



**You Can Observe a
Lot by Just
Watching:**

**An Homage to Carl
Shuster's
Contributions to
Horseshoe Crab
Biology**

**Mark L. Botton
Fordham University**

Biographical Highlights

- Born November 16, 1919 in Randolph, VT



- **B.S., Rutgers University (1942)**
- **Military service, Europe (1942-1945)**
 - **Army Infantry (1942-1943)**
 - **Army Air Force (1943-1945): 27 combat missions, Distinguished Flying Cross**

VETERANS HISTORY PROJECT

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Carl N. Shuster, Jr. Collection

Biographical Information

Name:

Carl N. Shuster, Jr.

State of Birth:

VT

Home State:

VA



Note

This interview was conducted by Veterans History Project volunteers on the National Mall in Washington, DC during the National World War II Reunion: Tribute to a Generation, May 27-30, 2004. Interviews in this group range from one minute to 25 minutes in length.

Gender

Male

Race

Collection Information [VIEW DIGITIZED COLLECTION](#)

Type of Resource:

Audio: Audio Cassette [item] -- Oral history interview

Audio: CD [1 item] -- Reference copy

Interviewer:

[Charles Stanhope](#)

Contributor Affiliation/Organization:

[Library of Congress](#)

Collection #:

AFC/2001/001/14281

Subjects:

Shuster Jr., Carl N.

World War, 1939-1945--Personal Narratives

United States. Army.

Cite as:

Carl N. Shuster, Jr. Collection

(AFC/2001/001/14281), Veterans History Project,

American Folklife Center, Library of Congress

<http://memory.loc.gov/diglib/vhp/bib/14281>

- **M.S., Rutgers University (1948)**

Thesis: On the gross anatomy and histology of the alimentary tract in early developmental stages of *Xiphosura* (= *Limulus*) *polyphemus*





**New Jersey Hall on
the “Old” Rutgers
Campus in New
Brunswick, NJ**



Thurlow C. Nelson

ESTUARINE *Bulletin*

UNIVERSITY OF DELAWARE - Spring 1960

- **Lecturer, Rutgers University (1948-1955)**
- **Summer Graduate Fellow, WHOI (1949-1955)**

- **Ph.D., NYU (1955)**

Thesis: On morphometric and serological relationships within the Limulidae, with particular reference to *Limulus polyphemus* (L.)



*Carl Sbuster and specimens he will measure in effort to determine size and growth rates of *Limulus* at points scattered from Maine to Florida.*

Report from Rutgers V(8), October 1953



The author's sons compare a living horseshoe crab with its likeness on the sun dial of the Marine Biological Laboratory at Woods Hole, Massachusetts. *Photograph by the author.*

- **University of Delaware (1955-1963)**
 - **Professor of Biological Sciences and Director, University of Delaware Marine Laboratories**
- **US Public Health Service, Narragansett, Rhode Island (1963-1971)**

- **Washington, DC area (1971-)**
- **US EPA (1971-1972)**
- **Federal Power Commission/Federal Energy Regulatory Commission (1972-1984)**
- **Flow General, Inc. (1984-1988)**

