



**Oyster reefs:
A key to the health
of our estuaries.**

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The Estuarine Arch

OYSTERS

Marsh

Water
quality

Algae

Shrimp
Crabs

Clams,
mussels

Fish

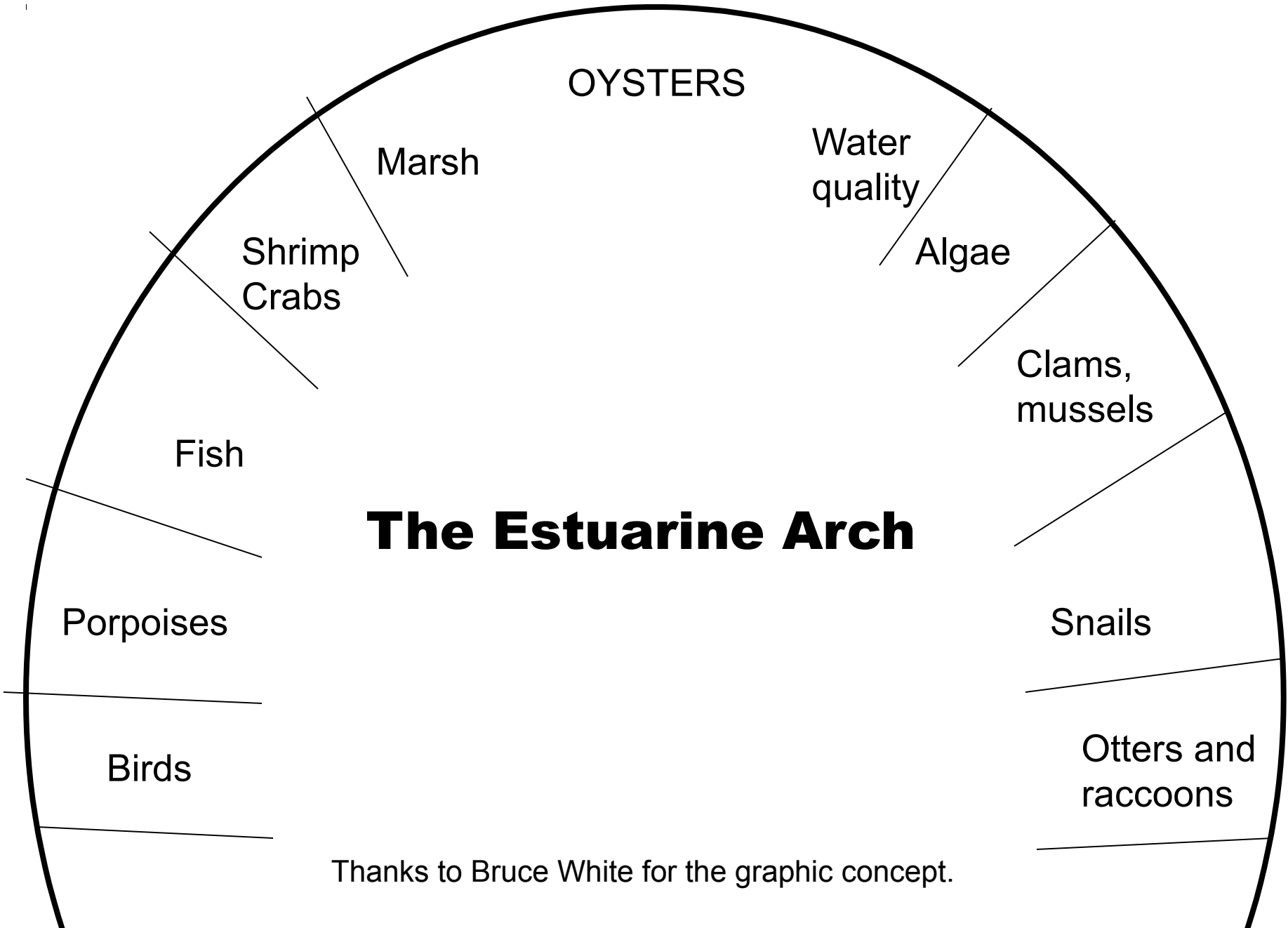
Snails

Porpoises

Otters and
raccoons

Birds

Thanks to Bruce White for the graphic concept.





**Oyster reefs:
Where are they found?
How are they made?
Why are they
important?
Why are they at risk?
What can we do to
help?**

Why are oyster reefs ecologically-important?

- **Create important habitat**
- **Provide food and refuge (places to hide)**
 - **Improve water clarity and quality**
- **Promote growth of underwater plants**
- **Reduce erosion, protect shorelines**
 - **‘Keystone species’**

Where can Eastern oysters be found?

Native range: Western Atlantic from the Gulf of St. Lawrence in Canada to the Gulf of Mexico, Caribbean, and coasts of Brazil and Argentina.

Introduced range: West coast of North America, Hawaii, Australia, Japan, England, and possibly other areas.

Habitat: Common in coastal areas; still occurs naturally in some areas as extensive reefs on hard to firm substrates, both intertidally (only underwater part of the time) and subtidally (always underwater).

In northern states, oysters populations are limited to the subtidal due to death from freezing in the intertidal in the winter months.



