

Humpback Whale Predation at Salmon Enhancement Facilities

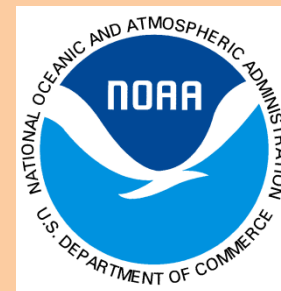
April to June 2010

By

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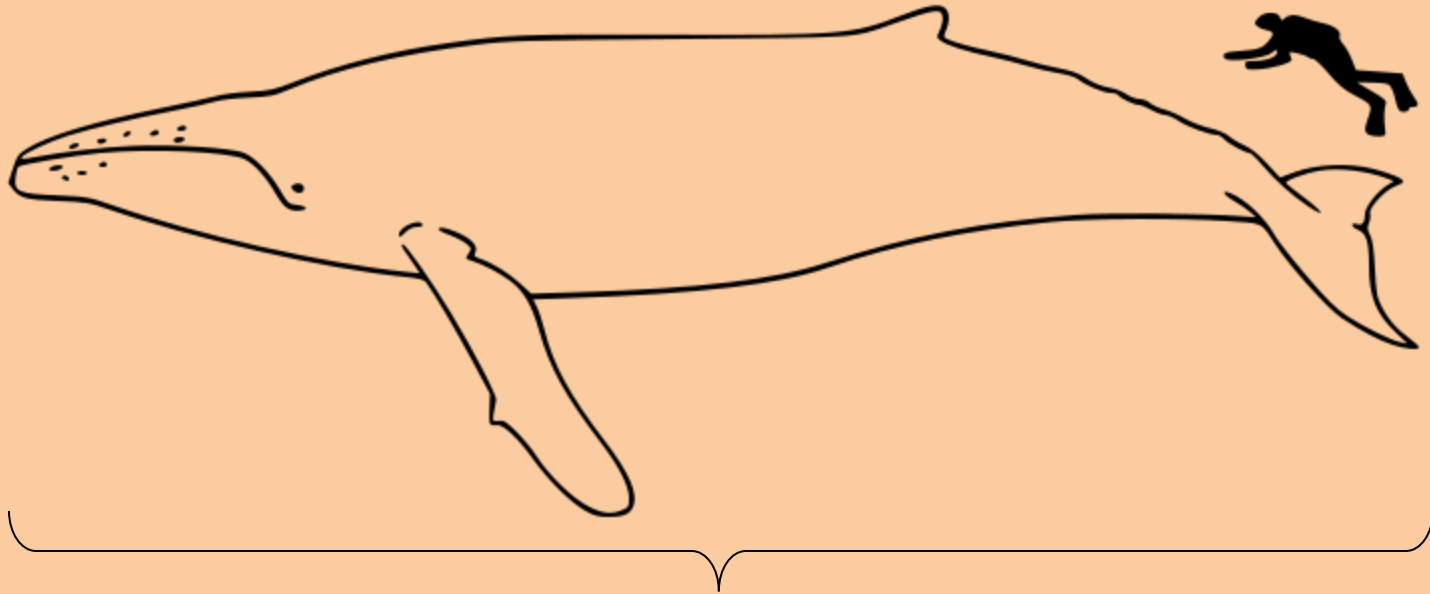


