EVOS ANNUAL PROJECT REPORT

Project Number: 040647
Project Title: Investigating the Relative Roles of Natural factors and Shoreline Harvest in Altering the Kenai Peninsula's Rocky Intertidal
PI Name: Dr. Jennifer Ruesink
Time Period Covered by Report: September 1st 2003 - June 30th 2004
Date of Report: June 30th, 2004

1. WORK PREFORMED:

Algal Production

The site specific growth rate of *Alaria nana* was quantified across 10 of our 11 survey sites early this spring during the peak growing season. Individual plants were tagged and two holes were punched in the plants' blade, on either side of the midrib, 6 cm above the meristem. This modification from last years' method has proven to decrease mortality. Kelp growth varied across sites (Fig. 1) and was lower at those sites that had a lower biomass of *Katharina* in 2003.

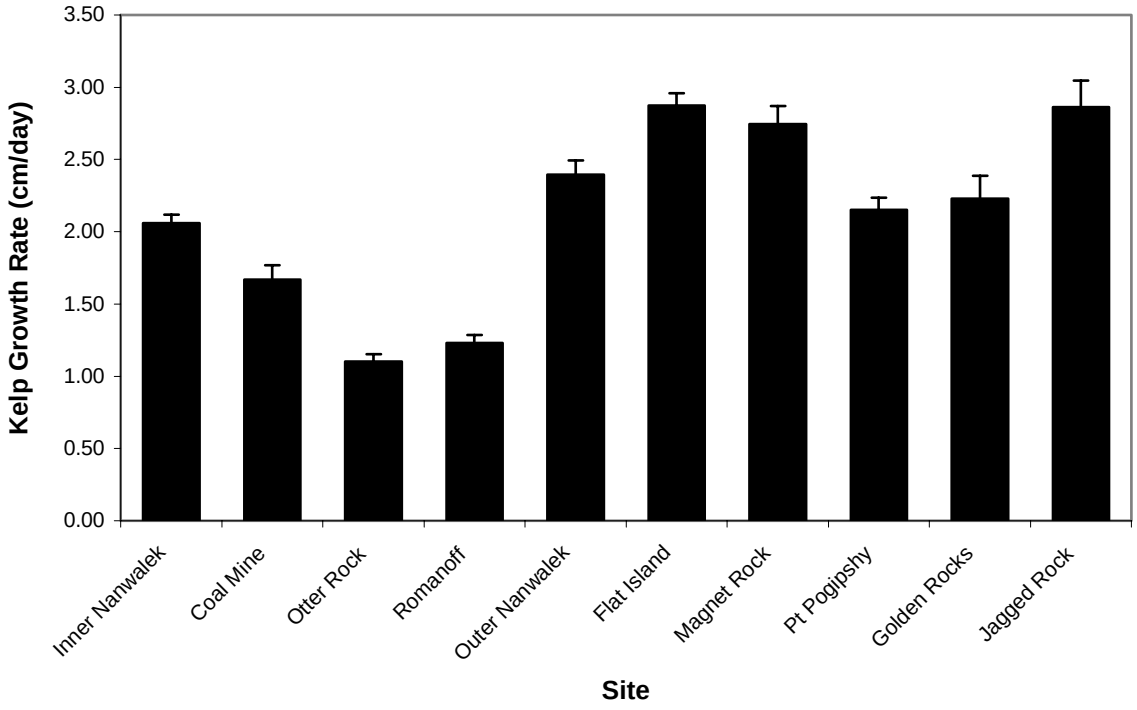

Figure 1: Daily growth rates of the ribbon kelp, *Alaria nana*, across 11 sites varying in *Katharina* density, sea otter presence and shoreline harvest. *Alaria nana* is the dominant kelp species at all of these sites except Pt Adams, an unharvested site where *Hedophyllum sessile* dominates.