**Typical South Carolina
fringing oyster reef
- “essential fish habitat”.**

4.19.2005



In most high salinity areas along the U.S. mid- and south-Atlantic coasts, including South Carolina, oysters live mostly in the intertidal zone. This means that when the tide goes out they are exposed to the air. This creates stress for the oysters , because they do not breathe air, but also offers them safety.



Oysters like to settle on solid
underwater structures.



Photos courtesy of M.W. Luckenbach

Oyster anatomy

(internal anatomy lying in left or lower valve)

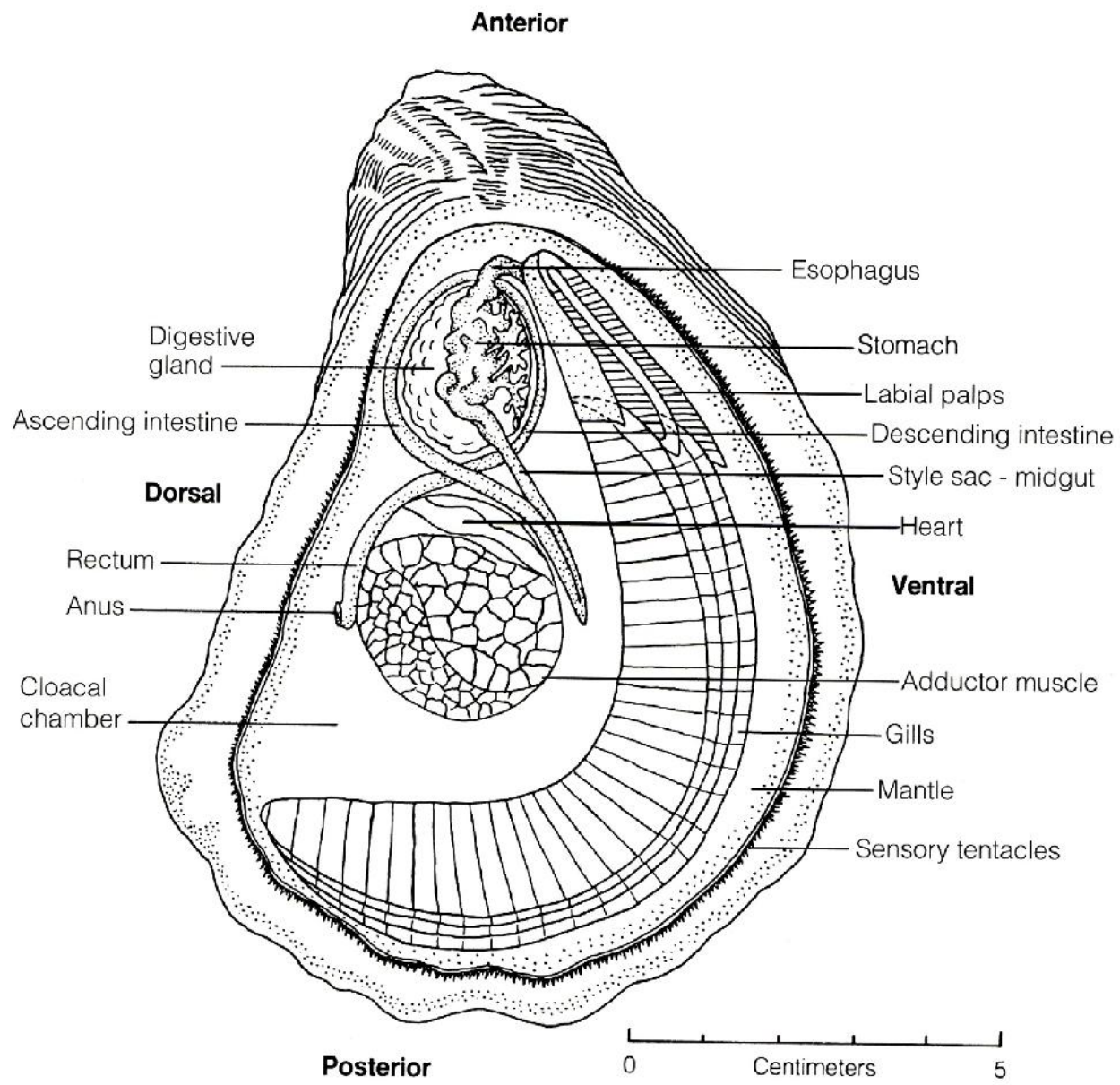


Figure 1. Oyster in left valve showing cardinal axes and digestive system including labial palps and gills. Redrawn from Galtsoff (1964).

