

# Oregon

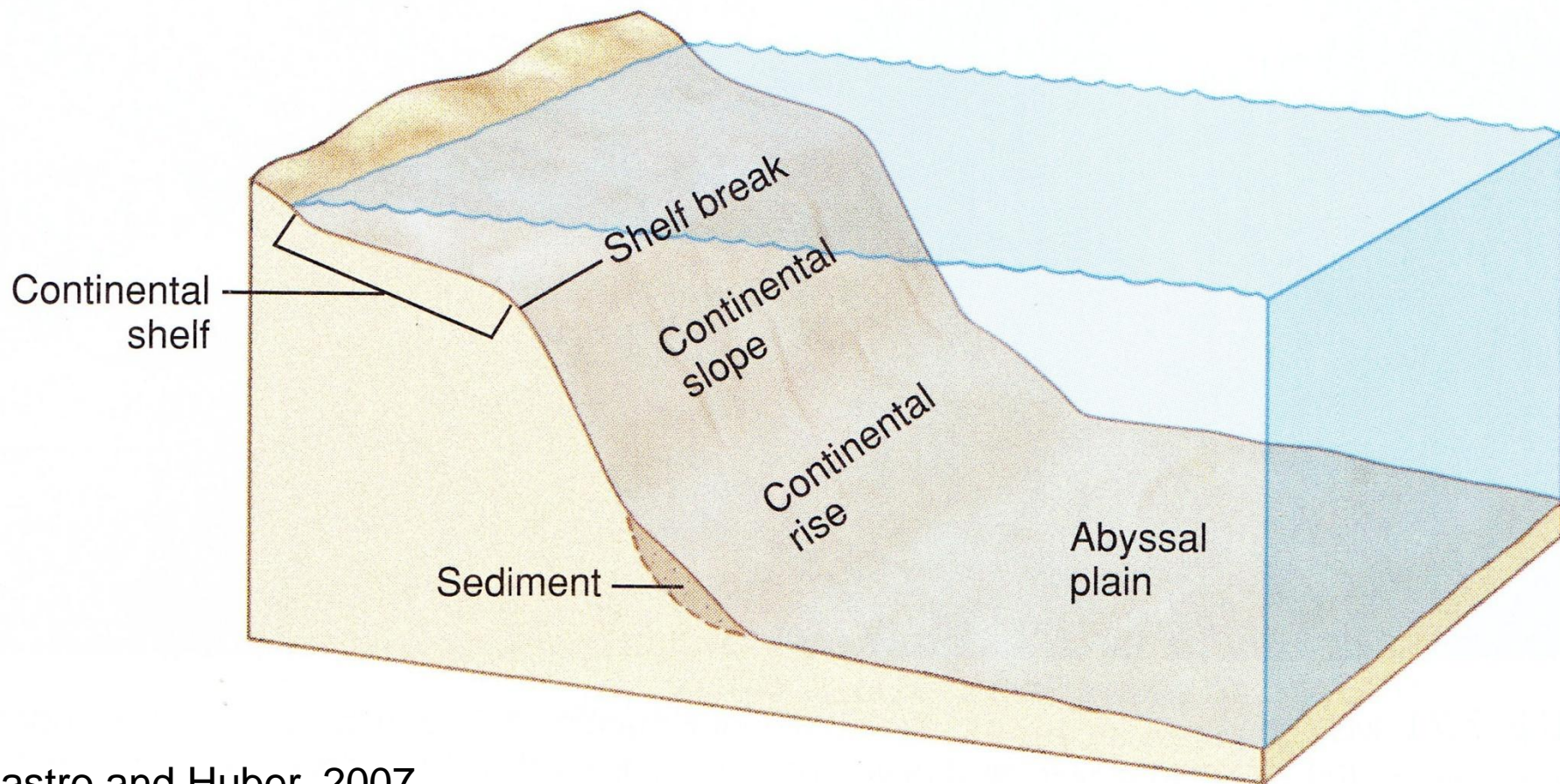
## Coastal Master Naturalists

Part 1: Onshore (Rocky & sandy shores,  
Headlands & sea stacks)

**Part 2: Offshore (Shallow subtidal to deep sea)**

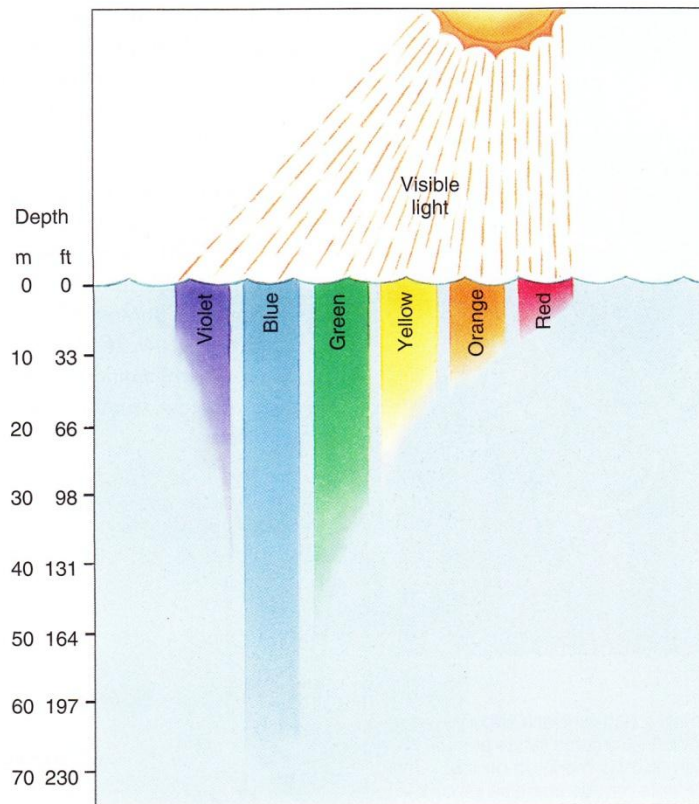
Part 3: Coastal Forests, Streams, & Estuaries

