Building a science-based tool for residential dock management

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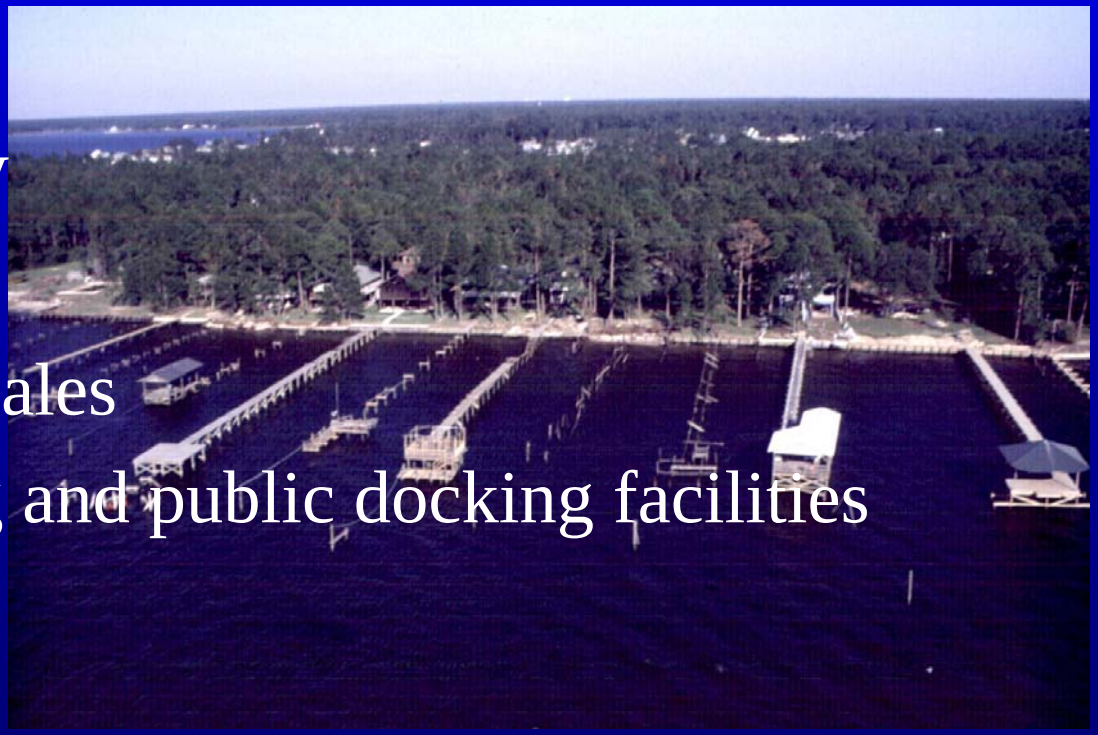
Science for Management

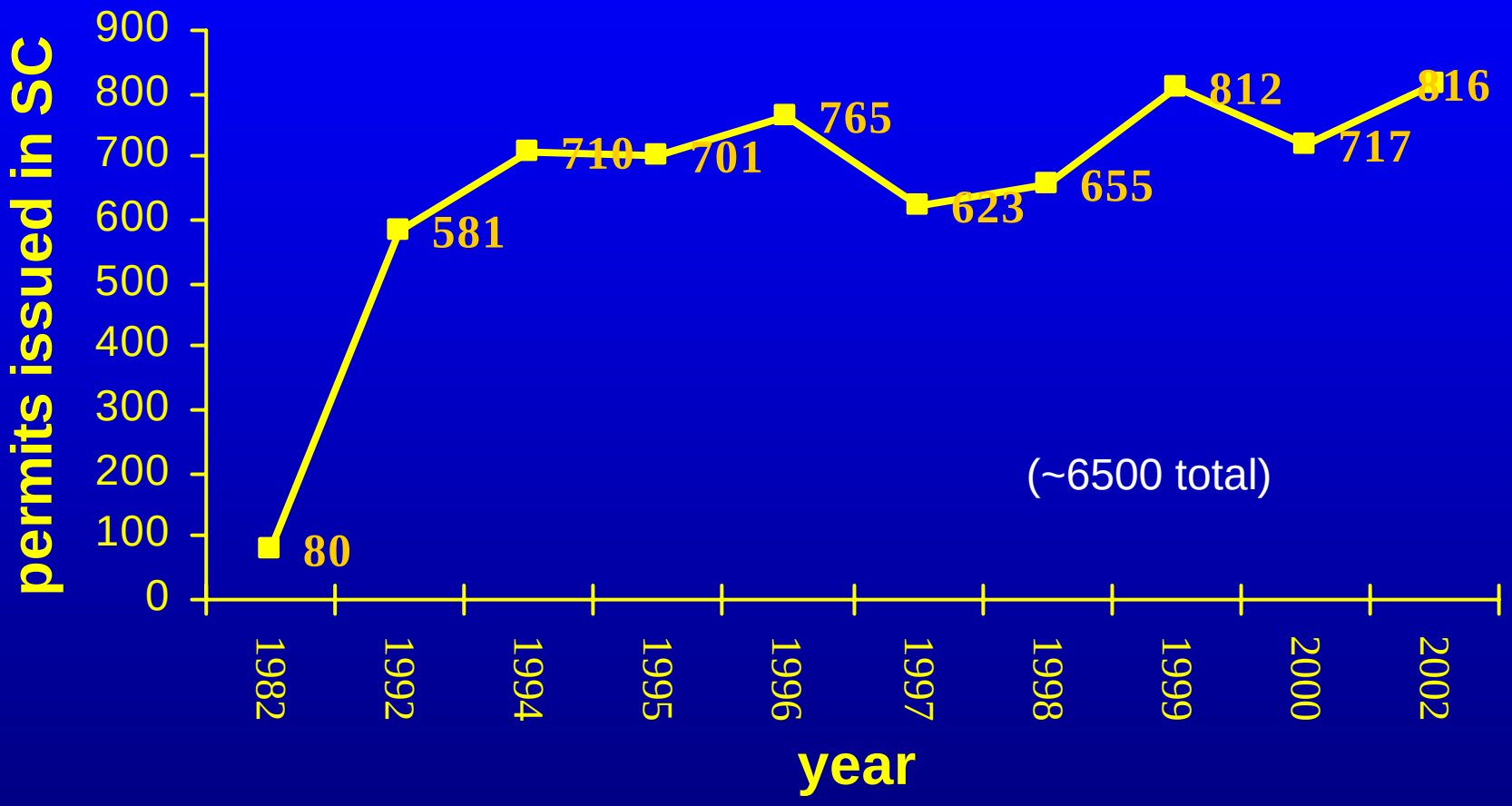
- Relevant
- Credible
- Timely
- Accessible

Problem Statement

- Growing population intent on living near the coast
- Desire for immediate access to water by private docks
- Further driven by
  - Strong economy
  - Increasing boat sales
  - Limited mooring and public docking facilities



Dock Permitting Numbers



- Maine - over 1500 permits issued between 1992 and 2002.
- New York - over 900 permits issued in 2002.

