A New Oyster for Chesapeake Bay?

Status of the Asian Oyster EIS & NOAA's Research Initiative

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Proposal to Introduce

- Intentional introduction of a non-native species: *Crassostrea ariakensis* (Asian or Suminoe oyster) – “Oregon strain”
- Joint Maryland/Virginia Proposal
- Purpose: *To establish an oyster population that reaches a level of abundance in Chesapeake Bay that would support sustainable harvests comparable to harvest levels during the period 1920-1970.*
- Proposed introduction is in state waters, but there are potential inter-state issues and effects beyond Chesapeake
- Federal jurisdiction is unclear

Timeline

1991 — VA industry requests non-native oyster

1992

1993 — First *C. gigas* study at VIMS
CBP Policy on Non-indigenous Aquatic Species

1994

1995

1996

1997 — First *C. ariakensis* (then called *C. rivularis*) study at VIMS

1998

1999

2000 — VSC industry aquaculture trial #1 (3,000 triploids)

2001 — VSC industry aquaculture trial #2 (60,000 triploids)

2002 — NC aquaculture project

2003 — NRC report released; STAC workshop
VSC industry aquaculture trial #3 (1,000,000 triploids)

2004 — EIS begins following congressional direction
NOAA initiates research program to support EIS

2005

National Research Council (NRC)

National Academy of Sciences

Science Advisers to the Nation

Non-native Oysters in the Chesapeake Bay

Released August 2003

Sponsors: Chesapeake Bay Commission

EPA	MDNR	MD Sea Grant
NOAA	VADEQ	VA Sea Grant
FWS	NFWF	CT Sea Grant

NRC – Highlights

- Examined case studies of shellfish introductions worldwide
- Compared global and regional (MD vs. VA) patterns of oyster aquaculture vs. public fishery systems
- Studied U.S. and international regulatory framework for managing non-native species introductions
- Identified initial elements for risk assessment of the proposed introduction in Chesapeake Bay
- Evaluated 3 management options
- Identified some common misconceptions… 5 Myths

NRC – Management Options

1. No use of non-native
   - ecologically reversible
   - economic decline may be irreversible
   - threat of a rogue introduction

2. Triploid aquaculture/research (6-7 years)
   - unlikely to solve the fishery crisis
   - reversible, at least in the early stages
   - perception of progress (less threat of rogue actions)
   - already closely scrutinized by CBP partners

3. Introduction of diploid
   - may or may not have desired outcomes
   - irreversible
   - ill-advised given current knowledge

NRC – Identified 5 Myths

Myth I: Declines in the oyster fishery and water quality of Chesapeake Bay can be quickly reversed

Myth II: Oyster restoration, whether native or non-native, will dramatically improve water quality

Myth III: Restoration of native oyster populations has been tried and will not work

Myth IV: *C. ariakensis* will rapidly repopulate the Bay, increasing oyster landings and improving water quality

Myth V: Aquaculture of triploid *C. ariakensis* will solve the economic problems of a devastated fishery and restore ecological services once provided by the native oyster

STAC Report

Scientific and Technical Advisory Committee
of the Chesapeake Bay Program

Workshop December 2003

Sponsors:
Chesapeake Bay Program
NOAA Chesapeake Bay Office

- Diploid introduction would be irreversible
- Spread beyond Chesapeake Bay would be inevitable
- Detailed research needs: 5 years minimum

Environmental Impact Study (EIS)

EIS Project Delivery Team (PDT)

Lead Agency:	Army Corps of Engineers (Norfolk District)
Co-Leads:	Maryland (MDNR) Virginia (VMRC)
Cooperating Agencies:	NOAA EPA FWS

EIS Steps

- Notice of Intent – Jan 5, 2004
- Public Scoping Meetings

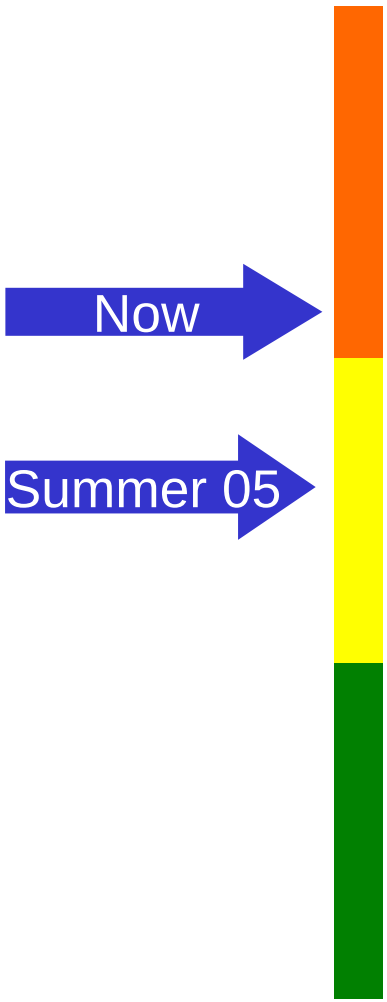
7 Alternatives:

1. No action
2. Expand native oyster restoration
3. Harvest moratorium
4. Native oyster aquaculture
5. Non-native oyster aquaculture
6. Introduce alternative non-native species
7. Introduce *C.a.* & discontinue native restoration
8. Combination of alternatives

EIS Steps

- Notice of Intent – Jan 5, 2004
- Public Scoping Meetings
- Risk Assessment, Decision Criteria, Evaluation of Alternatives
- Draft EIS
- Public Comment Period
- Final EIS
- Record of Decision

Tiered Risk Assessment



Tier 1: Risk characterization
Literature search
Identify:

- assessment endpoints
- analytical tools (models)
- data needs

Tier 2: Incorporates data from short-term studies, preliminary model runs, quantifies remaining uncertainty

Tier 3: Full risk assessment with project-relevant data from longer-term research, all major data gaps filled

NOAA Research Initiative

Guiding Documents:

- National Research Council (NRC)
- Scientific and Technical Advisory Committee (STAC)
- International Code of Practice on the Introduction and Transfers of Marine Organisms (ICES Protocols)

NOAA Research Initiative

Ecological

- water quality
- reef habitat

Economic

- local watermen
- processing industry

We need to determine:

- theorized benefits are real
- benefits will outweigh the risks/costs
- benefits can be achieve more quickly and cost-effectively with a non-native species than with the native oyster

NOAA Research Initiative

Biological Assessments

Economic Assessments

Summary of Research Needs for a Defensible EIS on the Non-native Oyster

Federal consensus document by NOAA, EPA, FWS

Major Research Topics

1. Understand *C. ariakensis* in its native range
2. Potential for population growth/sustainability
3. Susceptibility to known diseases
4. Interactions with native oyster
5. Human consumption risks
6. Potential to be fouling nuisance or invasive
7. Ecosystem services (reef, filtration, food web)

Understand *C.a.* in Native Range

- Taxonomy
  - What species are we dealing with?
  - Utility of previous literature?
- Population Genetics
  - Different genetic strains or phenotypic plasticity?
  - Which regions/genetic strains best for broodstock?
- Pathogens
  - Response to pathogens in native environment?
- Ecology
  - Do they build reefs? Under what conditions?
  - Competitive interactions with other oyster species?
  - Environmental tolerances?

Population Growth & Sustainability

- Demographic Model
- Larval Transport Model
- Data for Model Parameterization
  - Fecundity (size-specific)
  - Sex ratio
  - Fertilization coefficient
  - Effective fertilization distance
  - Spawning cues and synchrony
  - Interspecific gamete competition
  - Growth rate (age-specific)
  - Natural mortality (egg, larval, juv, adult)
  - Fishing mortality
  - Larval behavior
  - Substrate preference
  - Metamorphosis rate
  - Bottom type distributions
  - Existing C.v. populations
  - Environmental tolerances

Disease

- *Bonamia sp.*
  - Discovered in North Carolina
  - Could it spread to Chesapeake Bay?
- Herpes virus
  - Vertical transfer
- Other viral pathogens
- Common parasites and pathogens
  - Shell disease (*Polydora*, shell blisters)

Interactions with *C. virginica*

- Hybridization
- Gamete competition
- Ecological competition
  - Space
  - Food

Human Consumption Risks

- Uptake and clearance rates
  - Bacteria (fecal coliform)
  - Viral human pathogens
  - Protozoan human pathogens

Potential for Fouling Nuisance

- For example: Zebra Mussels
  - Will *C. ariakensis* become invasive?

Ecosystem Services and Functions

- Reef building
- Water quality
- Food web dynamics

NOAA Research Initiative

Biological Assessments

Economic Assessments

Summary of Research Needs for a Defensible EIS on the Non-native Oyster

Federal consensus document by NOAA, EPA, FWS

Economic Issues

- Spread to other regions with native oyster industries or aquaculture?
  - to the north – NJ, DE, CT, RI, MA, ME
  - to the south – NC, SC, GA, FL, Gulf states
- Disruption of market supply-demand?
  - current U.S. oyster supplies meet market demand
- Marketable product?
  - shelf-life and shipping (gapers, thin shells)
  - taste tests cancelled in NC (poor meat quality)
  - not commercially grown anywhere in world
  - grows fast in Chesapeake Bay (VSC pilot)
- Magnitude of economic and socio-cultural benefits anticipated?

Research Timeline

How long will this research take?