# Shallow Subtidal To Deep Sea

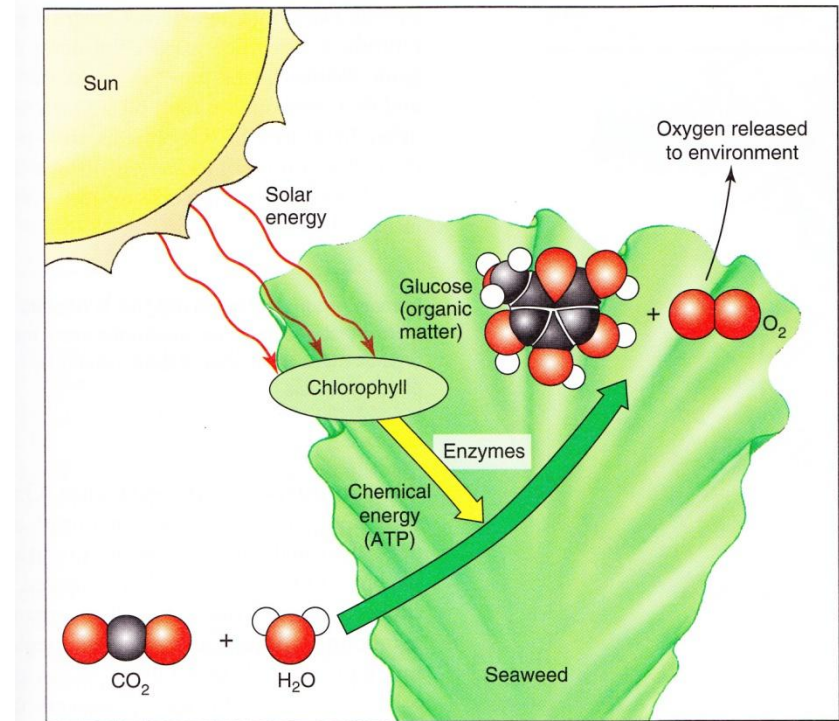


# Physical Attributes

## Penetration of Light

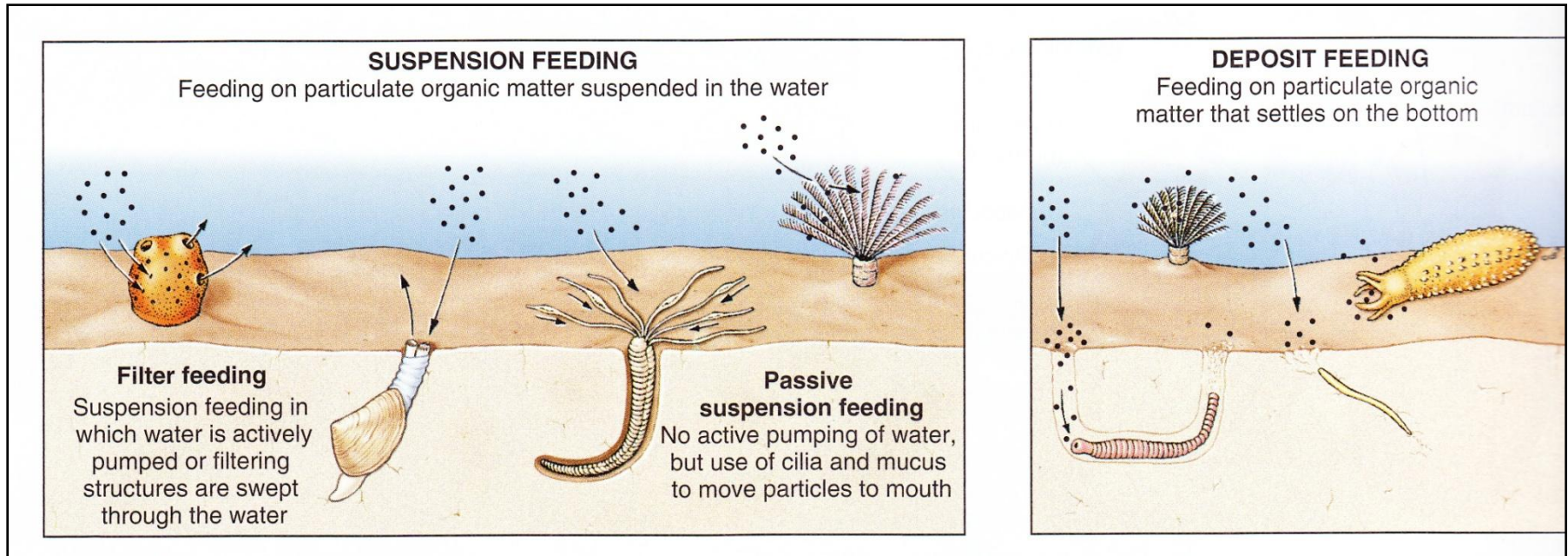


## Photosynthesis

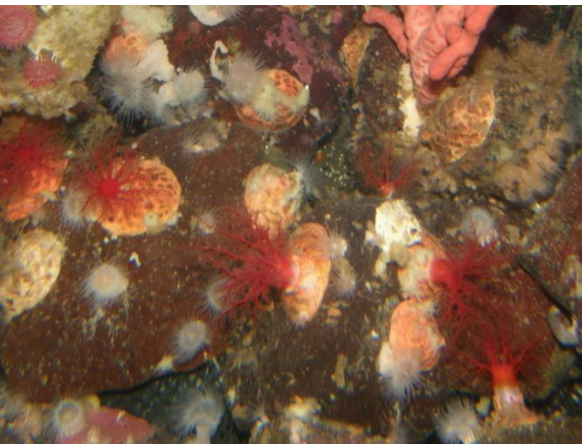


# Physical Attributes

## Particulate Organic Matter

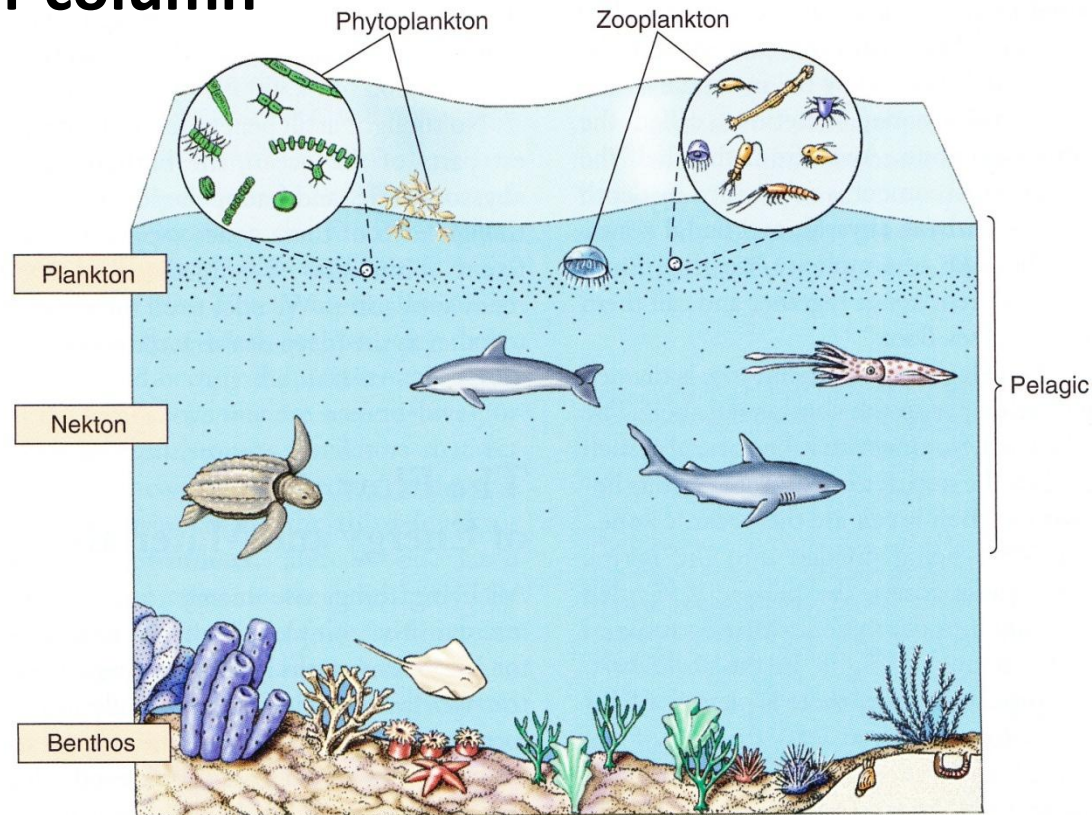


Castro and Huber, 2007

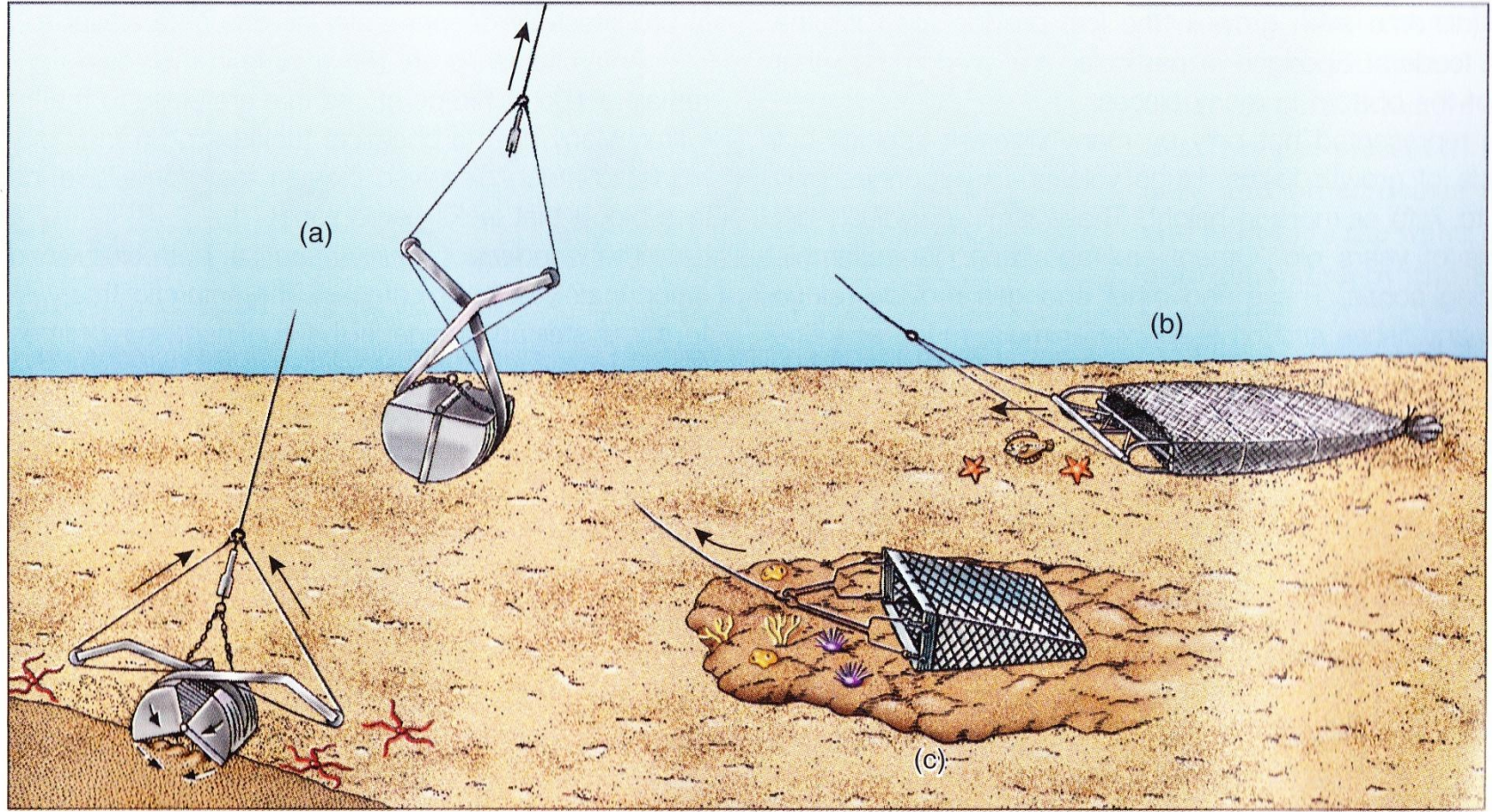


# Major Categories of Organisms

- **Benthos** – associated with sea floor
- **Nekton** – active swimmers associated with water column
- **Plankton** – passive floaters or weak swimmers associated with water column



