Salish Sea Ecosystem Conference

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Restoration action effectiveness: employing the concept of net ecosystem improvement

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Restoration Action Effectiveness: Employing the Concept of Net Ecosystem Improvement

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NW Straits Marine Conservation Initiative
Mission and Questions

Mission: "Protect and restore marine waters, species and habitats of the Northwest Straits to achieve **ecosystem health** and sustainable resource use through a citizen based approach"

The Tough Questions:

– How do we quantify and measure MRC project contribution in advancing Puget Sound ecosystem health and protection?

– How can we show we are making a difference?

Objective of this Work

- Utilize the outstanding work of the seven Marine Resources Committees (MRC's) to provide a **relevant and science-based perspective on the effects** of citizen-based actions on the health of the Puget Sound ecosystem.
  - Assess ability to quantify the outcomes
  - Make sure the approach is backed by the MRCs and Commission

Net Ecosystem Improvement (NEI)

- The ecosystem is fragmented, and some components are lost or degraded.
- The actions are de-fragmenting the ecosystem by protecting intact habitats and species in combination with restoring lost and degraded habitats and species in the ecosystem.
- NEI is being initiated as a workable method to address the mission of improving **ecosystem health** of the Straits.

NEI Definition – "…following development, there is an increase in the size and natural functions of an ecosystem or natural components of the ecosystem." (Thom et al. 2005)

**NEI** = Δfunction x area x probability

NEI Elements
(Diefenderfer et al. 2016, *Ecosphere*)

- Identify the *function* or *service* associated with an action using evidence summarized in a conceptual model
- Establish relationship between area (or other quantifiable measure of amount) and function
  - Verify relationship on site or with data from several comparable areas
- Define the area over which that function operates at your site
- Document assumptions
- Develop a focused monitoring plan as needed
- Develop a team dedicated to the analysis
- Disseminate the results

Example of an Ecosystem Model

Great Blue Heron
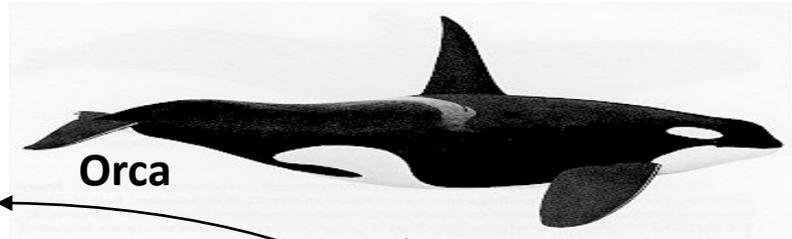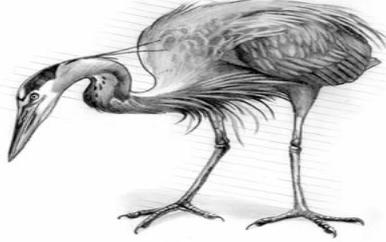
Orca

Scoters and other marine birds

Pacific salmon

food

food

food

Habitat, nesting sites

Nesting sites

Food (as larvae)

Dungeness crab

Feeding habitat

food

Olympia oysters

food

Forage fish

Feeding habitat, refuges

habitat

Eelgrass and kelp

Spawning, feeding, refuges

Spawning sites

Coastal forests

Shade for spawning

Habitat, sediment

Habitat, sediment

Beaches and bluffs

Woody debris

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EXAMPLE: Jefferson County MRC
Eelgrass Protection Program
(contact Cheryl Lowe; http://www.jeffersonmrc.org/projects/)
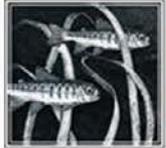
VOLUNTARY NO ANCHOR ZONES

