

Potential Impacts of Wave Energy Projects to Migration and Habitat Use of Green Sturgeon

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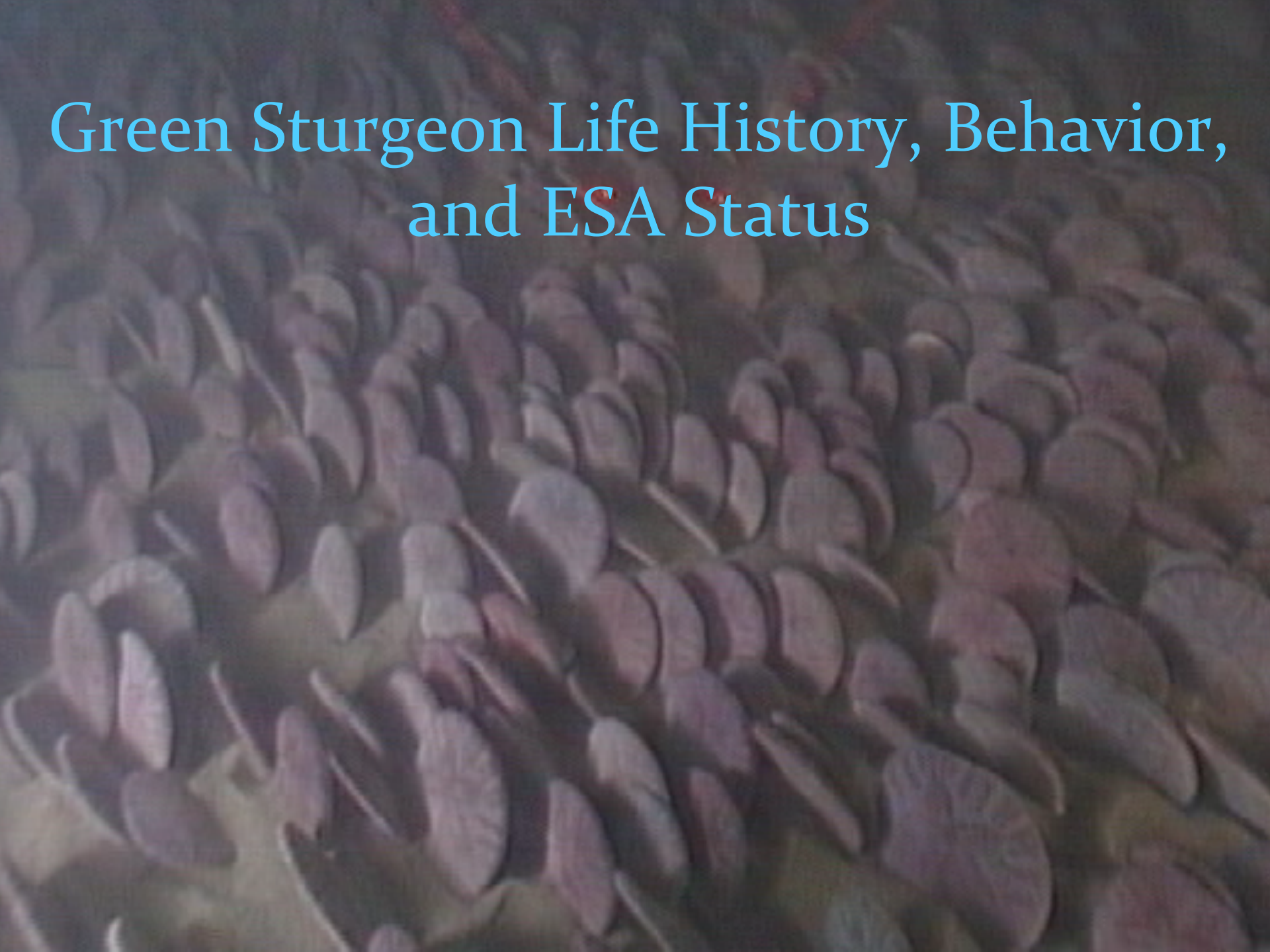
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Scope