Redrawn from Galtsoff (1964)

Oyster life cycle

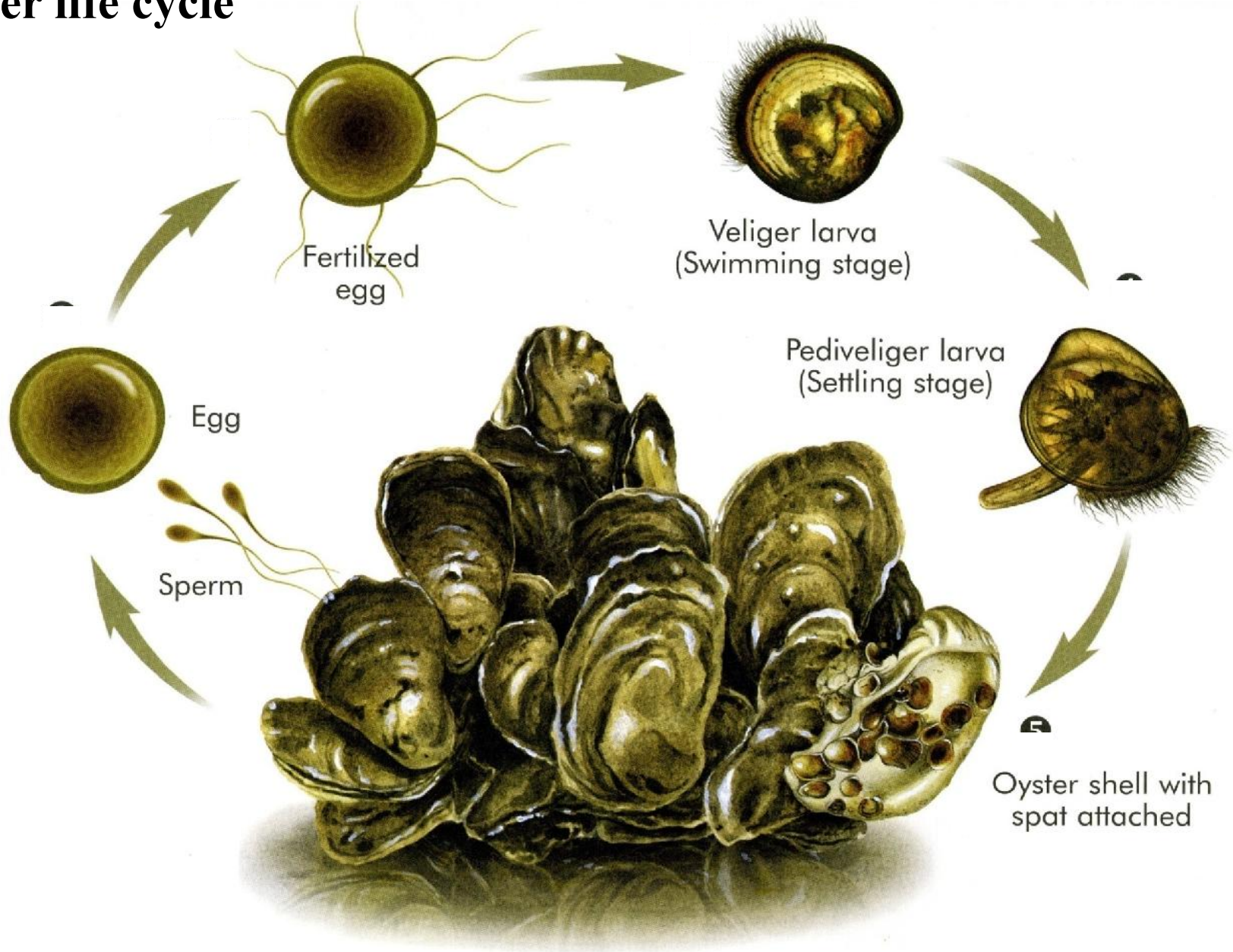
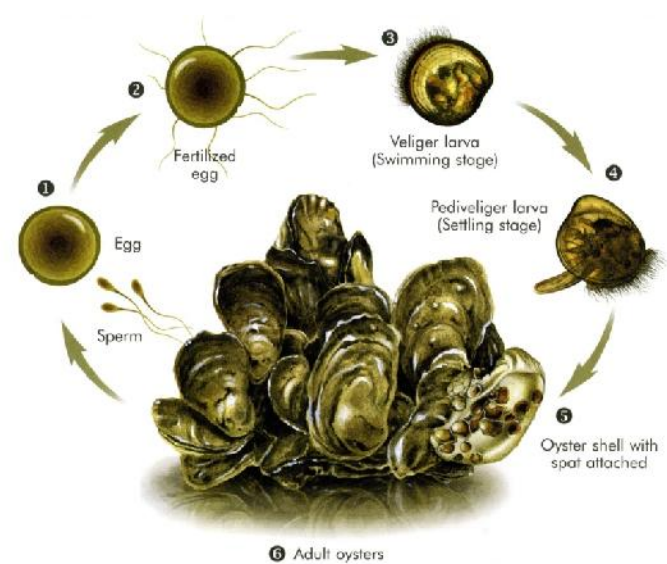


Image courtesy of www.loxahatcheeriver.or

6 Adult oysters

Oyster life cycle cont'd...

- Eastern oysters start out as males and switch to females as they grow larger (> 35mm).
- At water temperatures > 68°F, oysters release eggs and sperm into the water column where external fertilization occurs.
- Within 24 hrs, a shell and velum (cilia = tiny hairs) develop to allow the veliger (larva) to swim and feed in the plankton for up to 2 weeks.
- 'Eyed' larvae become more interested in exploring the substrate, rather than being up in the water column, and have a more developed foot.
- 'Eyed' larvae preferentially settle onto the shells of other oysters and metamorphose to form 'spat' (juvenile oysters).



