especies viven en el oceáno abierto por lo que no están bien estudiadas

Se emplean sumergibles para la colecta de especímenes evitando así su destrucción por la acción mecánica de las redes.

Phylum Ctenophora

- Orden Lobata
- Orden Beroida

DIVERSIDAD



Clase Tentaculata

Con tentáculos

Algunos aplanados oral-aboral

Algunos comprimidos en plano tentacular

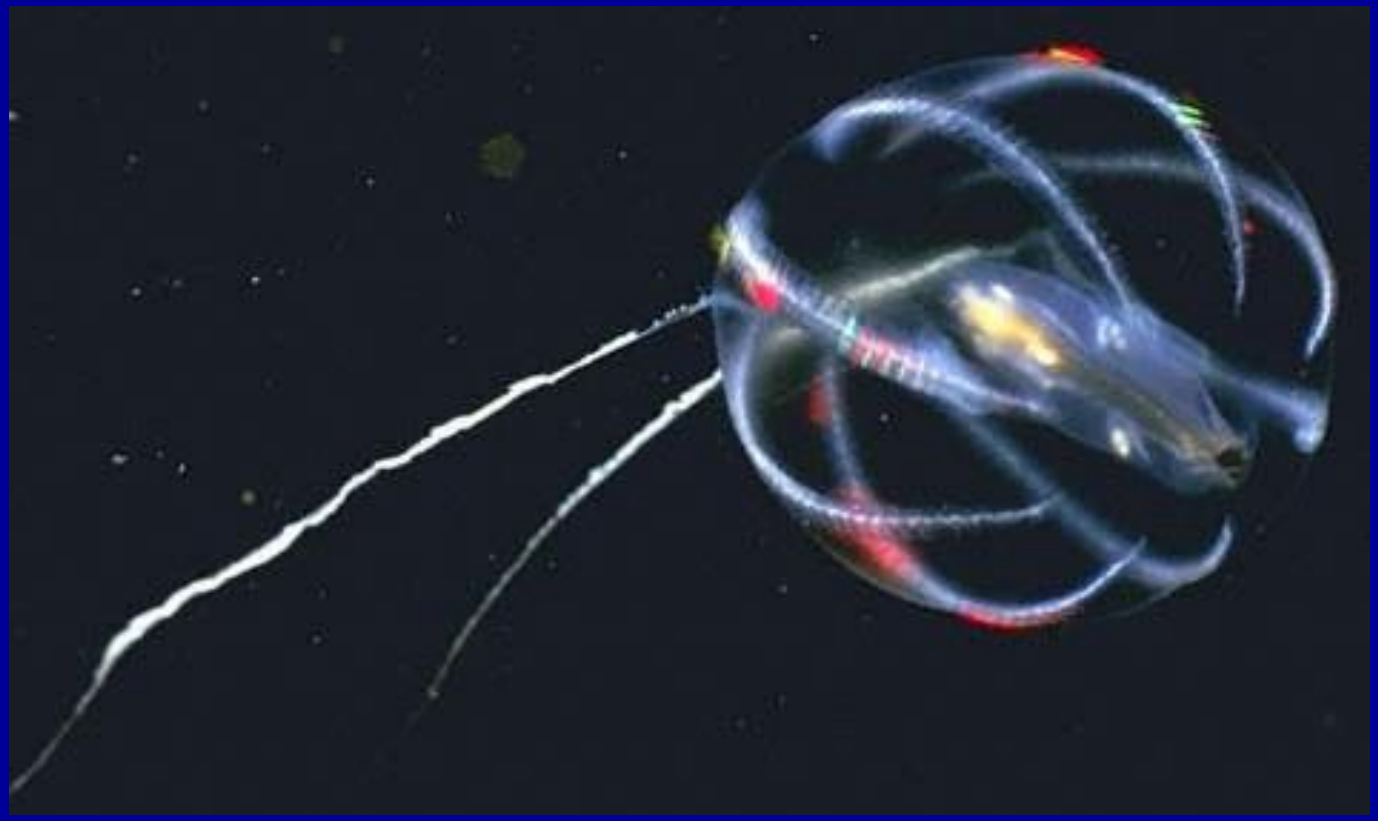
Algunos con filas de peines sólo en la larva

