(A short history of) long-term monitoring of pinto abalone in Sitka Sound, Alaska

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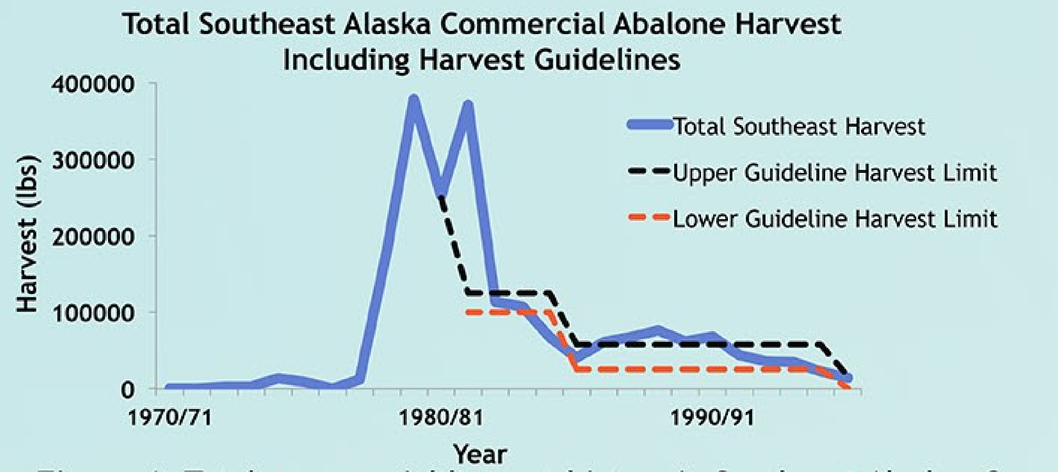
Background

Commercial harvest of pinto abalone throughout Southeast Alaska declined rapidly prior to fishery closure in 1996 (Fig. 1). A historical lack of population assessments was cited in the 2014 decision by the National Marine Fisheries Service as a reason to not list pinto abalone under the Endangered Species Act.[1] To this day, the true status and trajectory of pinto abalone stocks in Southeast Alaska remain unknown.



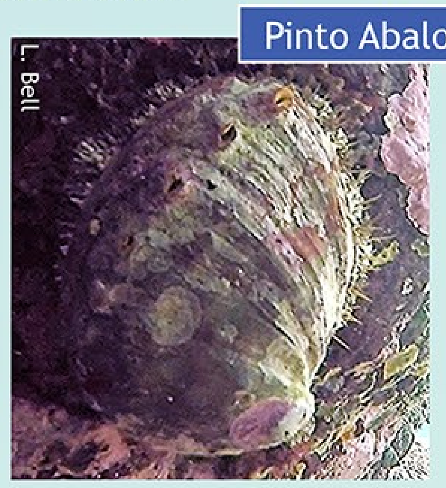


Figure 1. Total commercial harvest history in Southeast Alaska. Commercial harvest began in the mid-1970's, peak harvest occurred from 1978 -1982, and abalone stock declined until the fishery was closed indefinitely in 1996 (ADF&G data).

