# EVOS ANNUAL PROJECT REPORT

**Project Number:** 030647

**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:** January 1st 2003 – August 31st 2003

**Date of Report:** September 1st, 2003

## 1. WORK PERFORMED:

### Spatial Variation in *Katharina* Density & Size Structure

*Katharina tunicata* (Bidarki, Black Katy chiton) is a conspicuous grazer in mid-low intertidal areas on relatively wave-exposed rocky shoreline. *Katharina* density and size structure were quantified at 11 rocky intertidal sites located at the tip of the Kenai Peninsula (N 59° 15.523' W 151° 58.727' to N 59° 25.594' W151° 52.908') (Figure 1). These sites fall along a gradient of exploitation from heavily harvested to infrequently visited. These 11 sites include the eight pilot sites where exploratory data was collected in the summer of 2002 and three new sites that were added based on further discussions with local tribes. The current total of 11 monitoring sites is one site more than the original 10 that we proposed in our FY03 & FY04 GEM proposal.

The size frequency and density of Bidarkis were estimated in the field by counting and measuring all individuals found within ten randomly stratified $0.25m^2$ quadrats placed along two, 50 m horizontal transects spanning Bidarki habitat; the *Endocladia* (mid intertidal) and *Alaria* (low intertidal) zones. This method differs slightly from our FY 03 proposal yet is the same as described in our FY 04 resubmission proposal.

Fewer larger individuals exist at sites where accessibility is greatest and harvest pressure presumed highest (Figure 1). Data from 2001, 2002 and 2003 suggest that *Katharina* density and size structure differ among sites and among years (Figure 2 & 3AB). At two sites where we have a 3-year time series *Katharina* densities have increased from 2001 to 2003 (Figure 2). This trend reflects that local subsistence users have become increasingly reluctant to pick *Katharina* due to recent contaminant concerns, although *Katharina* recruitment variation may also be a contributing factor.