- **Adjunct Professor of Biological Oceanography, VIMS (1979-)**



PLATE II

TOPOGRAPHIC CHARACTERISTICS

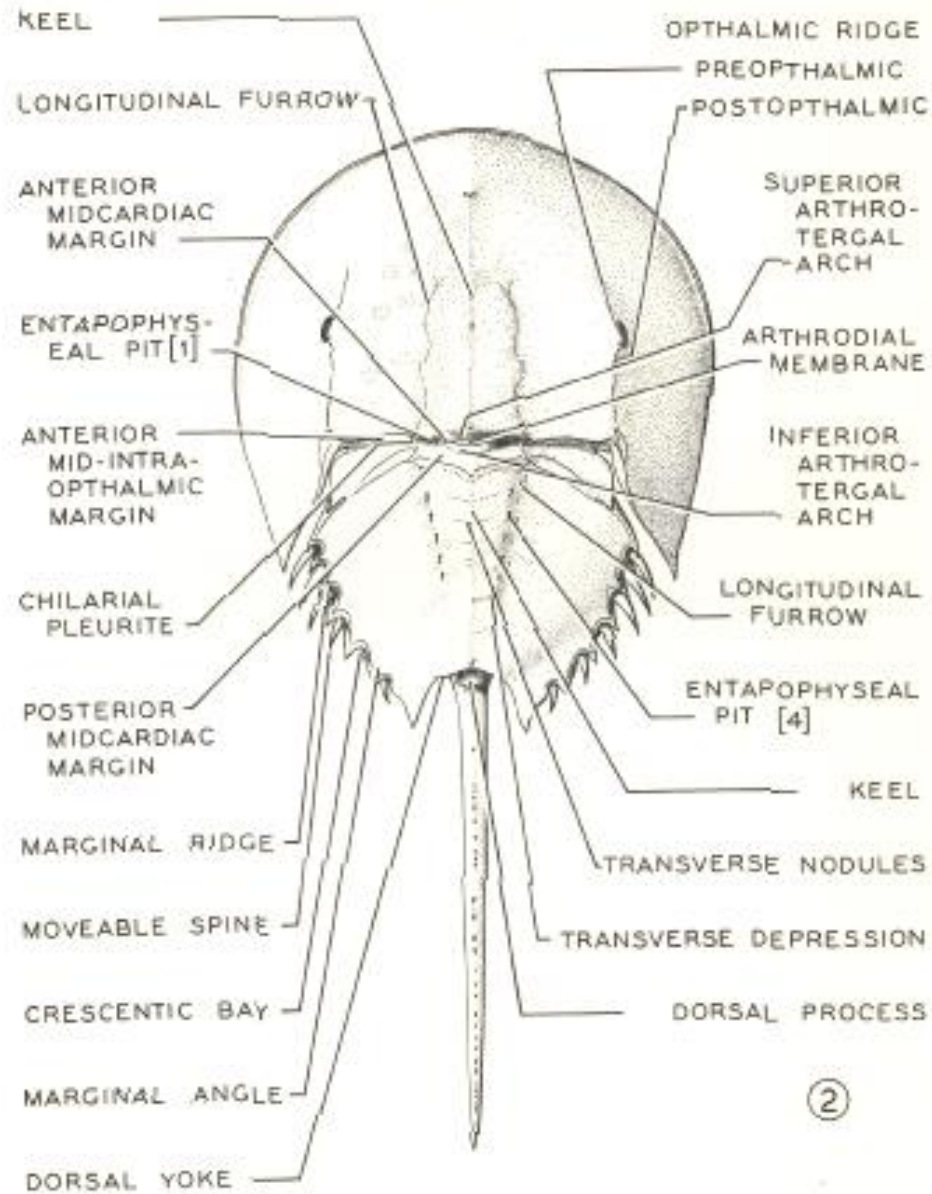
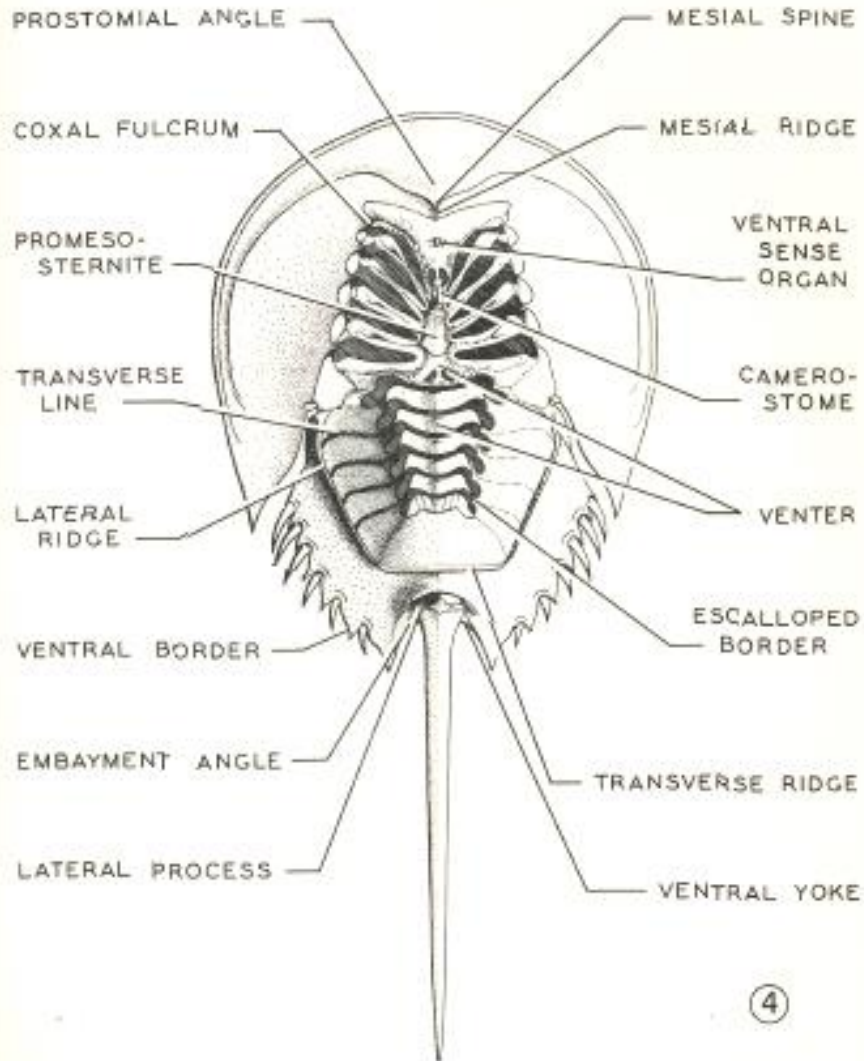
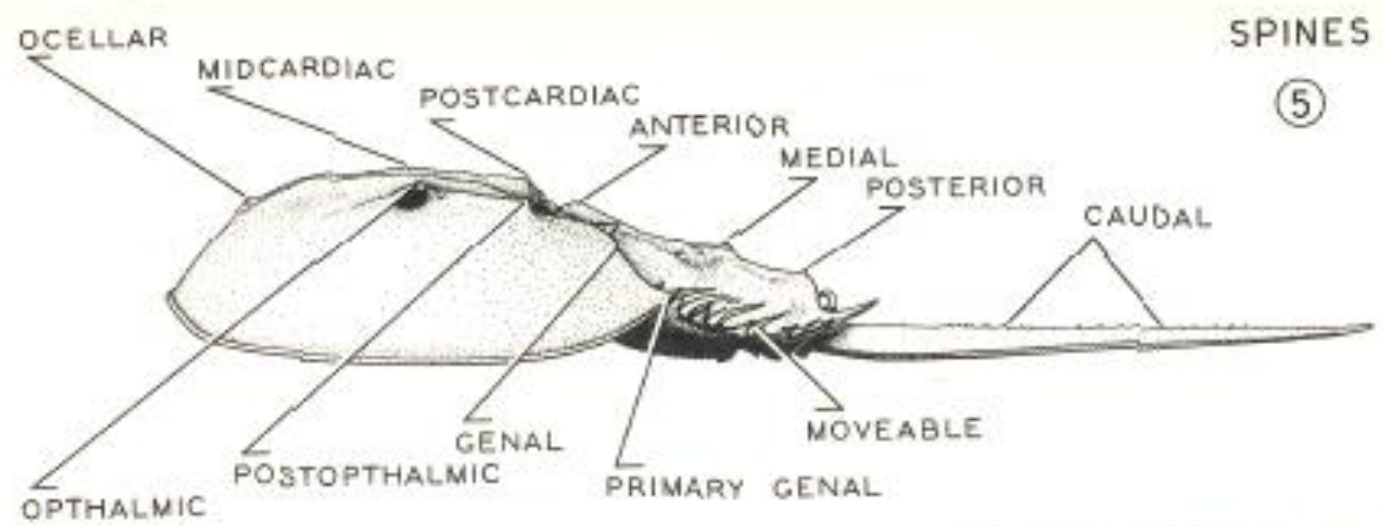