# Sampling Communities



Castro and Huber, 2007

# Cnidarians

Sea fan *Swiftia*



Sea anemones  
*Urticina* spp.

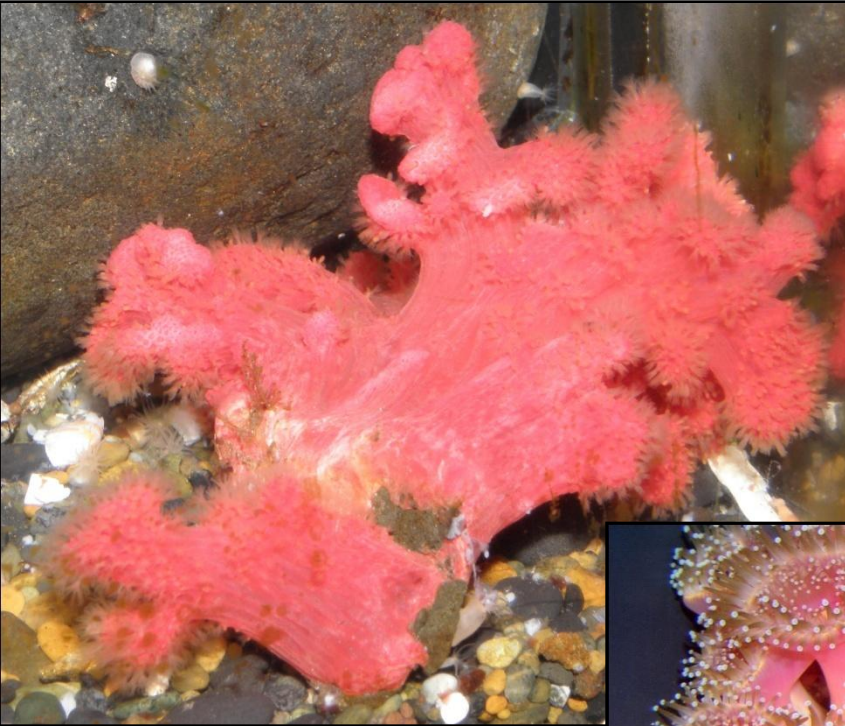


Sea pen *Ptilosarcus*



# Cnidarians

**Soft coral**



**Zooanthids**



**Corallimorphs**





# Echinoderms

Sea star *Mediaster*



Sea star *Henricia*



# Echinoderms

Sea star *Solaster* spp.