Pleurobrachia, Cestum

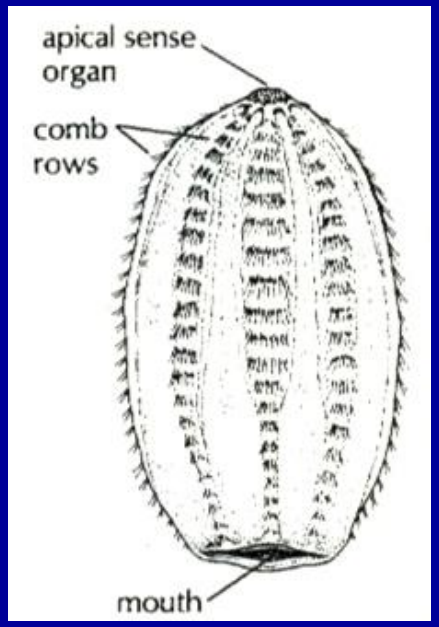
Clase Nuda

- Sin tentáculos
- Aplanados en el plano tentacular
- Boca y faringe anchos
- Canales gastrovasculares muy ramificados
- *Beroe*

Order Cydippida: *Pleurobrachia* spp.



Order Beroida: *Beroe* spp.

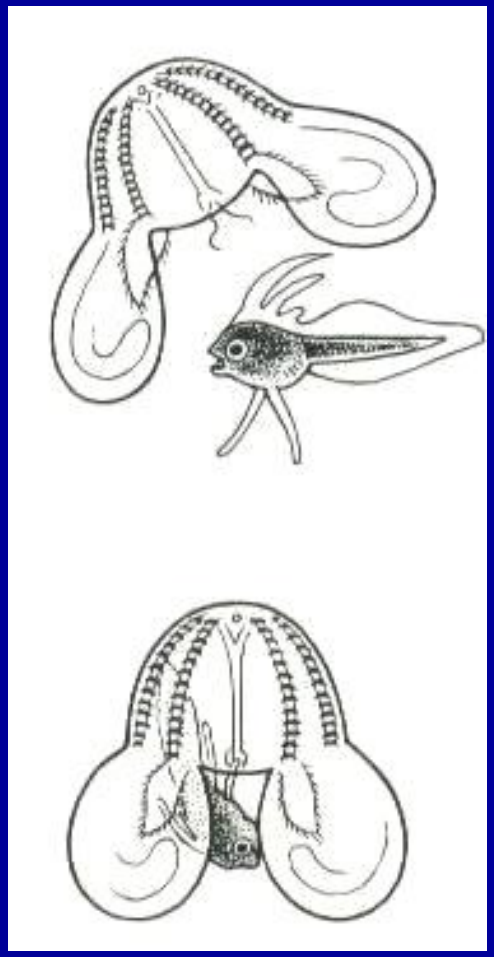


- Carece de tentátculos
- Pueden consumir presas superiores a su tamaño

Order Cestida: *Cestum* spp.

- Cuerpo comprimido: cinta
- Se mueve por movimiento de ondulación de las filas de peines
- El zooplancton queda atrapado en el mucus del cuerpo y es propulsado hacia la boca por las cilias.

Order Lobata: *Mnemiopsis* spp.