Problem Statement

Managers want better understanding of individual and cumulative impacts to ensure that additional docks:

1. Don’t unreasonably harm the environment,
2. Provide reasonable waterfront access if desired, and
3. Don’t unreasonably affect public access, navigation, or other uses.

Problem Statement

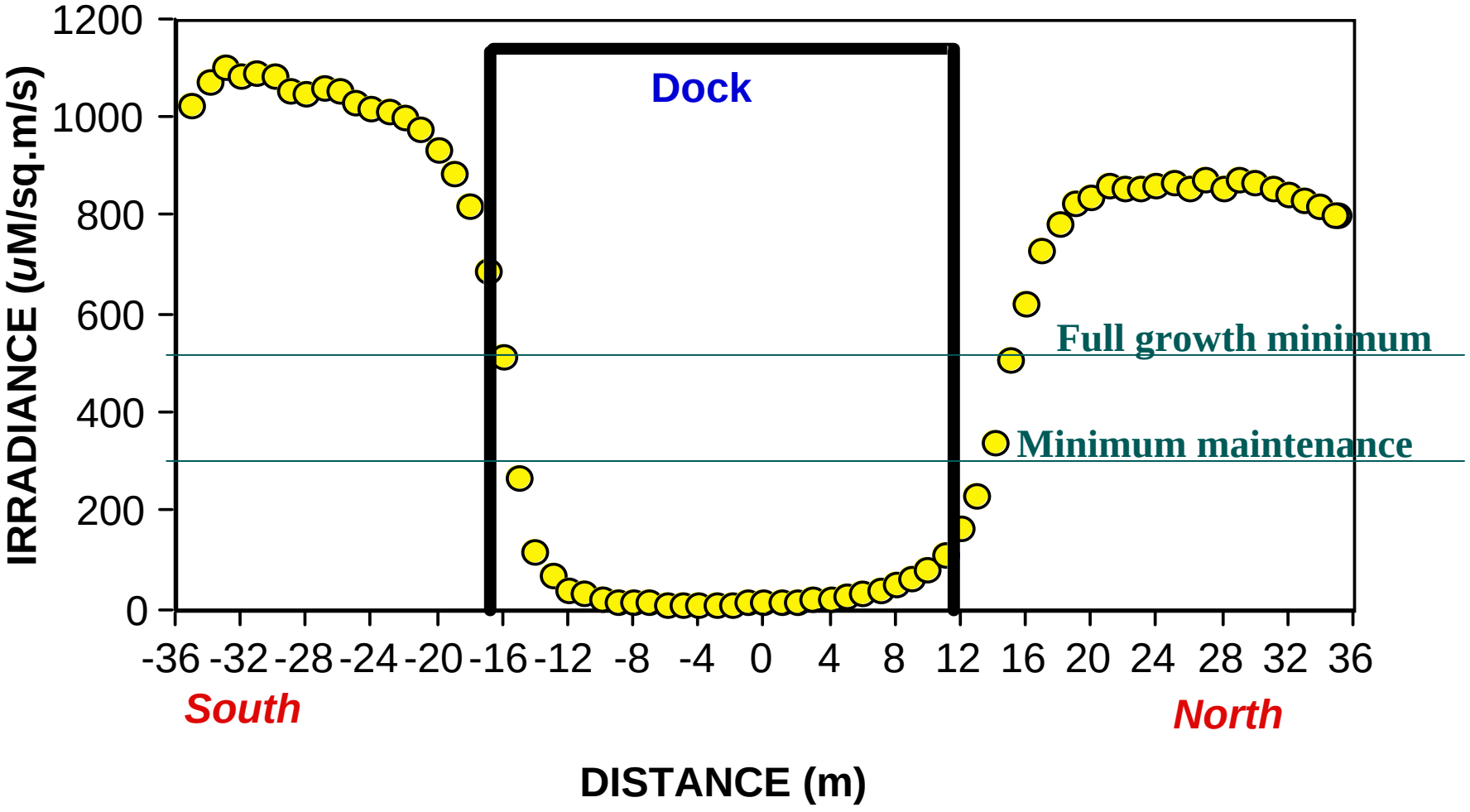
- Perceived ‘right’ to a dock.
- Long, arduous permit review process, yet no firm management policy or uniformity of design.
- Individual & cumulative impacts are poorly documented.
- Little justification to deny permits
  - 78% of permits in Cape Cod approved in first review
  - < 99% approved after appeal process (n=250)
  - 42 appeals of permits granted in SC in 2002.