- Green sturgeon life history / behavior / ESA status
- Planned wave energy site off Reedsport, Oregon
- Potential conflict with “migratory corridor”
- Proposed study to evaluate this potential conflict

Green Sturgeon Life History, Behavior, and ESA Status



Green Sturgeon

Spawn in 3 River Systems:

- ❑ Rogue River (OR)
- ❑ Klamath River (CA)
- ❑ Sacramento River (CA)

Two Distinct Population Segments

- ❑ Northern (Rogue & Klamath)
- ❑ Southern (Sacramento)

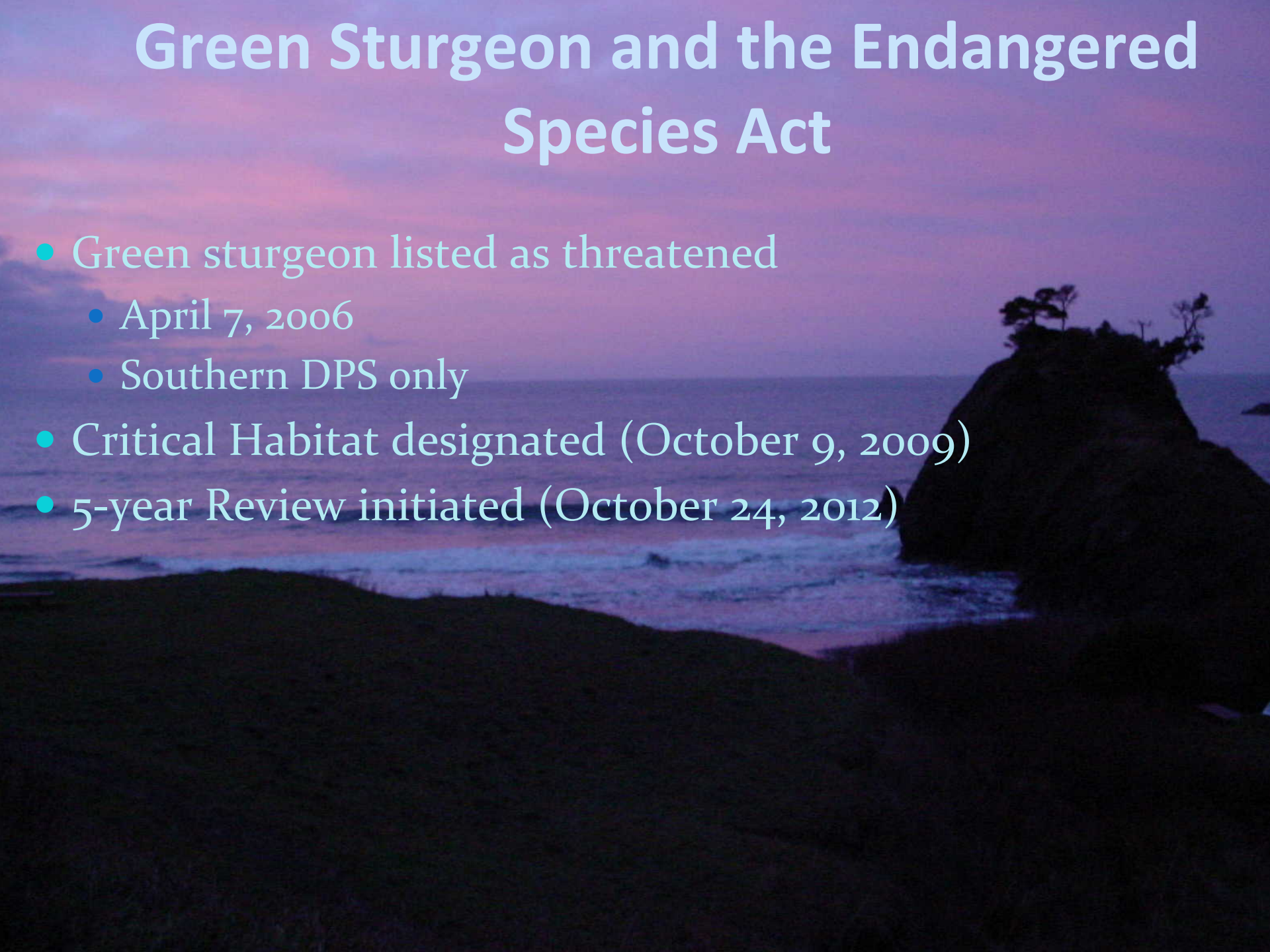
Anadromous

- ❑ Feed in ocean (nearshore) and estuaries
- ❑ Return to rivers to spawn once every 2 – 4 years