- Lóbulos orales se emplean para el movimiento y la captura de alimento.
- El zooplancton es atrapado en el mucos del cuerpo y es propulsado hacia la boca por el movimiento ciliar (= Cestida)

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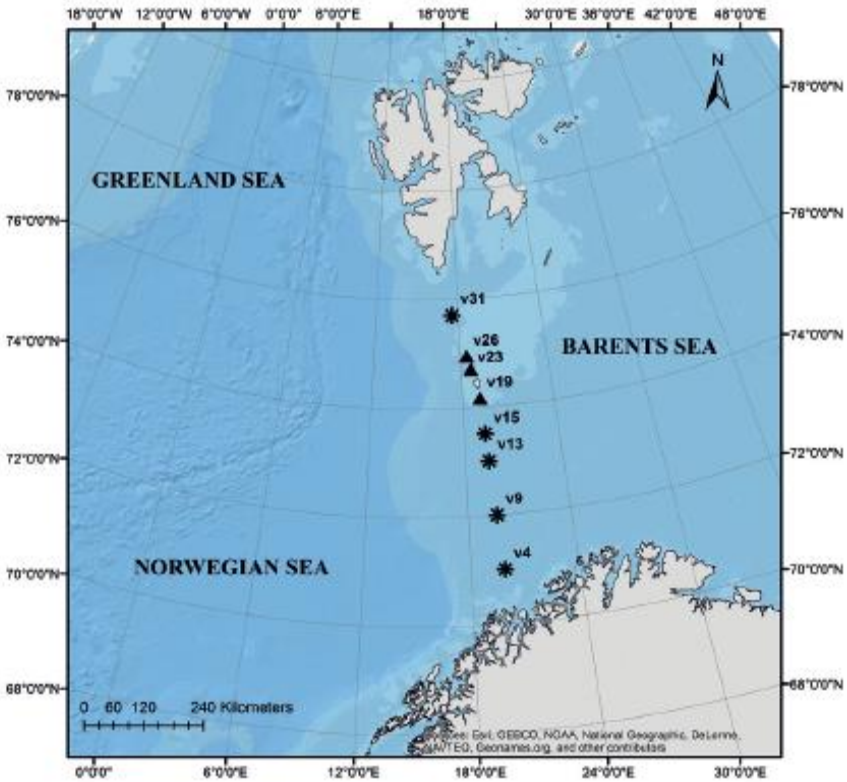
Maria I. Żmijewska

Pelagic coelenterates in the Atlantic sector of the Arctic Ocean – species diversity and distribution as water mass indicators

Distribution of sampling sites where triangles mark the Arctic Water Mass influence, and asterisks stand for the Atlantic Water Mass (Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, NAVTEQ, Geonames.org, and other contributors)