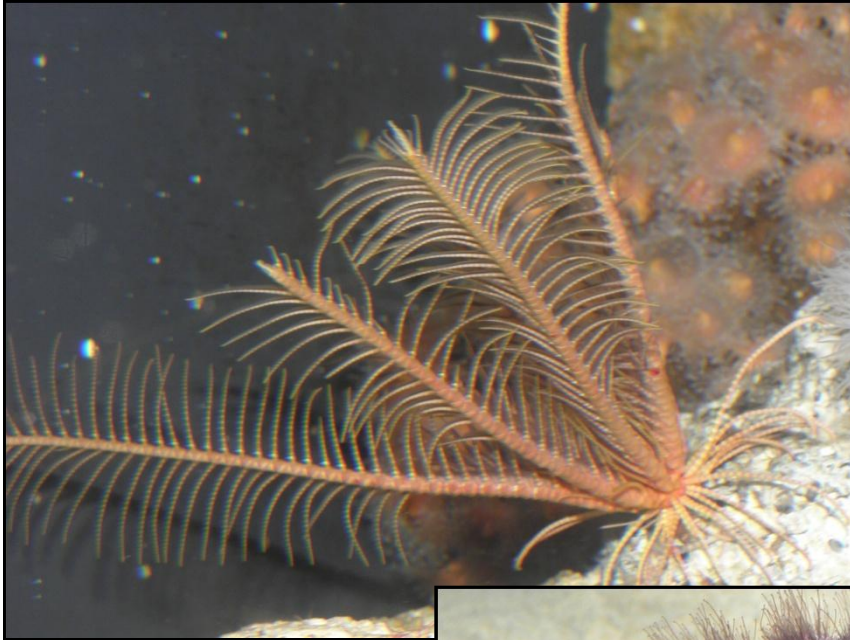


Sea star *Patiria*

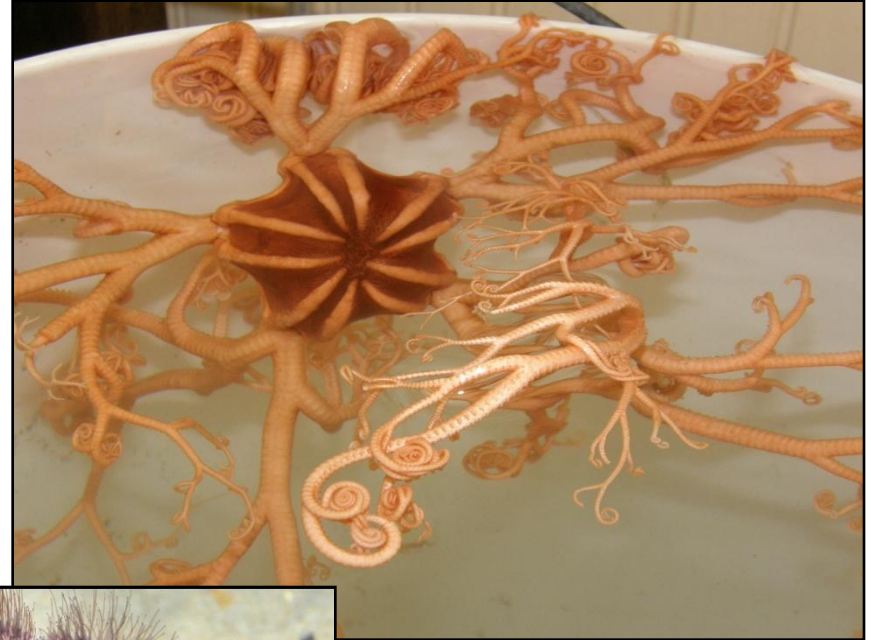


# Echinoderms

**Crinoids**



**Basket stars**



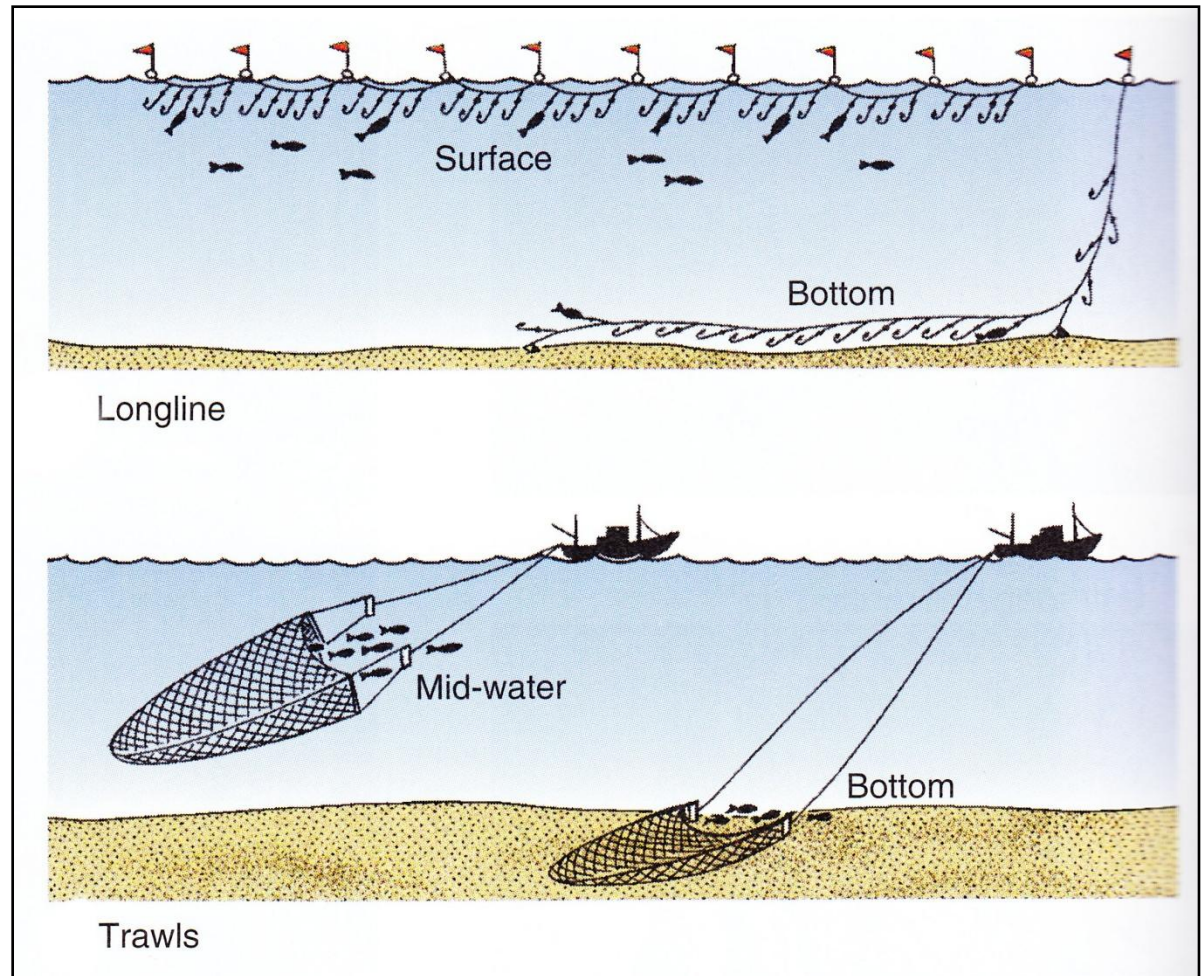
**Sand dollars**

# Fishes



# Nekton

- **Fishes**
  - Albacore tuna
  - Sable fish
  - Whiting
  - Hake

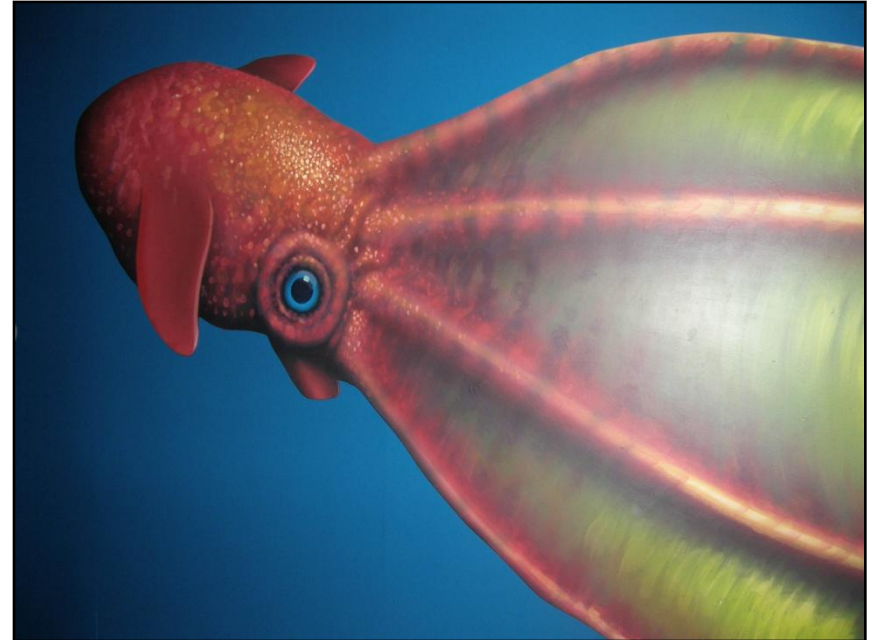


# Cephalopods

Vampire squid

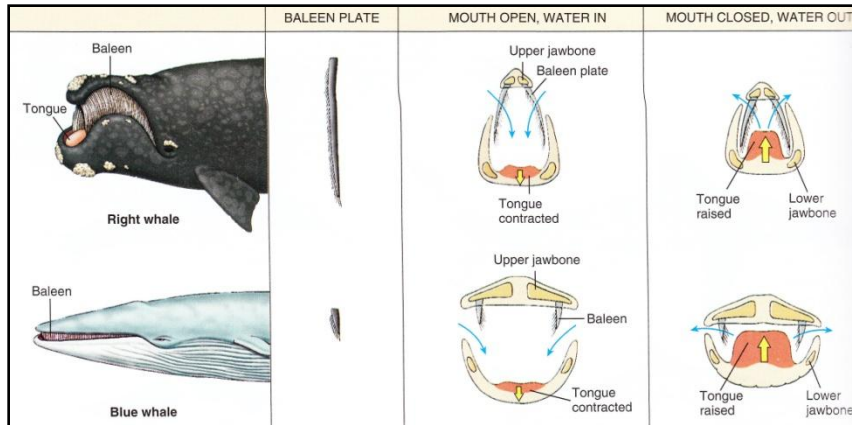


OCA mural



# Whales

## Baleen Whales – Mega Filter-feeders

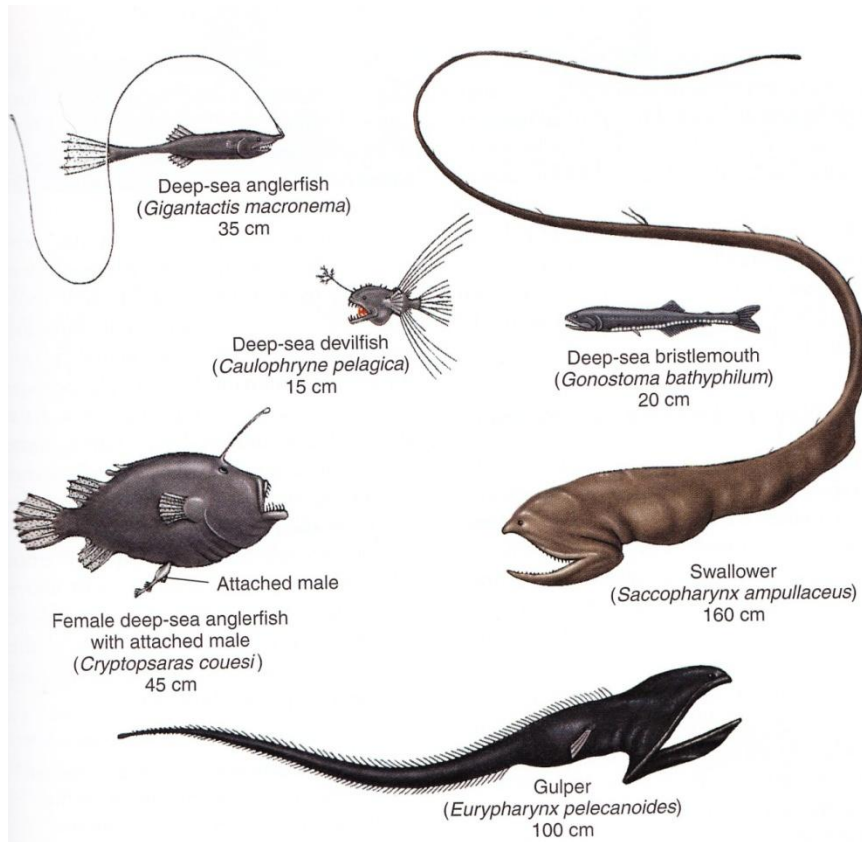


Castro and Huber, 2007

## Toothed whales & otters



# Into the Deep



- **Highly mobile scavengers & carnivores**
- **Rapidly appear at bait stations**



# Benthic-pelagic Coupling: Food Fall

- **Principal food supply**
  - Seaweeds
  - Phytoplankton
  - Terrestrial plants
    - Logs



<http://echinoblog.blogspot.com/2009/12/echinoderm-christmas-tree-antarctic.html>,

(accessed on 8-25-10)