Green Sturgeon and the Endangered Species Act

- Green sturgeon listed as threatened
 - April 7, 2006
 - Southern DPS only
- Critical Habitat designated (October 9, 2009)
- 5-year Review initiated (October 24, 2012)



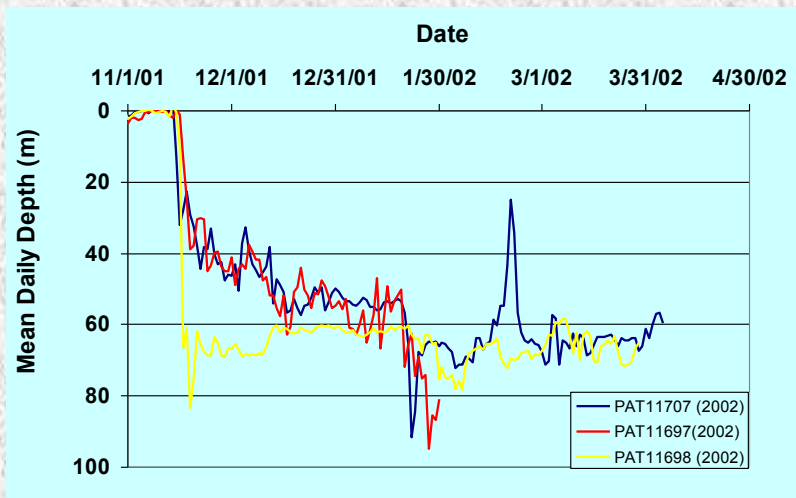
Timing of Migration (adults)

Activity	Time Period
Enter rivers (to spawn) and estuaries (to feed)	March - June
Leave rivers and estuaries	October – November
Oceanic nearshore (to feed)	November – February (or year-around)

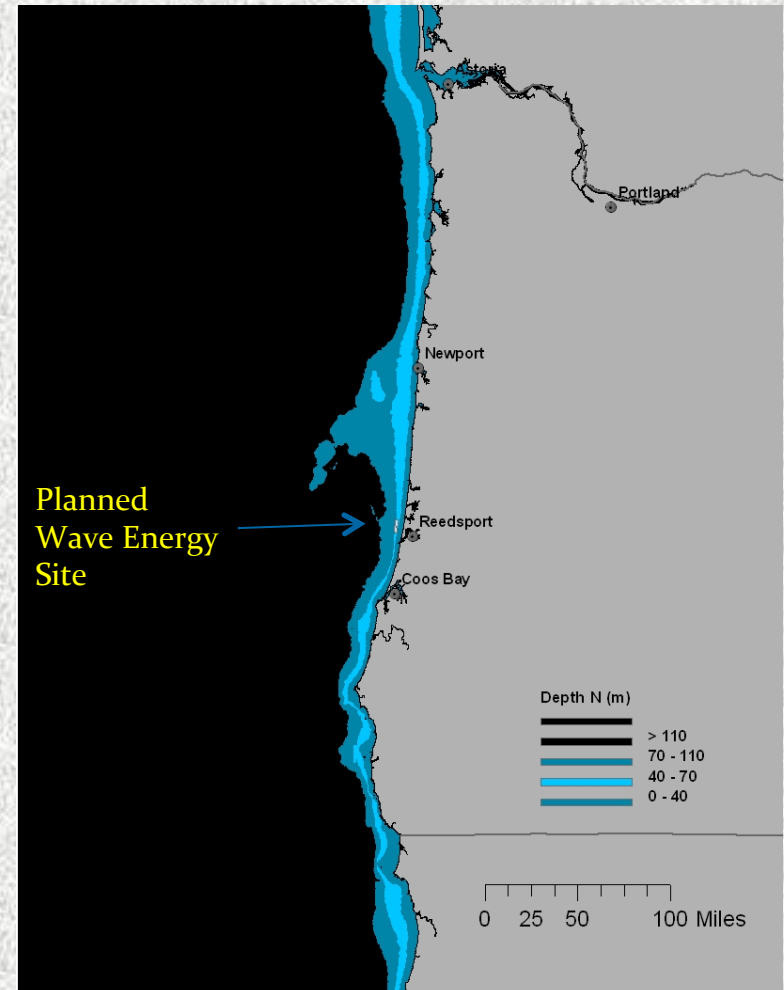
Note: This table is shown for example only, and should be considered an approximation and generality. For example, adult green sturgeon may enter and leave estuaries throughout the spring through fall months, but are generally all back in the ocean before December. Behavior may be different between adults and juveniles.