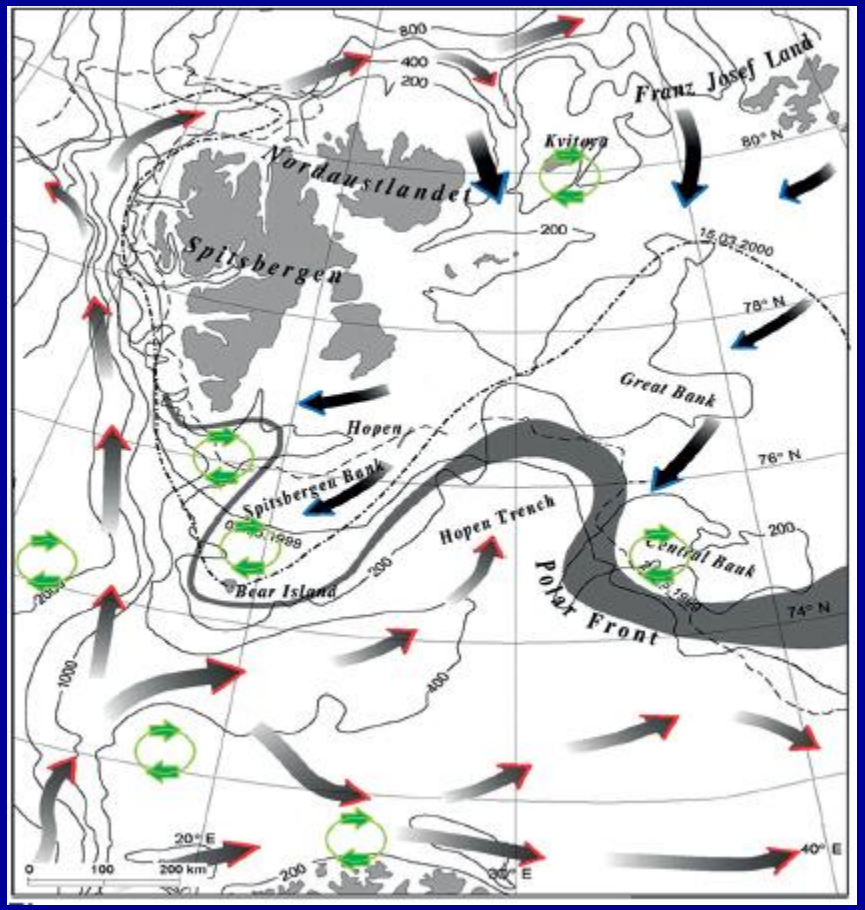


Abstract

Marginal seas of the Arctic Ocean are well recognized as one of the richest ecosystems in the world's ocean, being at the same time the most vulnerable to climate change. Such vulnerability affects the distribution of water masses, thus influences the pelagic species dispersal and local diversity.

For certain reasons some plankton species can be used as indicators of water mass distribution. Although the use of copepods and chaetognaths in such a manner is well documented, still little is known about the potential of pelagic Coelenterata as possible indicator species; they are still poorly investigated in this part of the Arctic Ocean. Therefore, a survey of these gelatinous animals was conducted in a transect between the Norwegian, Greenland, and Barents Seas in summer 2011. A total of 21 taxa were encountered and the most abundant was *Aglantha digitale*. Species distribution coupled with hydrological analysis of the investigated area enabled us to establish the water mass indicator taxa. Therefore, *A. digitale* was connected with the Atlantic Water Mass, while *Bougainvillia superciliaris* and large numbers of ctenophores were correlated with the Arctic Water Mass.

The results presented herein may provide the basis for developing new tools to analyze changes in the Arctic Ocean.



Hydrological map of the sampling area with identified water masses (darker arrow – ArW, brighter arrow – AtW), mesoscale gyres (circular arrows), and polar fronts (identified by name) (modified after Mitcheslon-Jacob 1993; Hop et al. 2006)

Water masses in the Barents Sea with temperature, salinity, and other information (modified after Loeng 1991, Wiborg 1955)

Name	Acronym	Temperature (°C)	Salinity (PSU)	Other descriptors
Coastal Water	CW	>2.0	<37.7	only one stratified throughout year
North Atlantic Water	AtW	>3.0	>35.0	characterized by *Calanus hyperboreus*
Arctic Water	ArW	<0.0	34.3-34.8	characterized by *Calanus finmarchicus*
Polar Front Water	PFW	-0.5-2.0	34.8-35.0	mixture of AtW and ArW