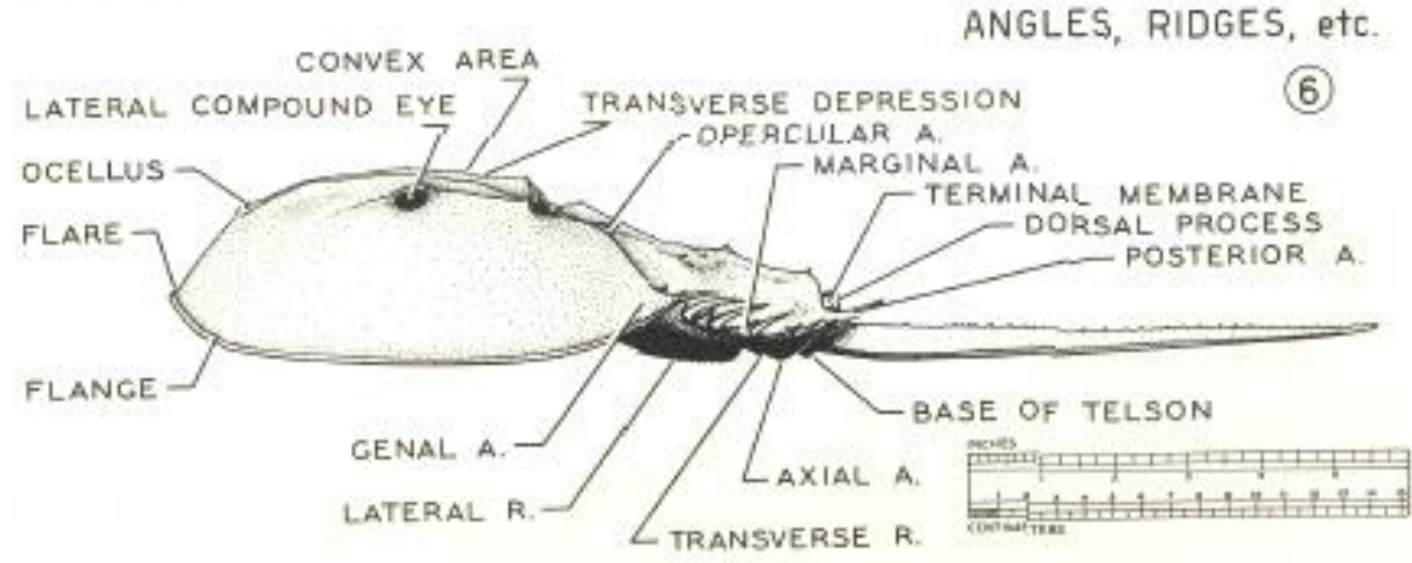
PLATE IV

TOPOGRAPHIC CHARACTERISTICS





SPINES
 ⑤



ANGLES, RIDGES, etc.
 ⑥

Publications by Carl N. Shuster

- **89 total publications listed in Google Scholar, spanning 67 years!**
- **First one = 1948, On the gross anatomy and histology of the alimentary tract in the early developmental stages of *Xiphosura (=Limulus) polyphemus* Linn. M.S. Thesis, Rutgers University.**
- **Most recent one = 2015, The Delaware Bay area, U.S.A.: A unique habitat of the American horseshoe crab, *Limulus polyphemus*. In: Carmichael et al. (eds.), Changing Global Perspectives on Horseshoe Crab Biology, Conservation and Management, Springer Publ., pp. 15-39.**

Publications by Carl N. Shuster

- Which one of Carl's papers has the most citations?

Publications by Carl N. Shuster

- **Which one of Carl's papers has the most citations?**
 - a) **Shuster, Barlow & Brockmann (eds.) 2003. The American Horseshoe Crab. Harvard University Press**

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- **Shuster & Botton (1985). A contribution to the population biology of horseshoe crabs, *Limulus polyphemus* (L.), in Delaware Bay, Estuaries 8: 363-372**

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- a) Shuster, Barlow & Brockmann (eds.) 2003. The American Horseshoe Crab. Harvard University Press
- b) Shuster & Botton (1985). A contribution to the population biology of horseshoe crabs, *Limulus polyphemus* (L.), in Delaware Bay, *Estuaries* 8: 363-372
- c) **Shuster (1982) A pictorial review of the natural history and ecology of the horseshoe crab *Limulus polyphemus*, with reference to other Limulidae, In: Bonaventura et al. (eds) Physiology and Biology of Horseshoe Crabs: Studies on Normal and Environmentally Stressed Animals. Alan R. Liss, New York, pp 1–52**

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Other information on publications by Carl N. Shuster

- Carl's Ph.D. thesis has been cited 45 times!
- Carl's most cited non-horseshoe crab paper:

Shuster & Pringle (1969) Trace metal accumulation by the American eastern oyster, *Crassostrea virginica*. Proc. Nat. Shellfish. Assn. 59: 91-103 Cited 119 times.

Estuaries Vol. 8, No. 4, p. 363–372 December 1985

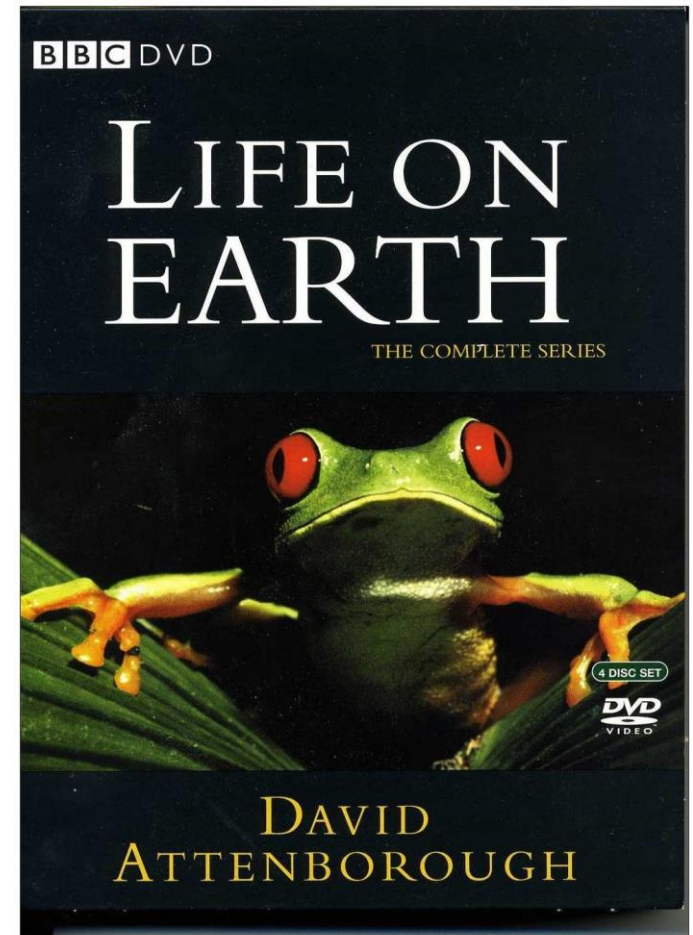
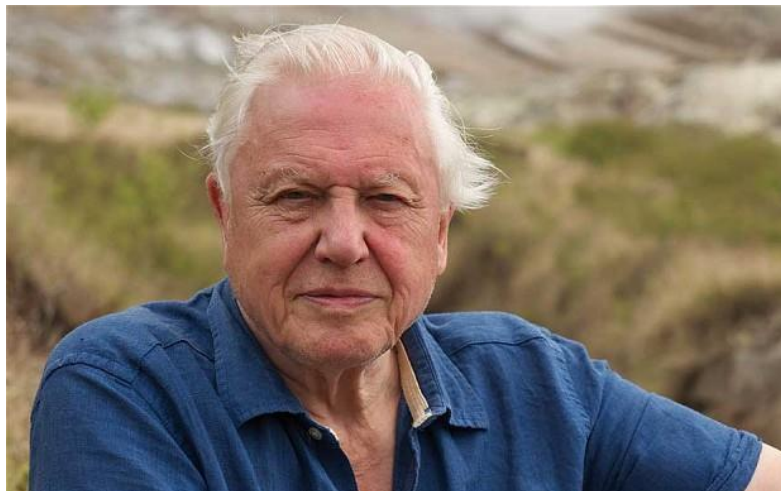
A Contribution to the Population Biology of Horseshoe Crabs, *Limulus polyphemus* (L.), in Delaware Bay¹