Oceanic Critical Habitat & Modeled “Migratory Corridor”

- Critical Habitat: 0 - 110 m (light & dark blue)¹
- Depths most frequently inhabited: 40 - 70 m (light blue = “migratory corridor”)¹
- Wave Energy Project planned outside of Umpqua River Estuary (feeding hotspot?)



¹Based on satellite tagging data and Oregon logbook data (Erickson and Hightower 2007; Lindley, unpublished data)



Importance of Umpqua River Estuary for Green Sturgeon (result of telemetry studies)

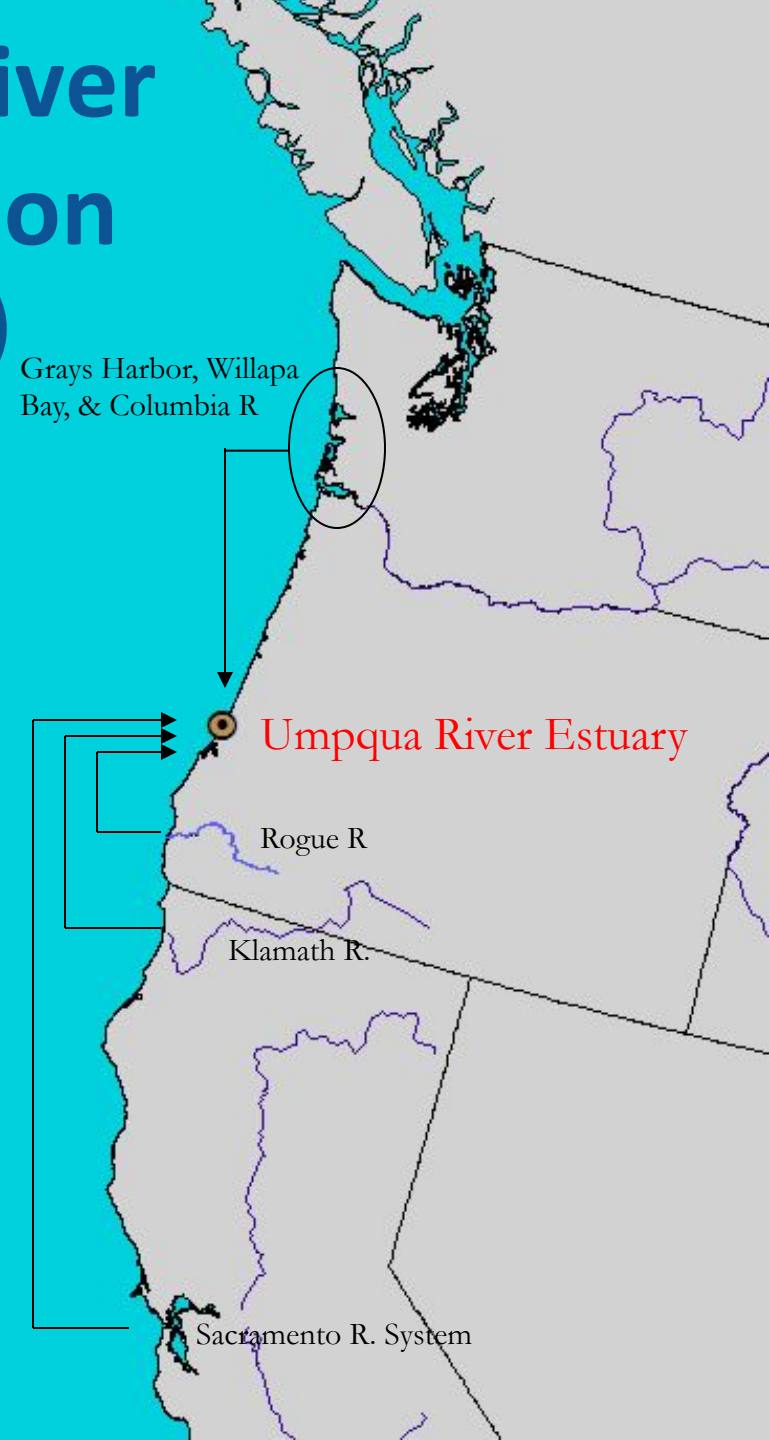
Tagging locations:

Grays Harbor, Willapa Bay, Columbia R.,
Rogue River, Klamath River, Sacramento R.

Some tagged individuals from each tagging location utilized the Umpqua River Estuary

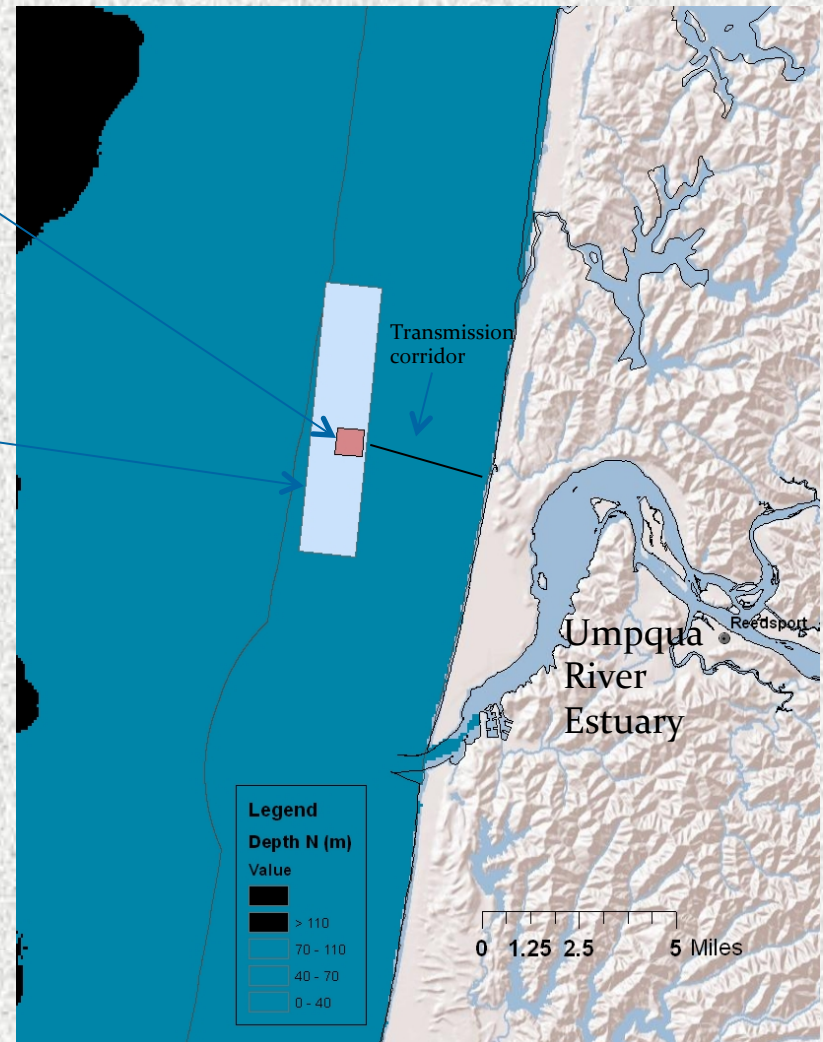
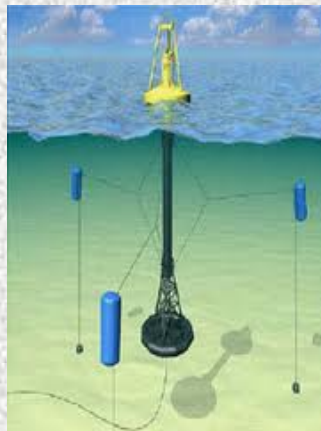
This estuary designated critical habitat