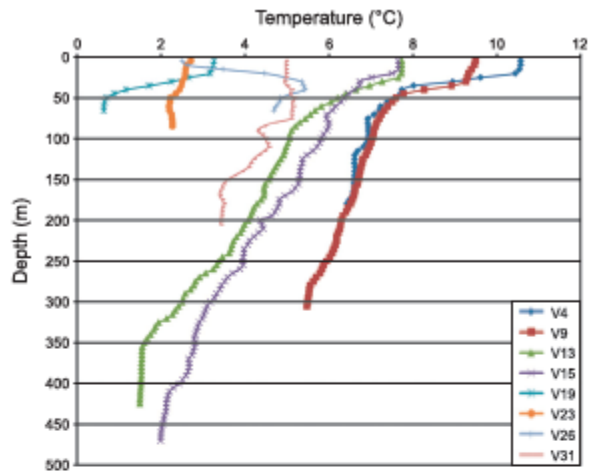


Figure 3

Temperature in relation to the depth at each site

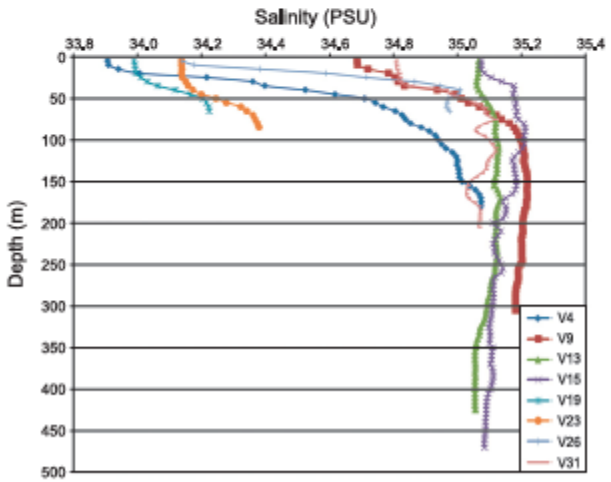


Figure 4

Salinity in relation to the depth at each site

List of taxa recorded in the investigated area

Taxa	Max abundance (ind. m^{-3})	Freq. (ind. $sample^{-1}$)
Beroe cucumis	1.09	0.11
Ctenophora undet.	27.28	3.70
Aeginopsis laurenti	0.83	0.06
Aglantha digitale	771.52	95.67
Bougainvillia superciliaris	11.48	1.40
Catablema vesicarium	3.34	0.21
Euphysa flammea	11.6	1.37
Euphysa aurata	1.66	0.17
Halitholus cirratus	3.59	0.31
Halopsis ocellata	0.17	0.01
Hybocodon prolifer	1.65	0.09
Leuckartiara octona	0.83	0.05
Mitrocomella polydiademata	0.72	0.04
Pentachogon haeckeli	0.34	0.02
Proboscidactyla flavicirrata	0.17	0.01
Ptychogena hyperborea	1.35	0.08
Rathkea octopunctata	3.59	0.47
Tiaropsis multicirrata	1.66	0.17
Hydromedusae undet.	4.23	1.15
Physophora hydrostatica (nect.)	2.69	0.17
Siphonophora (nect.) undet.	40.92	3.45

Spearman's correlation coefficient between hydrological parameters and biodiversity or the number of specimens

Parameters		Spearman's correlation coefficient
Number of species	temperature	-0.667
Number of individuals per cubic meter		-0.613
Number of species	salinity	-0.315
Number of individuals per cubic meter		0.321

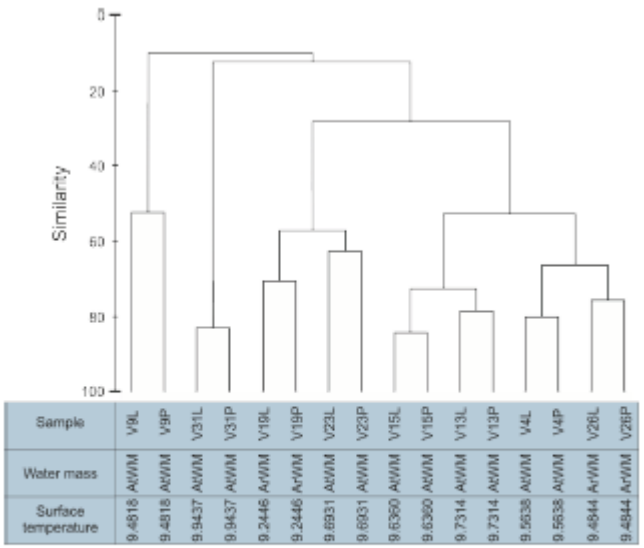


Figure 5

Cluster analysis for sites with water masses and surface temperatures taken into account