Science Workshop

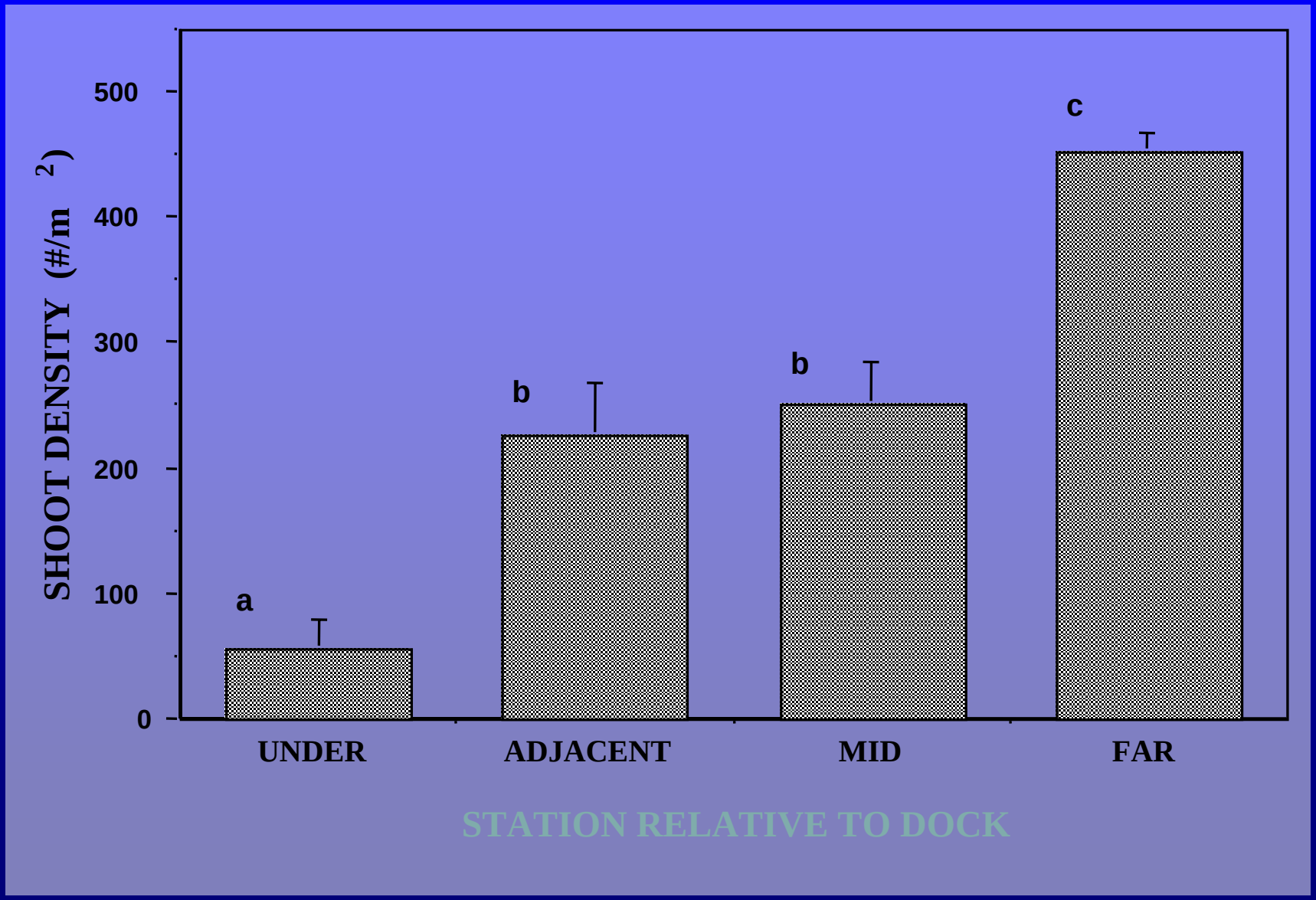
- Purpose
  - Synthesize scientific information on direct, cumulative, and secondary effects of docks on the coastal environments and their users.
  - Assess susceptibility of regions to the negative impacts associated with docks.
  - Identify gaps in research.
- Participants
  - scientists, coastal managers
  - from DE, MD, MA, NY, OR, SC, MS, WA, NJ, GA, CT, NH, ME