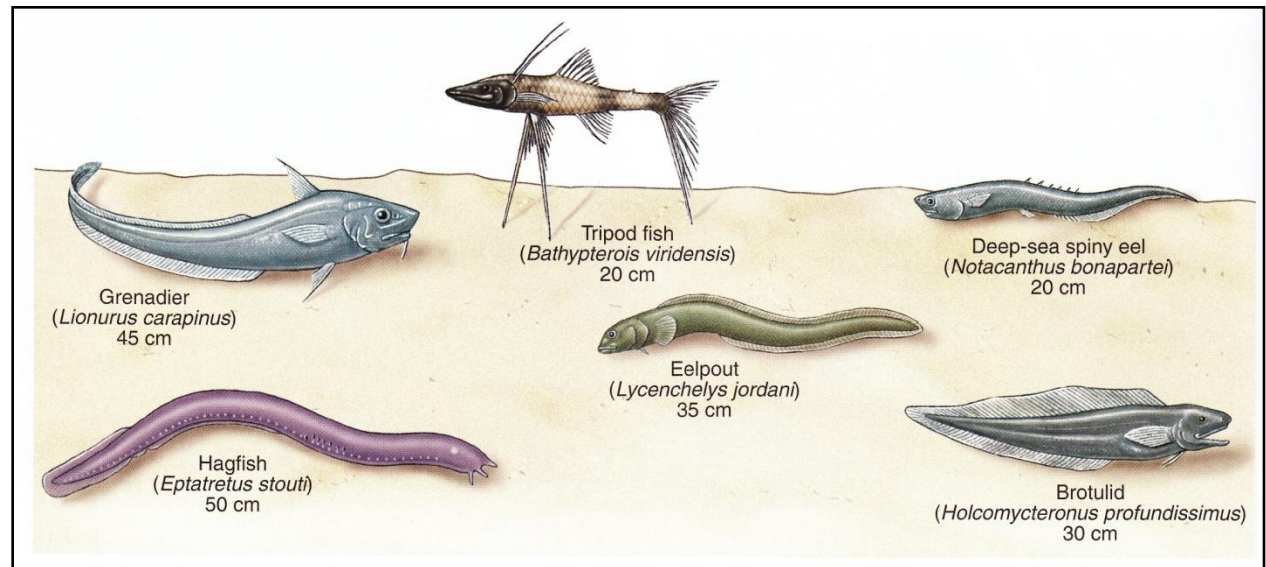


[http://www.search.com/reference/Sea\\_urchin](http://www.search.com/reference/Sea_urchin),

(accessed on 8-25-10)

# Bentho-pelagic Coupling: Food Fall

- **Principal food supply**
  - **Carcasses**
    - Fish
    - Whales!
- **Spatially and temporally unpredictable**



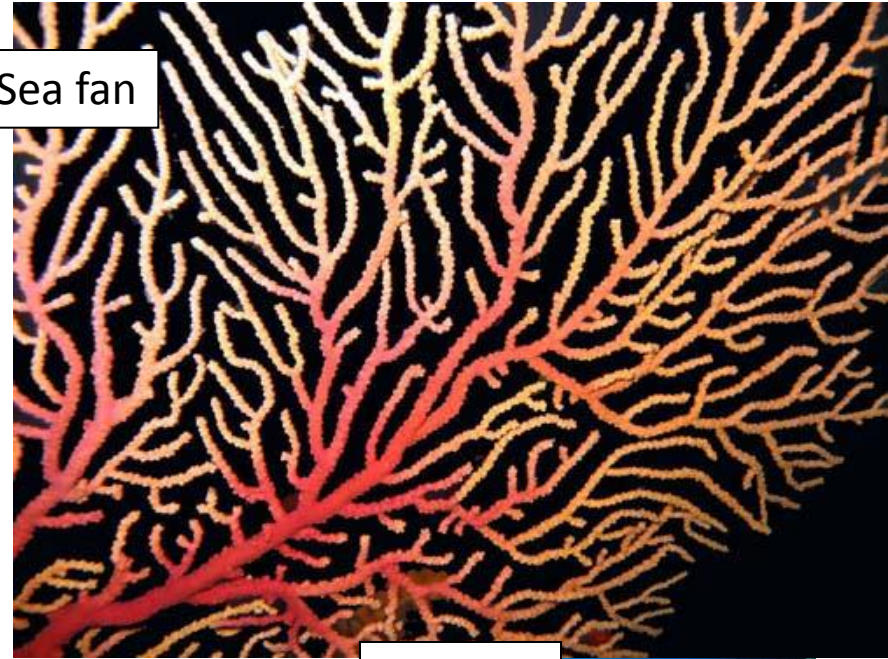
# Non-Vent Communities

Cold-water “corals”: gorgonians, sea whips, sea fans, hydrocorals, etc. → suspension feeders



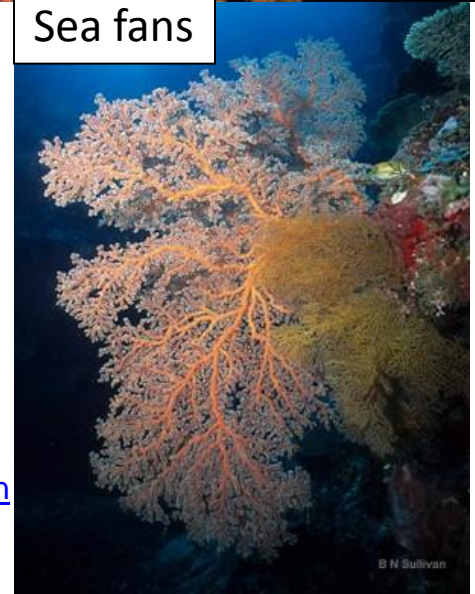
[http://www.ipsl.jussieu.fr/~jomce/acidification/Lophelia\\_pertusa\\_images.html](http://www.ipsl.jussieu.fr/~jomce/acidification/Lophelia_pertusa_images.html), (accessed on 8-25-10)

Sea fan

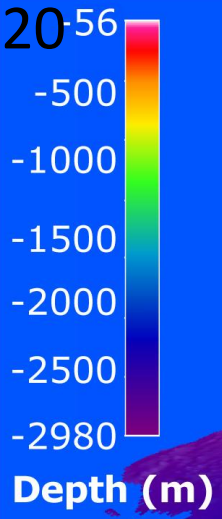


<http://www.calacademy.org/media/library/blogs/gulfofguinea/?m=200902>, (accessed on 8-25-10)

Sea fans



<http://scienceblogs.com/photosynthesis/index.php?page=2>,  
accessed on 8-25-10)



# Seamounts



2 X VE

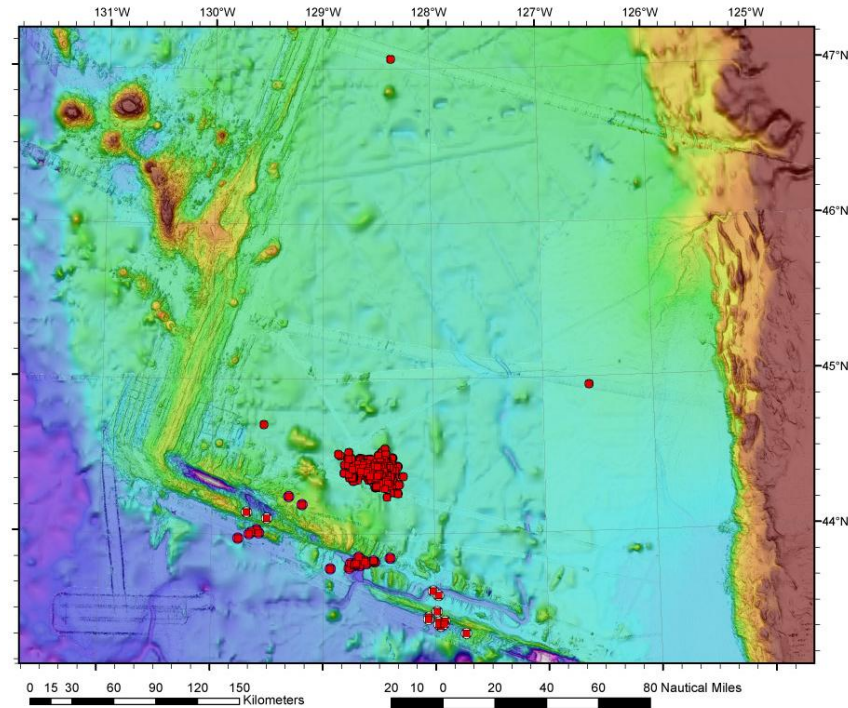


[http://www.oar.noaa.gov/research/2007/ocean\\_exploration.shtml](http://www.oar.noaa.gov/research/2007/ocean_exploration.shtml),  
(accessed on 8-25-10)