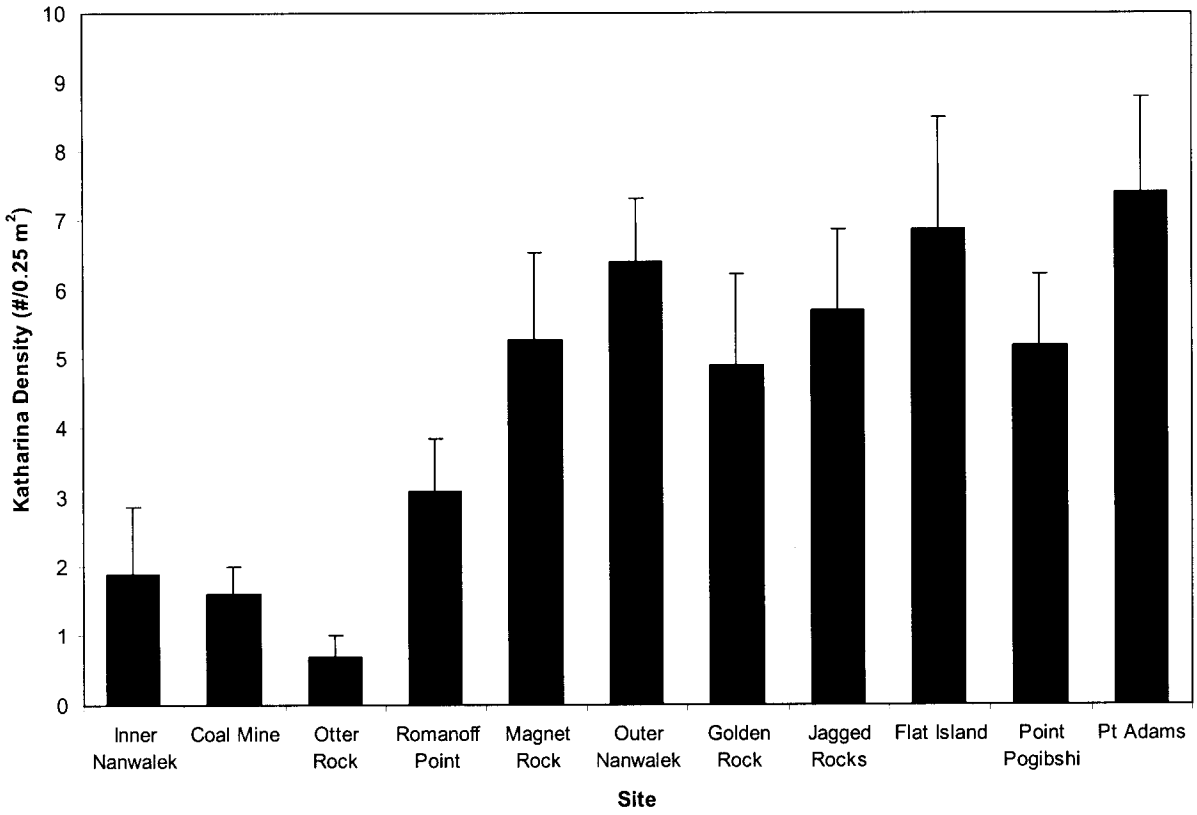



Figure 1: 2003 Density of *Katharina* (all sizes) across 11 sites located on the tip of the Kenai Peninsula, Alaska. Sites are arranged in decreasing accessibility from frequently visited sites to less frequently visited sites.

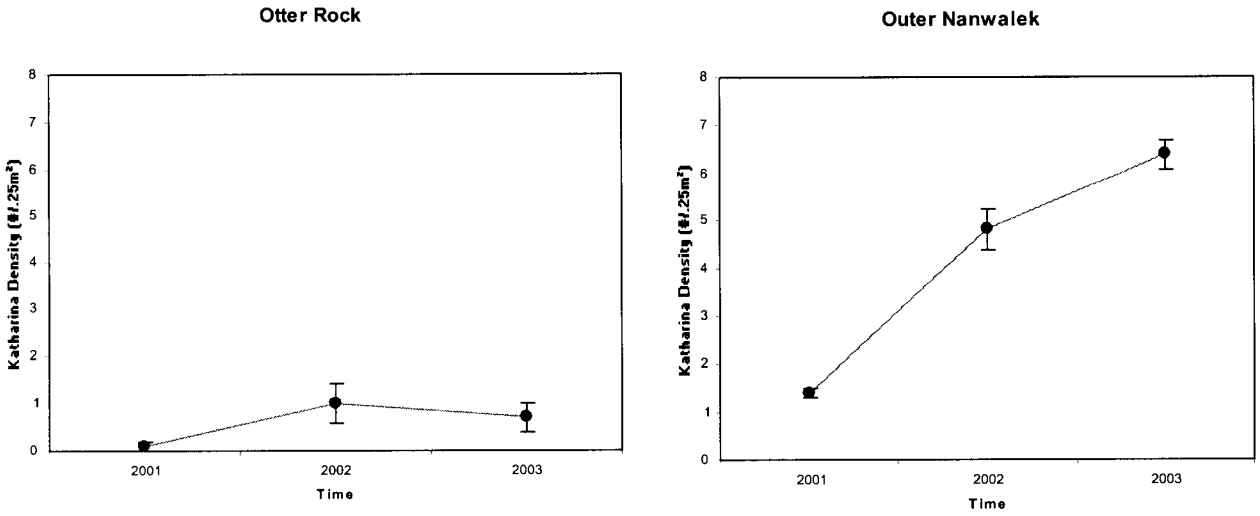



Figure 2: Three year time series of *Katharina* densities at two specific monitoring sites both of which have medium accessibility to subsistence harvest and high sea otter presence.