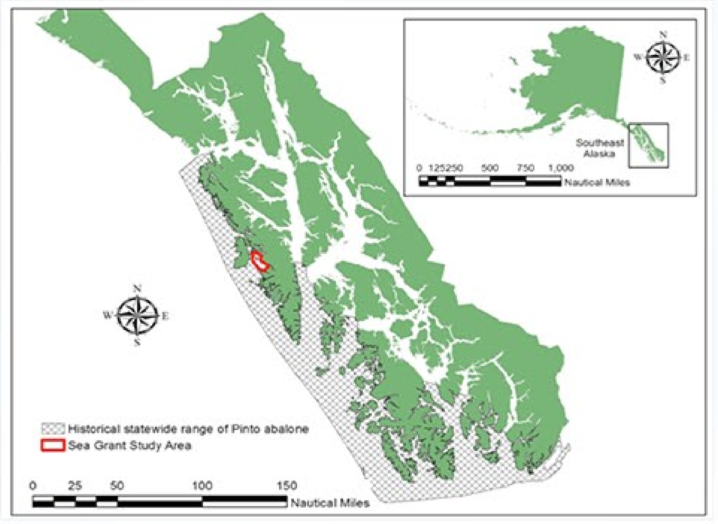
Research Questions

- What are densities of pinto abalone within aggregations in Sitka Sound and how do they change over time?
- Are local aggregations of pinto abalone in sufficient densities for fertilization success?
- What is the population size structure of pinto abalone, and is there evidence of recruitment?

Study Area

Sitka Sound, on the west coast of Baranof Island (Fig. 2), is near the northernmost limit of pinto abalone distribution. Sitka Sound is characterized by abundant rocky shoreline with numerous islands, which experience wave exposure ranging from exposed to very protected.

Figure 2. Approximate range of pinto abalone in Southeast Alaska shown by hatched area, with the Sitka Sound study area in red



Kelp bed in Sitka Sound

Methods

