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STUDY TITLE: Recovery in a High Arctic Kelp Community
REPORT TITLE: Recovery in a High Arctic Kelp Community
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BACKGROUND: High arctic kelp communities in Prudhoe Bay are considered sensitive habitats and have the potential of being impacted by factors such as oil and gas activities, sedimentation, and ice scour. Impacts can result in the removal or scouring of sessile organisms leaving open space for new recruitment or damaged organisms needing to recover. The over-arching goal of this project was to acquire a better understanding of how sessile communities recover after disturbances in the Boulder Patch, a high arctic kelp community in Prudhoe Bay.

OBJECTIVES:
Objective 1: Determine the timing of natural recruitment onto hard substrates.
Objective 2: Determine the effect of grazers on recruitment success.
Objective 3: Determine the effect of sedimentation on recruitment success.
Objective 4: What is the rate of vegetative regrowth of various sessile organism groups?

DESCRIPTION: This project explored how sessile kelp communities recover after disturbances in the Boulder Patch in Prudhoe Bay. Specifically this research determined the 1) timing of natural recruitment of sessile organisms onto hard substrates, 2) effect of grazers on recruitment success, 3) effect of sedimentation on recruitment success, and 4) rate of vegetative regrowth of various sessile organism groups. This project determined the timing of natural recruitment over a seven year time period by annually monitoring new settlement on rocks that were cleared in 2002. To determine grazer impacts, cleared rocks placed into grazer exclusion cages in 2002 were monitored for seven years. Sedimentation impacts on initial recruitment were determined by comparing new recruits that settled on the tops (where sediment accumulates) and undersides (where no sediment accumulates) of settling plates that were placed into the field for two years. To determine the rate of vegetative regrowth, partial clearings established in 2007 were monitored for regrowth of specific sessile organism groups for four years.

SIGNIFICANT CONCLUSIONS: This study found that initial recruitment of sessile organisms onto the cleared rocks started after three years but at less than 1% cover of recruited individuals. Less than 10% of the boulder surfaces were colonized after seven years. Recruitment was so slow that it was difficult to ascertain grazer impacts. After seven years, approximately 12% of the boulders excluded from grazers were covered with recruits. In contrast to grazers, sedimentation appeared to influence recruitment. After just two years, an average of 30 new individual recruits colonized the underside of the experimental settlement plates where sediments were excluded compared to less than three individuals on the tops. Lastly, this study showed that vegetative re-growth of sponges and encrusting coralline red algae was fast, especially when compared to recruitment. Sponges averaged 100% regrowth after two years and corallines averaged 40% after four years. Coralline regrowth was much slower at a site with higher sedimentation.

STUDY RESULTS: This work represents the first long-term measurements of recovery in nearshore kelp communities in the Beaufort Sea. Overall this study has shown that recovery of sessile communities from disturbances is very slow in the Beaufort Sea, especially if entire organisms are removed or killed. These results are supported by research conducted by Dunton in the 1980s. In addition to the slow recruitment, this study has shown that if some part of either sponges or corallines remain on the substrate after the disturbance, recovery can be quicker for these organisms, particularly in low sediment areas. Still, even with the faster recovery from regrowth, complete community recovery in this system after a disturbance may take a decade or more. Sedimentation was the one driver that appeared to influence recruitment and may also impact recovery rates. This study recommends that activities that may cause increases in sedimentation should be avoided in these kelp communities and that studies should be implemented on sedimentation influences on nearshore kelp communities.

STUDY PRODUCT(S):

Konar B (submitted) Recovery in a High Arctic Kelp Community. Marine Biology

Konar B (2012) Recovery of hard substrate benthic communities in the Beaufort Sea. Poster presentation at the Alaska Marine Science Symposium. 16-20 January 2012. Anchorage Alaska

Iken K, Konar B (2008) Biodiversity in coastal arctic Beaufort Sea. Oral presentation for the World Conference on Marine Biodiversity. November 2008. Valencia Spain

Konar B, Iken K (2007) Community dynamics in coastal Beaufort Sea boulder fields. Oral presentation at the Western Society of Naturalists. 8-11 November 2007. Ventura California

Konar B (2007) Recolonization of a high latitude hard-bottom nearshore community. Polar Biology 30:663-667

Iken K, Konar B (2007) Biodiversity in boulder fields in the coastal Beaufort Sea. Poster presentation at American Association for the Advancement of Science Arctic Division. 24-27 September 2007. San Francisco California

Iken K, Konar B, Schoenberg S, Chenelot H, Hondelero D, Lindstrom S (2006) Biodiversity in Arctic nearshore boulder communities. Oral presentation at the 1st NaGISA World Congress. 13-18 October 2006. Kobe Japan

Konar B (2006) Role of grazers on the recolonization of hard-bottom communities in the Alaska Beaufort Sea. Final Report for the OCS Study MMS 2006-015, University of Alaska Coastal Marine Institute, University of Alaska Fairbanks and USDOI, MMS, Alaska OCS Region. 23pp

Konar B, Iken K (2005) Competitive dominance among sessile marine organisms in a high arctic boulder community. Polar Biology 29:61-64

Debenham C (2005) Multiple stable isotopic analyses ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$, and δD) of the Boulder Patch, a high arctic kelp community: trophic and temporal perspectives. Masters Thesis. University of Alaska Fairbanks. 75pp

Konar B (2005) Role of grazers on the recolonization of hard-bottom communities in the Alaska Beaufort Sea. Oral presentation at the 86th Annual Meeting for the Western Society of Naturalists. 17-20 November 2005. Monterey California

Iken K, Konar B (2002) Losing the battle but not losing the war in competitive dominance in a boulder patch community. Poster presentation at the 83rd Annual Meeting for the Western Society of Naturalists. 8-11 November 2002. Monterey California

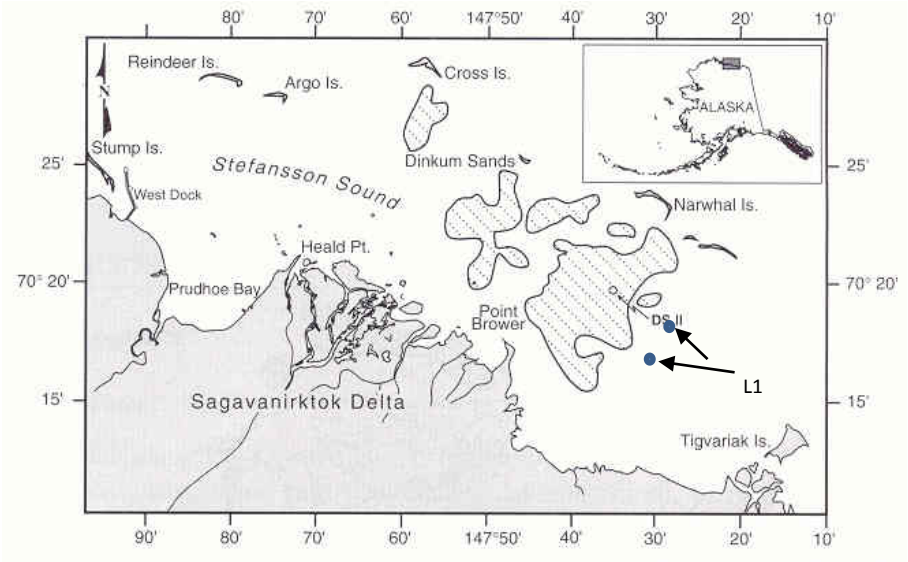

Figure 1. Chart of Boulder Patch showing study areas within Stefansson Sound. From Dunton and Schonberg 2000.