CARL N. SHUSTER, JR.
*General Research Corporation
Environmental Sciences Operations
McLean, Virginia 22102*

MARK L. BOTTON
*Fordham University
College at Lincoln Center
New York, New York 10023*



Sir David Attenborough
June, 1977 visit to
Delaware Bay, NJ with
the *Life on Earth* film
crew from the BBC



FRI June 2
HW - 0722
LW - 1314
HW - 1948

ALL SLAVES.
MEMBERS

Lab Meeting this morning

Give a School

MITCH

Reduced Price
↓ (only 25¢)

Get to Carrot

Mark Botton 1977

Harold H. Haskin



Shuster & Botton (1985): Some little-known trivia

- Original title was “An estimate of the 1977 spawning population of the horseshoe crab, *Limulus polyphemus*, in Delaware Bay”
- Intended journal was Chesapeake Science, which ceased publication in December, 1977

Shuster & Botton (1985): Some little-known trivia

- First submitted to Estuaries in 1979 (rejected)
- Re-submitted to Estuaries ~ 1980 or 1981 (rejected)

Shuster & Botton (1985)

- Second revised manuscript, now with a new title, was submitted to Estuaries in 1985, and accepted. The editor's cover letter stated that:

“One reviewer rated your manuscript fair, requiring minor revision, and the other rated it fair, not acceptable with any revision... Given the long history of this ms., many reviewers clearly have had problems with it...”

Shuster & Botton (1985)

- **Shoreline surveys of spawning adult HSC's ("back-of-the-envelope" estimates)**
- **Approximating the number of spawning females from densities of egg clusters**
- **Number of eggs per cluster**
- **Number of eggs in gravid females**

Carl had some notable insights in the Discussion section

“Significantly, the present center of spawning activity is along a beach largely undisturbed by man. Activities which alter or destroy beaches will ultimately have a negative impact upon populations of horseshoe crabs.” (p. 370)



“Limulus polyphemus is a slow growing animal...Once a population of this species is established it may therefore be more stable than a shorter-lived species. Conversely, if heavily harvested, it may take longer to repopulate an area.” (p. 370)



“Life table statistics are not available, especially for the several age classes of young Limulus. Should the need for management...arise, statistics on the fate of the young will be required in order to predict the effect of fishing and other pressures on populations.” (p. 371)



Carl Shuster and the Flourishing of International Cooperation: Visit to Delaware Bay in 1989 by Dr. Sekiguchi and Students



Hiroaki Sugita

Carl Shuster

Koichi Sekiguchi

Tomio Itow


Fumio Shishikura

1994 visit to Japan by Shuster and Botton, guided by Koichi Sekiguchi, Hiroaki Sugita, and others

市制40周年記念事業

生きている化石

カブトガニ



カブトガニ産卵地サミット

パネラー

- 関口名誉教授 (筑波大学)
- 杉田助教授 (筑波大学)
- 土屋研究員 (富岡市カブトガニ博物館)
- 国内のカブトガニ産卵地の研究者
- M.ボトン博士 (米国ワシントン大学)
- C.N.シュスターJr.博士 (米国カリフォルニア大学)

コーディネーター ● 酒見良司 (伊万里高等学校生物部顧問)

日時 / 7月23日(土) 午後2時

場所 / 市民センター 文化ギャラリー

Examining *Carcinoscorpius*
at the Shimoda Marine
Laboratory, 1994



With Hiroaki Sugita, Tomio
Itow, and Koichi Sekiguchi, 1994



With Koichi Sekiguchi at the entrance to the Kabutogani Museum in Kasaoka City, Japan in 1994





**With Koichi
Sekiguchi in Imari,
Japan in 1994,
admiring the HSC
tile on the sidewalk**



Measuring *Tachypleus tridentatus* at the Shimoda Marine Lab in 1994.

We were especially intrigued by the double pair of claspers in *Tachypleus* males, compared to the single pair in *Limulus*.

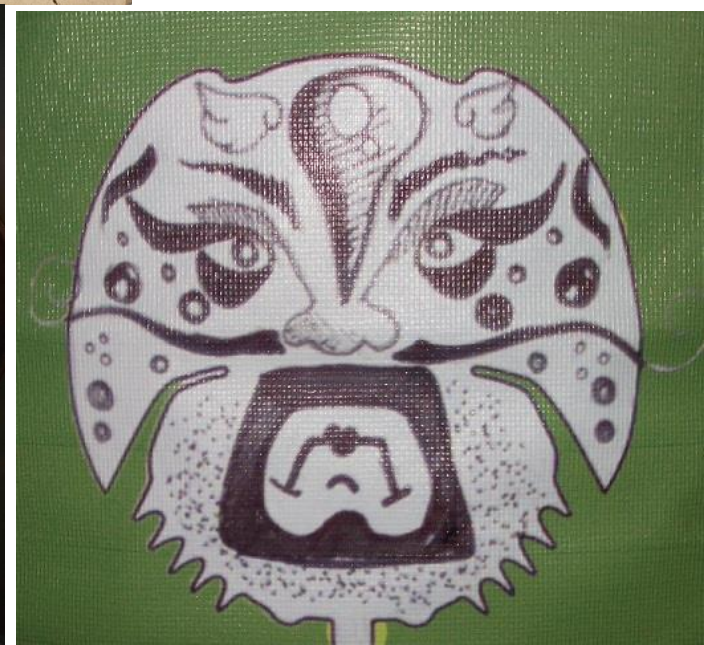
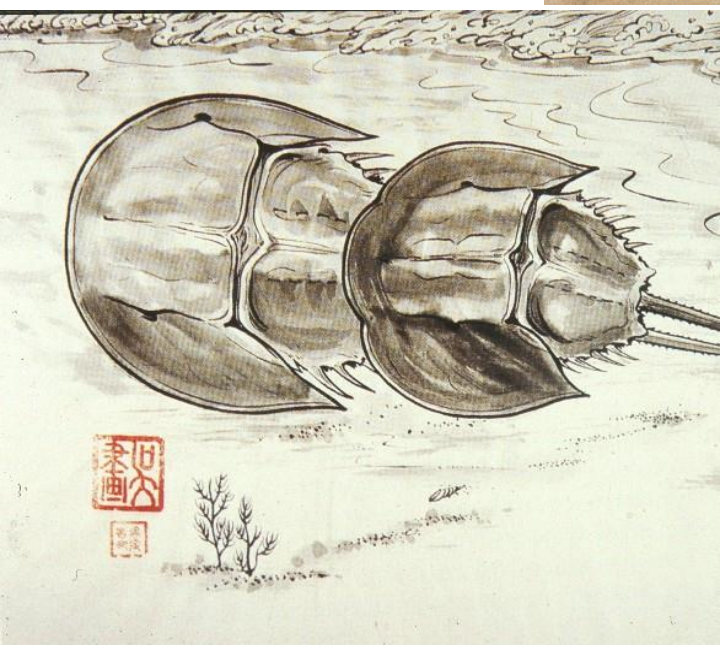
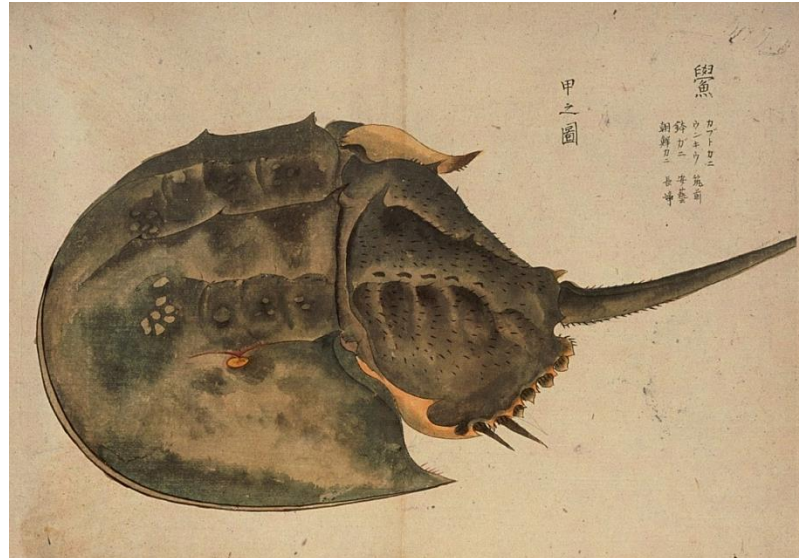
ZOOLOGICAL SCIENCE 13: 151–159 (1996)