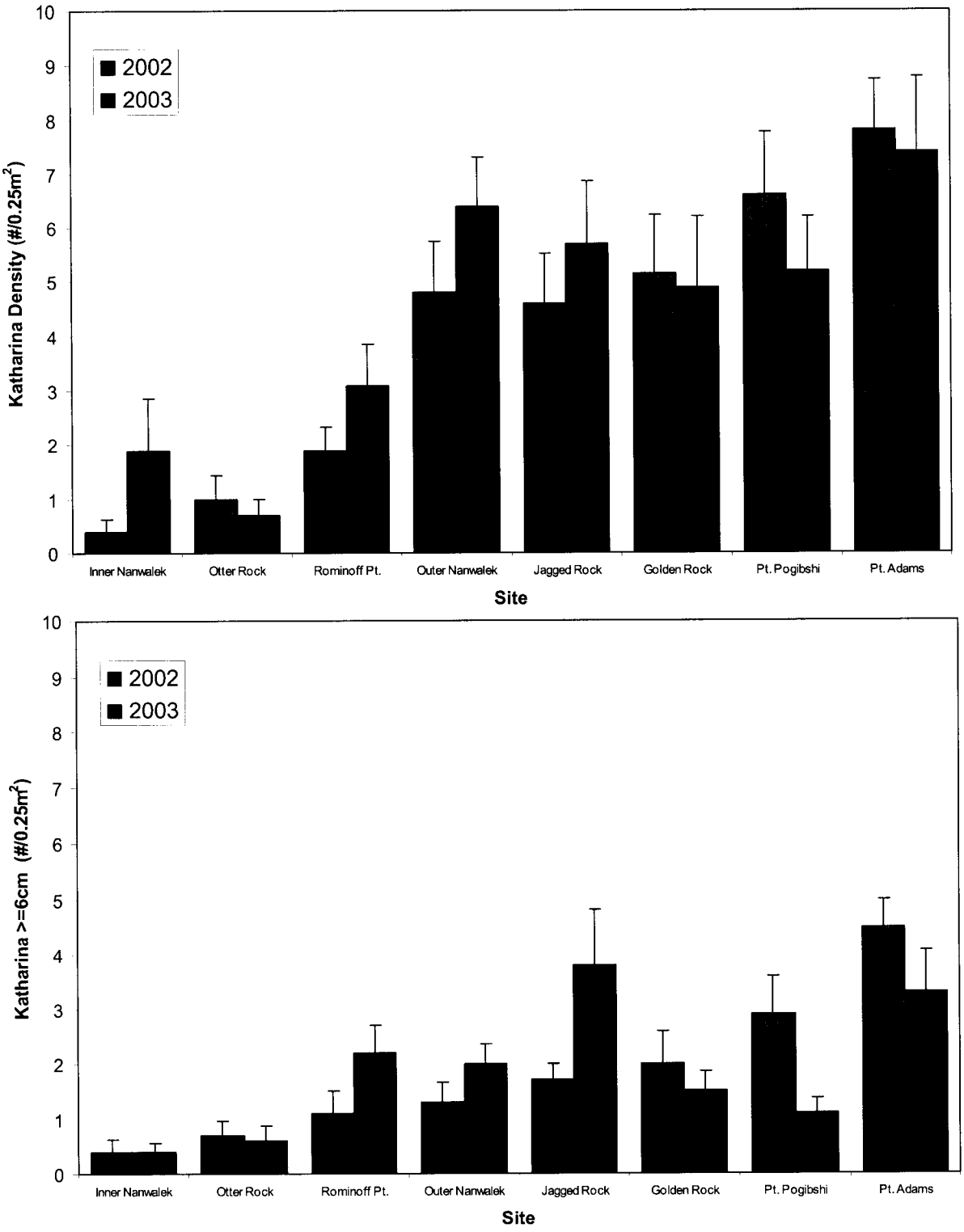