Site Selection & Survey Frequency

To achieve representation of pop. structure at different locations/habitats

To ensure inclusion of high density, 'easy-access' sites for more freq. sampling

random

1. Classified suitable abalone habitat using NOAA ShoreZone Database
2. Randomly selected 21 sites from 3 stratified regions (Fig. 3)
3. Timed swim abalone counts used to choose 6 (from 21) sites with varying densities
4. Bi-annually surveyed (spring and late summer) to assess seasonal variability

non-random

1. Density and aggregation data compiled from volunteer surveys and personal use information
2. Non-random selection of two high-density sites for frequent survey
3. Bi-weekly surveyed to characterize short-term variability

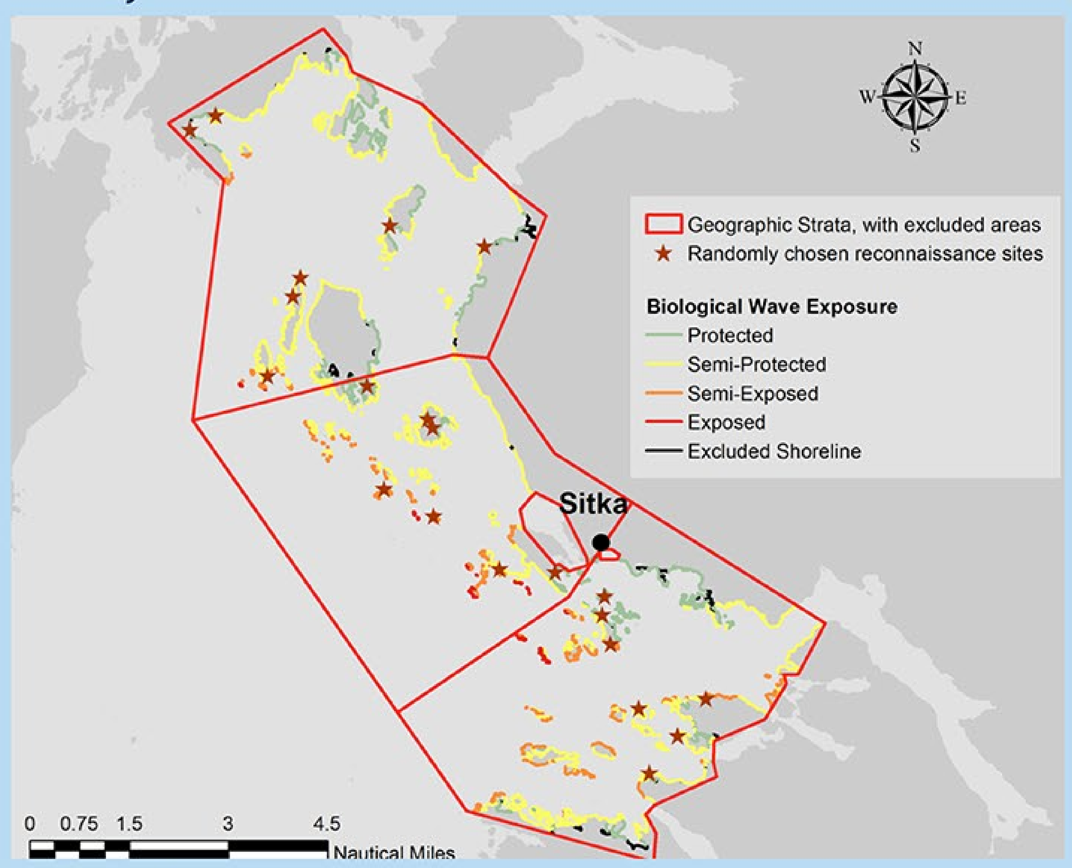
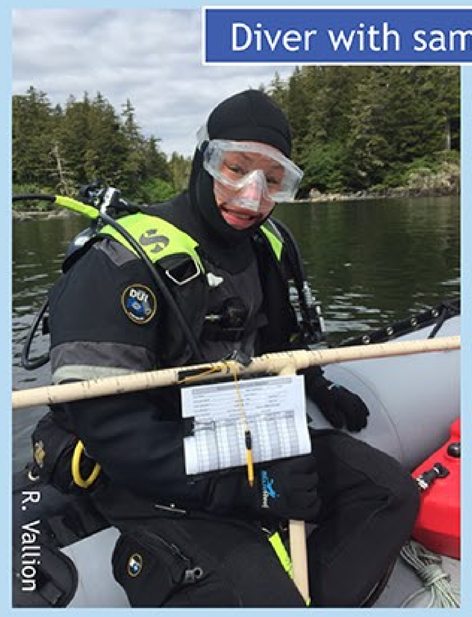