**ARMSTRONG
KETA INC.**





Introduction: The Size of the Problem



40-45 ft, ~ 37.5 tons

Introduction: The Size of the Problem



Image from National Geographic January 2000, developed by R.H. Lambertson

**15,000 gallons
of
seawater and
prey**



**Stomach may hold 1,190 kg of
juvenile salmon.**

Talk Overview

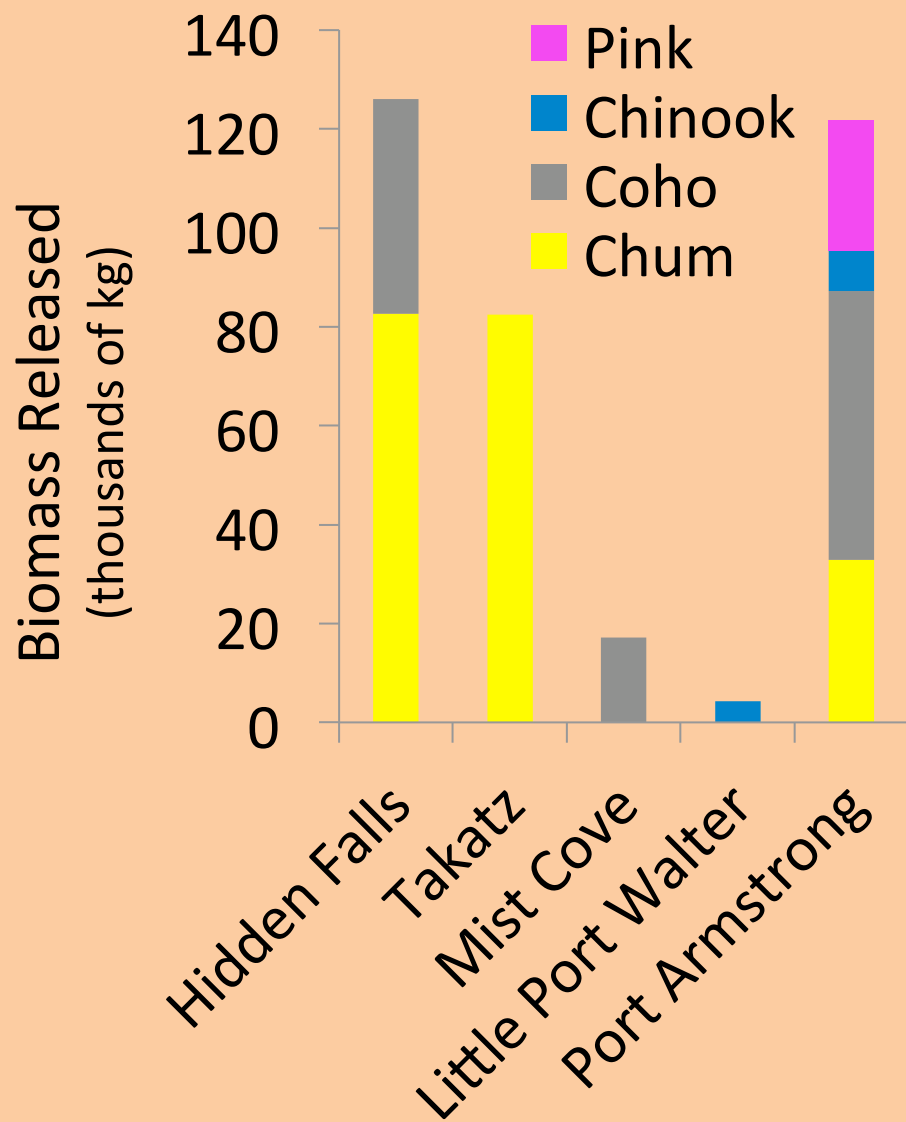
What we know: Pilot Study
Results

What we need to know: Future
Studies

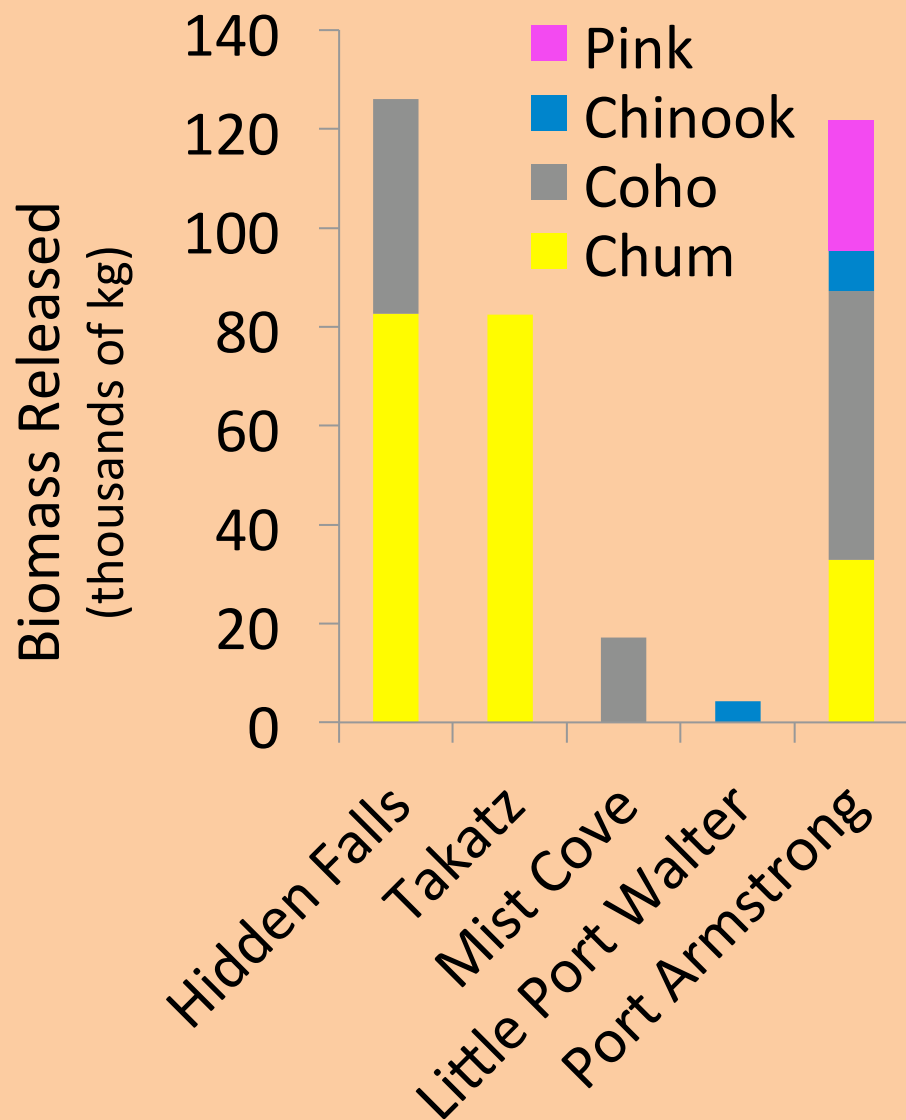


Art by Anna Kaiser

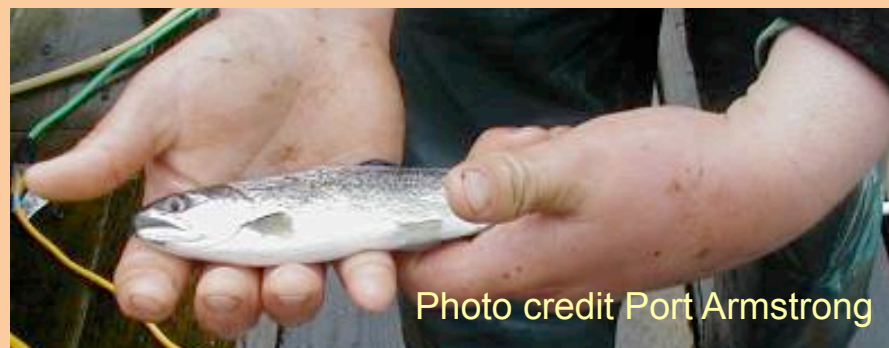
Release Sites



Release Sites



Pink Salmon Fry
~ 0.5 GRAMS



Chinook Smolts
50-75 GRAMS

Methods: Facility staff record observations

DATE: __/__/2010

Start Time __:__:__ AM / PM

End Time __:__:__ AM / PM

Observer Initials _____ Release Today? (circle one) Yes No

Weather (circle one of each category)

Cloud Cover

Precip.

Wind

Sunny

None

No Wind

Partly Cloudy

Fog

Breezy

Overcast

Rain

Windy

Other Species Sighted

none

_____ Sea lion(s)

_____ Harbor seal(s)

_____ Harbor porpoise(s)

_____ Killer whale(s)

_____ Sea otter(s)

_____ Other(s)

_____ Uncertain (describe animal/ behavior in comments)

Whale behavior (Circle all that apply)

No whales

Breathing at surface
& diving

Surface feeding
lunges

Breaching

Sleeping/logging

Other (describe in
comments)

Unable to observe
behavior

Are whales feeding against a barrier?

No barrier

Shoreline

Net pens

Bubbles

Rip tide

Kelp

Other

Uncertain (describe
in comments)

