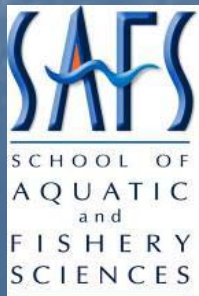


Restoration outplants of juvenile Pinto abalone (*Haliotis kamtschatkana*) in Washington State

J. Bouma, B. Allen, J. Davis,

P.A. Dinnel, C.S. Friedman, B. Peabody, D.P. Rothaus,

J. Suzuki, B. Vadopalas, J.T. Watson



Puget Sound
RESTORATION FUND



Shannon Point Marine Center

Western Washington University

Marine Science Education and Research

Contact Us

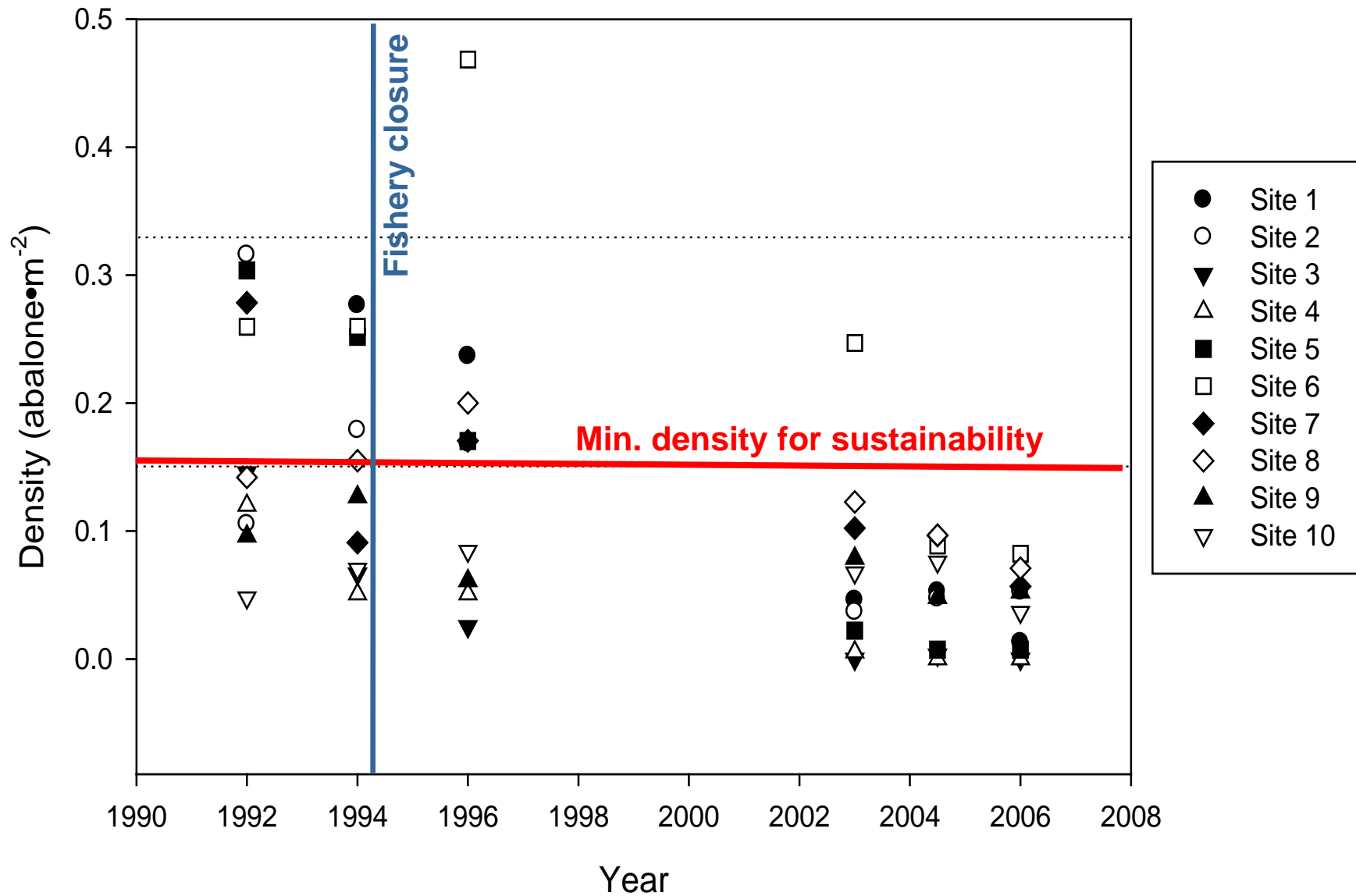




Outline

- Background
- Objectives
- Part 1: Captive Rearing
- Part 2: Restoration Outplants
- Discussion & Future Work