Note: Tagged green sturgeon were detected in SE Alaska, north of Vancouver Island, coasts of WA, OR, and CA, Yaquina Bay, Siuslaw River Estuary, Alsea Bay, Umpqua River Estuary, and Coos Bay. Green sturgeon also visit other bays that were not included in these acoustic studies. For example, Nehalem Bay, OR is designated critical habitat.

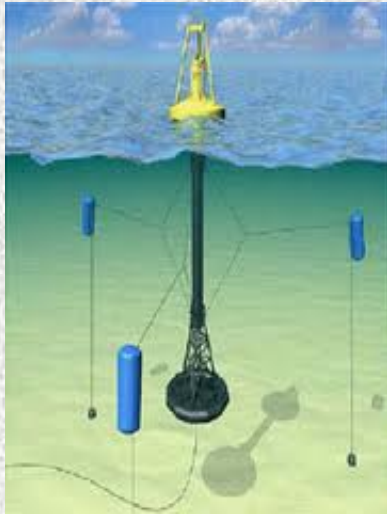


Reedsport Wave Energy Site

- 10-Buoy Site (licensed)
 - Expected deployment between 2013 – 2017
 - Project area ~0.25 square miles
 - Transmission corridor (2.6 miles long; 50' wide)
- 100-Buoy Expanded Phase
 - Not licensed
 - Project area = 1 x 5 miles
 - Depth range = 46 – 69 m