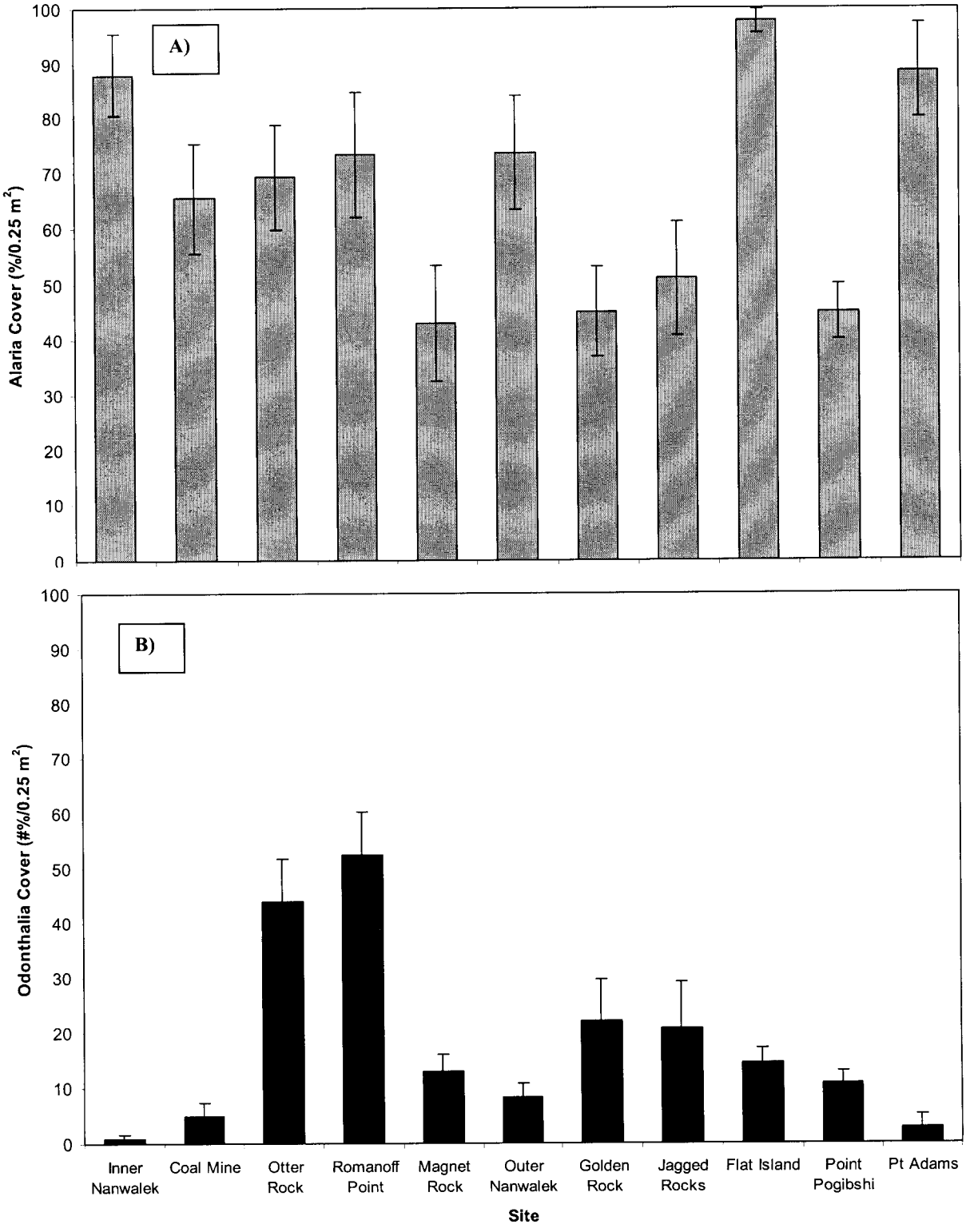