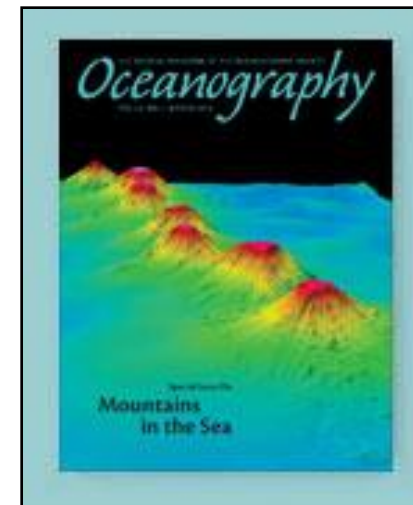
Image courtesy of the NOAA Vents Program

# Definition & Physical Features

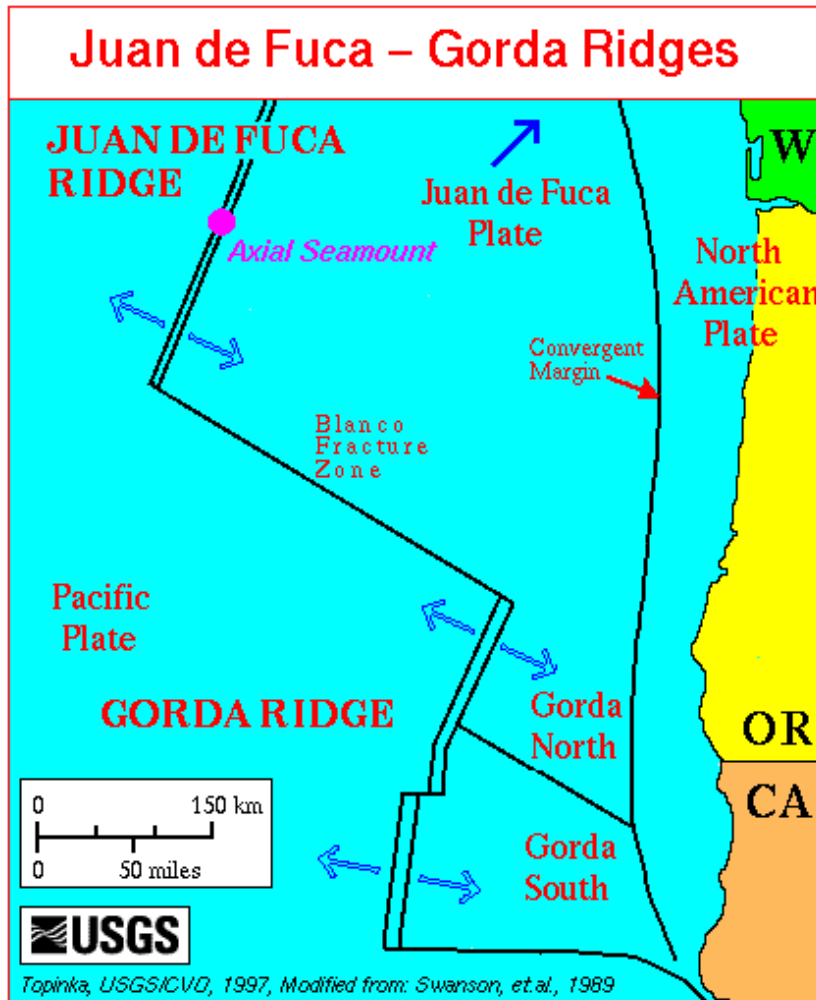
- **Mountain rising from the seafloor**
  - does not reach to the water's surface
  - often formed from extinct volcanoes
- **Usually found rising from a seafloor of 1,000–4,000 meters depth**
- **Often occur within deep sea**



<http://www.ridge2000.org/science/tcs/news/index.php>, (accessed on 8-25-10)



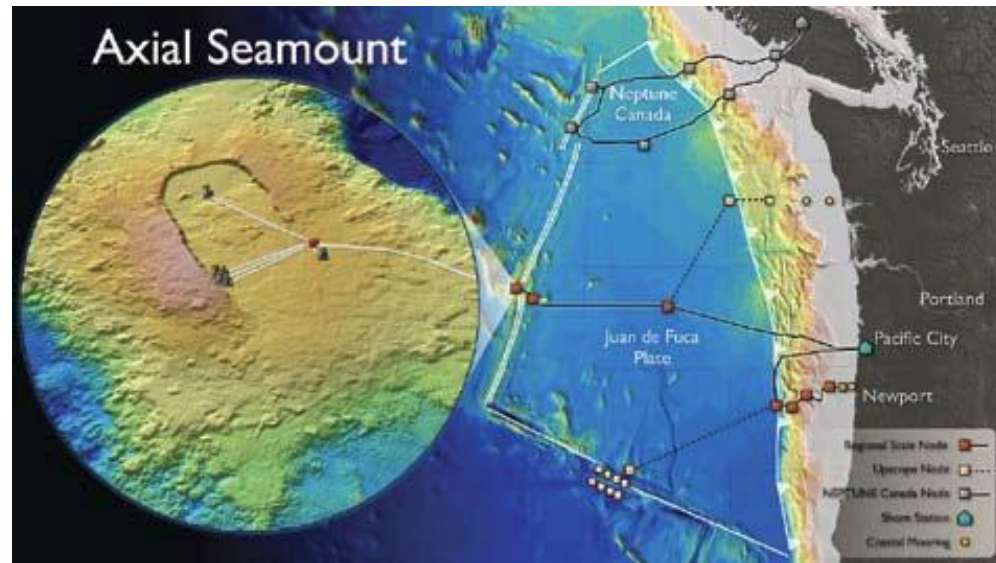
# Distribution in Oregon



- 3 tectonic plates
  - North American plate
  - Juan de Fuca plate
  - Pacific plate
- boundary between last two is marked by a submarine mountain chain: **Juan de Fuca Ridge**
- Young volcanoes, lava flows, and hot springs were discovered in the 1970s
- The ocean floor is spreading apart and forming new ocean crust along this **valley or "rift"**
- Magma from the Earth's interior is injected into the ridge and erupted at its top

# Axial Seamount

- Submarine volcano roughly 480 km west of Cannon Beach
- It rises 700 m above the mean level of the central Juan de Fuca
- Its summit contains a rectangular-shaped caldera that lies between two rift zones.
- Following the discovery of hydrothermal venting north of the caldera in 1983, a concentrated mapping and sampling effort was made in the mid-late 1980s.
- Hydrothermal vents colonized with biological communities are located near the caldera fault or along the rift zones.



<http://oceanunited.net/Ocean/index.php?option=com>,  
(accessed on 8-25-10)



<http://www.mbari.org/volcanism/Ridge/R-Hydrothermal.htm>,  
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[http://laueruptions.blogspot.com/2010\\_05\\_01\\_archive.html](http://laueruptions.blogspot.com/2010_05_01_archive.html), (accessed on 8-25-10)