Background



Pinto Abalone Recovery Project

- Multi-group Collaboration in Washington
 - Washington Department of Fish & Wildlife
 - University of Washington-SAFS
 - Puget Sound Restoration Fund
 - Western Washington University-SPMC
 - NOAA
 - Jamestown-S'Klallam Tribe
- Public outreach—website, documentary film, poster, presentations

www.pintoabalone.org

Pinto Abalone Recovery Project

How do we start to solve the problem?
By conducting pinto abalone research

- Captive rearing experiments
 - Habitat
 - Feeding
- Lab experiments
 - Tolerance
 - Behavior
- Restoration Strategies
 - Adult aggregation
 - Larval seeding
 - Experimental outplants



Experimental Juvenile Outplant

Objectives & Results

- 300 abalone, 4 sites, 1 yr
- Characterize juvenile abalone survivorship
- Measure effect of outplant size on survival

- Initial size matters
- Habitat complexity matters
- Average 1 yr shell growth for survivors=19.7mm



Objectives

1. DO NO HARM
2. Expand captive rearing program and hatchery facilities
3. Maximize grow-out of genetically diverse and disease free juvenile abalone
4. Conduct restoration outplants in the SJA

Part 1: Captive Rearing

Development of Hatchery Methods



Part 1: Captive Rearing

Expansion of Grow-Out Facilities



Part 1: Captive Rearing

Expansion of Grow-Out Facilities

- 5500 abalone (mean SL=6 mm) transferred from Mukilteo
- Families reared independently



Part 2: Restoration Outplants

- Shannon Point Marine Center, Anacortes
- Late Summer 2009
- 1200 juvenile abalone