Figure 3 A&B: Comparison of 2002 and 2003 densities of all *Katharina* (A) and only harvestable sizes (B) at 8 sites.

**Spatial Variation in Intertidal Biodiversity**

Algal and invertebrate biodiversity were quantified as described in our FY 03 proposal & FY 04 resubmission proposal. This community-level data will be analyzed with multivariate statistics (nonmetric multidimensional scaling, MDS) this fall, but particular species do appear to vary in relative abundance across sites (Figure 4 A - D).



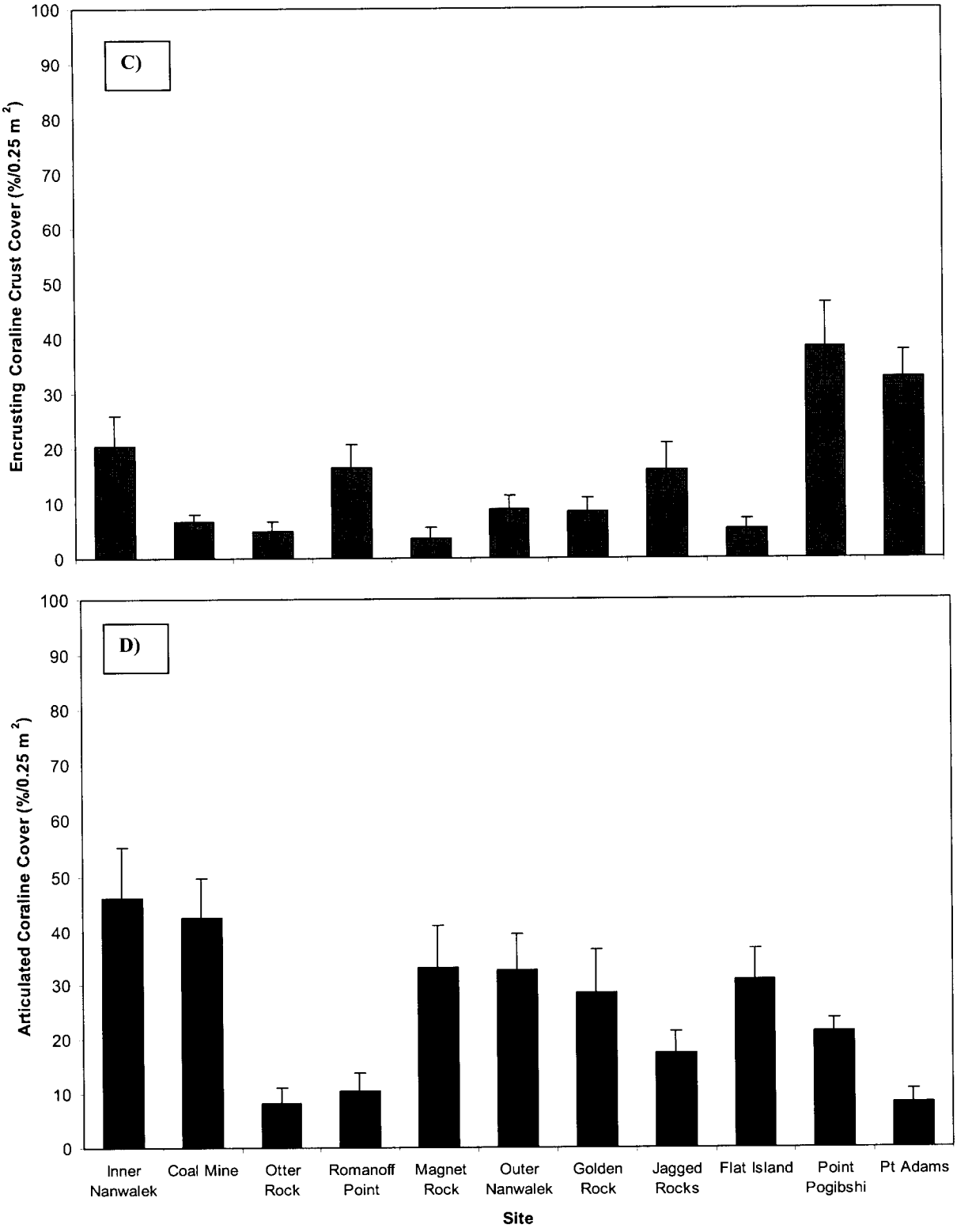



Figure 4 A, B, C& D: Percent cover of *Alara marginata* (A), *Odonthalia* spp. (B), encrusting coralline algae (C) and articulated coralline algae (D).

**Spatial Variation in Intertidal Biodiversity con't**

Katharina may influence the size structure of prey and competitor species, not simply abundance. Consequently, we also measured the maximum length of individual *Alaria* (a prey species) and Lottiadae (competitors) within the biodiversity quadrats. This is an addition to our FY 03 proposal but was described in our FY 04 resubmission proposal.