Disturbance - Action Model

Undisturbed eelgrass meadow

Boat anchoring

Shading from moored boats

Propeller scour of bottom

Anchor chain drag scour of bottom

Eelgrass disruption and loss

Loss of Net Eelgrass Primary Production

Loss of Dungeness crab rearing and reproduction habitat
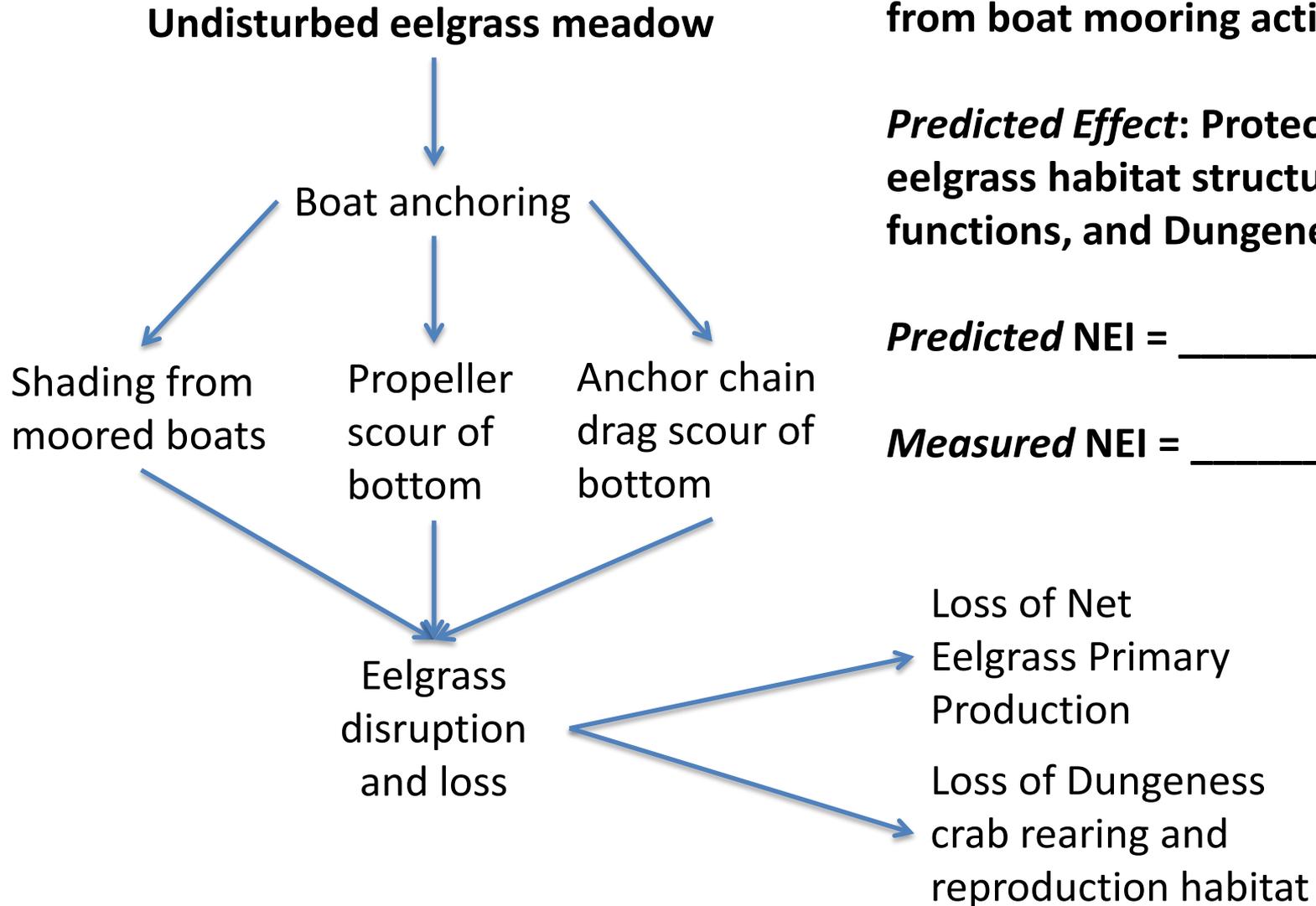
Action: **Establish anchor out zone to eliminate disturbances from boat mooring activities**

Predicted Effect: **Protection of eelgrass habitat structure and functions, and Dungeness crab**

Predicted **NEI = _____**

Measured **NEI = _____**

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Action Effectiveness Model (NEI) Applied to the *Eelgrass Protection Program*

- NEI = Δfunction x area x probability
  - *Example Action*: Eelgrass anchor out zone in Port Townsend
    - Functions
      a. Net primary production of eelgrass (total biomass produced/year)
      b. Crab refuge and protection (number of crabs protected)
    - Area = 52 acres (210,436m^2) protected in Port Townsend
    - Data set from Drayton Harbor (Thom et al. 1989), mouth of Sequim Bay (Thom et al. 2008), Straits eelgrass (Christiaen et al. 2016)

Eelgrass Net Primary Production
(an ecosystem 'function')

- <u>NPP Protected*</u>:

  $= 210,436 m^2 \times 900g$ dry m^{-2} year^{-1}

  $= 189,392 kg$ eelgrass dry year^{-1}

  $= 2,083$ tons wet eelgrass year^{-1}

- <u>Area of Eelgrass Protected *Perspective*</u>:

  $= 21.04$ha at PT

  $= 0.6\%$ (0.5 – 0.8%) of total Straits eelgrass (3,710 ±899ha)**

  $= 0.09\%$ of total Puget Sound eelgrass (23,150ha)**

  $= 21.04$ha/4,000ha PSP goal $= 0.5\%$ of goal

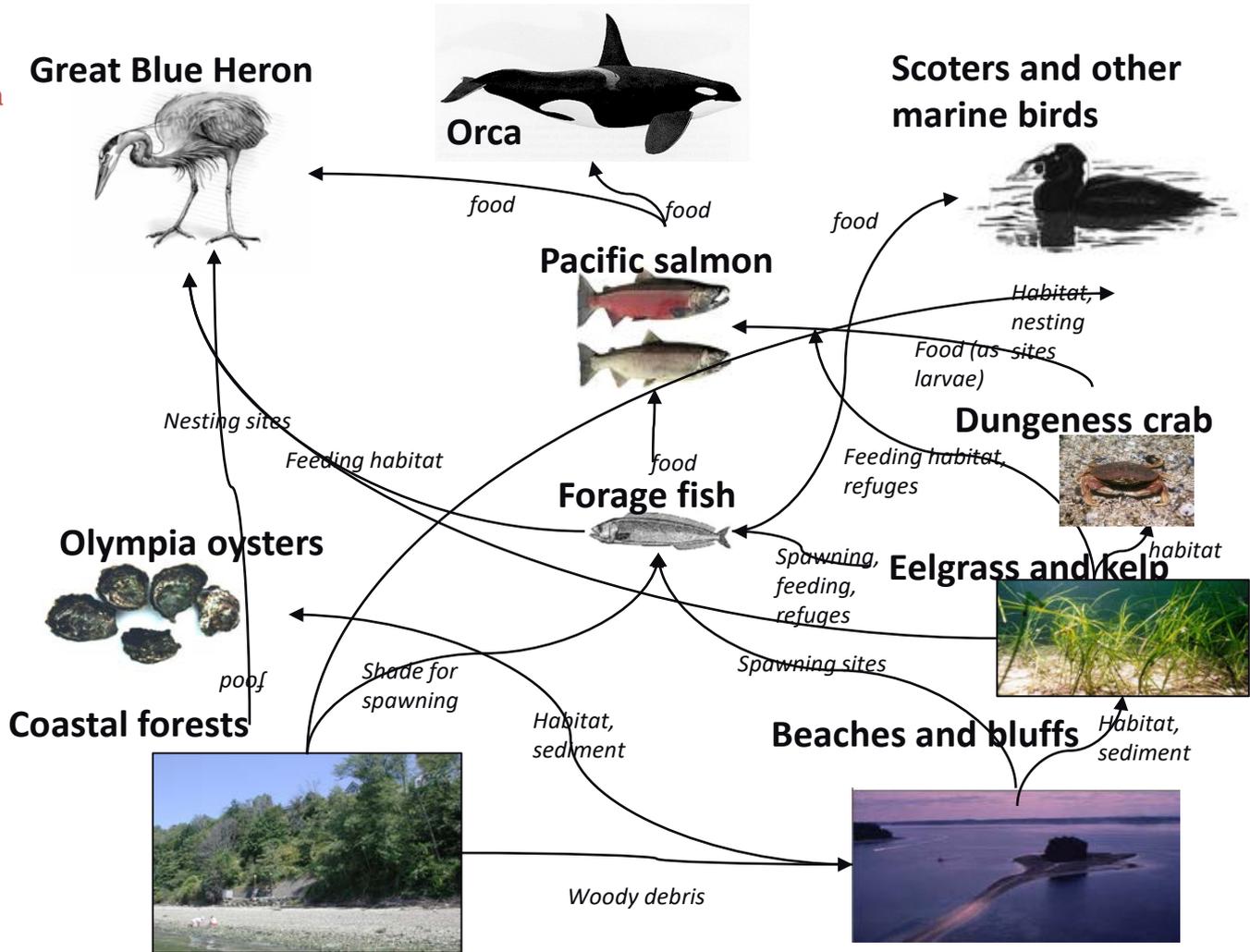(*Assumes that unprotected eelgrass would be damaged and/or functionally impaired; **Christiaen et al. 2016)

Dungeness Crab Protection
(contributes to an ecosystem 'service')

- Area of eelgrass protected = 210,436m^2

- Median crab density* = 0.16 m^{-2} (range 0.019 – 0.314 m^{-2})

- Crabs protected = 0.16 m^{-2} x 210,436 m^2
  - median = 33,670 (range = 3,998 – 66,077)

- Contribution to harvestable males**
  - median = 6,415 (range = 762 – 12,590)

(*Thom et al. 1989; **conversions in Higgins et al. 1997, Science 26:1431-1434)

Kelp recovery

Ocean acidification

Olympia oyster restoration

Derelict gear

Pinto abalone restoration

Blue carbon storage

Herring spawning support

Marine debris

Juvenile salmon support

Phytoremediation

Rain gardens

Bowman Bay restoration

Catch More Crab

Crabber outreach

Sound IQ- data
General outreach

Great Blue Heron

Orca

Scoters and other marine birds

food   *food*   *food*

Pacific salmon

Nesting sites

Feeding habitat

Habitat, nesting sites

Food (as larvae)

Dungeness crab

food

Forage fish

Feeding habitat, refuges

Olympia oysters

Spawning, feeding, refuges

Eelgrass and kelp

habitat

pool

Shade for spawning

Spawning sites

Coastal forests

Habitat, sediment

Beaches and bluffs

Habitat, sediment

Woody debris

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Summary

- Provides science-based evidence of action effectiveness
- Places actions in a broader ecosystem perspective
- Simple to calculate and communicate
- Helps proposers explain how effectiveness will be assessed
- Provides basis for an action-effectiveness monitoring plan
- Provides link to the mission
- Helps justify funding for the program
- Initiated in 2018 with the hire of a part time staff member