Small-scale Bidarki Removal Experiments

Last fall we established *Katharina* removal experiments at 7 sites; 2 unharvested sites, 3 harvested sites and 2 experimentally harvested sites. At each of these sites, *Katharina* exclosures were built on rock surfaces where all plants and animals had previously been removed. Exclosure rings, each 20 cm in diameter, were made of 2 part epoxy putty (Z-spar Slash Zone). At each site, half of the exclosures were painted with antifouling paint to preclude grazer entry while the other half were not and thus acted as treatment controls. The antifouling paint applied to the z-spar exclosure rings was successful at reducing grazer density by approximately 75% relative to ambient densities (Fig. 2).

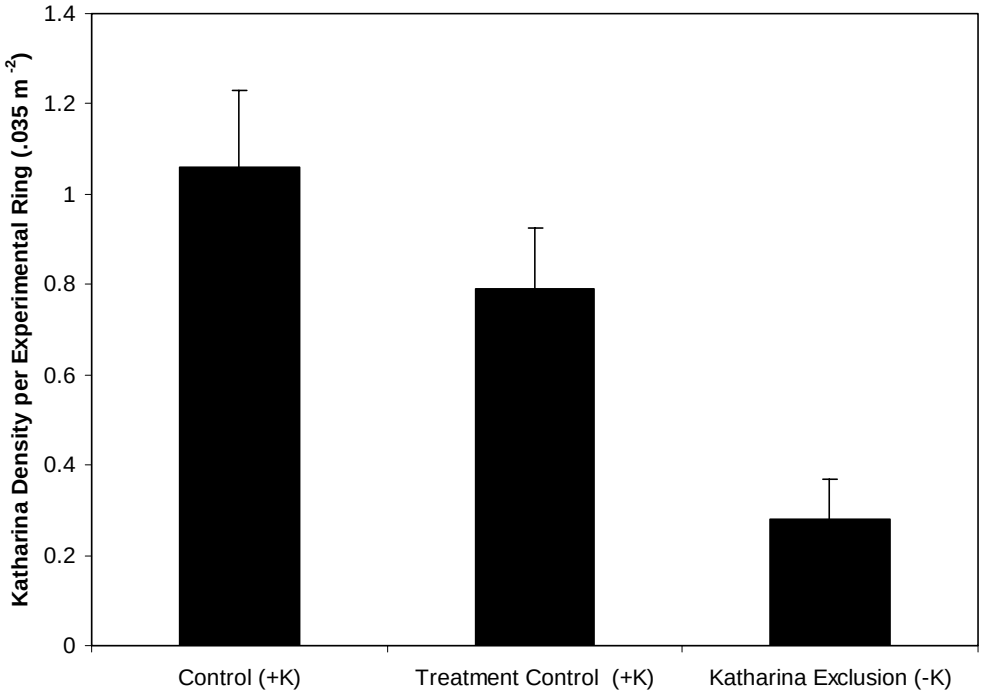

Figure 2. *Katharina* exclosures were successful at reducing *Katharina* density by 75% relative to surrounding densities. As a result, grazing pressure was successfully reduced within the exclosures.

The *Katharina* exclosures were repainted and repaired this April as some of the paint had worn off due to winter storm action. At the same time, young algal sporeling density was quantified. At Point Adams, sporeling density varied significantly among treatment (-K), treatment controls (+K) and true controls (+K) ($df = 2$, $F = 34.76$, $p < 1 \times 10^{-6}$) (Fig. 3A&B and Fig. 4). Interestingly, Pt Adams, an unharvested site and perhaps the most inaccessible sites to harvesters, is dominated by the perennial kelp *Hedophyllum sessile*. Where the grazers had been experimentally removed, *Alaria marginata*, the dominant annual kelp at the other 10 sites, flourished.

Figure 3 A&B: Photographs depicting the effect of removing *Katharina tunicata* on local primary production. A) In early May at Jagged Rock, this *Katharina* exclosure, with its red antifouling paint visible, had well over 200 *Alaria* sporelings within it. Some of these sporelings were already a foot in length. B) A *Katharina* exclosure and a treatment control at Pt Adams illustrate how the perennial kelp *Hedophyllum sessile*, visible in the background, has been replaced by the annual kelp *Alaria marginata* within the grazer exclusion ring.