Vessels in the Area

No Motorized Vessels

_____ Skiff
(includes motoring sailboat)

_____ Pleasure vessel

_____ Commercial fishing

_____ Ferry/Cruise Ship

_____ Whales near hatchery

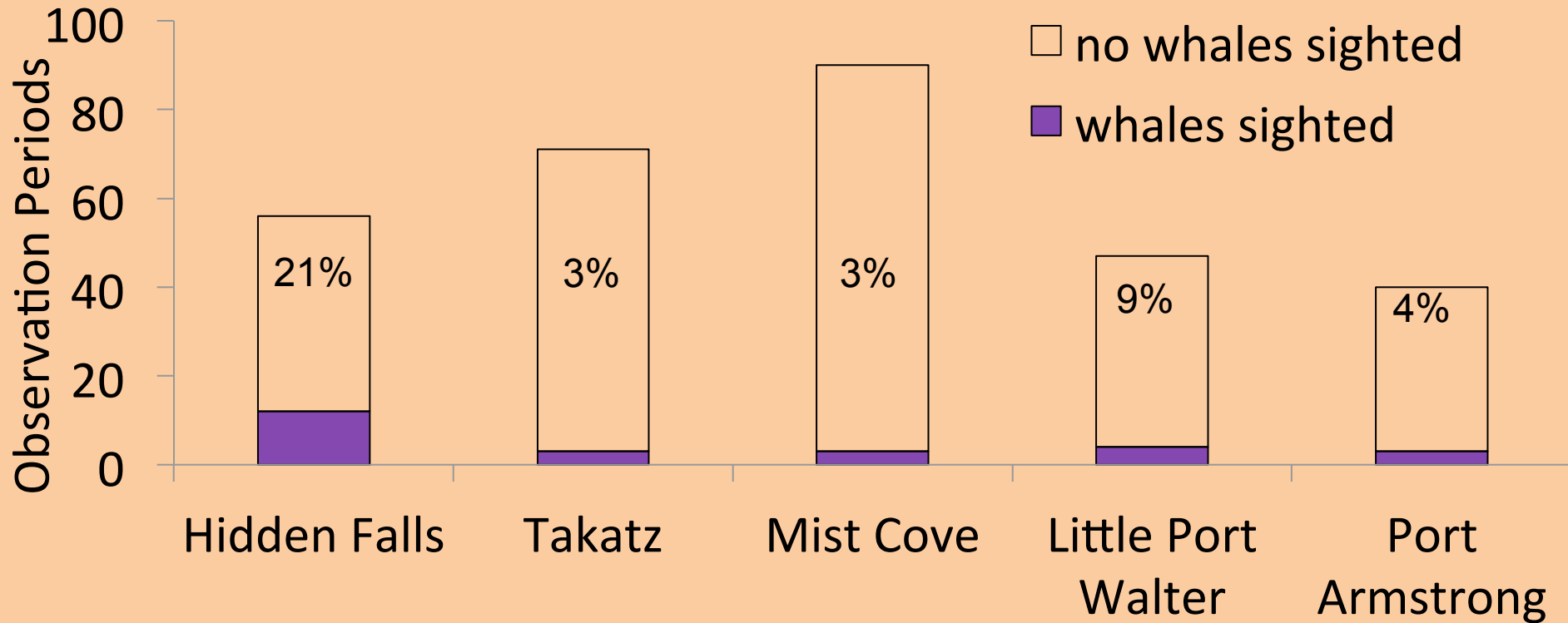
_____ Whales outside area

Comments (if photos were taken, frame numbers and photographer initials):