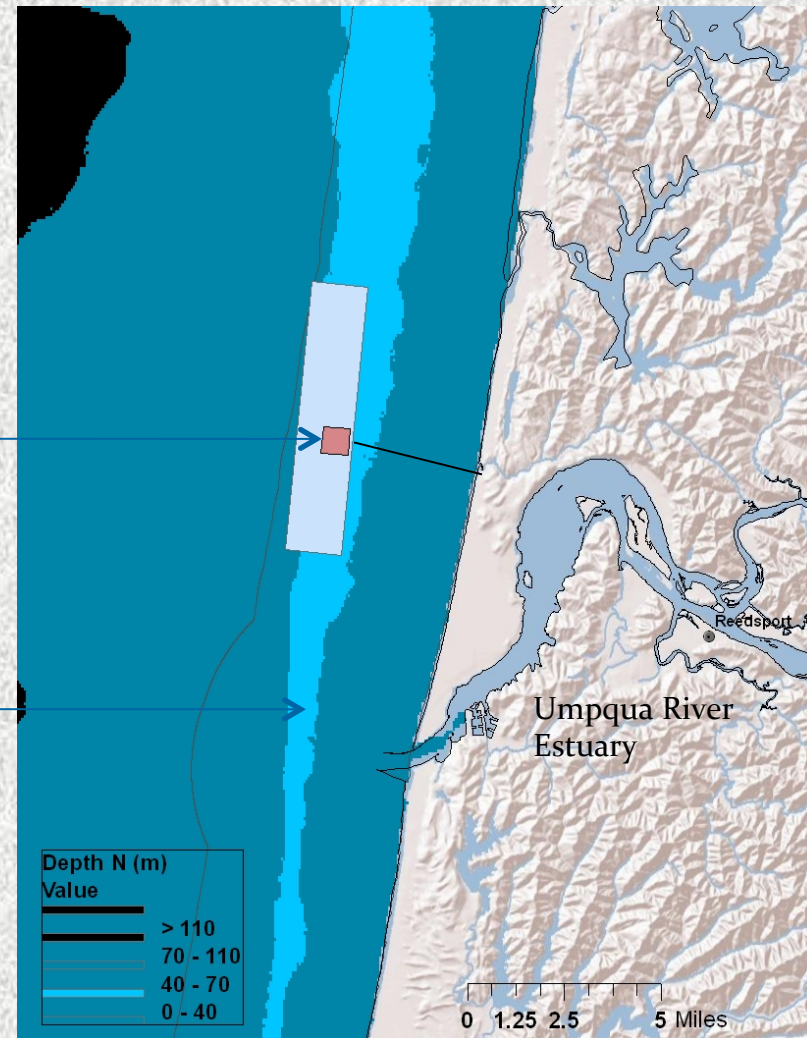
Potential Conflict



Wave Energy
Development

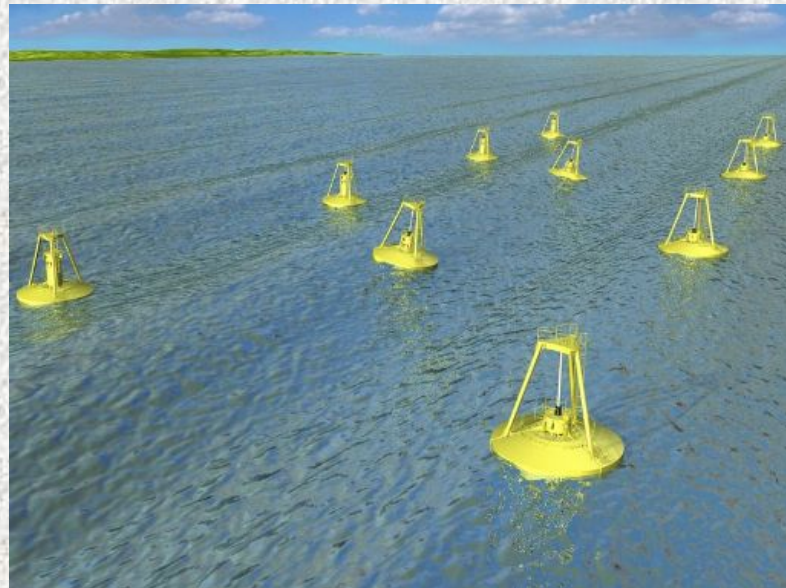
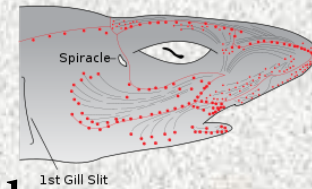


Green
Sturgeon
Migratory
Corridor



How Wave Energy Might Impact Green Sturgeon

- Electro Magnetic Field (EMF)
 - Like sharks, sturgeons have sensitive electroreceptors
- Noise
- Predators
- Habitat alteration