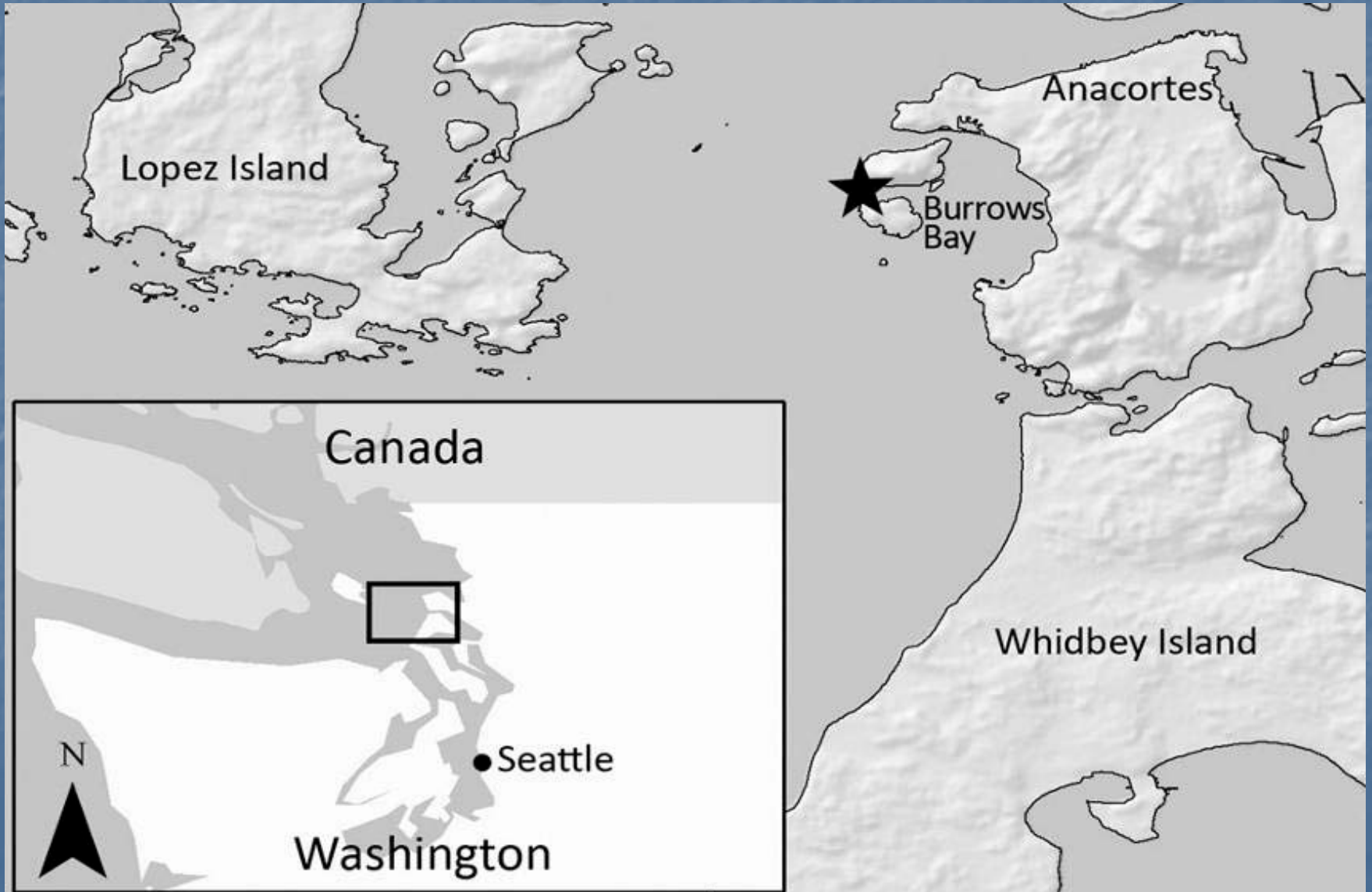


Methods

Site Selection

- Proximity to SPMC
- 4 sites: Burrows & Allan Islands
- Rugosity: clean coralline encrusted rocky reef/boulder
- High current flow & tidal exchange
- Depth
- Presence & composition of macroalgae
- Absence of predators

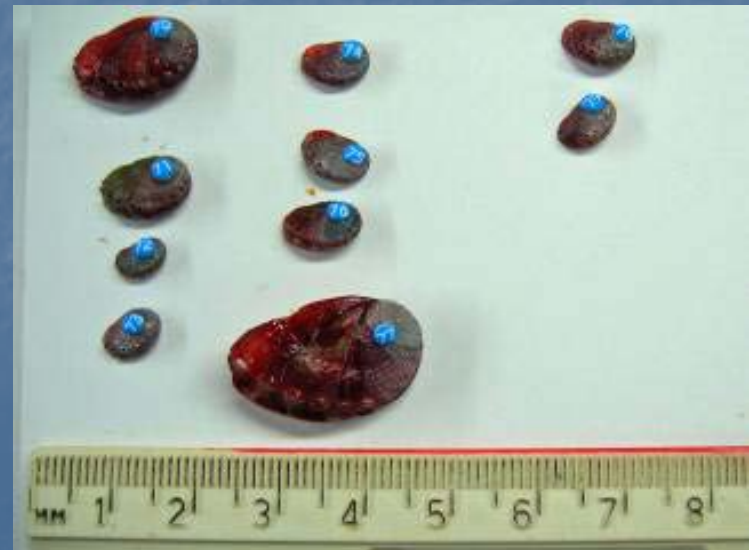
Methods



Methods

Juvenile Abalone Preparation

- Certified healthy & disease free
- Tagging
 - Half of all abalone uniquely tagged by color & number (n=600)
- Strict adherence to conservation genetic principles
 - Juveniles represented 8 families from 13 different parents
 - Allocated across four sites to optimize genetic diversity



Methods

Outplant Modules

- PVC tubes
- ~30 abalone/tube
- Tube loaded with Nereocystis
- Enclosed w/ oyster netting





Methods

Transport

- 1200 juvenile abalone, 40 tubes, 2 fish totes, 2 trucks
- Driven to Anacortes
- Stored overnight in flow-through raceways at SPMC