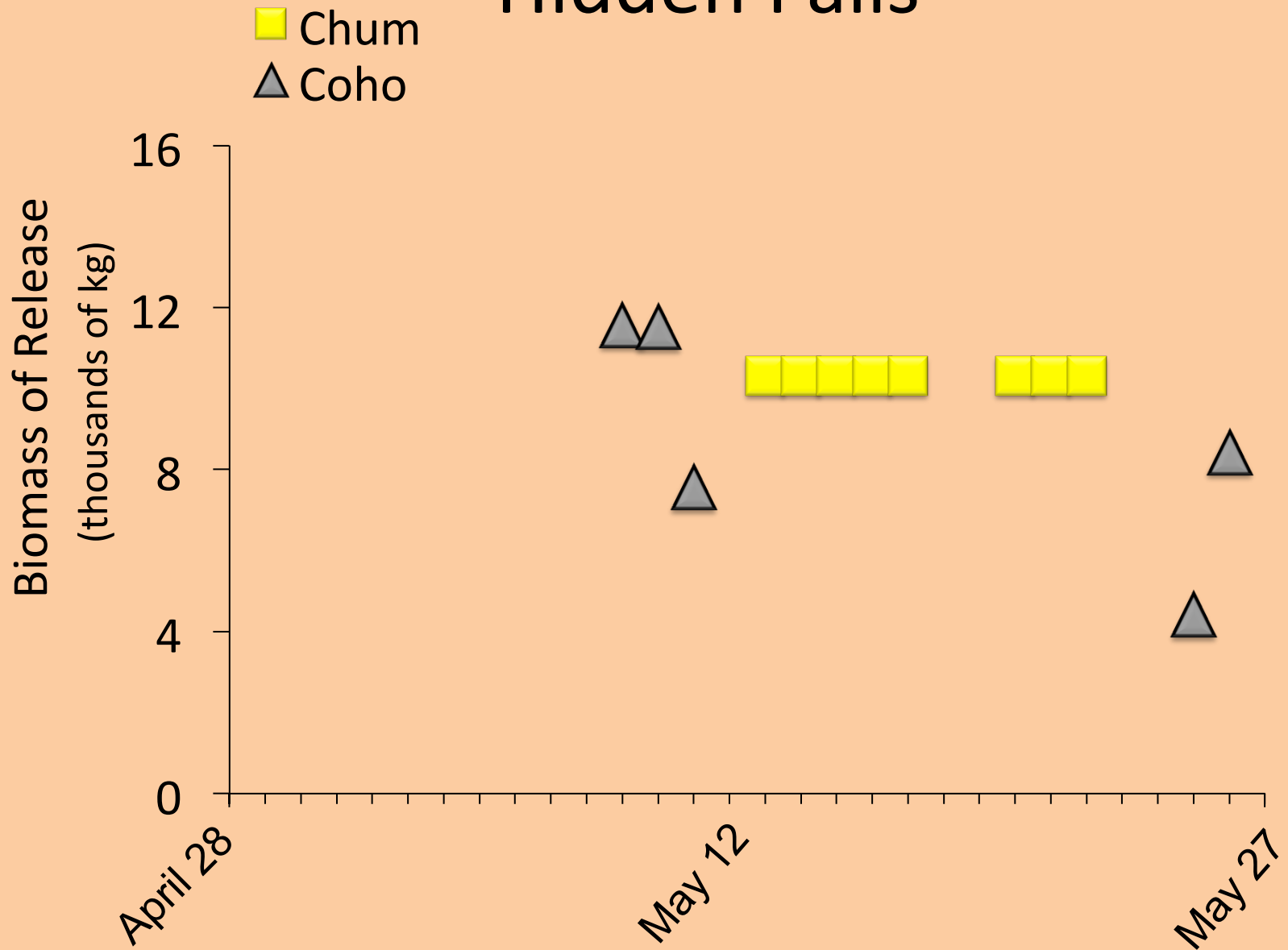
Photo credit Port Armstrong

Observation Periods with Whale Sightings

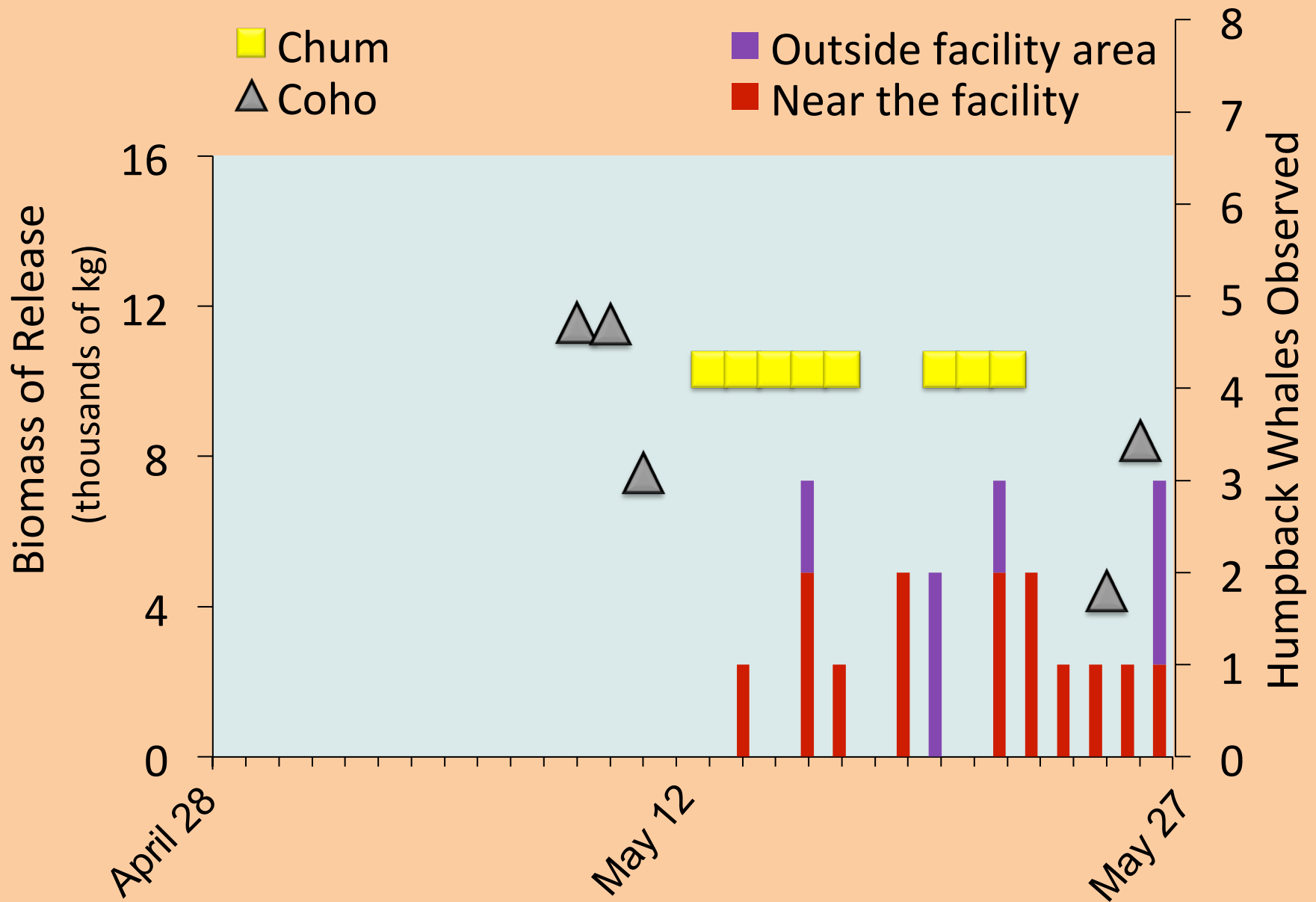


Not all facilities had the same level of humpback whale presence
(F-ratio=5.6554, df= 4, p=0.0002)

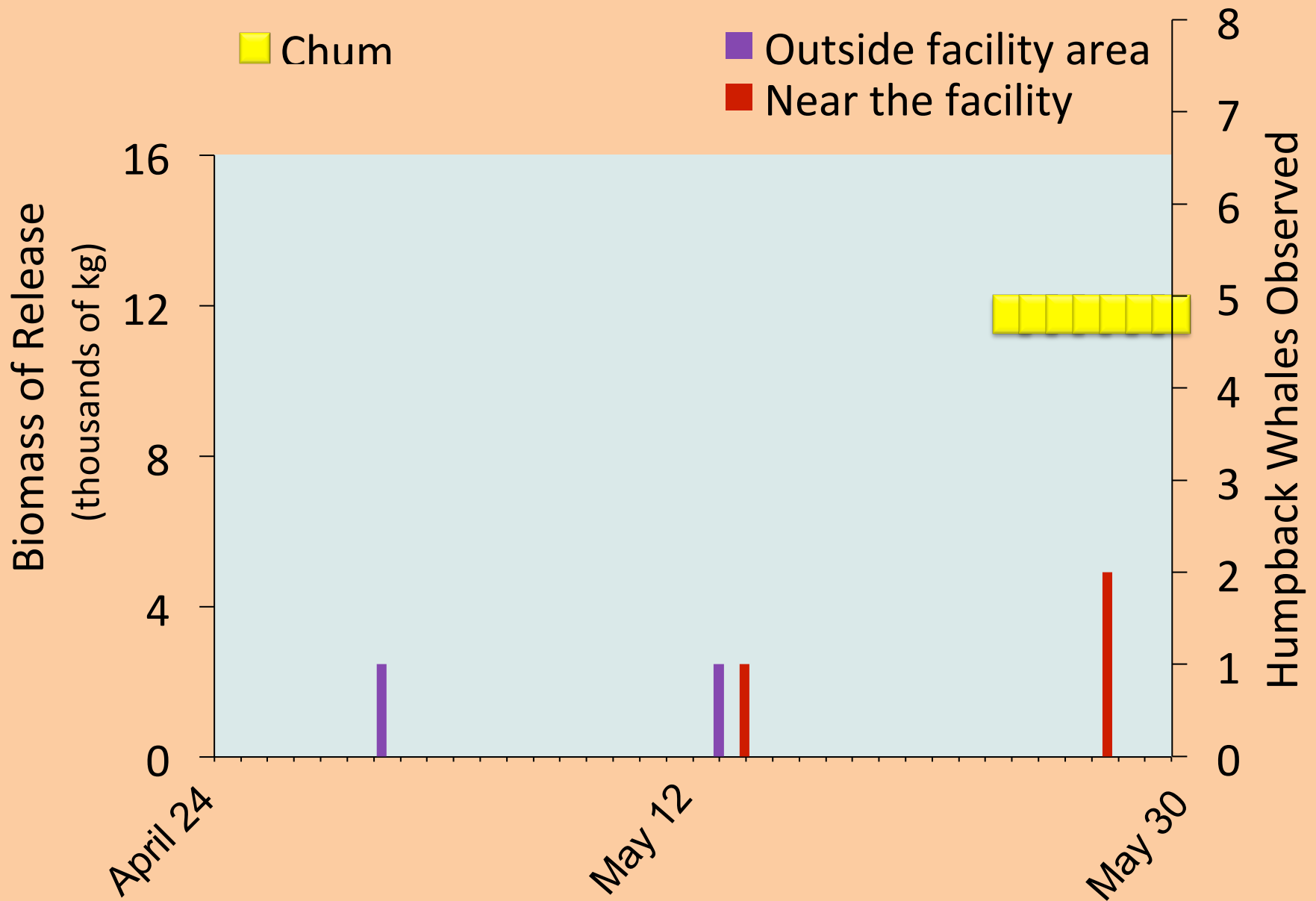
Whale Observations and Releases at Hidden Falls



