Evolution of Biogeography in the 21st Century
Development of a North Pacific Nonindigenous Species Database

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Charles Darwin entering natural history information into the PICES database.
Capture natural history in a hierarchical fashion to accommodate different needs and levels of knowledge.

For many questions, precise numerical habitat requirements or physiological tolerances are not needed and habitat and physiological classes will suffice.

Geography is biology – use distributions to infer habitat requirements and physiological tolerances.

Queriable natural history requires standardization even at the loss of some ecological nuance.

There will never be complete agreement. ("You can't please everyone, so you've got to please yourself" Garden Party, Rick Nelson, 1972)
Problem:
Natural history data are underutilized because of the difficulties in synthesizing information from multiple text-based sources.

Overall Goal:
Develop and populate a database of marine/estuarine species that can be queried for distributional, ecological, and physiological data at different taxonomic levels and spatial distributions.

Objectives of Present Project:
Develop an Access database structure and user interface for natural history data related to the potential for invasion of North Pacific species.
Species – Add/Edit
Hierarchical Biogeography - Realms

Environment And Biogeography

Mercenaria mercenaria

Biogeography | Regime | Ecosystem | Depth | Substrate | Energy | Temperature | Salinity

Update Database | Legend | Classify | Close | View / Edit Comment | View Summary | Advanced

MEOW (Spalding et al. 2007)

Select Publication | Coan et al., 2000

Arctic
Temperate Northern Pacific
Central Indo-Pacific
Eastern Indo-Pacific
Tropical Eastern Pacific
Temperate South America
Southern Ocean
Temperate Northern Atlantic
Western Indo-Pacific
Tropical Atlantic
Temperate Southern Africa
Hierarchical Biogeography - Provinces

Temperate Northern Pacific Realm

Mercenaria mercenaria

Realm: Temperate Northern Pacific

Biogeography Legend

Classification
- Native
- Nonindigenous
- Cryptogenic
- Transient
- Unclassified

Population
- Established
- Not Established
- Unknown
- Stocked

Established
A self-maintaining natural population, as indicated by its population size, occurrence over time, wide geographical distribution, and presence of juveniles and/or reproductive adults.
Hierarchical Biogeography - Ecoregions

Temperate Northern Pacific Realm

Mercenaria mercenaria

Realm: Temperate Northern Pacific

Province: Cold Temperate Northeast Pacific

Legend  Update Database  Close  Classify  View / Edit Comment  View Summary
Hierarchical Biogeography - Estuaries
Habitat

Mya arenaria

Unconsolidated Ecosystems
- Unvegetated Sediment
- Submerged Aquatic Vegetation
  - Macroalgal Beds
  - Emergent Marsh
  - Mangrove
  - Dune
  - Wrack
  - Other

Consolidated Ecosystems
- Coastal Shore
  - Burrowing Shrimp
    - Tide Flats
      - Clastic Sediments
      - Carbonate Sediment
    - Subtidal
      - Clastic Sediments
      - Carbonate Sediment

Pelagic Ecosystems

Update Database  Classify  Close  View / Edit Comment  Advanced
Temperature

Mya arenaria

Temperature Class Based On Annual Ranges

- Cold Water: No months > 10 degrees Celsius with minimum approaching 0 degrees Celsius
- Cool Temperate: Less than 4 months > 10 degrees Celsius
- Mild Temperate: Six months at 10 degrees Celsius and <= 4 months at 15 degrees Celsius
- Warm Temperate: No months cooler than 10 degrees Celsius and >= 4 months >= 15 degrees Celsius
- Outer Tropical: No months cooler than 10 degrees Celsius and approx. 4 months 20 degrees Celsius
- Inner Tropical: No months cooler than 18 degrees Celsius and >= 6 months 20 degrees Celsius

Physiological Class

- Stenothermal
- Mesothermal
- Eurythermal

Adult

- Minimum: [C]
- Maximum: [C]

Reproductive

- Minimum: [C]
- Maximum: [C]
Trophic Level And Feeding

Mya arenaria

- Trophic Level And Feeding
- Reproduction
- Development
- Habitat Assoc
- Life Style

- Symbiotic
- Parasite / Disease
- Ectoparasite
- Endoparasite
- Disease
- Symbiotic Algae

- Trophic Mode (Trophic Level)
- Photosynthetic
- Chemosynthetic
- Primary Producers (1)
- Herbivore (2)
- Predator (3 - 6)
- Scavenger
- Detritivore
- Decomposer
- Suspension Feeder
- Deposit Feeder
- Other

- Secondary Consumer (3)
- Tertiary Consumer (4)
- Quaternary Consumer (5)
- Quinary Consumer+ (6)

- Surface Deposit Feeder
- Subsurface Deposit Feeder

- Obligate
- Facultative

- Grazer
- Folivore
- Other
- Active
- Passive

Update Database
Close
View / Edit Comment
Advanced
Invasion - Vectors

Mya arenaria

Vectors

- Ships - Commercial
- Moveable Structures
- Aquaculture and Fisheries
- Infrastructure Development
- Research, Education, and Mitigation
- Aquarium and Plant Trade
- Recreational Boating and Fishing
- Live seafood
- Habitat Restoration and Mitigation
- Other / Unknown

Intentional Stocking / Release
- Aquaculture Escapees
- Aquaculture Associated
- Intentional Illegal Release
- Other

Atlantic Oysters
Pacific Oysters
The Evolution of Natural History for the 21st Century

Next Steps

Develop output utilities
Incorporate pictures of species
Add ability to access information pdf’s
Add automated import utilities
and
Populate for North Pacific Invaders
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Questions

Please visit the e-poster session on Thursday evening for a live demonstration of PICES Nonindigenous Species Information System