Methods

Introduction/Release

- Tubes loaded into coolers, transferred to dive boat
- Carried from surface to depth by divers
- Spread out over entire delineated site
- Wedged between substrate
- Oyster netting removed 24hr post introduction





Methods

Follow-Up Surveys

- 6 weeks post-outplant
- 2 sites w/ tagged abalone
- Exhaustive non-invasive survey
- Tag observations recorded, morts collected

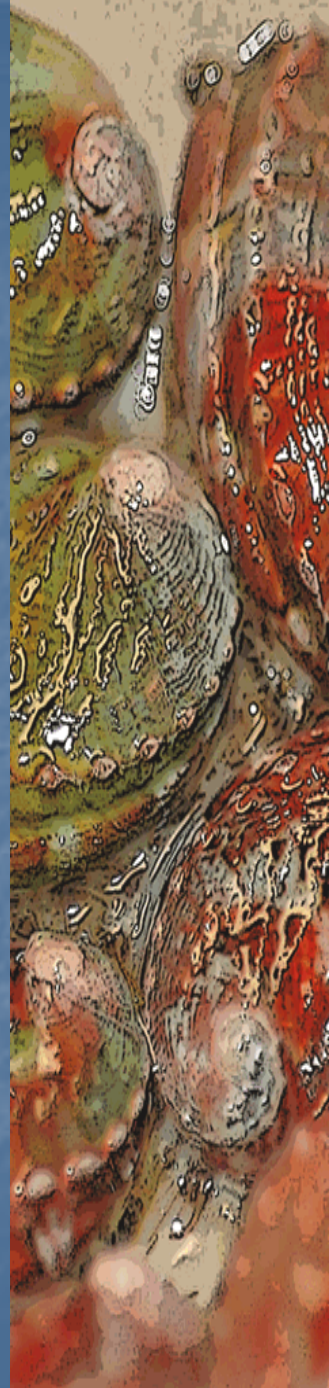
Results

■ Burrows West

- Live observations N=36 (Tag ID N=28)
 - Cryptic 67%
 - Exposed 33%
- Mortalities N=10
- 15% accounted (live & mort)

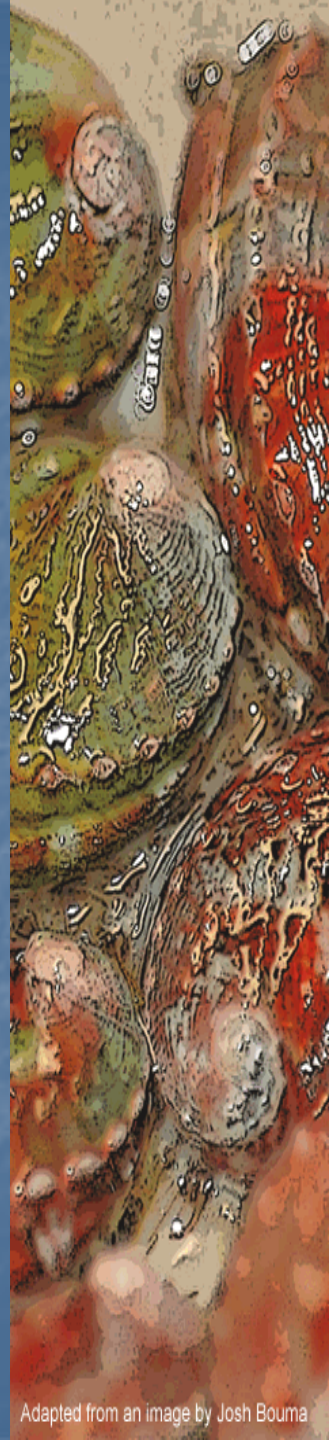
■ Allan South

- Live observations N=40 (Tag ID N=34)
 - Cryptic 73%
 - Exposed 27%
- Mortalities N=16
- 19% accounted (live & mort)



Discussion

- Continued surveys on existing sites
- Mark and recapture possibilities
 - Characterize growth & survival over time
 - Build models of reproductive potential of outplanted populations
 - Maximize outplant strategies
- Water quality parameters: Temperature, salinity, D.O., etc.
- Increased hatchery efficiency and productivity
- Additional restoration outplants



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Personnel Involved

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- Mike Rust (NOAA)
- Kristi Straus (UW)
- Nate Wight (UW)





Questions?

www.pintoabalone.org

Background

- **1979-1980**

 - WDFW established survey sites in the San Juan Archipelago.