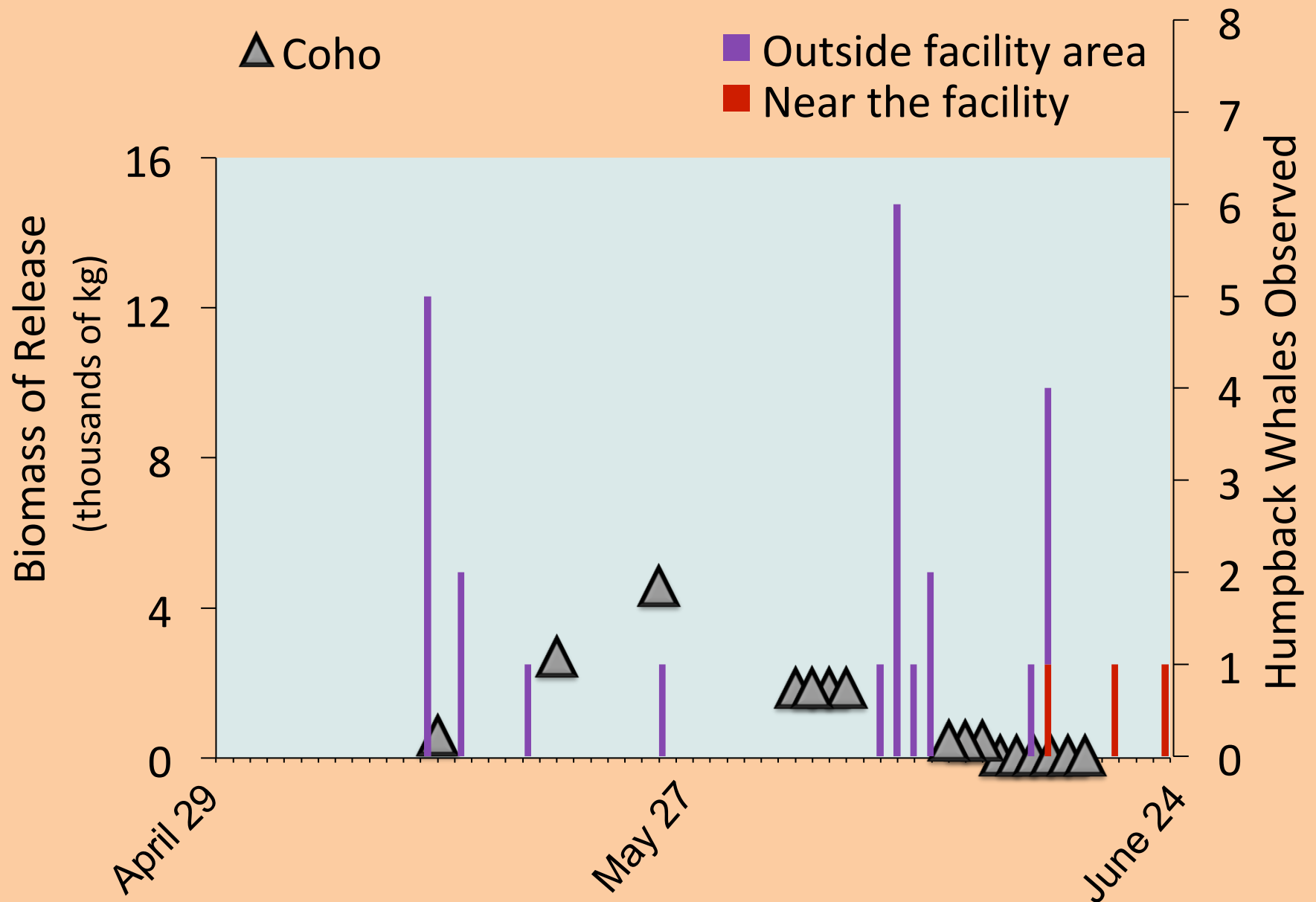
Whale Observations and Releases at Hidden Falls



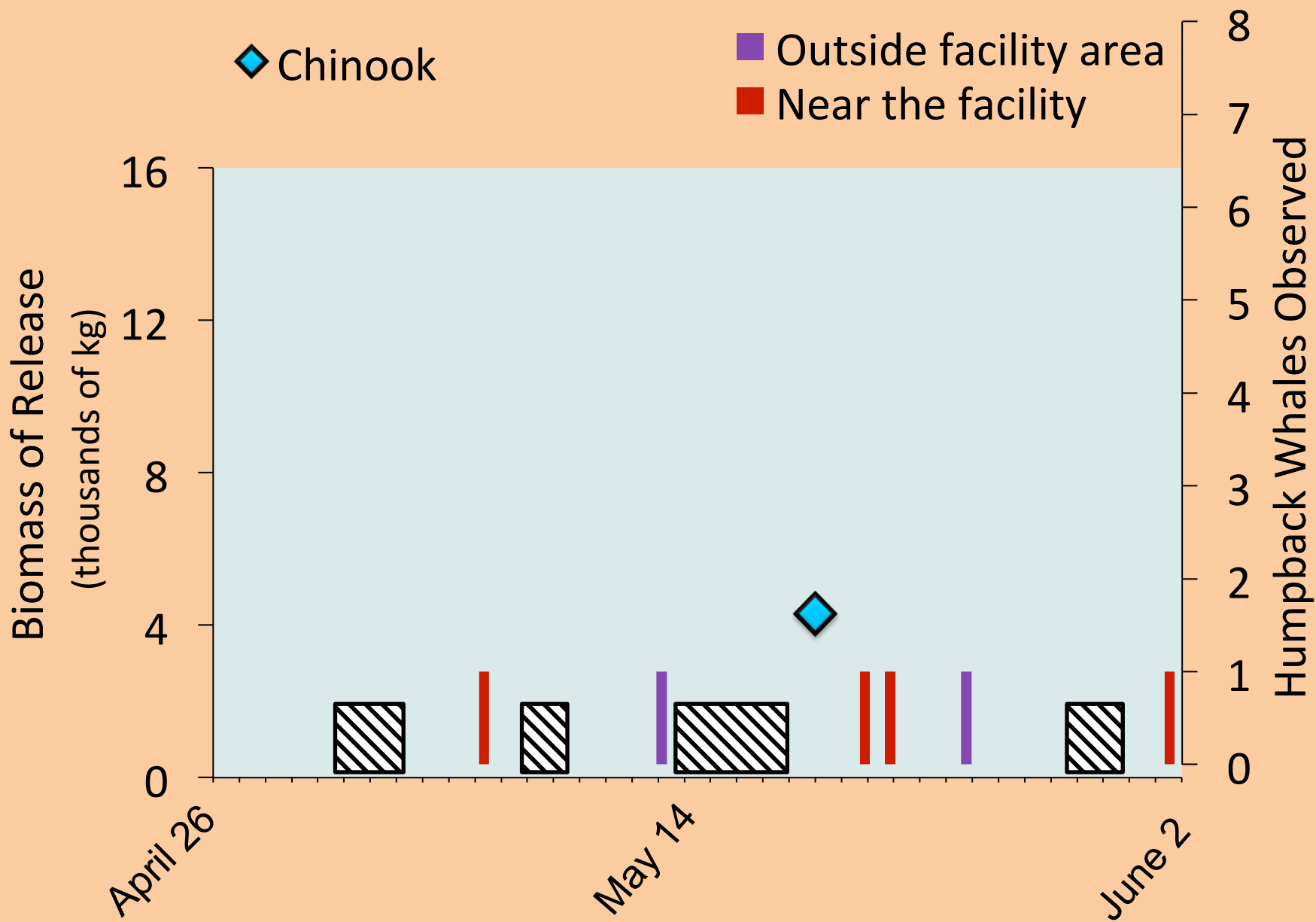
Whale Observations and Releases at Takatz