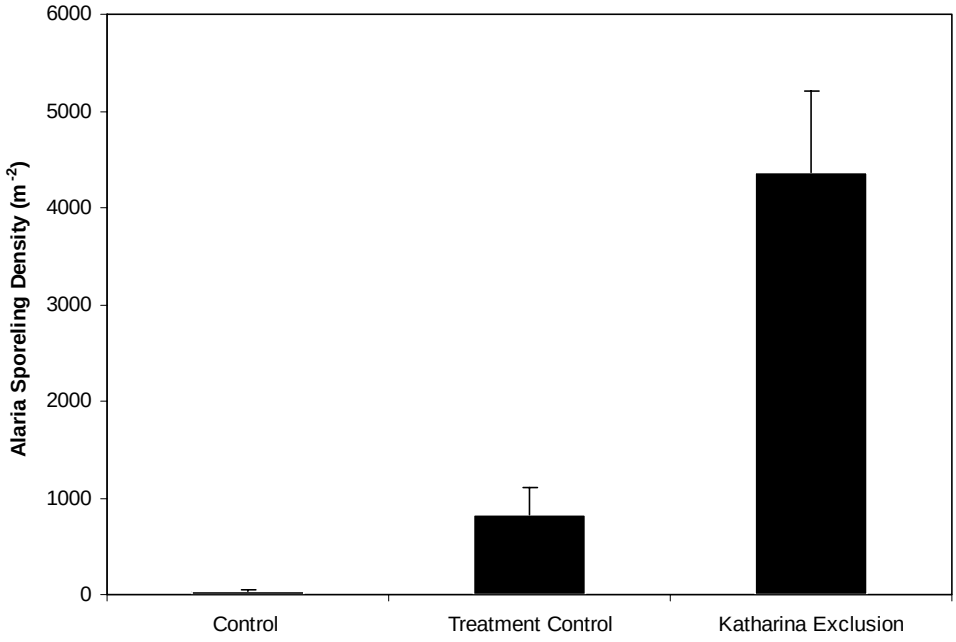

Figure 4. *Alaria* sporeling density varied significantly across control, treatment control and *Katharina* exclusion rings at Pt Adams, an unharvested site.

In June, the contents of these experiments were harvested in order to examine the differences in total biomass, *Alaria* production, species richness and limpet biomass between *Katharina* exclosures and treatment controls among harvested, pristine and experimentally harvested sites (Fig.5 A,B,C&D). (Note we are just completing this therefore two sites are missing from the following graphs).