 - Canadian commercial fishery peaked at 400 metric tons/year.

- **Mid 1980s - early 1990s**

 - Recreational takes in the San Juan Archipelago ~40,000 per year

 - Peak years for sea urchin and sea cucumber dive fisheries.

- **Early to mid 1990s**

 - Closure of all fisheries in Washington and Canada plus Alaskan commercial fishery

Background

- **1996**

Declines continue: Pinto abalone designated as a "sensitive species" and a "State Candidate Species".

Closure of Alaskan commercial fishery.

- **1999**

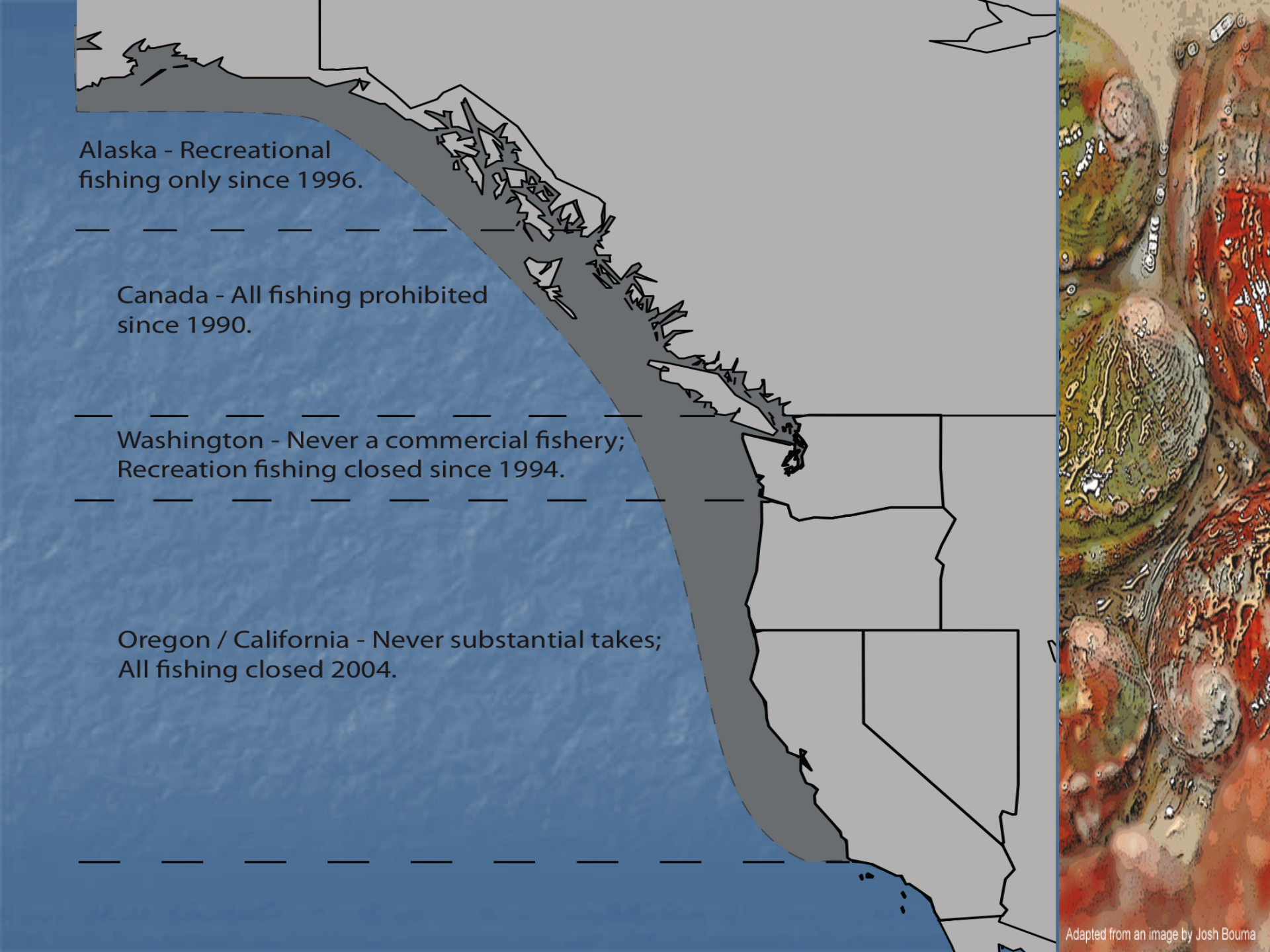
Canadian Government list pinto abalone as a "Threatened Species" under COSEWIC.