Impacts to Vegetation

Light Profile under a Dock



Eelgrass Density Under and Adjacent to Docks



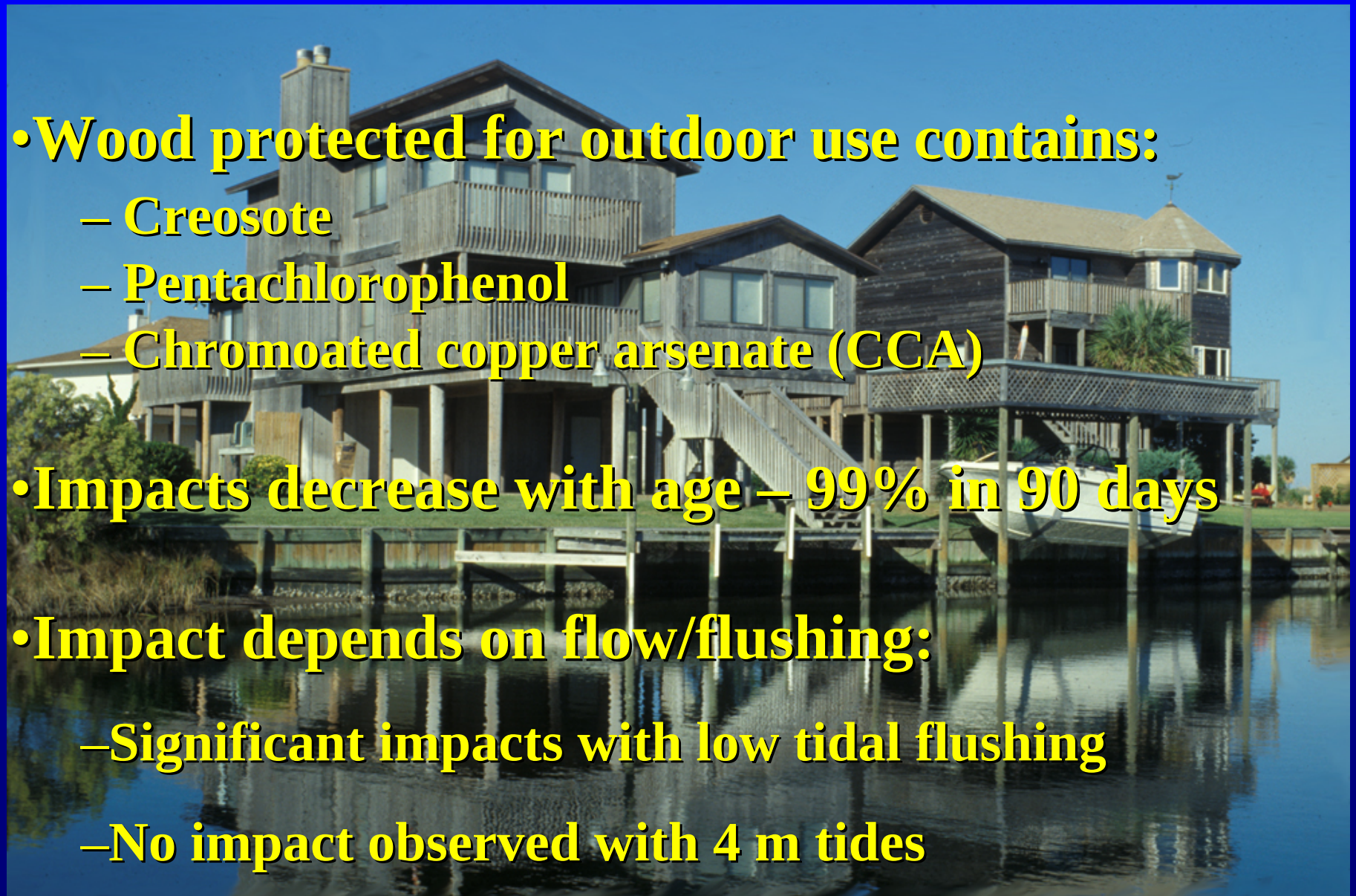
Impacts to vegetation

- Impacts include
  - Reduced shoot density
  - Reduced biomass
  - Reduced growth
  - Increased height (due to etiolation)
  - Increased erosion, undercutting of vegetation

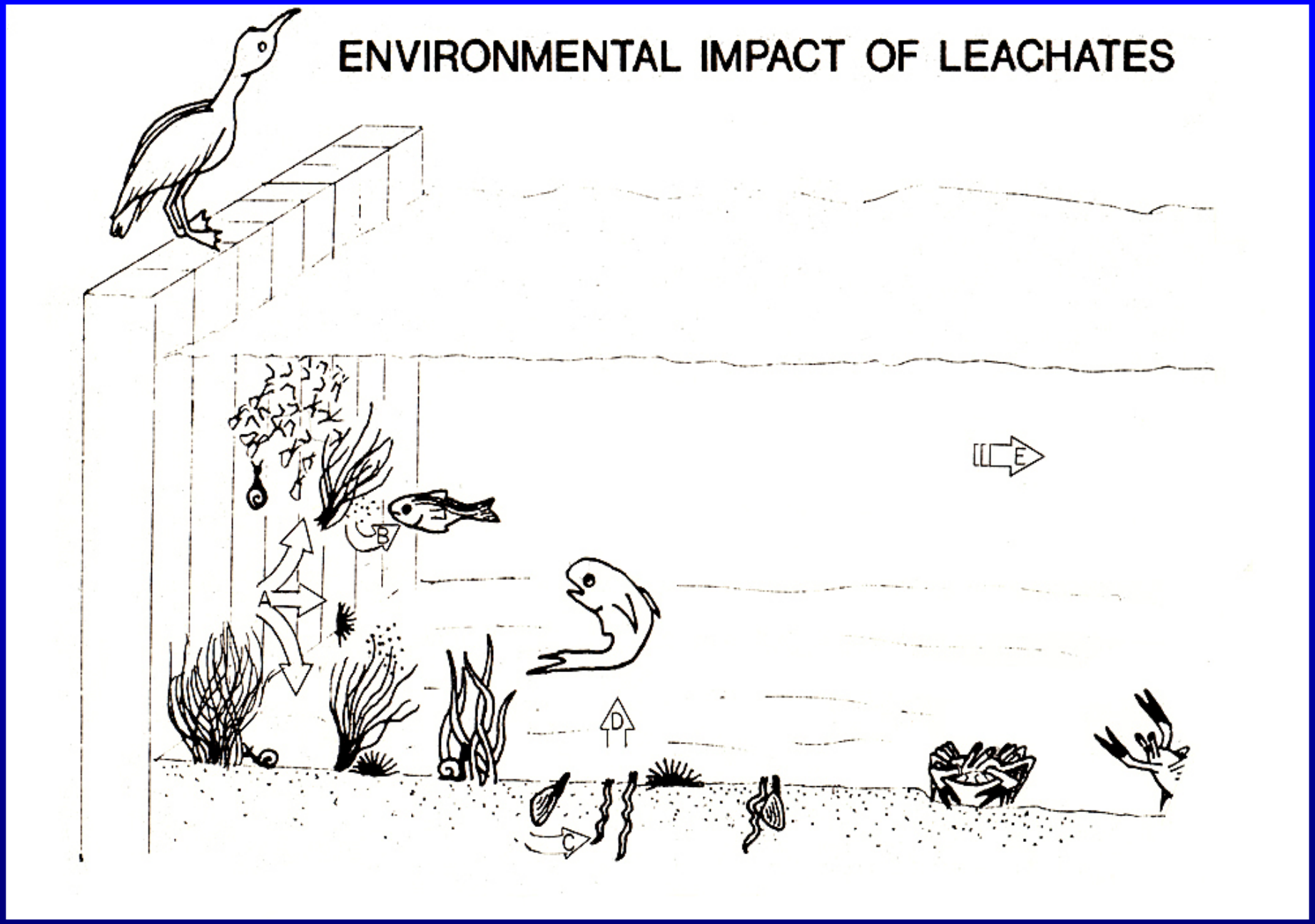
- Susceptibility varied by species:

Spartina patens	Distichlis spicata	S. alterniflora
Least		*Most*

Impacts from Contaminants

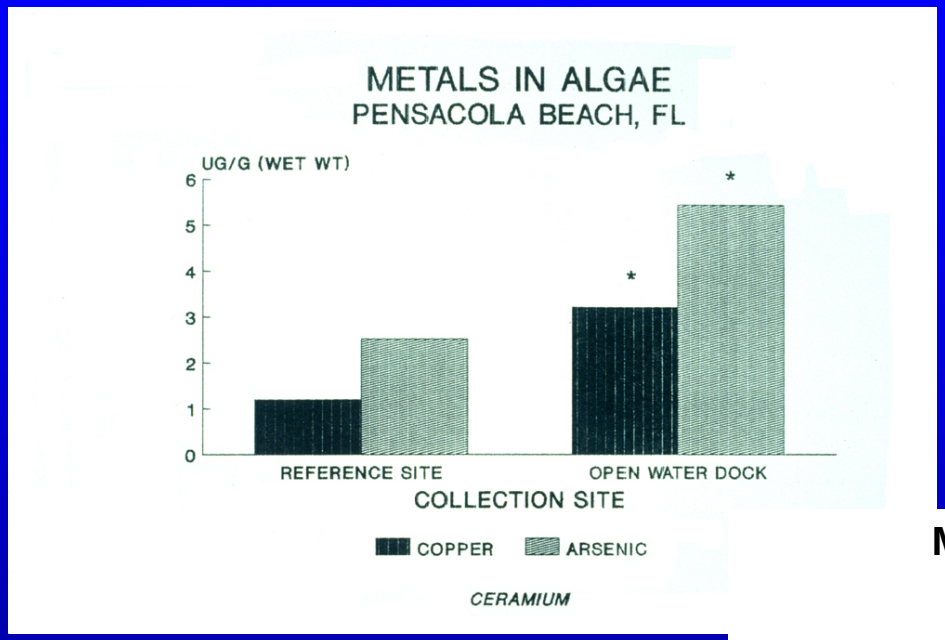


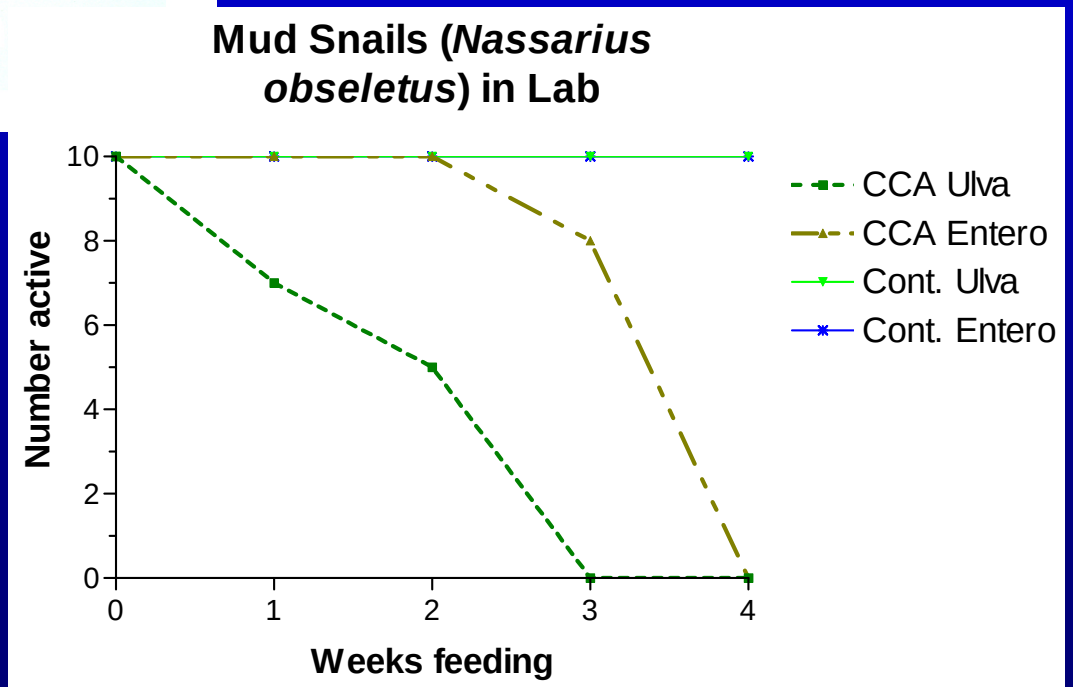
- Wood protected for outdoor use contains:
  - Creosote
  - Pentachlorophenol
  - Chromoated copper arsenate (CCA)
- Impacts decrease with age – 99% in 90 days
- Impact depends on flow/flushing:
  - Significant impacts with low tidal flushing
  - No impact observed with 4 m tides



(From Weis, J.S., and P. Weis (1992). J. Exp. Mar. Biol. Ecol. 161: 189-199.)

Impacts to low flushing areas





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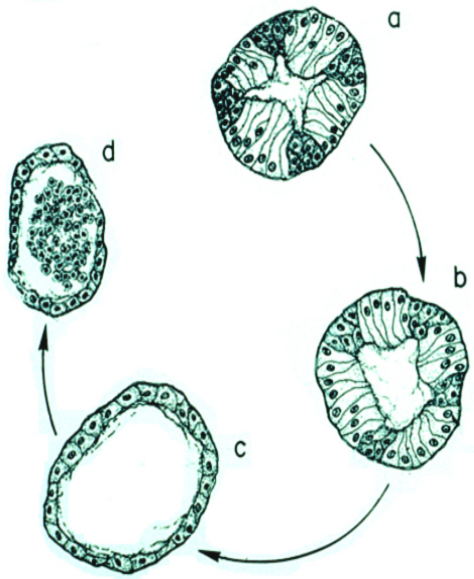
Impacts to low flushing areas