Eyed' oyster larvae

Eye spot

Velum

Digestive
gland

Umbo region
of shell

250 μ m





Examples Of
Predators of
Adult Oysters



Some of the species associated with oyster reefs

Red drum

Black drum

Spotted seatrout

Croaker

Spot

Weakfish

Flounder

Kingfish

Silver perch

Pinfish

Sheepshead*

Spadefish

Anchovies

Silversides

Striped blenny

Gobies

Menhaden

Mullet

Mummichog

Oyster toadfish

Bluefish

Permit

Leatherjacket

Lookdown*

Crevalle jack

Gizzard shad

Cownose ray

Smooth butterfly ray

Atlantic stingray

Bonnethead shark

Sharp-nosed shark

Grass shrimp

Brown shrimp

White shrimp

Blue crab

Mud crab

Snapping shrimp

Mussels

Clams

Polychaete worms

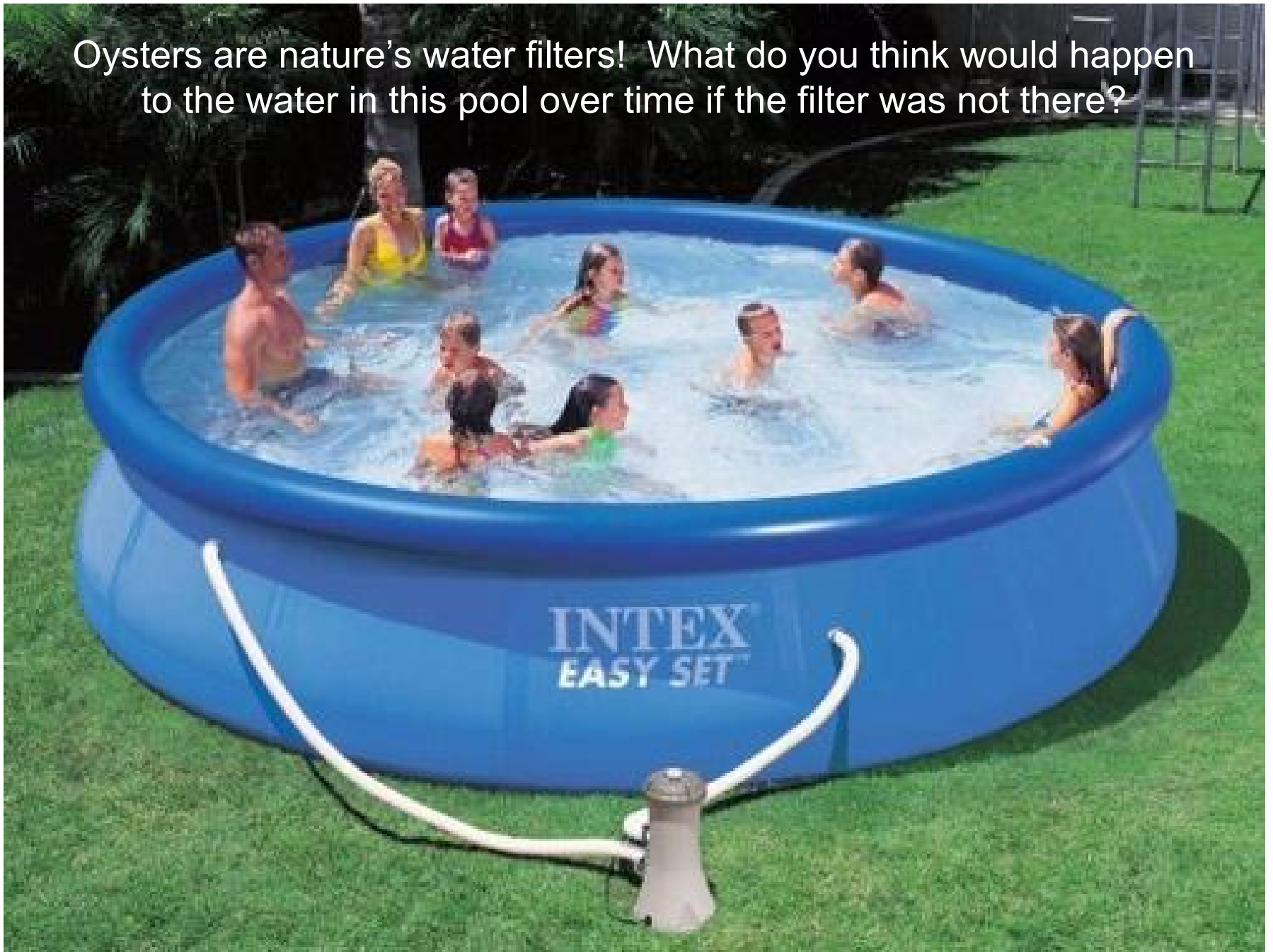
Oyster drills

Tulip shell

Whelk

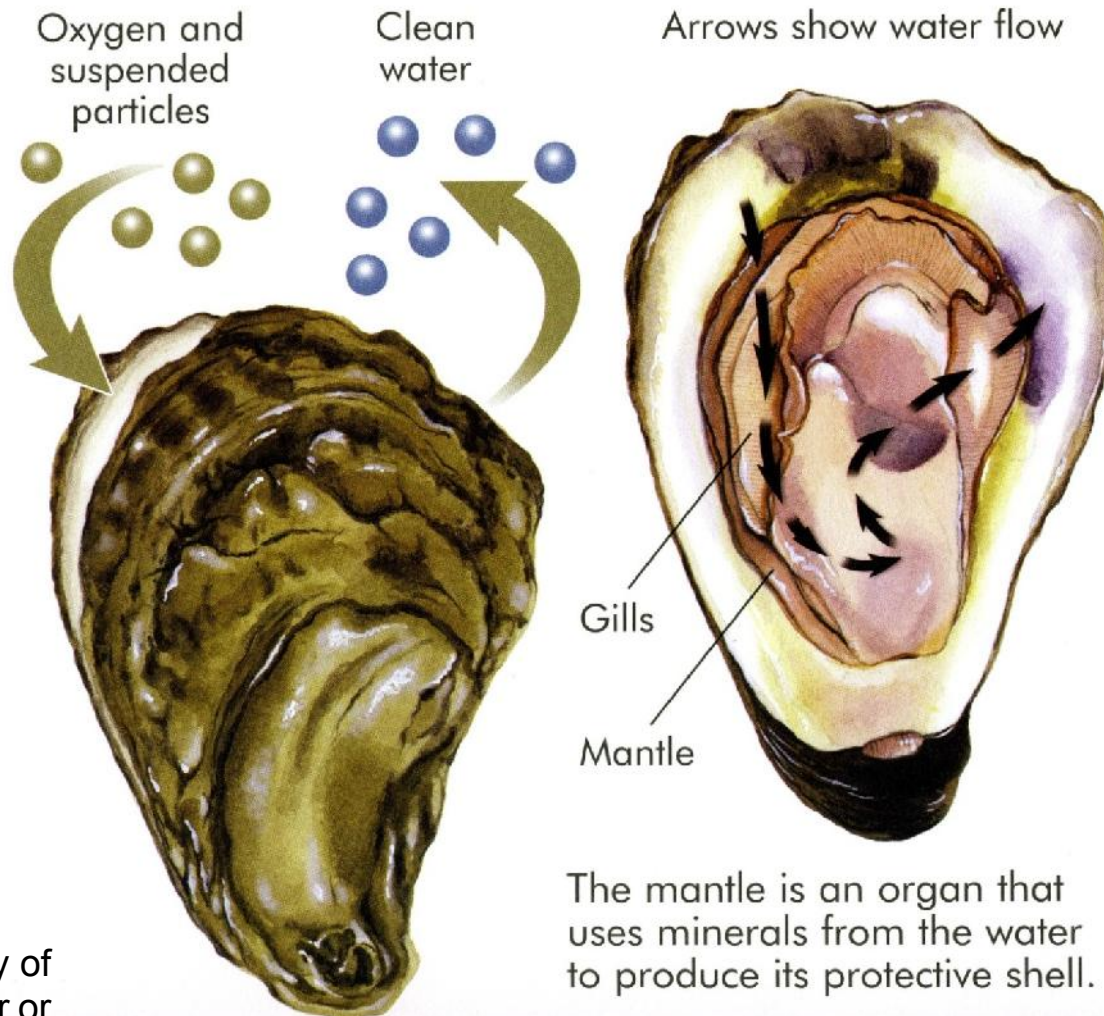


Oysters are nature's water filters! What do you think would happen to the water in this pool over time if the filter was not there?



Filter Feeding

Oysters use their gills to absorb oxygen and strain food out of the water. One adult can strain plankton and organic matter out of the water at a rate of up to 50 gallons per day (or 1500 times its body volume). A healthy oyster reef contributes significantly to overall water clarity in the estuary.



Oysters are nature's water filters!