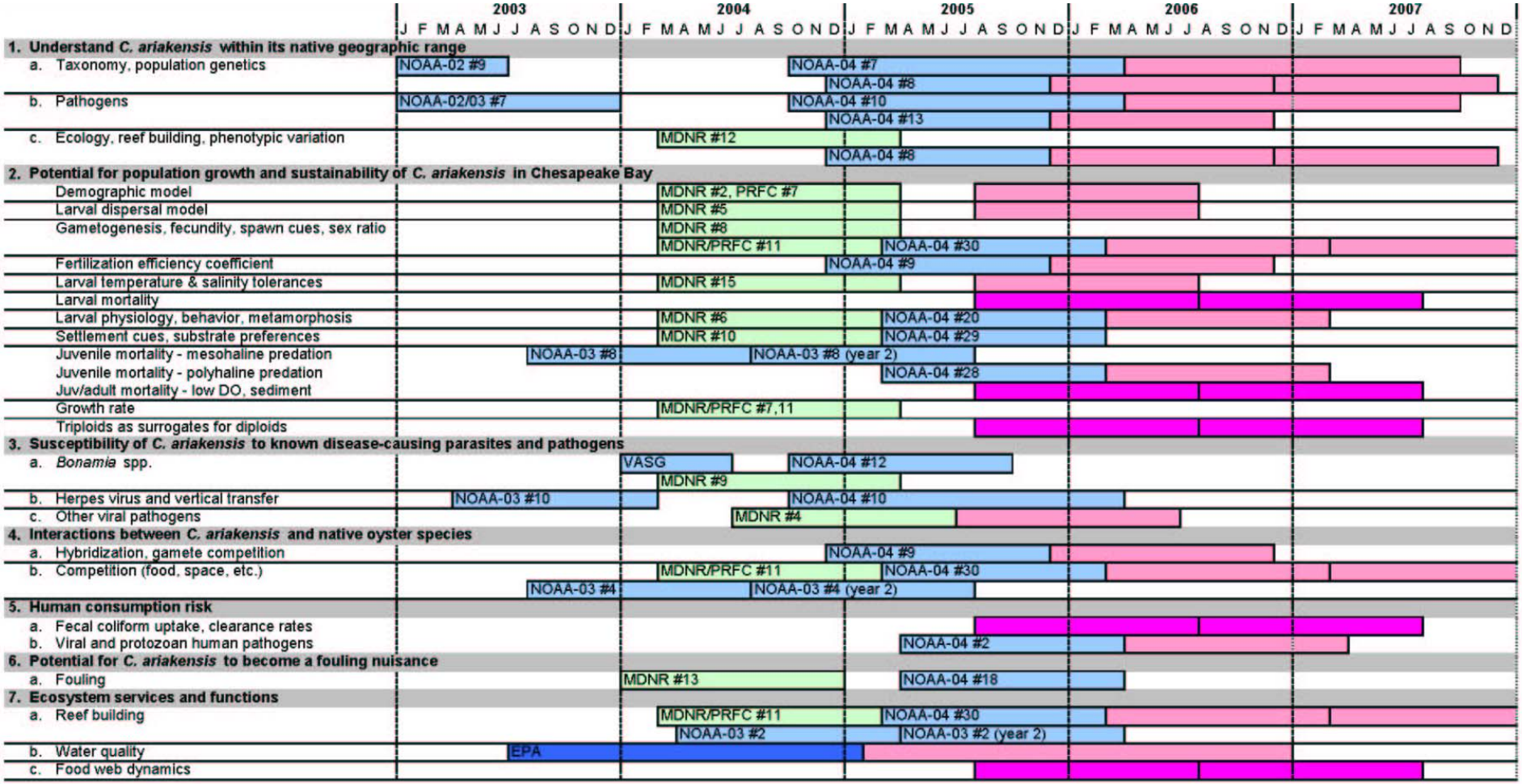
NRC: 6-7 years (maybe 5 years)

STAC: 5 years

Why?

- need to study adults, not just juveniles
- competitive interactions play out over time
- sequential nature of scientific investigation

Research Timeline



Funding Sources

- NOAA
- Maryland DNR
- Potomac River Fisheries Commission
- Virginia Sea Grant
- EPA Chesapeake Bay Program

NOAA Funding

Sponsor NRC study (FY02)	$ 50 K
National Sea Grant ODRP (FY03, FY04)	$352 K
Biosecurity/monitoring VSC trial (FY03)	$ 1 M
Research Initiative (FY04)	$ 2 M
Research Initiative (FY05)	$ 2 M
Research Initiative (FY06) anticipated	*$ 2 M*
TOTAL	**> $ 7.4 M**

Institutions

University of Maryland
- UMCES Horn Point Laboratory
- UMCES Chesapeake Biological Lab
- Biotechnology Institute, COMB
- College Park

Virginia Institute of Marine Science
- Gloucester Point
- Eastern Shore Laboratory

Smithsonian Env. Research Center

Hainan University

Institute of Oceanology Chinese Academy of Sciences

Rutgers University
- Haskins Shellfish Research

University of North Carolina
- Institute of Marine Science

North Carolina
- Division of Marine Fisheries

Johns Hopkins University
- Bloomberg School Public Health

Cooperative Oxford Lab

Versar, Inc.

Lynnhaven River, Virginia
Natural recruitment of native oysters following restoration.

Courtesy of Chesapeake Bay Foundation

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NOAA Funding

Native Oyster Restoration
Chesapeake Bay

Large-scale restoration – Maryland	$ 2 M
Large-scale restoration – Virginia	$ 2 M
Small watershed projects	$ 200 K
Oyster disease research (Sea Grant ODRP)	$ 2 M
NOAA divers – monitoring	?
TOTAL:	**> $ 6 M/yr**