- **2004**

NOAA lists pinto abalone as a federal "Species of Concern".

- **2008**

Canadian Government list pinto abalone as an "Endangered Species" under COSEWIC.



Alaska - Recreational fishing only since 1996.

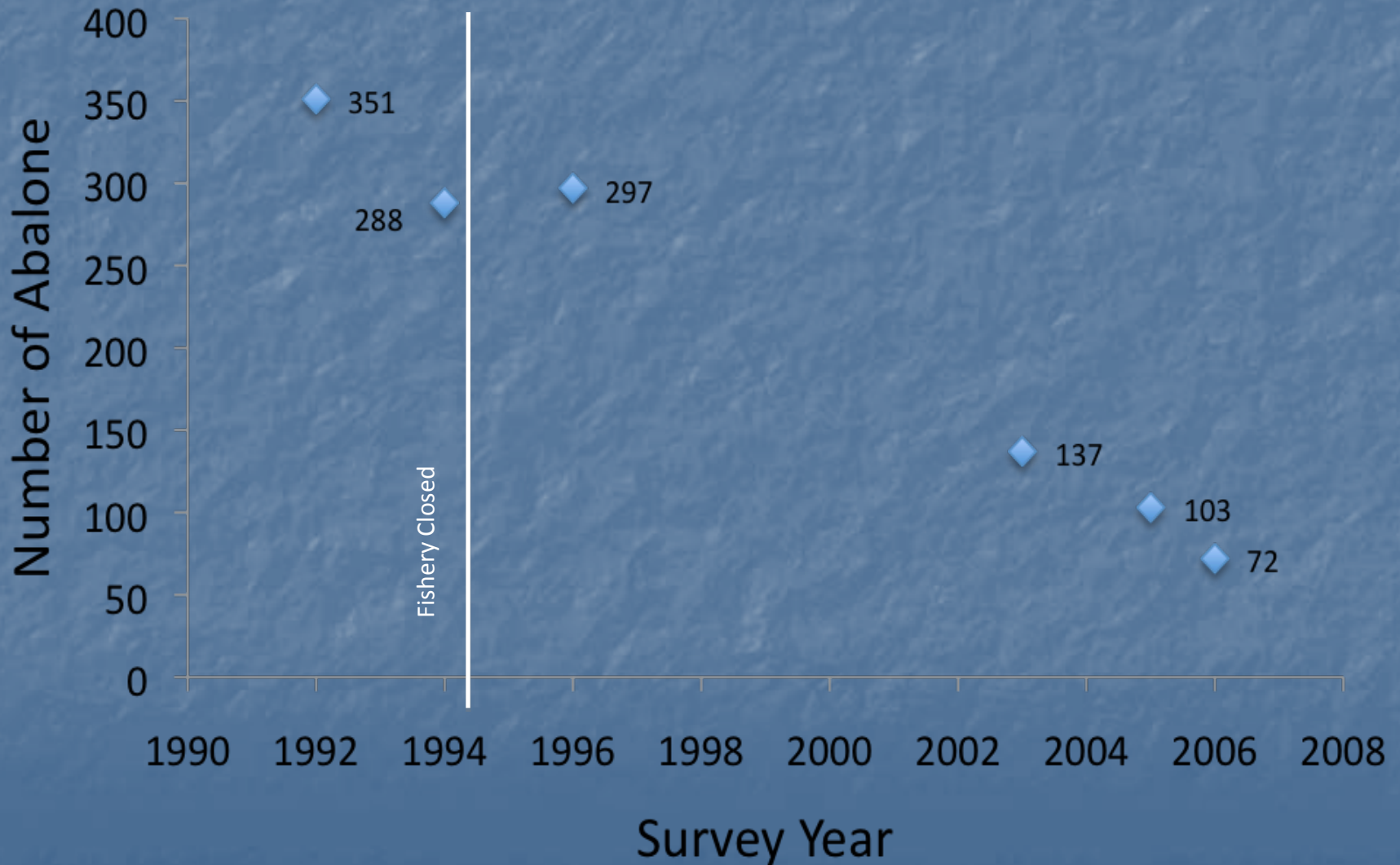
Canada - All fishing prohibited since 1990.