Proposed Study



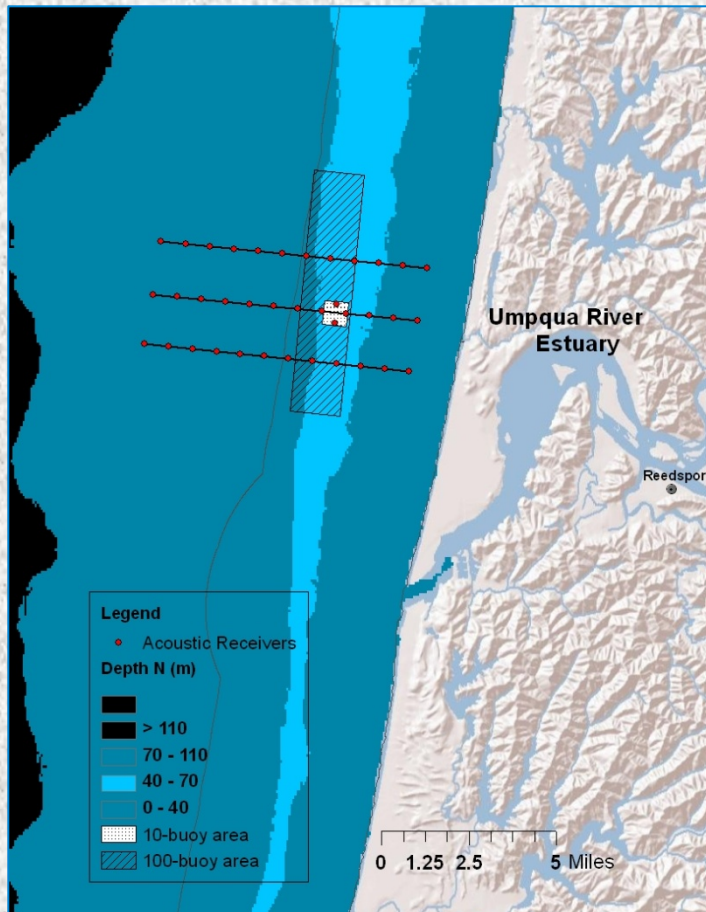
Acoustic-Telemetry

- Numerous green sturgeon are already at-large carrying long-lived coded acoustic transmitters ($n > 350$)



Study Design

- Lines of acoustic receivers will be deployed and anchored at sea to detect green sturgeon passing



Baseline (before) and “After” Studies

- Baseline Study (prior to completion of 10-buoy array)
 - 3-Lines of receivers will be deployed beginning February 2013 (testing will begin earlier)
 - Baseline study will be completed by ~ June 2014
 - Monitoring will encompass 3 of the semi-annual migrations
- “After” Experiment: Monitor Potential Impacts of the 10-buoy Array (grid connected)
 - Study design described above will be repeated
 - This phase is not yet funded

What We May Learn

- Whether timing and depth distribution of green sturgeon migration described by others is similar in this area
- Whether this area is used for foraging and therefore a concentration area
- Identify other acoustically tagged species in this area
- Determine whether patterns of green sturgeon migration and habitat use differ between the baseline study and the after-installation study

What are some of the Potential Impacts to Green Sturgeon?

- No impact
- Delayed migration (i.e., increased time to pass)
- Aborted migration (i.e., do not pass at all) and/or stop using this area for feeding
- Mortality (e.g., predators)
- Bottom line - uncertain



Cumulative Effects?

(Active Projects¹)

- Washington
 - Admiralty Inlet, Puget Sound (2 underwater turbines)
 - Deception Pass, Puget Sound (4 underwater turbines)
- Oregon
 - Offshore, near Tillamook (30 floating wind turbines)
 - Winchester Bay, near Reedsport (1 jetty-based structure)
 - Offshore, near Reedsport (10 – 100 buoys)
- California
 - San Francisco Bay Tidal Project (60 underwater turbines)

¹Pacific Fishery Management Council. Active West Coast Hydrokinetic Project. August 30, 2012.

Summary

- Determine whether and how green sturgeon utilize the area in and around the planned wave energy site for (a) migration and (b) feeding/concentration
- Determine how and when other tagged species may utilize this area (e.g., sharks)
- Determine whether migration or habitat use changes after installation of the energy project
- Broad applications of study results:
 - Evaluate potential impacts of other planned wave energy projects to sturgeons (nationwide)

Funders and Collaborators

- Funders:
 - Oregon Wave Energy Trust (OWET)
 - NOAA, NMFS, SW Fisheries Science Center (SWFSC)
 - Northwest National Marine Renewable Energy Center (NNMREC)
 - NOAA, NMFS, Protected Resources
- Collaborators – provide acoustic codes for tagged green sturgeon
 - ODFW, Clackamas
 - WDFW, Vancouver
 - UC Davis
 - Yurok Tribe
- Temporarily Provide Vemco VR2W receivers
 - ODFW, Marine Resources Program
 - NOAA, NMFS, NW Fisheries Science Center (NWFSC)
 - Environmental Protection Agency (EPA)