- Oysters are excellent at removing small particles (mud, sand, algae) that are floating in the water around them..
- Oysters (and other filter-feeding bivalves) are therefore capable of improving water quality and clarity (see right).
- Control phytoplankton, remove silt, and increase nutrient transfer from water column to the benthos.
- Newell (1988) estimated the feeding activity of oysters in Chesapeake Bay before and after overharvesting.



Date	Oyster biomass (Kg x 10 ⁶ Dry tissue weight)	Volume of water filtered (L x 10 ¹² per day)	Turnover time in days (total water column)	Turnover time in days (<9m depth zone)
Pre-1870	188.0	21.62	3.3	2.5
1880	106.8	12.27	5.8	4.4
1988	1.9	0.22	325.0	244.5

From: Newell, R.I.E. (1988). Ecological changes in Chesapeake Bay: Are they the result of overharvesting the American oyster, *Crassostrea virginica*? Understanding the Estuary: Advances in Chesapeake Bay Research. Proceedings of a Conference, 29th–31st March 1988, Baltimore, Maryland. Chesapeake Research Consortium Publication 129, pp. 536-546.

Oysters create natural breakwaters

South Carolina has more salt marsh than any other state on the Atlantic coast.

This is often protected by oyster reefs that reduce wave energy and also erosion of shorelines.

This is important in terms of sea level rise especially in South Carolina.