Washington - Never a commercial fishery; Recreation fishing closed since 1994.

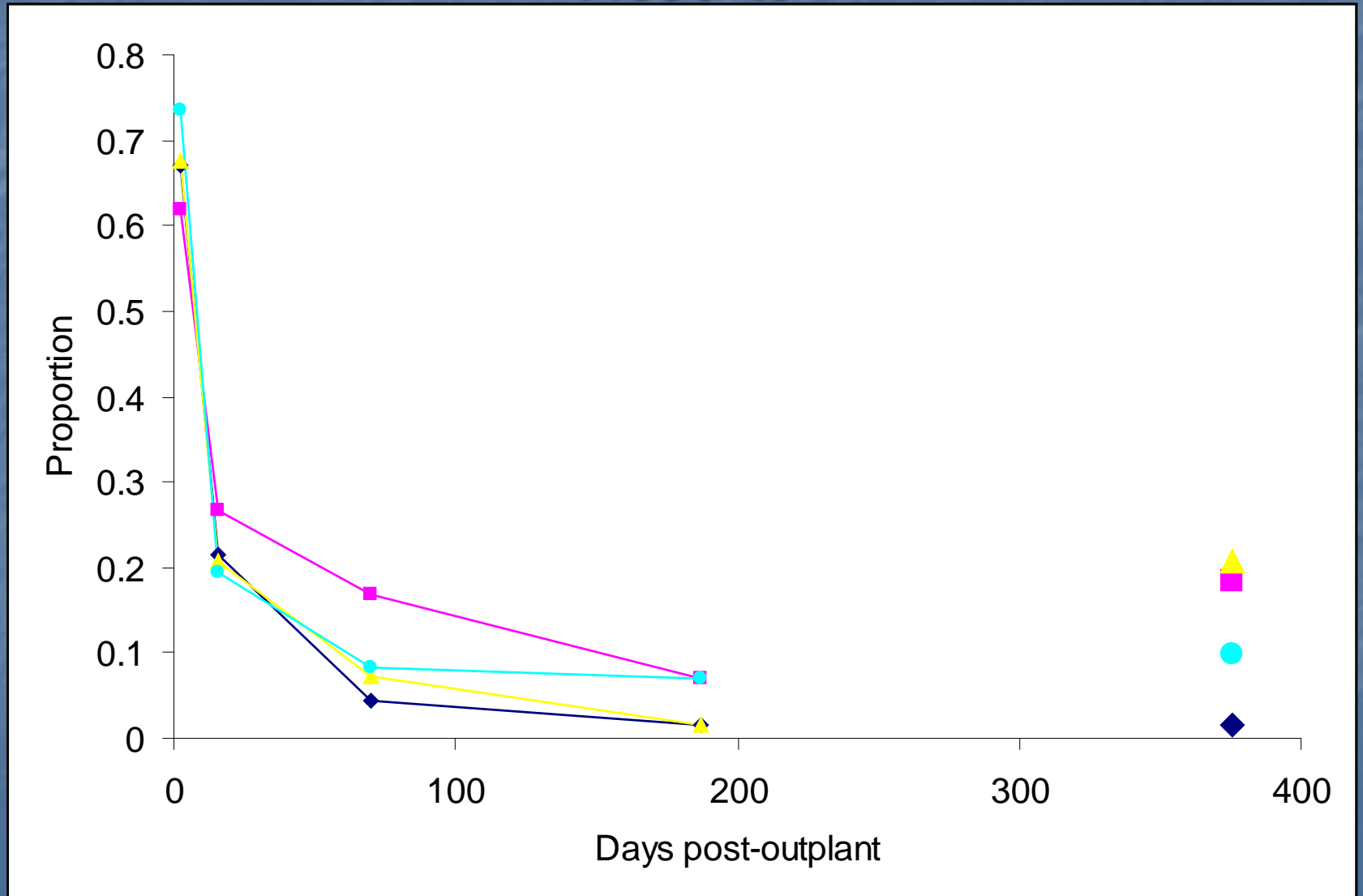
Oregon / California - Never substantial takes; All fishing closed 2004.