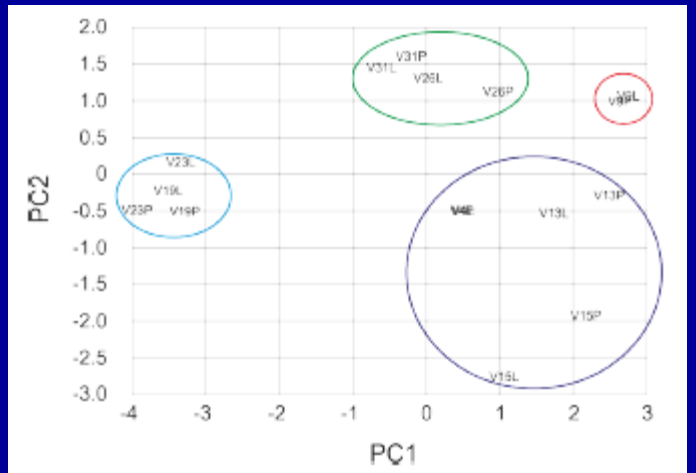


Figure 6

PCA for the calculated ecological indices with applied grouping (marked by circles)

SIMPER cumulative analysis for species composition similarities between AtW and ArW

Group ArW			Group ArW		
Species	Contribution (%)	Cumulative (%)	Species	Contribution (%)	Cumulative (%)
Aglantha digitale	64.44	64.44	*Aglantha digitale*	38.00	38.00
Ctenophora	17.97	82.41	Other	35.49	73.49
Other	12.02	94.43	Ctenophora	9.82	83.31
			Euphysa flammea	5.49	88.80
			Bougainvillia superciliaris	4.25	93.06