Typical South Carolina fringing oyster reef

Image courtesy of Bill Anderson, SCDNR



Examples Of Erosion



A black and white photograph showing a large number of small oyster boats on a body of water. The sun is low in the sky, creating a bright glow and long shadows. The boats are silhouetted against the lighter water and sky. In the foreground, a boat is partially visible with two people on board. Another boat is further out in the water with a person standing on it. The background is filled with many more boats stretching towards the horizon.


Economically important – the Eastern oyster, *Crassostrea virginica* has historically supported an important fishery on the East Coast.





Typical oyster roast on Daufuskie Island, South Carolina.

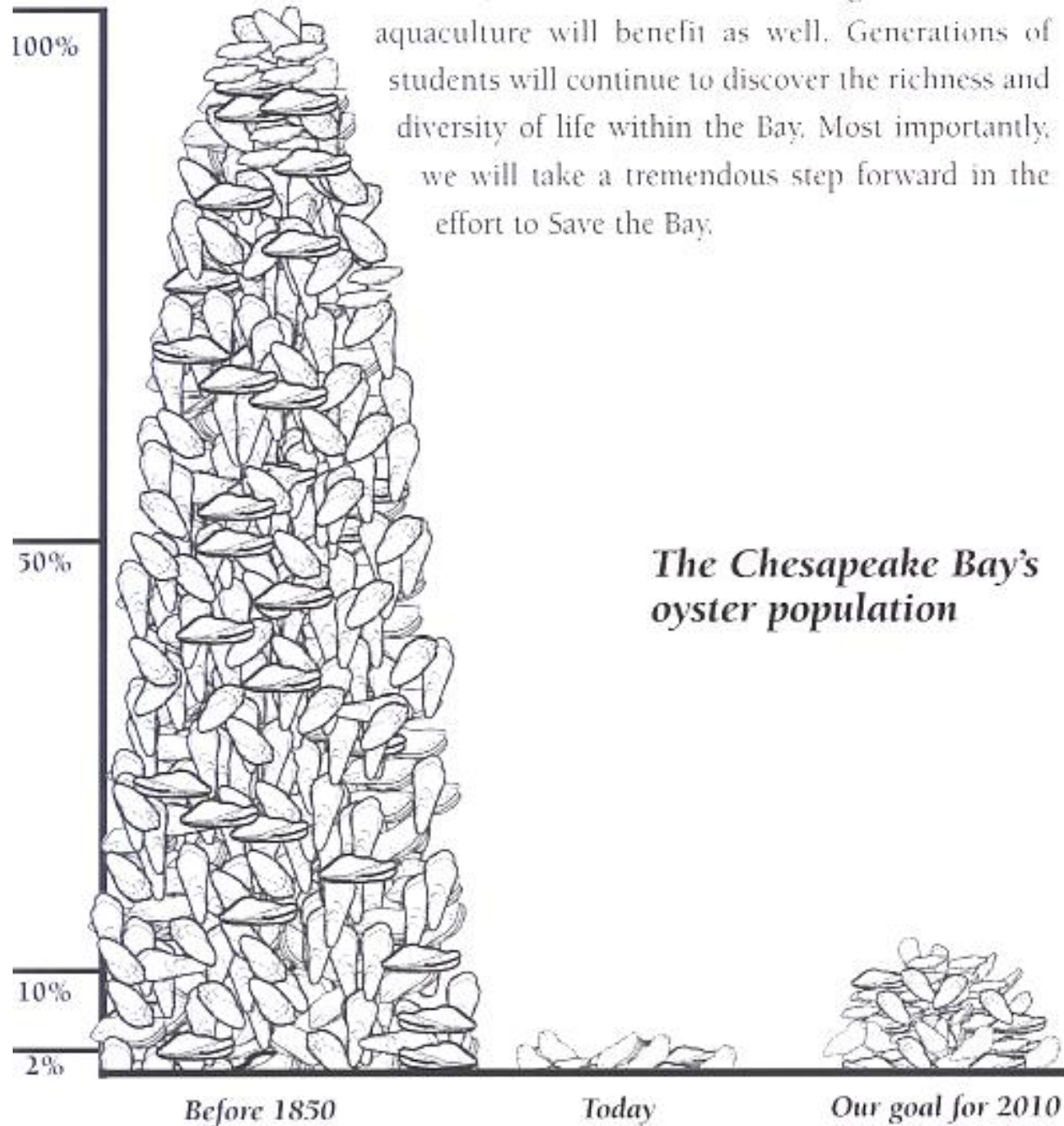


A pearl necklace with a diamond-encrusted clasp and a large pearl drop pendant. The necklace is made of pearls of varying sizes, with the largest pearl being the drop pendant. The clasp is set with several large, rectangular-cut diamonds. The drop pendant is also set with diamonds and features a large, pear-shaped pearl.

Interesting fact:

While all oysters are capable of producing pearls, most luxury pearls that are sold in jewelry stores are produced by a different group of animals (saltwater clam family).

industries, such as recreational fishing, tourism, and aquaculture will benefit as well. Generations of students will continue to discover the richness and diversity of life within the Bay. Most importantly, we will take a tremendous step forward in the effort to Save the Bay.