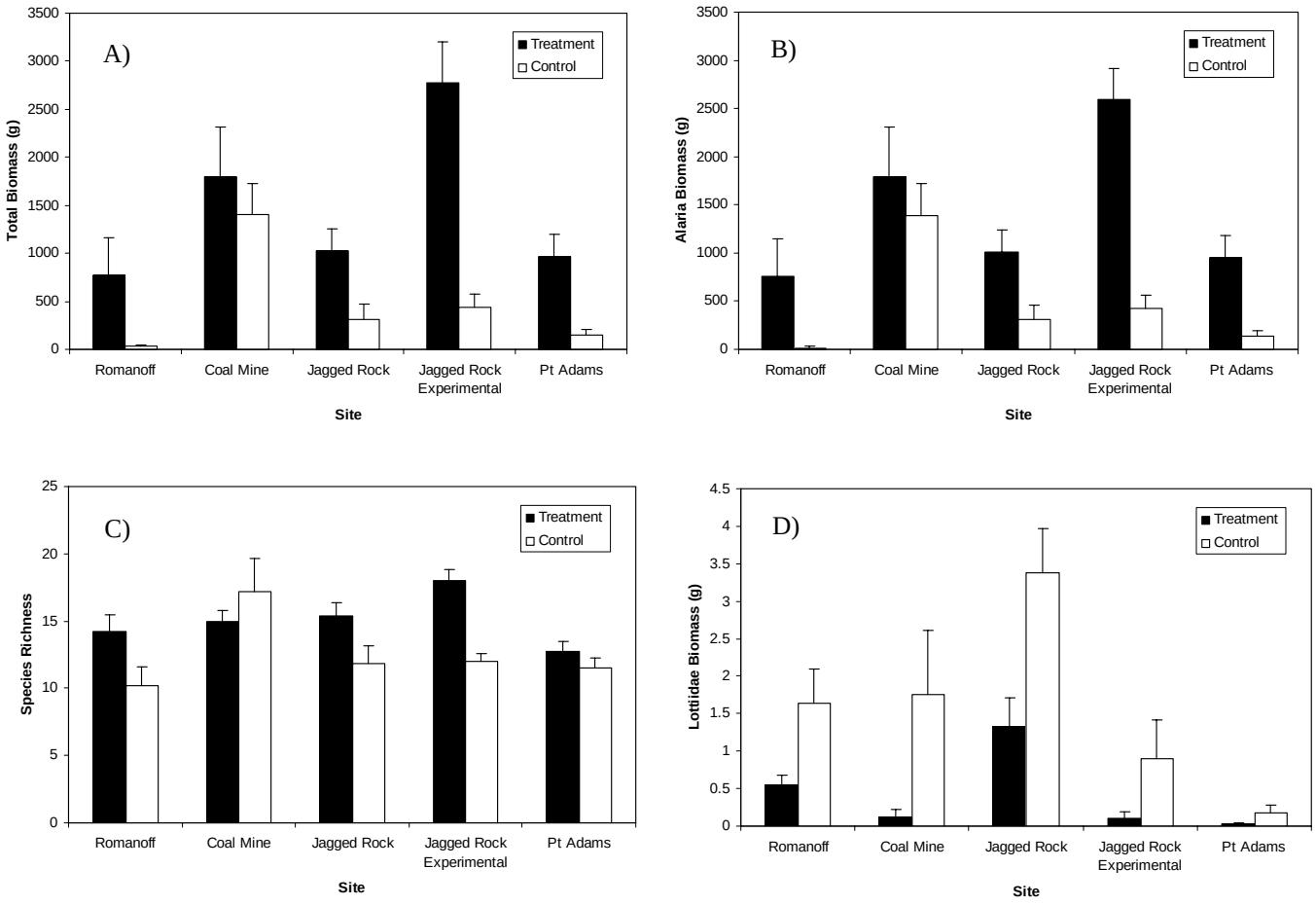

Figure 5: A)Total biomass, B)*Alaria* biomass, C)species richness and D) lottiadae biomass in *Katharina* exclusion treatments versus treatment controls across 5 sites varying in harvest pressure and sea otter presence. Romanoff Point is a harvested site with low sea otter presence where as Coal Mine is both harvested and has high sea otter presence. Jagged rock and Pt Adams are rarely to never harvested and have low sea otter presence. We experimentally reduced the densities of *Katharina* at Jagged Rock experimental.

On average, *Alaria* biomass accounted for 99% of the biomass located within the experimental rings (Fig 5 A&B) and was vastly greater within the *Katharina* exclosures relative to the controls. As expected, at Coal Mine where ambient *Katharina* densities are greatly reduced due to both harvest and sea otter presence, the difference between

treatment and control was smaller. Interestingly, the greatest difference between treatment and control occurred at the Jagged Rock Experimental site where we harvested all *Katharina* greater than 70 cm leaving still a high density of juvenile animals. Species richness, the number of algal and invertebrate species found within the rings, was greater within the *Katharina* exclusion rings except at Coal Mine, where ambient *Katharina* densities were very low and little difference existed between control and treatment rings. Limpets, of the family Lottiidae, showed the opposite trend suggesting that *Katharina* facilitate limpet recruitment, growth and survival.

Sea Otter Surveys

In addition to documenting the sea otter presence at each site during each site visit, we have conducted a formal sea otter survey of the study area. The number of sea otters observed and their GPS location were recorded from Point Pogipshy (N59^{o} 25' 731" W151^{o} 52' 097") to Pt Adams (N59^{o} 15 447 W151^{o} 58' 781"). A total of 145 adults and 50 pups were observed. This estimate is a minimum as some adults spend time off shore, as much as 5 miles (Nick Tanape personal communication), while others are cryptic and difficult to see. We plan to replicate this survey 4 times in order to derive an error estimate of sea otter abundance.