© 1996 Zoological Society of Japan

**Amplexus and Mating Behavior in the Japanese Horseshoe Crab,
*Tachypleus tridentatus***

Mark L. Botton¹, Carl N. Shuster, Jr.², Koichi Sekiguchi³
and Hiroaki Sugita⁴

Horseshoe Crab Conservation Goes International



ISSCHC 07 Program



11-14 June 2007
Dowling College, Oakdale
New York, USA

International Symposium on the Science and
Conservation of Horseshoe Crabs 2007

Session I	Population Status and Assessment
Session II	Biology, Ecology, and Multi-species Interactions
Session III	Culture and Captive Breeding
Session IV	Habitat Requirements, Management and Restoration
Session V	Biomedical Applications
Session VI	Traditional Uses
Session VII	Conservation and Management
Session VIII	Public Awareness and Community-based Conservation

**International Symposium on the
Science and Conservation of
Horseshoe Crabs
Long Island, NY
June, 2007**



HIDDEN TREASURE

Limuli Laboratory

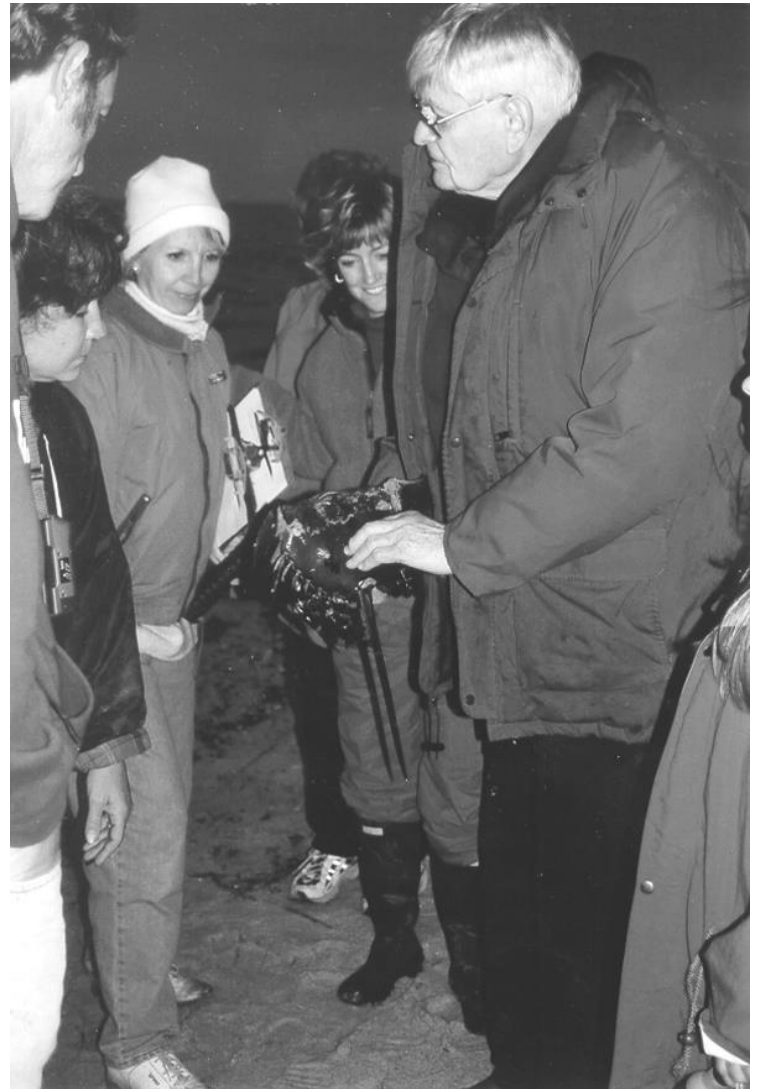
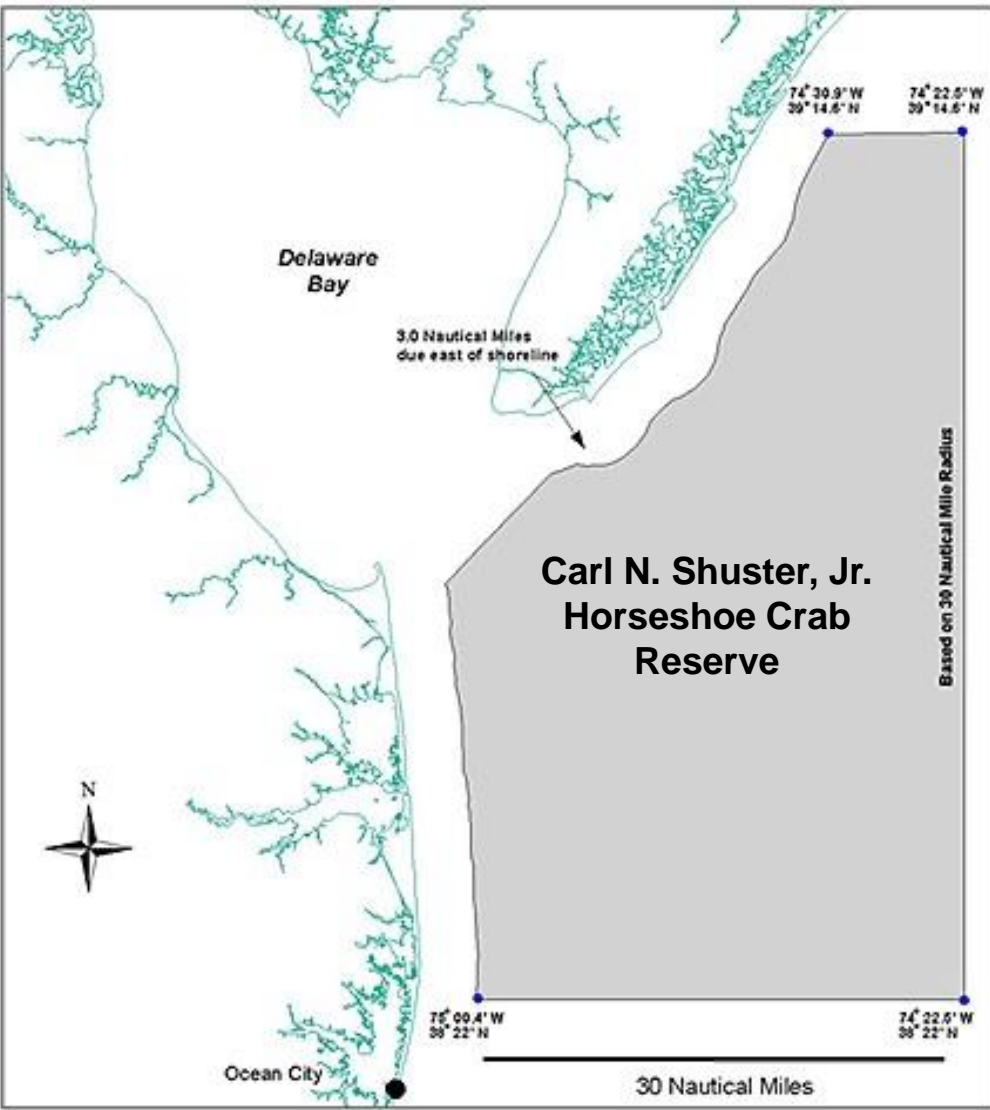