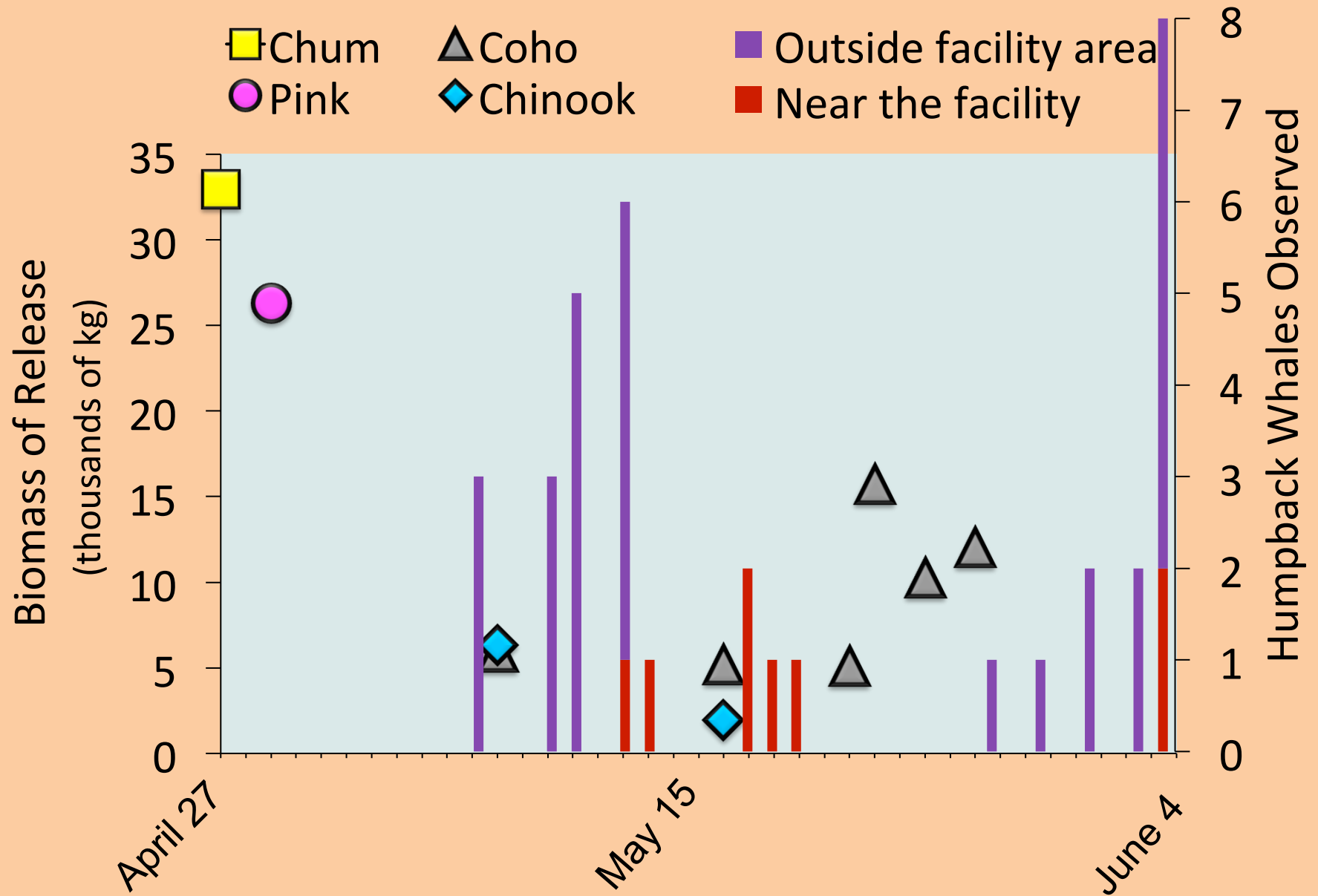
Whale Observations and Releases at Mist Cove



Whale Observations and Releases at Little Port Walter



Whale Observations and Releases at Port Armstrong



Summary of Predation

- Whales observed starting April 30th
- Whales directly targeting released fish at four of the five facilities with behaviors commonly seen with wild prey.
- Whales were present as singles and pairs.
- At Hidden Falls, whale presence is most consistent.
- Significant relationship between whale sightings and whether a release occurred the day before.