Figure 3. Map of 21 randomly chosen sites (7 per geographic stratum) for potential selection as permanent study sites. Sites ultimately selected are not shown for confidentiality reasons.



Site Layout

- 30 X 2 meter transects (Fig. 4)
- Transects established at the optimal depth zones for abalone: around -3 and -6 meters depth (relative to MLLW)
- Two Abalone Recruitment Modules (ARMs) were placed between transects, around -4 and -9 meters (MLLW) (Figs. 4, 5).

Survey Metrics

Dive surveys collected data on:

- Abalone density
- Abalone length (target ≥ 50 mm)
- Among-adult distances (within-transect)
- Abalone position (exposed or cryptic)
- Habitat (e.g. substrate, alga, crevices for every 10 meters)

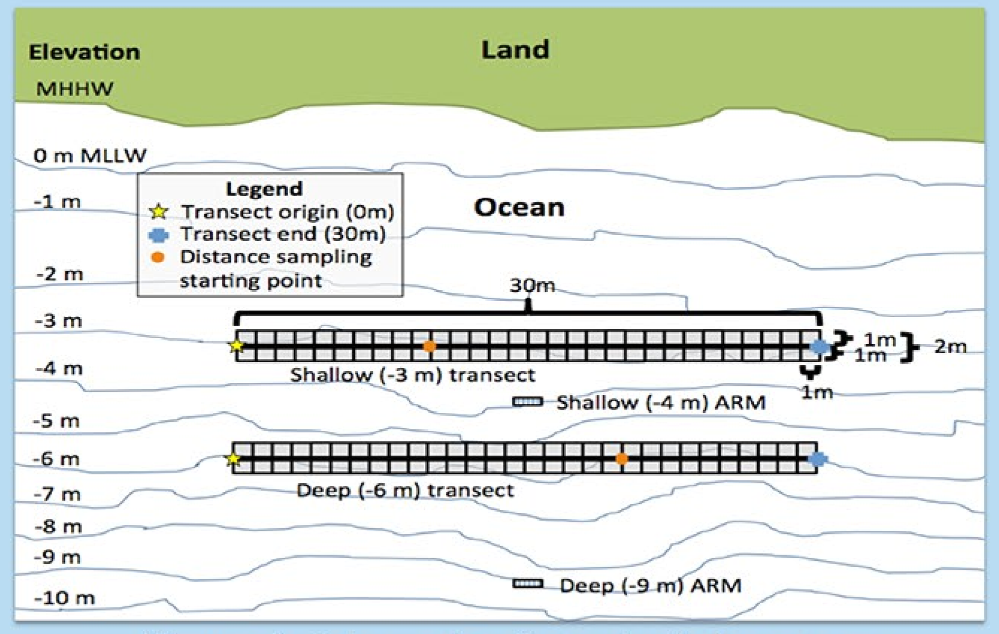


Figure 4. Schematic of standard site set-up

Figure 5. Artificial Recruitment Module ready for deployment[3]

Artificial Recruitment Modules (ARMs)

We constructed ARMs using same design as Defreitas (2003) and Bouma (2007, 2012) (Fig. 5). This design has been shown to be successful in attracting abalone recruits[2,3,4].

Initial Findings

Preliminary results suggest pinto abalone may be occurring in densities sufficient for successful fertilization; however, our sample unit size differed from other studies and needs to be manipulated post-hoc for direct comparisons. Though surveyors focused searches on abalone >50 mm, opportunistic finds of many juvenile abalone suggests successful recruitment may be occurring at some locations. We have not yet captured a density estimate during a verified spawning episode.

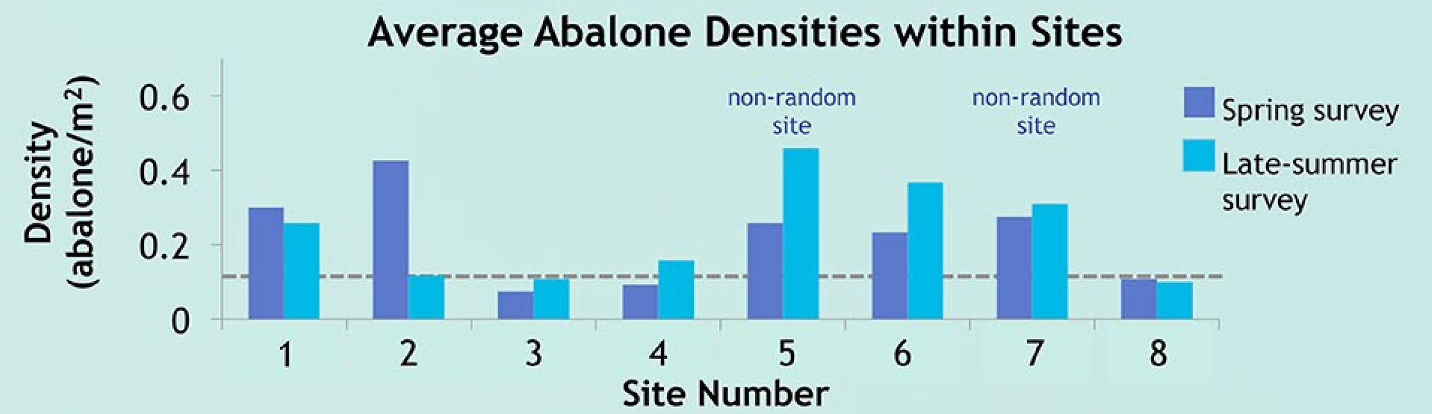


Figure 6. Within-site averages of abalone densities during seasonal surveys. Abalone <50 mm not included as they were only opportunistically sampled. Horizontal dotted line indicates the lowest measured successful spawning density of pinto abalone in British Columbia.[5] Our data shown here represent preliminary density estimates within specifically targeted sites, and thus should not be extrapolated to the population level.