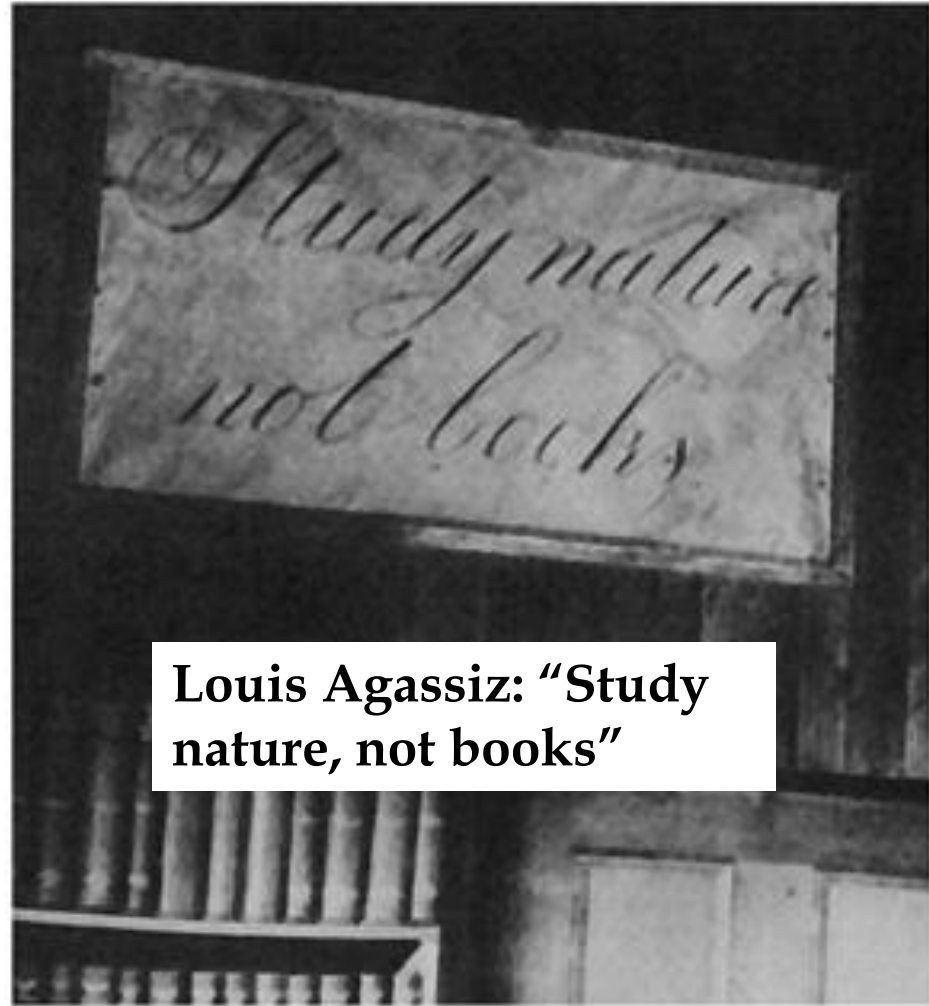
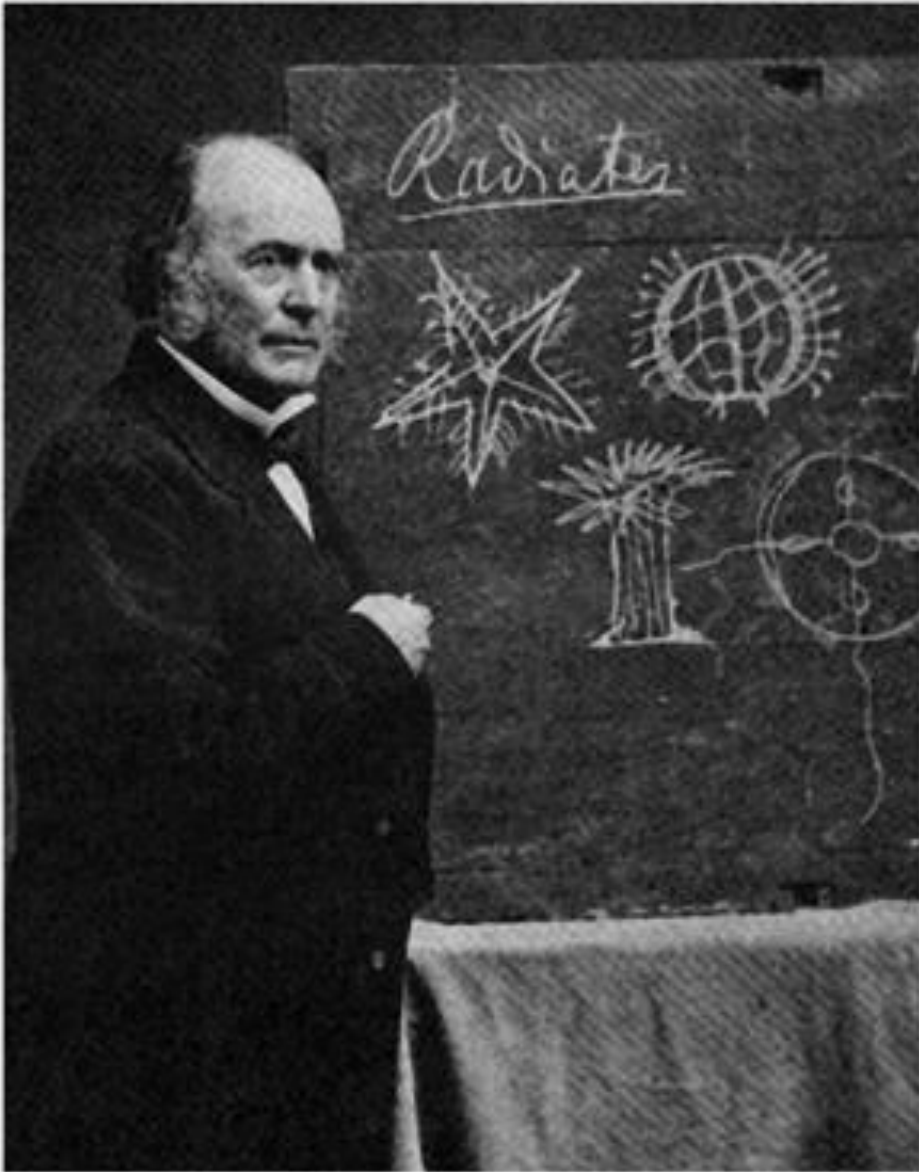
INTERNATIONAL WORKSHOP ON THE SCIENCE AND CONSERVATION OF ASIAN HORSESHOE CRABS