Digestive gland metaplasia



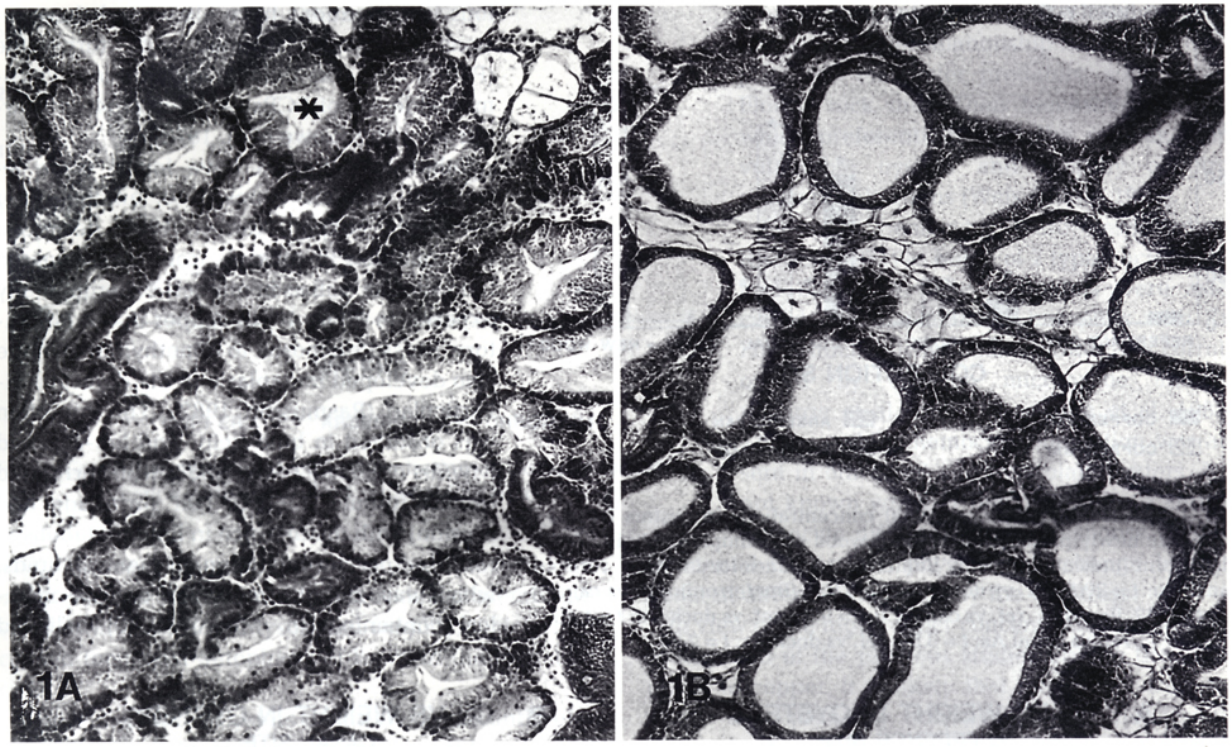


Fig. 1. *Crassostrea virginica*. Histological preparations of cross-sections through oyster soft tissues, demonstrating healthy and metaplastic digestive gland diverticula (H&E, ×160). (A) shows predominantly normal (type A) diverticula, except for one type B (✱). (B) shows severe metaplastic change, type C, with dilation of lumina and loss of cell height; type D (not shown) would also have necrotic cells sloughed into the lumina. Typing of metaplasia is done after Couch (1985)

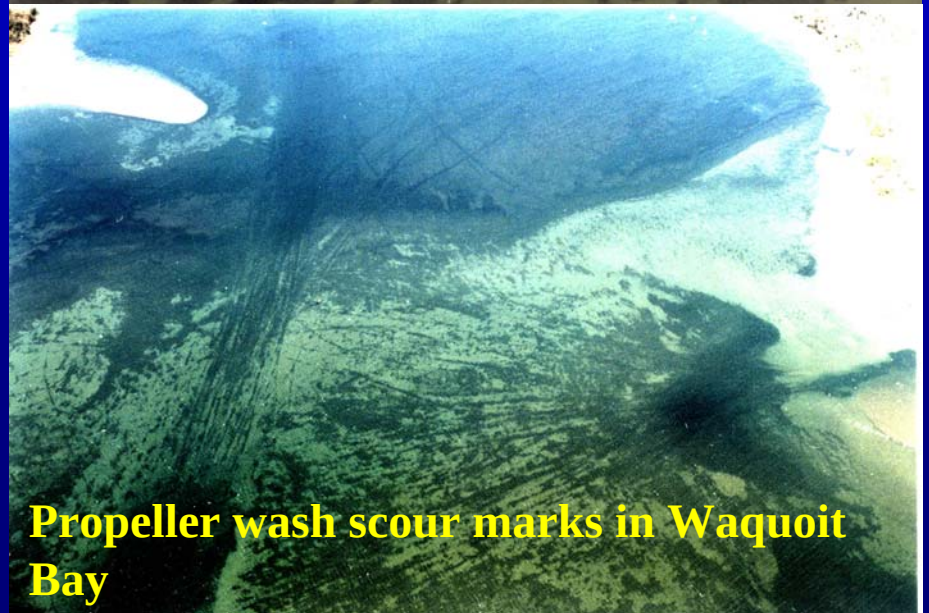
Impacts to high flushing areas

- Creeks with vs. without docks:
  - Same sediment Cu, Cr and As concentrations.
  - Oysters attached to pilings had > [Cu], but no physiological effects or acute toxicity.
- Creeks with new docks (4-12 mo.) vs. creeks without docks:
  - Same percent survival of mummichogs, juvenile red drum, white shrimp, mud snails, and oysters.

Priscilla Wendt, Robert Van Dolah, South Carolina Department of Natural Resources 2001

Impacts from boating/use

Propeller and mooring chain scour marks near docks



Propeller wash scour marks in Waquoit Bay

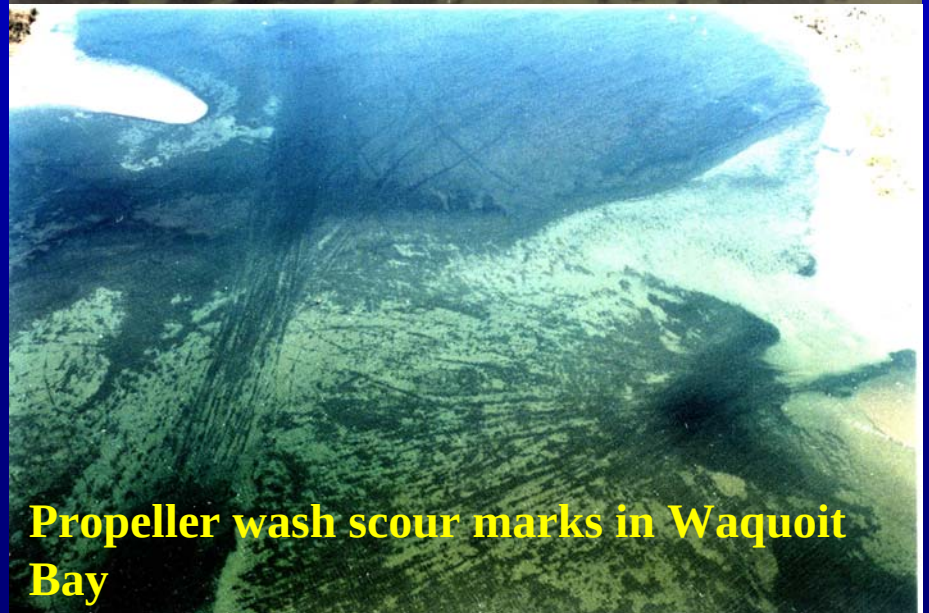
Issues of concern:

- SAV scaring, blowouts
- Fuel discharges
- Shoreline erosion
- Resuspension of sediments → Turbidity
- Noise
- Disturbance of wildlife

Study and figures by Rick Crawford, rcrawford@whoi.edu.