$$(\chi^2 = 14, df = 1, p = 0.0002)$$



Mitigations Strategies

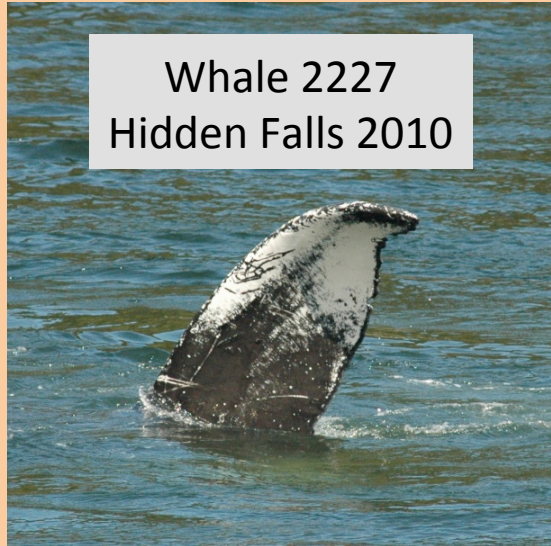
Trickle releases

Dragging the net pens to a different location

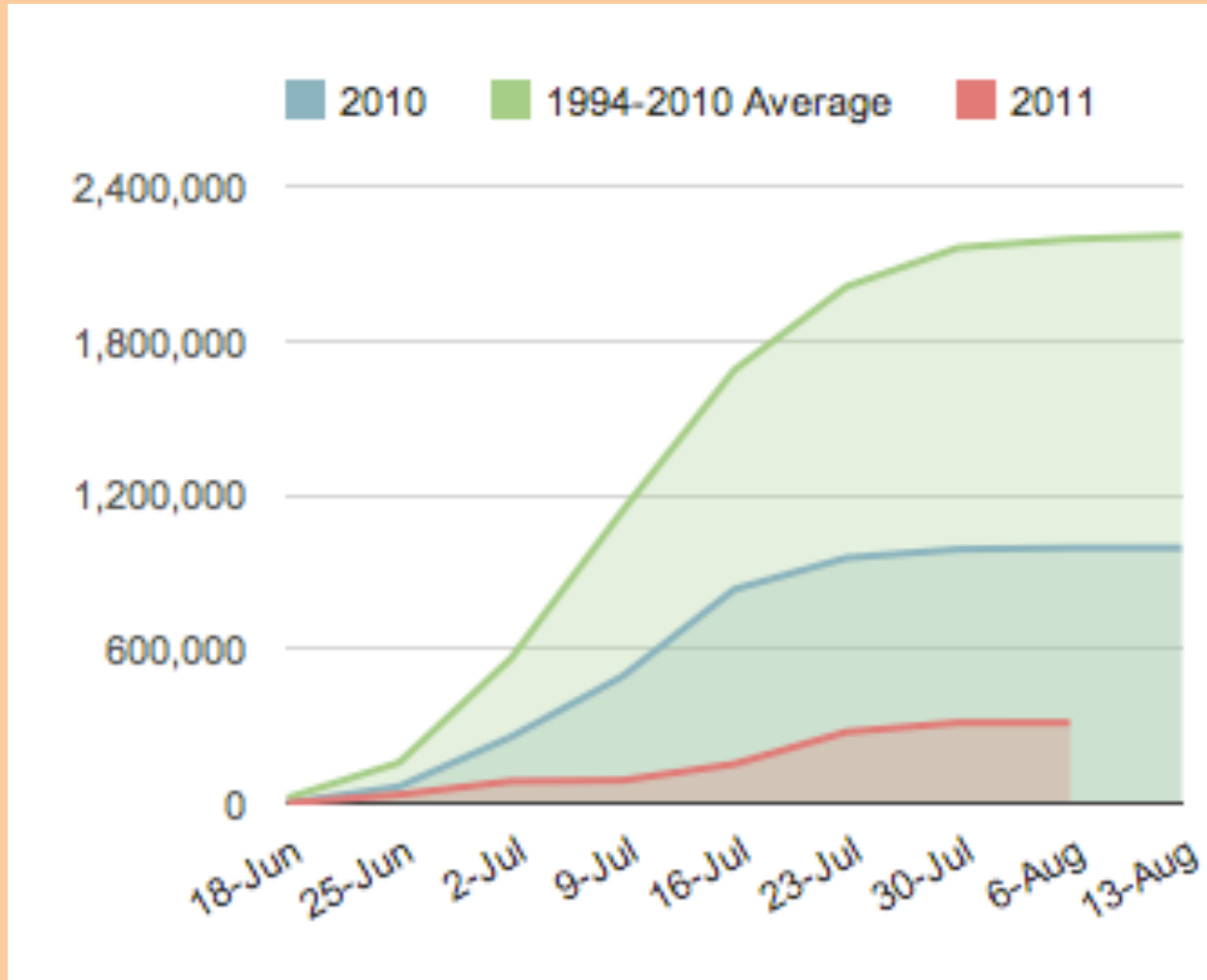
Night releases

Seasonal timing

Photo ID documents repeat offender!



2011 Chum Returns to Hidden Falls



1,060,000 forecast
313,331 returned
(30%)