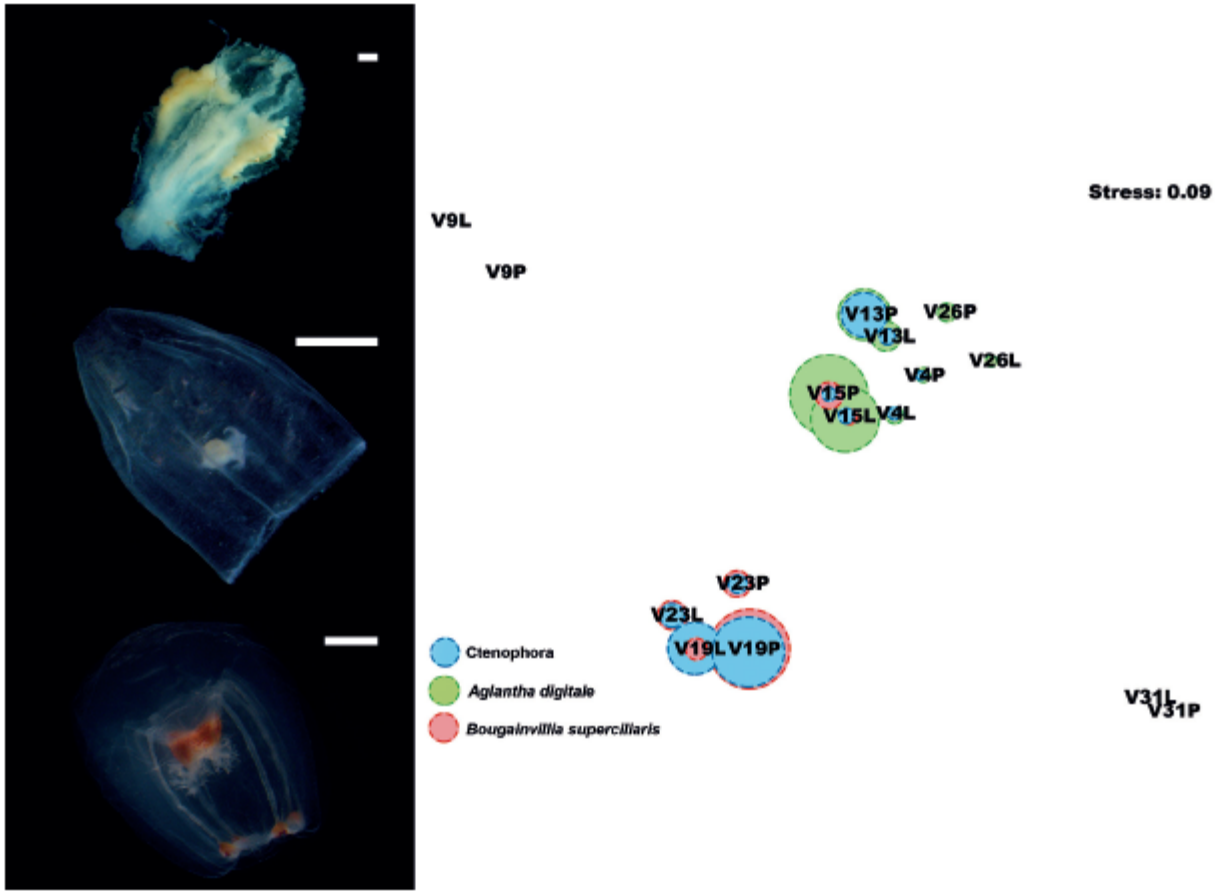


Figure 7

MDS of distribution of Ctenophora undet., *Aglantha digitale* and *Bougainvilla superciliaris* respectively from top

Scale bar: 1 mm

Conclusions

- Physiology, ecology, and life history of pelagic Coelenterata may lead to their better fitting into the role of water mass indicators in comparison to "hard-bodied" plankton species.
- Coelenterates species may serve as water mass indicators. In the Arctic Ocean, *Aglantha digitale* is an indicator of the Atlantic Water Mass, while *Bougainvillia superciliaris* and high abundance of ctenophores are associated with the Arctic Water Mass.
- Both hydrology and bottom topography of the investigated area affect the species distribution and diversity of pelagic Coelenterates, creating boundaries to their population expansion.
- The pattern of water mass distribution in the study area of the Arctic Ocean has changed over the past years, enabling larger amounts of Atlantic waters to enter this polar region.
- Atlantic Water Mass engulfment into the Barents Sea explains the presence of boreal species and their wide distribution.

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ORIGINAL PAPER

Se-Jong Ju · K. Scolardi · K. L. Daly
H. Rodger Harvey

Understanding the trophic role of the Antarctic ctenophore, *Callianira antarctica*, using lipid biomarkers

Para comprender mejor la función trófica de los ctenóforos en la Antártida durante el otoño e invierno austral, se recolectó una especie importante de ctenóforo cidípido, Callianira antarctica, durante abril / mayo (otoño) y agosto / septiembre (invierno) de 2002 en las cercanías de la bahía Marguerite. Se analizaron en animales el contenido de lípidos, clases de lípidos, ácidos grasos, alcoholes grasos y esteroles, junto con biomarcadores de lípidos en especies de krill y copépodos que representan presas potenciales de ctenóforos. El contenido de lípidos en los ctenóforos recolectados en invierno fue ligeramente mayor que en los animales en otoño (4.8 y 3.5% del peso seco, respectivamente).

Los lípidos polares fueron la clase de lípidos dominante en los ctenóforos, representando más de la mitad del contenido de lípidos, con cantidades significativas de alcoholes grasos libres (más del 10% del contenido total de lípidos) detectados.

La composición de la clase de lípidos, sin embargo, difirió significativamente entre las estaciones, con cantidades significativas de lípidos neutros (ésteres de cera y triacilgliceroles) solo detectados en animales desde el otoño.

Aunque las clases de lípidos dominantes en los ctenóforos variaron entre el otoño y el invierno, los lípidos individuales (es decir, ácidos grasos, alcoholes y esteroles) mostraron solo cambios menores entre temporadas.

Específicamente, los ácidos grasos poliinsaturados de cadena larga que se encuentran en gran abundancia en las larvas de krill también fueron elevados en los ctenóforos recolectados en invierno. También se observaron cantidades muy elevadas de alcoholes grasos monoinsaturados, particularmente 20: 1 (n-9) y 22: 1 (n-11), que se sabe que son componentes importantes de los ésteres de cera en copépodos calanoides.