Impacts from boating/use

Propeller and mooring chain scour marks near docks



Propeller wash scour marks in Waquoit Bay

"Motor boat traffic is far from a benign influence on the aquatic and marine environments."

Perceptions: Social Survey

Majority felt:

- Docks add to property value (86%)
- Should be allowed to have docks (73%)
- Docks are not harmful to aquatic environment (75%)
- Docks don't take away from views (80%)
- There are not too many docks (70%)

- Docks should be regulated (50/66%)
- Size restrictions OK (63/78%)
- There are places docks shouldn't be build (59/76%)
- Boating use harmful (~50%)

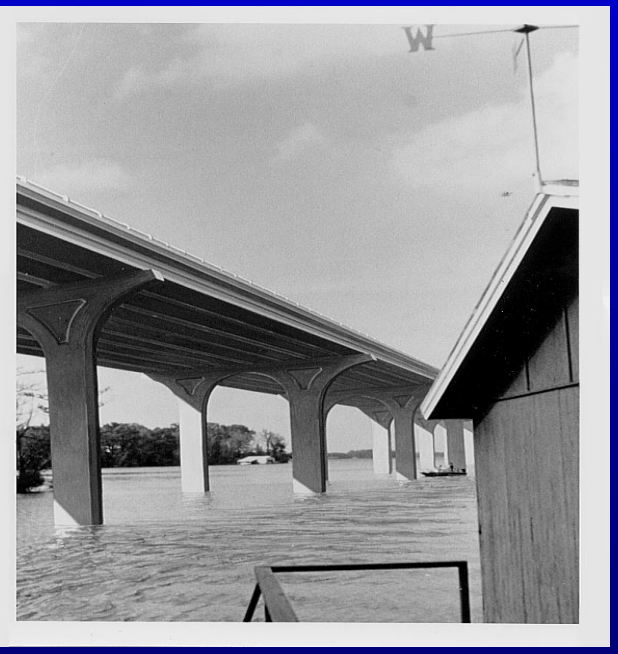
Source: Felts et al. 2001. Survey of Coastal Resident's Perceptions of Docks. J. P. Riley, Jr. Institute for Urban Affairs & Policy Studies, College of Charleston, South Carolina

Visual Impact Assessment

Visual impacts are determined by considering:

- **Landscape compatibility**
- **Scale contrast**
- **Spatial dominance**

Cross Lake: Before image



Cross Lake: Simulation

Aesthetics Preferences

- Likes:
  - Historic or generic coastal development
  - Water related development
  - Open/distance water views
  - Enhanced water access
  - Diverse, well maintained vegetation
- Dislikes:
  - Development in an undeveloped coastal landscapes
  - Tourist-like commercial development
- Differences in residents vs. visitors & young vs. old

Sources: Banerjee 1987, Cherem & Traweek 1977, Knutson et al 1993, Shannon et al 1990 Smardon 1987, Steinitz 1990, Wohlwill 1983, Zube and McLaughlin 1978, Neimann 1972, Palmer 1978.

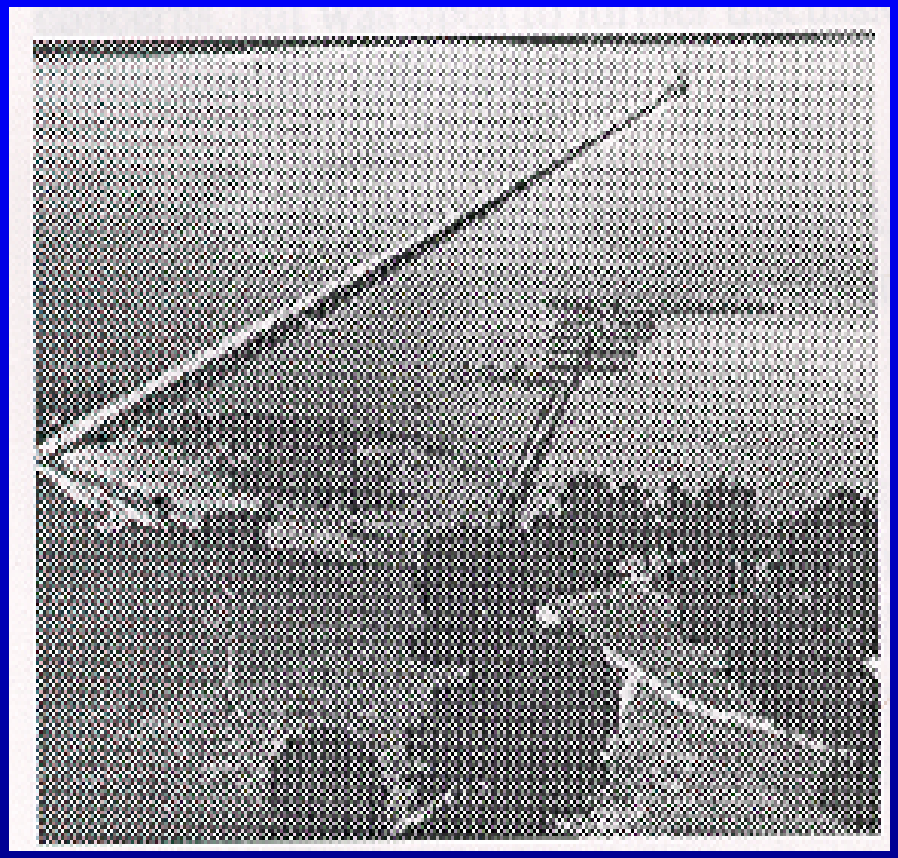
Regulatory Authorities

- **Maine and New York consider aesthetic uses in permitting process.**
- **Maine's Natural Resources Protection Act**
  - Requires an applicant to demonstrate that a proposed activity will not unreasonably interfere with existing scenic and aesthetic uses
  - Allows permit denial based solely on aesthetic impact
  - Defines visual impacts and establishes evaluation procedure and criteria.

Denial based on aesthetics

The Resort itself has significantly changed the character of the shoreline so looking solely at the view from the water and considering the developed nature of Rockland Harbor, visual quality might not be at issue.