Future directions to reduce predation

Continued Monitoring

Foraging Efficiency

Magnitude of Predation

Identify Cues

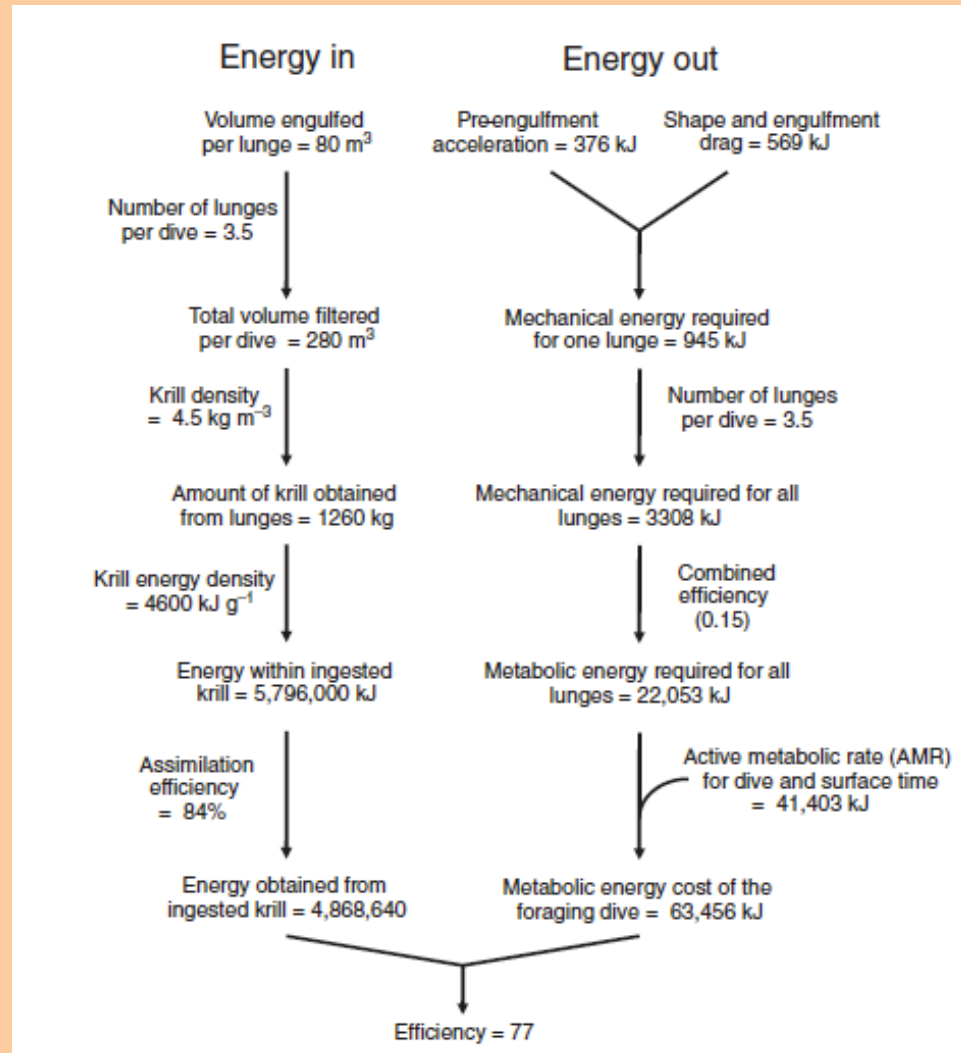
Economic Analyses



Foraging Efficiency



Foraging Efficiency



Magnitude of Predation



Magnitude of Predation



Magnitude of Predation



Magnitude of Predation

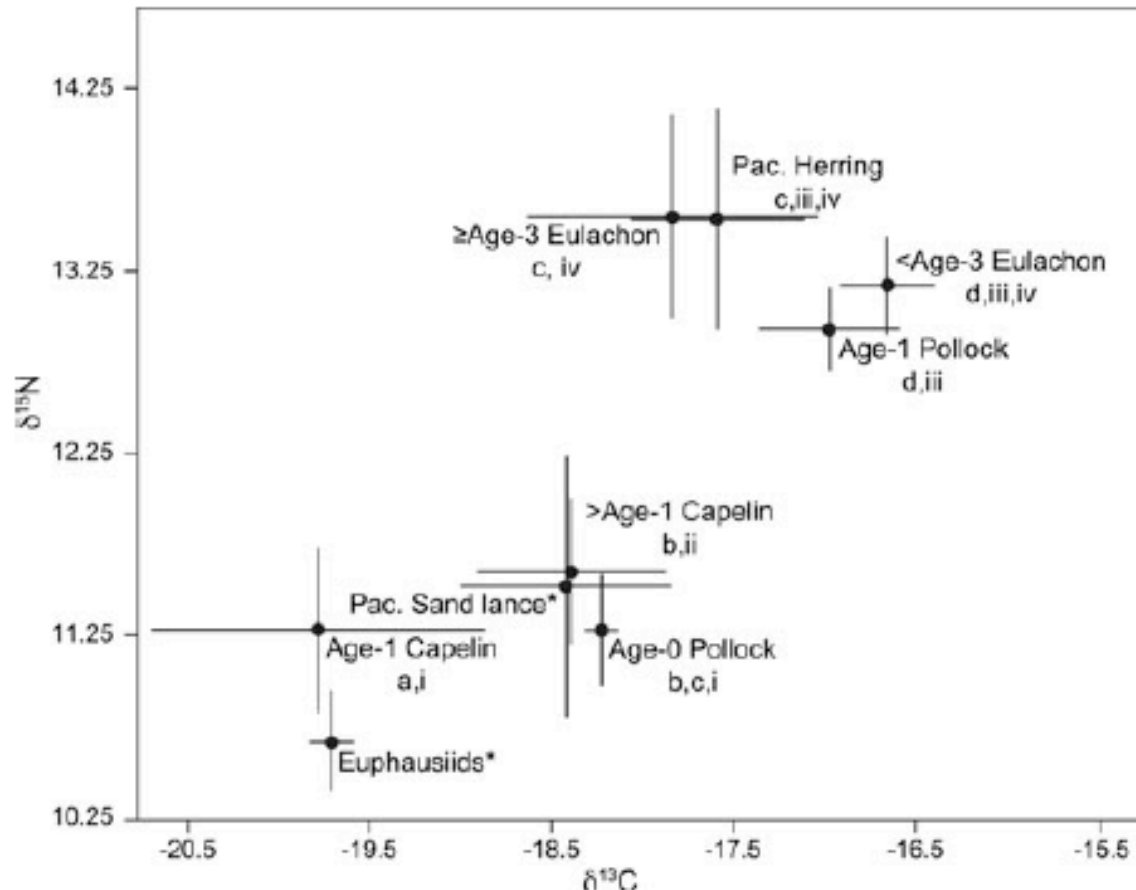
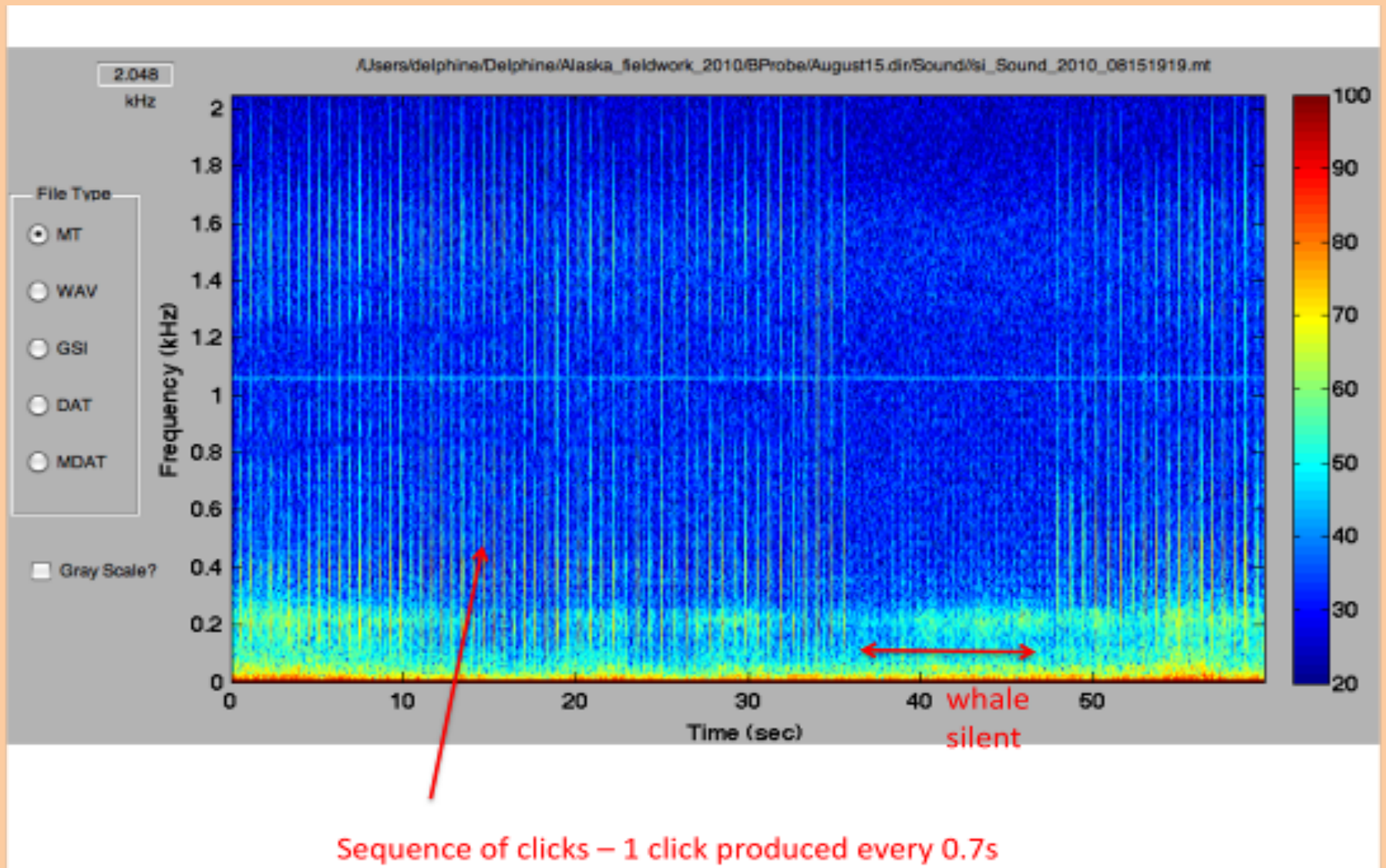


Figure 4. Mean values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ for potential Kodiak Island humpback whale prey. Samples were collected during mid-water trawl surveys. Letters indicate groupings for years in which mean $\delta^{13}\text{C}$ values were not significantly different, while Roman numerals indicate years in which mean $\delta^{15}\text{N}$ values were not significantly different as shown by *post hoc* tests. Species with an asterisk (*) are from Williams (2008) and were not included in variance testing.

Identify Cues



Economic Analysis

What is the cost to hatcheries

What is the cost to the fleet

Are the costs of mitigation justified by improved returns?



Why Study Humpback Whale Predation?

Humpback whales are a unique threat.

Mitigation methods have not solved the problem and have unknown effects on salmon survival.

Humpback whales, increasing at 5-7% per year.
(Calambokidis et al. 2008)

Best long-term strategy will be not to trick the whales, but to release in a way so as to minimize the attractiveness of the salmon as a prey source.



Thank
You!



Photo credit NSRAA

Thanks also to the salmon enhancement facility staff that diligently
observed and recorded data for this study