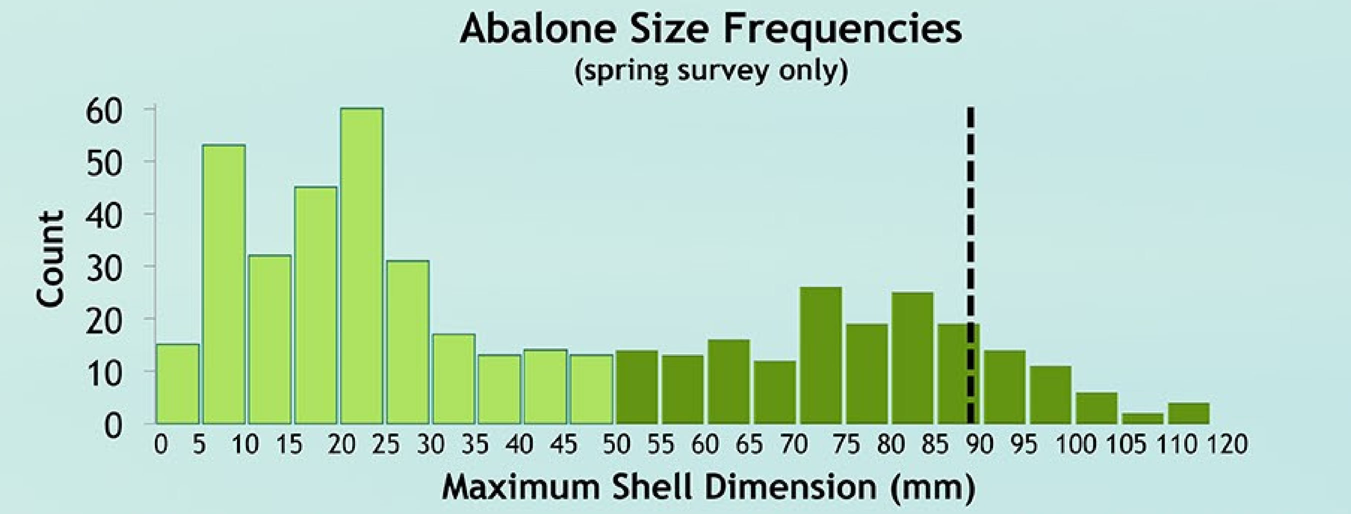


Figure 7. Pinto abalone size frequencies of all Sitka Sound sites combined during the first biannual survey. Dotted line indicates minimum size (89 mm) for personal use harvest in Southeast AK. Lighter green bars indicate the non-target individuals (abalone <50 mm) that were opportunistically counted during surveys focused on individuals >50 mm.

Next Steps

- Refine and expand similar monitoring surveys, protocol across Southeast AK, especially where reliable historical metrics exist
- Explore feasibility of distance sampling methods to better estimate aggregation sizes and more rigorous nearest neighbor distances
- Sample ARMs to use as an 'index' for recruitment events
- Compare abalone population demographics across gradients of re-introduced sea otter presence and abundance

Acknowledgements

We would like to thank the following people for their advice as we developed our methodology: M. Miner, T. Koeneman, J. Lessard, M. Ulrich, C. Catton, M. Neuman, D. Kushner, A. Bird, and J. Bouma. Many thanks to R. Vallion, K. Pendall, D. Kreiss-Tomkins, T. Schoening, D. McFadden, J. Metzger, C. Kemp, the ADF&G dive team (J. Meucci, E. Coonradt, D. Gordon, S. Kelley, D. Harris, T. Thynes, R. Bachman, Q. Smith, J. Stahl, and F. Pryor), crew of the R/V Kestrel (L. Skeek, G. Jackinski, E. Kandoll, B. Wilson), and divers at the American Academy of Underwater Sciences symposium for dive support.

Sea Grant Alaska #R/100-03

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