Denial based on aesthetics



However, the resort has allowed people to cross from a neighboring park to access the breakwater. This is the only access to the breakwater. From the park, the public has an unobstructed views. The proposal placed the pier directly next to the park were it blocked their view and access to the breakwater. Faced with a draft denial, the applicant withdrew.

Design based on aesthetic impact

Side by side comparison yields different impacts:

Alt 1: Elevated roadway.

Alt 2: Lower road way.

While less noticeable, the lower roadway blocks the horizon so people preferred alternative 1.

(Smardon & Karp 1992)

Recommendations

- Licensing decisions on docks and piers should be based on impacts to habitats, water quality, and existing uses, which include navigation, recreation, and scenic and aesthetic.
- Use should be water appropriate or water reliant.

Recommendations: Design

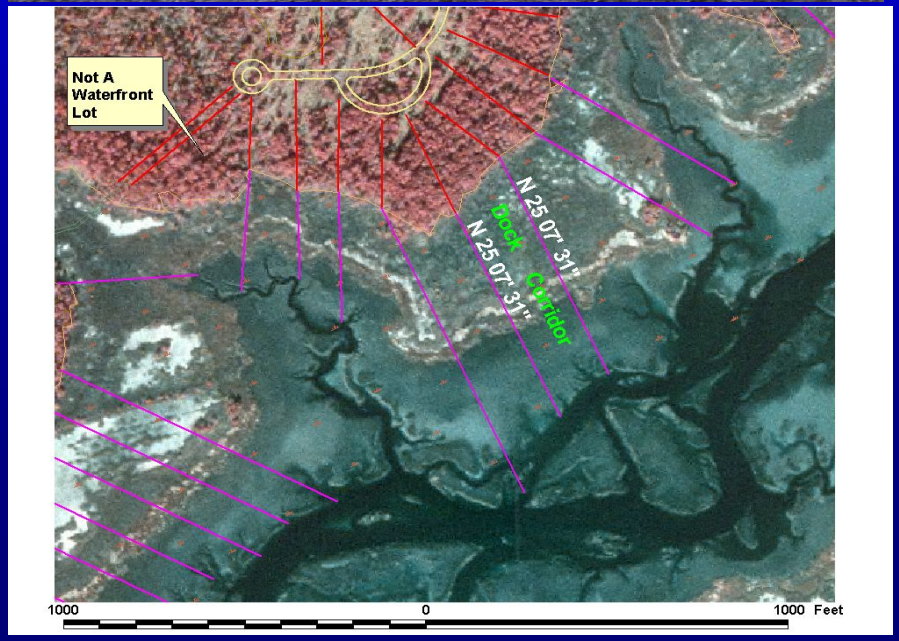
- Minimize shading impacts.
  - height – 4ft min
  - width – 4ft max
  - orientation – N-S may minimize shading impacts
  - length – access to mean low water
- Burdick and Short model – *Dock Design with the Environment in Mind*

Recommendations: Construction

- Consider CCA alternatives in low flow areas.
- Grating can minimize shading impacts in high latitudes.
- Light tunnels, reflective bottoms available.
- Float, rather than walk/drag materials in.
- Use low pressure installation – sharpen piling tips, install with drop hammer.

Recommendations: Boating impacts and navigation

- Dock should provide access to mean low water for a suitably sized boat.
- You have the right to access, not to a huge boat.
- Structures should not extend >25% in the water way
- Structures should not impeded Federal Navigation Projects or traditional navigation paths



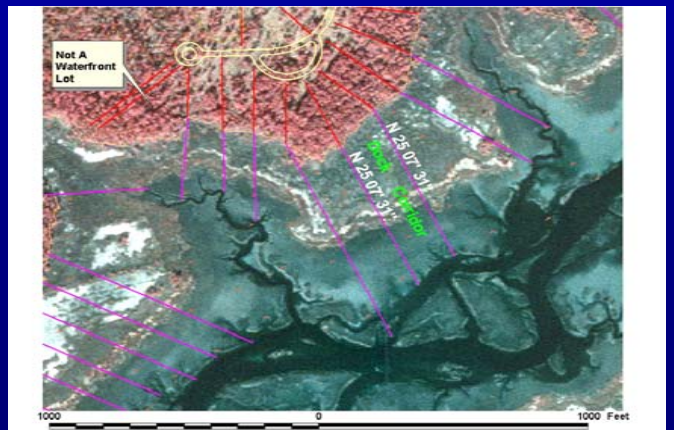
Recommendations: Aesthetics

- Aesthetics should be considered in the permitting process.
- Visual Impact Assessments are a reliable way to predict impacts.
- Surveys are good for values, but not good for aesthetic valuations.

Follow up

Workshop II: Management Tools – Nov. 18-19

- To compile and evaluate available tools (*e.g.*, planning, regulatory, design and construction) for dock and pier management.
- To initiate planning for regional meetings to inform coastal managers and planners about:
  - the environmental and social/aesthetic impacts of docks; and
  - the suite of management techniques available to minimize the direct and cumulative impacts of docks and piers on the coastal environment.



Assessment – Why it's working

1. Relevant - managers defined the problem, involved in planning and follow up
2. Credible – peer-reviewed
3. Timely – synthesis, not new research, used existing funds
4. NOAA paid for managers involvement, information transfer
5. Formal hand off to regional managers

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Follow up

- Synthesize the latest planning, regulatory, design and construction tools, including some case studies of how states/municipalities have used these tools to enhance dock/pier management.
- Compile factors a manager should consider in deciding whether to approve a permit for a residential dock.
- Build a database of current state/municipal methods for evaluating dock and pier proposals (SOPs, checklists, matrix, metrics considered, established standards).
- Expand existing dock and pier literature database to include references on management tools.
- Develop a list server to facilitate discussion between scientists, managers, and industry.

Follow up

- Get the word out fast - proceedings, talks, list servers
- Help managers find resources - searchable, web-based database of literature
- Tools for regulation - peer-reviewed synthesis paper
- Find opportunities to pursue research needs
  - Cumulative impacts
  - Boating impacts
  - Effects associated with altered flow
  - Regional variation, differences
  - Conceptual model to assess impacts of proposed single docks or develop regional dock management plans