The Hong Kong Wetland Park, Hong Kong, China • 13 - 16 June 2011

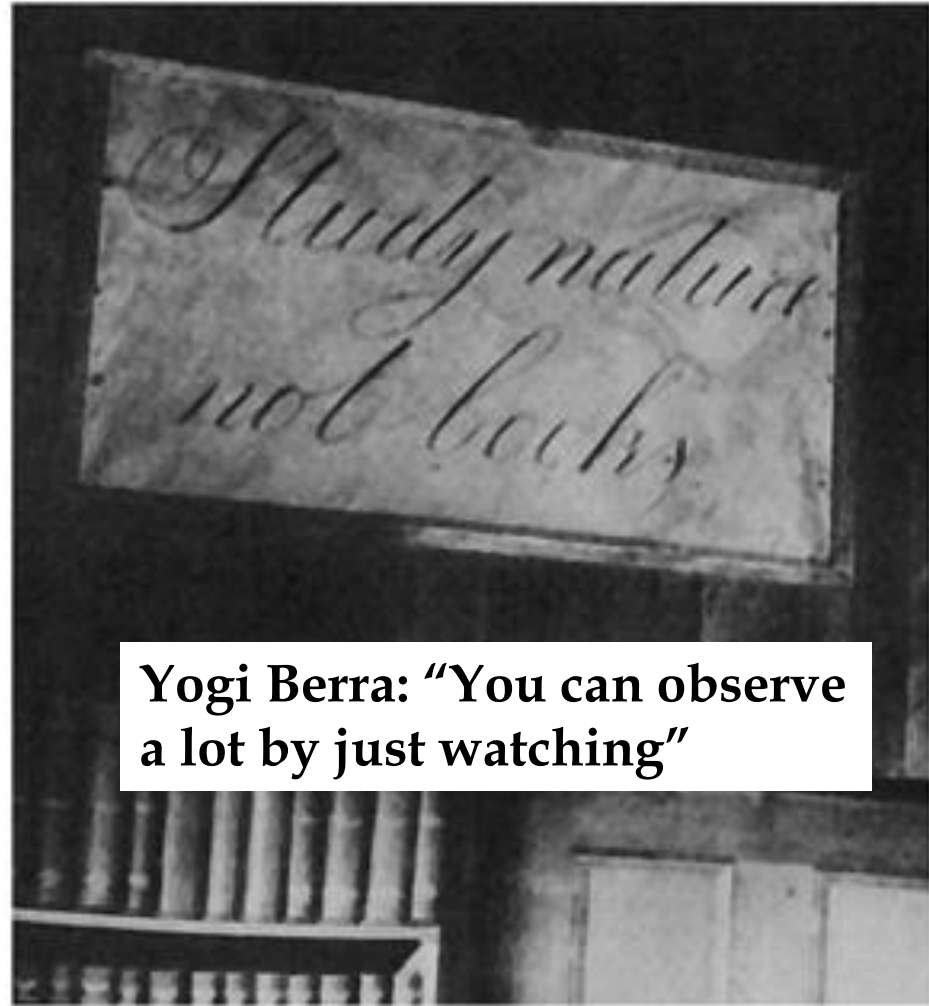
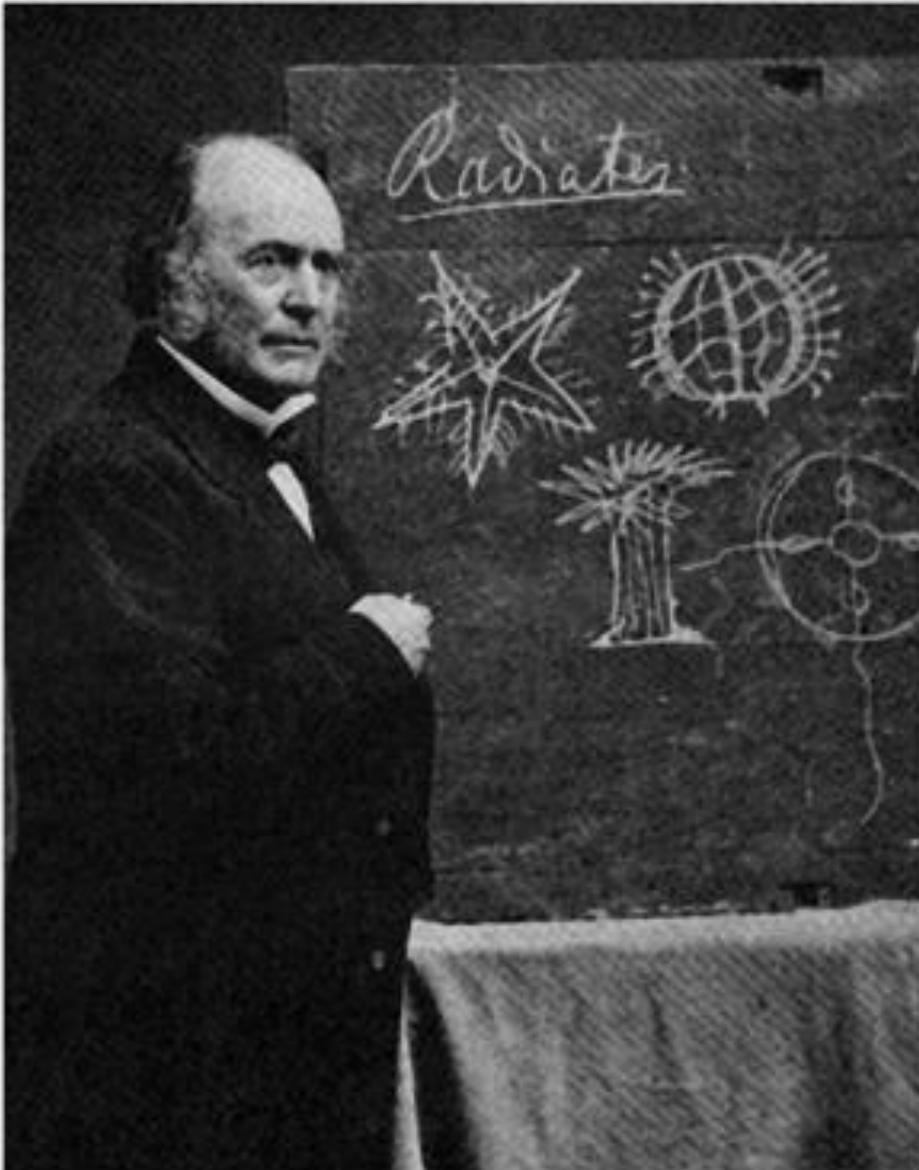