**Algal Production & Productivity**

We have quantified *Alaria* biomass, a measure of production, and average *Alaria* growth rates, a measure of productivity, at each of our 11 sites. As stated above, this is a new addition to our FY 04 proposal but important for describing the characteristics of each study site that could influence or be influenced by *Katharina*. A length-biomass relationship was established for *Alaria* by measuring the maximum length, and then drying and weighing individual plants of various sizes. This relationship allows us to estimate site specific *Alaria* biomass from field length measurements. *Alaria* growth rates have been quantified at each site by individually tagging 30 plants per site, punching a hole in the midrib of their blade just above the meristem region and measuring the change in the distance between where the hole was originally punched to it's current location over time (the 'conveyor belt method').

**Predation by Sea Otters and Sea Stars**

Sea otter presence is regularly monitored at each site to estimate natural predation pressure. Shoreline sea otter sightings are made each time a site is visited for monitoring and experimental research. Observations made this summer (2003) confirmed our suspicions based on observations made in 2001 and 2002 that there is differential otter presence among sites. These results are based on data collected throughout the summer only. One should note however that these animals do disperse wide distances and preferred overwintering sites may vary from preferred summer locations due to storms.

The potential for sea star predation by *Leptasterias* and *Evasterias* on *Katharina* is being quantified as part of our biodiversity sampling procedures.

**Small-scale Bidarki Removal Experiments**

Because sites may vary in their intertidal species assemblages for many reasons other than *Katharina* harvest, we have begun several experiments to tease apart the local impact of *Katharina* grazing pressure from the structuring forces of waves and other natural factors. A set of small scale experiments conducted at two harvested and two unharvested sites has recently been initiated (August 2003) to quantify the site-specific magnitude of *Katharina* grazing pressure (i.e. per capita interaction strength). These small scale experiments are a new addition to our FY 03 proposal and have been slightly modified from our FY 04 resubmission proposal. Ten small circular areas (diameter $\cong$ 30 cm) have been scraped clean. Z-spar rings covered in antifouling paint have been used to create impassible barriers to Bidarkis thereby creating mini exclosures ($n = 5$). Treatment controls are z-spar rings devoid of antifouling paint ($n = 5$). Algal sporeling biomass will be the response variable quantified in the spring of 2004. Because Lottiadae are both small and rare relative to *Katharina*, we are no longer carrying out a fully crossed experiment including *Katharina* and Lottiadae enclosures. Rather, we are increasing the power of this experiment by focusing on *Katharina* removals.

**Demography**

We have adopted three methods of tagging *Katharina* to increase the likelihood of obtaining usable demographic data. Currently, including all methods, we have marked over 900 individual *Katharina* spanning 8 size classes (11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 80+ mm) at 3 low-density and 3 high-density sites. Survival and growth will be determined through mark-recapture procedures. Two out of the three marking procedures involve marking individual *Katharina* with small numbered tags glued on to two of their dorsal plates. Prior to tagging, the pericardial tissue on these plates is removed with a Dreumel tool exposing the white calcareous plate. We are using this double marking technique due to high potential tag loss. As such, we are selecting 2 out of 8 plates to tag based on a predefined code unique to each of the 8 size classes. If indeed both tags are lost, cohorts can be identified by the code scrapped on their plates and followed through time. Furthermore, because individuals can vary in maximum length by +/- 2 cm due to body contraction or relaxation, we are removing individuals from the rock and recording their wet weights prior to the marking procedure. We are doing this both in the field to increase survival (method 1) and in the lab to increase tagging success (method 2). Because removing individuals from the rock may decrease their survival greatly we are employing a third tagging method. This method involves measuring the individuals in situ, assigning them a code and using the Dreumel tool to etch a code on to their dorsal plates. In this method (method 3) the individuals are not taken off the rock and weighed with hopes that this will increase their survival. The drawback of method 3 is that only cohort analysis is going to be possible as individuals are not differentiated with tags. These three tagging methods are more refined than what we originally proposed in our FY 03 proposal. Due to concerns of low survival of marked individuals, we have tagged more than 4 times the number of individuals than we originally proposed.