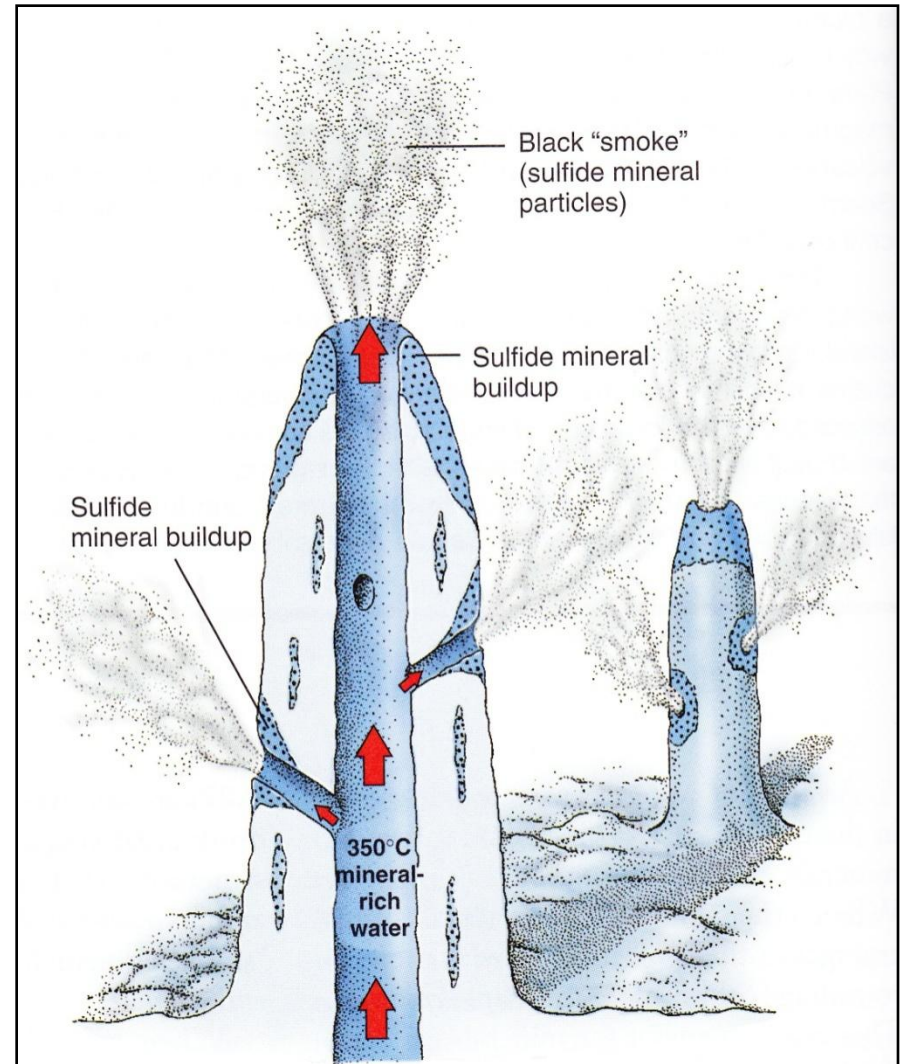
# Physical Features

- Axial Volcano is the site of [NeMO](#) (New Millennium Observatory) and the near real-time vent monitoring system [NeMO Net](#).
- NeMO
  - is a multi-year research effort (1998-present)
  - involves a time-series of *in situ* observations at the eruption and venting sites
- In January of 1998, SOSUS detected an eruption on Axial which was studied on an event response cruise in February 1998 and subsequent NeMO cruises.
- <http://www.pmel.noaa.gov/vents/geology/axial.html>



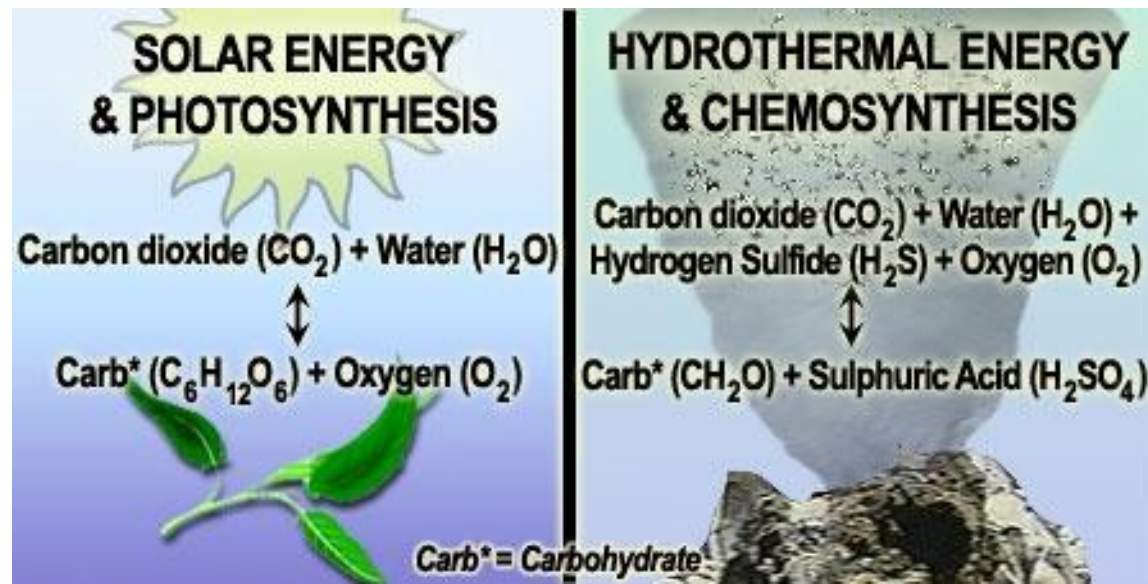
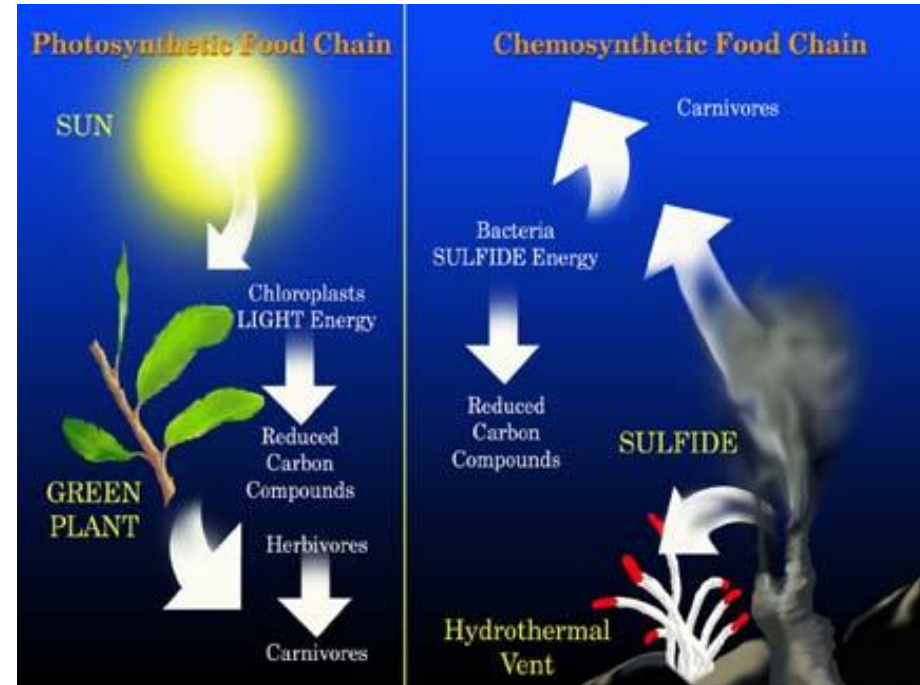
# Physical Features

- **Black smokers**
  - 350-400°C
- **White smokers**
  - 100-300°C
- **Complex sulfide mounds**
  - Godzilla on San de Fuca Ridge (45 m before collapse)



# Physical Features

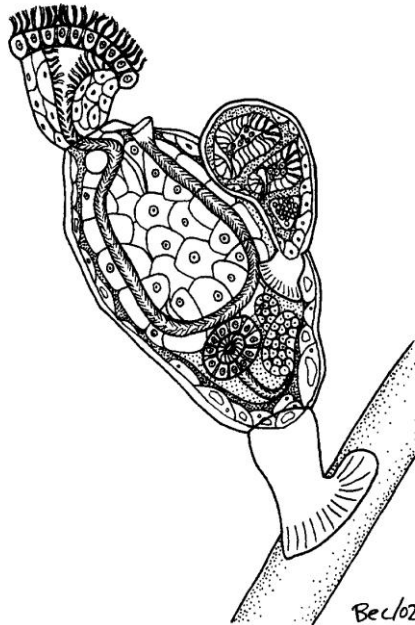
- Chemoautotrophic bacteria as primary producers
- Chemical energy rather than solar energy
- Entire food web based on chemosynthesis



<http://www.infolizer.com/?title=chemosynthesis+hydrothermal+vents>,  
(accessed on 8-25-10)

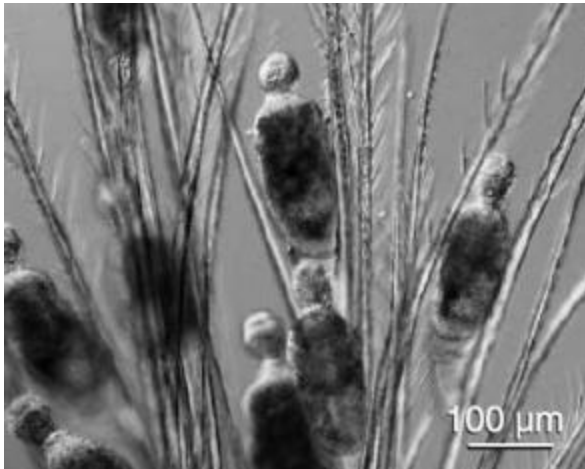
# Major Organisms

New Phyla.... On lobster lips, etc.