Courtesy of the Chesapeake Bay Program



BEFORE



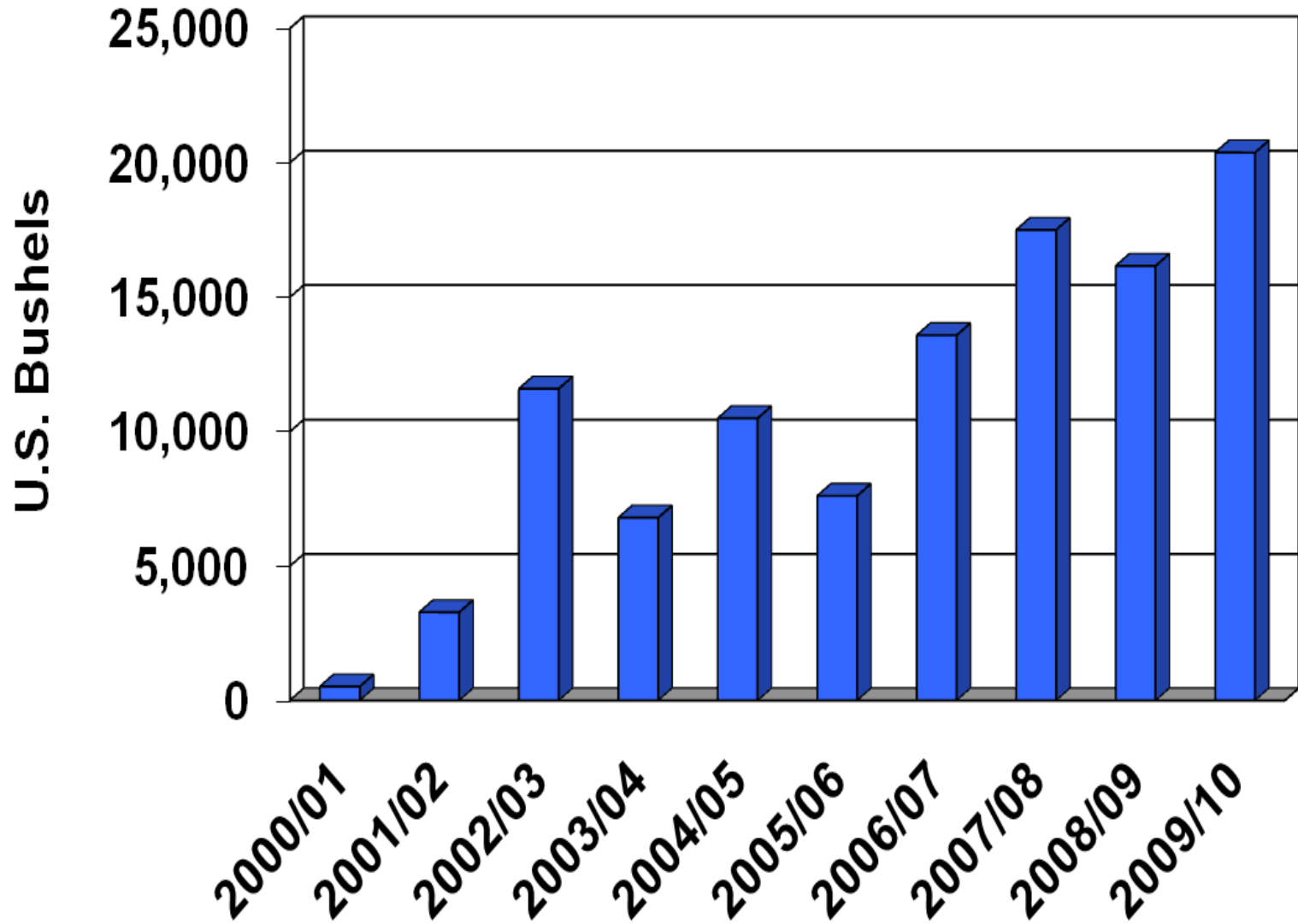
AFTER



McDonald's

Important to return oyster shells to the environment through recycling programs rather than putting them places where oyster larvae have no chance of finding them!

Good news: Oyster shell recycling is increasing...



SCORE reef-building: lends itself to high energy environments and areas closed due to poor water quality that are unsafe for collecting and eating oysters.



Image courtesy of Nancy Hadley, SCDNR

South Carolina Oyster Restoration and Enhancement (SCORE) Program

Volunteers:

- Help with recycling shells
- Build oyster habitats
- Monitor water quality
- Work with scientists
- Participants become connected with taking care of their resources e.g. oyster reefs



Summary of SCORE Reef Building Effort

- 2001-present
- 190 reefs, 37 sites
- ~ 40,000 bags; 600 tons



Shell bags quickly attract new oysters and create complex 3-D habitat in only a few months.

After one year a typical individual SCORE reef is home to 24,000 oysters, 7,500 mussels, 4,300 crabs.

Estimated total SCORE reef impacts:

- filter 220 million gallons day-1
- protect 1 mile of shoreline from erosion
- create 1.25 acres of habitat for

9 million oysters, 3 million mussels; 2 million mud crabs.