Marking began in June 2003, and chitons will be resampled (maximum length) in September 2003, April 2004 and September 2004. Length and weight will be measured for all marked individuals to determine summer (June-August) and winter (August-April) growth.

## 2. FUTURE WORK:

**Large-scale *Katharina* Removal Experiments**

Large scale harvest experiments will be initiated this fall (Sept 8$^{th}$ - 27$^{th}$ 2003) from a 5 x 5m area at 3 traditionally unharvested sites. This experiment was initially proposed to be conducted in the spring of 2003 however, after discussions with Dr. RT Paine from UW, we were advised to conduct them in the late summer or early fall. This timing also happens to be similar to the season that *Katharina* were traditionally harvested by subsistence gatherers in the past (personal communication John Moonin, Simeon Kavasnikof, Nick Tanape).

**Wave Force**

The maximum wave force at each site will be estimated with maximum wave force recorders known as dynamometers. We have begun constructing these instruments which

are made of a 15 cm length of 1.5 cm diameter CPVC tube which houses a spring upon which a 100 pound dacron line is tied leading to a wiffle ball. For more details on manufacturing & design go to http://www.stanford.edu/group/denny/.
We will notuse dissolution blocks to measure water motion as Denny 1985 suggests that maximum wave force is more important.

**Demography**

To estimate fecundity, we will measure length-specific gonad weight of individuals collected by locals for consumption or removed during experimental manipulations. Gonads will be excised, dried and measured following protocols in Salomon (2000).

## 3. COORDINATION/COLLABORATION:

We have been coordinating and collaborating with the Principal Investigators of the GEM Project 03575, 'Designing a Community Involvement / Community Based Monitoring Plan for GEM' grant. This project has informed the community involvement aspect of our project.

Other impromptu collaborations have flourished this summer. We have had logistical and technical exchanges with Dr. Terrie Klinger from the University of Washington, School for Marine Affairs and Dr. Sandra Lindstrom from the University of British Columbia, Department of Botany.

## 4. COMMUNITY INVOLVEMENT / TEK & RESOURCE MANAGEMNET APPLICATIONS:

We launched our 2003 field season this year with another Natural Resources Community Meeting and First Annual Bidarki Race in Port Graham to share the pilot data we collected in 2002 with the community and discuss our plans for 2003. We also had a community meeting in Homer in June 2003 to share our project plans with local science based NGOs and government agencies. The Bidarki Team will be sharing this summers data at the 'Wisdom Keepers' meeting in Port Graham on September 25$^{th}$ 2003, a TEK meeting designed by Port Graham Tribal Council and facilitated by the Chugach Regional Resources Commission. We will also be sharing our data at community meetings in Nanwalek and Seldovia in September 2003 and during 'Sea Week' in Nanwalek in May 2004.

The TEK portion of this project, spearheaded by Dr. Henry Hungtington in collaboration with Nick Tanape, Nancy Yeaton, Anne Salomon and Dave Glahn, will be initiated at the Wisdom Keepers meeting this coming September. One-on-one semi directed interviews will commence in January 2004.

## 5. INFORMATION TRANSFER:

**Publications:**
None to date

**Conferences:**
None to date

**Workshops / Presentations:**
Centre of Alaskan Coastal Studies, Peterson Bay July 2003
Natural Resources Meeting in Port Graham, June 2003

**Information Products:**
Project Web Site
Community Meeting and Information Posters (see attached)

## 6. BUDGET:

Rather then buying an aluminum skiff and trailer, we decided that it would more cost effective to rent a boat. As such, our initial proposed expenditure of $18000 (boat) + $2000 (trailer) dollars was reduced to $2000 x 4 months = $8000 to cover boat rental. We did however need to purchase a 9.9 hp Yamaha four stroke kicker motor for safety purposes ($ 2400) in addition to renting the boat. Other expenditures associated with travel among field sites include moorage fees and a small kayak. This budget change is reflected in our FY 04 resubmission proposal and was approved by NOAA.

**Signature of PI:** _____

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