Sea Temperature

Temperature loggers (i buttons) were deployed at each site in May to discern any major differences in water temperatures among the 11 sites. This addition to our proposal was suggested to us by a tribal elder and subsistence harvester while working in the field together on the project itself last field season. This addition illustrates how listening to local knowledge and local questions can lead to more collaborations and possible insight.

Spatial Variation in *Katharina* Density, Size Structure & Biodiversity

Katharina density and biodiversity surveys are currently being conducted across 11 sites which fall along a gradient of harvest pressure and sea otter presence. To date, 3 sites have been completely surveyed. We plan to complete the rest of these surveys by August 15th.

Demography

Only 1 animal out of 573 tagged animals has been officially 'recaptured'. This animal did not grow in length over the year that it was tagged and was relocated 4 meters from where it was origionaly tagged. 2 tagged animals, known locally as 'Bingo Bidarkis', were found this winter on Nanwalek reef and were reported to our local contact but unfortunately, no length data was recorded. The lack of recaptures may be due to tag loss, tag fouling, mortality and or increased predation due to the tagging procedure itself. Of course, wide dispersal distances is another explanation although not likely a major contributing factor. Unfortunately, we were also unable to identify animals whose plates were etched yet untagged likely due to algal settlement occurring during the interm 12 months.

2. **FUTURE WORK:**

Sea Otter Foraging

Detailed foraging observations will begin mid July.

Wave Force

The maximum wave force measurements will be taken throughout August and September when the fall storms begin.

Statistical Analysis and Manuscript Preparation

Although begun, statistical analysis and manuscript preparation will be in full swing as the field season winds down in September.

3. COORDINATION/COLLABORATION:

We have been collaborating with Kim Kloeker and James Bodkin from USGS on our sea otter foraging research, a new aspect of this research. After the 2003 field season, it became clear that sea otters may be contributing more to *Katharina* mortality than we originally anticipated. Consequently, we have begun to collect data to model the magnitude of this affect. Anne Salomon was trained by Kim Kloecker on the techniques involved in sea otter foraging research. Anne plans to train local high school children and interested residents of Port Graham.

We have begun a new joint project with Scott Pegau and Terry Thompson from the National Estuarine Research Reserve to investigate the extent of *Katharina* movement. Because the reserve has the technology to conduct underwater filming and a new interest to begin working more closely with the local tribes, we plan to film Katharina movement over a complete tidal cycle this July. We also plan to involve interested high school kids from Port Graham and Nanwalek on this project. The reserve has also kindly provided an office for the 'Bidarki Team' to base out of.

4. COMMUNITY INVOLVEMENT / TEK & RESOURCE MANAGEMNET APPLICATIONS:

In January we completed 15 semi-directed interviews with elders from Port Graham. We have decided to expand our sample population to include young marine subsistence harvesters and thus, have continued our interviews this summer. Interviews in Nanwalek will be conducted this August and September. We have used the oral history and traditional ecological knowledge that we currently have to complete the first draft of a book with the following working title: All things are connected: Bidarkis, The Alitiqq and their Changing Shoreline. The objective of this illustrated book is 2 fold. We want to provide something for the tribes which could facilitate the sharing of local ecological knowledge from one generation to the other, a hurdle pointed out at last years' Wisdom Keepers meeting. Furthermore, we want to share the information that we have recorded and some of the scientific results we have found in an attractive, readable format, unlike

most technical reports which are rarely read and gather dust. This book has also been written with a broader audience in mind.

5. INFORMATION TRANSFER:

Publications:
Scientific Poster Presentation of current results

Conferences:
Marine Sciences in Alaska, Anchorage, Alaska January 2004
4th World Fisheries Congress, Vancouver, BC Canada

Workshops / Presentations:
Wisdom Keepers Port Graham September 2003
Islands and Oceans Visitors Center Presentation, Homer, Alaska May 2004
Community Meeting Port Graham, Alaska June 2004

Information Products:
Scientific Poster Presentation
Project Web Site
Community Meeting and Information Posters

6. BUDGET:

We have made no adjustments to our FY04 Budget

Signature of PI: _____

Project Web Site Address: http://depts.washington.edu/jlrlab/Salomon/index.html