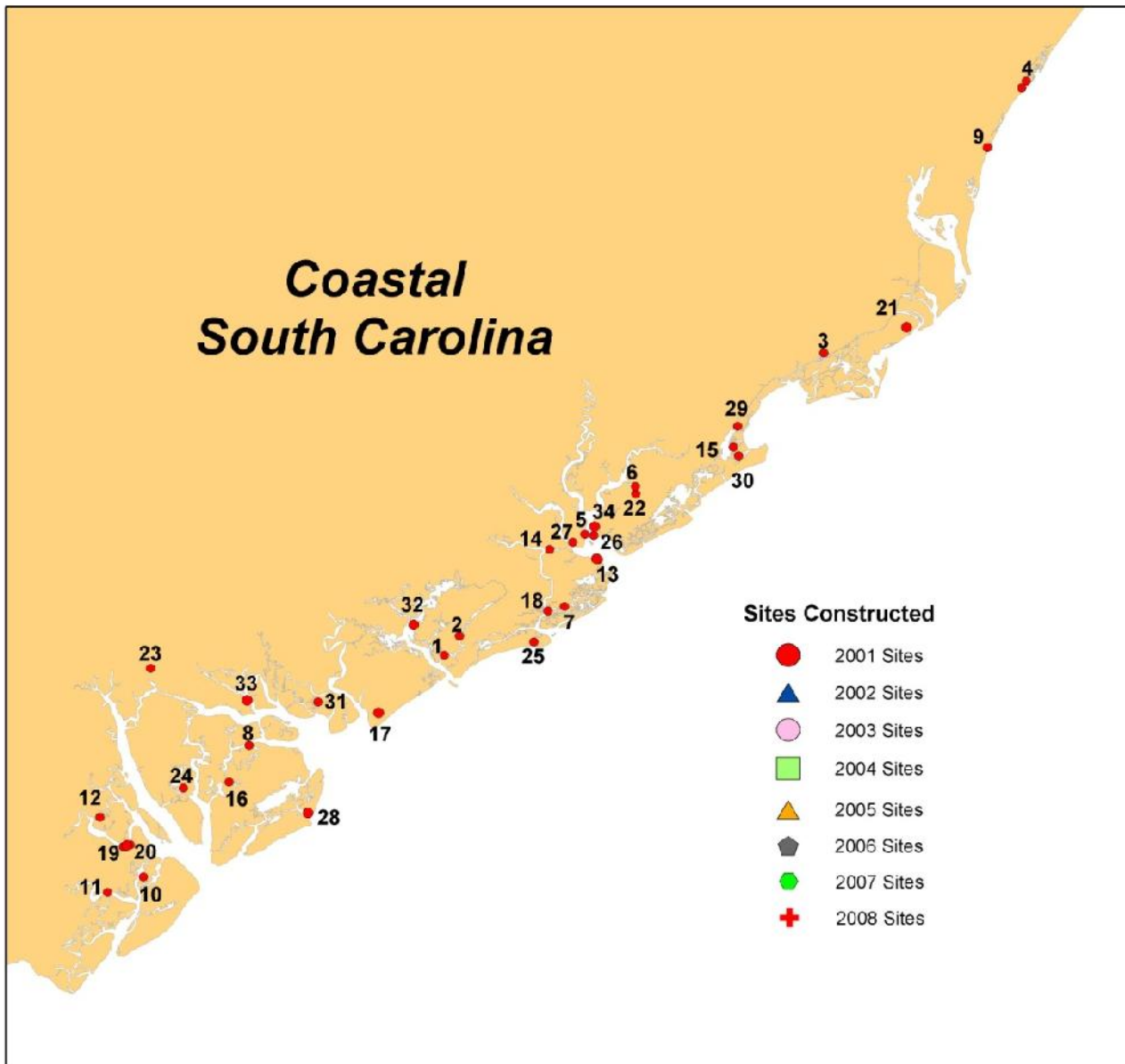




SCORE reefs also facilitate shoreline stabilization leading to marsh re-growth (2-3 yrs).



South Carolina Oyster Restoration and Enhancement Sites



Site Names and Years Built

1. Rockville ●
2. Boy Scout Camp ●◆
3. McClellanville ●
4. Murrell's Inlet ●○■
5. SC Aquarium ●
6. Palmetto County Park ●▲○
7. Bovens Island ●○▲
8. Dataw ●○■
9. Pawleys Island ●
10. Pinckney Refuge ●
11. Pinckney Landing ●○
12. Callawassee ●
13. Fort Johnson ●○▲■◆▲◆+
14. Alberta Long Lake ▲
15. Cape Romain 1 ▲
16. Chowan Creek ▲
17. Edisto ▲○◆●+
18. Sol Legare ▲
19. Trask Boat Landing ▲○■◆▲◆●+
20. Waddell Center ▲■
21. Huntington Beach ○
22. Boone Hall ○
23. Beaufort Marine Inst. ○
24. Port Royal ○◆
25. Kiawah ■◆
26. Patriots Point ■▲◆
27. Riverland Terrace ■▲◆●
28. Hunting Island ◆●+
29. Cape Romain 2 ●
30. Cape Romain 3 ●
31. Hutchinson Island ●
32. Bears Bluff +
33. Wimbee Creek +
34. Mt. Pleasant Waterfront Park +

Sites Constructed

- 2001 Sites
- ▲ 2002 Sites
- 2003 Sites
- 2004 Sites
- ▲ 2005 Sites
- ◆ 2006 Sites
- 2007 Sites
- + 2008 Sites