<http://copepodo.wordpress.com/2010/04/30/unhoger-para-symbion/>,  
(accessed on 8-25-10)

<https://copepodo.wordpress.com/2010/04/30/unhoger-para-symbion/>,  
(accessed on 8-25-10)



<http://www.marlin.ac.uk/generalbiology.php?speciesID=3892>, (accessed on 8-25-10)



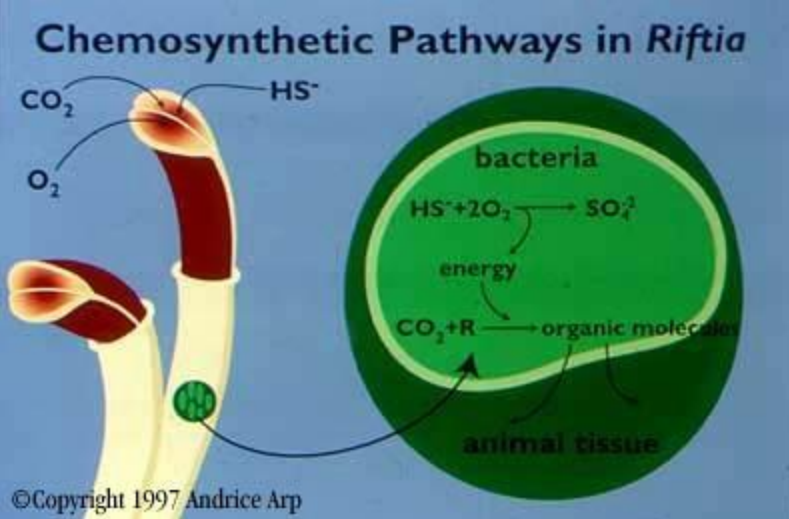
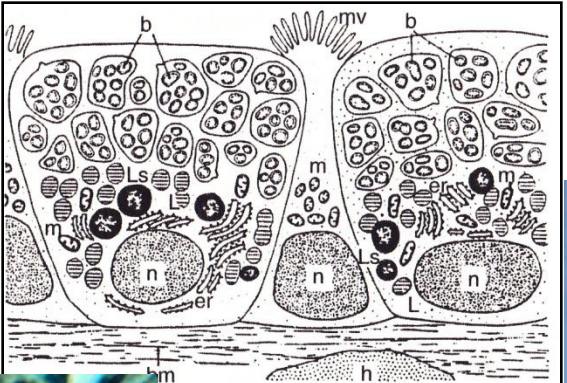
# Chemotrophic Food Web

- Chemosynthetic bacteria
- Invertebrates with internal symbiotic bacteria
  - Hydrothermal vent worms
  - Mussels
  - Clams
- and

<http://io9.com/5536752/five-creatures-that-prove-life-could-exist-on-other-planets-or-in-space>, (accessed on 8-25-10)



[www.biology.kenyon.edu/slonc/bio3/symbiosis.html](http://www.biology.kenyon.edu/slonc/bio3/symbiosis.html), (accessed on 8-25-10)



<http://www.mbari.org/molecular/mussels.htm>, (accessed on 8-25-10)

# 29 Chemotrophic Food Web

<http://nationalzoo.si.edu/Animals/Invertebrates/News/default.cfm>,  
(accessed on 8-25-10)

- Invertebrates & fishes
  - Consume bacteria
  - Consume animals



<http://www.marinebio.net/marinescience/04benthon/dsvents.htm>, (accessed on 8-25-10)



[http://www.geekologie.com/2007/05/deep\\_sea\\_creatures.php](http://www.geekologie.com/2007/05/deep_sea_creatures.php), accessed on 8-25-10)

[http://www.oar.noaa.gov/research/2007/ocean\\_exploration.shtml](http://www.oar.noaa.gov/research/2007/ocean_exploration.shtml),  
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<http://www.marshallsystem.com/ecology.htm>, (accessed on 8-25-10)



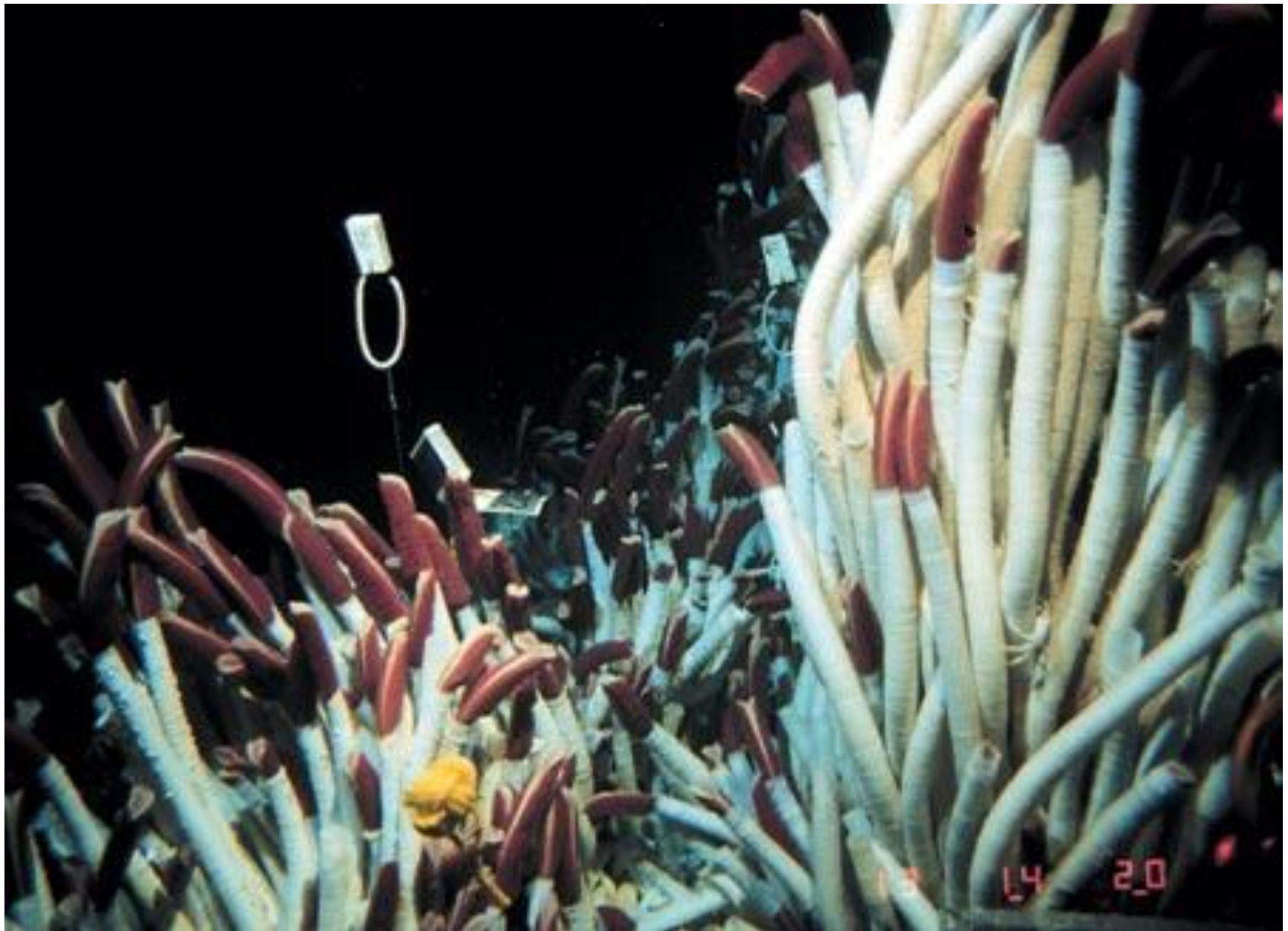
# Comparison

## Vent Fauna

- Annelids
  - Giant tube worms
  - Other segmented worms
- Molluscs
  - Mussels
  - Clams
  - Snails
- Arthropods
  - Crabs
  - Shrimp
  - etc.

## Non-Vent Fauna

- Echinoderms
  - Sea stars
  - Brittle stars
  - Sea cucumbers
  - Sea urchins
  - Sea lilies
- Cnidarians
  - Sea anemones
  - Hydrocorals
  - Sea pens & whips
- Sponges
  - Glass sponges (hexactinellid species)
- Arthropods
  - Giant amphipods & isopods



# Sources

1. Castro, P. and M.E. Huber. 2007. Marine Biology 7<sup>th</sup> edition. McGraw-Hill . New York, NY. P.459
2. Internet sources (accessed 8-25-10):
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  - [http://www.ipsl.jussieu.fr/~jomce/acidification/Lophelia\\_pertusa\\_images.html](http://www.ipsl.jussieu.fr/~jomce/acidification/Lophelia_pertusa_images.html)
  - <http://www.calacademy.org/medialibrary/blogs/gulfofguinea/?m=200902>
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  - <http://www.biology.kenyon.edu/slonc/bio3/symbiosis.html>
  - <http://www.mbari.org/molecular/mussels.htm>
  - <http://nationalzoo.si.edu/Animals/Invertebrates/News/default.cfm>
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