Background

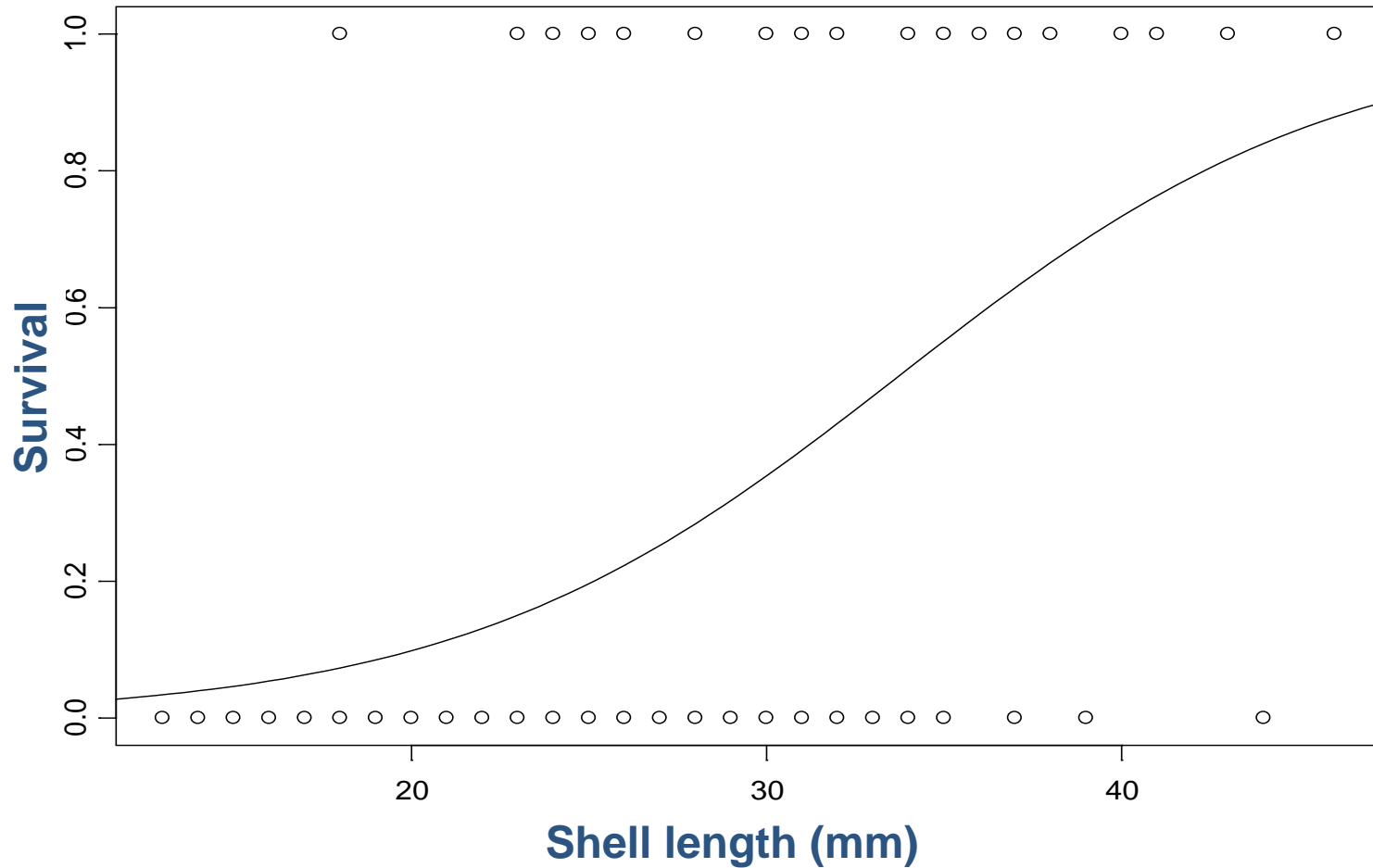
Abalone abundance at survey sites, by year



Experimental Outplant Results



Experimental Outplant Results



Methods

Genetically Diverse Outplant Cohort