Other speakers will discuss Carl's significant contributions to HSC management and public education





Louis Agassiz: "Study nature not books"



Yogi Berra: "You can observe a lot by just watching"



Carl has always stressed the importance of long-term observations of nature.

This was the typical scene south of the Rutgers University Cape Shore Laboratory *ca.* 1980



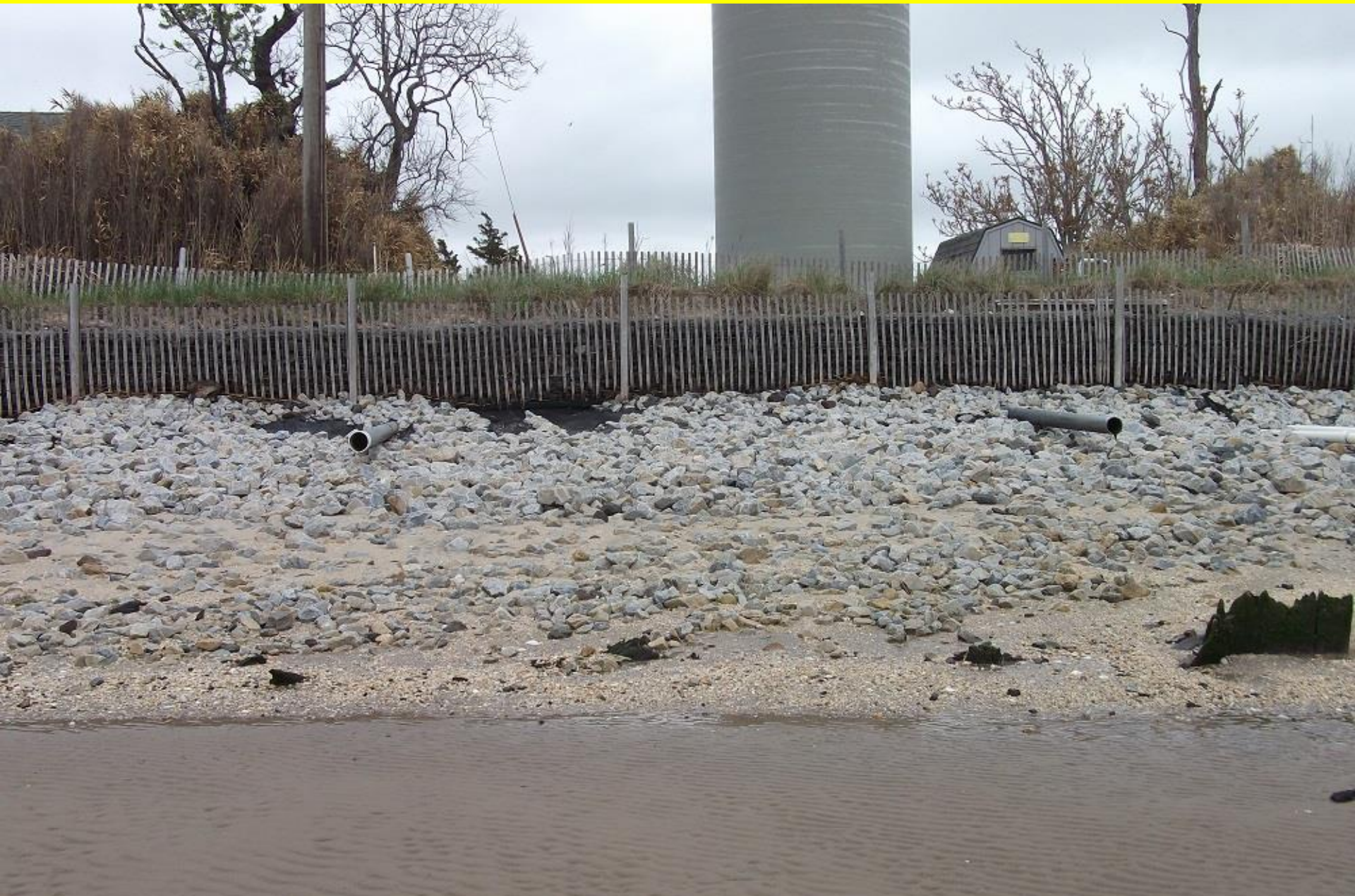
The same region in May, 2016



A little further to the south, in May, 2016



**The beach directly in front of the Cape Shore Lab itself –
the very beach where I first met Carl in 1977!**





Carl's keen observations and insights about HSC's have been indispensable.

Thank you for your inspiration guidance, and friendship!